MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Maryland Department of Transportation

State Highway Administration

STANDARD SPECIFICATIONS

for

CONSTRUCTION

and

MATERIALS

July 2026

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GENERAL PROVISIONS

GP - SECTION 1: DEFINITIONS AND TERMS

GP-1.01 GENERAL

Portions of Part III Technical Requirements of these Standard Specifications for Construction and Materials are written in the Active Voice writing style.

Wherever in these General Provisions or in other Contract Documents the terms or abbreviations are used, the meaning shall be as provided herein.

GP-1.02 ORGANIZATIONAL STRUCTURE

The Maryland Department of Transportation is composed of the following Administrations:

(i) Maryland Port Administration

(ii) Maryland Transit Administration

(iii) State Highway Administration

(iv) Maryland Aviation Administration

(v) Motor Vehicle Administration

(vi) Maryland Transportation Authority; and

(vii) Office of the Secretary

GP-1.03 ORGANIZATIONAL DEFINITIONS

Administration—The word "Administration" shall mean any one of the Administrations within the Maryland Department of Transportation, as listed in GP-1.02

Administrator—The chief executive officer of an Administration.

Department—The word "Department" shall mean the Maryland Department of Transportation.

Engineer—Any person designated by the Administrator or the procurement officer, acting directly or through his duly authorized representative, such representative acting within the scope of the particular duties assigned to him or of the authority given him.

Inspector—The authorized representative of the procurement officer assigned to make detailed inspection of any or all portions of the work, or materials therefore.

Procurement Officer—Any person authorized by a State agency in accordance with law or regulations to formulate, enter into, or administer Contracts or make written determinations and findings with respect to them. The term also includes an authorized representative acting within the limits of authority.

Secretary—The chief executive officer of the Maryland Department of Transportation.

GP-1.04 ABBREVIATIONS

AAN	American Association of Nurserymen
AAPA	American Association of Port Authorities
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ARA	American Railway Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASLA	American Society of Landscape Architects

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Transit Association
AWWA	American Water Works Association
AWS	American Welding Society
AWPA	American Wood Preservers Association
AGC	Associated General Contractors of America
BOCA	Building Officials Conference of America
COMAR	Code of Maryland Regulations
CRSI	Concrete Reinforcing Steel Institute
EEI	Edison Electric Institute
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration, U.S. Department of Transportation
FCC	Federal Communications Commission
FHWA	Federal Highway Administration, U.S. Department of Transportation
FRA	Federal Railway Administration, U.S. Department of Transportation
FSS	Federal Specifications and Standards, General Services Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineers Society

IMSA	International Municipal Signal Association
IPCEA	Insulated Power Cable Engineers Association
IRT	Institute for Rapid Transit
MASH	Manual for Assessing Safety Hardware
MBMA	Metal Building Manufacturers' Association
MOSH	Maryland Occupational Safety and Health
MSMT	Maryland Standard Method of Tests (as developed by the Maryland Department of Transportation State Highway Administration)
MdMUTCD	Maryland Manual on Uniform Traffic Control Devices
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NCHRP	National Cooperative Highway Research Program
NEC	National Electric Code
NESC	National Electric Safety Code
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
RLMI	Reflector and Lamp Manufacturers' Institute
SAE	Society of Automotive Engineers
SAWP	Society of American Wood Preservers
SSPC	Society for Protective Coatings

UL	Underwriters Laboratories, Incorporated
QPL	Qualified Products List

GP-1.05 DEFINITIONS

Award—The transmission by the procurement agency, after all necessary approvals have been obtained, of:

(1) The executed Contract; or

(2) Written notice of award to the selected vendor.

Bid—A statement of price, terms of sale, and description of the supplies, services, construction or construction related services offered by a bidder to the State in response to an Invitation for Bids.

Bid Bond—See Proposal Guaranty.

Bid Form—The approved form on which an Administration requires bids to be set forth and submitted.

Bidder—A person formally submitting a bid for the work contemplated, acting directly or through a duly authorized representative.

Board—The Board of Public Works of the State of Maryland.

Business—A corporation, partnership, individual, sole proprietorship, joint venture, or any other legal entity through which commercial activity is conducted.

Calendar Day—Every day shown on the calendar, Saturdays, Sundays and holidays included.

Change Order—A written order signed by the responsible procurement officer, directing a Contractor to make changes which the changes clause of a Contract authorizes the procurement officer to order with or without the consent of the Contractor. ***TC-1.03 shall also apply.***

Construction—The process of building, altering, repairing, improving, or demolishing any structure, building, or other improvement to real property. Construction includes any major work necessary to repair, prevent damage to, or sustain existing components of an improvement to real property. Construction does not include the maintenance or routine operation of an existing improvement to real property, or activities related to an energy performance Contract.

Contract—Any agreement:

(1) In writing except as otherwise authorized; and

(2) Entered into by a procurement agency for the acquisition of supplies, services, construction, construction related services, architectural services or engineering services.

Contract does not include:

(1) Collective bargaining agreements with employee organizations or agreements creating employer-employee relationships, as defined in State Personnel and Pensions Article, §13-101, Annotated Code of Maryland; or

(2) Medicaid, Medicare, Judicare, or similar reimbursement contracts for which user eligibility and cost are set by law or regulation.

Contract Documents—The written agreement executed between an Administration and the successful bidder, covering the performance of the work and furnishing of labor, equipment, and materials, by which the Contractor is bound to perform the work and furnish the labor, equipment, and materials, and by which the Administration is obligated to compensate the Contractor at the mutually established and accepted rate or price. The Contract Documents shall include the Invitation for Bids, Notice to Contractors, Instructions to Bidders, Proposal, Contract Forms and Bonds, General Provisions, Specifications, Supplemental Specifications, all Special Provisions, all Technical Provisions, all Plans, and Notices to Proceed, also any written Change Orders and Supplemental Agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions.

Contract Drawings—See definition of "Plans."

Contract Item (Pay Item)—An item of work specifically described and for which a price, either unit or lump sum, is provided. It includes the performance of all work and the furnishing of all labor, equipment, and materials, described herein or described in any Supplemental Specifications or Special Provisions.

Contract Modification—Any written alteration in the Specifications, delivery point, date of delivery, Contract period, price, quantity, or other provision of any existing Contract, whether accomplished in accordance with a Contract Provision, or by mutual action of the parties to the Contract. It includes change orders, extra work orders, supplemental agreements, Contract amendments, or reinstatements.

Contractor—Any person having a Contract with a procurement agency. Contractor does not include an employee with an employment Contract, or an employee organization with a collective bargaining agreement.

Day—Calendar day unless otherwise designated.

Invitation for Bids—Any document, whether attached or incorporated by reference, used for soliciting bids under procurement by competitive sealed bidding and small procurement procedures including requests for quotations.

Materials—Any substances specified for use in the construction of the project and its appurtenances.

Notice to Contractors—The advertisement for Bids for all required work or materials. Such advertisement will indicate the location and magnitude of the work to be done or the character and quantity of the material to be furnished and the time and place of the opening of bids.

Notice to Proceed—A written notice to the Contractor of the date on or before which the Contractor shall begin the prosecution of the work to be done under the Contract.

Payment Bond—Security as stated in COMAR 21.06.07.01B as a guarantee that Contractor will pay in full all bills and accounts for materials and labor used in the work, as provided by law.

Performance Bond—Security as stated in COMAR 21.06.07.01B, guaranteeing complete performance of the Contract.

Person—Any individual or a corporation, partnership, sole proprietorship, joint stock company, joint venture, unincorporated association, union, committee, club, or other organization or legal entity.

Plans—The official drawings issued by the Administration as part of the Contract Documents, including those incorporated in the Contract Documents by reference.

Proposal—The response by an offeror to a request for proposals issued by a procurement agency to obtain goods or labor. The response may include but is not limited to an offeror's price and terms for the proposed Contract, and description of technical expertise, work experience and other information as requested in the solicitation. As used herein the word "proposal" means "bid."

Proposal Guaranty—The security, in the form stated in COMAR 21.06.07.01B, designated in the Proposal, to be furnished by the offeror as a guaranty of good faith to enter into a Contract with the State, if the work of constructing the improvement is awarded to the offeror.

Resident Business—A business whose principal office or principal base of operations is located in the State.

Responsible Bidder or Offeror—A person who has the capability in all respects to perform fully the Contract requirements, and the integrity and reliability that shall assure good faith performance.

Responsive Bid—A bid submitted in response to an Invitation for Bids that conforms in all material respects to the requirements contained in the Invitation for Bids.

Specification—A written description of functional characteristics, or the nature of a construction item to be procured. It may include a statement of any of the user's requirements and may provide for inspection, testing, or preparation of a construction item before procurement.

State—The State of Maryland acting through its authorized representative.

Subcontract—Any agreement entered into by the Contractor or a subcontractor for a portion of the construction or any other part of the work in connection with, and under the terms of, the Contract.

Subcontractor—Any person undertaking a portion of the construction or any other part of the work under the terms of the Contract, by virtue of an agreement with the Contractor or a subcontractor who, prior to such undertaking has received the approval of the Administration. Subcontractor does not include an employee with an employment contract, or an employee organization with a collective bargaining agreement.

Superintendent—The executive representative of the Contractor authorized to receive and execute instructions from the procurement officer, and who shall supervise and direct the construction.

Supplemental Specifications—Additions and revisions to the Standard Specifications. Generally include new or improved procedures, construction items or materials developed subsequent to the publication of Standard Specifications.

Surety—The corporate body bound with and for the Contractor, for the full and complete performance of the Contract, and for the payment of all debts pertaining to the work. When applying to the Bid Bond, it refers to the corporate body which engages to be responsible in the execution by the bidder of a satisfactory Contract.

Third Tier Contracting—The process in which the Contractor subcontracts a portion of the Contract to a subcontractor who in turn subcontracts a portion of the Contract to a third party. This latter action is termed entering into a third tier Contract.

Work—Work shall be understood to mean the furnishing of all labor, materials, equipment, and other incidentals necessary to the successful completion of the project and the carrying out of all the duties and obligations imposed by the Contract.

GENERAL PROVISIONS

GP - SECTION 2: BIDDING REQUIREMENTS AND CONDITIONS

GP-2.01 BID IRREVOCABLE

Unless otherwise provided in the Invitation for Bids, bid prices are irrevocable for 90 days following bid opening.

GP-2.02 CONTENTS OF BID FORMS

On Contracts with electronic bidding TC-2.02 Contents of Bid Forms shall be used in lieu of GP-2.02.

All papers included in, bound thereto or attached to the bid form are necessary parts thereof and shall not be detached, separated or altered. The Plans, Specifications, Supplemental Specifications, referred to in the Specifications, and all other Contract Documents will be considered a part of the bid form whether attached thereto or not.

GP-2.03 INTERPRETATION OF QUANTITIES IN BID SCHEDULE

Where designated as estimated quantities, the quantities in the prepared bid schedule are approximate only. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the Contract and as provided in GP-4.04 Variation in Estimated Quantities.

GP-2.04 SITE INVESTIGATION

The Contractor acknowledges that the Contractor has investigated and satisfied itself as to the conditions affecting the work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during prosecution of the work. The Contractor further acknowledges that the Contractor has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the State, as well as from information presented by the drawings and specifications made a part of this Contract. Any failure by the Contractor to acquaint itself with the available information may not relieve the Contractor from responsibility for estimating properly the difficulty or cost of successfully performing the work. The State assumes no responsibility for any conclusions or interpretations made by the Contractor on the basis of the information made available by the State.

GP-2.05 TAXES-RESPONSIBILITY FOR PAYMENT, EXEMPTIONS, FORMS TO FILE, ETC.

(a) The Contractor is responsible for, and by submitting a bid agrees to pay, all retail sales, income, real estate, sales and use, transportation and special taxes applicable to and assessable against any materials, equipment, processes and operations incident to or involved in the construction. The Contractor is responsible for ascertaining and acquainting itself with such taxes and making all necessary arrangements to pay same.

(b) The Contractor shall indicate its Federal Tax Identification or Social Security number on the face of each invoice billed to the Administration.

(c) The Administration or the Comptroller of the Treasury may withhold any payment under this Contract until the Contractor and any subcontractors performing any duties under this Contract have paid all State taxes or other obligations due the State of Maryland. The taxes or other obligations shall be resolved either by set-off of the amount due the Contractor against the amounts due the State or by direct payment.

GP-2.06 PREPARATION OF BID

On Contracts with electronic bidding TC-2.03 Preparation of Bid shall be used in lieu of GP-2.06.

(a) The bidder shall submit his bid upon the blank forms furnished by the Administration. The bidder shall specify a price in dollars and cents for each pay item given, and shall show the products of the respective unit prices and quantities written in figures in the column provided for that purpose, together with the total amount of the bid obtained by adding the amounts of the several items.

(b) The bid form(s) shall be filled out legibly in ink or typed. The bid, if submitted by an individual, shall be signed by the individual. If submitted by a partnership, the bid shall be signed by such member or members of the partnership an have authority to bind the partnership. If submitted by a corporation or other business entity, the same shall be signed by an officer with his or her position stated below the signature line. Such signature shall constitute the Contractor's representation and warrant that the signing party has the Contractor's authorization to do so, binding the Contractor to the bid and to the Contract. All bids shall be signed in ink. All erasures or alterations shall be initialed by the signer in ink.

(c) Bid Samples and Descriptive Literature. If the Invitation for Bids requires the bidder to furnish samples or descriptive literature, it shall be submitted with the bid, unless the Invitation for Bids provides otherwise.

(d) Offerors shall identify those portions of their proposals which they deem to be confidential, proprietary information or trade secrets and provide any justification of why such materials should not be disclosed by the State under the Maryland Public

Information Act, Title 4 of the General Provisions Article of the Annotated Code of Maryland.

(e) Foreign Corporations – Pursuant to the Corporations and Associations, Title 7 of the Annotated Code of Maryland, corporations not incorporated in the State shall register with the State Department of Assessments and Taxation, before doing any interstate or foreign business in this State. Before doing any intrastate business in this State, a foreign corporation shall qualify with the Department of Assessments and Taxation.

GP-2.07 PROPOSAL GUARANTY

On Contracts with electronic bidding TC-2.04 Proposal Guaranty shall be used in lieu of GP-2.07.

(a) No bid will be considered for any Contract in excess of $100,000 unless accompanied by a guaranty in an amount not less than 5 percent of the amount bid, or such amount as may be specified elsewhere in the bid documents and made payable to the State of Maryland.

(b) Acceptable forms of security for bid guaranty shall be:

(1) A bond in a form satisfactory to the State underwritten by a surety company authorized to do business in this State;

(2) A bank certified check, bank cashier's check, bank treasurer's check, or trust account;

(3) Pledge of securities backed by the full faith and credit of the United States government or bonds issued by the State of Maryland; or

(4) Cash or other securities—if submitted pursuant to COMAR 21.06.07.01.

GP-2.08 DELIVERY OF BIDS

On Contracts with electronic bidding TC-2.05 Delivery of Bids shall be used in lieu of GP-2.08.

Each bid must be submitted in a sealed envelope plainly marked to indicate its contents. When sent by mail, the sealed bid must be addressed to the Administration at the address and in care of the official in whose office the bids are to be received. All bids shall be filed prior to the time and at the place specified in the Notice to Contractors. Bids received after the time for opening of bids will be treated in accordance with the provisions of GP-2.12.

GP-2.09 COMMUNICATIONS AND INTERPRETATIONS PRIOR TO BID OPENING

Any information regarding the requirements or the interpretation of any provision of the General Provisions, Special General Provisions, Specifications or any part of the bidding documents shall be requested, in writing, from the procurement officer, and delivered no later than 10 days prior to the scheduled date of bid opening. Responses to questions or inquiries having any material effect on the bids shall be made by written addenda, or by written notice sent to all prospective bidders. **DO NOT MAKE VERBAL INQUIRIES**.

Any verbal interpretations or oral pre-bid statements made by State employees or their representatives shall not be binding upon the State.

GP-2.10 AMENDMENTS TO INVITATIONS FOR BIDS

On Contracts with electronic bidding TC-2.06 Amendments to Invitations for Bids shall be used in lieu of GP-2.10.

(a) Form. Each amendment to an Invitation for Bids shall be in writing and identified as such.

(b) Acknowledgements. Unless otherwise provided, the bidder shall acknowledge receipt of all amendments.

GP-2.11 PRE-OPENING MODIFICATION OR WITHDRAWAL OF BIDS

On Contracts with electronic bidding TC-2.07 Pre-Opening Modification or Withdrawal of Bids shall be used in lieu of GP-2.11.

(a) Procedure. Bids may be modified or withdrawn by written notice delivered to and received in the office designated in the Invitation for Bids before the time and date set for bid opening. Written notice of modification or withdrawal may be delivered by hand delivery, overnight carrier, or by US Postal mail. Any notice addressed in this subsection must be received before the time and date set for bid opening.

(b) Disposition of Bid Security. If a bid is withdrawn in accordance with this regulation, the bid security, if any, shall be returned to the bidder.

GP-2.12 LATE BIDS, LATE WITHDRAWALS, AND LATE MODIFICATION

On Contracts with electronic bidding TC-2.08 Late Bids, Late Withdrawals, and Late Modifications shall be used in lieu of GP-2.12.

(a) Policy. Any bid received at the place designated in the solicitation after the time and date set for receipt of bids is late. Any request for withdrawal or request for modification received after the time and date set for opening of bids at the place designated for opening is late.

(b) Treatment. A late bid, late request for modification, or late request for withdrawal may not be considered. Late bids will be returned to the bidder unopened. Upon written approval of the Office of the Attorney General, exceptions may be made when a late bid, withdrawal, or modification is received before Contract award, and the bid, withdrawal, or modification would have been timely but for the action or inaction of State personnel directing the procurement activity or their employees.

NOTE: Provision GP-2.12(b) does not apply to Federal Aid projects.

GP-2.13 OPENING AND RECORDING OF BIDS

(a) Opening and Recording. Bids and modifications shall be opened publicly, at the time, date, and place designated in the Invitation for Bids. The name of each bidder, the bid price, and such other information as is deemed appropriate shall be read aloud or otherwise made available. This information also shall be recorded at the time of bid opening. The bids shall be tabulated or a bid abstract made. The opened bid shall be available for public inspection at a reasonable time after bid opening but in any case before Contract award except to the extent the bidder designates trade secrets or other proprietary data to be confidential as set forth in COMAR 21. Material so designated shall accompany the bid and shall be readily separable from the bid in order to facilitate public inspection of the nonconfidential portion of the bid. Prices, makes, and model or catalog numbers of the items offered, deliveries, and terms of payment shall be publicly available at a reasonable time after bid opening but in any event before Contract award regardless of any designation to the contrary at the time of bid opening.

(b) Confidential Data. The procurement officer shall examine the bids to determine the validity of any requests for nondisclosure of trade secrets and other proprietary data identified in writing. Confidential, proprietary information, and trade secrets furnished by a bidder or offeror may be disclosed to another State agency if there is a need for the information and may not be disclosed outside of State government except as provided by the Public Information Act or other applicable laws of this State.

GP-2.14 MISTAKES IN BIDS

(a) Mistakes Discovered Before Opening. A bidder may correct mistakes discovered before the time and date set for bid opening by withdrawing or correcting the bid as provided in GP-2.11.

(b) Confirmation of Bid. If the procurement officer knows or has reason to conclude that a mistake may have been made, the bidder may be required to confirm the bid. Situations in which confirmation may be requested include obvious, apparent errors on

the face of the bid or a bid unreasonably lower than the other bids submitted. If the bidder alleges mistake, the bid may be corrected or withdrawn upon written approval of the Office of the Attorney General if any of the following conditions are met:

(1) If the mistake and intended correction are clearly evident on the face of the bid document, the bid shall be corrected to the intended correct bid and may not be withdrawn. Examples of mistakes that may be clearly evident on the face of the bid document are typographical errors, errors in extending unit prices, transposition errors, and arithmetical errors.

(2) A bidder may be permitted to withdraw a low bid if:

(a) A mistake is clearly evident on the face of the bid document but the intended correct bid is not similarly evident; or

(b) The bidder submits proof of evidentiary value which clearly and convincingly demonstrates that a mistake was made.

(c) Mistakes Discovered After Award. Mistakes may not be corrected after award of the Contract except when the procurement officer and the head of a procurement agency makes a determination that it would be unconscionable not to allow the mistake to be corrected. Changes in price are not permitted. Corrections shall be submitted to and approved by the Office of the Attorney General.

GP-2.15 MINOR IRREGULARITIES OR INFORMALITIES

General. Minor irregularities or informalities in bids, as defined below, may be waived if the procurement officer determines that it shall be in the State's best interest. The procurement officer may either give a bidder an opportunity to cure any deficiency resulting from a technicality or minor irregularity in its bid, or waive the deficiency where it is to the State's advantage to do so.

When at any public opening of bids, a bid appears to be irregular, as herein specified, this fact may be announced when read. Said bid shall be read as other bids and then referred to the procurement officer for consideration and appropriate action thereon in accordance with these General Provisions, Law and Regulation.

A minor irregularity is one which is merely a matter of form and not of substance or pertains to some immaterial or inconsequential defect or variation of a bid or proposal from the exact requirement of the solicitation, the correction or waiver of which would not be prejudicial to other bidders or offerors. The defect or variation in the bid or proposal is immaterial and inconsequential when its significance as to price, quantity, quality, or delivery is trivial or negligible when contrasted with the total cost or scope of the supplies or services being procured and the intent and meaning of the entire bid or proposal is clear.

GP-2.16 CANCELLATION OF INVITATIONS FOR BIDS

On Contracts with electronic bidding TC-2.09 Cancellation of Invitations for Bids shall be used in lieu of GP-2.16.

(a) Before opening of bids a solicitation may be canceled in whole or in part when the State determines this action is fiscally advantageous or otherwise in its best interest.

(b) When a solicitation is canceled before bid opening, the bids shall be returned to the vendors submitting them and notice of cancellation shall be included.

GP-2.17 REJECTION OF INDIVIDUAL BIDS OR PROPOSALS

(a) Any bid may be rejected in whole or in part when it is in the best interest of the State to do so.

(b) Reasons for rejection of a bid may include but are not limited to:

(1) The bid is not responsive i.e., it does not conform in all material respects to the solicitation.

(2) Unreasonable price.

(3) The bidder submitting the bid is determined to be nonresponsible. A determination of nonresponsibility may be made for, but is not limited to, any of the following reasons:

(a) Bidder debarred or ineligible and period of debarment or ineligibility not expired.

(b) The unit prices contained in a bid are unbalanced.

(c) Evidence of collusion among bidders.

(d) Inadequate quantity and/or quality of experience, plant, equipment, financing, manpower or other resources required to perform the Contract.

(e) Bidder's workload which, in the judgement of the Administration, might hinder or prevent the prompt completion of the subject work if awarded.

(f) Default by the bidder on other Contracts.

(g) Failure to pay or satisfactorily settle all reasonable and just bills due for labor and material on prior or current Contracts.

(h) The same person has an interest in more than one bid on a Contract exclusive of being named by another bidder as a subcontractor.

(i) Failure to perform satisfactorily on other Contracts awarded, and the conditions leading to unsatisfactory performance remain unresolved.

(j) Any other reason affecting the bidder's ability to perform, or record of business integrity.

(k) Bidder not otherwise qualified and eligible to receive an award under applicable laws and regulations.

(4) The bidder or offeror fails to supply information to the procurement officer promptly, after notification from the procurement officer that such information is required in connection with a determination to be made pursuant to this GP- 2.17.

GP-2.18 REJECTION OF ALL BIDS

(a) After opening of bids or proposals but before award, all bids or proposals may be rejected in whole or in part when the procurement officer, with the approval of the appropriate Department head or designee, determines that this action is fiscally advantageous or otherwise in the State's best interest.

(b) A notice of rejection of all bids shall be sent to all vendors that submitted bids, and bids which have been opened shall be retained by the Administration.

GP-2.19 BID EVALUATION AND AWARD

(a) General. The Contract is to be awarded to the responsible and responsive bidder whose bid meets the requirements and evaluation criteria set forth in the Invitation for Bids, and is either the lowest bid price or lowest evaluated bid price.

(b) Determination of Lowest Bidder. Bids shall be evaluated to determine which bidder offers the lowest cost to the State in accordance with the evaluation criteria set forth in the Invitation for Bids.

Except as otherwise provided under GP-2.14 Mistakes in Bids:

(1) The unit price will govern in the event of a discrepancy between the unit price bid and the extended price (product of unit price multiplied by the quantity).

(2) The sum of the extended prices will govern in the event of a discrepancy between the total lump sum bid and the extended prices.

(3) The written words will govern in the event of a discrepancy between the prices written in words and the prices written in figures.

(4) If a unit price has been omitted, the unit price will be determined by dividing the extended price by the quantity.

The Administration reserves the right to make the award by item, or groups of items, or total bid if it is in the best interest of the State to do so unless the bidder specifies in his bid that a particular or progressive award is not acceptable.

(c) Award. Upon determination of the lowest bidder, review of the bid for responsiveness, and satisfaction that the bidder is responsible, the Contract may be awarded to that bidder. A Contract may be awarded to a bidder offering a higher quality item than that designated in the Invitation for Bids if that bidder is also the lowest responsive and responsible bidder.

GP-2.20 TIE BIDS

On Administration Federal Aid Contracts, the preference to in-State Contractors does not apply.

(a) Definition. Tie bids are responsive bids from responsible bidders that are identical in price, terms and conditions and which meet all the requirements and evaluation criteria set forth in the Invitation for Bids.

(b) Award. In the instance of tie bids, the award shall be made in accordance with COMAR 21.05.02.14. If identical low bids are received from an in-State and out-of-State bidder, the award shall be made to the in-State bidder. If identical low bids are received from in-State bidders or from out-of-State bidders, a drawing shall be conducted, and a witness shall be present to verify and certify the result.

GP-2.21 RESIDENT BUSINESS PREFERENCE

(a) When awarding a Contract by competitive sealed bidding, if the State in which a nonresident firm submitting the lowest responsible bid is located gives a competitive advantage to its resident businesses, a procurement agency may give an identical competitive advantage to the Maryland firm submitting the lowest responsive and responsible bid in order to determine Contract award.

(b) A competitive advantage may include:

(1) A percentage preference;

(2) An employee residency requirement;

(3) Any other provision that favors a nonresident firm over a Maryland firm.

(c) This provision GP-2.21 shall not apply if it conflicts with any Federal grant or regulation affecting this Contract.

GP-2.22 MULTIPLE OR ALTERNATE BIDS

Unless multiple or alternate bids are requested in the solicitation, these bids may not be accepted. However, if a bidder clearly indicates a base bid, it shall be considered for award as though it were the only bid submitted by the bidder.

GP-2.23 BID PROTESTS

A bid protest must be in writing and filed with the procurement officer. Oral objections, whether or not acted on, are not protests.

(a) Time for Filing.

(1) A bid protest shall be filed not later than 7 days after the basis for protest is known or should have been known, whichever is earlier.

(2) A protest based on alleged improprieties in the solicitation which are apparent before the bid opening or the closing date for receipt of initial proposals shall be filed before the opening date or the closing date for receipt of initial proposals.

(b) Content of Written Protest.

(1) Name and address of protestor.

(2) Bid or Contract number.

(3) Reasons for protest.

(4) Supporting exhibits, evidence or documents to support claim. If not available within filing time, indicate expected availability date.

(5) Mark envelope "protest."

Bid protests will be resolved pursuant to COMAR 21.10.02.

GENERAL PROVISIONS

GP - SECTION 3: AWARD AND EXECUTION OF CONTRACT

GP-3.01 AWARD OF CONTRACT (SEE GP-2.19)

Written notice of award shall be sent to the successful bidder. A Notice of Award may be rescinded at any time prior to execution of the Contract by the Administrator.

GP-3.02 RETURN OF PROPOSAL GUARANTY

All proposal guaranties, except those of the three lowest bidders, will be returned immediately following opening and the review of the proposals. The guaranty of the three lowest bidders will be returned following the execution of the Contract and approval by the Board, if required. The Contractor has the right to substitute a bid bond for other bid security at any time prior to return of the proposal guaranty.

GP-3.03 PERFORMANCE BOND AND PAYMENT BOND REQUIREMENTS

(a) Acceptable security for performance and payment shall be as stated in COMAR 21.06.07.01B.

(b) Performance and Payment Bonds. A performance and payment bond is required for all construction Contracts in excess of $100,000 each in the amount equal to at least 100 percent of the Contract price. The bonds shall be delivered by the bidder to the Administration no later than the time the Contract is to be executed. If the bidder fails to deliver the required bonds, the bid shall be rejected, the bid security shall be enforced, and award of the Contract may be made to the next lowest responsive and responsible bidder.

(1) The required performance bond shall be in the form specified in COMAR 21.07.02.10, Exhibit A.

(2) The required payment bond shall be in the form specified in COMAR 21.07.02.10, Exhibit B.

GP-3.04 EXECUTION OF CONTRACT

(a) The Contract shall be effective only upon receipt by the Administration of the proper, executed Contract form, and performance and payment bonds (if required), approval by the Board of Public Works, (if required), and execution of the Contract by the Administration.

(b) After a Notice of Award, as provided in GP-3.01, has been issued to a bidder, the Administration shall forward the formal Contract form and the appropriate forms for the payment and performance bonds (if any) to the bidder for execution. The bidder will execute the Contract form and return same, together with fully executed payment and performance bonds (if any), to the Administration within 10 days after receipt of same. After receipt of properly executed Contract form and payment and performance bonds, (if any), the Administration will execute the Contract within 60 days and forward the bidder a copy; provided, however, that the Board has approved the Contract if such approval is required. If the Administration fails to execute the Contract and the period of irrevocability has expired, the bidder may, as its sole remedy, withdraw its bid.

GP-3.05 FAILURE TO EXECUTE CONTRACT

Failure of the bidder to execute the Contract and file acceptable security as defined in GP-3.03 within the time aforesaid shall be just cause for the annulment of the award and the forfeiture of the proposal guaranty which shall become the property of the State of Maryland, not as a penalty but in liquidation of damages sustained. Award may then be made to the next lowest responsive, responsible bidder or the work may be readvertised and constructed under Contract or otherwise, as the Administration may decide.

GENERAL PROVISIONS

GP - SECTION 4: SCOPE OF WORK

GP-4.01 INTENT OF CONTRACT

(a) The Contractor shall (within specified tolerances) perform all work in accordance with the lines, grades, typical cross sections, dimensions, and other data shown on the Plans or as modified by written orders including the furnishing of all materials, implements, machinery, equipment, tools, supplies, transportation, labor, and all other things necessary to the satisfactory prosecution and completion of the project in full compliance with the Contract requirements.

(b) The documents composing the Contract Documents are intended to be complementary, and to describe the construction and completion of the work. Anything mentioned in the Specifications and not shown on the Contract drawings, or shown on the Contract drawing and not mentioned in the Specifications shall be of like effect as if it is shown or mentioned in both.

(c) Omissions from the drawings or Specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and Specifications or which are customarily performed shall not relieve the Contractor from performing such omitted or misdescribed details of work, but they shall be performed as if fully and correctly set forth and described in the drawings and Specifications.

GP-4.02 GENERAL PROVISIONS CONTROLLING

In the event of a conflict between these General Provisions and any other provision of the Contract Documents, these General Provisions shall prevail unless such other provision expressly provides to the contrary.

GP-4.03 ENTIRE CONTRACT

The Contract Documents represent the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations or agreements either written or oral.

GP-4.04 VARIATIONS IN ESTIMATED QUANTITIES

On Administration Contracts, in addition to GP-4.04 Variations in Estimated Quantities, TC-7.08 Eliminated Items shall apply.

Where the quantity of a pay item in this Contract is an estimated quantity and where the actual quantity of such pay item varies more than 25 percent above or below the estimated quantity stated

in this Contract, an equitable adjustment in the Contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 125 percent or below 75 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the procurement officer shall, upon receipt of a written request for an extension of time within 10 days from the beginning of the delay, or within a further period of time which may be granted by the procurement officer before the date of final settlement of the Contract, ascertain the facts and make the adjustment for extending the completion date as in the procurement officer's judgement the findings justify.

GP-4.05 DIFFERING SITE CONDITIONS

(a) The Contractor shall promptly, and before such conditions are disturbed, notify the procurement officer in writing of:

(1) Subsurface or latent physical conditions at the site differing materially from those indicated in this Contract; or

(2) Unknown physical conditions at the site of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract.

The procurement officer shall promptly investigate the conditions, and if the procurement officer finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the Contract modified in writing accordingly.

(b) No claim of the Contractor under this clause shall be allowed unless the Contractor has given the notice required in (a) above; provided however, the time prescribed therefore may be extended by the State.

(c) No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

GP-4.06 CHANGES

(a) The procurement officer may unilaterally, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make any change in the work within the general scope of the Contract, including but not limited to changes:

(1) In the Specifications (including drawings and designs);

(2) In the method or manner of performance of the work;

(3) In the State-furnished facilities, equipment, materials, services, or site; or

(4) Directing acceleration in the performance of the work.

(b) Any other written order or an oral order, including a direction, instruction, interpretation or determination, from the procurement officer that causes any such change, shall be treated as a change order under this clause, provided that the Contractor gives the procurement officer written notice stating the date, circumstances, and source of the order and that the Contractor regards the order as a change order.

(c) Except as herein provided, no order, statement, or conduct of the procurement officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment hereunder.

(d) Subject to paragraph (f), if any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this Contract, whether or not changed by any order, an equitable adjustment shall be made and the Contract modified in writing accordingly. Provided, however, that except for claims based on defective specifications, no claim for any change under (b) above shall be allowed for any costs incurred more than 20 days before the Contractor gives written notice as therein required; and provided further, that in the case of defective Specifications for which the State is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with such defective Specifications.

(e) If the Contractor intends to assert a claim for an equitable adjustment under this clause, the Contractor shall, within 30 days after receipt of a written change order under (a) above or the furnishing of written notice under (b) above, submit to the procurement officer a written statement setting forth the general nature and monetary extent of such claim, unless this period is extended by the State. The statement of claim hereunder may be included in the notice under (b) above.

(f) Each Contract modification or change order that affects Contract price shall be subject to the prior written approval of the procurement officer and other appropriate authorities and to prior certification of the appropriate fiscal authority of fund availability and the effect of the modification or change order on the project budget or the total construction cost. If, according to the certification of the fiscal authority, the Contract modification or change order will cause an increase in cost that will exceed budgeted and available funds, the modification or change order may not be made unless sufficient additional funds are made available or the scope of the project is adjusted to permit its completion within the project budget.

(g) No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

GP-4.07 NEGOTIATED PAYMENT PROVISION

If the Contractor is entitled to an equitable adjustment, the Contractor shall be allowed to add the following maximum percentages for overhead and profit to the Contractor's costs for labor and materials:

(a) Twenty percent may be added by the Contractor for overhead and profit for work performed by the Contractor's own forces.

(b) Fifteen percent may be added by the subcontractor for overhead and profit for work performed by the subcontractor; the Contractor may add an additional 5 percent of the subcontractor's costs for labor and materials.

(c) The provisions of paragraphs (a) and (b) above apply only to price adjustments negotiated prior to completion of the added or changed work and do not apply to work performed on a force account basis as provided for in Section GP-9.02 ***(On Administration Contracts TC-7.03 Force Account Work shall apply)*** or GP-4.04 Variations in Estimated Quantities.

GP-4.08 UNAUTHORIZED WORK

Work done contrary to or regardless of the instructions of the procurement officer; work done beyond the lines and grades shown on the Contract Drawings, or as given; or any extra work done without written authority will be considered as unauthorized and at the expense of the Contractor and will not be measured or paid for. Work so done may be ordered removed and/or replaced at the Contractor's expense.

GP-4.09 FINAL CLEAN UP

Upon completion of the work specified in the Contract and before final payment will be made, the construction area and all other adjoining areas, other than those owned by him, occupied by the Contractor during the construction of said Contract shall be cleaned of all surplus and discarded materials, spilled materials, excess materials left deposited on the permanent work as a result of the Contractor's operations, false work, and rubbish and temporary structures and buildings, that were placed thereon by the Contractor. The adjoining areas mentioned above, outside the normal pay limits for seeding, will be reshaped, seeded and mulched, or otherwise restored as directed by the procurement officer at the Contractor's expense.

GP-4.10 WARRANTY OF CONSTRUCTION

On Administration Contracts GP-4.10 Warranty of Construction does not apply unless otherwise specified in the Contract Documents.

(a) In addition to any other warranties at law or set out elsewhere in this Contract, the Contractor warrants for one year after final acceptance of the work, that work

performed under this Contract conforms to the Contract requirements and is free of any defect of equipment, material or design furnished, or workmanship performed by the Contractor or any of the Contractor's subcontractors or suppliers at any tier. With respect to any part of the work which the State takes possession of prior to final acceptance, such warranty shall continue for a period of one year from the date the State takes possession. Under this warranty, the Contractor shall remedy at the Contractor's own expense any such failure to conform or any such defect. In addition, the Contractor shall remedy at the Contractor's own expense any damage to State owned or controlled real or personal property, when that damage is the result of the Contractor's failure to conform to Contract requirements or any such defect of equipment, material, workmanship, or design. The Contractor shall also restore any work damaged in fulfilling the terms of this clause. The Contractor's warranty with respect to work repaired or replaced hereunder will run for one year from the date of such repair or replacement.

(b) The State shall notify the Contractor in writing within a reasonable time after the discovery of any failure, defect, or damage.

(c) Should the Contractor fail to remedy any failure, defect, or damage described in (a) above within a reasonable time after receipt of notice thereof, the State shall have the right to replace, repair, or otherwise remedy such failure, defect, or damage at the Contractor's expense.

(d) In addition to the other rights and remedies provided by this clause, all subcontractors', manufacturers', and suppliers' warranties expressed or implied, respecting any work and materials shall, at the direction of the State, be enforced by the Contractor for the benefit of the State. In such case if the Contractor's warranty under (a) above has expired, any suit directed by the State to enforce a subcontractor's, manufacturer's or supplier's warranty shall be at the expense of the State. The Contractor shall obtain any warranties which the subcontractors, manufacturers, or suppliers would give in normal commercial practice.

(e) If directed by the procurement officer, the Contractor shall require any such warranties to be executed in writing to the State.

(f) Notwithstanding any other provision of this clause, unless such a defect is caused by the negligence of the Contractor or the Contractor's subcontractors or suppliers at any tier, the Contractor shall not be liable for the repair or any defects of material or design furnished by the State nor for the repair of any damage which results from any such defect in State furnished material or design.

(g) The warranty specified herein shall not limit the State's rights under GP-5.13 Acceptance for Maintenance clause of this Contract.

GENERAL PROVISIONS

GP - SECTION 5: CONTROL OF THE WORK

GP-5.01 AUTHORITY OF THE PROCUREMENT OFFICER

(a) The procurement officer shall decide all questions which may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of said work; all questions which may arise as to the interpretation of any or all Plans and Specifications; and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor.

(b) The procurement officer shall determine the amount and quantity of work performed and materials which are to be paid for under the Contract.

(c) The procurement officer shall have the authority to suspend the work wholly or in part due to the failure of the Contractor to carry out provisions of the Contract.

GP-5.02 CONFORMITY WITH CONTRACT REQUIREMENTS

All work performed and all materials furnished shall be in conformity with the Contract requirements.

In the event the procurement officer finds the materials or the finished product in which the materials are used or the work performed are not in reasonably close conformity with the Contract requirements and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor.

In the event the procurement officer finds the materials or the finished product in which the materials are used are not in conformity with the Contract requirements but that acceptable work has been produced, the procurement officer shall then make a determination if the work shall be accepted. In this event, the procurement officer will document the basis of acceptance by a change order which will provide for an appropriate adjustment in the Contract price. Any action taken pursuant to this paragraph may not result in an increase of the Contract price.

GP-5.03 DISCREPANCIES IN THE CONTRACT DOCUMENTS

In the event the Contractor discovers any discrepancies in the Contract Documents, the Contractor shall immediately notify the procurement officer. The procurement officer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Contract. For governing order of Contract Documents, see TC-3.01.

GP-5.04 COOPERATION BY CONTRACTOR

The Contractor will keep available on the project site at all times one complete set of Contract Documents.

The Contractor shall give the work the constant attention necessary to facilitate the progress thereof, and shall cooperate with the procurement officer and inspectors in every way possible.

The Contractor shall assign to the Contract as the Contractor's agent, a competent superintendent capable of communicating in English and capable of reading and thoroughly understanding the Contract Documents and thoroughly experienced in the type of work being performed, who shall receive instructions from the procurement officer or authorized representatives. The superintendent shall have full authority to execute the order or directions of the procurement officer without delay, and to promptly supply such materials, equipment, tools, labor and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of work sublet. Said superintendent shall be on the project site at all times when the work is in progress.

GP-5.05 COOPERATION WITH UTILITIES

It is understood and agreed that the Contractor has considered in the Contractor's bid all of the permanent and temporary utility appurtenances in their present or relocated positions and that no additional compensation will be allowed for delays, inconvenience, or damage sustained by the Contractor due to any interference from the said utility appurtenances or the operation of moving them.

The Contractor shall have responsibility for notifying all affected utility companies prior to the necessity of performing any work on their utilities and shall cooperate with them in achieving the desired result. All damage to utility facilities caused by the Contractor's operations shall be the responsibility of the Contractor.

GP-5.06 COOPERATION BETWEEN CONTRACTORS

(a) Separate Contractors on adjoining or overlapping work shall cooperate with each other as necessary. Such cooperation shall include:

(1) Arrangement and conduct of work;

(2) Storage and disposal of materials, etc., by each in such manner as to not unnecessarily interfere with or hinder the progress of the work being performed by other Contractors. Contiguous work shall be joined in an acceptable manner.

(b) The Administration and Department shall have the right, at any time, to Contract for and perform other work on, near, over or under the work covered by this Contract. In addition, other work may be performed under the jurisdiction of another Administration or State agency. In such cases, when a dispute arises among Contractors, the procurement officer will decide which of the procurement officers will have

jurisdiction over said dispute. The Contractor shall cooperate fully with such other Contractors and carefully fit the Contractor's own work to such other work as may be directed by the procurement officer.

(c) The Contractor agrees that in the event of dispute as to cooperation the procurement officer will act as referee. The Contractor agrees to make no claims against the Administration for any inconvenience, delay or loss experienced by them because of the presence and operations of other Contractors.

GP-5.07 AUTHORITY AND DUTIES OF INSPECTORS

Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector is not authorized to revoke, alter or waive any requirements of the Contract, nor is the inspector authorized to approve or accept any portion of the complete project. The inspector is authorized to call the attention of the Contractor to any failure of the work or materials to conform to the Contract. The inspector shall have the authority to reject materials or suspend the work until any questions at issue can be referred to and decided by the procurement officer. Inspectors shall perform their duties at such times and in such manner as will not unnecessarily impede progress on the Contract.

The inspector shall in no case act as foreman or perform other duties for the Contractor, nor interfere with the management of the work by the latter. Any advice, instruction, direction or other order which the inspector may give the Contractor shall not be construed as binding the procurement officer in any way, or releasing the Contractor from fulfilling all of the terms of the Contract.

Where there is disagreement between the Contractor (or the Contractor's representative) and the inspector, such as refusal by the Contractor to use properly approved material, performing work not in compliance with Plans and Specifications, and/or refusing to suspend work until problems at issue can be referred to and decided by the procurement officer, the inspector will immediately direct the procurement officer's attention to the issues of disagreement. If the Contractor still refuses to make corrections, comply or suspend work, the procurement officer will prepare and deliver in writing to the Contractor, by mail or otherwise, a written order suspending the work and explaining the reason for such shutdown. As soon as the inspector is advised of the delivery of the shutdown order, the inspector shall immediately leave the site of the work and any work performed during the inspector's absence will not be accepted or paid for and may be required to be removed and disposed of at the Contractor's expense.

GP-5.08 INSPECTION OF WORK

All materials and each part or detail of the work shall be subject at all times to inspection by the procurement officer or authorized representative, and the Contractor will be held strictly to the materials, workmanship, and the diligent execution of the Contract. Such inspection may include mill, plant or shop inspection, and any material furnished under the Contract is subject to such inspection. The procurement officer, or representative, shall be allowed access to all parts of the

work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the procurement officer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standards required by the Contract. Should the work thus exposed or examined prove acceptable, adjustments in Contract time and price will be made pursuant to Section GP-4.06 for the uncovering or removing, and the replacing of the covering or making good of the parts removed. Should the work so exposed or examined prove unacceptable, the uncovering, or removing and replacing, shall be at the Contractor's expense.

When the United States Government or any railroad, corporation or other agency is to pay a portion of the cost of the work covered by this Contract, their respective representatives shall have the right to inspect the work.

GP-5.09 REMOVAL OF DEFECTIVE WORK

All work and materials which do not conform to the requirement of the Contract will be considered unacceptable, unless otherwise determined acceptable under the provisions in GP-5.02.

Any defective work, whether the result of poor workmanship, use of defective materials, damage through carelessness or any other cause, found to exist shall be removed and replaced by work and materials which shall conform to the Specifications or shall be remedied otherwise in an acceptable manner authorized by the procurement officer.

Upon failure on the part of the Contractor to comply promptly with any order of the procurement officer, made under the provisions of these General Provisions the procurement officer shall have authority to cause defective work to be remedied or removed and replaced and unauthorized work to be removed and to deduct the costs from any monies due or to become due the Contractor under this Contract.

GP-5.10 LOAD RESTRICTIONS

(a) The Contractor shall comply with all State and local requirements pertaining to speed, size and weight of motor vehicles.

(b) The Administration may indicate in the Contract load restrictions on any road or structure within the vicinity of the project.

(c) The Contractor shall take into account any and all posted bridges, the crossing of which might be contemplated by the work on the Contract. No loads in excess of posted limits will be allowed in the prosecution of the work on any Contract, unless the required permits are obtained from the appropriate State and local governmental agencies.

(d) The Contractor shall consider possible detrimental effects of operating heavy paving and grading equipment contiguous to retaining walls, pipe culverts, arches, forms for concrete work as well as construction existing prior to this Contract.

(e) The procurement officer shall have the right to limit passage of heavy equipment (plus loads) when such passage or usage is causing apparent or visible damage to embankments, paving, structures or any other property.

(f) Within the Baltimore City limits, the Department of Transit and Traffic of the City of Baltimore has jurisdiction for oversize and overweight vehicle movements. Permits are obtainable from the Transit and Traffic Department.

GP-5.11 MAINTENANCE OF WORK DURING CONSTRUCTION

(a) The Contractor shall maintain the work during construction and until acceptance. This maintenance shall constitute continuous and effective work prosecuted as required with adequate equipment and forces to the end that all parts of the work be kept in satisfactory condition at all times.

(b) Particular attention shall be given to drainage, both permanent and temporary. The Contractor shall use all reasonable precautionary measures to avoid damage or loss that might result from accumulations and concentrations of drainage water, and material carried by such water and such drainage shall be diverted or removed when necessary to prevent damage to excavation, embankments, surfacing, structures or property. Suitable measures shall be taken by the Contractor to prevent the erosion of soil in all construction areas where the existing ground cover has been removed.

(c) All cost of maintenance work during construction and before final acceptance shall be included in the price bid and the Contractor will not be paid additional amount for such work, except as otherwise provided.

(d) In the event that the Contractor's work is ordered shutdown for failure to comply with the provisions of the Contract, the Contractor shall maintain the entire project as provided herein, and provide such ingress and egress for local residents or tenants adjacent to the project site, for tenants of the project site, and for the general public as may be necessary during the period of suspended work or until the Contract has been declared in default.

(e) On projects where traffic flow is maintained, the Contractor shall be responsible for repair of all traffic damages to the work, either partially or totally completed, until such time as the work is accepted by the procurement officer. Responsible, as used here, shall mean the responsibility for restoration, and the cost thereof unless otherwise expressly provided for in the Special Provisions.

GP-5.12 FAILURE TO MAINTAIN ENTIRE PROJECT

On Administration Contracts GP-5.12 Failure to Maintain Entire Project does not apply; TC-4.02 shall apply.

Failure on the part of the Contractor, at any time, to comply with the provisions of GP-5.11, will result in the procurement officer's immediately notifying the Contractor to comply with the required maintenance provisions. In the event that the Contractor fails to remedy unsatisfactory maintenance within 24 hours after receipt of such notice, the procurement officer will immediately proceed with adequate forces and equipment to maintain the project, and the entire cost of this maintenance will be deducted from monies due the Contractor.

GP-5.13 ACCEPTANCE FOR MAINTENANCE

(a) Partial Acceptance for Maintenance. If at any time during the performance of the work the Contractor substantially completes a unit or portion of the work, the Contractor may request the procurement officer to make final inspection of that unit. If the procurement officer finds upon inspection that the unit has been satisfactorily completed in compliance with the Contract, the procurement officer may accept that unit as being completed and the Contractor may be relieved of further maintenance responsibility for that unit. Generally, partial acceptance for maintenance will only be considered when the Administration feels that such action is in the public interest. Such partial acceptance for maintenance shall in no way void or alter any of the terms of the Contract.

(b) Subcontractor Final Acceptance. Upon due notice from the contractor of presumptive completion of all responsibilities of a subcontractor, the procurement officer shall make a construction inspection and if at such inspection all construction provided for and contemplated by the Contract is found complete in regard to the assign duties of the subcontractor by the Contract and subcontractor agreement between the Contractor and subcontractor. Such inspection shall constitute the final subcontractor inspection and the procurement officer shall make the Subcontractor Acceptance for maintenance as of that date, and the Contractor shall be notified of such acceptance in writing. The Contractor will be responsible for providing a copy of the written acceptance to the Subcontractor. After acceptance for maintenance the Administration will assume responsibility for maintenance except where otherwise provided by the Contract and items that are identified as partial on the subcontractor agreement with the Contractor. Once the Subcontractor Accepted for Maintenance letter is issued that Subcontractor is relieved of their contractual obligations as of the date on said letter. For a subcontractor to work on a project after they have been issued a Subcontractor Final Acceptance letter, a new subcontractor agreement and subcontractor approval request must be resubmitted for work by that subcontractor to be performed after the date on the acceptance letter.

(c) Final Acceptance for Maintenance. Upon due notice from the Contractor of presumptive completion of the entire project, the procurement officer shall make a

construction inspection and if at such inspection all construction provided for and contemplated by the Contract is found completed, such inspection shall constitute the final inspection and the procurement officer shall make the acceptance for maintenance as of that date, and the Contractor shall be notified of such acceptance in writing. After acceptance for maintenance the Administration will assume responsibility for maintenance except where otherwise provided by the Contract.

(d) If, however, at any construction inspection any work in whole or in part is found unsatisfactory, the procurement officer shall give the Contractor the necessary instructions as to the work required for final completion and acceptance for maintenance. The Contractor forthwith shall comply with and execute such instructions. Upon completion of such work, another inspection shall be made which shall constitute the final inspection if the said work is found to have been completed satisfactorily. In such event, the procurement officer shall make the acceptance for maintenance and the Contractor shall be notified as aforesaid. After final acceptance for maintenance, the Administration will assume responsibility for maintenance except where otherwise provided by the Contract.

(e) Unless otherwise provided in this Contract, acceptance by the State shall be made as promptly as practicable after completion and inspection of all work required by this Contract, or that portion of the work that the procurement officer determines can be accepted separately. Acceptance shall be final and conclusive except as regards latent defects, fraud, such gross mistakes as may amount to fraud or the State's rights under any warranty or guarantee or any claims or counter claims reserved by the State.

GP-5.14 FILING OF CLAIM BY CONTRACTOR

Unless a shorter period is prescribed by law or elsewhere in this Contract,

(a) The Contractor shall file a written notice of claim for extension of time, equitable adjustment, extra compensation, damages, or any other matter (whether under or relating to this Contract) with the procurement officer within 30 days after the basis for the claim is known or should have been known, whichever is earlier.

(b) Contemporaneously with or within 90 days of the filing of a notice of a claim, but no later than the date that final payment is made, a Contractor shall submit the claim to the appropriate procurement officer. The claim shall be in writing and shall contain:

(1) An explanation of the claim, including reference to all Contract provisions upon which it is based;

(2) The amount of the claim;

(3) The facts upon which the claim is based;

(4) All pertinent data and correspondence that the Contractor relies upon to substantiate the claim; and

(5) A certification by a senior official, officer, or general partner of the Contractor or subcontractor, as applicable, that, to the best of the person's knowledge and belief, the claim is made in good faith, supporting data are accurate and complete, and the amount requested accurately reflects the Contract adjustment for which the person believes the Administration is liable.

(c) The claim shall also contain itemized supporting data for the elements of cost the Contractor claims to have incurred or it will incur. This data shall be in sufficient detail to permit analysis by the Administration of material, labor, equipment, subcontract and overhead costs as well as profit and shall include all work covered by the claim, whether deleted, added, or changed. Subcontract cost shall be supported by similar detailed data.

(d) A notice of claim or a claim that is not filed within the prescribed time shall be dismissed.

GP-5.15 DISPUTES

(a) This Contract is subject to the provisions of Title 15, Subtitle 2, State Finance and Procurement Article (Dispute Resolution) of the Annotated Code of Maryland and COMAR 21.10.

(b) Except as otherwise may be provided by law, all disputes arising under or as a result of a breach of this Contract that are not disposed of by mutual agreement shall be resolved in accordance with this clause.

(c) As used herein, claim means a written demand or assertion by one of the parties seeking, as a legal right, the payment of money, adjustment or interpretation of contract terms, or other relief, arising under or relating to this contract. A voucher, invoice, or request for payment that is not in dispute when submitted is not a claim under this clause. However, if the submission subsequently is not acted upon in a reasonable time, or is disputed as to liability or amount, it may be converted to a claim for the purpose of this clause.

(d) Within 30 days after contractor knows or should have known of the basis for a claim relating to this contract, contractor shall file a written notice of claim with the procurement officer.

(e) Contemporaneously with, or within 90 days after, the filing of a notice of claim, contractor shall submit the written claim to the procurement officer. If contractor so requests, the procurement officer, on conditions the procurement officer deems satisfactory to the unit, may extend the time in which contractor must submit the claim. An example of when a procurement officer may grant an extension includes situations

in which the procurement officer finds that a contemporaneous or timely cost quantification following the filing of the notice of claim is impossible or impractical.

(f) The claim shall set forth all the facts surrounding the controversy. Contractor, at the discretion of the procurement officer, may be afforded an opportunity to be heard and to offer evidence in support of the claim.

(g) The procurement officer shall mail or deliver written notification of the final decision within:

(1) 90 days after the procurement officer receives the claim if the claim is an amount for which the Appeals Board accelerated procedure, set forth in COMAR 21.10.06.12, may be used;

(2) 180 days after the procurement officer receives the claim for a claim not covered under g(1) of this clause; or

(3) A longer period that the procurement officer and contractor agree to in writing.

(h) The final decision may award a contract claim only for those expenses incurred not more than 30 days before contractor was initially required to have filed the notice of claim.

(i) The procurement officer's decision is the final action of the agency. If the procurement officer fails to render a final decision within the time required, contractor may deem the failure to be a final decision not to pay the claim.

(j) If the final decision grants the claim in part and denies the claim in part, the agency shall pay contractor the undisputed amount. Payment of the partial claim is not an admission of liability by the agency and does not preclude the agency from recovering the amount paid if a subsequent determination modifies the final decision.

(k) Contractor may file a written appeal with the Maryland State Board of Contract Appeals within 30 days of receipt of notice of the decision.

(l) Pending resolution of a claim, contractor shall proceed diligently with the performance of the contract in accordance with the procurement officer's decision.

GENERAL PROVISIONS

GP - SECTION 6: CONTROL OF MATERIAL

GP-6.01 GENERAL

All materials shall meet all quality requirements of the Contract. In order to expedite the inspection and testing of the materials, the Contractor shall notify the procurement officer in writing of the sources from which the Contractor proposes to obtain all materials requiring approval, testing, inspection, or certification prior to incorporation into the work as soon as possible after receipt of notification of award of the Contract.

GP-6.02 STORAGE AND HANDLING OF MATERIALS

Materials shall be so stored as to assure the preservation of their quality and acceptability for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the right of way or project site may be used for storage purposes and for the placing of the Contractor's plant and equipment; such storage areas must be restored to their original condition by the Contractor at the Contractor’s expense. Any additional space required must be provided by the Contractor at the Contractor’s expense.

Materials shall be handled in such a manner as to preserve their quality and acceptability for the work.

GP-6.03 UNACCEPTABLE MATERIALS

(a) Materials represented by samples taken and tested in accordance with the specified tests and failing to meet required values shall be considered to be defective regardless of prior tests or approvals.

(b) Unless otherwise allowed by the procurement officer as set forth below, defective materials shall be removed from the site with any tags, stamps or other markings implying conformance with Specifications removed or obliterated.

(c) Where defects can be corrected, the Contractor may propose such corrective action as the Contractor deems appropriate to the procurement officer. The procurement officer may approve the corrective action but in so doing does not assume responsibility for the success thereof. Retests will be made to determine the acceptability of the material after corrective measures have been taken. No person other than the procurement officer may change any provision of the Specifications or the Contract without written authorization.

(d) The cost of replacing, correcting and/or removal of defective material will be the responsibility of the Contractor.

(e) The cost of repairing or replacing other materials damaged by the installation, correction and/or removal of defective materials will be the responsibility of the Contractor.

GP-6.04 ADMINISTRATION FURNISHED MATERIAL

The Contractor shall furnish all materials required to complete the work, except those specified to be furnished by the Administration. Materials furnished by the Administration will be delivered or made available to the Contractor at the point or points specified in the Special Provisions. The cost of handling and placing all materials, after they are delivered to the Contractor, shall be considered as included in the Contract price for the item in connection with which they are used.

The Contractor shall be held responsible for all material delivered to the Contractor, and deductions will be made from any monies due to the Contractor to make good any shortages and deficiencies, from any cause whatsoever, and for any damage which may occur after such delivery, and for any demurrage charges.

In cases where materials are supplied by the Administration and incorporated in the Contract work by the Contractor, materials inspection and acceptance will not be prerequisite for acceptance of the final product as the product pertains to these items.

GENERAL PROVISIONS

GP - SECTION 7: LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

GP-7.01 COMPLIANCE WITH LAWS

The Contractor hereby represents and warrants that:

(a) It is qualified to do business in the State of Maryland and that it will take such action as, from time to time hereafter, may be necessary to remain so qualified;

(b) It is not in arrears with respect to the payment of any monies due and owing the State of Maryland, or any department or unit thereof, including, but not limited to, the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of this Contract;

(c) It shall comply with all Federal, State, and local laws, regulations, and ordinances applicable to its activities and obligations under this Contract, including the provisions of COMAR Title 21 that are applicable to construction Contracts and which are incorporated herein by reference; and

(d) All requirements set forth in Federal assistance instruments applicable to this Contract shall be satisfied. Therefore, to the extent that the requirements which are specified in the assistance instrument conflict with regulations adopted under COMAR Title 21, the former shall control.

GP-7.02 PERMITS AND LICENSES

(a) The Contractor shall procure at the Contractor's own expense such permits, licenses, insurance and governmental approval as may be necessary in order to comply with Federal, State, and local laws, ordinances, and regulations in performance of the work. The Contractor shall further give all notices necessary and incidental to the due and lawful prosecution of the work.

(b) Federal permits, from the U.S. Corps of Engineers, Environmental Protection Agency, and/or United States Coast Guard, for erection of structures in tidal waters will be obtained by the Administration and the Contractor shall comply with the requirements of such permits. Any required Federal permits, however, desired by the Contractor for temporary structures such as docks, piers, anchorages, etc., must be applied for and obtained by the Contractor.

GP-7.03 PATENTED DEVICES, MATERIALS, AND PROCESSES

If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the patentee or owner and a copy of such agreement shall be filed with the Administration; if no such agreement is made or filed as noted, the Contractor and the surety shall indemnify and save harmless the State, any affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, materials or process, or any trademark or copyright, and shall indemnify, protect and save harmless the State, its officers, agents and employees with respect to any claim, action, cost or judgement for patent, trademark or copyright infringement, arising out of purchase or use of materials, construction, supplies, equipment or services covered by this Contract.

GP-7.04 FEDERAL PARTICIPATION

When the United States Government pays all or any portion of the cost of a project, the work shall be subject to the inspection of the appropriate federal agency. Such inspection shall in no sense make the federal government a party to this Contract, and will not interfere, in any way, with the rights of either party hereunder.

GP-7.05 CONSTRUCTION SAFETY AND HEALTH STANDARDS

It is a condition of this Contract, and shall be made a condition of each subcontract entered into pursuant to this Contract, that the Contractor and any subcontractor shall not require any laborer or mechanic employed in performance of the Contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to the person's health or safety, as determined under construction safety and health standards and regulations (Title 29, Code of Federal Regulations, Part 1926, formerly Part 1518, as revised from time to time) promulgated by the United States Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standard Act, (83 Stat. 96) and under any construction safety and health standards and regulations promulgated by the Commissioner of Labor and Industry in accordance with the Maryland Occupational Safety and Health Act, of the Labor and Employment Article, Title 5 of the Annotated Code of Maryland (as the same may be amended from time to time).

The Contractor and each subcontractor shall permit inspection without delay and at any reasonable time on any premises where the work is being performed by a federal or state inspector authorized to investigate compliance with the above mentioned federal and state statutes and regulations.

The Contractor further agrees to correct any violations found to exist during such inspection within a reasonable time after the issuance of any citation, unless the Contractor contests the validity thereof through the appropriate administrative and judicial process.

GP-7.06 PUBLIC CONVENIENCE AND SAFETY

The Contractor at all times shall conduct the work in such a manner as to ensure the least practicable obstruction to all forms of traffic. The convenience of the general public, tenants, and of the residents along and/or adjacent to the improvement shall be provided for. Equipment and/or materials stored upon the project shall be placed so as to cause a minimum of obstruction to the public. Sprinkling shall be performed at the direction of the procurement officer. The Contractor shall, unless otherwise specified, provide and maintain in passable condition such temporary access, roads and bridges as may be necessary to accommodate traffic diverted from the project under construction, or using the project under construction and shall provide and maintain in a safe condition temporary approaches to, and crossings of the project. Existing Department facilities planned to be removed, but which might be of service to the public during construction are not to be disturbed until other and adequate provisions are made. Existing mailboxes shall be maintained or reset in positions accessible to the public and to mail deliveries during construction and subsequent to construction in their final locations in a satisfactory condition. On Department facilities occupied by railroad tracks, temporary platforms for the entrance and exit of passengers to and from the railway cars shall be provided and maintained in an approved manner by the Contractor. Fire hydrants on or adjacent to the project shall be kept accessible to fire apparatus at all times, and no material or obstruction shall be placed within 15 ft of any such hydrant. All footways, gutters, sewer inlets and portions of the project adjoining the work under construction shall not be obstructed more than is absolutely necessary. Work closed down for the winter or at any other times shall be left entirely accessible at all points to fire apparatus.

GP-7.07 DETOURS

Detours may be indicated in the Contract Documents, or at the Contractor's request traffic may be detoured over approved routes along existing roads when acceptable to the procurement officer. Detours over existing State roads will be designated, marked and maintained by the appropriate Administrations. All other detours will be the responsibility of the Contractor.

GP-7.08 BARRICADES AND WARNING SIGNS

The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs and other traffic control devices, and shall take all necessary precautions for the protection of the work and safety of the public. All highways and other Department facilities closed to vehicular traffic shall be protected by effective barricades, and obstructions shall be illuminated during hours of darkness with electric lights.

The Contractor shall erect warning signs in advance of any place on the project where operations may interfere with the use of the facility by vehicular traffic, and at all other points where the new work crosses or coincides with an existing roadway or traffic lane(s). Such warning signs shall be constructed and erected in accordance with the Manual on Uniform Traffic Control Devices, or as directed.

The Contractor shall furnish, erect and maintain warning and direction signs in the number required by the procurement officer and at locations designated by the procurement officer

throughout the limits of the project. For street and highway type traffic, the signs shall conform in every respect to the requirements of the Manual on Uniform Traffic Control Devices (MdMUTCD) for Streets and Highways. Signs must be freshly painted and adequately reflectorized before being placed on any project. No work may be performed or begun unless an adequate number of signs of the proper category are in place.

In cases where the Contractor's sequence of operations results in grade differentials which would be hazardous to vehicular traffic the Contractor shall, at the direction of the procurement officer provide suitable substantial traffic barriers to the extent determined by the procurement officer.

GP-7.09 FLAGGING OF MOTOR VEHICLE TRAFFIC

For all construction Contracts requiring the flagging of motor vehicles licensed for operation on the highways of Maryland, said flagging shall be conducted as specified in the Manual on Uniform Traffic Control Devices for Streets and Highways.

GP-7.10 MAINTENANCE OF TRAFFIC

Unless otherwise noted in the Special Provisions, it shall be the Contractor's responsibility to maintain pedestrian and vehicular traffic safely, adequately and continuously on all portions of existing facilities affected by the Contractor’s work. In addition to existing facilities undergoing improvement, this also applies to crossroads, approaches, crossovers, and entrances affected or made necessary by the Contractor’s work.

GP-7.11 PRESERVATION AND RESTORATION OF PROPERTY

(a) The Contractor shall not enter upon public or private property (outside of the right-of-way or project area) for any purpose without obtaining permission and the Contractor shall be responsible for the preservation of all public and private property, trees, monuments, signs and markers, and fences thereon, and shall use every precaution necessary to prevent damage or injury thereto. All Department signs and markers that are affected by the work shall be carefully removed when grading operations begin and delivered to the procurement officer. The Contractor shall take suitable precaution to prevent damage to underground or overhead public utility structures; shall protect carefully from disturbances or damages all land monuments and property marks until the procurement officer has referenced their location; and shall replace them as directed by the procurement officer.

(b) The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work, resulting from any act, omission, neglect or misconduct in the Contractor’s manner or method of executing said work, or at any time due to defective work or materials, and said responsibility shall not be released until the work shall have been completed and accepted. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work, or at consequence of the nonexecution thereof on the part of the Contractor, the Contractor shall restore, at

the Contractor's own expense, such property to a condition similar to, or equal to, that existing before such damage or injury, in an acceptable manner. In case of the failure on the part of the Contractor to restore such property or make good such damage or injury, the procurement officer may, upon 48 hours notice, proceed to repair, rebuild or otherwise restore such property as may be deemed necessary and the cost thereof will be deducted from any monies due or which may become due the Contractor under this Contract.

GP-7.12 LAND, AIR, AND WATER POLLUTION

(a) The Contractor shall incorporate all permanent erosion control features into the work at the earliest practicable time as required by the Contract Documents. Temporary pollution control measures will be used to correct conditions that develop during construction that were not foreseen during design; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

(b) The Contractor's attention is directed to the fact that temporary pollution control may include control measures outside the right of way or project site where such work is necessary as a direct result of project construction. The procurement officer shall be kept advised of all such off site control measures taken by the Contractor. This shall not relieve the Contractor of the basic responsibilities for such work.

(c) In case of failure on the part of the Contractor to control erosion, pollution or siltation, the procurement officer reserves the right to employ outside assistance or to use the procurement officer's own forces to provide the necessary corrective measures. All expenses incurred by the procurement officer in the performance of such duties for the Contractor shall be withheld from monies becoming due to the Contractor.

(d) Contractors and suppliers must submit evidence to the Administration that the governing Federal, State and local air pollution criteria will be met. This evidence and related documents will be retained by the Administration for on-site evaluation.

GP-7.13 RESPONSIBILITY FOR DAMAGE CLAIMS

(a) The Contractor shall indemnify and save harmless, and shall require that each subcontractor shall indemnify and save harmless the State and all of its representatives from all suits, actions, or claims of any character brought on account of any injuries or damages sustained by any person or property in consequence of any neglect in safeguarding the work or through the use of unacceptable materials in the construction of the improvement, or on account of any act or omission by the said Contractor or subcontractor, or as a result of faulty, inadequate or improper temporary drainage during construction, or on account of the use, misuse, storage or handling of explosives, or on account of any claims or amounts recovered for any infringement of patent, trademark, or copyright, or from any claims or amounts arising or recovered under the

Workmen's Compensation Laws, or any other State or local law, bylaw, ordinance, regulation, order or decree whether by itself or its employees or subcontractors. The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work resulting from any act, omission, neglect or misconduct, in the manner or method of executing said work satisfactorily or due to the nonexecution of said work or at any time due to defective work or materials and said responsibility shall continue until the improvement shall have been completed and accepted.

(b) The Contractor shall conduct its operations upon the right of way of any railroad company fully within the rules, regulations and requirements of the railroad company. The Contractor shall be responsible for acquainting itself with such requirements as the railroad company may demand.

(c) The Contractor shall be held responsible for any accidents that may happen to the railroad company as a result of its operations.

(d) The Contractor shall not be held responsible for any claims arising from accidents incurred because of any traffic and/or general use permitted during the time the project or any section thereof is open to traffic under the terms of GP-7.15 except from accidents which are attributable to the Contractor's negligence.

GP-7.14 LIABILITY INSURANCE

On Administration Contracts, in addition to GP-7.14 Liability Insurance, TC-5.01 Insurance shall apply.

Prior to the start of work on this Contract, the Contractor shall submit to the procurement officer a certificate of insurance indicating that the Contractor carries comprehensive general public liability and property damage insurance in the amounts specified elsewhere in the Contract. ***On Administration Contracts the Contractor shall submit to the procurement officer a certificate of insurance prior to the execution of the Contract.***

The Contractor may require each subcontractor to carry comprehensive general public liability and property damage insurance in amounts sufficient to cover the subcontractor's exposure under the Contract, and may require proof of coverage prior to the start of work on each subcontract.

GP-7.15 USE AND POSSESSION PRIOR TO COMPLETION

On Administration Contracts in addition to GP-7.15 Use and Possession Prior to Completion, TC-4.03 Use and Possession Prior to Completion shall apply.

The Administration shall have the right to take possession of or use any completed or partially completed part of the work. Such possession of or use shall not be deemed an acceptance of any work not completed in accordance with the Contract. While the Administration is in such possession, the Contractor shall be relieved of the responsibility for loss or damage to that portion

of the work in possession of the Administration, other than that resulting from the Contractor's fault or negligence. If such prior possession or use by the Administration delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment in the Contract price or the time of completion will be made and the Contract shall be modified in writing accordingly.

GP-7.16 CONTRACTOR'S RESPONSIBILITY FOR WORK

(a) Except as herein elsewhere provided, until final acceptance of the work by the Administration, the Contractor shall have the charge and care thereof and shall take every reasonable precaution against injury or damage to any part thereof by the action of the elements, or from any other cause, whether rising from the execution or from the nonexecution of the work. The Contractor, except as herein elsewhere provided, shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof. Material lost or structures damaged as a result of faulty temporary drainage during construction or the action of the elements shall be replaced or repaired by the Contractor at no cost to the Administration. The Contractor shall make good or replace at the Contractor’s own expense and as required any Administration furnished material which may be broken, lost through fire, theft, or otherwise damaged, or in any way made useless for the purpose and use intended subsequent to delivery to the Contractor by the Administration and prior to final acceptance of the work even though such breakage, damage, loss or uselessness may result from causes beyond the control of the Contractor.

(b) In case of suspension of work for any cause whatever, the Contractor shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the work, provide for normal drainage and shall erect any necessary temporary structures, signs, or other facilities at the Contractor’s expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under this Contract, and shall take adequate precautions to protect new growth and other important vegetative growth against injury.

GP-7.17 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES

At points where the Contractor's operations are adjacent to properties of railway, telegraph, telephone, and power companies, or are adjacent to other property, damage to which might result in expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made by the Contractor.

The Contractor shall cooperate with the owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a

reasonable manner, that duplication or rearrangement work may be reduced to a minimum and that services rendered by those parties will not be unnecessarily interrupted.

In the event of interruption to utility services as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with the said authority in the restoration of service. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority.

GP-7.18 PERSONAL LIABILITY OF PUBLIC OFFICIALS

In carrying out any of the provisions of the Contract, or in exercising any power or authority granted to them by or within the scope of the Contract, there shall be no liability upon the Administrator, procurement officer or other authorized representatives, either personally or as officials of the State, it being understood that in all such matters they act solely as agents and representatives of the State.

GP-7.19 NO WAIVER OF LEGAL RIGHTS

The Administration shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefore, from showing the true amount and character of the work performed and materials furnished by the Contractor, nor from showing that any such measurement, estimate or certificate is untrue or is incorrectly made, nor from showing that the work or materials do not in fact conform to the Contract. The Administration shall not be precluded or estopped, notwithstanding any such measurement, estimate or certificate and payment in accordance therewith, from recovering from the Contractor or the Contractor's sureties, or both, such damage as it may sustain by reason of the Contractor's failure to comply with the terms of the Contract. Neither the acceptance by the Administration, or any representative of the Administration, nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Administration, shall operate as a waiver of any portion of the Contract or of any power herein reserved, or of any right to damages.

The waiver of any breach of the Contract shall not be held to be a waiver of any other or subsequent breach.

GP-7.20 NONDISCRIMINATION IN EMPLOYMENT

(a) Compliance with State Law and Regulations.

(1) State Law.

The Contractor agrees:

(a) Not to discriminate in any manner against an employee or applicant for employment because of race, color, religion, creed, age, sex, sexual orientation, gender identification, marital status, national origin,

ancestry genetic information or any otherwise unlawful use of characteristics, or disability of a qualified individual with a disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or the individual's refusal to submit to a genetic test or make available the results of a genetic test;

(b) To include a provision similar to that contained in subsection (a), above, in any subcontract except a subcontract for standard commercial supplies or raw materials; and

(c) To post and to cause subcontractors to post in conspicuous places available to employees and applicants for employment, notices setting forth the substance of this clause.

(2) Sanctions for Noncompliance.

In the event of the Contractor's noncompliance with the nondiscrimination provisions of this Agreement, the Department shall impose such sanctions as it may determine to be appropriate, including but not limited to:

(a) Withholding of payment to the Contractor under the agreement until the Contractor complies, and/or

(b) Cancellation, termination or suspension of the Agreement in whole or in part.

(b) Compliance with Federal Law.

Contractors providing materials, equipment, supplies, or services to the State under this Contract herewith assure the State that they are conforming to the provisions of the Civil Rights Act of 1964 and Section 202 of Executive Order 11246 of the President of the United States of America as amended by Executive Order 11375, as applicable.

The Contractor shall comply with all applicable Federal laws pertaining to nondiscrimination in employment.

GP-7.21 SANCTIONS UPON IMPROPER ACTS

In the event the Contractor, or any of its officers, partners, principals or employees, is convicted of a crime arising out of, or in connection with, the procurement of work to be done or payment to be made under this Contract, the Contract may, in the discretion of the Department, be terminated for default under GP-8.08.

Section 16-203 of the State Finance and Procurement Article of the Annotated Code, and COMAR 21.08.01, which relate to Contracts with persons convicted of bribery, attempted bribery or conspiracy to bribe are incorporated in this Contract by reference.

Section 11-205 of the State Finance and Procurement Article and COMAR 21.08.03 relating to collusion for purposes of defrauding the State are incorporated into this Contract by reference.

Section 16-101 of the State Finance and Procurement Article and COMAR 21.08.04 relating to debarment for offenses other than bribery are incorporated into this Contract by reference.

GP-7.22 NONHIRING OF EMPLOYEES

No official or employee of the State of Maryland, as defined under General Provisions Article, §5- 101, Annotated Code of Maryland, whose duties as such official or employee include matters relating to or affecting the subject matter of this contract, shall during the pendency and term of this contract and while serving as an official or employee of the State become or be an employee of the contractor or any entity that is a subcontractor on this contract.

GP-7.23 CHOICE OF LAW

The Parties hereby agree that:

(a) This Contract was made and entered into in Maryland, and under the laws of Maryland.

(b) The law of Maryland shall govern the resolution of any issue arising in connection with this Contract, including, but not limited to, all questions concerning the validity of this Contract; the capacity of the parties to enter therein; any modification or amendment thereto; and the rights and obligations of the parties hereunder.

GP-7.24 CONTINGENT FEE PROHIBITION

(a) The Contractor warrants that it has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee or agent working for the Contractor, to solicit or secure this Contract, and that it has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee or agent, any fee or any other consideration contingent on the making of this Contract.

(b) For breach or violation of this warranty, the Administration shall have the right to terminate this Agreement without liability, or, in its discretion, to deduct from the Contract price or consideration, or otherwise recover, the full amount of such fee, commission, percentage, brokerage fee, gift or contingent fee.

GP-7.25 MULTI-YEAR CONTRACTS CONTINGENT UPON APPROPRIATIONS

If the General Assembly fails to appropriate funds or if funds are not otherwise made available for continued performance for any fiscal period of this Contract succeeding the first fiscal period, this Contract shall be canceled automatically as of the beginning of the fiscal year for which funds were not appropriated or otherwise made available; provided, however, that this will not affect

either the State's rights or the Contractor's rights under any termination clause in this Contract. The effect of termination of the Contract hereunder will be to discharge both the Contractor and the State from future performance of the Contract, but not from their rights and obligations existing at the time of termination. The Contractor shall be reimbursed for the reasonable value of any nonrecurring costs incurred but not amortized in the price of the Contract. The State shall notify the Contractor as soon as it has knowledge that funds may not be available for the continuation of this Contract for each succeeding fiscal period beyond the first.

GP-7.26 COST AND PRICE CERTIFICATION

(a) The Contractor by submitting cost or price information certifies that, to the best of its knowledge, the information submitted is accurate, complete, and current as of a mutually determined specified date prior to the conclusion of any price discussions or negotiations for:

(1) A negotiated Contract, if the total Contract price is expected to exceed $100,000 or a smaller amount set by the procurement officer.

(2) A change order or Contract modification, expected to exceed $100,000 or a smaller amount set by the procurement officer.

(b) The price under this Contract and any change order or modification hereunder, including profit or fee, shall be adjusted to exclude any significant price increase occurring because the Contractor furnished cost or price information which, as of the date agreed upon between the parties, was inaccurate, incomplete, or not current.

GP-7.27 CORPORATE REGISTRATION AND TAX PAYMENT CERTIFICATION

Corporations are required to execute a certification of corporation registration and tax payment in the form included in the Contract Documents.

GP-7.28 BUY AMERICAN STEEL ACT

The Provisions of COMAR 21.11.02 pertaining to implementation of the "Buy American Steel" Act (Subtitle 3 of Title 17 of the State Finance and Procurement Article of the Annotated Code of Maryland) are incorporated in this Contract by reference.

GP-7.29 MINORITY BUSINESS ENTERPRISE AND AFFIRMATIVE ACTION

(a) This Contract is subject to Executive Order 01.01.170.15, December 9, 1970; amended by Order 01.01.1976.05, July 9, 1976 (Code of Fair Practices), and COMAR 21.11.04 Contractor's Affirmative Action Plan Review/Approval and Compliance Monitoring Process DOT. This Contract is also subject to the applicable provisions of Title 14,

Subtitle 3 of the State Finance and Procurement Article of the Annotated Code of Maryland; COMAR 21.11.03 Minority Business Enterprise Policies; and provisions of COMAR 11.01.10 which incorporate by reference the current revision of the Minority Business Enterprise Program. Copies of the Minority Business Enterprise Program may be obtained from the Department of Transportation Office of Minority Business Enterprise, P.O. Box 8755, BWI Airport, Maryland 21240. This Contract is also subject to all applicable Federal and State laws and regulations pertaining to Minority Business Enterprise and Affirmative Action.

(b) To the extent any of the above laws or regulations are applicable to this Contract they are specifically incorporated herein.

(c) Third Tier Contracting. Two conditions must be met before an Administration may approve a third tier contracting arrangement which may be entered into to meet an MBE goal.

(1) The Administration awarding the Contract must be satisfied that there is no way except by third tier contracting that an MBE goal can be achieved; and

(2) The Contractor must request from the Administration in writing, prior to the award of the Contract, that approval be granted for each third tier Contract arrangement. The request must contain specifics as to why a third tier contracting arrangement should be approved.

An Administration approving a third tier Contract should do so in writing, setting forth the parameters of the Contract. All records of the Contract will be maintained by the Administration granting approval.

Third tier contracting to meet an MBE goal is to be considered the exception and not the rule.

GP-7.30 PREVAILING WAGE CONTRACTS FOR PUBLIC WORKS

(a) The Provisions of Subtitle 2 of Title 17 of the State Finance and Procurement article of the Annotated Code of Maryland and COMAR 21.11.11 pertaining to Prevailing Wage for Public Works are incorporated in construction Contracts of $500,000 or more by reference.

(b) When all or a portion of the cost of a project is funded by the U.S. Government, and the cost of the project exceeds $2,000, the minimum wage rates and benefits paid to workmen under the Contract shall be those prevailing in the locality as predetermined by the Secretary of Labor pursuant to the Davis Bacon Act (40 USC 276a to a-7) and Regulations (29 CFR, Part 5) promulgated thereunder. Davis Bacon rates applicable to this agreement, if any, are specified elsewhere in the Contract Document.

GP-7.31 SMALL BUSINESS PROCUREMENTS

If the solicitation for bid indicates that this procurement has been designated for small business preferences, the appropriate provisions of COMAR 21.11.01 pertaining to small business preferences shall apply and are incorporated herein by reference.

GP-7.32 FINANCIAL DISCLOSURE

The Contractor shall comply with Election Law Article, Title 14 (§§14-101—14-108) Annotated Code of Maryland, which requires that every person that enters into a single contract with the State, a unit of the State, a county, a municipal corporation, or other political subdivision of the State, in which the cumulative consideration is at least $200,000, shall file the following reports and statements.

Within 15 business days after the award of the contract, a Registration Statement shall be filed with the State Board of Elections that includes:

(a) The person's name and address;

(b) Any resident agent of the Contractor business located in the State;

(c) If known, each person who has a beneficial ownership of the Contractor business entity; and

(d) Any other information required by the State Board of Elections. Beneficial ownership means:

(i) Any ownership interest of 5 percent or more in a business;

(ii) Any ownership interest of 5 percent or more in one or more entities in a chain of parent and subsidiary entities, any one of which participates in at least 5 percent of the capital or profits of a business; or

(iii) Possession of an interest that exists under a contract, a relationship, an understanding, or any other arrangement and entitles a person to benefits substantially equivalent to an ownership interest of 5 percent or more of a business.

GP-7.33 POLITICAL CONTRIBUTION DISCLOSURE

The Contractor shall comply with Election Law Article, Title 14 (§§14-101—14-108) Annotated Code of Maryland, which requires that within 15 business days after filing the Registration Statement required by GP-7.32, the Contractor shall also file with the State Board of Elections an Initial Contribution Statement covering the preceding 24 months disclosing:

(a) The name of each candidate, if any, to whom one or more applicable contributions in a cumulative amount of $500 or more were made during the reporting period;

(b) The office sought by each candidate named in item (a) of this paragraph;

(c) The amount of aggregate contributions made to each candidate named in item (a) of this paragraph;

(d) The name of each unit of a governmental entity with which the person had a single contract involving cumulative consideration of at least $200,000 during the reporting period;

(e) The nature and amount of public business done with each unit of a governmental entity in item (d) of this paragraph; and

(f) If the public business was done or the contribution was made by another person but is attributed to the person filing the statement, the name of the person who did the public business or made the contribution and the relationship of that person to the person filing the statement.

Throughout the contract term the Contractor shall file a Semi-annual Statement with the State Board of Elections containing the information required for the Initial Contribution Statement on or before:

(a) May 31, to cover the six (6) month period ending April 30; and

(b) November 30, to cover the six (6) month period ending October 31.

Additional information is available on the State Board of Elections Website: http://www.elections.state.md.us/campaign_finance/index.html.

GP-7.34 CONFLICT OF INTEREST LAW

It is unlawful for any State officer, employee, or agent to participate personally in an official capacity through decision, approval, disapproval, recommendation, advice, or investigation in any Contract or other matter in which the person, the person's spouse, parent, child, brother, or sister has a financial interest or to which any firm, corporation, association, or other organization in which the person has a financial interest or in which the person is serving as an officer, director, trustee, partner, or employee is a party, or to which any person or organization with whom the person is negotiating or has any arrangement concerning prospective employment, is a party, unless such officer, employee, or agent has previously complied with the provisions of General Provisions Article, Title 5 of the Annotated Code of Maryland.

The Contractor shall comply with the provisions of State Finance and Procurement Article, §13-212.1, Annotated Code of Maryland and COMAR 21.05.08.08.

GP-7.35 PRE-EXISTING REGULATIONS

In accordance with the provisions of Section 11-206 of the State Finance and Procurement Article, Annotated Code of Maryland, the regulations set forth in Title 21 of the Code of Maryland Regulations (COMAR Title 21) in effect on the date of execution of this Contract are applicable to this Contract.

GP-7.36 RETENTION OF RECORDS

(a) The Contractor shall retain and maintain all records and documents, including, but not limited to, cost or pricing data, relating to this Contract for three years after final payment by the State hereunder or any applicable statute of limitations, whichever is longer, and shall make them available for inspection and audit by authorized representatives of the State, including the procurement officer or designee at all reasonable times.

(b) The Contractor shall include the provisions of paragraph (a) in every subcontract.

GENERAL PROVISIONS

GP - SECTION 8: PROSECUTION AND PROGRESS

GP-8.01 SUBCONTRACTING

On Administration Contracts, in addition to the provisions of GP-8.01 Subcontracting, TC-5.03 Subcontracting and Subcontractors and TC-7.05 Progress Payments shall apply.

Except as may be provided elsewhere in the Contract, the Contractor to whom a Contract is awarded shall perform with its own organization and with the assistance of workmen under the Contractor's immediate supervision, work of a value of not less than 50 percent of the total original value of the Contract.

No portion of the Contract shall be subcontracted, assigned, or otherwise disposed of except with the written consent of the procurement officer. Any assignment, subcontract, or other disposition of all or part of this Contract without the express written consent of the procurement officer shall be null and void. Consent to subcontract, assign, or otherwise dispose of any portion of the Contract shall not be construed to relieve the Contractor or surety of any responsibility for the fulfilling of all the requirements of the Contract.

Prompt Payment of Subcontractors and Suppliers. This Contract and all subcontracts issued under this Contract at any tier are subject to the provisions of State Finance and Procurement Article, §15-226, Annotated Code of Maryland, and COMAR 21.10.08, in its entirety. The terms "undisputed amount", "prime contractor", "contractor", "subcontractor", and "supplier" have the meanings stated in COMAR 21.10.08.01. A contractor shall promptly pay its subcontractors or suppliers any undisputed amount to which they are entitled for work performed under a State procurement contract. If a contractor fails to make payment within the period prescribed in COMAR 21.10.08.03A, a subcontractor or supplier may request a remedy in accordance with COMAR 21.10.08. A contractor shall include in its subcontracts at any tier for work under this contract language that incorporates the provisions, duties, and obligations of §§A—D, State Finance and Procurement Article, §15-226, Annotated Code of Maryland, and COMAR 21.10.08.

The Contractor shall incorporate by reference or otherwise include these General Provisions in every subcontract issued pursuant to or under this Contract, and shall require that the same reference or inclusion be contained in every subcontract entered into by any of its subcontractors.

GP-8.02 NOTICE TO PROCEED

On Administration Contracts, in addition to GP-8.02 Notice To Proceed, TC-5.02 Notice to Proceed and Project Schedule shall apply.

After the Contract has been executed, the Administration will, within the time limit specified by the Administration elsewhere in the Contract Documents, issue to the Contractor a "Notice to

Proceed" and this notice will stipulate when the Contractor is expected to begin work. The specified Contract time shall begin on the date stipulated in the Notice to Proceed or, if an earlier start is authorized in the Notice to Proceed, on the day work (other than the erection of the inspection office, construction stakeouts and mobilization) actually starts. Work done prior to receipt of the Notice to Proceed is unauthorized and will not be measured or paid for.

GP-8.03 PROSECUTION OF THE WORK

(a) The Contractor shall begin work promptly within the time specified by the procurement officer and shall notify the procurement officer at least 48 hours before starting work.

(b) After the work has been started, it shall be prosecuted continuously on all acceptable working days without stoppage until the entire Contract is complete.

(c) Should the prosecution of the work for any reason be discontinued, the Contractor shall notify the procurement officer of its intention to stop and shall also notify the procurement officer at least 24 hours in advance of resuming operations. Said notification shall be confirmed in writing.

GP-8.04 PROGRESS SCHEDULE

(a) Within 30 days after Notice to Proceed, the Contractor shall furnish the procurement officer a "Progress Schedule" showing the proposed order of work and indicating the time required for the completion of the work. Said progress schedule shall be used to establish major construction operations and to check on the progress of the work. The Contractor shall submit revised progress schedules as directed by the procurement officer. ***On Administration Contracts, the Progress Schedule shall be submitted in conformance with TC-5.02 Notice to Proceed and Project Schedule.***

(b) If the Contractor fails to submit the progress schedule within the time prescribed, or the revised schedule within the requested time, the procurement officer may withhold approval of progress payment estimates until such time as the Contractor submits the required progress schedules or may terminate the Contract for default.

(c) If, in the opinion of the procurement officer, the Contractor falls significantly behind the approved progress schedule, the Contractor shall take any and all steps necessary to improve its progress. This may require the Contractor to increase the number of shifts, initiate or increase overtime operations, increase days of work in the work week, or increase the amount of construction plants, or all of them. The procurement officer may also require the Contractor to submit for approval supplemental progress schedules detailing the specific operational changes to be instituted to regain the approved schedule, all without additional cost to the Administration.

(d) Failure of the Contractor to comply with the requirements of the procurement officer under this provision shall be grounds for determination by the procurement officer that the Contractor is not prosecuting the work with such diligence as will ensure

completion within the time specified. Upon such determination, the procurement officer may terminate the Contractor's right to proceed with the work, or any separable part thereof, in accordance with GP-8.08 of these General Provisions.

GP-8.05 LIMITATIONS OF OPERATION

The Contractor shall conduct the work at all times in such a manner and in such sequence as will assure the least interference with the public.

GP-8.06 CHARACTER OF WORKMEN, METHODS, AND EQUIPMENT

The Contractor shall employ sufficient labor and equipment for prosecuting the several classes of work to full completion in the manner and time required by the Contract.

Workmen must have sufficient skill and experience to perform properly the work assigned to them. All workmen engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform all work properly and satisfactorily.

Any person employed by the Contractor or by any subcontractor who, in the opinion of the procurement officer, does not perform work in a proper manner or is intemperate or disorderly shall, at the written request of the procurement officer, be removed forthwith by the Contractor or subcontractor employing such foreman or workman, and shall not be employed again in any portion of the work without the approval of the procurement officer.

Should the Contractor fail to remove such person or persons as required above, or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the procurement officer may withhold estimates which are or may become due on the Contract until a satisfactory understanding has been reached.

Equipment to be used on the work shall meet the requirements of the work and produce a satisfactory quality of work. The procurement officer may order the removal and require replacement of any unsatisfactory equipment.

When the methods and equipment to be used by the Contractor in accomplishing the construction are not prescribed in the Contract, the Contractor is free to use any methods or equipment that the Contractor demonstrates to the satisfaction of the procurement officer will accomplish the Contract work in conformity with the requirements of the Contract.

When the Contract specifies that the construction be performed by the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the procurement officer in writing. If the Contractor desires to use a method or type of equipment other than those specified in the Contract, he may request authority from the procurement officer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed to be used and an explanation of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing construction work in conformity with Contract requirements. If, after trial use of the

substituted methods or equipment, the procurement officer determines that the work produced does not meet Contract requirements, the Contractor shall discontinue the use of the substituted method or equipment and shall complete the remaining construction with the specified methods and equipment. The Contractor shall remove the deficient work and replace it with work of specified quality, or take such other corrective action as the procurement officer may direct. No change will be made in basis of payment for the construction items involved nor in Contract time as the result of authorizing a change in methods or equipment under these provisions.

GP-8.07 SUSPENSION OF WORK

On Administration Contracts, in addition to GP 8.07 Suspension of Work, TC-4.04 Suspension of Work shall apply.

(a) The procurement officer unilaterally may order the Contractor in writing to suspend, delay, or interrupt all or any part of the work for a period of time as the procurement officer may determine to be appropriate for the convenience of the State.

(b) If the performance of all or any part of the work is for an unreasonable period of time, suspended, delayed, or interrupted by an act of the procurement officer in the administration of this Contract, or by the procurement officer's failure to act within the time specified in this Contract (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this Contract (excluding profit) necessarily caused by an unreasonable suspension, delay, or interruption and the Contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent (1) that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor; or (2) for which an equitable adjustment is provided for or excluded under any other provisions of this Contract.

(c) No claim under this clause shall be allowed:

(1) For any costs incurred more than 20 days before the Contractor shall have notified the procurement officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order); and,

(2) Unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of a suspension, delay, or interruption, but not later than the date of final payment under the Contract.

GP-8.08 TERMINATION FOR DEFAULT-DAMAGES FOR DELAY-TIME EXTENSIONS

(a) If the Contractor refuses or fails to prosecute the work, or any separable part thereof, with such diligence as shall ensure its completion within the time specified in this

Contract, or any extension thereof, fails to complete said work within this time, or fails to provide any required annual and renewable bond 30 days prior to expiration of the current bond then in effect, the State may, by written notice to the Contractor, terminate the Contractor's right to proceed with the work or the part of the work as to which there has been delay. In this event the State may take over the work and prosecute the same to completion, by Contract or otherwise, and may take possession of and utilize in completing the work the materials, appliances, and plant as may be on the site of the work and necessary therefore. Whether or not the Contractor's right to proceed with the work is terminated, the Contractor and its sureties shall be liable for any damage to the State resulting from the Contractor's refusal or failure to complete the work within the specified time.

(b) If fixed and agreed liquidated damages are provided in the Contract and if the State so terminates the Contractor's right to proceed, the resulting damage shall consist of such liquidated damages until a reasonable time as may be required for final completion of the work together with any increased costs occasioned the State in completing the work.

(c) If fixed and agreed liquidated damages are provided in the Contract and if the State does not so terminate the Contractor's right to proceed, the resulting damage shall consist of these liquidated damages until the work is completed or accepted.

(d) The Contractor's right to proceed may not be so terminated nor the Contractor charged with resulting damages if:

(1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the State in either its sovereign or contractual capacity, acts of another Contractor in the performance of a Contract with the State, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of either the Contractor or the subcontractors or suppliers; and,

(2) The Contractor, within 10 days from the beginning of any such delay (unless the procurement officer grants a further period of time before the date of final payment under the Contract), notifies the procurement officer in writing of the causes of delay. The procurement officer shall ascertain the facts and the extent of the delay and extend the time for completing the work when, in the procurement officer's judgement, the findings of fact justify such an extension, and the procurement officer's findings of fact shall be final and conclusive on the parties, subject only to appeal as provided in the "Disputes" clause of this Contract.

(e) If, after notice of termination of the Contractor's right to proceed under the provisions of this clause, it is determined for any reason that the Contractor was not in default

under the provisions of this clause, or that the delay was excusable under the provisions of this clause, the rights and obligations of the parties shall, if the Contract contains a clause providing for termination for convenience of the State, be the same as if the notice of termination had been issued pursuant to the clause. If, in the foregoing circumstances, this Contract does not contain a clause providing for termination for convenience of the State, the Contract shall be equitably adjusted to compensate for the termination and the Contract modified accordingly; failure to agree to any such adjustment shall be a dispute concerning a question of fact within the meaning of the clause of this Contract entitled "Disputes."

(f) The rights and remedies of the State provided in this clause are in addition to any other rights and remedies provided by law or under this Contract.

(g) As used in paragraph (d)(1) of this clause, the term "subcontractors or suppliers" means subcontractors or suppliers at any tier.

GP-8.09 LIQUIDATED DAMAGES

Time is an essential element of the Contract and it is important that the work be vigorously prosecuted until completion.

For each day that any work shall remain uncompleted beyond the time specified elsewhere in the Contract, the Contractor shall be liable for liquidated damages in the amount provided for in the solicitation, provided, however, that due account shall be taken of any adjustment of specified completion time for completion of work as granted by approved change orders.

GP-8.10 TERMINATION FOR CONVENIENCE OF THE STATE

(a) The performance of work under this Contract may be terminated by the State in accordance with this clause in whole, or from time to time in part, whenever the procurement officer shall determine that such termination is in the best interest of the State. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which performance of work under the Contract is terminated, and the date upon which such termination becomes effective.

(b) After receipt of a Notice of Termination, and except as otherwise directed by the procurement officer, the Contractor shall:

(1) Stop work under the Contract on the date and to the extent specified in the Notice of Termination;

(2) Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of the portion of the work under the Contract as is not terminated;

(3) Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by Notice of Termination;

(4) Assign to the State in the manner, at the times, and to the extent directed by the procurement officer, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated, in which case the State shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

(5) Settle all outstanding liabilities and all claims arising out of the termination of orders and subcontracts, with the approval or ratification of the procurement officer, to the extent the procurement officer may require, which approval or ratification shall be final for all the purposes of this clause;

(6) Transfer title and deliver to the State, in the manner, at the times and to the extent, if any, directed by the procurement officer, (a) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in connection with the performance of the work terminated by the Notice of Termination, and (b) the completed or partially completed plans, drawings, information, and other property which, if the Contract had been completed, would have been required to be furnished to the State;

(7) Use the Contractor's best effort to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the procurement officer, any property of the types referred to in (6) above; provided, however, that the Contractor (a) shall not be required to extend credit to any purchaser, and (b) may acquire any such property under the conditions prescribed by and at a price or prices approved by the procurement officer; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the State to the Contractor under this Contract or shall otherwise be credited to the price or cost of the work covered by this Contract or paid in such other manner as the procurement officer may direct;

(8) Complete performance of such part of the work as may not have been terminated by the Notice of Termination; and

(9) Take such action as may be necessary, or as the procurement officer may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the State has or may acquire an interest. The Contractor may submit to the procurement officer a list, certified as to quantity and quality, of any or all items of termination inventory not previously disposed of, exclusive of items the disposition of which has been directed or authorized by the procurement officer, and may request the State to remove such items or enter into a storage agreement covering them. Not later than 15 days thereafter, the State shall accept title to such items and remove

them or enter into a storage agreement covering the same; provided, that the list submitted shall be subject to verification by the procurement officer upon removal of the items, or if the items are stored, within 45 days from the date of submission of the list, and any necessary adjustment to correct the list as submitted shall be made prior to final settlement.

(c) After receipt of a Notice of Termination, the Contractor shall submit to the procurement officer the Contractor's termination Claim, in the form and with certification prescribed by the procurement officer. Such claim shall be submitted promptly but in no event later than one year from the effective date of termination, unless one or more extensions in writing are granted by the procurement officer, upon request of the Contractor made in writing within the one year period or authorized extension thereof. However, if the procurement officer determines that the facts justify such action, the procurement officer may receive and act upon any such termination claim at any time after the one year period or any extension thereof. Upon failure of the Contractor to submit its termination claim within the time allowed, the procurement officer may determine, on the basis information available to the procurement officer, the amount, if any, due to the Contractor by reason of the termination and shall thereupon pay to the Contractor the amount so determined.

(d) Subject to the provisions of paragraph (c), the Contractor and the procurement officer may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of work pursuant to this clause, which amount or amounts may include a reasonable allowance for profit on work done; provided, that such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total Contract price as reduced by the amount of payments otherwise made and as further reduced by the Contract price of work not terminated. The Contract shall be amended accordingly, and the Contractor shall be paid the agreed amount. Nothing in paragraph (e) of this clause, prescribing the amount to be paid to the Contractor in the event of failure of the Contractor and the procurement officer to agree upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts which may be agreed upon to be paid to the Contractor pursuant to this paragraph.

(e) In the event of the failure of the Contractor and the procurement officer to agree as provided in paragraph (d), upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, the procurement officer shall pay to the Contractor the amounts determined by the procurement officer as follows, but without duplication of any amounts agreed upon in accordance with paragraph (d):

(1) With respect to all Contract work performed before the effective date of the Notice of Termination, the total (without duplication of any items) of:

(a) The cost of the work;

(b) The cost of settling and paying claims arising out of the termination of work under subcontracts or orders, as provided in paragraph (b)(5) above, exclusive of amounts paid or payable on account of supplies or materials delivered or services furnished by subcontractors before the effective date of the Notice of Termination of Work under this Contract, which amounts shall be included in the cost on account of which payment is made under (a) above; and

(c) A sum, as profit on (a) above, determined by the procurement officer to be fair and reasonable; provided, however, that if it appears that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed under this subdivision (c) and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

(2) The reasonable cost of the preservation and protection of property, incurred pursuant to paragraph (b)(9) above, and any other reasonable cost incidental to termination of work under this Contract, including expense incidental to the determination of the amount due to the Contractor as the result of the termination of work under this Contract.

The total sum to be paid to the Contractor under (1) and (2) of this paragraph shall not exceed the total Contract price as reduced by the amount of payments otherwise made and as further reduced by the Contract price of work not terminated. Except for normal spoilage, and except to the extent that the State shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor as provided in (e)(1) above, the fair value, as determined by the procurement officer, of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to the State or to a buyer pursuant to paragraph (b)(7).

(f) Costs claimed, agreed to, or determined pursuant to (c), (d), (e) and (i) hereof shall be in accordance with COMAR 21.09 (Contract Cost Principles and Procedures) as in effect on the date of this Contract.

(g) The Contractor shall have the right of appeal, under the clause of this Contract entitled "Disputes", from any determination made by the procurement officer under paragraphs (c), (e), or (i) hereof, except that if the Contractor has failed to submit its claim within the time provided in paragraph (c) or (i) hereof, and has failed to request extension of such time, the Contractor shall have no such right of appeal. In any case where the procurement officer has made a determination of the amount due under paragraphs (d), (e), or (i) hereof, the State shall pay to the Contractor the following:

(1) If there is no right of appeal hereunder or if no timely appeal has been taken, the amount so determined by the procurement officer; or

(2) If an appeal has been taken, the amount finally determined on such appeal.

(h) In arriving at the amount due the Contractor under this clause there shall be deducted:

(1) All unliquidated advance or other payments or account theretofore made to the Contractor, applicable to the terminated portion of this Contract;

(2) Any claim which the State may have against the Contractor in connection with this Contract; and

(3) The agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by the Contractor or sold, pursuant to the provisions of this clause, and not otherwise recovered by or credited to the State.

(i) If the termination hereunder be partial, the Contractor may file with the procurement officer a claim for an equitable adjustment of the price or prices specified in the Contract relating to the continued portion of the Contract (the portion not terminated by the Notice of Termination), and such equitable adjustment as may be agreed upon shall be made in such price or prices. Any claim by the Contractor for an equitable adjustment under this clause shall be asserted within ninety (90) days from the effective date of the termination notice, unless an extension is granted in writing by the procurement officer.

(j) The State may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the Contractor in connection with the terminated portion of this Contract whenever, in the opinion of the procurement officer, the aggregate of such payments shall be within the amount to which the Contractor shall be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this clause, such excess shall be payable by the Contractor to the State upon demand, together with interest computed at the legal rate for the period from the date such excess payment is received by the Contractor to the date on which the excess is repaid to the State; provided, however, that no interest shall be charged with respect to any such excess payment attributable to a reduction in the Contractor's claim by reason of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date as determined by the procurement officer by reason of the circumstances.

(k) Unless otherwise provided for in this Contract, or by applicable statute, the Contractor shall, from the effective date of termination until the expiration of three years after final settlement under this Contract, preserve and make available to the State at all reasonable times at the office of the Contractor but without direct charge to the State, all its books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this Contract and relating to the work terminated hereunder, or, to the extent approved by the procurement officer, photographs, microphotographs, or other authentic reproductions thereof.

GP-8.11 SUCCESSFUL TERMINATION OF CONTRACTOR'S RESPONSIBILITY

A Contract will be considered as successfully fulfilled when the work has been completed in accordance with the terms of the Contract; when final acceptance has occurred; when final payment has been authorized; when all of the obligations of the Contractor and its surety have been complied with; and when final payment has been made.

GENERAL PROVISIONS

GP - SECTION 9: PAYMENT

GP-9.01 SCOPE OF PAYMENT

GP-9.01 SCOPE OF PAYMENT ***does not apply; TC-7.04 Scope of Payment shall apply.***

Payment to the Contractor will be made for the actual quantities of Contract items performed in accordance with the Plans and Specifications and if, upon completion of the construction, these actual quantities show either an increase or decrease from the quantities given in the bid schedule, the Contract unit prices will still prevail, except as provided in GP-4.04 Variations in Estimated Quantities.

The payment of any partial estimate or of any retained percentage except by and under the approved final estimate and voucher, in no way shall affect the obligation of the Contractor to repair or renew any defective parts of the construction or to be responsible for all damages due to such defects.

When requested in writing by the Contractor and approved by the procurement officer, payment allowance will be made for nonperishable material to be incorporated in the work delivered and stockpiled at the work site or other approved site. Material for which payment has been made, wholly or partially, shall not be removed from the worksite or other approved site.

Payment to the Contractor under this section for materials on hand in no way will be construed as acceptance by the Administration of title to the material. Title shall remain with the Contractor until the project has been completed and accepted in accordance with GP-5.13.

Contractor shall indicate his Federal Tax Identification or Social Security Number on the face of each invoice billed to the State.

On Contracts in excess of $25,000, the Contractor, prior to receiving a progress or final payment under this Contract, shall first certify in writing that the Contractor has made payment from proceeds of prior payments, and that the Contractor will make timely payments, from the proceeds of the progress or final payment then due to the Contractor, to its subcontractors and suppliers in accordance with his contractual arrangements with them and State Finance and Procurement Article, §17-106. This certification may be required by the procurement officer for Contracts of $25,000 or less.

The Contractor shall also obtain from each subcontractor a certification that it has made payment from proceeds of prior payments to any of its lower tier subcontractors, and will make timely payments to its lower tier subcontractors and suppliers in accordance with its contractual arrangements with them. This certification is not required from subcontractors who have no lower

tier subcontracts. These certifications may be required by the procurement officer for contracts of $25,000 or less.

In addition to any other remedies provided by law or this Contract, any Contractor or subcontractor of any tier who fails to make payment as required by the certification set forth in the above paragraphs within 30 days from the date such payments is due shall be obligated to include with such payment interest at the rate of 10 percent per annum from the date the payment was due to the date the payment was actually made to the subcontractor or lower tier subcontractor.

GP-9.02 FORCE ACCOUNT WORK

GP-9.02 FORCE ACCOUNT WORK ***does not apply; TC-7.03 Force Account shall apply.***

When the Contractor is required to perform work as a result of additions or changes to the Contract for which there are no applicable unit prices in the Contract, the Administration and Contractor shall make every effort to come to an agreed upon price for the performance of such work. If an agreement cannot be reached, the Administration may require the Contractor to do such work on a force account basis to be compensated in accordance with the following:

(a) Labor. For all labor and for foremen in direct charge of the specific operations, the Contractor shall receive the actual wages for each and every hour that said labor and foremen are actually engaged in such work.

(b) Materials. For materials accepted by the procurement officer and used, the Contractor shall receive the actual cost of such materials delivered on the work, including transportation charges paid by the Contractor (exclusive of machinery rentals as hereinafter set forth).

(c) Equipment. For any machinery or special equipment (other than small tools, whether rented or owned), the use of which has been authorized by the procurement officer, the Contractor shall receive the rates agreed upon in writing before such work is begun, or the Contractor shall receive those rates which may be specified elsewhere in the Special Provisions. For the purpose of definition, equipment with a new cost of $500 or less will be considered small tools.

(d) Materials and Supplies Not Incorporated in the Work. For materials and supplies expended in the performance of the work (excluding those required for rented equipment) and approved by the procurement officer, the Contractor shall receive the actual cost of such materials and supplies used. The Contractor shall receive a reasonable allowance for materials used but not expended in the performance of the work.

(e) Subcontractors. The Contractor shall receive the actual cost of work performed by a subcontractor. Subcontractor's cost is to be determined as in (a), (b), (c), and (d) above, plus the fixed fee for overhead and profit allowance computed as in (g).

(f) Superintendence. No additional allowance shall be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.

(g) Contractor's Fixed Fee. The procurement officer and the Contractor shall negotiate a fixed fee for force account work performed pursuant to this GP-9.02 by its forces and by its subcontractors, as compensation for overhead and profit for the work performed. Failure of the Contractor and the procurement officer to negotiate a fixed fee consistent with applicable cost principles in COMAR 21.09.01 shall be treated as a dispute pursuant to GP-5.15 and the Contractor shall proceed diligently with the performance of the force account work to completion. The Contractor's fixed fee shall include an amount equal to the sum of 65 percent of (a) which shall include, but not be limited to, the following:

(1) Compensation for all costs paid to, or in behalf of, workmen by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits or other benefits that may be required by collective bargaining agreement or other employment Contract generally applicable to the classes of labor employed in the work.

(2) Bond premiums, property damage, liability and workmen's compensation insurance premiums, unemployment insurance contributions and Social Security taxes on the force account work.

In addition, the Contractor's fixed fee may include an amount not to exceed 20 percent of (b) and 5 percent of (d), and 5 percent of (e) with the exception of that portion chargeable to equipment as defined above.

(h) Compensation. The compensation as set forth above shall be received by the Contractor as payment in full for change order work done on a force account basis. At the end of each day, the Contractor's representative and the procurement officer shall compare records of the cost of work as ordered on a force account basis.

(i) Statements. No payment will be made for work performed on a force account basis until the Contractor furnishes the procurement officer duplicate itemized statements of the cost of such force account work detailed as to the following:

(1) Name, classification, date, daily hours, total hours, rate, and extension for such laborer, or foreman.

(2) Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.

(3) Quantities of materials, prices and extensions.

(4) Transportation of materials.

(5) Payments of items under (i)(1) shall be accomplished by copies of certified payrolls. Under (i)(2) original receipted invoices for rentals must be provided if requested by the procurement officer. Paragraphs (i)(3) and (i)(4) shall be accompanied by original receipted invoices for materials used and transportation charges. If, however, the materials used in the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the original invoices the statements shall contain or be accompanied by an affidavit of the Contractor which shall certify that such materials were taken from his stock, that the quantity claimed was actually used and that the price and transportation of the material as claimed represent actual cost. Any request for payment under this Section shall be submitted in the order outlined by the above.

GP-9.03 PROGRESS PAYMENTS

GP-9.03 PROGRESS PAYMENTS ***does not apply; TC-7.05 Progress Payments shall apply.***

(a) Current Estimates.

(1) Lump Sum Contracts. If requested by the Administration, the Contractor shall furnish an acceptable breakdown of the lump sum Contract price showing the amount included therein for each principal category of the work. Said breakdown shall be in such detail so as to provide a basis for estimating monthly progress payments.

(2) Monthly Estimates. Each month the Administration will pay the Contractor for the Contract value of the work satisfactorily performed during the preceding calendar month, including authorized extras and additions less 5 percent. The 5 percent of the total Contract value retained by the Administration will not be released until final payment (unless partially released in a semi-final payment). Current estimates will be based upon the procurement officer's estimate of quantity (including materials and/or equipment complete in place) satisfactorily performed. In the instance of lump sum items, the procurement officer's estimate shall be the proper fraction of the lump sum items satisfactorily performed during the preceding month. All quantities, estimates and fractions will be reasonably accurate approximations and are subject to correction (a) in subsequent current estimates, (b) in any semi-final estimate and, (c) in final payment. Any and/or all partial payments may be withheld in the event current requirements of the Specifications have not been complied with by the Contractor. Should either the procurement officer or the Contractor be of the opinion that any estimates, quantities and/or fractions (either as to an individual current estimate or accumulations thereof) do not represent a reasonably accurate approximation of actual work, then details questioned shall be reviewed and then any corrections adjusted for in the next current estimate.

(3) Escrow Accounts For Retained Funds. The Contractor may elect to have retained funds paid to an escrow agent who may invest the funds in an approved interest-bearing account which, upon completion of the Contract, will be paid to the Contractor to the extent to which the Contractor is entitled. The Contractor's election to use the escrow account procedure must be indicated on the Contract Documents, and the escrow agreement must be in a form and under terms approved by the Administration. The Contractor shall forfeit its right to the use of the escrow account if the Contractor refuses or fails to indicate an election prior to execution of the Contract.

NOTE: This provision GP-9.03(a)(3) shall not apply if it conflicts with any Federal grant or regulation affecting this Contract.

(b) Semi-Final Estimate Payments.

(1) Upon completion of the project and the acceptance by the Administration of the project for maintenance, the Administration, at the Contractor's request and with consent of surety, will pay the Contractor, within 30 calendar days of said request, what is hereby known as a semifinal estimate payment. Such a semifinal estimate payment will be based upon (a) quantities the Administration has computed and set up as proposed final quantities and (b) a reasonably accurate estimate for those quantities for which the Administration has not yet completed computations. The quantities which the Administration sets forth as proposed final quantities shall be so designated. To arrive at the amount of semi-final estimate payment there shall be deducted from the apparent estimated value of the Contract (a) total of an amounts previously paid to the Contractor as current estimates and (b) sums deemed chargeable against the Contractor properly deductible, including liquidated damages, and as a retainage, a sum not less than 1 percent the total value of the Contract.

(2) In cases where there has been substantial completion of the project and there are remaining only inconsequential or minor work items such as painting, seeding, mulching, or planting to be completed and such items cannot be completed for an extended period of time because of seasonal or weather conditions, there shall be made a semi-final inspection and if the work completed is found by the Administration to be satisfactory, then there is deemed to be partial acceptance on the entire project except for the uncompleted work items. Upon the above referred to partial acceptance, the Administration, within 30 days from such partial acceptance, upon request of the Contractor and with consent of surety, shall pay to the Contractor, what is hereby known as a partial semi-final estimate payment. Such a semi-final estimate payment will be based upon (a) quantities the Administration has computed and set up as proposed final quantities and (b) a reasonably accurate estimate for those quantities for which the Administration has not yet completed computations. The quantities which the Administration sets forth as proposed final quantities shall be so designated. To arrive at the amount of semi-final estimate payment,

there shall be deducted from the apparent estimated value of the Contract (a) total of all amounts previously paid to the Contractor as current estimates, and (b) sums deemed chargeable against the Contractor properly deductible, including liquidated damages, and as a retainage, a sum equal to 1 percent of the total value of the Contract. (Said retainage is not to be less than $2,000).

(3) If all retained funds have not been paid to an escrow agent, as provided for in GP-9.03(a)(3), the Administration shall, upon payment of the semi-final estimate, place the remaining retainage in an interest-bearing escrow account, as designated and on such terms and conditions as specified by the procurement officer. At the time of final payment, any retainage due, and any interest accrued on the retainage due from the time of payment of the semi-final estimate, shall be paid to the Contractor.

GP-9.04 FINAL ACCEPTANCE AND FINAL PAYMENT

GP-9.04 FINAL ACCEPTANCE AND FINAL PAYMENT ***does not apply; TC-7.06 Final Acceptance and Final Payment shall apply.***

(a) When the Contractor has completed a Contract, and it has been accepted for maintenance in accordance with the provisions of GP-5.13, the Administration will promptly proceed:

(1) To make any necessary final surveys;

(2) To complete any necessary computation of quantities; and

(3) To submit to the Contractor, within 60 days after final completion and acceptance of the project by the procurement officer for maintenance, for the Contractor's consideration, a tabulation of the proposed final quantities. This tabulation shall be accompanied by a statement setting forth: (a) the additional work performed under change orders and/or supplemental agreements; (b) the authorized extension of time; (c) the number of days which have been charged against the Contractor as having been used to complete the Contract, and (d) any deductions, charges or liquidated damages which have been made or imposed.

(b) The Contractor shall then have a period of 10 calendar days, dating from the date upon which the Contractor received the aforementioned tabulation from the Administration, in which:

(1) To decide whether or not to accept final payment upon such a basis, and

(2) To notify the Administration, in writing, of the decision. The Contractor may request an additional period up to 10 calendar days in which to notify the Administration of the Contractor's decision. In the event the Contractor notifies

the Administration that the Contractor protests final payment on such a basis, that notification shall outline the reason(s) for said protest.

(c) Upon receipt of a notification of acceptance as provided for in paragraph (b) above, the Administration shall prepare the final estimate and final payment forms and submit them to the Contractor. These forms shall show all data noted in paragraph (a) above, together with deductions for all prior payments. The Contractor shall execute these forms and return them to the Administration within 30 calendar days from the date they are received for execution and payment. If such signed forms are not received by the Administration within the specified time, the Administration will prepare duplicate forms for execution and payment. Such action by the Administration shall be deemed to constitute acceptance and final payment.

(d) If, under the provisions of paragraph (b) above, the Contractor notifies the Administration of the Contractor's protest and nonacceptance of the data submitted to the Contractor, the Administration shall pay the Contractor a semi final estimate, or an additional semi final estimate in the event a semi final estimate has already been paid based upon the data noted in paragraph (a) above, with deductions for all prior payments. A retainage equal to 1 percent of the total value of the Contract shall be withheld by the Administration. The acceptance of such semi final estimate, or additional semi final estimate, shall not be considered as a waiver on the part of the Contractor of its right to pursue the Contractor's protest and press for acceptance and final payment.

(e) In the event the Contractor does not accept the data submitted to the Contractor as described in paragraph (a) above and/or has outstanding a claim filed in accordance with GP-5.14, the procurement officer and the Contractor shall confer at mutually convenient times and endeavor to reconcile all points of disagreement expeditiously. If such reconciliation is accomplished, the Administration will promptly proceed with acceptance and final payment on the reconciled basis and in accordance with the provisions of paragraph (c) above. If reconciliation is not accomplished within 30 days, the decision of the procurement officer shall be reviewed by the Administrator and appropriate legal counsel. After review by the Administrator, the decision of the procurement officer is deemed to be the final action. The procurement officer shall furnish a copy of the final decision to the Contractor by certified mail, return receipt requested. This decision may be appealed by the Contractor to the Maryland State Board of Contract Appeals. This must be done by filing a written notice of appeal to the Appeals Board within 30 days from the date of the final decision. Failure to provide timely notification to the procurement officer shall constitute a waiver by the Contractor of its right under the Disputes Clause and final payment may be made by the Administrator based on the procurement officer's recommendation.

(f) All prior partial estimates and payments shall be subject to correction at the time of acceptance and final payment and if the Contractor has been previously overpaid, the amount of such overpayment shall be set forth in the Final Payment forms and the Contractor hereby agrees that he will reimburse the Administration for such

overpayment within six months of receipt of such advice, and its surety will not be granted release from obligations under the terms of the Contract until reimbursement has been made in full.

(g) Payment for the full apparent value of the Contract thus determined shall become due and payable to the Contractor within ninety (90) days after acceptance of the project by the procurement officer for maintenance, as hereinafter provided. As a condition precedent to final payment, the Contractor shall be required to execute a general release of all claims against the Administration arising out of, or in any way connected with, this Contract.

(h) In accordance with §7-222 of the State Finance and Procurement Article of the Annotated Code of Maryland, certification must be obtained from the Comptroller of the Treasury, and the Employment Security Administration, that all State taxes have been paid prior to release of final payment on a construction Contract. The check will be processed and mailed only after notification is received from both departments that no State tax is owed.

GP-9.05 LATE PAYMENTS

GP-9.05 LATE PAYMENTS ***does not apply; TC-7.07 Late Payments shall apply.***

(a) Payments to the Contractor pursuant to this Contract shall be made no later than 30 days after the State's receipt of a proper invoice from the Contractor. Charges for late payment of invoices, other than as prescribed by Title 15, Subtitle 1, of the State Finance and Procurement Article, Annotated Code of Maryland, or by the Public Service Commission of Maryland with respect to regulated public utilities, as applicable, are prohibited.

(b) A proper invoice shall include: a description of the items or services provided; the date the goods were received or the inclusive dates the services were rendered; the Contract price(s); retention, if any; the basis for the billing; the Contract or purchase order number; the Contractor's Federal Tax Identification Number or Social Security Number; the name and address of the proper invoice recipient.

(c) In order to receive payment of interest, the Contractor must submit a proper invoice for accrued interest within 30 calendar days after the payment date of the amount on which the interest is claimed to have accrued. Interest may not be claimed for more than one year following the 31st calendar day after the date that a proper invoice was received, or on amounts representing unpaid interest, or on an amount due under a Contract remaining unpaid for any period prior to July 1, 1983, or if a claim has been filed under State Finance and Procurement Article, Title 15 of Subtitle 2 of the Code.

(d) For the purposes of this Contract an amount will not be deemed due and payable if:

(1) The amount invoiced is inconsistent with the Contract.

(2) The proper invoice has not been received by the person or office specified in the Contract.

(3) The invoice or performance under the Contract is in dispute or the Contractor has failed to otherwise comply with the provisions of the Contract.

(4) The item or services have not been accepted.

(5) The quantity of items delivered is less than the quantity invoiced.

(6) The items or services do not meet the quality requirements of the Contract.

(7) The Contract provides for progress payments, and the proper invoice for the progress payment has not been submitted pursuant to the schedule contained in the agreement.

(8) The Contract provides for withholding a retainage and the invoice is for the retainage, all stipulated conditions for release of the retainage have not been met.

(9) The Contractor has not submitted satisfactory documentation or other evidence reasonably required by the procurement officer or by the Contract concerning performance under the Contract and compliance with its provisions.

TERMS AND CONDITIONS

TC - SECTION 1: REFERENCES AND DEFINITIONS

TC-1.01 LANGUAGE

These specifications incorporate the selective use of the imperative mood. In general, specifications in the imperative mood will imply a direct responsibility upon the subject "the Contractor" to perform an action. Depending on the context of the specification, the subject may also be the supplier, fabricator, or manufacturer. For example, the imperative sentence "Notify the Bureau of Mines when coal is encountered" implies, "The Contractor shall notify the Bureau of Mines."

For specifications that are not in the imperative mood, the word "shall" refers to obligatory requirements or actions of the Contractor, supplier, fabricator, or manufacturer as applicable; "will" refers to actions of the Administration.

All work pertaining to these Specifications shall be completed as specified in the Contract Documents or as directed by the Engineer. When used in these Specifications, the term "specified" refers to requirements stated herein or included elsewhere in the Contract Documents. Refer to GP-4.01.

Terms such as directed, accepted, acceptable, approved, approval, authorized, determined, permitted, and satisfactory are implicitly followed by the words "by the Engineer", "to the Engineer", or "of the Engineer."

The word "submit" or "submittal" implies that the Contractor shall provide the applicable submittal in writing to the Engineer for approval. If otherwise, the Contract Documents will specify where to make the submittal. No applicable work may proceed without written approval. These requirements apply to all submittals, whether for details, methods, schedules, or materials. Refer to TC-4.01 and Section 499.

The word "ensure" obligates the Contractor to fulfill a specific requirement or complete an indicated action in conformity with the Contract Documents.

The phrase "remove and dispose" obligates the Contractor to assume possession of the specified material, remove it from the area, and properly dispose of it off site. Even when not specifically addressed, all waste materials shall be disposed of in this manner. All costs for this work shall be included in the applicable Contract work at no additional cost to the Administration.

Unless otherwise specified, when terms such as "repair", "restore", "replace", and "remove and replace" are used in reference to unacceptable work, whatever the reason or cause for the work being rejected, it shall be implicitly understood that the Contractor shall perform the applicable

work in conformance with the Contract Documents, in an acceptable manner, and at no additional cost to the Administration. Refer to GP-5.02, GP-5.09, and GP-7.16.

Unless specifically stated otherwise, all material, labor, equipment, tools, and incidentals necessary to perform and complete the work as specified and detailed in the Contract Documents, including all generally recognized and inherent aspects of the work, shall be included in either the lump sum or unit price for the the Contract (Pay) item. When specific aspects of the work are listed in Measurement and Payment, it shall be construed to be an all-inclusive list.

TC-1.02 REFERENCES

Reference to Specifications or procedures beginning with the letters M, R, or T shall be understood to be AASHTO.

Reference to Specifications or procedures beginning with the letters A, B, C, D, E, F, G, ES or P shall be understood to be ASTM.

References to all Specifications and procedures shall be understood to be the most recently published standard at the time of advertisement unless otherwise specified in the Contract Documents.

The words “using”, “per”, and “meet” or “meeting”, when referring to a specification or procedure, imply “in strict accordance with.”

TC-1.03 DEFINITIONS

Additional Work—Work not required or provided for in the original Contract.

Administration—The term shall be construed to be the Maryland Department of Transportation State Highway Administration as established in conformance with the laws of Maryland.

Base Course—The one or more layers of specified material and thickness placed on a subbase or a subgrade to support a surface course.

Bridge—A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 ft between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening. For lengths, all dimensions shall be parallel to the center line of the roadway. The dimensions of handrails will not be taken into account in measuring bridge lengths.

Any bridge or highway grade separation structure includes the connecting highways, substructure, superstructure, roadway approaches, entrance plazas, interchanges, overpasses, underpasses, and other structures which the Administration may deem necessary together with all property rights,

easements, franchises, and interests acquired by the Administration for the construction and operation of the bridge.

Certification—A document which verifies that the material and work complies with the applicable specifications and includes the actual test results to confirm the statement. The contents of the certification shall be on the Contractor's/vendor's/manufacturer's letterhead or approved document and shall be duly signed by a company officer.

Certifications for metal products, when required, shall include a statement that the material was melted and manufactured in the United States except as provided in Section 165 of the Surface Transportation Assistance Act of 1982, as amended by Section 1041(a) and 1048(a) of the Intermodal Surface Transportation Efficiency Act of 1991 with regard to the furnishing and coating of iron and steel products. A nationwide waiver for this provision has been granted for pig iron and processed, pelletized, and reduced iron ore.

Change Order—A written document amending the Contract by adding, deleting, or modifying the Contract to include price, time, work, and conditions not previously addressed within the Contract. Refer to GP-1.05.

Contract Time—The number of working days, calendar days, or a calendar date specified in the Contract Documents indicating the time period allowed for the completion of the Contract work.

Controlling Operation—An operation which at the particular time under consideration has a controlling effect on the progress of the project as a whole.

Culvert—Any structure not classified as a bridge which provides an opening under any roadway.

Domestic Manufacture—When referring to metallic items such as structural steel, pipe, reinforcement, bridge rails, etc., the term Domestic Manufacture means those metal products that have been melted and manufactured within the United States.

Drainage Ditch—In general, any open water course other than gutters, constructed as indicated in the Contract Documents.

Equipment—All machinery, tools, and apparatus necessary for the proper construction and acceptable completion of the work, together with the necessary supplies for upkeep and maintenance.

Federal Agencies—Reference to any Federal agency or officer shall be deemed made to any agency or officer succeeding in conformance with law to the powers, duties, jurisdictions, and authority of the agency or officer mentioned.

General Provisions (GP)—Contract provisions published as part of, or as a supplement to the Standard Specifications intended for general application and repetitive use.

Holidays—In the State of Maryland, holidays occur on:

January 1	New Year's Day
3rd Monday in January	Martin Luther King's Birthday
3rd Monday in February	President's Day
4th Monday in May	Memorial Day
June 19	Juneteenth National Independence Day
July 4	Independence Day
1st Monday in September	Labor Day
2nd Monday in October	Columbus Day
November 11	Veteran's Day
4th Thursday in November	Thanksgiving Day
December 25	Christmas Day

All days of General and Congressional Elections (not primary elections) throughout the State.

If a legal holiday falls on a Sunday, the following Monday shall be deemed and treated as a holiday.

If a legal holiday falls on a Saturday, the Friday immediately preceding shall be deemed and treated as a holiday.

Laboratory—The testing laboratory of the Maryland Department of Transportation State Highway Administration (or other Administrations) or any other testing laboratory designated by the procurement officer.

Median—The portion of a divided highway separating the traveled ways for traffic in opposite directions.

MdMUTCD—Maryland Manual on Uniform Traffic Control Devices.

Pavement Structure—The surface, base, or subbase course placed in layers on a subgrade to support and distribute the traffic load to the roadbed.

Plans—The official drawings issued by the Administration as part of the Contract Documents, including those incorporated in the Contract Documents by reference. These include the official approved plans, profiles, typical cross sections, working drawings, and supplemental drawings or exact reproductions that show the location, character, dimensions, and details of the work to be done.

Profile Grade—The trace of a vertical plane intersecting the top surface of the proposed wearing surface usually along the longitudinal center line of the roadway. Profile grade means either elevation or gradient of the vertical plane.

Ramp—A connecting roadway between two intersecting highways at a highway separation.

Right-of-Way—The area acquired and reserved by the Administration for use in constructing the proposed improvement and appurtenances.

Roadbed—The graded portion of a highway within the top and side slopes prepared as a foundation for the pavement structure and shoulders.

Road or Highway—Both the word road and the word highway include rights-of-way, surfaces, subgrades, shoulders, median dividers, drainage facilities and structures, roadway cuts, roadway fills, traffic barriers, bridges, highway grade elimination structures, tunnels, overpasses, underpasses, interchanges, entrance plazas, approaches, and other structures forming an integral part of a street, road, or highway; including bicycle and walking paths and related storm water management facilities and structures. Any other property acquired for the construction, operation, or use of the highway.

Roadside—A general term denoting the area adjoining the outer edge of the roadbed within the right-of-way. Extensive areas between the roadways of a divided highway may also be considered roadside.

Roadside Development—Work for the preservation of natural and landscaped areas and the rehabilitation and protection against erosion of all areas disturbed by construction through turf establishment and the placing of other ground covers, suitable planting, and other improvements to increase the effectiveness and enhance the appearance of the highway.

Seal Coat—An application of asphalt material followed by an application of cover coat aggregate.

Shoulder—The portion of the roadbed contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk—The portion of the roadway constructed for use by pedestrians.

Slopes—The inclined graded areas beyond the shoulder, extending from the shoulders to the natural, undisturbed surface of the ground.

Special Provisions (SP)—Specifications for a specific item or condition requirement peculiar to an individual project and not otherwise thoroughly or satisfactorily detailed in the Contract Documents.

Special Provisions Insert (SPI)—Additions and revisions to the Standard Specifications that have been officially approved.

Standard Specifications—The most current book of Specifications entitled "Standard Specifications for Construction and Materials" published by the Administration and intended for general application and repetitive use.

Standards—The official Standards for Highway and Incidental Structures, maintained on the Administration website. The latest incorporated revisions issued on or before the date of advertisement of the Contract.

State Highway System—That system of roads owned, operated, or maintained by the Administration.

State Road—Any public road included in the State highway system.

Structures—Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, end walls, buildings, sewers, service pipes, underdrains, foundation drains, steps, fences, and other features that may be encountered in the work and not otherwise classified.

Subbase—The layers of specified or selected material of designed thickness placed on a subgrade to support a base course or surface course.

Subgrade—The top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed.

Substructure—All of that part of the structure below bottoms of bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with the back walls and wing walls.

Superstructure—All of that part of the structure above bottoms of bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, except as noted above for substructure.

Surface Course—One or more layers of a pavement designed to accommodate the traffic load.

Traveled Way—The portion of the roadway for the movement of vehicles, exclusive of shoulders.

Trench—An excavation made for the purpose of installing or removing pipes, drains, catch basins, etc., which is later refilled.

Working Day—A calendar day upon which, in the judgement of the Engineer, weather and soil conditions are such that the Contractor can advantageously work more than half of the Contractor's current normal force for more than five consecutive hours on a controlling operation. Working days will not be charged on Saturdays, Sundays, and State recognized holidays unless the Contractor actually works more than five hours on a controlling operation.

Working Drawings—Stress sheets, shop drawings, fabrication details, erection plans, plans for false work, forms, centering, cribs, cofferdams and masonry layouts, bending and placing drawings, bar schedules for reinforcement steel, and any other supplementary plans or similar data that the Contractor may be required to furnish.

TERMS AND CONDITIONS

TC - SECTION 2: BIDDING REQUIREMENTS AND CONDITIONS

TC-2.01 PROJECT CLASSIFICATION

The Administration will estimate the cost of the Contract and classify it within one cost group and letter designation as follows:

COST GROUP ESTIMATE	COST GROUP LETTER CLASS
Up to $ 100 000	A
$ 100 001 to $ 500 000	B
$ 500 001 to $ 1 000 000	C
$ 1 000 001 to $ 2 500 000	D
$ 2 500 001 to $ 5 000 000	E
$ 5 000 001 to $ 10 000 000	F
$10 000 001 to $ 15 000 000	G
$ 15 000 001 to $ 30 000 000	H
$ 30 000 001 to $ 50 000 000	I
$ 50 000 001 to $ 75 000 000	J
$ 75 000 001 to $ 100 000 000	K
Over $ 100 000 000	L

The letter designation will be published as part of the Notice to Contractors.

TC-2.02 CONTENTS OF BID FORMS

All documents included in or attached to the bid form are necessary parts thereof and shall not be detached, separated or altered. The Plans, Specifications, Supplemental Specifications, referred to in the Specifications, and all other Contract Documents will be considered a part of the bid form whether attached thereto or not.

TC-2.03 PREPARATION OF BID

(a) The bidder shall submit their bid utilizing only the electronic forms furnished by the Administration. The bidder shall specify a price in dollars and cents for each pay item given.

(b) The bid form(s) shall be filled out using the Administration-required electronic bidding software. The bid, if submitted by an individual, shall be electronically signed by the individual. If submitted by a partnership, the bid shall be electronically signed by such member or members of the partnership and have authority to bind the partnership. If

submitted by a corporation or other business entity, the same shall be electronically signed by an officer with his or her position stated below the signature line. Such signature shall constitute the Contractor's representation and warrant that the signing party has Contractor's authorization to do so, binding the Contractor to the bid and to the Contract. There shall be no strikethrough text submitted though the Administration-required electronic bidding software.

(c) Bid Samples and Descriptive Literature. If the Invitation for Bids requires the bidder to furnish samples or descriptive literature, it shall be electronically submitted with the bid, unless the Invitation for Bids provides otherwise.

(d) Offerors shall identify those portions of their proposals which they deem to be confidential, proprietary information, or trade secrets and provide any justification of why such materials should not be disclosed by the State under the Maryland Public Information Act, General Provisions Article, Title 4 of the Annotated Code of Maryland.

(e) Foreign Corporations – Pursuant to the Corporations and Associations Article, Title 7 of the Annotated Code of Maryland, corporations not incorporated in the State shall register with the State Department of Assessments and Taxation before doing any interstate or foreign business in this State. Before doing any intrastate business in this State, a foreign corporation shall qualify with the Department of Assessments and Taxation.

TC-2.04 PROPOSAL GUARANTY

(a) No bid will be considered for any Contract in excess of $100,000 unless accompanied by a guaranty in an amount not less than 5 percent of the amount bid, or such amount as may be specified elsewhere in the bid documents and made payable to the State of Maryland.

(b) Acceptable forms of security for bid guaranty shall be:

(1) A bond that is electronically verifiable through the Administration-required electronic bidding software and website in a form satisfactory to the State underwritten by a surety company authorized to do business in this State;

(2) A bank certified check, bank cashier's check, bank treasurer's check, or trust account;

(3) Pledge of securities backed by the full faith and credit of the United States government or bonds issued by the State of Maryland; or

(4) Cash or other securities—if submitted pursuant to COMAR 21.06.07.01.

TC-2.05 DELIVERY OF BIDS

The bid shall be submitted only via the Administration-required electronic bidding software and website. Paper copy submittals of the bid will not be accepted, except for the Proposal Guaranty. An authorized representative is required to sign the bid electronically. The Administration may choose to reject a bid if it is not electronically signed by an authorized representative.

The bidder shall ensure delivery of its bid with all required components and attachments, including, but not limited to:

(a) Schedule of Prices.

(b) Proposal electronic bidding file with Bidder's Certificate.

(c) Bid Security;

(1) Bid Bond with electronic verification.

(2) A clear electronic image of all other acceptable forms of proposal guaranty must be uploaded to Manual Verification tab for Bid Bond and submitted with the bid. The original proposal guaranty with the Contractor name, Contract number, and the bid opening date must be sent to or delivered to: Attention: C/O Contract Award Division, Building #4, Maryland Department of Transportation State Highway Administration, 7450 Traffic Drive, Hanover MD 21076. It must be received by the Administration no later than three business days after bid opening.

(3) No bid will be considered unless the proposal guaranty is received by the Administration by the bid opening date and time. An acknowledgement may be obtained by the bidder as a proof of proposal guaranty delivery.

(d) MBE/DBE forms.

(e) Other related documents as specified in the Contract.

The Bidder is solely responsible for any errors and for timely submission of the bid, all components thereof, and all attachments, through the electronic bidding system. The Administration assumes no responsibility for any claim arising from the failure of any Bidder or of the electronic delivery system to cause any bid, bid component, or attachment to not be delivered or to deliver corrupt files before the time set for bid opening.

TC-2.06 AMENDMENTS TO INVITATIONS FOR BIDS

(a) Form. Each amendment to an Invitation for Bids shall only be made electronically and identified as such.

(b) Acknowledgements. The bidder shall acknowledge receipt of all amendments through the Administration-required electronic bidding software and website.

TC-2.07 PRE-OPENING MODIFICATION OR WITHDRAWAL OF BIDS

(a) Procedure. Bids may be modified or withdrawn only through the Administration-required electronic bidding software and website before the time and date set for bid opening.

(b) Disposition of Bid Security. If a bid is withdrawn in accordance with this regulation, the bid security, if any, shall be returned to the bidder.

TC-2.08 LATE BIDS, LATE WITHDRAWALS, AND LATE MODIFICATION

(a) Policy. The Administration-required electronic bidding software and website will not accept the submission of bids after the designated time and date set for bid opening. The Administration-required electronic bidding software will neither allow the withdrawal nor the modification to a submittal after the designated time and date set for bid opening. Any bid received at the place designated in the solicitation after the time and date set for receipt of bids is late. Any request for withdrawal or request for modification received after the time and date set for opening of bids at the place designated for opening is late.

(b) Treatment. A late bid, late request for modification, or late request for withdrawal may not be considered. Late bids will be returned to the bidder unopened. Upon written approval of the Office of the Attorney General, exceptions may be made when a late bid, withdrawal, or modification is received before Contract award, and the bid, withdrawal, or modification would have been timely but for the action or inaction of State personnel directing the procurement activity or their employees.

NOTE: Provision TC-2.08(b) does not apply to Federal Aid projects.

TC-2.09 CANCELLATION OF INVITATIONS FOR BIDS

(a) Before opening of bids a solicitation may be cancelled in whole or in part when the State determines this action is fiscally advantageous or otherwise in its best interest.

(b) When a solicitation is cancelled before bid opening, the bid security shall be returned to the vendors submitting them and notice of cancellation shall be included.

TC-2.10 VALUE ENGINEERING CHANGE PROPOSALS

The Contractor may submit to the District Engineer, in writing, Value Engineering Change Proposals (VECP) for modifying the Contract Documents for the purpose of reducing the total cost of construction without reducing design capacity or quality of the finished product. The District Engineer will then forward the proposal to the Chief Engineer with recommended action. The final decision to accept or deny the VECP will be made by the Chief Engineer. The

Administration will not consider appeals once the final decision is made. If accepted by the Administration, net savings resulting from a VECP will be equally divided between the Administration and the Contractor.

The Contractor may elect to pursue one of the following options:

Option 1— Submit the detailed plans, specifications, and estimate of savings, or

Option 2— Submit a written concept of the VECP for tentative approval and if accepted, submit the detailed plans, specifications, and estimate for final approval at a later date.

Each VECP shall result in a net savings to the Contract cost without impairing essential functions and characteristics of the items or of any other part of the project, including but not limited to service life, reliability, economy of operation, ease of maintenance, desired aesthetics, and safety.

As a minimum, the Contractor shall submit the following information before final approval of a VECP can be given:

(a) A statement that the proposal is submitted as a VECP.

(b) A statement concerning the basis for the VECP and benefits to the Administration, together with an itemization of the Contract items and requirements affected by the VECP.

(c) A detailed estimate of the cost under the existing Contract and under the VECP.

(d) Proposed plans, specifications, and recommendations as to how the VECP changes shall be accomplished.

(e) A statement as to the time by which a change order adopting the VECP must be issued so as to obtain the maximum cost effectiveness. The Administration will require 30 days to review and approve a VECP.

(f) The Contractor's engineering cost for the VECP.

The Administration will process the VECP in the same manner as prescribed for any other proposal that would necessitate issuance of a change order. The Administration may accept, in whole or in part, any VECP by issuing a change order, which will identify the VECP on which it is based. The Administration will not be liable to the Contractor for failure to accept or act upon any VECP submitted pursuant to these requirements nor for any delays to the work attributable to any VECP proposal. Until a proposal is affected by a change order, the Contractor shall remain obligated to the terms and conditions of the existing Contract. If an executed change order has not been issued by the date upon which the Contractor's proposal specifies that a decision should be made, or any other date as the Contractor may subsequently have specified in writing, the proposal shall be deemed rejected.

The change order affecting the necessary Contract modification will establish the net savings agreed upon, will provide for adjustment in the Contract prices or Contract time, and will indicate the net savings to be equally divided between the Contractor and the Administration. The Contractor's costs for preparation of the VECP and the Administration's costs to review and administer the VECP will be deducted from the gross savings. The Administration reserves the right to include in the agreement any conditions it deems appropriate for consideration, approval, and implementation of the proposal. The Contractor's 50 percent share of the net savings shall constitute full compensation for affecting all changes pursuant to the agreement.

Acceptance of the VECP and performance of the additional work will not change the Contract time limit as a result of the VECP, unless specifically provided for in the change order authorizing the VECP.

The Administration expressly reserves the right to adopt a VECP for general use in Contracts administered by the Administration when it determines that the proposal is suitable for application to other Contracts. VECPs identical or similar to previously submitted proposals will be eligible for consideration and compensation under these provisions if such proposals were not previously adopted for general application to other Contracts administered by the Administration. When a VECP is adopted for general use, compensation pursuant to these requirements will be applied only to those Contracts awarded and for which the subject VECP has been submitted prior to the date of adoption of the specific VECP.

Proposed changes in the basic design of a bridge or pavement type, or requiring modification to the right of way limits, will not normally be considered as an acceptable VECP. Quantity decreases or elimination of any Contract pay items as a result of changing field conditions, errors, etc. will not be considered as an acceptable VECP. If a VECP is based upon or similar to a change in the Plans, Specifications, or Special Provisions adopted by the Administration prior to submission of the VECP, the Chief Engineer will reject the proposal.

These requirements apply to all VECPs initiated and developed by the Contractor and which are identified as such by the Contractor at the time of its submission to the Chief Engineer; however, nothing herein shall be construed as requiring the Chief Engineer to consider or approve a VECP submitted by the Contractor.

Subject to these provisions, the Administration or any other public agency will have the right to use all or part of any accepted VECP on other projects without obligation or compensation of any kind to the Contractor.

In the event a VECP is accepted by the Administration, the provisions of the Contract Documents that pertain to adjustment of Contract unit prices due to alterations of Contract quantities will not apply to the items adjusted or deleted as a result of affecting the VECP by change order.

TC-2.11 OWNER/OPERATOR

For the purpose of labor compliance, the term "Owner/Operator" will be defined as being the individual who owns and operates their own vehicle.

The prevailing wage rates shall not apply to these individuals. However, they shall appear on the payroll of the Contractor or subcontractor with the notation "Owner/Operator."

Employees of Owner/Operator shall be subject to prevailing wage rates and shall appear on a certified payroll.

TC-2.12 DEBARMENT / SUSPENSION

Pursuant to Maryland Board of Public Works Advisory 2003-4, the Administration verifies whether bidders, their affiliates, or their subcontractors have been suspended or debarred by the State of Maryland or the federal government by using the following lists:

1. See http://bpw.maryland.gov/Pages/debarments.aspx for the State of Maryland debarment list.

2. See http://www.sam.gov/ and click on 'Search Records' for the federal debarment list.

TC-2.13 PARTNERING

The Administration invites the Contractor, subcontractors, and suppliers to participate in a voluntary partnership agreement for the work. The partnership will be structured to draw on the strengths of each organization through open communication, teamwork, and cooperative action to identify and achieve reciprocal goals. The objectives are effective and efficient Contract performance, completion within the Contract bid price, on schedule, and in conformance with the Contract Documents. This partnership will not change the legal relationship of the parties to the Contract nor relieve any party from any of the terms of the Contract.

The Administration will contact the Contractor to determine if there is an interest in partnering. If the Contractor is interested, the Administration's Assistant District Engineer Construction and the Contractor's management representative will meet, plan, and organize a partnering development team. Persons recommended to be on the team are: The Administration's District Engineer, Assistant District Engineer, Area Engineer, Construction Project Engineer, and Project Design Engineer, the Contractor's designated on site project manager, and key project supervision personnel of both the Contractor and principal subcontractors and suppliers. FHWA and key local government personnel will also be invited to attend as necessary. The initial workshop team meeting will be held prior to the Preconstruction Conference. Follow up workshops may be held regularly as agreed by the Contractor and the Administration.

The partnership will be bilateral. Participation is voluntary. All partnering costs will be shared equally by the Contractor and the Administration.

TERMS AND CONDITIONS

TC - SECTION 3: SCOPE OF WORK

TC-3.01 GOVERNING ORDER OF CONTRACT DOCUMENTS

The Contract Documents, including but not limited to the Standard Specifications, the Special Provisions Inserts, the Plans, Special Provisions, and all supplementary documents are essential parts of the Contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In the event of any discrepancy between the drawing and figures written thereon, the figures, unless obviously incorrect, will govern over scaled dimensions. In the event of any discrepancy between the various Contract Documents, the governing order from highest to lowest shall be Special Provisions, Plans, Special Provisions Inserts, and Standard Specifications.

General Provisions will govern over all Contract Documents unless expressly provided for in the Contract.

TC-3.02 CONSTRUCTION DOCUMENTS TO SUCCESSFUL BIDDER

The bidders on each Contract advertised by the Administration are responsible to download the Plans, Invitation for Bids Books, Cross Sections (if provided), and As-Built Plans (if provided) during the bidding process from the websites listed elsewhere in the Invitation for Bids. Upon award and if requested, the Administration will provide the successful bidder electronic copies of Plans, Invitation for Bids Books Cross Sections (if included), and As-Built Plans (if included).

TC-3.03 RIGHTS IN THE USE OF MATERIALS FOUND ON THE PROJECT

The Contractor, with the approval of the Engineer may use on the project any excavated stone, gravel, sand, or other material conforming to the requirements of the Contract Documents.

When these materials are used for select, capping, modified, or common borrow and conform to the pertinent materials Specifications, payment will only be made at the Contract unit price for the class of excavation from which the materials are obtained.

In the event these materials are processed through a crushing, screening, washing, or sorting plant for use as another pay item, the Contractor will be paid both for the excavation of such materials at the Contract unit price and at the Contract unit price for which the material is used. The Contractor shall replace with other acceptable material all of the portion of the excavated material removed and used that was needed for use in the embankments, backfills, approaches, or otherwise, at no additional cost to the Administration.

If however, these materials are not processed and paid for as described in the preceding paragraph, and their use creates a shortage of embankment, backfill, approaches, or other material, the Contractor shall provide acceptable replacement material for all the material needed for embankments, backfills, approaches, or otherwise. In this case, the replacement material shall be paid for at the unit price for the item the Class 1 Excavation is used for, or the unit price bid for the Class 1 Excavation, whichever is the lower unit price bid.

The Contractor shall not excavate nor remove any material that is not within the limits of excavation, as indicated by the slope and grade lines, without written authorization from the Engineer.

TC-3.04 SAFETY HAZARDS IN CONFINED SPACES

The Contractor shall be responsible for gas detection in and ventilation of confined spaces.

When procedures require workers to enter confined spaces such as steel or concrete box section type superstructures, particularly when the interior is closed off at both ends, the Contractor shall be cognizant of the potential health hazards.

The Contractor shall adhere to all applicable MOSH regulations. The Contractor shall have approved detecting devices available and shall conduct tests for oxygen content and presence of gases, such as combustible gas, carbon dioxide, methane, carbon monoxide, and hydrogen sulfide whenever any fabrication, erection, or inspection operations are to be performed within the confined spaces. The Contractor shall apply mechanical ventilation continuously to the confined space during occupancy to maintain the proper oxygen content and shall conduct air tests periodically during the occupancy.

TERMS AND CONDITIONS

TC - SECTION 4: CONTROL OF WORK

TC-4.01 WORKING DRAWINGS

(a) General. The Plans shall be supplemented by working drawings as necessary to adequately control the work. All authorized alterations affecting the requirements and information given on the working drawings shall be in writing to the Engineer. When reference is made to the working drawings, the interpretation shall be the working drawings as affected by all authorized alterations then in effect.

Working drawings shall show details of all structures, lines, grades, typical cross section of roadway, general cross sections, location, and designation of all units and elements.

The Contractor shall provide, at no additional cost to the Administration, all required working drawings and shall have them adequately checked, after which they shall be submitted to the Engineer for review. The Engineer may reject working drawings and return them for revisions, in which case the Contractor shall submit revised working drawings as required. No items involving the drawings shall be incorporated into the work until the Engineer has accepted the drawings for use; however, acceptance shall not relieve the Contractor of any responsibility in connection with them. All working drawings shall be furnished in duplicate for preliminary examination for projects prepared by the Administration and in triplicate for projects prepared by consultant engineering firms for the Administration. After the Engineer has accepted working drawings for use, the Contractor shall furnish additional copies as requested.

All working drawings shall be on sheets measuring 22 in. by 34 in. or 24 in. by 36 in. and shall have a standard title block at the lower right corner approximately 4 in. by 8 in. (2 in. for the revision column on the left side and the remaining 6 in. for the title) indicating the following information in the order named:

Name of Contractor (and subcontractor, if applicable)
Address of Contractor (and subcontractor, if applicable)
Sheet Title (Reinforcement Details, etc.)
Name of Structure
Crossing
For (Maryland Department of Transportation State Highway Administration)
By (Indicate name of Contractor's official or engineer, or other parties authorized to sign official documents.)

List all Administration Contract numbers, complete Federal Aid number, if any, and the date the drawing was completed. The left portion of the title block shall be headed "Revisions" and the space used as needed.

Working drawings for standard scuppers are not required. A sketch or statement specifying the type and number of standard scuppers required and the length of the downspout is acceptable.

The working drawings shall be submitted for review to the applicable Director's Office. A copy of the transmittal letter shall be forwarded to the appropriate District Engineer. The number of working drawings to be furnished shall be as specified above and addressed to one of the following:

Maryland Department of Transportation State Highway Administration
Director, Office of Structures
707 North Calvert Street
Baltimore MD 21202
(Refer to Category 400 of the Contract Documents for working drawing submissions.)

Maryland Department of Transportation State Highway Administration
Director, Office of Construction
7450 Traffic Drive
Hanover MD 21076

Maryland Department of Transportation State Highway Administration
Director, Office of Environmental Design
707 North Calvert Street
Baltimore MD 21202

Maryland Department of Transportation State Highway Administration
Director, Office of Highway Development
707 North Calvert Street
Baltimore MD 21202

Maryland Department of Transportation State Highway Administration
Director, Office of Maintenance
7491 Connelley Drive
Hanover MD 21076

Maryland Department of Transportation State Highway Administration
Director, Office of Materials Technology
7450 Traffic Drive
Hanover MD 21076

Maryland Department of Transportation State Highway Administration
Director, Office of Traffic and Safety
7491 Connelley Drive
Hanover MD 21076
(Refer to Category 800 of the Contract Documents for working drawing submissions.)

(b) Working Drawings for Falsework Systems. Falsework systems (design, plans, and construction) shall be the responsibility of the Contractor, including submitting and obtaining written acceptance of the design and plans by the Engineer before erection.

The Contractor shall utilize a Professional Engineer (P.E.) registered in the State of Maryland who has at least five years experience in falsework design for bridge construction and repair. The falsework design calculations and plans shall be signed by the P.E. and bear the seal of the P.E. The submittal of the design and falsework plans shall include the P.E.'s resume showing evidence of the required experience.

The P.E.’s plans and design calculations shall evaluate and qualify all products and components including manufactured products and proprietary items for their intended service. Acceptance by the Engineer of falsework systems shall not in any way relieve the Contractor of the responsibility for the safety and adequacy of the design and construction for the falsework systems and operations, including all components.

Every structure in the construction Contract will require a separate falsework design analysis, separate plans, and design submittal as set forth above. This applies even though structures may appear to be identical.

Each falsework system shall be designed to support all vertical and horizontal loading with enough redundancy to prevent progressive failure. Vertical loading, differential settlement forces, live load where applicable, and all horizontal, lateral, and longitudinal forces shall be taken into account. Unbalanced temporary loading caused by placement sequence shall also be provided for in the design. Adequate diagonal bracing in all planes shall be employed.

All falsework systems (designs, plans, and construction) shall provide for adequate foundations with bearings below the frost line or on rock or on piling, and for possible settlement. If additional subsurface data is necessary, it shall be obtained and analyzed for proper design of the plans and performance of construction.

Falsework designs and plans shall include protection against impact from uncontrolled highway vehicles, accidental collision of a crane boom or other construction equipment and vehicles, traffic vibration, flood waters, high winds, and any other envisioned contingent situations.

TC-4.02 FAILURE TO MAINTAIN PROJECT

GP-5.12 (Failure to Maintain Entire Project) is not applicable to Administration Contracts. The provisions of this TC shall apply.

If the Contractor, at any time, fails to respond to the provisions of GP-5.11 (Maintenance of Work During Construction), the procurement officer will immediately notify the Contractor to comply with the required maintenance provisions. If corrective actions do not begin within four hours after receipt of the notice, the procurement officer may:

(a) Notify the contractor to suspend all other work until the unsatisfactory maintenance is corrected, or

(b) Proceed at any time with adequate forces and equipment to maintain the project. The entire cost of this maintenance will be deducted from monies due the Contractor on the next progress payment.

TC-4.03 USE AND POSSESSION PRIOR TO COMPLETION

In addition to the provisions of GP-7.15 (Use and Possession Prior to Completion) the following will apply on Administration Contracts:

Upon written authorization of the procurement officer, the Contractor may be relieved of maintenance during the time the Administration has taken possession. Any portion of the work that may be disturbed or damaged shall be restored at respective Contract prices for items involved, or on the basis of a predetermined arrangement entered into by the Contractor and procurement officer before the performance of the restoration work.

TC-4.04 SUSPENSION OF WORK

In addition to the provisions of GP-8.07 (Suspension of Work), the following shall apply on Administration Contracts.

The Engineer will have the authority to suspend the work wholly or in part due to the failure of the Contractor to correct conditions unsafe for the workers or the general public; for failure to carry out the requirements of the Contract Documents, or as directed in conformance with the Contract Documents for conditions considered unsuitable for the prosecution of the work.

TC-4.05 DISPUTE MEDIATION

When a dispute arises out of or relates to the Contract or breach thereof, and if the dispute cannot be settled through negotiation or the partnering issue resolution process, either party may first elect to try in good faith to settle the dispute by nonbinding mediation administered by a mutually agreed upon qualified mediator before proceeding with other dispute resolution procedures including litigation.

TERMS AND CONDITIONS

TC - SECTION 5: LEGAL RELATIONS AND PROGRESS

TC-5.01 INSURANCE

In addition to the provisions of GP-7.14 (Liability Insurance), the following shall apply on Administration Contracts.

The Contractor shall maintain in full force and effect third party legal liability insurance necessary to cover claims arising from the Contractor's operations under this agreement that cause damage to the person or property of third parties. The insurance shall be under a standard commercial general liability (CGL) form endorsed as necessary to comply with the above requirements and the other requirements of this Section. The State of Maryland shall be listed as an additional insured on the policy. The limit of liability shall be no less than $1 000 000 per occurrence/$2 000 000 general aggregate. The insurance shall be kept in full force and effect until all work has been satisfactorily completed and accepted.

When specified in the Contract Documents or otherwise required by law, the Contractor shall carry the type and amounts of insurance in addition to any other forms of insurance or bonds required under the terms of the Contract and these Specifications.

All insurance policies required by this Section, elsewhere in the Contract Documents, or otherwise required by law, shall be kept in full force and effect until all work has been satisfactorily completed and accepted. The Contractor shall be responsible for the payment of all deductibles or self-insured retentions.

All insurance policies required by this Section, elsewhere in the Contract Documents, or otherwise required by law, (other than Workers' Compensation Policies) shall include endorsements:

(a) Stating that the State of Maryland is an additional insured with respect to liability arising from the Contractor's operations under this agreement that cause damage to the person or property of third parties.

(b) Stating that such coverage as is provided by the policies for the benefit of the additional insureds is primary and any other coverage maintained by such additional insureds (including self-insurance pursuant to the Maryland Tort Claims Act) shall be non-contributing with the coverage provided under the policies.

(c) Containing waivers of subrogation with respect to all named insureds and additional insureds.

(d) Stating that the insurer has the duty to adjust claims and provide a defense with regard to such claims made against the additional insured.

All insurance policies required by this Section, elsewhere in the Contract Documents, or otherwise required by law, (including Workers' Compensation Policies) shall be endorsed to state that the insurer shall provide at least seven days notice of cancellation or nonrenewal to:

Maryland Department of Transportation State Highway Administration
Director, Office of Construction
7450 Traffic Drive
Hanover MD 21076

Evidence of insurance shall be provided to the Administration at the address listed above prior to the award of the Contract by means of a Certificate of Insurance with copies of all endorsements attached.

Any policy exclusions shall be shown on the face of the Certificate of Insurance or provided with the Certificate of Insurance.

Certificates of Insurance shall comply with all requirements of the Maryland Annotated Code, Insurance Article, §19-116. Certificates of Insurance shall be on a form approved by the Maryland Insurance Commissioner (Commissioner). Standard Certificate of Insurance forms currently adopted for use by the Association for Cooperative Operations Research (ACORD) or the Insurance Services Office (ISO) are deemed approved by the Commissioner and are acceptable. Outdated ACORD or ISO forms (those with a revision date prior to the date of the form currently adopted for current use by ACORD or ISO) are not acceptable. The Contractor shall ensure that all required Certificates of Insurance satisfy all requirements of §19-116 of the Insurance Article, including the prohibition against the issuance of any certificate of insurance that contains false or misleading information or that purports to amend, alter, or extend the coverage provided by the policies referenced in the certificate.

The Certificate of Insurance shall be accompanied by a document (a copy of State License or letter from insurer) that indicates that the agent signing the certificate is an authorized agent of the insurer.

No acceptance and/or approval of any Certificate of Insurance or insurance by the Administration shall be construed as relieving or excusing the Contractor, or the Contractor's Surety from any liability or obligation imposed upon either or both of them by the provisions of this Contract or elsewhere in the Contract Documents.

The cost of the insurance will not be measured but will be incidental to the Contract lump sum price for Mobilization. If an item for Mobilization is not provided, the cost of the insurance will be incidental to the other items specified in the Contract Documents.

Contractor and Railroad Public Liability and Property Damage Insurance shall be provided as specified in TC-6.05.

TC-5.02 NOTICE TO PROCEED AND PROJECT SCHEDULE

Within 45 days after the Contract has been executed, the Administration will issue to the Contractor a Notice to Proceed. This notice will stipulate the date on or before which the Contractor is expected to begin work. No work shall be started before receipt of the Notice to Proceed.

The requirement GP-8.04 (Progress Schedule) to submit a progress schedule within 30 days after Notice to Proceed is modified as follows:

Unless otherwise specified, on Administration projects the proposed project schedule shall be submitted within 14 days after receiving the Notice of Award. The Contractor shall not begin work on the project until the project schedule is approved by the Administration. However, time charges shall begin no later than the time stipulated in the Notice to Proceed.

TC-5.03 SUBCONTRACTING AND SUBCONTRACTORS

In addition to the provisions of GP-8.01 (Subcontracting), the following shall apply on Administration Contracts:

The subcontractors named in the Contractor's bid and approved by the Administration and those approved when subsequently submitted shall perform the Contract items as approved by the Administration. Requests for permission to sublet, assign, or otherwise dispose of any portion of the Contract shall be in writing and include the item number or numbers and the dollar value. The Contractor shall give assurance that the minimum wage for labor, as specified in the Contract Documents, shall apply to labor performed on all work sublet, assigned, or otherwise disposed of.

When a subcontractor has been approved by the Administration for the performance of specific items of work on the Contract, the Administration will not allow the Contractor to substitute another subcontractor, except in the event the Contractor requests in writing that the approved subcontractor be relieved of the necessity of performance of the work. Any change of subcontractors shall be requested in writing by the Contractor and shall have the written concurrence of the previously designated subcontractor. Concurrence shall not be unreasonably delayed, in the judgement of the Administration.

If a subcontractor does not perform to the satisfaction of the Contractor, the Contractor may request to be allowed to perform the work with its own forces or request that another subcontractor, mentioned by name, be substituted. When reasons submitted for the substitution of the subcontractor indicate that the change will be in the best interest of the Administration, approval of the request will be granted.

Roadside production of materials, unless performed by the Contractor, shall be considered as subcontracting. This shall be construed to mean the production of crushed stone, gravel, or other materials by means of portable or semi portable crushing, screening, or washing plants, established or reopened in the vicinity of the work for the purpose of supplying materials to be incorporated into the work on a designated project or projects.

The purchase of sand, gravel, crushed stone, crushed slag, batched concrete aggregates, ready mix concrete, or other materials produced at and furnished from established and recognized commercial plants, together with the delivery of the materials to the site of the work by the producer or by recognized commercial hauling companies, will not be considered as subcontracting.

Prompt Payment Subcontractors. The Contractor shall promptly pay a subcontractor any undisputed amount including retainage to which the subcontractor is entitled for work under the Contract within 10 calendar days of receiving a progress, semi final, or final payment in conformance with the latest edition of the State Finance and Procurement Article, §15-226, Annotated Code of Maryland.

The Administration has established the following time frame for subcontractor payment: When a progress, semi final, or final payment is processed and payment is received by the Contractor, payment shall be made to all subcontractors within 10 calendar days.

Each month, the Construction Project Engineer (CPE) will review the current pay items with the Contractor and all involved subcontractors to ensure that all work satisfactorily completed in conformance with the Contract Documents is included in the monthly progress payment. For payment purposes, the same quantity totals used to compute the payment to the Contractor will be the basis for payment to the subcontractor.

If the Contractor withholds payment from a subcontractor beyond 10 days, the Contractor shall:

(a) Notify the subcontractor in writing and state the reason why payment is being withheld; and

(b) Provide a copy of the notice to the CPE and the District Engineer.

If the subcontractor does not receive payment within the required 10 days, the subcontractor shall give written notice of nonpayment to the CPE and the District Engineer.

The notice shall:

(a) State the name of the Contractor, the Contract Number, and the amount in dispute.

(b) Provide an itemized summary on which the amount is based; and

(c) If known, provide an explanation for any dispute concerning payment by the Contractor.

The CPE will then notify the Assistant District Engineer, Construction (ADE) of the dispute. The ADE will verbally contact the Contractor within two business days to ascertain whether the amount withheld is an undisputed amount.

If the ADE determines that a part or all of the amount withheld is an undisputed amount, the ADE will instruct the Contractor to pay the subcontractor the undisputed amount within three business days. The instructions will be confirmed in writing.

The ADE will verbally communicate to the subcontractor the results of the discussion with the Contractor and confirm the results in writing.

If the Contractor fails to pay the subcontractor the undisputed amount within the specified three business days, the subcontractor may report the nonpayment in writing to the ADE.

Upon receipt of notification of nonpayment from the subcontractor, the ADE will schedule a meeting to verify and discuss the nonpayment issue. This meeting will be held at the District Office no later than 10 calendar days after receiving notice from the subcontractor.

Invited to this meeting will be the Contractor, the subcontractor, the ADE, and the CPE. The purpose of this meeting will be to establish why payment was not made to the subcontractor in the required time period. If it is determined that the Contractor is delinquent in payment to the subcontractor, further progress payments to the Contractor may be withheld until the subcontractor is paid.

If payment is not made to the subcontractor within seven business days after the ADE determines that the Contractor is delinquent in paying the subcontractor and the next progress payment becomes due, the progress payment will not be processed and a second meeting will be held at the District Office to address the dispute. The second meeting will be held no later than five business days after the close of the seven-day period. If the results of this second meeting reveal that payment to the subcontractor continues to be delinquent, the ADE may order a suspension of work based upon the failure of the Contractor to carry out the provisions of the Contract or the ADE may allow work to continue and withhold future progress payments as stated above.

In addition, the Administration may require the Contractor to pay a penalty to the subcontractor, in an amount not exceeding $100 per day, from the date the payment was directed to be made by the ADE.

A penalty will not be imposed for any period that the ADE determines the subcontractor was not diligent in reporting nonpayment in conformance with the Contract Documents. The Contractor to whom an instruction or order is directed shall comply with the instruction or order.

The Contractor shall notify the CPE when payment has been made to the subcontractor. The CPE will verify the payment with the subcontractor to ensure payment was received.

A Contractor or subcontractor may appeal the decision of the District Engineer to the Procurement Officer in conformance with GP-5.15 (Disputes). The Procurement Officer will render a final decision on this issue in conformance with GP-5.15 (Disputes) and the contractor shall comply with the Procurement Officer's decision.

An act, failure to act, or decision of a procurement officer or a representative of the Administration, concerning a payment dispute between a contractor and subcontractor under this chapter, may not:

(a) Affect the rights of the contracting parties under any other provision of lay; or

(b) Be used as evidence on the merits of a dispute between the Administration and the contractor or the contractor and the subcontractor in any other proceeding.

A decision of the Administration under these Terms and Conditions is not subject to judicial review or the provisions of COMAR 21.10.04.

Any administrative costs incurred by the Administration will be deducted from the Contractor's retainage at the conclusion of the project.

Nothing in this provision will prevent the subcontractor from pursuing a claim with the surety under the Contractor's payment bond at any time.

TC-5.04 CULTURAL RESOURCES

The Contractor shall be aware of the potential of cultural resources on the project. During the construction phase, whenever anything that might appear to be a cultural resource of a historical, archeological, or paleontological nature is encountered, such an object shall not be disturbed. Work shall be stopped and rescheduled in a way that shall avoid not only the objects but also the area of discovery, and the Engineer shall be notified at once. The Engineer will arrange for the evaluation of the situation by the appropriate authorities and for the ultimate disposition of the matter, taking the evaluation of the situation by the appropriate authorities into consideration.

TC-5.05 DETERMINATION AND EXTENSION OF CONTRACT TIME

The Contractor shall complete the work contracted for in an acceptable manner within the number of working days, calendar days, or calendar date as specified in the Invitation for Bids.

The Engineer will make available to the Contractor each week a record showing the number of days charged to the Contract for the preceding week. The Contractor will be allowed one week in which to protest and 30 days in which to file a written statement, setting forth in what respects time charges are incorrect.

If satisfactory fulfillment of the Contract with extensions and increases authorized under GP-4.04 (Variations in Estimated Quantities) and changes specified in the General Provisions require the performance of work in greater quantities than specified in the Invitation for Bids, the Contract time allowed for performance may be adjusted based on the quantities, cost, and the nature of the work involved.

The Contractor, under certain conditions, may be granted permission or be ordered to suspend operations as defined in GP-8.07 (Suspension of Work) on working day Contracts. If the Contractor elects and is permitted to do any work, the time charged shall bear the same ratio to the

total time allowed for the completion of the work, as the value of the work done during such time bears to the total value of the Contract. However, the resultant number of days to be charged for any particular month will never exceed the number of calendar days for that month, excluding Saturdays, Sundays, or official holidays on which no work was performed on a controlling item.

Time used in performing work of an emergency nature ordered by the Engineer for the convenience of the traveling public or for the production or delivery of materials for storage, if performed during the period of suspension, will not be charged against the Contract time.

Following the date on which all work has been completed, except those landscaping items on which work is restricted to specified seasons and when inspection and acceptance for maintenance is being deferred pending completion of those landscaping items on which work is not permissible at the time because such work is currently out of season, and for no other reason, no time will be charged against the Contract until such time as it is again permissible to proceed with such work. However, time will be charged during any extensions of the specified season that may be granted the Contractor.

Request for extension of Contract time shall be submitted in conformance with Section 109 as specified in the Contract Documents.

TERMS AND CONDITIONS

TC - SECTION 6: RESTRICTIONS AND PERMITS

TC-6.01 MOVING OF EQUIPMENT

The Contractor will not be permitted to move over or operate on any road (except on the road under construction) any power shovels, rollers, concrete mixers, cranes, tractors, or any other heavy equipment of weight or dimensions in excess of Maryland Motor Vehicle Law or Administration's regulations without first obtaining the usual permit. In case of permits for oversize and overweight vehicle movements, attention is directed to Maryland Motor Vehicle Laws requiring the Administration to collect a fee on every such vehicle movement using highways of the State. The payment of and securing of such permit is required irrespective of whether the movement is in connection with a subject Contract or for other purposes

TC-6.02 LOAD AND SPEED LIMITATIONS

The Bidder's attention is directed to the Annotated Code of Maryland, Transportation Article, Section 24-206, authorizing the appropriate County authorities of the counties listed below, to establish such load limits and appropriate speed limits on County roads as may be necessary to preserve the roads and provide adequately for public safety. The Bidder is advised to consult with the County Engineer in order to ascertain the extent of any restrictions applicable to County roads that the County authorities may propose to establish in connection with the construction of a Contract.

COUNTIES WITH LOAD AND SPEED LIMITATIONS
Allegany (AL)
Anne Arundel (AA)
Baltimore (BA)
Carroll (CL)
Frederick (FR)
Harford (HA)
Howard (HO)
Montgomery (MO)
Prince George’s (PG)
St. Mary’s (SM)
Washington (WA)

TC-6.03 COMPLIANCE WITH MARYLAND VEHICLE LAWS

The Maryland Vehicle Law requires each motor vehicle, trailer, semitrailer, and pole trailer driven on a highway to be registered.

There are some exceptions to this general requirement concerning nonresidents. If a nonresident is operating a vehicle in Maryland as described below the nonresident exemption is not applicable, and the vehicle being operated shall be titled and registered in conformance with the applicable Motor Vehicle Laws when the vehicle is:

(a) Used for transporting persons for hire, compensation, or profit;

(b) Regularly operated in carrying on business in this State;

(c) Designed, used, or maintained primarily for the transportation of property; or

(d) In the custody of any resident for more than 30 days during any registration year.

In addition to the titling and registration requirements for vehicles being operated in Maryland, all equipment being used shall be properly identified. Maryland classifies this equipment as "Special Mobile Equipment", which is defined as a vehicle that:

(a) Is not used primarily for highway transportation or property; and

(b) Is operated or moved on highway only as an incident to its nonhighway use.

Special mobile equipment includes a road construction or maintenance machine, mobile crane, ditch digger, well driller, concrete mixer, job site office vehicle, or portable power generator.

An interchangeable license plate is issued to special mobile equipment; however, titling is not required.

For additional information concerning the requirements for titling and registering vehicles in Maryland, contact the Motor Vehicle Administration, Chief, Division of Vehicle Registration.

The Contractor shall adhere to all State Motor Vehicle Laws and safety regulations.

TC-6.04 RESTORATION OF SURFACES OPENED BY PERMIT

The right to construct or reconstruct any utility in the highway or to grant permits for same at any time is reserved by the Administration.

Upon the presentation of a duly authorized and satisfactory permit, which provides that all necessary repair work shall be paid for by the party to whom the permit is issued, the Contractor shall allow parties bearing such permits to make openings in the highway.

The Contractor shall, when directed by the Engineer, make all necessary repairs due to such openings. This work will be paid for as additional work, as provided in these Specifications, and will be subject to the same conditions as original work performed.

TC-6.05 RAILROAD HIGHWAY GRADE CROSSINGS AND SEPARATIONS

When the Contractor is required to haul materials across the tracks of any railroad, or elects to do so, the Contractor shall make arrangements with that railroad for any new private crossings or for the use of any existing private crossing.

All work to be performed by the Contractor in the construction of railroad/highway separation structures on the railroad right-of-way shall be done in a manner satisfactory to the engineer of the railroad company and shall be performed at times and in a manner that does not interfere with the movement of trains or traffic upon the tracks. The Contractor shall take precaution to avoid accidents, damage, or unnecessary delay or interference with trains or other property. In addition to the insurance specified in TC-5.01 and when work covered under the Contract is to be performed within 50 ft of the rails of the railroad's tracks, the Contractor shall carry Contractor and Railroad Public Liability and Property Damage Insurance as specified in the Contract Documents.

Prospective Bidders on Contracts crossing railroad right-of-way are advised that the railroad company will require the Contractor to obtain, pay for, and have approved by the railroad, certain broad forms of public liability and property damage insurance policies before entering upon the railroad property. As a general rule, details of these policies are set forth in the Contract Provisions; but in case of omission from the Contract Provisions, the Contractor is required to communicate with the railroad to ascertain the type of insurance required, if any, and make provisions for the insurance in the Bid.

Unless otherwise specified, cost for the insurance policies, whether described in the Contract Provisions or ascertained by the Contractor, will not be paid for, but will be incidental to the other items specified in the Contract Documents.

All work on portions of structures over railroad right-of-way shall conform to all rules and regulations of the owners of the right-of-way. The Contractor shall acquire full knowledge of these rules and regulations and comply therewith to the satisfaction of the owners of the railroad right-of-way.

TC-6.06 BRIDGES AND OTHER WORK IN OR OVER WATERS OF THE STATE

All work in, on, or over waters under control of the Department of the Army or the Environmental Protection Agency of the United States shall conform to all applicable Federal permits, rules, and regulations. All of these rules and regulations are hereby part of the Contract. The Contractor is cautioned and charged with the responsibility of obtaining complete knowledge thereof and compliance therewith. The Contractor shall also comply with the provisions of other applicable Federal, State, and local laws and is cautioned to become knowledgeable with any pertinent regulations of the Maryland Department of Natural Resources and Maryland Department of Environment.

Work may be over or under navigable waters that are under the jurisdiction of the U.S. Coast Guard (USCG), Fifth District Bridge Office (OBR), 431 Crawford Street, Portsmouth, VA 23704.

Do not interfere with the free navigation on the waterways unless allowed in a USCG permit or as approved by the Engineer. Submit any required coordination documents to the Engineer so they can contact the U.S. Coast Guard headquarters on behalf of the Contractor for approval at least 45 days prior to proposed closures or proposed restrictions on waterway traffic. The U.S. Coast Guard may notify mariners and waterway users via local broadcasts. Fully comply with all laws, regulations, and operational requirements of the USCG, including those specified on USCG permits. Abide by the mitigation measures found in the project's NEPA document.

Make good for damages caused to crafts or persons, where damage or injury is attributable to acts of the Contractor in accordance with maritime laws.

Do not dispose any waste materials and debris in the surrounding waters. Report any incidental spills to the Engineer. Remove and dispose of materials at an approved waste site. The removal of waste materials and debris including hauling to an approved spoil area will not be measured but the cost will be incidental to the pertinent items specified in the Contract Documents.

All costs or expenses incurred by the Contractor in complying with the conditions in this section will not be measured but the cost will be incidental to the pertinent items specified in the Contract Documents.

TC-6.07 USE OF EXPLOSIVES

All blasting operations, including the storage and handling of explosives and blasting agents, shall be performed in conformance with the applicable provisions of the Contract Documents and all other pertinent Federal, State, and local regulations. All explosives shall be stored in a secure manner, and all of these storage places shall be marked clearly "DANGEROUS EXPLOSIVES" and shall be in the care of competent watchpersons at all times. Whenever explosives are used, they shall be of such character and in such amount as is permitted by the State and local laws and ordinances and all respective agencies having jurisdiction over them. The use or storage of explosives will not be permitted under, adjacent to, or on any existing structures unless authorized in writing by the Engineer.

At least 14 days prior to commencing drilling and blasting operations, or any time the Contractor proposes to change the drilling and blasting methods, the Contractor shall submit a Blasting Plan to the Engineer for review. The Blasting Plan shall contain the full details of the drilling and blasting patterns and controls the Contractor proposes to use. The Blasting Plan submittal is for quality control and record keeping purposes. Review of the Blasting Plan by the Engineer shall not relieve the Contractor of the responsibility for the accuracy and adequacy of the plan when implemented in the field. If at any time during the progress of the work the method of drilling and blasting does not produce the desired result, the Contractor shall submit a revised Blasting Plan until a technique is arrived at that shall produce the desired results.

Before firing any blast in areas where flying rock may result in personal injury or damage to property or the work, the rock to be blasted shall be covered with approved blasting mats, soil, or other equally serviceable material, to prevent flying rock. The Contractor shall notify each public utility company having structures in proximity to the site of the work of the intention to use explosives. This notice shall be given sufficiently in advance to enable the companies to take any steps they may deem necessary to protect their property from damage. This notice shall not relieve the Contractor of responsibility for any damage resulting from the Contractor's blasting operations.

The Engineer will have the authority to prohibit or halt the Contractor's blasting operations when: the methods being employed are not obtaining the required results; an unstable condition exists; or the safety and convenience of the traveling public is jeopardized.

TC-6.08 AERIAL ELECTRIC LINES

The Contractor shall be aware that State law requires that a 10 ft radial clearance shall be maintained for all construction equipment and materials in relation to electric lines carrying 750 volts or more. Because the State law is more stringent than the Federal laws, the State law shall be considered the minimal distance.

The Contractor shall also be aware of, and comply with, all other Federal, State, and local laws; and utility company requirements and regulations as specified in GP-7.01 (Compliance With Laws).

TC-6.09 HAZARDOUS MATERIAL

(a) If the Contractor encounters or exposes during construction any abnormal conditions that indicate the presence of a hazardous material or toxic waste, work in the area shall immediately be suspended and the Engineer notified. The Contractor's operations in this area shall not resume until permitted by the Engineer; however, the Contractor may continue working in other areas of the project, unless directed otherwise.

Abnormal conditions shall include, but not be limited to, the presence of barrels, obnoxious or unusual odors, excessively hot earth, smoke, or any other condition that could be a possible indicator of hazardous material or toxic waste. Where the Contractor performs necessary work required to dispose of these materials and no items have been identified in the Contract Documents, the work shall be performed under a change order.

(b) For any material furnished on the project by the Contractor suspected to be hazardous or toxic, the Engineer may require the Contractor to have it tested and certified to be in conformance with all applicable requirements and regulations. Material found to be hazardous or toxic shall not be incorporated into the work. The required testing will be determined by the Engineer and may include, but not be limited to, the EPA Toxicity Characteristic Leaching Procedure (TCLP) or its successor. The evaluation and interpretation of the test data will be made by the Engineer. Testing and certification shall be at no additional cost to the Administration.

(c) Disposition of the hazardous material or toxic waste shall be made in conformance with all applicable requirements and regulations.

TC-6.10 RECYCLED OR REHANDLED MATERIAL

Refer to 900.03 in the Contract Documents.

TC-6.11 CONSTRUCTION AND WASTE MATERIAL

All wood, trash, debris, and other foreign matter shall be removed from within the right-of-way limits and disposed of by the Contractor. The Contractor shall make all necessary arrangements to obtain suitable disposal locations and shall furnish the Engineer with a copy of resulting agreements. Disposal shall be in conformance with all Federal, State, and local ordinances.

TC-6.12 STRUCTURE UNDERCLEARANCES AND OVERHEAD CLEARANCES

General. The requirements for underclearances at structures shall apply to the entire usable roadway areas including shoulders. Unless otherwise specified in the Contract Documents or directed by the Engineer, the Contractor shall ensure that the following underclearances are maintained.

(a) All bridges (except pedestrian bridges) over Interstate, United States, or State highways shall have a 16.0 ft minimum vertical underclearance.

(b) All bridges (except pedestrian bridges) over secondary/county roads and local roads shall have a 14.5 ft minimum underclearance.

(c) All Pedestrian bridges shall have a minimum vertical underclearance 1 ft higher than those specified above. However, if there are bridges in the general vicinity of the proposed pedestrian bridge that have an underclearance greater than the minimum required underclearance of the pedestrian bridge, then the pedestrian bridge will have its underclearance increased to equal the highest overpass bridge. Removal of existing pavement under an existing pedestrian bridge to conform to the 1 ft higher requirement will not be required unless specified in the Contract Documents. Refer to the requirements included under the Resurfacing portion of this Specification.

(d) All bridges with overhead structural elements (e.g. through truss bridges, movable bridges with overhead bracing for counterweights, etc.) shall have a 17.5 ft minimum overhead vertical clearance.

When the above requirements are not met, the Engineer will contact the District Engineer and the Office of Structures to determine the need for remedial actions. When remedial actions are required, and there are no pay items for the work in the Contract Documents, the provisions of GP-4.06 (Changes) and GP-4.07 (Negotiated Payment Provisions) shall apply. The cost of

measurements to determine clearance heights will be incidental to other pertinent items in the Contract Documents.

Throughout construction, a minimum of 14.5 ft underclearance shall be maintained at all bridges, over each lane or shoulder open to traffic. No portion of formwork, temporary protective shields, etc. including connection devices shall encroach on this underclearance. If, during the construction, less than 16.0 ft of vertical underclearance is provided on bridges specified in (a), (c) or (d) above, the Engineer will inform the District Engineer, the Office of Structures, and the Chief of the Administration's Motor Carrier Division of the exact reduced minimum clearance and the effective dates of the reduction. The Contractor shall furnish and erect signs indicating the exact minimum underclearance. The signs and their locations shall be approved by the Engineer. Signs shall be removed and become the property of the Contractor when the intended underclearance is restored.

Resurfacing. The minimum underclearances shall be maintained whenever resurfacing a roadway. This may require grinding the existing pavement prior to placing the resurfacing material. Immediately after completing the resurfacing operation and when the lane closures are still in the effect, the Contractor, in the presence of the Engineer, shall measure the minimum vertical underclearance. The Engineer will submit results to the Office of Structures. The cost of these measurements will be incidental to other pertinent items specified in the Contract Documents. Whenever highway overpass bridges are in the general vicinity of a pedestrian bridge and the grinding is not required to maintain the specified clearances, the roadway under the pedestrian bridge shall be ground to provide a higher underclearance than the adjacent bridges. This requirement will be waived whenever the Engineer contacts the District Engineer and the Office of Structures and determines that the grinding would have an adverse effect on drainage, utilities, etc.

TC-6.13 HAULING OVER PROPOSED STRUCTURES

If the Contractor desires to haul across the proposed structures, they shall first apply for and obtain written permission from the Administration's District Engineer for each type of hauling equipment to be used. The approval will include the following provisions, which shall be complied with:

(a) Maximum total gross load (vehicle plus load), 45 tons.

(b) Maximum actual load of any axle, 15 tons.

(c) Minimum axle spacing, 14 ft (does not apply to tandem axles).

(d) Only rubber tired vehicles will be permitted.

(e) Maximum speed of loaded vehicle, 5 miles/hour.

(f) Maximum speed of unloaded vehicle, 15 miles/hour

(g) Minimum distance between traveling vehicles, 300 ft.

(h) Travel path across structures shall be midway between curbs/ parapets.

(i) Bridge deck shall be kept clean at all times

(j) At the conclusion of hauling, the Contractor shall thoroughly clean the entire roadway surface of the bridges and other parts of the bridges requiring cleaning as a result of the hauling operations.

The Contractor shall submit bonafide evidence to the Administration's District Engineer as to total weight of the loaded vehicle as well as the maximum weight of any axle thereon.

The Engineer's representative will be in frequent observation to enforce speeds, position of vehicles on the bridge and limitations as to vehicle spacing.

Any violation will result in the immediate cancellation of the approval for hauling operations predicted thereby.

The Contractor is responsible for damages to the bridges caused by their operations.

TC-6.14 STORING MATERIALS AND EQUIPMENT ON/AGAINST STRUCTURES RESTRICTION

Materials, and waste shall not be stored on or against any structure or structure element and equipment shall not be placed or used on any structure during the construction phase or finished or final configuration unless the written permission is obtained from the Administration's District Office and the Office of Structures for each type of material or equipment to be stored.

Loads, vehicle or other weight (materials etc.) that exceeds the bridge posted weight limit, if posted, or exceeds Maryland's legal vehicle loads on bridges, (with no posted bridge weight limits), are prohibited on the structure at any time, except as modified by the following. If the Contractor's intended operations will impose loads on the structure that exceed the weights listed above, the Contractor shall submit to the Engineer the type of material, its weight, the area that will be affected by the load, and its location on the structure. No stock pile of material regardless of unit weight shall be more than 4 ft high. If equipment is to be used, submit the maximum gross weight, axle spacing, load per axle, and proposed location on the structure. The maximum gross weight must include the vehicle weights in the most critical load position, i.e. front axle on crane with boom extended and element hanging. A special Hauling Permit is a requirement anytime equipment is moved over a structure that is over legal weight limit.

If any load requires evaluation, then a professional engineer registered in the State of Maryland and experienced in bridge design shall perform a load analysis to ensure that the load on the structure will not create an overstress condition on any bridge element. This analysis also includes effects of legal loads crossing the structure, if applicable. Analyses shall be submitted for review and loading cannot be imposed until written approval is received. Such submission does not guarantee acceptance by the Office of Structures, which reserves the sole right to accept or reject the proposed loading.

For structures under construction or rehabilitation, the Contractor shall also submit information pertaining to the phase of construction, such as which members have been modified or separated from the remainder of the structure, or have been newly constructed.

Any materials or equipment that would have a detrimental affect to the structure such as aluminum products placed against concrete surfaces shall be adequately protected to prohibit them from coming in contact with each other. Any discoloration or damage to the structure as a result of material or equipment being stored on/against the structure shall be removed or repaired.

TERMS AND CONDITIONS

TC - SECTION 7: PAYMENT

TC-7.01 MEASUREMENT OF QUANTITIES

For all items of work, other than those to be paid by lump sum, after the work is completed and before final payment is made, the Engineer will make final measurements to determine the quantities of various items of work performed as the basis for final settlement. The Contractor in case of unit price items will be paid for the actual amount of work performed and for the actual amount of materials in place in conformance with the Specifications and final measurements. All work completed under the Contract will be measured by the Engineer in conformance with the United States Standard Measure.

All longitudinal measurements for area will be made along the actual surface and not horizontally, and no deductions will be made for individual fixtures having an area of 9 ft^2 or less. For all transverse measurements for area of base course and pavements, the dimensions to be used in calculating the pay area will be the neat dimensions shown on the Plans or directed in writing by the Engineer.

Structure measurements shall conform to the neat lines shown on the Plans or as directed in writing, unless otherwise provided for elsewhere in the Contract Documents.

Volumes of excavation, tamped fill, and borrow pits will be calculated per cubic yard from the cross section and the use of average end area formulas. Volumes of other work such as masonry, removal of masonry, etc. will be calculated using arithmetical formulas. Where the volume is bounded by varying dimensions and there are no simple volumetric formulas applicable, frequent cross sections will be taken and the cubic yard volume computed from average end area formulas.

Cement will be measured by weight.

All items that are measured by the linear foot such as pipe culverts, traffic barrier, underdrains, etc., will be measured parallel to the base or foundation upon which such structures are placed unless otherwise specified in the Contract Documents.

The term gauge when used in connection with the measurement of uncoated steel sheet and light plates shall mean the U.S. Standard Gauge, except that when reference is made to the measurement of galvanized or aluminum sheets used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing, the term gauge shall mean that specified in M 36, M 167, M 196, or M 197.

When the term gauge refers to the measurement of wire, it shall mean the Washburn & Moen wire gauge as referenced in the New Departure Handbook. A tolerance of plus or minus 0.003 in. shall apply.

The term ton shall mean the short ton consisting of 2000 pounds avoirdupois. All materials that are specified by the ton shall be weighed on accurate, approved scales conforming to the requirements of the National Bureau of Standards Handbook 44. A digital recorder and printout shall be required on all truck scales. The digital recorder shall produce a printed record of the gross, tare, net weights, the time, date, truck identification, and Contract Number. Provisions shall be made so that the scales may not be manually manipulated during the process. The system shall be interlocked to allow printing only when the scale has come to rest.

Except for computer operated scales, all weights shall be certified by a bonded weigh person supplied by the Contractor, producer, or supplier. The security bond shall be $100 000.

If the material is shipped by rail, the car weight shall be accepted but the payment will be limited to the actual weight of material. Car weight will not be acceptable for material to be passed through mixing plants.

All materials for which measurements are obtained by the cubic yard shall be hauled in approved vehicles and measured at the point of delivery. No allowance will be made for the settlement of material in transit. Approved vehicles for this purpose shall be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual contents may be readily and accurately determined. Unless all approved vehicles are of uniform capacity, each approved vehicle shall bear a plainly legible identification mark indicating the specific approved capacity. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard may be weighed, and the weight will be converted to cubic yard for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Laboratory and shall be agreed to by the Contractor before the method of measurement of pay quantities will be approved by the Engineer.

Liquid asphalt material delivered for the project will be measured by volume in each railroad tank car, tank truck, distributor tank, or drums in which it is delivered. The measurements will be taken when the asphalt material is of a uniform temperature and free from air bubbles. The temperature of the material will be recorded.

The volumetric measurement of the asphalt material will be based upon a temperature of 60 F.

Reference is made to D1250, Petroleum Measurement Tables.

Only the quantity of asphalt material actually placed in the work and accepted will be considered in determining the amount due the Contractor.

Timber will be measured by the thousand board foot measurement (MBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

The term lump sum when used as an item of payment will mean complete payment for the unit of work described.

When complete structure or structural unit (in effect, lump sum work) is specified as the unit measurement, the unit will be construed to include all necessary fittings and accessories.

Rental of equipment will be measured in hours of actual working time, moving in and moving out costs, if any, and necessary traveling time of the equipment within the limits of the project, except when special conditions make some other method of measurement desirable.

TC-7.02 PAYMENT ALLOWANCES FOR STORED MATERIAL

When the Contractor requests payment allowance for materials, the following terms and conditions shall apply:

(a) For superstructure members delivered to the project or in storage at an approved site, an allowance of 100 percent of the material cost plus freight charges as invoiced may be made provided the cost does not exceed 90 percent of the Contract price of the applicable Contract item. The allowance will be based upon validated invoices or bills for material including freight charges, and a copy thereof shall be made a part of the documented records for the project.

(b) For reinforcement steel, piling, pipe, traffic barrier, signs and sign assemblies, form lumber, falsework, temporary structures, and other nonperishable material delivered to the project or in storage at an approved site, excluding aggregates, cement, seed, plants, fertilizer, or other perishable items, an allowance of 100 percent of the invoiced cost of the material plus freight charges to the Contractor may be made provided the cost does not exceed 90 percent of the Contract price of the applicable Contract item. Such material shall be delivered and stock-piled at the project site or an approved location (TC-7.02(d)) after being tested by the Administration and found to have conformed to the Specifications, if applicable, or to have been accepted under an approved certification program prior to the allowance.

(c) No allowance will be made for fuels or other materials that will not structurally assist the construction of a finished work item.

No payment for stored material will be made if it is anticipated that the material will be incorporated into the work within 30 days of the written request.

(d) Material for which an allowance is requested shall be stored in an approved manner in areas within the State of Maryland where damage is not likely to occur. If any of the stored materials are lost or become damaged in any manner, the Contractor shall be responsible for repairing or replacing the damaged materials. The value of the lost or damaged material will be deducted from the Contractor's subsequent estimates until replacement has been accomplished. The request for allowances for any materials stored on private property within the State of Maryland shall be accompanied by a

release from the owner and/or tenant of such property agreeing to permit the removal of the materials from the property at no cost to the Administration.

The material shall be clearly marked with the Administration's Contract Number on individual units. If the material is normally shipped to the project in bundles or other forms of packaging, the Administration's Contract Number shall be clearly marked or affixed to the package. When the material is not stored at the actual project site, the material shall be physically separated by fencing or equivalent barrier from other materials stored at the same site. The material shall be accessible to the Administration at all times.

When it is considered impractical to store materials on the actual project, the Engineer may approve storage areas in the vicinity of the actual project, which will be considered at the project site.

When storage of the materials within the State of Maryland is not practical, approval shall be obtained from the District Engineer for storage elsewhere. Storage of materials outside the State of Maryland will be subject to the conditions set forth in this provision and limited to materials exceeding $25 000, which are designed and fabricated exclusively for use on a specific project.

(e) Material for which payment has been made, either wholly or partially, shall not be removed from the approved location until such time that it is to be incorporated into the work unless authorized by the Engineer.

(f) The Contractor shall submit a written request for payment to the District Engineer at least two weeks prior to the estimate cutoff date established by the District Engineer. The following items shall accompany the written request for payment:

(1) Consent of surety specifying the material type and the items in which the material is to be used.

(2) Validated invoices with the signature of an officer of the company supplying the material showing actual cost.

(3) A notarized statement attesting that the invoices as submitted do not include charges or fees for placing, handling, erecting, or any other charges or markups other than the actual material cost, sales tax if applicable, and freight charges.

(4) Bills of lading showing delivery of the material. The request for allowances for any materials stored on property outside the State of Maryland shall be accompanied by a release from the owner or tenant of such property agreeing to permit verification by the Inspector that the material is stored at the approved location, and to permit the removal of the materials from the property at no cost to the Administration.

(5) Inspection test reports, certifications and/or a written statement from the Inspector attesting to the inspection and approval of the material.

(6) A statement explaining why the material cannot be stored on the project, if the Contractor is requesting to store material at a location other than the project site. The statement shall include the methods of storage, separation, and identification to be used by the Contractor. The Contractor shall provide a method of inventory control and withdrawal satisfactory to the Administration, which shall be used by the Contractor to monitor materials not stored on the project.

(7) A breakdown of the Contract line item bid unit price showing the relationship of the cost of the stored material to the costs of all other materials, labor, and components of the work included in the Contract line item unit price bid by the Contractor.

Upon receipt of the above by the District Engineer and verification by the Inspector that the material is stored at the approved location, the District Engineer will authorize payment.

The Contractor shall pay the material provider the amount shown on the invoice within 10 days of receipt of payment from the Administration. Evidence of payment shall be provided to the Administration. Failure to make invoice payments as specified will be cause to deduct the monies from future estimates and/or deny future stored materials payment requests.

Copies of all pertinent data shall be made by the Contractor and distributed to the Inspector for retention as part of the documented records for the project.

TC-7.03 FORCE ACCOUNT WORK

When the Contractor is required to perform work due to additions or changes to the Contract for which there are no applicable unit prices, the Administration and Contractor will make every effort to come to an agreed price for the performance of the work. If an agreement is not reached prior to the time that work must begin, the Administration will give written notification to the Contractor to proceed with the work on a force account basis while continuing to pursue a negotiated settlement. Failure to reach agreement prior to the completion of the work will necessitate that the work be completed and compensated in conformance with the following:

(a) Labor. Before any force account work begins, the Engineer and the Contractor must agree on the hourly labor rates for all laborers and foremen to be engaged in the work. The number of laborers and foremen engaged in the work will be subject to regulation by the Engineer and shall not exceed the number the Engineer deems most practical and economical for the work. For all labor and foremen in direct charge of the force account work, excluding general superintendence, compensation will be as follows:

(1) Certified Pay Rate. The Contractor shall receive the hourly pay rate shown on the Certified Payrolls for each hour that labor and foremen are actually engaged

in the work. Hourly pay rates that exceed those previously agreed upon must be authorized by the Engineer. Submit certified payrolls in conformance with the Contract Documents.

(2) Fringe Benefits. The Contractor shall receive the direct cost for fringe benefits that are required by collective bargaining agreements or other employment Contracts and that are not included in the certified hourly pay rate.

(3) Payroll Burden. The Contractor shall receive the following indirect costs at the applicable percentage of the certified hourly pay rate.

Social Security Tax
Medicare Tax
Unemployment Taxes
Worker's Compensation Insurance
Contractor's Public Liability Insurance
Contractor's Property Damage Liability Insurance

(4) Overhead and Profit on Labor. The Contractor shall receive an allowance of 18 percent of the sum total of (1), (2), and (3).

To substantiate the cost for (2) and (3), the Contractor shall furnish the Engineer a certified itemized breakdown. Instead of submitting an itemization for (3), the Contractor may elect to receive for Payroll Burden an amount equal to 20 percent of the certified hourly pay rate.

(b) Materials. For materials required to perform the work and accepted by the procurement officer, the Contractor shall receive the actual cost of the materials delivered on the work including tax and transportation charges paid by the Contractor (exclusive of machinery rentals as specified in (c) below).

In addition, the Contractor will be allowed 18 percent of the actual cost of materials, tax, and applicable transportation charges.

To substantiate materials and transportation cost, original receipted invoices shall be submitted.

If the materials used in the force account work are not specifically purchased for the work but are taken from the Contractor's stock, then in lieu of the original invoices the statements shall contain or be accompanied by an affidavit from the Contractor that shall certify that the materials were taken from the Contractor's stock, that the quantity claimed was actually used, and that the price and transportation cost of the material as claimed represents the actual cost.

The Administration reserves the right to furnish materials as it deems appropriate, and the Contractor shall have no claim for any costs, overhead, or profit on these materials.

(c) Equipment. For all equipment other than small tools, the Contractor shall receive rental rates as established herein and agreed to in writing before the work is begun for the actual time the equipment is in operation on force account work. Transportation costs directly attributable to force account work will be allowed. For the purpose of definition, equipment with a new cost of $1000 or less will be considered small tools.

(1) Contractor Owned Equipment. For all equipment utilized on force account work, the hourly rate for each piece of equipment and attachments will be the Blue Book monthly rate for the make and model multiplied by the appropriate rate adjustment factor, divided by 176, plus the hourly operating costs. The Contractor shall furnish to the Engineer a complete description, including the serial numbers and year of manufacture, for all pieces of equipment used on force account work.

The hourly rate for each piece of equipment will be the sum of the base machine rate, attachment rate, and operating rates established in the Rental Rate Blue Book for Construction Equipment current at the time the equipment is used.

(2) Equipment Rented Exclusively for Force Account Work. In cases where a piece of equipment is rented or leased by the Contractor from a third party exclusively for force account work, the actual invoiced amount will be paid when the rates are reasonably in line with established rental rates for the equipment in question and are approved by the Engineer.

In addition, the Contractor will be allowed 5 percent of the actual invoiced amount

(3) Moving Equipment. When it is necessary to obtain equipment exclusively for force account work from sources beyond the project limits, the cost of transferring the equipment to the site of the work and return will be allowed as an additional expense. Where the move requires the use of a hauling unit, the move in allowance will be limited to the rental rate for the hauling unit, as computed in (c) (1) above, plus operator wages.

When equipment is transferred under its own power, the moving allowance will be limited to half the hourly rental rate, as computed in (c) (1) above, plus operator's wages. If the move out is to a different location, payment will in no instance exceed the amount of the move in. Move in allowance will not be made for equipment brought to the project for force account work if it is subsequently retained on the project and utilized for Contract items or related work.

(4) Standby Time. Standby rates shall apply when a piece of equipment is required to remain on the project on standby status when authorized by the Engineer. When a unit works for a portion of a day and is on standby for a portion, the total time allowed shall not exceed 8 hours for that day. Standby rates shall be

half of the normal hourly base rates without the operating expenses. Standby rates shall not exceed 8 hours per day and will be allowed for working days only.

Equipment that is required to be on the project for transporting personnel or materials will be paid at the hourly rental rate for the actual hours per day it is utilized, with the remainder being standby time as computed above.

No compensation will be allowed for equipment that is inoperable due to breakdown.

(d) Subcontracting. The Contractor shall receive the cost of work performed by a subcontractor as determined in (a), (b), and (c). In addition, the Contractor will be allowed an allowance of $500 or 8 percent of the total combination of (a), (b), and (c), whichever sum is greater.

(e) Compensation. The compensation as specified in (a) through (e) above shall be received by the Contractor as payment for work done on a force account basis, which shall be full compensation for all costs associated with the force account including overhead and profit for the work performed.

(f) Force Account Daily Report. At the end of each day's work on any Force Account, the Engineer and Contractor's representative must complete a Daily Force Account Report. This report must be signed by both the Engineer and the Contractor's representative on a daily basis. Daily Force Account Reports for work performed and signed by a subcontractor, must also be signed by the Contractor. Each party shall retain a copy as substantiation of all labor, equipment, and materials used in the performance of the Force Account work.

(g) Partial Payment. The Contractor may request partial payment for force account work prior to submitting final documentation. Partial payment will be limited to 50 percent of the estimated amount for the work accomplished until all documentation has been received and approved.

(h) Final Payment. The final force account payment request from the Contractor will be subject to audit as specified in GP-7.36 Retention of Records.

TC-7.04 SCOPE OF PAYMENT

Payment to the Contractor will be made from the actual quantities of Contract items performed in conformance with the Plans and Specifications. If, upon completion of the construction, these actual quantities show either an increase or decrease from the quantities given in the bid schedule, the Contract unit prices will still prevail, except as provided in GP-4.04 (Variations in Estimated Quantities).

The payment of any partial estimate or of any retained percentage except by and under the approved final estimate and voucher shall in no way affect the obligation of the Contractor to repair or renew any defective parts of the construction or to be responsible for all damages due to such defects.

When requested in writing by the Contractor and approved by the procurement officer, payment allowance will be made for nonperishable material to be incorporated in the work delivered and stockpiled at the work site or other approved site in conformance with TC-7.02.

Payment to the Contractor under this section for materials on hand shall not be construed in any way as acceptance by the Administration of title to the material. Title shall remain with the Contractor until the project has been completed and accepted in conformance with GP-5.13 (Acceptance for Maintenance).

The Contractor Federal Tax Identification or Social Security Number shall be included on the face of each invoice billed to the State.

On Contracts in excess of $25 000, the Contractor and any subcontractor with a lower tier subcontract, prior to receiving a progress or final payment under this Contract, shall first certify in writing that he has made payment from proceeds of prior payments, and that he will make timely payments from the proceeds of the progress or final payment then due him, to his subcontractors and suppliers in conformance with his contractual arrangement with them.

The Contractor shall also obtain from each subcontractor a certification that payment from proceeds of prior payments have been made to any lower tier subcontractors and that timely payments will be made to the lower tier subcontractors and suppliers in conformance with contractual arrangements with them. This certification is not required from subcontractors who have no lower tier subcontracts. These certifications may be required by the procurement officer for Contracts of $25 000 or less.

In addition to any other remedies provided by law or this Contract, any Contractor or subcontractor of any tier who fails to make payment as required by the certifications set forth in the above paragraph within 30 days from the date such payment is due shall be obligated to include with such payments interest at the rate of 10 percent per annum from the date the payment was due to the date the payment was actually made to the subcontractor or lower tier subcontractor.

TC-7.05 PROGRESS PAYMENTS

(a) Current Estimate.

(1) Lump Sum Contracts. The Contractor shall furnish an acceptable breakdown of the lump sum Contract price showing the amount included therein for each principal category of the work. Said breakdown shall be in such detail so as to provide a basis for estimating monthly progress payments.

(2) Monthly Estimates. Each month the Administration will pay the Contractor for the Contract value of the authorized work satisfactorily performed during the preceding calendar month, less variable retainage specified in (3) Variable Retainage. Retainage will not be released until final payment (unless partially released in a semifinal payment or released to a subcontractor as per TC- 7.05(a)(3)(F)). Current estimates will be based upon the procurement officer's estimate of satisfactorily performed work (including materials and/or equipment complete in place). In the instance of lump sum items and each items, the procurement officer's estimate will either be the percentage of the item satisfactorily performed during the preceding month or as specified in contract documents. All quantities, estimates, and fractions will be reasonably accurate approximations and are subject to corrections: (a) in subsequent current estimates; (b) in any semi final estimate; and (c) in final payment. Any or all partial payments may be withheld in the event the Contractor has not complied with current requirements of the Specifications. Should either the procurement officer or the Contractor be of the opinion that any estimates, quantities, or fractions (either as to an individual current estimate or accumulations thereof) do not represent a reasonably accurate approximation of actual work, then the details questioned will be reviewed. Any necessary corrections and adjustments will be made in the next current estimate.

(3) Variable Retainage. The Contract will be subject to a variable retainage. Any variation in retainage (increase or decrease) will be at the discretion of the Administration and the District Engineer. Those meeting the minimum qualifications may have retainage reduced upon request of the Contractor with consent of surety. This request shall be processed through the District Engineer. If, in the opinion of the District Engineer at any time during the performance of the work, the evaluation of the contract or Contractor changes, retainage reduction may be reconsidered.

Minimum Qualifications are as follows: After 50 percent project completion and upon request, Contractors with 'A' evaluations for the last two years may be reduced from 5 percent to 1 percent. Project completion percentage will be based upon actual work completed (excluding monies paid for stored materials). An interim evaluation of the current project would need to be completed and would need to be an 'A'.

At 50 percent project completion and upon request, Contractors with 'B' evaluations or any combination of 'A' and 'B' evaluations for the last two years may be reduced from 5 percent to 2.5 percent, and remain at that level until released upon final payment. Project completion percentage will be based upon actual work completed (excluding monies paid for stored materials). An interim evaluation of the current project would need to be completed and would need to be an 'A' or 'B'.

Contractors with 'C' evaluations or any combination of 'C' and 'D' evaluation for the past two years will begin and remain at 5 percent for the life of the project.

Contractors with a 'D' evaluation for the last two years will begin at 5 percent. Project performance will be evaluated monthly with the retainage being raised to 10 percent for continued 'D' performance.

New Bidders. Contractors who have not been previously rated by the Administration may be eligible for a reduction in retainage. To be eligible, their past performance on highway and bridge work shall be documented by the government agency with whom they had a contract and their performance shall be documented on Administration forms. Contractors who do not fit into the above criteria would require a 5 percent retainage throughout the life of the Contract.

Subcontractors.

(A) Sections A-F apply if the contractor has furnished 100 percent payment security and 100 percent performance security.

(B) The contractor may not retain from any payment due a subcontractor a percent of the payment greater than the percent for retainage specified above.

(C) A subcontractor at any tier may not retain from any payment due a lower tier subcontractor a percent of the payment greater than the percent of payments retained from the subcontractor.

(D) A contractor and a subcontractor are not prohibited, by §§A and B, from withholding an amount in addition to retainage if the contractor or subcontractor determines that a subcontractor's performance under the subcontract provides reasonable grounds for withholding the additional amount.

(E) The contractor and each subcontractor at any tier shall include, in all of their subcontracts for work called for by this contract, wording that incorporates the provisions of §§B—E.

(F) A subcontractor may submit written notification to the Contractor requesting to have their portion of the retainage released if the following requirements are met.

(1) All tasks assigned to the subcontractor within the subcontractor agreement are satisfied.

(2) All related pay items associated with the subcontractor's responsibility have had all required documentation for those items submitted and approved by the Administration.

(3) The Contractor has notified the Administration that the subcontractor has fulfilled its contractual obligations, including submitting all required documentation, and has requested that the Administration conduct an Interim Subcontractor Final Inspection.

(4) The Administration has performed the said Interim Subcontractor Final Inspection. The Administration will verify that all Contract requirements have been satisfied during the Subcontractor Final Inspection, and issue in writing a Subcontractor Accepted for Maintenance letter. Subcontractor Accepted for Maintenance letter does not relieve the Contractor of the responsibility to perform the work to specifications or remedy its latent defects.

(5) All issues, including punch list items, and claims related to the subcontractor's work are resolved.

When (1)-(5) are met, the Contractor shall verify that the subcontractor's requested retainage is accurate and then submit, in writing, the subcontractor's request to release the subcontractor's portion of the retainage held by the Administration. The Assistant District Engineer-Construction (ADE-C) or department head shall then perform a subcontractor final inspection to determine if a Subcontractor Final Acceptance for Maintenance is warranted, if the acceptance is approved then the retainage request will be processed as per this specification. If the Subcontractor Final Acceptance for Maintenance is not granted, a list of outstanding responsibilities shall be provided to the contractor by the Administration for the subcontractor to complete in order to request another follow up Final Subcontractor Inspection.

Once the request is approved by the Administration, the Administration will submit to the Contractor "Subcontractor's Final Quantities" within 60 days of the approval. The tabulation shall be accompanied by a statement setting forth:

(a) The eliminated work, changed work and additional work performed under change orders and/or supplemental agreements by the subcontractor;

(b) The authorized extension or adjustments of time;

(c) The number of days that have been charged to date of the subcontractor's early retainage request;

(d) Any deductions, charges, or liquidated damages that have been made or imposed to date of the subcontractor's early retainage request. The Contractor shall have a period of 30 days from the date of receiving the aforementioned tabulations from the Administration, in which:

(1) To decide whether or not to accept the subcontractor's final tabulation of final quantities, and

(2) To notify the Administration, in writing, of the decision. The Contractor may request an additional period of 30 days in which to notify the Administration of their decision. In the event the Contractor notifies the Administration that the Contractor or subcontractor protests the final quantities on such basis, the notification shall outline the reasons for said protest.

After all parties have agreed upon the Subcontractor's Final Quantities, the Administration will begin the process of releasing the subcontractor's portion of the retainage. Once the Subcontractor Final Quantities are agreed upon, those items cannot be disputed at a future date and these items are considered finalized unless further work has been performed due to a partial item status or other contractual responsibilities of the Contractor in which further work had to be completed for said item.

The Contractor will have a period of 10 days to submit payment of the released retainage to the requesting subcontractor, after the Contractor has received said payment from the Administration for the subcontractor's portion of the remaining retainage held. The Contractor cannot hold additional retainage from the subcontractor after the subcontractor's final portion of retainage is released.

(4) Escrow Accounts For Retained Funds. The Contractor may elect to have retained funds paid to an escrow agent who may invest the funds in an approved interest bearing account which, upon completion of the Contract, will be paid to the Contractor to the extent to which the Contractor is entitled. The Contractor's election to use the escrow account procedure shall be indicated on the Contract Documents, and the escrow agreement shall be in a form and under terms approved by the Administration. The Contractor shall forfeit the right to the use of the escrow account for refusal or failure to indicate an election prior

to execution of the Contract. Note: This shall not apply if it conflicts with any Federal grant or regulation affecting the Contract.

(b) Semi-Final Estimate Payments.

(1) Upon completion of the project and the acceptance by the Administration for maintenance, the Administration, at the Contractor's request and with the consent of surety, will initiate a Memorandum of Action by the Director, Office of Construction, Department of Transportation State Highway Administration, authorizing semi final payment. Such a semi final estimate payment will be based upon: (a) quantities the Administration has computed and set up as proposed final quantities, and (b) a reasonably accurate estimate for those quantities for which the Administration has not yet completed computations. The quantities that the Administration sets forth as proposed final quantities shall be so designated. To arrive at the amount of the semi final estimate, the following will be deducted from the apparent estimated value of the Contract: (a) total of all amounts previously paid to the Contractor as current estimates, and (b) sums deemed chargeable against the Contractor including liquidated damages, and as a retainage, a sum not less than 1 percent of the total value of the Contract.

(2) In cases where there has been substantial completion of the project and there are remaining only inconsequential or minor work items such as painting, seeding, mulching, or planting to be completed and such items cannot be completed for an extended period of time because of seasonal or weather conditions, a semi final inspection will be made. If the work completed is found to be satisfactory, then there is deemed to be a partial acceptance on the entire project except for the uncompleted work items. Upon the above referred to partial acceptance, the Administration, within 30 days from such partial acceptance, upon request of the Contractor and with consent of surety, shall pay to the Contractor, what is hereby known as a partial semi final estimate payment. Such a semi final estimate will be based upon: (a) quantities the Administration has computed and set up as proposed final quantities, and (b) a reasonably accurate estimate for those quantities for which the Administration has not yet completed computations. The quantities that the Administration sets forth as proposed final quantities shall be so designated. To arrive at the amount of the semi final payment, the following will be deducted from the apparent estimated value of the Contract: (a) total of all amounts previously paid to the Contractor as current estimates; and (b) sums deemed chargeable against the Contractor including liquidated damages, and as a retainage, a sum equal to 1 percent of the total value of the Contract or $2000 whichever is greater.

(3) If all retained funds have not been paid to an escrow agent, as provided for in (a)(4), the Administration shall, upon payment of the semi final estimate, place the remaining retainage in an interest bearing escrow account, as designated and on such terms and conditions as specified by the procurement officer. At the

time of the final payment, any retainage due, and any interest accrued on the retainage due from the time of payment of the semi final estimate, shall be paid to the Contractor.

TC-7.06 FINAL ACCEPTANCE AND FINAL PAYMENT

(a) When the Contractor has completed a Contract, and it has been accepted for maintenance in conformance with the provisions of GP-5.13 (Acceptance for Maintenance), the Administration will promptly proceed:

(1) To make any necessary final surveys;

(2) To complete any necessary computations of quantities; and

(3) To submit to the Contractor for consideration, within 60 days after final completion and acceptance for maintenance by the procurement officer, a tabulation of the proposed final quantities, and a list of deficiencies required to be corrected prior to issuing a materials clearance. This tabulation shall be accompanied by a statement setting forth: (a) the additional work performed under change orders and/or supplemental agreements; (b) the authorized extension of time; (c) the number of days that have been charged to complete the Contract; and (d) any deductions, charges, or liquidated damages that have been made or imposed.

(b) The Contractor shall then have a period of 30 days from the date of receiving the aforementioned tabulation from the Administration, in which:

(1) To decide whether or not to accept final payment upon such a basis, and

(2) To notify the Administration, in writing, of the decision. The Contractor may request an additional period up to 30 days in which to notify the Administration of the decision. In the event the Contractor notifies the Administration that the Contractor protests final payment on such a basis, that notification shall outline the reasons for said protest.

(c) Upon receipt of a notification of acceptance as provided for in paragraph (b) above, final acceptance of the completed Contract will be contingent upon the Administration's authorized materials clearance. Within 20 days after the above conditions are met, the Administration will prepare the final estimate and final payment forms and submit them to the Contractor. These forms will show all data noted in paragraph (a) above, together with deductions for all prior payments. Within 30 days from the date these forms are received, the Contractor shall execute them and return them to the Administration for execution and payment. If such signed forms are not received by the Administration within the specified time, the Administration will prepare duplicate forms for execution and payment. Such action by the Administration shall be deemed to constitute acceptance and final payment.

(d) If under the provisions of paragraph (b) above, the Contractor notifies the Administration of the Contractor's protest and nonacceptance of the data submitted to the Contractor, the Administration shall pay the Contractor a semi final estimate, or an additional semi final estimate in the event a semi final estimate has already been paid based upon the data noted in paragraph (a) above, with deductions for all prior payments. A retainage equal to 1 percent of the total value of the Contract will be withheld by the Administration. The acceptance of such semi final estimate, or additional semi final estimate, shall not be considered a waiver on the part of the Contractor of its right to pursue the Contractor's protest and press for acceptance and final payment.

(e) In the event the Contractor does not accept the data submitted to the Contractor as described in paragraph (a) above and/or has outstanding a claim filed in conformance with GP-5.14 (Filing of Claim by Contractor), the procurement officer and the Contractor shall confer at mutually convenient times and endeavor to reconcile all points of disagreement expeditiously. If such reconciliation is accomplished, the Administration will promptly proceed with acceptance and final payment on the reconciled basis and in conformance with the provisions of paragraph (c) above. If reconciliation is not accomplished within 30 days, the decision of the procurement officer shall be reviewed by the Administrator and appropriate legal counsel. After review by the Administrator, the decision of the procurement officer is deemed to be the final action. The procurement officer shall furnish a copy of the final decision to the Contractor by certified mail, return receipt requested. This decision may be appealed by the Contractor to the Maryland State Board of Contract Appeals. This shall be done by filing a written notice of appeal to the Appeals Board within 30 days from the date of the final decision. Failure to provide timely notification to the procurement officer shall constitute a waiver by the Contractor of its right under GP- 5.15 (Disputes), and final payment may be made by the Administration based on the procurement officer's recommendation.

(f) All prior partial estimates and payments shall be subject to correction at the time of acceptance and final payment. If the Contractor has been previously overpaid, the amount of such overpayment shall be set forth in the Final Payment forms and the Contractor hereby agrees that the Contractor will reimburse the Administration for such overpayment within 180 days of receipt of such advice, and the Contractor's surety will not be granted release from obligation under the terms of the Contract until reimbursement has been made in full.

(g) Within 10 days after the provisions of (a) through (f) have been fulfilled, the procurement officer shall notify the Contractor that final acceptance of the project has been made. This notice will initiate the processing of the Memorandum of Action by the Administration's Chief Engineer, authorizing final payment. Final Payment will be due and payable within 30 days of the Chief Engineer's Memorandum of Action. As a condition precedent to Final Payment, the Contractor shall be required to execute a general release of all claims against the Administration arising out of, or in any way connected with the Contract.

(h) In conformance with subsection 7-222 of the State Finance and Procurement Article of the Annotated Code of Maryland, certification must be obtained from the Comptroller of the Treasury, and the Employment Security Administration, that all State taxes have been paid prior to the release of final payment on a construction Contract. The check will be processed and mailed only after notification is received from both departments that no State tax is owed.

TC-7.07 LATE PAYMENTS

(a) Payments for semi final estimates shall be made within 30 days of the date when the amount becomes due and payable as evidenced by the Director's Memorandum of Action. Payments for final estimates shall be made within 30 days of the date when the Contract amount becomes due and payable as evidenced by the Chief Engineer's Memorandum of Action. Charges for late payments of invoices, other than as described by Title 15, Subtitle 1, of the State Finance and Procurement Article, Annotated Code of Maryland, or by the Public Service Commission of Maryland with respect to regulated public utilities, as applicable, are prohibited.

(b) Contracts that specify invoicing required - Unless a payment is unauthorized, deferred, delayed, or set-off under COMAR 21.02.07, Payments to the Contractor pursuant to this Contract shall be made no later than 30 days after the State's receipt of a proper invoice from the Contractor.

The Contractor may be eligible to receive late payment interest at the rate of 9 percent per annum if:

(1) The Contractor submits an invoice for the late payment interest within 30 days after the date of the State's payment of the amount on which the interest accrued; and

(2) A contract claim has not been filed under State Finance and Procurement Article, Title 15, Subtitle 2, Annotated Code of Maryland.

The State is not liable for interest:

(1) Accruing more than one year after the 31st day after the agency receives the proper invoice; or

(2) On any amount representing unpaid interest. Charges for late payment of invoices are authorized only as prescribed by Title 15, Subtitle 1, of the State Finance and Procurement Article, Annotated Code of Maryland, or by the Public Service Commission of Maryland with respect to regulated public utilities, as applicable.

(c) A proper invoice shall include: a description of the items or services provided; the date the goods were received or the inclusive dates the services were rendered; the Contract

prices; retention, if any; the basis for the billing; the Contract or purchase order number; the Contractor's Federal Tax Identification Number or Social Security Number; and the name and address of the proper invoice recipient.

(d) In order to receive payment of interest, the Contractor must submit a proper invoice for accrued interest within 30 days after the payment date of the amount on which the interest is claimed to have accrued. Interest may not be claimed for more than one year following the 31st day after the date that a proper invoice was received, or on amounts representing unpaid interest, or on an amount due under a Contract remaining unpaid for any period prior to July 1, 1983, or if a claim has been filed under State Finance and Procurement Article, Title 15 of subtitle 2 of the Code.

(e) For the purposes of this Contract an amount will not be deemed due and payable if:

(1) The amount invoiced is inconsistent with the Contract.

(2) The proper invoice has not been received by the person or office specified in the Contract.

(3) The invoice or performance under the Contract is in dispute or the Contractor has failed to otherwise comply with the provisions of the Contract.

(4) The items or services have not been accepted.

(5) The quantity of items delivered is less than the quantity invoiced.

(6) The items or services do not meet the quality requirements of the Contract.

(7) The Contract provides for progress payments, but the proper invoice for the progress payment has not been submitted pursuant to the schedule contained in the agreement.

(8) The invoice is for the retainage, but not all stipulated conditions for release of the retainage have been met.

(9) The Contractor has not submitted satisfactory documentation or other evidence reasonably required by the procurement officer or by the Contract concerning performance under the Contract and compliance with its provisions.

TC-7.08 ELIMINATED ITEMS

In addition to the provisions of GP-4.04 Variations in Estimated Quantities, the following shall apply to Administration Contracts.

Should any Contract items contained in the Invitation for Bids be found unnecessary for the proper completion of the work contracted, the Engineer may, upon written order to the Contractor,

eliminate such Contract items from the Contract and no allowance will be made for items so eliminated in making final payment to the Contractor except for material costs incurred prior to notification of the elimination of the items.

CATEGORY 100
PRELIMINARY

SECTION 101 — CLEARING AND GRUBBING

101.01 DESCRIPTION

Clear and grub within the specified limits.

101.01.01 Definitions.

(a) Clearing. The removal and disposal of trees, fallen timber and rotten wood, brush, shrubs, vegetation, rubbish, fences, and structures not specified in the Contract Documents for removal and disposal. Unless otherwise specified, clearing outside the LOD includes the removal of rubbish only.

(b) Grubbing. An earth-disturbing activity, which includes the removing from the ground and disposing of all stumps, roots and stubs, brush, and debris.

(c) Limits of Disturbance (LOD). The maximum allowable limit of earth disturbance as delineated in the Contract Documents. When not delineated in the Contract Documents, the LOD will be 10 ft beyond the top of cut, toe of slope, or limit of ditch excavation. Do not perform earth-disturbing activities beyond the LOD without authorization.

(d) Limits. Clearing and grubbing is confined to the LOD and authorized modifications to the LOD. When indicated in the Contract Documents, the limit of clearing may include the area between the LOD and the right-of-way or easement lines.

(e) Grading Unit. A contiguous area of erodible material exposed at one time, not to exceed 20 acres.

(f) Disturbed Area. An area where erodible material is exposed by construction activities.

(g) Stabilization Measures. Activities that prevent erosion. These activities include the placement of temporary mulch, temporary seed, permanent seeding such as turfgrass establishment, soil stabilization matting, riprap, stone aggregate, and asphalt or concrete paving. The placement of one or more of these temporary or permanent stabilization measures to the satisfaction of the Engineer will meet the requirements for proceeding to the next grading unit or operation.

101.02 MATERIALS

Not applicable.

101.03 CONSTRUCTION

101.03.01 Erosion and Sediment Control. Unless otherwise specified or approved, limit the clearing and grubbing area to a single 20 acres grading unit per grading operation. Once this first unit is half graded and stabilization measures are in place and approved, the work may proceed to a second 20 acres grading unit. When approved by the Engineer, the clearing and grubbing area may exceed the one grading unit requirement when necessary to balance earthwork or when grading interchanges. Maintain erosion and sediment controls as specified.

The grading operation will be limited to the Contractor's ability to provide adequate resources to perform the grading in a timely manner and to provide and maintain the proper erosion and sediment control measures. The Engineer is the final authority in this determination. When wet soil conditions are encountered, the clearing, grubbing, and grading of another unit will be allowed, once stabilization of the initial unit is approved.

The maximum area that may be cleared and grubbed is limited to a single grading unit unless otherwise specified and approved. Work may proceed to a subsequent grading unit once at least 50 percent of the current grading unit is stabilized as determined and approved by the Regional Environmental Coordinator. Unless specifically approved, no more than 30 acres cumulatively may be disturbed at any given time.

101.03.02 Tree Preservation Areas and Tree Branch Pruning. Trees, shrubs and plants to remain in place will be designated on the plans as specified in Section 120 or will be designated by the Engineer.

(a) Protect Tree Preservation Areas and other designated plants in conformance with GP- 7.11 and as specified in Section 120.

(b) Perform Tree Branch Pruning as specified in Section 712. Cut and trim tree branches overhanging paved areas of the roadway to maintain a vertical clearance of 16 ft above the pavement or conform to the specifications of any Tree Preservation Plan developed by the Administration.

101.03.03 Fences. Remove and dispose of all fences within the right of way, unless otherwise specified.

101.03.04 Mailboxes. Remove and reset mailboxes as directed.

101.03.05 Grubbing.

(a) Excavation Areas. Remove all embedded stumps and roots to a depth of at least 3 ft below the subgrade or slope surface. Refill all depressions made below the subgrade or slope surfaces with materials suitable for embankment and compact as specified in Section 204.

(b) Low Embankments. Grub areas where the total depth of the embankment is less than 3 ft.

(c) High Embankments. In areas where the embankment is 3 ft or more in depth, cut off trees and stumps as close to the ground as practical but not greater than 1 ft above the ground surface. Near the toe of embankment slopes, remove trees and stumps that are within 1 ft of the slope surface.

(d) Stormwater Management (SWM) Facilities. In areas specified for SWM facilities, grub excavation areas and embankments as specified in 101.03.05(a) and 101.03.05(b) regardless of the total depth of the embankment. When SWM facility embankments include embankment cores, grub to a depth at least equal to the depth of the cut-off trench.

101.03.06 Stream and Channel Changes. When an LOD is not specified, clear and grub 5 ft beyond the top of the cut slopes or as directed.

101.03.07 Disposal.

(a) Burning. Burn only under the constant care of a watchperson and according to applicable laws and ordinances of respective jurisdictions.

(b) Disposal Locations. Remove from the right-of-way and dispose of all unburned material and debris. Make all necessary arrangements to obtain suitable disposal locations. Furnish the Engineer with a copy of resulting agreements.

(c) Wood Disposal. If disposal of wood to the public is proposed, submit the disposal plan to the District Engineer for review, and obtain approval prior to beginning the clearing and grubbing operation. Perform this method of disposal from a location that is off the job site.

(d) Ash Tree Quarantine. Wood of Ash trees of the genus Fraxinus is quarantined and may not be moved outside the State of Maryland.

101.03.08 Damage to Trees and Other Protected Resources.

(a) Ensure that the LOD and all protected resources are demarcated as specified in Section 107.

(b) Perform damage repair and damage compensation as specified in Section 712 for damage beyond the LOD due to work operations. Refer to Occupying Wetlands provisions in the Contract Documents for unauthorized impacts to wetlands, wetland buffers, Waters of the United States (WUS), and floodplains.

101.04 MEASUREMENT AND PAYMENT

Clearing and Grubbing will not be measured but will be paid for at the Contract lump sum price. The payment will be full compensation for the removal and disposal of fences, removal and resetting of mailboxes, damage repair and compensation for trees, restoration measures for damaged or destroyed protected resources, repair to other damaged properties, removal and disposal of existing buildings when not covered as a specific pay item in the Contract Documents, and material, labor, equipment, tools, and incidentals necessary to complete the work.

101.04.01 Tree Branch Pruning to remove branches overhanging paved areas, and any other Tree Branch Pruning specified in the Contract Documents, will be paid for separately at the Contract lump sum price.

CATEGORY 100
PRELIMINARY

SECTION 102 — REMOVAL AND DISPOSAL OF EXISTING BUILDINGS

102.01 DESCRIPTION

Remove and dispose of existing buildings, including foundations, footings, or any part thereof, and backfill as specified. Locations of buildings included in the work will be designated in the Contract Documents by the circled numbers ①, ②, ③ etc.

102.02 MATERIALS

Not applicable.

102.03 CONSTRUCTION

Schedule the removal, razing, or occupation of buildings and appurtenances as one of the first items of work. Post and protect the buildings from vandalism and theft.

Remove and dispose of buildings scheduled for temporary use immediately when vacated.

Buildings and appurtenances may be disposed of by burning if they are not located close to habitable dwellings and if not prohibited by local or State laws, regulations, ordinances, or by the fire marshal.

Salvaged materials shall become the property of the Contractor. Selling of merchantable material and removal by the purchaser shall be done only during daylight working hours and accompanied by a Contractor's representative.

102.04 MEASUREMENT AND PAYMENT

Removal and Disposal of Existing Buildings will not be measured but will be paid for at the Contract lump sum price. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. Buildings not designated for removal and disposal in the Contract Documents will not be measured but the cost will be incidental to Section 101. The Administration reserves the right to eliminate from this item any or all buildings or structures. For each building eliminated from this item, the item will be credited to the extent of the cost eliminated, which will be determined from a breakdown submitted by the Contractor showing the tabulation of individual unit costs used in arriving at the Contract price for this item. Submit a breakdown of the Contract lump sum price for Removal and Disposal of Existing Buildings to the Engineer prior to beginning work.

CATEGORY 100
PRELIMINARY

SECTION 103 — ENGINEERS OFFICE

103.01 DESCRIPTION

Furnish, clean, and maintain in good condition an Engineers Office at an approved location within the immediate vicinity of the project. The office shall be separate from any offices used by the Contractor, and it and all items therein shall be for the exclusive use of the Administration's Engineers and Inspectors. Rented properties conforming to the type of office specified in the Contract Documents will be acceptable.

103.02 MATERIALS

Not applicable.

103.03 CONSTRUCTION

Set up, equip, and make the office ready for use as approved by the Engineer at least five days prior to commencement of other work on the project. When an Engineers Office is not specified, have the computer system ready for use at least five days prior to the start of any work on the project. Leave the office and components in place until all field records are complete.

Protect the Administration and Administration employees from any loss or damage to their property stored in the Engineers Office. Provide protection in the amount of twenty thousand ($20 000) dollars, nondeductible, per each occurrence, for loss or damage due to fire, theft, vandalism, storms, floods, or any combination thereof. Complete the reimbursement, replacement, or repair within 30 days from the date the Engineer reports the loss.

If facilities, equipment, or services become defective, are stolen, or for other reasons do not function as intended, repair or replace with an equal or better unit within one business day after notification by the Engineer at no additional cost to the Administration.

Unless otherwise specified, the office and all furnished equipment and accessories shall become the property of the Contractor at the completion of the project. Upon removal of the office, restore the location to a condition acceptable to the Engineer.

103.03.01 Mobile Housing Unit. Provide a mobile housing unit having floor space of at least 100 ft^2 and window area of at least 10 ft^2. Ensure it is entirely enclosed, waterproofed, and has a door that locks. Provide a table 36 in. x 48 in. x 40 in. high and one closet equipped with a lock. Furnish two keys for each lock. Provide satisfactory heating and cooling. Relocate the unit as directed.

103.03.02 Handicap Accessibility. When handicap accessibility is necessary, comply with the latest accessibility guidelines of the Americans with Disabilities Act (ADA).

103.03.03 Mobile Office Trailers. Anchor in accordance with the manufacturer's recommendations. Office trailers, as defined under the Industrialized Building and Manufactured Homes Act of Maryland, shall be approved by the Maryland Department of Housing and Community Development and bear the Maryland Certification Insignia in the interior of the office.

103.03.04 Quality Control Laboratory. Section 915.

103.03.05 Requirements for All Offices. For the office components listed, provide quantities as noted in Table 103.03.07A in accordance with the type of office specified.

(a) Entirely enclosed, weatherproofed, and completely insulated to at least an R11 rating.

(b) Finished inside and outside in compliance with Maryland Building Codes.

(c) A ceiling height of at least 7 ft.

(d) A 4 ft x 1 ft sign with the message "ENGINEERS OFFICE – STATE HIGHWAY ADMINISTRATION" attached to or mounted in front of the office. The sign shall have a black background and have white lettering at least 3 in. high.

(e) A 5 in. x 7 in. no smoking sign posted on the outside of each entrance to the office, plant laboratory, and mobile housing unit.

(f) Interior and exterior doors equipped with different key locks. Interior doors keyed alike. Exterior doors keyed alike. An additional dead bolt lock for each exterior door. Four keys for each interior and exterior lock.

(g) Operable windows with latches, screens, and venetian blinds or shades.

(h) Wired in accordance with the National Electrical Code, with lighting to provide an illumination level of at least 75 ft-c.

(i) Equipment capable of heating the office to at least 70 F and cooling to at least 78 F.

(j) Sanitary restroom facilities located within or near the field office, to include toilet and hand-washing fixtures of adequate quantity to accommodate the number of persons on site. If the field office is within a permanent building, the restroom shall include hot

and cold potable water, hand soap, and hand towels or air dryers. For a mobile type office without plumbing, provide sanitary portable toilets on site with waterless hand soap dispenser. The restroom facilities shall have locking doors and provide sufficient privacy.

(k) Complete all utility connections and pay utility usage costs.

(l) Maintain the facilities in a clean and sanitary condition. Sweep the floor and remove the trash daily. Perform all work on an as needed basis, as directed.

(m) A parking area for the exclusive use of Administration employees with the number of spaces as specified. Post signs to designate the assigned parking areas. Stabilize the parking area as directed and in accordance with Section 308.

(n) Multi-purpose Type ABC fire extinguisher (at least 10 lb.), equipped with a pressure gauge and maintained in accordance with OSHA standards.

(o) ANSI 24 Unit First Aid Kit furnished and maintained as described in 29 CFR 1926.50.

(p) A 4 ft x 9 ft waterproof bulletin board installed in a readily accessible area within the project limits for displaying employee and public notices as required for the project.

(q) Landline telephone service with desktop corded telephone including a digital answering system.

(r) One 12 ft^2 or larger refrigerator.

(s) One drinking water cooler, including bottled water and disposable cups.

103.03.06 Engineers Office Equipment and Services. Provide the following items with quantities as listed in Table 103.03.07B. Ensure the computer system is ready for use on or before the day the Engineers Office is to be occupied.

(a) Computer System. A Windows PC computer system with the following minimum hardware. The computer system is for the sole use of the Engineer. Any remote access to the computer by the Contractor may be allowed only with the permission and supervision of the Engineer.

(1) Computer Hardware. Minimum Specifications as follows.

Specification	Type A - Desktop Computer	Type B - Laptop Computer
Processor Type	Intel Core i5	Intel Core i5
Processor Speed	2.4 Ghz	2.4 Ghz
Memory	8 GB RAM	8 GB RAM
Graphics	Intel HD	Intel HD
Hard Drive	500 GB	500 GB

Optical Drive	DVD +/- RW Drive	DVD +/- RW Drive
Monitor/Display	24 in. Widescreen HD LED	15 in. 1366 x 768 HD LED
Keyboard	Keyboard with numeric keypad	Integral Keyboard with numeric keypad
Mouse	USB Optical 3-Button Mouse	USB Optical 3-Button Mouse
Integral Touchpad	N/A	Yes
Web Cam	External or with monitor	Integral
Microphone	External or with monitor	Integral
Speakers	External or with monitor	Integral
USB Ports	4 (2 front, 2 rear)	3
Wireless Connectivity	N/A	Yes
Other	-	(See "a." below.)

i. Additional Laptop Computer Requirements. A carrying case, a 120V AC adapter/charger, and a 150W 12V DC to 120V AC power inverter for in-vehicle use of the laptop.

a. If the project does not include an Engineers Office. A mobile Wi-Fi hotspot for remote internet access for the laptop.

(2) Computer Software. Provide and install the following software for each computer.

Type	Software Package
Operating System	Microsoft Windows 10 or newer
Productivity Tools	**32-bit** Microsoft Office Professional 2016 or newer
PDF File Reader	Adobe Acrobat Reader - current version
Note: Include all current software updates and service packs.	

(3) Miscellaneous Computer Supplies. For each computer, provide three 64-GB USB flash drive storage devices, one surge-protected outlet strip, and blank recordable CD-RW disks as needed.

(4) When the computer system is no longer required, the Construction Management Software system, including original user manuals, program disks, and all data files, will be removed by the Engineer and become the property of the Administration. Wipe computer hard drives and storage devices that are an integral part of the system under the supervision of the Engineer. The remaining computer system shall remain the property of the Contractor.

(b) Internet Service. Unlimited high-speed internet service approved by the Engineer, using the optimal service type available at the field office location. The service shall

include a modem and wireless router, and all necessary cabling. Provide internet with minimum 5 Mbps download and 2 Mbps upload speeds.

(c) High-Capacity Multi-function B&W Laser Copier/Scanner/Printer. With automatic document feeder capable of printing at least 25 letter-size copies per minute and handling documents of up to 11 in. x 17 in., with 2 GB RAM memory. The unit shall be network enabled, supporting Windows 8 through 10 operating systems. Include two 500-sheet universal paper drawers. Provide up to 600 dpi color scanning capability, with scanning to email, USB, or computer in TIFF, JPEG, and PDF file formats. Supply paper, toner, and provide maintenance service as needed.

(d) Low-Capacity Multi-function Color Ink Jet Printer/Scanner/Copier/FAX. With automatic document feeder capable of printing at least 10 letter-size color copies per minute. The unit shall be network enabled, supporting Windows 8 through 10 operating systems. Provide up to 600 dpi color scanning capability, with scanning to USB or computer in TIFF, JPEG, and PDF file formats. Supply paper, ink, and provide maintenance service as needed.

(e) Paper Shredder. Cross-cut paper shredder capable of shredding at least 10 sheets at a time.

(f) Digital Camera. 16.0-megapixel resolution camera with 5X optical zoom. Include two rechargeable battery packs, battery charger, 32 GB SD memory card, USB connection cable, carrying strap, and protective case. Photos and removable media will be the property of the Administration. The Administration assumes no responsibility for the condition of the camera when it is returned to the Contractor at project completion.

103.03.07 Specific Field Office Requirements.

Type A Engineers Office. Standard office trailer with at least 200 ft^2 of floor area under one roof.

Type B Engineers Office. Standard office trailer with at least 400 ft^2 of floor area under one roof.

Type C Engineers Office. Standard office trailer with at least 700 ft^2 of floor area under one roof.

Type D Engineers Office. One-story structure containing at least 1300 ft^2 of floor area under one roof. Modular construction is acceptable. Office trailers are not acceptable.

Table 103.03.07A – Specific Quantity Requirements by Office Type

TYPE AND QUANTITY				ITEM
A	**B**	**C**	**D**	
—	1	2	—	Inner Offices-100 ft^2 each
—	1	1	—	General office area
—	—	—	4	Inner Offices-120 ft^2 each
—	—	—	1	Conference room-240 ft^2
—	—	—	1	Storeroom with shelves-120 ft^2
1	1	1	2	Restroom, 30 ft^2
—	1	1	1	Inner office ingress and egress to the other rooms
3	4	4	5	32 in. x 60 in. Executive type desks with center drawers
3	4	4	5	Swivel chairs padded with arm rests
1	1	1	1	30 in. x 72 in. slant top drafting table and stool, approximately 40 in. high at the front edge
1	2	3	6	30 in. x 72 in. folding utility table, 30 in. high
—	—	—	1	12-person conference table with padded chairs
2	6	10	12	Additional padded chairs
1	2	2	3	Plan racks
1	1	1	2	Coat racks
1	1	1	1	3 ft x 6 ft blackboard or whiteboard
1	2	3	3	Desktop printing calculators with paper tape
1	1	2	6	Legal size steel filing cabinets, 4 drawer fire resistant (D label) with locks
—	2	2	2	Standard size steel filing cabinets, 4 drawers with locks
1	1	1	5	Bookcases having four shelves 36 in. x 12 in.
1	2	2	2	Closets, full height, measuring at least 24 in. x 30 in., equipped with locks, and at least two shelves in each
1	1	1	—	Utility cabinet with 3 adjustable shelves
1	1	1	—	Overhead cabinet at least 8 ft long, 15 in. deep, and 18 in. high
1	1	1	2	Fire extinguishers as specified in 103.03.05
1	1	1	2	Telephones with separate lines, as specified in 103.03.05
2	2	2	2	Battery-operated smoke detectors
4	8	10	15	Designated parking spaces

Table 103.03.07B - Office Equipment Quantity Requirements

ITEM	SECTION	QUANTITY
Type A - Desktop Computer	103.03.06(a)(1)	As specified
Type B - Laptop Computer	103.03.06(a)(1)	As specified
High-Capacity Multi-function B&W Laser Copier/Scanner/Printer	103.03.06(c)	As specified
Low-Capacity Multi-function Color Ink Jet Printer/Scanner/Copier/FAX	103.03.06(d)	As specified
Paper shredder	103.03.06(e)	As specified
Digital camera	103.03.06(f)	As specified
Monitor 24 in. Widescreen HD LED with integrated webcam and microphone that is compatible with project assigned devices	103.03.06	As specified

103.03.08 Recycling. Provide for the recycling of paper, cardboard, glass bottles and containers, plastic bottles and containers, and aluminum cans at the Engineers Office and the Contractor's facilities for the project.

Furnish approved containers and remove the material from the site on an approved schedule and as directed. All material shall be taken to an authorized recycling facility.

103.04 MEASUREMENT AND PAYMENT

Engineers Office will not be measured but will be paid for at the Contract lump sum price for the pertinent Engineers Office specified.

Payment of 50 percent of the Contract lump sum price will be payable on the first estimate after the complete installation of the Engineers Office. The remaining 50 percent will be prorated and paid in equal amounts on each subsequent monthly estimate. The number of months used for prorating will be the number estimated to complete the work. The final month's pro-rata amount will not be paid until the office is removed and the area is restored. The payment will be full compensation for site preparation, utility costs, all specified furnishings, to provide, equip, clean, maintain, insure, remove and dispose of the office, restore the site, recycling, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The only exception to the all-inclusive Contract lump sum price is the stabilization of the parking area, which will be measured and paid for using the pertinent items as specified in the Contract Documents.

The office equipment listed in Table 103.03.07B will not be measured but the cost will be incidental to the contract price for the Engineers Office item. If an item for Engineers Office is not specified, the cost of the office equipment will be incidental to the payment for Mobilization. In absence of either item, payment will be incidental to the other items specified in the Contract Documents.

The repair or replacement of defective, stolen, or otherwise defective facilities, equipment, and services, which do not function as intended, with an equal or better facilities, equipment, and services at no additional cost to the Administration.

Recycling. The Contractor shall be considered the owner of any profit and be responsible for all incurred costs.

CATEGORY 100
PRELIMINARY

SECTION 104 — MAINTENANCE OF TRAFFIC

104.00 GENERAL

This Section sets forth the traffic control requirements necessary for the safe and continuous maintenance of traffic throughout the area affected by the work and is intended to minimize inconveniences to the traveling public, while providing for the safety of motorists, pedestrians, and workers. Maintain vehicular and pedestrian traffic on or along any transportation facility as specified in the Contract Documents.

When speed of traffic is noted, this means the posted speed or prevailing travel speed, whichever is higher, unless otherwise specified.

All applicable Maintenance of Traffic equipment shall conform to NCHRP Report 350 and/or MASH 2016 criteria for Test Level 3.

When no longer needed, remove items used for temporary maintenance of traffic from the project site. All removed items shall become the property of the Contractor, unless otherwise specified.

Ensure that at least 90 percent of all reflective barrier markers, warning lights, and raised pavement markers are operational at any given time. Correct deficiencies within 24 hours after notification.

Upon initial installation, temporary traffic control signs shall have at least 70 percent of the reflectivity specified in 950.03 over 90 percent of the reflectorized surface. Channelizing devices shall have at least 80 percent of the reflectivity specified in 950.03 over 90 percent of the reflectorized surface.

Replace damaged traffic control signs within four hours of notification. Take necessary corrective action, as approved, to adequately warn and protect the public until the signs are replaced.

The Contract Documents will specify one or more of the items listed in the following sections. When work is specified to be accomplished under the Maintenance of Traffic item, the work will be incidental to the Contract price for Maintenance of Traffic.

CATEGORY 100
PRELIMINARY

SECTION 104.01 — TRAFFIC CONTROL PLAN (TCP)

104.01.01 DESCRIPTION

Develop and implement a TCP. The TCP will include the design and placement of items such as signing, pavement markings, delineation, channelization, barriers, crash cushions, and other items as required.

TCPs may be implemented within a single project or jointly between two or more projects. In situations where TCPs are jointly implemented, ensure that correct and nonconflicting guidance is presented to the traveling public.

Prior to commencement of Contract work, the successful bidder shall complete a Traffic Control Plan Certification. Indicate whether the Administration's TCP will be implemented (Option 1), the Administration's TCP will be modified (Option 2), or a TCP will be developed (Option 3). Submit the TCP in writing to the Engineer at least 20 days prior to starting any work. Submit changes to the approved TCP in writing at least five days prior to implementing the change. For emergencies, the approval process will be completed within four hours. All changes to the TCP shall be approved in writing by the Engineer prior to implementation. Submit for approval supporting documentation containing an assessment of safety and mobility impacts of the modified or proposed TCP. Contact the Engineer to determine what level of detail and types of analysis are required for the assessment. No work shall begin until the required traffic control patterns and devices are in place.

Refer to Contract Documents for Work Restrictions.

When TCP Option 2 or Option 3 is selected, the following shall apply:

(a) Plans and revisions to plans shall be drawn to the same degree, likeness, and sophistication as that of the Contract Plans.

(b) Submittals shall be on sheets measuring 22 in. x 34 in. with a standard margin and a standard title block at the lower right corner approximately 4 in. x 8 in., or on 8- 1/2 in. x 11 in. paper with a 1 in. margin and a title block.

Include the following information in the title block and in the order listed.

(1) Name of Contractor (and subcontractor, if applicable).

(2) Address of Contractor (and subcontractor, if applicable).

(3) Sheet Title.

(4) Administration Contract Numbers and complete Federal Aid Number.

(5) "Prepared for Maryland Department of Transportation State Highway Administration."

(6) Signature block for approval by Contractor's Traffic Manager and date of approval.

(c) All lines shall be clean, sharp, solid, and heavy enough for adequate reproduction. The scale of phase details on the TCP shall be 1 in. equals 100 ft. Additional plans that revise the design plans shall be at the same scale as the Contract Plans.

(d) Do not use white pigment to cover lines.

(e) Plans shall indicate the proposed traffic movements throughout the area affected by the work for each phase of construction. Label all routes and show north arrow and any other information that would clarify the TCP.

Any monetary savings from changes to the TCP made by the Contractor and approved by the Engineer will be divided equally between the Contractor and the Administration.

104.01.02 MATERIALS

Not applicable.

104.01.03 CONSTRUCTION

Not applicable.

104.01.04 MEASUREMENT AND PAYMENT

Any traffic control plan developed by the Contractor will not be measured but the cost will be incidental to other pertinent items specified in the Contract Documents.

CATEGORY 100
PRELIMINARY

SECTION 104.02 — MAINTENANCE OF TRAFFIC (MOT)

104.02.01 DESCRIPTION

Maintain traffic safely and efficiently through and around the area affected by the work.

104.02.02 MATERIALS

Traffic Materials Section 950

104.02.03 CONSTRUCTION

(a) Maintenance of Existing Roadway. Maintain the existing roadway surface and shoulders, including crossroads, ramps, approaches, crossovers, medians, detour roads, entrances, and pavement markings within the limits of the project, throughout the duration of the Contract.

Repair potholes, shoulder defects, and hazardous conditions that exist or develop throughout the duration of the Contract.

(b) Existing Regulatory Signs, Warning Signs, Guide Signs, and Pavement Markings. Relocate, turn, completely cover with opaque material, or remove with the approval of the Engineer, signs that are not applicable due to temporary traffic conditions. Properly redisplay signs to traffic as soon as conditions warrant. Replace any signs misplaced or damaged by the Contractor's operations.

Prior to construction and in the company of the Engineer, inventory and note the location, type, size, and color of all existing pavement markings, legends, and symbols. Submit the results on a marked up set of the Contract Plans or on Contractor prepared sketches or drawings.

(c) Storage and Movement of Equipment, Material, and Vehicles. All equipment, material, storage, and parking areas shall have advance written approval from the Engineer. Employee vehicles shall not be parked within the right-of-way of the through highway, without a written exception. Equipment and material shall not be stored or permitted to stand in unprotected areas or open areas within 30 ft of traffic except as follows:

(1) Approved traffic barrier is in place prior to storage of equipment and materials.

(2) Equipment and material is at least 4 ft behind traffic barrier as measured from the bottom, nontraffic side of the barrier.

(3) Equipment or material is stored in conformance with the AASHTO Roadside Design Guide.

Restore areas used for storage of equipment and material to original condition immediately upon completion of use, at no additional cost to the Administration.

Vehicles and equipment shall enter and leave the work area in the direction of traffic flow.

Work on or adjacent to the traveled way shall be performed in the direction of traffic flow, unless written approval is obtained prior to beginning the work.

The Contractor's vehicles and equipment shall enter on and exit from the roadway at interchanges or legally allowed public use crossovers. Do not make U-turns across medians and crossovers signed FOR USE OF AUTHORIZED AND EMERGENCY VEHICLES ONLY, without written approval.

(d) Warning Lights and Devices. Use warning lights and flags on warning signs as specified in the TCP, the Contract Documents, or as directed. During hours of darkness, attach one Type A low intensity flashing warning light to the traffic side of channelizing devices used to warn of a spot hazard. Attach two Type A low intensity flashing warning lights to the top of each Type III barricade.

(e) General Requirements for Temporary Pavement Markings (TPMs). For pavement marking dimensions refer to Pavement Marking Dimension Table following (f)(10) below.

(1) Temporary pavement markings are those markings placed upon the roadway to serve an area of work activity or a work phase for a period of time after which they are to be removed.

When approved, a less than full complement of pavement markings and reduced dimension markings for dashed center lines and lane lines may be used, but for a period of not more than two weeks.

(2) TPMs may be either full dimension or reduced dimension as specified in the Contract Documents or as directed.

(3) Full dimension TPMs shall be in accordance with the MdMUTCD and the Pavement Marking Dimension Table following (f)(10).

(4) Reduced dimension TPMs shall be in accordance with the MdMUTCD and the Pavement Marking Dimension Table following (f)(10), except that the dashed center lines and lane lines may consist of 4 ft segments and 36 ft gaps.

(f) Specific Requirements for TPMs.

(1) As a minimum, place all center and lane lines at the close of each day.

(2) During the work day, while work activities are underway, clearly define all vehicle paths by center and lane lines, channelizing devices, signs, or other traffic control devices.

(3) Along two-lane, two-way roadways, place a center line consisting of a continuous double solid yellow center line, a single dashed yellow center line at full dimension, or a single dashed yellow center line at reduced dimension as directed.

(4) Mark and sign 'no passing zones' as specified or as directed. A no passing zone may be identified by signing for a period not to exceed seven days.

(5) Along multilane undivided roadways, identify the center line using a continuous double solid yellow line.

If a two-way left turn is present, see (6) below.

If the roadway is three lanes, the center line may be either a continuous double solid yellow center line or, where passing is permitted in the single lane direction, a continuous single solid yellow and single dashed yellow combination center line. For the placement of no passing zones, see (f)(4) above.

(6) Along multilane undivided roadways having a two-way left turn lane, the left-turn lane need not be marked provided that the lane is continuously delineated using channelizing devices spaced at no more than 200 ft. The devices shall separate the opposing flows of traffic and provide areas where left-turning vehicles may store while awaiting the opportunity to turn.

(7) Along multilane roadways having reversible lanes, mark the lanes with the full complement of pavement markings as described in the MdMUTCD.

(8) Where edge lines are not in place, delineate the edge of the roadway by using appropriate channelizing devices or other delineation.

(9) Specific pavement marking, and complementary signing details are shown on the Temporary Traffic Control (TTC) Typical Applications.

(10) Contact the Office of Materials Technology (OMT) for the latest approved TPM materials.

PAVEMENT MARKING DIMENSION TABLE			
LINE TYPE	**MATERIAL**	**REQUIRED MINIMUM EFFECTIVE WIDTH, in.**	
		EXPRESSWAYS AND FREEWAYS	**OTHER ROADWAYS**
Lane Lines	Paint	5	5
	Preformed Tape	5	5
Lane Shifts, Lane Divides and Severe Alignment Changes	Paint	5	5
	Preformed Tape	5	5
Center Lines *See Note	Paint	5	5
	Preformed Tape	5	5
Edge Lines	Paint	5	5
	Preformed Tape	5	5
Ramp Edge Lines	Paint	5	5
	Preformed Tape	5	5
Gore Marking	Paint	10	10
	Preformed Tape	10	10
Auxiliary	Paint or Preformed Tape	Same as particular line being extended	Same as particular line being extended

Note: Provide a discernible space of 4 in. to 5 in. between double lines.

(g) Channelizing Devices. Install traffic channelizing in accordance with the MdMUTCD, the Contract Documents, and the following:

(1) Spacing in feet for channelizing devices in a taper shall be no more than the posted speed limit in mph.

(2) Spacing in feet for channelizing devices in a tangent shall be no more than twice the posted speed limit in mph.

(3) To define interchange gore areas or other unusual alignments, space channelizing devices at 25 ft intervals, unless the Engineer directs a closer spacing.

(4) Space channelizing devices at approximately 6 ft intervals at driveways and intersections, so that sight distance at these locations is not restricted.

(5) The Contractor's name or identification mark may be placed in an inconspicuous location on the channelizing device, facing away from traffic. No advertising is permitted.

104.02.04 MEASUREMENT AND PAYMENT

Unless otherwise specified, Maintenance of Traffic will not be measured but will be paid for at the Contract lump sum price. The payment will be full compensation for relocating, turning, completely covering and uncovering or removing and resetting, maintaining in like new condition, and cleaning existing and temporary traffic signs and other traffic control devices. Included is the inventory of all existing pavement markings and the treatment of any other traffic control device not included in these Specifications but necessary for the fulfillment of the Contract requirements and implementation of the approved Traffic Control Plan, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Payment of the Contract lump sum price will be prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating will be the number estimated to complete the work.

(a) When additional Contract pay items for Maintenance of Traffic are specified in the Contract Documents, measurement and payment will conform to the pertinent pay items.

(b) Cones, reflective collars, anchoring devices, STOP/SLOW paddles, sign flags, and warning lights will not be measured but the cost will be incidental to the Contract price for Maintenance of Traffic unless otherwise specified.

(c) Temporary traffic control devices that need replacement shall be replaced immediately, as directed. The cost of replacement, including all material, labor, equipment and tools, will not be measured but will be incidental to the Contract price for Maintenance of Traffic except when specifically set up in the Contract Documents as a separate Contract pay item.

(d) Material, equipment, and labor necessary for the construction and removal of temporary or detour roads will be measured and paid for at the Contract unit price for the pertinent items used.

104.02.04.01 When specified in the Contract Documents, Maintenance of Traffic will be measured and paid for at the Contract price per unit day.

104.02.04.02 When there is no item in the Contract Documents, maintenance of traffic will not be measured but the cost will be incidental to other pertinent items specified in the Contract Documents.

CATEGORY 100
PRELIMINARY

SECTION 104.03 — TEMPORARY RAISED PAVEMENT MARKERS (RPMS)

104.03.01 DESCRIPTION

Furnish, install, and remove as necessary, temporary RPMs.

104.03.02 MATERIALS

Temporary RPMs	QPL

104.03.03 CONSTRUCTION

Install temporary RPMs, as specified in the Contract Documents and in accordance with the manufacturer's recommendations.

104.03.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Increases or decreases in quantities will not be a basis for renegotiation of the Contract unit price.

(a) Temporary Raised Pavement Markers will be measured and paid for at the Contract unit price per each.

(b) Removal of Temporary Raised Pavement Markers will be measured and paid for at the Contract unit price per each.

(c) Reimbursement will be made at the Contract unit price for each marker damaged by snowplow operations.

CATEGORY 100
PRELIMINARY

SECTION 104.04 — TEMPORARY CONCRETE TRAFFIC BARRIER (TCB) FOR MAINTENANCE OF TRAFFIC

104.04.01 DESCRIPTION

Furnish, place, reset, and remove TCB.

104.04.02 MATERIALS

Precast Concrete Traffic Barrier	950.01
Vertical Panels and Reflective Barrier Markers	QPL

TCB shall conform to NCHRP Report 350 and/or MASH 2016 criteria for Test Level 3.

104.04.03 CONSTRUCTION

Maintain TCB in alignment and in a like new condition.

Remove and relocate TCBs as directed.

Install reflective barrier markers and vertical panels (object markers) on the TCB as specified.

Connections. In addition to the pin and loop connection shown on the Standards, the channel splice, vertical I beam, and lapped joint connections specified in the AASHTO Roadside Design Guide, and the proprietary T-Lok and J-J Hook Systems will be allowed provided only one type of joint connection is used for the length of the barrier.

104.04.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for furnishing, placing, maintaining and removal from the project site as directed, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

(a) Temporary Concrete Traffic Barrier for Maintenance of Traffic and Reset Temporary Concrete Traffic Barrier for Maintenance of Traffic will be measured and paid for at the Contract unit price per linear foot measured along the center line of the top of the barrier.

The payment for Reset Temporary Concrete Traffic Barrier for Maintenance of Traffic will include removal from its original placement, transporting, and resetting it in its new temporary location.

(b) Reflective Barrier Markers and Vertical Panels will be measured and paid for at the Contract unit price per each.

CATEGORY 100

PRELIMINARY

SECTION 104.05 — TRAFFIC BARRIER W-BEAM (TBWB) FOR MAINTENANCE OF TRAFFIC

104.05.01 DESCRIPTION

Furnish, install, maintain, reset, and remove temporary TBWB. Refer to 605.01.01 and 605.01.02.

104.05.02 MATERIALS

Traffic Barrier W-Beam	918.01
Traffic Barrier Posts	918.02
Hardware for Traffic Barriers	918.03
Wood Offset Blocks	918.04
Composite Offset Blocks	Section 605

TBWB shall conform to NCHRP Report 350 and/or MASH 2016 criteria for Test Level 3.

104.05.03 CONSTRUCTION

Refer to 605.03.01, 605.03.02, and 605.03.03.

TBWB. Use construction methods in accordance with the applicable portions of Section 605.

TBWB Replacement. Immediately replace damaged portions of the TBWB. Install the TBWB to the correct horizontal and vertical alignment using offset blocks in kind.

TBWB Reset. When work is sufficiently completed through a traffic control area and TBWB is no longer required, remove and reset the TBWB and all components to a new work area as specified. Restore the previous location to original condition.

TBWB End Treatments. Refer to Section 104.09 and Section 104.10.

Place an approved end treatment at all ends of TBWB prior to opening to traffic.

104.05.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for furnishing and installing all cables, posts, brackets, traffic barrier W-beam, hardware, galvanizing, excavation, backfilling, connections to rigid structures, removal, restoration of the area, and for all material, labor, equipment, tools, and incidentals necessary to complete the work as directed.

(a) Traffic Barrier W-Beam for Maintenance of Traffic will be measured and paid for at the Contract unit price per linear foot.

(b) Replacing sections of the traffic barrier that have been damaged by vehicular traffic while in place will be measured and paid for at the Contract unit price per linear foot for the Traffic Barrier W-Beam Replacement for Maintenance of Traffic item.

(c) Reset Traffic Barrier W-Beam for Maintenance of Traffic will be measured and paid for at the Contract unit price per linear foot.

(d) Temporary Traffic Barrier End Treatments will be measured and paid for at the Contract unit price per each.

CATEGORY 100
PRELIMINARY

SECTION 104.06 — TUBULAR MARKERS

104.06.01 DESCRIPTION

Furnish, install, and remove tubular markers for maintenance of traffic.

104.06.02 MATERIALS

Tubular Markers	QPL
Reflectorization	950.03

Tubular Markers may be manufacturer-certified as NCHRP Report 350 and/or MASH 2016 compliant as long as there are no attachments to the device.

104.06.03 CONSTRUCTION

Install tubular markers as recommended by the manufacturer and as approved by the Engineer.

104.06.04 MEASUREMENT AND PAYMENT

Tubular Markers will be measured and paid for at the Contract unit price per each. The payment will be full compensation for removal and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Tubular markers damaged due to traffic operations will be measured and paid for at the Contract unit price per each for Replacement of Tubular Marker Mast. If the base detaches from the pavement, replace the entire tubular marker assembly at no additional cost to the Administration, unless damaged by Administration snow removal operations.

CATEGORY 100
PRELIMINARY

SECTION 104.07 — ARROW PANEL (AP)

104.07.01 DESCRIPTION

Furnish and place APs for temporary use.

104.07.02 MATERIALS

Arrow Panel QPL

104.07.03 CONSTRUCTION

At least 24 hours before use, furnish and test the arrow panel (AP). The AP shall be self-contained, vehicle-mounted or portable. Use a self-contained trailer unit unless otherwise specified.

If a full matrix display board is used as an AP, it shall comply to this specification and it shall be able to display a left arrow, right arrow, double arrow, and a four-corner caution mode per the Arrow Panel tables.

Elements. The AP unit shall conform to the Arrow Panel tables and be arranged with double-pointed arrow configuration capable of displaying a left arrow, right arrow, double arrow, and a four-corner caution mode. A sequential chevron, sequential arrow and single bar caution panel shall not be displayed.

ARROW PANEL	
UNIT	**MdMUTCD TYPE**
Portable	A, D
Vehicle Mounted	B
Self-Contained Trailer	C

Arrow Board Type	Minimum Size	Minimum Legibility Distance	Minimum Number of Elements
A	48 in. x 24 in.	1/2 mile	12
B	60 in. x 30 in.	3/4 mile	13
C	96 in. x 48 in.	1 mile	15
D	None*	1/2 mile	12

∗Length of arrow equals 48 in., width of arrowhead equals 24 in.

Type A, B, and C arrow boards shall have solid rectangular appearances. A Type D arrow board shall conform to the shape of the arrow.

The color presented by the AP lights shall be yellow. Lights with the pre-flash option of white strobe or pulsed lighting shall not be displayed.

APs shall have both manual and automatic dimmer devices capable of reducing the light intensity by 50 percent. Periodically clean the photocells in order to prevent malfunctioning of the brightness control. Dimmer devices are mandatory during night operation. The devices shall include a fail-safe system that ensures maximum brightness during daytime operations and a reduction in brightness of up to 50 percent during periods of darkness, regardless of which dimmer device is operational.

The APs shall provide full illumination within at least a 24 degree cone perpendicular to the panel face.

The flashing rate shall be not less than 25 or more than 40 flashes per minute as required in the MdMUTCD.

Power Supply. The AP shall operate from a solar powered electrical system and consist of battery power and solar array panels and be capable of providing power supply to the AP for 21 consecutive days without auxiliary charge.

Deployment. Place APs as specified. Maintain APs in good operating order.

(a) The AP shall conform to the applicable requirements of the MdMUTCD and only be used to supplement other required traffic control devices. Use the "Arrow" mode when closing a through travel lane on a multilane roadway. Place only one AP in the "Arrow" mode for each stationary lane closure. “Arrow” mode shall not be used to indicate a lane shift. Moving work operations may utilize one or more APs for a single lane closure. Ensure that placement does not cause driver confusion near ramps, median crossovers, and side road intersections.

(b) Place the AP facing approaching traffic in conformance with the minimum legibility distances specified in the Arrow Panel table. Ensure that the display is level.

(c) For stationary lane closures, place the AP on the shoulder at the beginning of the taper (nearest to oncoming traffic). Where there are narrow or no existing shoulders adjacent to the closed lane behind the channelizing devices, place the AP as near to the beginning of the taper as possible.

(d) For interior lane closure when the AP is displaying a flashing double arrow, center the AP in the closed lane and place it at the downstream end of the shifting taper.

(e) For a lane closure on a two-lane, two-way roadway, or for a shoulder closure on roadways, use the “Caution” mode. In "Caution" mode, one light is displayed in each corner.

(f) For moving operations, refer to Section 104.23.

104.07.04 MEASUREMENT AND PAYMENT

Arrow Panels will be measured and paid for at the Contract price per unit day. A unit day will consist of any approved usage within a work shift, regardless of start time or whether the shift runs into another calendar day. Each arrow panel will be paid for only once per unit day, regardless of how many times it may be relocated. When an arrow panel is used for part of a day, it will be measured and paid for as a unit day. When operations require continuous 24 hour use of an arrow panel, the unit day will be measured as 24 hour periods from start to finish.

The payment will be full compensation for all material, labor, equipment, tools, and incidentals required to set up and operate at the site as required, and at any relocated site as specified and as directed.

CATEGORY 100
PRELIMINARY

SECTION 104.08 — TEMPORARY TRAFFIC SIGNS (TTS)

104.08.01 DESCRIPTION

Furnish, install, and maintain TTS on or along all transportation facilities.

104.08.02 MATERIALS

Wood Sign Supports	921.05 and 921.06
Reflectorization	950.03
Sign Material	950.08
Square Perforated Tubular Steel Sign Supports	As Approved by the Office of Traffic and Safety
Composite Aluminum Signs, Plastic Signs, Flexible Roll Up Signs, Portable Sign Supports, and Mounting Hardware	QPL

Use fluorescent orange for all orange colored work zone signs. Use reflectorized signs for both daytime and nighttime use.

Temporary traffic signs and supports shall conform to MASH 2016 criteria for Test Level 3.

104.08.02.01 Sign Thickness.

(a) Aluminum Signs. Use the following minimum thickness for fabricated aluminum signs mounted on wood or steel tubular posts.

LONGEST DIMENSION OF SIGN (in.)	MINIMUM THICKNESS (in.)
≤ 12	0.040
12+ to 24	0.063
24+ to 36	0.080
36+ to 48	0.10
> 48	0.125

(b) Composite aluminum and flexible Roll Up Signs. When composite aluminum, plastic, or flexible roll up signs are used on portable supports, the support shall be approved by the Office of Traffic and Safety to hold that sign material. When supported on portable sign supports, composite aluminum signs shall be at least 0.08 in. thick.

104.08.03 CONSTRUCTION

104.08.03.01 Sign Design and Fabrication. Design and fabricate signs according to the Administration's Standard Highway Sign Book (SHSB). You may request a copy of the SHSB from the Office of Traffic and Safety, Traffic Engineering Design Division. Submit designs of signs not included in the SHSB in scaled sketches for approval. Direct written requests to the Engineer.

All work area warning signs with the exception of the "2(3) LEFT(RIGHT) LANE CLOSED XX" (W20-5a(1)) signs shall be 48 in. x 48 in., unless otherwise specified. Sign W20-5a(1) shall be 60 in. x 60 in., unless otherwise specified.

104.08.03.02 Sign Installation. Place signs in accordance with the MdMUTCD and the Contract Documents. Adjust signs along the highway to provide adequate sight distance to work zone signs and existing signs. Ensure that signs are not obscured or obstructed. Ensure that supplemental signs do not cover any part of the face of the primary sign.

Mount signs that will be in place for more than three working days on wood posts or on square perforated tubular steel posts, unless otherwise specified. Do not place any additional bracing on wood posts unless the sign is behind a protective barrier. The tops of the wood posts shall not protrude more than 3 in. beyond the nearest edge of the sign.

Portable sign supports shall be self-erecting. They shall be able to withstand a wind velocity of 70 mph and be able to maintain themselves within 5 degrees of rotation around their vertical axis.

Do not install signs before they are inspected and approved. Do not display signs to traffic until directed. Properly maintain the TTS, leave in place while applicable, and remove immediately when no longer required. When operations are performed in phases or stages, display only those signs to traffic that apply to the present conditions.

When one or more signs do not indicate of actual conditions, such as during periods of temporary shutdown or extended periods of no work being performed (including lunchtimes and overnight periods), remove the entire work zone setup, remove the inapplicable signs, turn them away so they are not visible to any traffic, or completely cover them with an approved opaque material.

When signs are no longer needed, remove temporary traffic signs, associated materials and incidentals from the project site. Remove materials become the property of the Contractor.

104.08.03.03 Sign Maintenance and Sign Replacement. Maintain signs in a new or like new condition. Maintain sign faces free of tape, tape residue, or any other foreign matter. Remove all advertisements from signs and supports.

When directed, replace signs with poor reflectivity or those that become faded, illegible, or damaged. Signs that are not new may be used only if the reflective intensity at a divergence angle of 0.2 degrees and incidence angle of minus 4 degrees conforms to at least 70 percent of the values as specified in 950.03 over 90 percent of their reflectorized surface. At other times throughout the duration of the Contract, the sign reflectivity intensity shall be at least 60 percent. The acceptability of the signs shall be determined by 1 ft square test plates calibrated in accordance with these requirements.

104.08.04 MEASUREMENT AND PAYMENT

104.08.04.01 Temporary Traffic Signs will be measured and paid for at the Contract unit price per square foot of sign for the Temporary Traffic Sign item. The payment will be full compensation for furnishing the signs and supports, installation, relocation, maintenance, cleaning, replacement due to non-traffic damage and normal wear, removal, and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

104.08.04.02 Where signs have been set and damaged by traffic, and the Engineer determines that they are not repairable, replacement will be measured and paid for at the Contract unit price per square foot of sign for the Temporary Traffic Sign item. The payment will be full compensation for furnishing the signs and supports, installation, relocation, maintenance, cleaning, removal, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 100
PRELIMINARY

SECTION 104.09 — TEMPORARY TRAFFIC BARRIER END TREATMENTS

104.09.01 DESCRIPTION

Furnish, install, maintain, reset, and remove temporary traffic barrier end treatments in conformance with the manufacturer's recommendations or as directed. Refer to 605.01.01 and 605.01.02.

104.09.02 MATERIALS

Temporary Traffic Barrier End Treatments	Refer to the Contract Documents or QPL
Temporary Crash Cushion Sand Filled Plastic Barrels (SFPB)	104.10.02

Temporary Traffic barrier End Treatments shall conform to NCHRP Report 350 and/or MASH 2016 criteria for Test Level 3.

104.09.03 CONSTRUCTION

Refer to 605.03.01, 605.03.02, and 605.03.03. Document each step of the installation, and complete and submit the manufacturer installation checklist for the installed product.

Temporary End Treatments.

(a) Install Temporary Traffic Barrier End Treatments as specified on the Plans and the Book of Standards and according to the manufacturer’s instructions.

The nose section shall be reflectorized as approved by the Office of Traffic & Safety.

(b) Install SFPB as specified in 104.10.03.

Inspection of End Treatments.

(a) Perform a daily visual inspection of the devices to ensure that no damage has occurred, and that the end treatment is capable of functioning as intended.

(b) Following an impact, an approved reflectorized drum will suffice temporarily as reflectorization for the end treatment. Repair or replace the damaged end treatment within four hours after notification.

104.09.04 MEASUREMENT AND PAYMENT

Temporary Traffic Barrier End Treatments, Remove and Reset Temporary Traffic Barrier End Treatments, and Repairing Temporary Traffic Barrier End Treatments will be measured and paid for at the Contract unit price for one or more of the items listed below unless otherwise specified.

(a) Temporary Traffic Barrier End Treatments will be measured and paid for at the Contract unit price per each for the type specified. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to provide a complete temporary traffic barrier end treatment.

(b) Temporary crash cushion sand filled plastic barrels will be measured and paid for as specified in 104.10.04.

(c) Remove and Reset Temporary Traffic Barrier End Treatments will be measured and paid for at the Contract unit price per each for the type specified. The conditions specified for the initial installation and removal of the end treatment shall be applicable to removing and resetting the end treatment.

(d) Temporary Traffic Barrier End Treatment Spare Parts Package furnished and installed will be measured and paid for at the Contract unit price per each for the type specified. The payment will be full compensation for the complete clearing and removal of debris and damaged unsalvageable parts, and for all material, labor, equipment, tools, and incidentals necessary to construct the temporary end treatment to the configuration specified.

When spare parts packages are furnished by the Administration, Repairing Temporary Traffic Barrier End Treatments will be measured and paid for at the Contract unit price per each for the type specified. The payment will be full compensation for pickup and all transportation, installation, reconnection to fixed objects where necessary, complete clearing and removal of debris and damaged unsalvageable parts, and for all material, labor, equipment, tools, and incidentals necessary to construct the temporary end treatment to the configuration specified.

Payment will not be made for spare parts packages used for end treatments damaged due to the Contractor’s operations.

(e) Removal of the temporary traffic barrier end treatments will not be measured but the cost will be incidental to the initial Contract unit price per each. Removal shall include patching of any holes made to anchor or stabilize the end treatment, and cleaning and clearing the area of all debris.

(f) Refer to 605.04.19.

(g) Refer to 606.04.12.

CATEGORY 100
PRELIMINARY

SECTION 104.10 — TEMPORARY CRASH CUSHION SAND FILLED PLASTIC BARRELS (SFPB)

104.10.01 DESCRIPTION

Furnish and install SFPB.

104.10.02 MATERIALS

Sand	901.01
Plastic Barrels (Yellow)	QPL

SFPB shall conform to NCHRP Report 350 and/or MASH 2016 criteria for Test Level 3.

104.10.03 CONSTRUCTION

Prior to installing the SFPB, level the ground supporting the system utilizing material comparable to the existing ground or as approved.

The components, assembly, placing configuration, and filling of the individual plastic barrels with varying weights of sand shall be in accordance with the manufacturer's recommendations or as specified in the Contract Documents. Barrels shall be watertight. SFPB may stand on pallets up to 4 in. high.

Reflectorize the first barrel of the SFPB configuration as specified. Following an impact, an approved reflectorized drum will suffice temporarily as reflectorization for the SFPB. Replace damaged barrels within four hours after notification.

Use dry and loose sand in the barrels. Do not use bags of sand. Add an antifreeze agent to the sand in accordance with the manufacturer's recommendations. Have sufficient replacement materials available.

Immediately after the SFPB have served the intended purpose, is to remove the installation and restore the site as directed.

104.10.04 MEASUREMENT AND PAYMENT

Temporary Crash Cushion Sand Filled Plastic Barrels will be measured and paid for at the Contract unit price per barrel for one or more of the items listed below and specified in the Contract Documents.

(a) Temporary Crash Cushion Sand Filled Plastic Barrels for Maintenance of Traffic.

(b) Replace Temporary Crash Cushion Sand Filled Plastic Barrels for Maintenance of Traffic.

(c) Remove and Reset Temporary Crash Cushion Sand Filled Plastic Barrels for Maintenance of Traffic.

The payment will be full compensation for excavation, regrading, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 100
PRELIMINARY

SECTION 104.11 — TEMPORARY PAVEMENT MARKINGS

104.11.01 DESCRIPTION

Furnish, install, and remove temporary pavement markings as specified or as directed by the Engineer. Markings include lines, letters, numbers, arrows, and symbols.

104.11.02 MATERIALS

Pavement Marking Paint	951.01
Black Out Tape	951.02
Removable Pavement Markings	951.08

104.11.03 CONSTRUCTION

104.11.03.01 Quality Assurance/Quality Control. Refer to 549.03. Employ certified technicians to perform quality control testing. The Engineer will perform quality assurance checks by completing the Nighttime Visibility Evaluations per MSMT 729.

104.11.03.02 Warranty Period. Maintain and correct any defects in the pavement markings for a period of 180 days from the date of application for tape, thermoplastic or epoxy, and 60 days for paint. Replace defective pavement markings within this warranty period as necessary and as directed at no additional cost to the Administration. When paint is used as a temporary marking for a lane shift/closure that is to be greater than 60 days in length, it shall be reapplied every 60 days.

104.11.03.03 Application and Removal. Apply pavement markings per the manufacturer's recommendations and as specified. Apply markings in the same direction as the flow of traffic. Apply the markings to the locations specified or as directed.

Pavement markings may be applied to either new or existing paved surfaces. Apply markings to newly paved surfaces before traffic is allowed on the pavement.

For milling and paving operations, non tape markings may be used for temporary markings between lifts and temporary raised pavement markings (RPM)s are not required. Use removable tape for temporary markings applied to the final surface.

When temperatures are too low to allow the placement of removable tape on the final surface, request a written exception for the use of other type of markings in lieu of removable tape.

Completely remove all non-applicable pavement markings within the travel way and adjacent to the travel way for lane shifts as necessary and as directed.

Surface Condition. Ensure the pavement surface is clean, dry, and free of all contaminants prior to applying any pavement markings. Remove all residual, loose or poorly applied pavement markings as necessary and as directed.

Pavement Marking Removal. Completely remove all removable pavement markings prior to applying permanent markings. Remove any objectionable adhesive residue on stage construction or final surfaces of Portland cement concrete pavements by water blasting or other methods as approved. Do not use open flame to remove any pavement markings or adhesive residue. Remove all pavement markings in a manner that ensures there is no damage to the existing or final surface.

Black out Tape. Black out tape may be used for masking existing markings in accordance with MdMUTCD. Use to mask existing marking for temporary shift conditions of less than 14 days and where the traffic will return to the original alignment and markings. For shifts longer than 14 days, remove the existing marking by hydro blasting and replace with new permanent /final markings when original alignment returns.

Retroreflectance. The initial retroreflectance readings for temporary pavement markings shall be a minimum of 250 millicandelas/lux/square meter and 150 millicandelas/lux/square meter for white and yellow markings, respectively. The pavement markings will be monitored per MSMT 729 during the Warranty Period.

104.11.04 MEASUREMENT AND PAYMENT

Payment for Removable Pavement Markings, Removal of Removable Pavement Markings, Pavement Marking Paint, and the Removal of Existing Pavement Markings will be measured and paid for using one or more of the items listed below and as specified.

Payment will be full compensation for furnishing, placing, complete removal of lines, letters, numbers, arrows, symbols, and the removal of all residue. Payment will also cover maintenance and replacement of the markings during the 180 day period, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Removal and replacement of temporary pavement markings required beyond the 180 day period will be measured and paid for at the Contract unit price for the pertinent temporary pavement marking item.

Temporary markings replaced during the 180 day period as a result of plowing will be paid for at the Contract unit price for the pertinent temporary marking item, as determined.

(a) Pavement Marking Paint-in width specified-per linear foot.

(b) Removable Pavement Line Markings-in width specified-per linear foot.

(c) Removable Letters, Symbols, Arrows, and Numbers per square foot.

(d) Removal of Removable Pavement Marking Lines-any width-per linear foot.

(e) Removal of Removable Letters, Symbols, Arrows and Numbers per each.

(f) Removal of Existing Pavement Line Markings-any width per linear foot.

(g) Removal of Existing Letters, Symbols, Arrows, and Numbers per square foot.

(h) Blackout Tape Lines-in width specified-per linear foot.

(i) Removal of Blackout Tape Lines-any width-per linear foot.

CATEGORY 100
PRELIMINARY

SECTION 104.12 — DRUMS FOR MAINTENANCE OF TRAFFIC

104.12.01 DESCRIPTION

Furnish, set, reset, maintain, and remove drums for maintenance of traffic.

104.12.02 MATERIALS

Reflectorization	950.03
Plastic Drums	QPL

Drums may be manufacturer-certified as NCHRP Report 350 and/or MASH 2016 compliant as long as there are no attachments to the device.

Drums shall be manufactured of low density polyethylene (LDPE), 36 in. in height, and have a diameter of at least 18 in. The drum shall have four, 6 in. wide horizontal, circumferential, alternating orange and white stripes, with the top stripe being orange. Drums may have one or more flat sides as long as the minimum 18 in. diameter is satisfied. Drums may include recycled plastic content. The drum base may contain up to 100 percent recycled content.

Use high performance wide angle white and fluorescent orange sheeting on all drums.

104.12.03 CONSTRUCTION

Use sand-filled bases or bags of sand to keep the drums from moving. Install sandbags on the base of the drum only. Rubber or plastic bases or recycled tires, weighing between 20 lb and 40 lb, may be used as a substitute for sandbags.

The Contractor's name or identification mark may be neatly stenciled at the bottom of the nonreflective portion of the drum in letters no more than 2 in. high. No other markings or wording may be on the vertical side of the drum.

Maintain drums in a new or like new condition. Replace drums damaged by traffic within four hours after notification. Damaged drums shall be recycled to the extent possible. The disposition of the damaged drums shall be provided prior to payment for any replacement drums.

104.12.04 MEASUREMENT AND PAYMENT

Drums for Maintenance of Traffic will be measured and paid for once at the Contract unit price per each. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Where drums have been set and damaged by traffic and the Engineer determines that they are not repairable, replacement will be measured and paid for at the Contract unit price. A disposition as specified in 104.12.03 is required prior to payment.

CATEGORY 100
PRELIMINARY

SECTION 104.13 — BARRICADES FOR MAINTENANCE OF TRAFFIC

104.13.01 DESCRIPTION

Furnish, set, reset, maintain, and remove barricades for maintenance of traffic.

104.13.02 MATERIALS

Reflectorization	950.03
Barricades	QPL

Barricades shall conform to NCHRP Report 350 and/or MASH 2016 criteria for Test Level 3.

104.13.03 CONSTRUCTION

Use barricade rails conforming to the MdMUTCD, with a minimum rail length of 5 ft. Use approved reflective sheeting and installation procedures.

Replace barricades damaged by traffic within four hours after notification.

Mount signs so that no more than half of the top two rails or one third of the barricade is covered. Mount signs on the barricade so that the bottom of the sign is at least 12 in. above the ground or surface. The bottom of rectangular signs shall not be mounted higher than the bottom of the top rail. Do not use aluminum signs.

104.13.04 MEASUREMENT AND PAYMENT

Barricades will be measured and paid for once at the Contract unit price per each for the pertinent barricade item specified in the Contract Documents. The payment will be full compensation for warning lights (when required), the maintenance and removal of any required warning lights, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Where barricades have been set and damaged by traffic, and the Engineer determines that they are not repairable, replacement will be measured and paid for at the Contract unit price.

CATEGORY 100
PRELIMINARY

SECTION 104.14 — CONES FOR MAINTENANCE OF TRAFFIC

104.14.01 DESCRIPTION

Furnish, set, reset, maintain, and remove cones for maintenance of traffic.

104.14.02 MATERIALS

Reflectorization	950.03
Cones	QPL

Cones may be manufacturer-certified as NCHRP Report 350 and/or MASH 2016 compliant as long as there are no attachments to the device.

All cones shall meet MdMUTCD and be new or like new condition. All cones shall be orange in color. Cones shall be at least 28 in. high, 10 in. diameter at the inside of the base, and reflectorized with two white retroreflective stripes. The top stripe shall be 6 in. wide and located 3 in. to 4 in. from the top of the cone. The second stripe shall be 4 in. wide and located 2 in. below the top band.

Tall-Weighted Cones. When specified, tall-weighted cones shall be at least 42 in. high and 7 in. diameter at the inside of the base. Tall-weighted cones shall be manufactured of low density polyethylene (LDPE) and have four high performance wide angle white and orange retroreflective stripes. The stripes shall be horizontal, circumferential and 6 in. wide. Alternate stripe colors with the top stripe being orange. Any non-retroreflective spaces between the orange and white stripes shall not exceed 1/2 in.

104.14.03 CONSTRUCTION

The Contractor's name or identification mark may be neatly stenciled at the bottom of the cone in a maximum of 2 in. high letters. Place no other markings or writings on the vertical area of the cone. Turn the cone so that the Contractor's name or identification mark faces away from traffic.

Equip all cones with approved weights or anchor collars (15 lb maximum) as needed to maintain an upright position. Anchor collars shall fit to the base of the cone. For tall-weighted cones use anchor collars weighing 10 lb to 30 lb.

Replace cones damaged by traffic within four hours or as directed after being notified.

104.14.04 MEASUREMENT AND PAYMENT

Cones for maintenance of traffic and cones that have to be replaced will not be measured but the cost will be incidental to the Contract price for Maintenance of Traffic.

CATEGORY 100
PRELIMINARY

SECTION 104.15 — FLAGGER

104.15.01 DESCRIPTION

Furnish flaggers when specified or directed. Flaggers shall have completed an Administration approved flagger training course within the last four years. The failure of any flagger to perform the required duties will be grounds for replacement.

Flaggers shall utilize two-way radios, field telephones, or pilot vehicles when not within sight distance of each other, or when directed.

104.15.02 MATERIALS

Reflective sheeting on the STOP/SLOW paddle	950.03

Paddles shall be 24 in. x 24 in. with letters at least 8 in. high and mounted at least 5 ft above the ground.

104.15.03 CONSTRUCTION

Flagging shall conform to MdMUTCD. All outfits and equipment (STOP/SLOW paddles, pilot cars or other vehicles, air horns or bullhorns, field telephones, two-way radios, site illumination, etc.) will be subject to approval. Use STOP/SLOW paddles unless otherwise permitted.

104.15.04 MEASUREMENT AND PAYMENT

Flagger will not be measured but the cost will be incidental to the Contract price for Maintenance of Traffic.

When an item for Flagger is included in the Contract Documents, Flagger will be measured and paid for at the Contract unit price per hour. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 100
PRELIMINARY

SECTION 104.16 — MODIFICATION OF EXISTING SIGNS

104.16.01 DESCRIPTION

Relocate, remove, cover, modify copy, reinstall, or change existing highway signs relating to the construction activity. This work is in addition to the temporary traffic signs specified in 104.08.

104.16.02 MATERIAL

Sign Panel Supports and Hardware	909.07, 921.05, 921.06, 950.04, A123, A153, and A709
Reflective and Non-reflective Sheeting	950.03
Sign Materials	950.08

Use an approved opaque sign covering material.

104.16.03 CONSTRUCTION

Modify existing signs as specified.

104.16.04 MEASUREMENT AND PAYMENT

Modification of existing signs will be measured and paid for using one or more of the items listed below and specified in the contract documents. The payment will be full compensation for all excavation, backfill, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

(a) Relocate Wood Sign Supports per each support.

(b) Sign Modifications to Overhead Sign Structures per square foot.

(c) Relocate Sign per square foot.

(d) Remove Sign per square foot.

(e) Modify Copy per each character.

(f) Install or Remove Shield per each.

(g) Cover Sign per square foot.

(h) Relocate Sign Luminaire per each.

CATEGORY 100
PRELIMINARY

SECTION 104.17 — TEMPORARY MOVABLE TYPE CONCRETE TRAFFIC BARRIER (MCTB)

104.17.01 DESCRIPTION

Furnish, place, assemble, maintain, move, and remove and dispose of movable interlocking type concrete traffic barrier. Movable barrier systems shall consist of individual units that remain connected for the total length when being moved in one continuous operation.

104.17.02 MATERIAL

Precast Movable Concrete Barrier and Transfer Device	QPL
Reflective Barrier Markers	QPL

MCTB shall conform to NCHRP Report 350 and/or MASH 2016 criteria for Test Level 3.

104.17.03 CONSTRUCTION

Perform all transfer shifts using the transfer device. The transfer device shall be capable of moving and transferring the barrier as required, and of operating on the curve and grades specified. Ensure that the device does not extend into traffic.

The Engineer will inspect the movable barrier upon delivery and throughout the life of the project. Replace any damaged or defective units as directed. Install reflective barrier markers as specified. Maintain the barrier and reflective barrier markers in a like new condition.

Perform all maintenance operations for the transfer device. Have sufficient spare parts and personnel available to ensure that the required lane configurations are in place at the required times. Failure to move the MCTB at the proper time will be cause for penalty under TC-4.02.

104.17.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

(a) The initial installation of the Temporary Movable Type Concrete Traffic Barrier will be measured and paid for at the Contract unit price per linear foot measured in place from end to end.

(b) Transfer shifts of the barrier will be measured and paid for at the Contract unit price per linear foot for the Transfer Shift of Movable Type Concrete Barrier item. The measurement will be end to end of the barrier actually shifted. The Contract unit price will apply to each shift.

(c) Replacing sections of the barrier that have been damaged by vehicular traffic while in place will be measured and paid for at the Contract unit price per each for the Replacement Sections for Movable Type Concrete Barrier item. Replacement of sections damaged by the Contractor's operations shall be at no additional cost to the Administration.

(d) Resetting the barrier will be measured and paid for at the Contract unit price per linear foot for the Reset Movable Type Concrete Barrier item. The payment will also include removal from its original placement and transporting and resetting it in its new temporary location.

(e) Reflective barrier markers will be measured and paid for as specified in 104.04.04(b).

(f) End treatments will be measured and paid for under the pertinent item specified in the Contract Documents.

CATEGORY 100
PRELIMINARY

SECTION 104.18 — TRAFFIC MANAGER (TM)

104.18.01 DESCRIPTION

Provide a Traffic Manager (TM).

104.18.02 MATERIALS

Not applicable.

104.18.03 CONSTRUCTION

Submit the TM's name for approval at least 10 days prior to commencing any work on the project. Provide proof that the TM has completed an Administration approved Temporary Traffic Control training course within the last four years. A change in the appointment of any TM throughout the duration of the Contract will require a written submittal for approval. Any failure of the TM to perform the required duties will be grounds for replacement. The TM shall be available at all times and be on site within 1/2 hour during periods of active work in the work zone.

The TM shall do the following:

(a) Implement the Traffic Control Plan (TCP), maintain an up-to-date TCP, and provide a copy to the Engineer following any changes.

(b) Closely coordinate the operations with the Engineer and supervise the maintenance of traffic on the project, including those involving subcontractors.

(c) Make on-site inspections of the area affected by the work on a regular basis including Saturdays, Sundays, and holidays, and be available for consultation at all times. When the TCP is in place, make daily inspections during hours of operations and at least one night inspection per week. Perform additional inspections as directed.

(d) During holiday periods, in addition to the monitoring of the maintenance of traffic, conduct a surveillance of any area affected by the Contract work.

(e) Maintain a daily log of the inspections and include the date, time, hours worked, condition of maintenance of traffic, and any corrective action taken. Furnish a copy of the daily log to the Engineer by the following day.

(f) Provide coordination between adjacent work zone operations to ensure that inappropriate or conflicting messages or devices are not displayed to traffic.

(g) Immediately, notify the Engineer of any accident or incident within the area affected by the Contract.

(h) Make inspections during and immediately after adverse weather conditions to ensure that the traffic control devices are clean, undamaged, and in the correct position.

104.18.04 MEASUREMENT AND PAYMENT

The Traffic Manager will not be measured but the cost will be incidental to the Contract price for Maintenance of Traffic.

CATEGORY 100
PRELIMINARY

SECTION 104.19 — PORTABLE VARIABLE MESSAGE SIGNS (PVMS)

104.19.01 DESCRIPTION

Furnish, install and relocate portable, self-contained, trailer mounted variable message signs.

104.19.02 MATERIALS

PVMS QPL

All materials shall be like new, corrosion resistant, and unaffected by water spray, salt, oil, gasoline, and all other contaminants in the quantities normally found along the edge of the traveled roadway. Construction, materials, and operation shall meet NFPA, UL, and NEC. Ensure that sign messages are visible and legible for a distance of 900 ft from any point along the traveled approach roadway at all times. The PVMS shall be equipped with a sighting device to provide alignment for maximum visibility.

104.19.03 CONSTRUCTION

104.19.03.01 Equipment.

Trailer. In accordance with Maryland Motor Vehicle Law.

Structural Support. The structural support framework shall allow the system to be assembled into a unit and be mounted on the trailer and shall provide the support mechanism between the sign panel assembly, the power supply, and the controller.

The framework shall provide sufficient support to prevent damage to any unit component when the sign is in down and locked position during normal highway travel.

The deployed structure shall supply adequate support to allow complete sign operation, including raising and lowering of the sign panel, during sustained wind speeds of 85 mph.

The display windows shall be made of impact-resistant clear Lexan or as approved.

Sign Panel. Not to exceed 144 in. length, 90 in. height, 12 in. depth.

Display.

(a) Capable of displaying three lines of text.

(b) Each line of text shall be constructed using either a discrete matrix or a full matrix display.

(c) Capable of displaying eight characters per line.

(d) The character height shall be at least 18 in.

(e) If discrete matrix display is used, each character shall be displayed using a 5 x 7 array with at least eight array modules per line.

A 4-1/4 in. to 7 in. space shall exist between each display line with no glare reflection.

(f) If full matrix display is used, the sign shall have at least 25 rows and 45 columns of disks. Each display line shall have at least 7 rows and 45 columns of disks and a 4-1/4 in. to 7 in. space between each display line with no glare reflection.

Flip Disk Mechanism.

(a) Be electromagnetically activated, with a service life of at least 200 million operations.

(b) Have a reflective surface that will maintain color intensity for at least three years.

(c) Be circular or rectangular, with a visible surface area between 3-3/4 in^2. and 4-1/4 in^2.

LED Illumination. LED illumination for each matrix element shall:

(a) Meet ITE specification for amber color.

(b) Utilize AlInGaP substrate.

(c) Each LED shall produce at least a 1 candela output on center at 25 mA drive current.

(d) Each matrix element shall have at least two LED's located within the perimeter of the flipping disk.

(e) Provide full illumination within at least a 24 degree cone perpendicular to the sign face.

(f) Have an operating temperature range of -40 F to 160 F.

PVMS UNIT.

Lift Mechanism.

(a) Electric or electrically assisted hydraulic mechanism capable of raising and lowering the sign panel.

(b) Capable of being raised or lowered manually.

(c) Furnished with a stainless steel safety bolt to prevent the sign panel from lowering once in the raised position. A self-locking mechanism shall be incorporated into the safety bolt to prevent it from being inadvertently dislodged.

(d) Designed to allow the raised sign panel to rotate 360 degrees about the vertical axis.

(1) Allow rotation clockwise and counter-clockwise.

(2) A mechanism shall be provided to lock the sign panel in place, at any position.

Electrical Connections and Gauges.

(a) All wiring from power sources to PVMS equipment shall use locking cable connectors.

(b) Volt and amp gauges shall be provided for both AC and DC.

(c) Standard negative ground system shall be tied to the sign chassis.

(d) Lightning protection shall be supplied to the load side of the sign system's distributed power lines to withstand multiple surges in excess of 600 volts.

Power Supply. Either a solar powered electrical system, or existing commercial electrical service.

Solar Powered Electrical System. Battery power system and solar array panels capable of displaying a two page message for 21 consecutive days without auxiliary charge.

Sign Controller.

(a) Capable of driving the matrix display panel operating over a -50 F to 150 F range and in a 20 percent to 100 percent noncondensing humidity range.

(b) Accommodate 100 preprogrammed, user-defined messages.

(c) Capable of displaying three sequenced messages. On/Off time for each message in a sequence shall be user adjustable within a range of 0 seconds to 5 seconds.

(d) Designed for fail-safe prevention of improper information display in the case of a system malfunction.

(e) Cause a user defined default message to be displayed in case of failure of the PVMS unit when flip disk mechanism is used.

(f) Have the capability of retrieving all messages stored in temporary memory.

(1) Temporary memory shall be nonvolatile.

(2) All messages and programs shall remain resident in the controller's memory in the event of a power failure.

(3) Have an RS-232 port to facilitate connection of an external communication device.

(g) Capable of automatic system recovery after power outages to the central controller without operator intervention, including the ability to maintain an up-to-date status on a remote unit if sign is operated from a remote location.

(h) Monitor and display the battery output voltage and solar array activities (charging/discharging) and blank the sign when the battery output voltage drops below the manufacturer's recommended output level.

(i) Capable of monitoring and displaying the status of the photocell and adjusting the sign illumination to match the ambient light conditions. The controller shall have at least nine levels of dimming from 10 percent to 100 percent brightness.

(j) Contained in a secure weatherproof cabinet located on the controller housing and insulated to protect against excessive vibration, temperature or tampering.

(1) Equipped with a lockable door latch and an interior cabinet dome light.

(2) Provided with a keyboard storage location inside the cabinet.

(3) Security locks shall include those installed by the manufacturer and an additional hardened hasp/lock combination with a user changeable combination. This hasp/lock setup shall be installed in a manner to maximize its effectiveness in stopping unauthorized access to the sign controls. For control box surfaces not compatible with the hasp/lock setup, other supplemental high security locking devices may be approved by the Engineer.

Security.

(a) Lock all trailer control cabinets when not attended by Administration employee or contractors, whether being stored, in transport, or deployed and activated.

(b) Do not store or maintain any passwords on the PVMS.

(c) Remove any password attached or inscribed on the PVMS trailer or equipment.

(d) Change the password when it is no longer secure, or every 6 months, whichever comes first.

(e) Some older model PVMS may not have a changeable password, so extra measures shall be taken to hide the password.

(f) Do not leave Owner/Instruction manuals in the trailer control cabinets. Manuals should be copied and made available to the personnel responsible for deploying the PVMS Signs.

(g) When equipped with a detachable keyboard, remove it from the trailer and secure in the transport vehicle, field office, or at the respective shop.

(h) Failure to comply with these security standards or any subsequent PVMS tampering incidents will be cause for penalty under TC-4.02.

(i) Construction and District Inspectors will ensure contractor compliance.

Character Set Software.

(a) Have all of the standard ASCII characters and symbols.

(b) Provide left and right arrows.

(c) Have all alphanumeric entries performed with a keyboard or keypad that causes the same character to be displayed on the matrix. Arrow symbols shall be generated via a cursor pad on the keyboard or keypad.

(d) Have messages default to self-centering display with the ability to left or right justify a display when full matrix is used.

104.19.03.02 Set up and operate the PVMS on the project site 24 hours in advance of actual use. Ensure that each unit is functioning properly and approved. Locate the PVMS as specified.

Aim the PVMS at approaching traffic in accordance with the 900 ft minimum visibility and legibility requirement. Ensure that the PVMS is level and that the sign face is not obscured by highway alignment or glare from either sunlight or vehicle headlights.

104.19.04 MEASUREMENT AND PAYMENT

Portable Variable Message Sign will be measured and paid for at the Contract price per unit day. A unit day will consist of any approved usage within a work shift, regardless of start time or whether the shift runs into another calendar day. Each portable variable message sign will be paid for only once per unit day, regardless of how many times it may be relocated. When a portable variable message sign is used for part of a day, it will be measured and paid for as a unit day. When operations require continuous 24 hour use of a portable variable message sign, the unit day will be measured as 24 hour periods from start to finish.

The payment will be full compensation for the electrical power and hook up, setup and maintenance of computer programs, changing messages, and for all material, labor, equipment, tools and incidentals necessary to complete the work.

CATEGORY 100
PRELIMINARY

SECTION 104.20 — TEMPORARY ORANGE CONSTRUCTION FENCE

104.20.01 DESCRIPTION

Furnish, install, and maintain new or like new temporary orange mesh construction fence. This fence is not to be used as a safety barrier.

104.20.02 MATERIALS

Precast Concrete Blocks	903.05
Tie Wire, Tension Wires, Tension Wire Clips and Hardware	914.02
Orange Mesh Fencing	As approved

Fence posts shall be 4 ft high, 1.90 in. diameter round posts; or 5-1/2 ft high, 2 in. steel U channel posts, as specified herein.

Submit samples of the fence fabric, fence posts, movable precast concrete blocks, tie wire, tension wires, and other miscellaneous hardware for approval.

104.20.03 CONSTRUCTION

Temporary orange construction fence shall be at least 4 ft high and with a maximum post spacing of 8 ft. When installed on a paved surface, support the fence by inserting the round post into a precast concrete block having a round hole through the center of the block. When installed in unpaved areas, use steel U channel fence posts driven 1-1/2 ft into the ground. Installation of the fence in any other manner will require approval.

Secure the fabric to the posts by wrapping a tie wire around the horizontal fence strands and the posts. Install a top tension wire to prevent sagging. When installed on paved surfaces, the Engineer will determine if a bottom tension wire is required.

Remove the fence when the Engineer determines that the fence is no longer required. The removed fence is the property of the Contractor.

Damaged Construction Fence. Repair or replace damaged construction fence within four hours after notification.

104.20.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Temporary Orange Construction Fence will be measured and paid for at the Contract unit price per linear foot for the actual number of linear feet measured to the centers of end posts.

Remove and Reset Temporary Orange Construction Fence will be measured and paid for at the Contract unit price per linear foot.

CATEGORY 100
PRELIMINARY

SECTION 104.22 — AUTOMATED FLAGGER ASSISTANCE DEVICE (AFAD)

104.22.01 DESCRIPTION

An automated flagger assistance device (AFAD) is designed for remote operation by a certified flagger. AFADs shall only be used in situations where there is only one lane of approaching traffic in the direction to be controlled. The AFAD shall be either Type I 'STOP/SLOW' Sign system or Type II 'Red/Yellow' Lens system.

Furnish, install, and maintain a portable, self-contained, AFAD for temporary traffic control as specified in the Contract Documents or as directed. The AFAD shall be crashworthy as specified in Section 104. Furnish certified flagger(s) per 104.15.01 to operate the AFAD(s). Install AFAD related signs and channelizing devices as specified in the Book of Standards for Highways and Incidental Structures.

104.22.02 MATERIALS

AFAD	QPL
Cones for Maintenance of Traffic	104.14.02
Reflectorization	950.03
Sign Material	950.08

The AFAD shall be capable of being operated from the controller cabinet mounted on the unit. The unit shall have the ability for manual override in case of remote failure.

104.22.02.01 General System Requirements.

(a) Gate Arm. The AFAD shall include a gate arm that is at least 6 ft long and the end of the arm shall reach at least to the center of the lane being controlled. The gate arm shall not extend in the opposite lane. The arm shall have vertical alternating red and white stripes on both sides at 16 in. intervals measured horizontally. The arm shall be made of lightweight rigid material. A retroreflective red or retroreflective fluorescent orange/red flag (minimum of 18 in. square) shall be attached on the end of the roadside end.

(b) Remote Control. The AFAD shall be equipped with a weatherproof handheld remote control that is capable of displaying the status of the AFAD display. The remote control

shall be programmable to control either one unit or two units and be able to control units over the required range.

(c) Power Supply. The AFAD shall be able to operate from a solar powered electrical system and consist of battery power and solar array panels.

(d) Trailer. The trailer shall be painted orange and shall comply with Maryland Motor Vehicle Law.

104.22.02.02 Type I 'STOP/SLOW' Sign AFAD Requirements.

(a) 'STOP/SLOW' Sign. Type I AFAD unit shall include a 'STOP/SLOW' sign that alternately displays the STOP (R1-1) face and the SLOW (W20-8) face of a 'Stop/Slow' paddle. The 'STOP/SLOW' sign shall have an octagonal shape and shall be fabricated of rigid material. The size of the 'STOP/SLOW' sign shall be at least 30 in. x 30 in. with letters at least 8 in. high. The background of the STOP face shall be red with white letters and a border. The slow face shall be diamond shaped with fluorescent orange background and black letters and a border. Both faces of the 'STOP/SLOW' sign shall be reflectorized as specified in 950.03. The bottom of the 'STOP/SLOW' sign shall be mounted a minimum of 7 ft above the pavement.

(b) AFAD Related Signs. Type I AFAD shall be supplemented by stationary sign(s) with one of the following options:

(1) Separate 'WAIT ON STOP' (R1-7) and 'GO ON SLOW' (R1-8) signs attached side by side below the STOP/SLOW sign. Each sign shall be 24 in. x 30 in. The background of the sign shall be white with black letters and border, and the sign face shall be reflectorized as specified in 950.03.

(2) One combined sign with combined message 'WAIT ON STOP GO ON SLOW' attached below the 'STOP/SLOW' sign. The sign shall be 36 in. x 36 in. The background of the sign shall be white with black letters and border, and the sign face shall be reflectorized as specified in 950.03.

The signs ('WAIT ON STOP', 'GO ON SLOW', or the combined 'WAIT ON STOP GO ON SLOW') shall be positioned on the same support structure as the AFAD such that they are in the same direct line of view of approaching traffic as the sign faces of the AFAD.

(c) Conspicuity Devices. The Type I AFAD shall be supplemented with active conspicuity devices. Each AFAD unit shall include a red Stop Beacon mounted a maximum of 24 in. above the 'STOP/SLOW' face and yellow warning lights mounted to the side or above the 'STOP/SLOW' face. The Stop Beacon shall consist of a 12 in. red LED signal head with a visor and shall steadily illuminate in circular red only during the STOP sign display. The Warning Lights shall illuminate in flashing yellow during the SLOW sign display.

104.22.02.03 Type II 'Red/Yellow' Lens AFAD Requirements.

(a) Signal Head. Type II AFAD unit shall have a signal head with one set of circular red and circular yellow lenses. The circular red shall be placed on top and the circular yellow below. The signal head shall be as specified in 950.15 and shall meet the physical display and operational requirements of conventional traffic signals according to Part IV of the MdMUTCD. The signal head shall be aluminum or polycarbonate and have two, 12 in. LED indications. The signal head shall be equipped with a visors which extend beyond the signal head a minimum of 10 in. All signal housings shall be black or yellow. The signal head shall have the ability to accommodate a back plate. The lower signal head shall be mounted at a minimum height of 7 ft measured from the bottom of the yellow indication to the road surface.

(b) AFAD Related Sign. Type II AFAD shall be supplemented by stationary 24 in. x 36 in. 'STOP HERE ON RED' sign (R10-6 or R10-6a). The sign shall have a white background with black letters and border, and the sign face shall be reflectorized as specified in 950.03. The sign shall be installed per MD 104.01-17 on the right-hand side in advance of the unit at the point at which drivers are expected to stop when the steady circular red lens is illuminated.

104.22.03 CONSTRUCTION

104.22.03.01 AFAD. Place the AFAD unit as shown in the Contract Documents or as directed, with all signs and traffic control devices visible to the driver of the initial approaching vehicle. Install advance warning signs and install cones along the road center line and around the AFAD according to the Book of Standards and the Contract Documents. Ensure that the AFAD is operational for the duration of the lane closure.

The AFAD shall be like new, corrosion resistant, and unaffected by water spray, salt, oil, gasoline, and all other contaminants in the quantities normally found along the edge of the traveled roadway. Construction, materials, and operation shall be according to NFPA, ULI, and NEC. When used at night, the AFAD location shall be adequately illuminated.

104.22.03.02 Operation.

(a) Type I 'STOP/SLOW' Sign AFAD.

SLOW to STOP transition. The red Stop Beacon shall enter a 'flashing mode' approximately 2 seconds before transitioning from the SLOW face to the STOP face. When the AFAD unit displays the STOP face, the red Stop Beacon shall illuminate in steady red, and the gate arm shall begin descent to the down position 2 seconds after the beacon has displayed the solid red light.

STOP to SLOW transition. The gate arm shall begin to ascend to the upright position as the face changes from STOP to SLOW and the red stop light shall cease to illuminate. The yellow beacon(s) shall enter flashing mode.

(b) Type II 'Red/Yellow' Lens AFAD.

To stop road users. The AFAD shall display a steadily illuminated circular red lens and with the gate arm in the down position.

To transition to circular red, the flashing circular yellow lens shall enter into 3 seconds to 5 seconds steady circular yellow illumination phase prior to transitioning to the steadily illuminated circular red condition. The gate arm shall begin its descent 3 seconds to 5 seconds after the circular red lens is illuminated.

To permit road users to proceed. The AFAD shall display a flashing circular yellow lens and the gate arm shall be in the upright position.

To transition to circular yellow condition, the gate arm shall begin its ascent to an upright position simultaneously with the start of the illumination of the flashing circular yellow lens.

104.22.03.03 Flaggers. Provide certified flaggers on-site and use one of the following methods to operate the AFAD(s):

(a) Method 1 – Place an AFAD at each end of the work area.

(b) Method 2 – Place an AFAD at one end and place a flagger at the opposite end.

The flagger operating the AFAD shall be able to view the device and the approaching traffic during the operation.

104.22.03.04 Cones. Install cones according to the MdMUTCD, the Book of Standards, the Contract Documents, and the following:

(a) Install a minimum of 11 cones spaced at 20 ft maximum along the center line on the approach to the AFAD.

(b) Use a minimum of 7 cones to form the shoulder taper to delineate the AFAD.

104.22.04 MEASUREMENT AND PAYMENT

104.22.04.01 Automated Flagger Assistance Device will be measured and paid for at the Contract price per unit day per each Automated Flagger Assistance Device. A unit day will consist of any approved usage within a work shift, regardless of start time or whether the shift runs into another calendar day. Each Automated Flagger Assistance Device will be paid for only once per unit day, regardless of how many times it may be relocated. When an Automated Flagger Assistance Device is used for part of a day, it will be measured and paid for as a unit day. The payment will be full compensation for the Automated Flagger Assistance Device, and for all material, labor, equipment, tools, and incidentals necessary to setup and operate the Automated Flagger Assistance Device at the site as required and at any relocated site as specified or as directed. When operations require

continuous 24 hour use of an automated flagger assistance device, the unit day will be measured as 24 hour periods from start to finish.

104.22.04.02 Certified flaggers to operate the Automated Flagger Assistance Device will be measured and paid for at the Contract unit price per hour as specified in 104.15.04.

104.22.04.03 Cones to delineate the center line in the approach to the Automated Flagger Assistance Device and form the taper in front of the Automated Flagger Assistance Device will not be measured but the cost will be incidental to the Contract unit price for Automated Flagger Assistance Device.

104.22.04.04 Automated Flagger Assistance Device related signs (R1-7, R1-8, R10-6, R10-6a) will not be measured but the cost will be incidental to the Contract unit price for Automated Flagger Assistance Device.

CATEGORY 100
PRELIMINARY

SECTION 104.23 — PROTECTION VEHICLE (PV)

104.23.01 DESCRIPTION

Furnish a PV as required.

The PV shall consist of a work vehicle with approved flashing lights as required by the standard TCP's and either:

(a) A truck-mounted attenuator (TMA) with support structure designed for mounting the system to the work vehicle, or

(b) A trailer truck-mounted attenuator (TTMA) designed for attaching the system to the work vehicle by a pintle hook.

Provide an arrow panel (arrow mode for multilane roadways and caution mode on two-lane, two-way roadways) in accordance with 104.07.03. The arrow panel shall be integral to either the work vehicle or the TMA/TTMA.

No part of the TMA/TTMA shall be designed to intrude under the support vehicle during impact or require a safety clearance under the support vehicle that extends forward of the rear axle.

General. The ballast of the work vehicle shall meet the manufacturer's specification for the TMA/TTMA and be firmly secured to prevent movement during an impact.

All exposed steel on the attenuator shall be primed and painted yellow. The undercarriage and support frame may be primed and painted black. All welding shall be performed by or under the direct supervision of a certified welder.

The rear facing surface of the TMA/TTMA shall have an inverted "V" chevron pattern formed by alternating 4 in. wide black and yellow stripes as shown in Standard No. MD 104.01-19C. The sides of the TMA/TTMA shall have a border of 4 in. red and white reflective tape as shown on Standard No. MD 104.01-18A.

The TMA/TTMA shall have a standard lighting system including brake lights, tail lights, turn signals, and ICC bar lights. All wiring shall be protected and adequately supported. The TTMA trailer shall conform to Maryland Motor Vehicle Law governing trailers.

Impact Performance. TMA/TTMAs manufactured prior to January 1, 2005, shall have passed NCHRP Report 350 Tests 50 and 51 Level 3. TMA/TTMAs manufactured after January 1, 2005, shall have passed NCHRP Report 350 Tests 50, 51, 52, and 53 Level 3.

Dimensions.

(a) Road clearance for the TMA/TTMA shall be 12 in. ± 1 in. or as specified by the manufacturer.

(b) Total weight of the TMA, exclusive of the work vehicle, shall not exceed 2100 lb unless it is trailer-mounted.

Durability. The manufacturer shall ensure that travel vibration, in either a vertical (for TMA) or horizontal position, will not affect the performance of the work vehicle or the TMA/TTMA.

Certifications. Provide certification that the TMA/TTMA is in good working order, has not been damaged, conforms to the requirements of the manufacturer's specifications (model number, roll ahead distance, truck weight, etc.), and includes the date of manufacture.

The manufacturer shall certify that moisture penetration will not impede the energy impact absorption properties or add significantly to the weight of the TMA/TTMA.

Tilting. An electrically powered tilt system shall be incorporated to facilitate the tilting of the TMA cartridge to a 90 degree position from horizontal. The unit shall have a locking device to secure the TMA system in the vertical position. The completed tilt system shall be factory assembled.

104.23.02 MATERIALS

The size of the work vehicle and the method of attachment shall be as specified in the TMA/TTMA manufacturer's specifications, and as tested according to NCHRP Report 350 and/or MASH 2016 at Test Level 3. The gross vehicle weight rating (GVWR) of the work vehicle shall be a minimum of 14 000 lb, and any fuel tank or container of hazardous materials shall be at least 10 1/2 ft from the rear of the work vehicle.

104.23.03 CONSTRUCTION

Not applicable.

104.23.04 MEASUREMENT AND PAYMENT

Protection Vehicle will be measured and paid for at the Contract price per unit day. A unit day will consist of any approved usage within a work shift, regardless of start time or whether the shift runs into another calendar day. Each protection vehicle will be paid for only once per unit day, regardless of how many times it may be relocated. When a protection vehicle is used for part of a

day, it will be measured and paid for as a unit day. When operations require continuous 24 hour use of a protection vehicle, the unit day will be measured as 24 hour periods from start to finish.

The payment will be full compensation for the complete protection vehicle, including the truck mounted attenuator/trailer truck mounted attenuator and arrow panel, licensed work vehicle operator, unless a separate pay item has been established for the Operator, relocating the protection vehicle, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 100
PRELIMINARY

SECTION 104.24 — WORKERS PRESENT TRAILER (WPT)

104.24.01 DESCRIPTION

A Workers Present Trailer (WPT) is designed to enhance motorists' situational awareness when entering a work zone where workers are present. When activated, a WPT will display alternating flashing YELLOW signal heads (beacons).

Furnish, install, operate, and relocate a portable, self-contained, WPT with flashing beacons and 'Work Zone - Fines Higher When Flashing' (R2-6(5)) sign as specified or as directed.

104.24.02 MATERIALS

Workers Present Trailer	QPL
Reflectorization	950.03
Sign Material	950.08
Traffic Signal Heads	950.15

Each WPT unit shall include the trailer, structural support system, sign panel assembly, lift mechanism, power supplies, trailer mounted controller, flashing beacons, communications, and ancillary equipment. All materials for the WPT shall be like new, corrosion resistant, and unaffected by water spray, salt, oil, gasoline, and all other contaminants in the quantities typically found along the edge of a traveled roadway. Construction, materials, and operation shall be in accordance with NFPA, UL, and NEC.

The WPT trailer shall be painted orange and shall comply with Maryland Motor Vehicle Law.

104.24.02.01 Equipment.

(a) Trailer. In accordance with Maryland Motor Vehicle Law governing trailers.

(b) Structural Support. Refer to 104.19.

(c) Sign Panel.

(1) 'Work Zone - Fines Higher When Flashing' (R2-6(5)) sign shall be attached to the WPT. The sign dimension shall be 48 in. wide by 60 in. high. The top portion of the sign face shall have a fluorescent orange background with black letters and border, and the lower portion of the sign face shall have a white background with black letters and border, and the sign face shall be

reflectorized as specified in 950.03. The sign shall be mounted to the WPT at a minimum mounting height of 5 ft measured from the bottom of the sign to the road surface and in a manner that allows for easy removal when necessary for maintenance. The minimum mounting height shall be increased to 7 ft if the trailer is placed in business, commercial, or residential areas.

(d) Lift Mechanism.

(1) The lift mechanism shall be installed such that the sign panel can be raised and lowered manually.

(2) A corrosion resistant safety bolt or pin shall be provided to prevent the sign panel from lowering once in the raised position. A self-locking mechanism shall be incorporated into the safety bolt or pin to prevent it from being inadvertently dislodged.

(e) Electrical Connections and Gauges.

(1) All wiring from power sources to WPT equipment shall use locking cable connectors.

(2) Volt and amp gauges shall be provided for DC.

(3) Standard negative ground system shall be tied to the sign chassis.

(f) Power Supply. The WPT shall operate from a solar powered electrical system consisting of battery power and solar array panels. The electrical system shall be capable of supporting continuous operation of the system for 21 consecutive days without an auxiliary charge and be capable of being charged by a generator or other commercially available power source in case of malfunction, damage, or failure of the primary solar powered electrical system.

(g) Controller Requirements. The controller shall be capable of the following.

(1) Being controlled locally at the unit and remotely via a remote on/off via cellular connection and an internet accessible interface.

(2) Driving a flashing beacon operating over a -30 F to 125 F range and in a 20 percent to 95 percent noncondensing humidity range.

(3) Monitoring and displaying the battery output voltage and solar array actives (charging and discharging).

(4) Being contained in a sheet metal or high-density polyethylene (HDPE), weatherproof cabinet located on the controller housing and insulated to protect against excessive vibration and temperature. The cabinet shall be equipped

with a lockable door with hasp/lock setup installed in a manner to maximize its effectiveness in stopping unauthorized access to the beacon controls. Other physical locking devices may be approved by the Engineer.

(h) Yellow Lens Requirements.

(1) The WPT unit shall have two 12 in. circular signal heads mounted on the front side of the WPT facing approaching traffic. Each signal head shall have one circular yellow lens. The indications shall illuminate in an alternating flashing pattern when activated and shall be mounted in one of the following ways:

(i) Mounted Top/Bottom with one signal head placed above and below the R2- 6(5) sign. A signal head mounted at the bottom of the R2-6(5) sign shall be mounted a minimum height of 5 ft measured from the bottom of the signal head to the road surface.

(ii) Mounted Top Only with both signal heads placed at the same height and symmetrically centered above the R2-6(5) sign.

(iii) Mounted Left and Right Side with both signal heads placed at the same height on the left and right side of the R2-6(5) sign. Signal heads mounted on the left and right side of the sign shall be mounted at a minimum height of 7 ft measured from the bottom of the signal heads to the road surface.

(2) Signal heads shall be as specified in 950.15 and shall meet the physical display and operational requirements of flashing beacons according to Part IV of the Maryland Manual on Uniform Traffic Control Devices (MdMUTCD). Each signal head shall be aluminum or polycarbonate having one 12 in. YELLOW LED indication. The signal head shall be equipped with a visor which extends beyond the signal head a minimum of 10 in. All signal housings shall be black or yellow.

(i) Beacon Status Indicator. WPT shall be supplemented with one 4 in. minimum diameter yellow LED warning light mounted on the back of the WPT. The warning light shall be mounted a minimum of 7 ft measured from the bottom of the warning light to the road surface and shall not be visible to motorists approaching the WPT from the front. The warning light shall illuminate in a flashing pattern when the front-facing signal heads are activated, and shall not illuminate when the front-facing signal heads are deactivated. The warning light will enable workers downstream in the work zone to confirm the WPT system is operational.

(j) Communications. The WPT systems shall be equipped with a vendor-provided cellular and modem communication system.

(k) Monitoring System Requirements.

(1) GPS shall be used to monitor trailer location.

(2) Be capable of reporting sign panel orientation.

(3) Be capable of reporting the current time and date, flashing beacon operating status, battery voltage, available solar power, trailer location in latitude/longitude, sign panel heading, and system malfunction.

(4) Be capable of configuring customizable alerts and immediately communicating alerts and device malfunction via electronic notification (e.g. text or email) to responsible individuals.

(5) Be capable of providing real-time information automatically to the Administration or its designee with connected capabilities. The connected capabilities shall allow the WPT to transfer reportable data over a cloud network without human interaction using communication technology. The WPT shall provide a cellular network router used for remote communications and real-time GPS tracking to inform remote system users of the reportable data.

(6) Provide electronic communication between the WPT, WPT central server, and the Administration or its designee following the Administration's protocol.

(l) Default Requirements. WPT systems shall revert to a non-flashing mode upon system malfunction. Upon system malfunction, the WPT system shall immediately contact a minimum of three responsible individuals via the remote monitoring system described in the Operating System Requirements section. The WPT system repairs shall be the responsibility of the contractor and rendered in a manner that will return the WPT to full operation condition in the most expeditious manner.

(m) Operating System Requirements.

(1) The flashing beacon controller shall be enclosed in a cabinet mounted on each trailer.

(2) Be controlled with a Graphical User Interface for programming on-site.

(3) A web interface shall be used for remote programming, monitoring, and reporting.

(4) Be capable of scheduling unique and reoccurring schedules.

(5) Be capable of tracking and recording accurate date/time, location, sign panel orientation, WPT identification number, and project number.

(6) The operating system shall be equipped with diagnostic capabilities in the event of a system malfunction.

(7) The system shall have the capability of identifying the malfunction in a manner that will expedite the return to full operational mode.

(n) Logging/Reporting. Flashing beacons on the WPT shall be activated when workers are present in the work zone and deactivated when workers are not present.

(1) The operating system shall have an integrated mechanism capable of logging date and time information when the flashing beacons are activated and deactivated.

(2) Be capable of locally storing 30 days of activation/deactivation records with a time and date stamp, GPS location, sign panel orientation, WPT identification number, Administration project number, and have sufficient memory to store at least 100,000 records in the cloud.

(3) Be capable of remote access to activate/deactivate, retrieve records, and to download records in a printable format.

(4) Be capable of transmitting real-time information of device activation/deactivation and updated every 15 minutes. Information shall be retained for one year following project completion date and be stored in the cloud and available to the Administration upon request.

(5) Reports indicating the date and time flashing beacons are activated and deactivated, GPS location, sign panel orientation, WPT identification number, shall be provided daily to the Office of Traffic and Safety and its designated representative.

104.24.03 CONSTRUCTION

Furnish, install and test the WPT on the project site 24 hours in advance of actual use to ensure that each unit is functioning properly.

Place the WPT unit as shown in the Contract Documents or as directed and aim WPT at approaching traffic to ensure sign panel and flashing beacons are visible and legible for a distance of 900 ft from any point along the travel approach roadway. Ensure the WPT is level and that the sign face is not obscured by highway alignment or glare from either sunlight or vehicle headlights. Install temporary concrete traffic barrier or drums around the WPT according to the Book of Standards and the Contract Documents.

Activate the WPT when workers are present in the work zone. Deactivate the WPT when workers are not present. Ensure that the WPT is operational for duration while workers are present in the work zone.

The WPT shall be able to withstand wind of 80 mph.

104.24.04 MEASUREMENT AND PAYMENT

104.24.04.01 Workers Present Trailer will be measured and paid for at the Contract price per unit day for each Workers Present Trailer unit. A unit day will consist of any approved usage within a work shift, regardless of start time or whether the shift runs into another calendar day. Each Workers Present Trailer will be paid for only once per unit day, regardless of how many times it is relocated. When a Workers Present Trailer is used for part of a day, it will be measured and paid for as a unit day. When operations require continuous 24 hour use of a Workers Present Trailer, the unit day will be measured as 24 hour periods from start to finish.

The payment will be full compensation for the Workers Present Trailer and for all material, labor, equipment, tools and incidentals necessary to furnish, install, operate, and maintain the Workers Present Trailer at the site as required and at any relocated site as specified or as directed.

104.24.04.02 Workers Present Trailer related sign R2-6(5) will not be measured but the cost will be incidental to the Contract unit price for Workers Present Trailer.

104.24.04.03 The signal heads/beacons will not be measured but the cost will be incidental to the Contract unit price for the Workers Present Trailer.

CATEGORY 100
PRELIMINARY

SECTION 104.26 — REMOVABLE RUMBLE STRIPS

104.26.01 DESCRIPTION

Furnish, install, maintain, and remove removable rumble strips.

104.26.02 MATERIALS

Removable Rumble Strips QPL

Rumble strips shall be white in color, 4 in. wide, and 0.250 in. thick.

104.26.03 CONSTRUCTION

104.26.03.01 Quality Assurance/Quality Control. Perform quality control testing using technicians certified by the Administration.

104.26.03.02 Warranty Period. Maintain the rumble strips and repair defects for a period of 180 days from the date of application. Replace as necessary within this period as directed at no additional cost to the Administration. Refer to GP-5.11.

At least 90 percent of the total number of rumble strips in any lane shall be free from signs of failure due to blistering, excessive cracking, discoloration, smearing or spreading under heat, chipping, spalling, or poor adhesion to the pavement. Replace rumble strips showing wear or a thickness less than 0.20 in.

104.26.03.03 Application and Removal. The pavement surfaces shall be completely dry and free of oil, grease, sand, dirt, dust, loose aggregate, soil, salt, and other contaminants. Apply the rumble strips in accordance with the manufacturer's recommendations and the Contract Documents. Place perpendicular to the flow of traffic and located as specified.

Space the strips between 4 ft and 10 ft on center, with a pattern of at least 10 but not more than 12 strips per set. Decrease the spacing within each set as motorists approach the work zone. The spacing between the sets shall be as specified.

Do not place on sharp horizontal or vertical curves. Use in conjunction with other traffic control devices or visual cues that will assist drivers in identifying the appropriate action to take.

For installations where the roadway is wider than one lane in each direction, install in one-lane width segments utilizing butt joints. Do not overlap. Continue at least 1 ft onto each shoulder. Do not install over pavement seams, joints, or deteriorating markings and substrates.

When no longer required, remove rumble strips and residue. Return the pavement surface to its original condition.

104.26.04 MEASUREMENT AND PAYMENT

Removable Rumble Strips will be measured and paid for at the Contract unit price per linear foot. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Removal and replacement required beyond the 180 day period will be measured and paid for at the Contract unit price for the Removable Rumble Strip item.

Replacements made during the service life due to plowing will be paid for at the Contract unit price for the Removable Rumble Strip item.

104.26.04.01 Removal, Replacement, and Corrective Actions. Any additional cost, including maintenance of traffic, for the removal of rumble strips that are installed inaccurately or incorrectly shall be at no additional cost to the Administration. In addition, the current road user fee will be applied when traffic disruption occurs during corrective actions.

CATEGORY 100
PRELIMINARY

SECTION 104.27 — TEMPORARY PORTABLE RUMBLE STRIPS (TPRS)

104.27.01 DESCRIPTION

Furnish, install, maintain, adjust, and remove temporary portable rumble strips (TPRS). Work shall consist of preparing the road surface, installing, maintaining, adjusting, and removing temporary rumble strips in construction work zones at the locations shown in the Contract Documents or as directed.

104.27.02 MATERIALS

Temporary Portable Removable Rumble Strips QPL

104.27.02.01 TPRS shall consist of thermoset cast urethane, engineered polymers, or rubber materials. TPRS shall not curl or deform across the width of the strip, maintaining its rigidity. The face of the strips shall be a non-slip textured surface. Each strip shall be capable of being installed without adhesives or bolts.

104.27.02.02 TPRS shall consist of a single segment or be comprised of interlocking sections. The color of the TPRS shall be white, orange, or black. Each TPRS segment shall be 3/4 in. to 1 in. thick, 10 ft to 12 ft long, and 8 in. to 15 in. wide. TPRS shall be deemed safe by the manufacturer for use by motorcycles and able to withstand tractor trailer traffic with minimal movement.

104.27.03 CONSTRUCTION

104.27.03.01 Installation, Monitoring, and Removal. Select the appropriate TPRS from the QPL for the posted speed limit of the roadway. Provide a copy of the manufacturer's installation guidelines to the Engineer. Install and remove according to the manufacturer's recommendations and the Contract Documents. Verify placement with the Engineer prior to installation. Each segment shall be uniform in color throughout the work zone.

104.27.03.02 Installation. Do not use TPRS on loose gravel, bleeding asphalt, heavily rutted pavements, milled or unpaved surfaces. Do not place TPRS through pedestrian crossings and railroad crossings. Do not use TPRS in rain, snow, or icy weather conditions. Do not extend TPRS onto the shoulder without the approval of the Engineer. Do not place TPRS on sharp horizontal or vertical curves; instead, install TPRS in advance of the curve so they are visible to approaching traffic.

Clean the roadway to remove dust, sand, and other debris. Arrange the strips in an array consisting of three complete strips per lane spaced and configured according to the manufacturer's recommendations and the Book of Standards. The length of each strip, whether comprised of one segment or interlocking segments, should be within 12 in. of the full lane width. Center TPRS in the lane.

104.27.03.03 Monitoring. Monitor, maintain alignment, and repair the TPRS if needed. Ensure that the rumble strips are perpendicular to the lane and that the correct spacing between rumble strips is maintained at all times. Correct the positioning of the rumble strips if any strip moves by more than 1 ft in any direction during the work period. If any strip comes out of alignment, clean the strip on both sides, and reset the strip onto a clean roadway surface.

104.27.03.04 Removal. Remove TPRS from the roadway when lane restrictions are removed or as directed. After removing the TPRS, clean and restore pavement to normal condition.

104.27.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

104.27.04.01 The initial installation of Temporary Portable Rumble Strips will be measured and paid for at the Contract unit price per each array per unit day. A unit day will consist of any approved usage within a 24 hour calendar day period. When a temporary portable rumble strip array is used for part of a day, it will be measured and paid for as a unit day. An array consists of three complete temporary portable rumble strips spanning a single lane. Payment will be full compensation for cleaning the roadway surface, installing the rumble strip, and maintaining the strip through the duration of each day's use, including cleaning and resetting of the strip if it comes out of alignment.

104.27.04.02 Remove and Relocate Temporary Portable Rumble Strips will be paid for at the Contract unit price per each array. The payment includes removal of the temporary portable rumble strip array, relocating the array to a new location, cleaning the roadway surface, installing the rumble strips, and maintaining the strips through the duration of each day's use, including cleaning and resetting the strip if it comes out of alignment.

104.27.04.03 Removal of the temporary portable rumble strips at the end of each workday and final removal will be incidental to the item Temporary Portable Rumble Strips, including cleaning and restoring the pavement to normal conditions.

CATEGORY 100
PRELIMINARY

SECTION 104.28 — SPEED DISPLAY TRAILER (SDT)

104.28.01 DESCRIPTION

Furnish, install, operate, maintain, relocate, and remove a portable, self-contained, trailer mounted, speed display trailer (SDT) with static speed limit sign. The SDT includes a static speed limit sign and a speed feedback sign (dynamic radar speed display).

The SDT shall be compliant with the Maryland Manual on Uniform Traffic Control Devices (MdMUTCD) and Maryland Standard Sign Book.

104.28.02 MATERIALS

Speed Display Trailer	QPL
Reflectorization	950.03
Sign Material	950.08

Each SDT shall include the trailer, structural support system, sign panel assembly, lift mechanism, power supplies, trailer mounted controller, non-invasive speed detection device, and ancillary equipment. All materials for the SDT shall be like new, corrosion resistant, and unaffected by water spray, salt, oil, gasoline, and all other contaminants in the quantities typically found along the edge of a traveled roadway. Construction, materials, and operation shall be in accordance with NFPA, UL, and NEC.

The SDT trailer shall be painted orange and shall comply with Maryland Motor Vehicle Law.

104.28.02.01 Equipment.

(a) Speed Feedback Sign (SFS). A SFS shall supplement the static speed limit sign and shall be positioned below the speed limit sign. It shall consist of a static and a dynamic display. The SFS shall not flash, strobe, change color, or use other animated elements integrated into the dynamic display.

(1) Static. The static portion of the SFS shall include the YOUR SPEED legend and shall have a black legend on a fluorescent yellow background. The minimum letter height shall be 6 in. with Series C Standard Alphabet font from the Maryland Standard Sign

Book. Reflective sheeting shall be as specified in 950.03. The sign shall be rectangular in shape.

(2) Dynamic. The format of the message to be displayed on the changeable message sign (CMS) portion of the sign shall be XX where XX is the measured vehicle speed in miles per hour (mph). The color of the changeable message legend shall be a yellow (amber) luminous legend on a black opaque background. The minimum LED number height shall be 14 in. The width of the numbers shall be similar to Series E Standard Alphabet font from the Maryland Standard Sign Book. The CMS shall produce brightness greater than 10,000 candela per square meter at maximum intensity. The housing for the dynamic components shall be a minimum National Electrical Manufacturers Association (NEMA) 3R rated. The display shall adjust automatically for ambient or operational light conditions. The CMS display may use a full or discrete matrix display. If discrete matrix display is used, each character shall be displayed using a minimum array of 5 columns by 7 rows with at least two array modules per line. If a full matrix display is used, the sign shall have a pixel arrangement of at least 5 columns by 7 rows per character with at least 3 LEDs per pixel. The CMS shall conform to ITE specifications for yellow (amber) color warning applications. The CMS shall provide full illumination within at least a 24 degree cone perpendicular to the sign face. The operating temperature range of the LED shall be -30 F to 125 F.

(b) Static Speed Limit Sign Panel. A R2-1 (48 in. x 60 in.) Speed Limit sign shall be attached to the trailer. The sign shall be easily removed and replaced. The static sign face shall be reflectorized as specified in 950.03. The top of the Speed Limit sign shall include a Work Zone plaque with a minimum size of 48 in. x 12 in. The Work Zone plaque shall have a black legend and border on a fluorescent orange background with 6 in. Series C Standard Alphabet font from the Maryland Standard Sign Book.

(c) Trailer. In accordance with Maryland Motor Vehicle Law governing trailers.

(d) Lift Mechanism.

(1) The lift mechanism shall be installed such that the sign panel can be raised and lowered.

(2) A corrosion resistant safety bolt or pin shall be provided to prevent the sign panel from lowering once in the raised position. A self-locking mechanism shall be incorporated into the safety bolt or pin to prevent it from being inadvertently dislodged.

(e) Electrical Connections and Gauges.

(1) All wiring from power sources to SDT equipment shall use locking cable connectors.

(2) Volt and amp gauges shall be provided for DC.

(3) Standard negative ground system shall be tied to the sign chassis.

(f) Power Supply. The SDT shall operate from a solar powered electrical system consisting of battery power and solar array panels. The electrical system shall be capable of supporting continuous operation of the system for 21 consecutive days without an auxiliary charge, and be capable of being charged by a generator or other commercially available power source in case of malfunction, damage, or failure of the primary solar powered electrical system.

(g) Controller Requirements. The controller shall be capable of the following.

(1) Controlling the SFS operating over a -30 F to 125 F range and in a 20 percent to 95 percent noncondensing humidity range.

(2) Designed for fail-safe prevention of improper information display in the case of a system malfunction.

(3) Monitoring and displaying the battery output voltage and solar array actives (charging and discharging).

(4) Monitoring and displaying the status of the photocell and adjusting the sign illumination to match the ambient light conditions. The controller shall have at least nine levels of dimming from 10 percent to 100 percent brightness.

(5) Being contained in a sheet metal or high-density polyethylene (HDPE), weatherproof cabinet located on the controller housing and insulated to protect against excessive vibration and temperature. The cabinet shall be equipped with a lockable door with hasp/lock setup installed in a manner to maximize its effectiveness in stopping unauthorized access to the controls. Other physical locking devices may be approved by the Engineer. The cabinet shall have an interior cabinet light or backlit controller display.

(6) Having remote access to modify speed thresholds, and download vehicle speed readings.

(7) Storing vehicle speed readings with a time and date stamp and have sufficient memory to store 100,000 readings.

(h) Speed Display Software.

(1) The SDT shall be supplied with a non-invasive speed detection unit. The unit shall be able to be rotated on a separate vertical axis from the SDT to allow for better aiming and detection. The unit shall detect and display the speed of only approaching traffic.

(2) The speed display software shall be able to display vehicle speeds that are traveling over a set threshold. The SDT shall also be capable of not displaying a vehicle speed over a separate set threshold.

(3) The SDT speed display software shall have the capability of modifying speed thresholds.

(i) Warning Beacons. Warning lights and/or beacons shall not be attached to the sign or the trailer.

104.28.03 CONSTRUCTION

Furnish, install and test the SDT on the project site 24 hours in advance of actual use to ensure that the unit is functioning properly. Coordinate location with Administration and its Automated Speed Enforcement Contractor for Automated Speed Enforcement.

Place the SDT unit as shown in the Contract Documents or as directed and aim SDT at approaching traffic to ensure sign panel is visible for a minimum distance of 600 ft for nighttime conditions and 800 ft for normal daylight conditions from any point along the travel approach roadway. Ensure the SDT is level and that the sign face is not obscured by highway alignment or glare from vehicle headlights. Install temporary concrete traffic barrier or drums around the SDT according to the Book of Standards and the Contract Documents.

The SDT shall be able to withstand wind of 80 mph.

When deployed, the mounting height to the bottom of the speed limit sign shall be a minimum of 7 ft from near edge of traveled roadway in accordance with the MdMUTCD. The mounting height to the bottom of the SFS shall be high enough to ensure traffic barrier, devices, or other obstructions will not block visibility of the SFS.

The Contractor is responsible for continuous operation of the SDT including any maintenance, repair, troubleshooting, or replacement.

104.28.04 MEASUREMENT AND PAYMENT

104.28.04.01 Speed Display Trailer will be measured and paid for at the Contract price per unit day for each Speed Display Trailer unit. Each Speed Display Trailer will be paid for only once per unit day, regardless of how many times it is relocated. When a Speed Display Trailer is used for part of a day, it will be measured and paid for as a unit day. When operations require continuous 24 hour use of a Speed Display Trailer, the unit day will be measured as 24 hour periods from start to finish.

The payment will be full compensation for the Speed Display Trailer and for all material, labor, equipment, tools, and incidentals necessary to furnish, install, operate, and maintain the Speed Display Trailer as specified or as directed.

104.28.04.02 Signs attached to the Speed Display Trailer will not be measured but the cost will be incidental to the Contract unit price for the pertinent Speed Display Trailer item.

104.28.04.03 Drums for Maintenance of Traffic. Drums will be measured and paid for as specified in 104.12.

104.28.04.04 Temporary Concrete Traffic Barrier and Reset Temporary Concrete Traffic Barrier shall be measured and paid for as specified in 104.04.04. Reflective Barrier Markers and Vertical Panels shall be measured and paid for as specified in 104.04.04.

104.28.04.05 Temporary Traffic Barrier End Treatments, Remove and Reset Temporary Traffic Barrier End Treatments and Repairing Temporary Traffic Barrier End Treatments will be measured and paid for as specified in 104.09.04

CATEGORY 100
PRELIMINARY

SECTION 104.29 — TRUCK MOUNTED VARIABLE MESSAGE SIGN (TVMS)

104.29.01 DESCRIPTION

Furnish, install and relocate a portable, self-contained, truck mounted, variable message sign.

104.29.02 MATERIALS

Each unit shall contain the work vehicle structural support system, sign panel assembly, lift mechanism, power supplies, sign mounted controller, and ancillary equipment.

All materials for TVMS shall be like new, corrosion resistant, and unaffected by water spray, salt, oil, gasoline, and all other contaminants in the quantities normally found along the edge of the traveled roadway. The TVMS construction, materials, and operation shall meet NFPA, UL, and NEC. Ensure that sign messages are visible and legible for a distance of 900 ft from any point along the traveled approach roadway at all times.

The TVMS shall not block the driver's rear view vision when either in the transport or the deployed position.

104.29.03 CONSTRUCTION

104.29.03.01 Equipment.

Truck. The work vehicle size and the method of attachment shall be as specified in the manufacturer's specifications. All vehicles shall be in accordance with Maryland Motor Vehicle Law.

Structural Support. The structural support framework shall allow the system to be assembled into a unit and be mounted on the truck and shall provide the support mechanism between the sign panel assembly, the power supply, and the controller.

The framework shall provide sufficient support to prevent damage to any TVMS components when the sign is in the down and locked position during normal highway travel.

The sign panel shall be mounted as a permanent fixture of the truck and provide a minimum height of 7 ft from the bottom of the sign to the surface of the roadway when in its operating position. Affixing a trailer mounted unit to a truck is prohibited.

The deployed structure shall supply adequate support to allow complete sign operation including raising and lowering of the sign panel during sustained wind speeds of 85 mph.

The display windows shall be made of impact-resistant clear Lexan or as approved.

Sign Panel. Sign panel dimensions shall not exceed 92 in. wide by 54 in. high unless approved. The TVMS shall be capable of displaying three lines of text with the following requirements:

(a) Each line of text shall be constructed using a full matrix display.

(b) The sign shall be capable of displaying six characters per line.

(c) The character height shall be at least 12 in.

(d) The sign shall have a pixel arrangement of at least 20 rows by 40 columns, with at least 3 LEDs per pixel.

LED Illumination. LED illumination for each matrix element shall have the following characteristics:

(a) LED shall meet to the ITE specification for amber color.

(b) LED shall utilize A1InGap substrate.

(c) Each LED shall produce at least one candela output on center at 25 mA drive current.

(d) LED shall provide full illumination within at least a 24 degree cone perpendicular to the sign face.

(e) Operating temperature range of the LED shall be -30 F to 125 F.

TVMS Unit. Submit a catalog cut and character set for any TVMS approval to the Office of Traffic and Safety, Chief of Traffic Operations. Furnish examples of standard messages to be used on the sign.

Lift Mechanism.

(a) The lift mechanism shall be capable of being raised and lowered manually.

(b) A self-locking mechanism shall be provided to prevent the sign panel from lowering once in the raised position.

Electrical Connections and Gauges.

(a) All wiring from power sources to TVMS equipment shall use locking cable connectors.

(b) Each sign shall be equipped with an automatic lamp intensity regulator that maintains a constant output with a varying battery voltage.

(c) Standard negative ground system shall be tied to the vehicle chassis.

Power Supply. The TVMS shall operate from a solar powered electrical system.

Sign Controller. The controller shall:

(a) Be capable of driving the matrix display panel operating over a -30 F to 125 F range and in a 20 percent to 95 percent noncondensing humidity range.

(b) Accommodate 50 preprogrammed, user-defined messages.

(c) Be capable of displaying three sequenced messages. On/Off time for each message in a sequence shall be user adjustable at one-tenth of a second increments within a range of 0 second to 5 seconds.

(d) Be designed for fail-safe prevention of improper information display in the case of a system malfunction. In the event of a system malfunction, the sign shall display a blank message.

(e) Have the capability of retrieving all messages stored in temporary memory.

(1) Temporary memory shall be nonvolatile.

(2) All messages and programs shall remain resident in the controller's memory in the event of a power failure.

(3) Have an RS-232 port to facilitate connection of an external communication device.

(f) Monitor and display the battery output voltage and solar array activities (charging and discharging) and blank the sign when the battery output voltage drops below the manufacturer's recommended output level.

(g) Be capable of monitoring and displaying the status of the photocell, adjust the sign illumination to match the ambient light conditions, and have at least nine levels of dimming from 10 percent to 100 percent brightness.

(h) Be contained in a sheet metal or high density polyethylene (HDPE), weatherproof cabinet located on the controller housing, and insulated to protect against excessive vibration and temperature.

(1) The cabinet shall have a lockable door latch.

(2) The keyboard/input device storage location shall be provided inside the cabinet.

Character Set Software. The character set software shall:

(a) Have all the standard ASCII characters and symbols.

(b) Provide left and right arrows.

(c) Have all alphanumeric entries performed with a keyboard or keypad that causes the same character to be displayed on the matrix. Arrow symbols shall be generated via a cursor pad on the keyboard or keypad.

(d) Have messages default to self-centering display with the ability to left or right justify.

104.29.03.02 Operation. Set up and operate the TVMS 24 hours in advance of actual use to ensure that each unit is functioning properly and approved.

Variable Message Sign Mode. Use the TVMS in variable message sign mode on roadways where the posted speed limit is less than or equal to 40 mph. The TVMS is intended for mobile operations. If used for stationary construction or maintenance operations, do not leave the TVMS in place for more than eight consecutive hours.

Arrow Panel Mode. The TVMS may be used in lieu of a Type C arrow panel on any roadway as long as the TVMS is capable of displaying a left arrow, right arrow, double arrow, and a four-corner caution mode and as specified in 104.07.03. Lights with a preflash option of white strobe or pulsed lighting shall not be displayed.

Use the TVMS only as a supplement to other required traffic control devices. When closing a through travel lane on a multilane roadway, use the "Arrow" mode only. Only one TVMS in the "Arrow" mode shall be used for each stationary lane closure. Moving work operations may utilize one or more TVMS for a single lane closure.

(a) Ensure that the placement does not cause driver confusion near ramps, median crossovers, and side road intersections.

(b) For stationary lane closures, place the TVMS on the shoulder at the beginning of the taper (nearest to oncoming traffic). Where there are narrow or no existing shoulders adjacent to the closed lane behind the channelizing devices, place the TVMS as near to the beginning of the taper as possible.

(c) For moving maintenance type activities along multilane highways where a lane is closed, place the TVMS at the rear of the activity in the closed lane on a vehicle separate from the maintenance vehicle itself. For paint striping activities, additional vehicles with TVMS or arrow panels in the arrow mode may be required to supplement the work operation. TVMS shall always remain upstream of the maintenance vehicles where

adequate recognition distance is available. The vehicle carrying the TVMS shall be equipped with signing and lighting as required by the standard TCPs.

(d) TVMS shall only display the "Caution" mode for a lane closure on a two-lane, two-way roadway, or for a shoulder closure on any roadway. The "Caution" mode on a TVMS shall show displays of circular appearance in each of the four corners of the TVMS. The circle diameters shall range from 9.5 in. to 11 in. and utilize approximately 30 pixels. The circles shall be offset from the left and right edge between 3 in. and 6 in. and from the top and bottom edge between 1.5 in. and 3 in. The vertical spacing between the centers of the circles shall range from 2.5 to 3 times the diameter of the circles. The horizontal spacing between the centers of the circles shall range from 1.75 to 2 times the vertical spacing.

Install the TVMS as specified.

The TVMS shall be designed so that it supplies a minimum visibility and legibility distance of 900 ft. Ensure that the TVMS is level and that the sign face is not obscured by highway alignment or glare from either sunlight or vehicle headlights.

104.29.04 MEASUREMENT AND PAYMENT

Truck Mounted Variable Message Sign will be measured and paid for at the Contract price per unit day. A unit day will consist of any approved usage within a work shift, regardless of start time or whether the shift runs into another calendar day. Each truck mounted variable message sign will be paid for only once per unit day, regardless of how many times it may be relocated. When a truck mounted variable message sign is used for part of a day, it will be measured and paid for as a unit day. When operations require continuous 24 hour use of a truck mounted variable message sign, the unit day will be measured as 24 hour periods from start to finish.

The payment will be full compensation for the vehicle, setup and maintenance of computer programs, changing messages, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 100
PRELIMINARY

SECTION 104.30 — PORTABLE TRAFFIC SIGNAL (PTS)

104.30.01 DESCRIPTION

Furnish, install, and maintain a portable, self-contained, trailer mounted traffic signal for maintenance of traffic operations as specified in the Contract Documents or as directed by the Engineer.

104.30.02 MATERIALS

Portable Traffic Signal (PTS)	As Approved by Office of Traffic and Safety

104.30.03 CONSTRUCTION

Place PTS trailers in the closed lane during alternating one-lane, two-way traffic operations, without intruding into the travel lane, or as directed by the Engineer.

The Contractor is responsible for all setup procedures necessary for the PTS including setting up the trailers, setting up and testing the remote monitoring system notification, aiming signal heads, interconnecting the signal controllers, aiming, and adjusting vehicle detection units, and installing the timing provided by the Office of Traffic & Safety.

104.30.03.01 Equipment.

Each PTS shall be a trailer mounted unit. A PTS system shall consist of two or more trailers. Each unit shall be self-contained battery powered with solar assist, consist of two signal heads per trailer, and a solid state signal controller. One signal head should be mounted on an overhead mast arm capable of extending over the travel lane. The other signal head shall be mounted on a vertical upright. The PTS system shall have non-intrusive vehicle detectors and each PTS must be interconnected to each other at all times with a twisted pair shielded cable or wireless radio link with sufficient range, as specified in the Contract Documents or as directed.

Trailer. The trailer shall conform to Maryland Motor Vehicle Law governing trailers.

Support Structure. The PTS trailer shall be capable of accommodating a vertical upright and a horizontal mast arm. The trailer and all mounted equipment shall be structurally adequate for unlimited, normal operation in wind velocities typically encountered on the roadway (gusts of 80 MPH). No additional ballast shall be used to achieve the structural stability required for normal operation. Additional ballast includes but is not limited to, sandbags, concrete/cement blocks and

steel, cast, or iron weights (secured or unsecured). PTS trailers shall be manufactured to accommodate the option of transporting two signal trailers with one vehicle. Each signal trailer shall be equipped with four stabilizing/leveling jacks, one on each corner of the trailer. The PTS trailer shall have adequate structural integrity to facilitate lifting and placing the PTS trailer as required.

Lift Mechanism. The PTS shall contain a lift mechanism that is electric or electrically-assisted hydraulic, as well as a manual mechanism capable of raising and lowering the mast arm. The mast arm shall extend a minimum of 9 ft from the side of the trailer.

Signal Heads/Display Requirements. The PTS shall meet the physical display and operational requirements of conventional traffic signals according to Part IV of the MdMUTCD. Signal Heads shall be cast aluminum and have three, 12 in. LED indications, conforming to ITE Specifications for "Vehicle Traffic Control Signal Heads" and NEMA Standards TS1 and TS2. Signal heads shall be equipped with visors which extend beyond the signal head a minimum of 10 in. All signal housings shall have a black face and yellow housing. The signal heads shall have the ability to accommodate back plates and rotate horizontally 180 F. The PTS shall have a reversible signal head mounting feature which will allow two trailers to be placed in the same lane of traffic. Both signal heads shall be able to be rotated and locked into position to provide the optimum visibility to motorists. The overhead signal shall have a minimum clearance height of 17 ft and a maximum clearance height of 19 ft, measured from the bottom of the green indication to the road surface. The lower signal head shall be mounted to a vertical upright at a minimum height of 8 ft measured from the bottom of the green indication to the road surface.

Power Requirements. Each PTS Trailer shall be equipped with batteries sufficient to operate the signal for a minimum of 21 days at 72 F without charging. The charging system shall include 390 watts (minimum) of solar collection capability and an onboard battery charger capable of being used with a 110 volt power source. The system shall also include an onboard monitoring system capable of regulating and providing a visual display of the battery voltage and solar input.

Operational Requirements. Each PTS shall be equipped with an operating system having the following capabilities:

(a) The signal controller shall be enclosed in a cabinet mounted on each trailer.

(b) The controller shall be furnished with a keypad or LCD display screen to allow for the signal operator to program the signal under all weather conditions. The controller shall have the capability of connecting to a PC or laptop for programming.

(c) The signal controller shall operate between -30 F and 150 F and in a 20 percent to 100 percent humidity range.

(d) A conflict monitoring system conforming to NEMA Standards shall be provided.

(e) The PTS shall have the capability of being operated in a fixed time, traffic actuated or manual control mode.

(f) Fixed time mode operation option must include the ability to provide a minimum of five automatic signal timing changes within a 24 hour period.

(g) The operating system shall have the ability to control a minimum of 7 traffic phases.

(h) Programmable green times from 3 seconds to 250 seconds, yellow times from 3.5 seconds to 6 seconds, and red times from 1 second to 250 seconds shall be provided. All programmable green times shall be in 1 second increments. All programmable clearance times shall be in 0.5 second increments.

(i) The PTS shall have the ability to facilitate minimum / maximum green time programming in the traffic actuated mode in a manner that will extend the green times in predetermined programmable segments as required.

(j) The operating system shall have a programmable time-of-day feature that will allow the maximum green times to be changeable by time of day.

(k) The operating system shall have the capability of facilitating standby modes of red, red flash and yellow flash mode.

(l) The operating system shall be capable of facilitating traffic actuation with true presence capability.

(m) The operating system shall have an integrated mechanism capable of recording system malfunctions including date and time of system failure. This information shall be available in a printable format.

(n) The operating system shall be capable of accommodating a pre-emption system with optical activation which provides a priority green phase in the direction of appropriately equipped approaching emergency vehicles.

(o) The operating system shall have the capability to allow the PTS to be connected to and controlled by a standard NEMA controller.

(p) The operating system shall have a manual control option that will allow the Traffic Manager to manually control the signal to coordinate the PTS system for special operations.

(q) The operating system shall be equipped with diagnostic capabilities in the event of a system default.

(r) The system shall have the capability of identifying the default in a manner that will expedite the return to full operational mode.

Monitoring System Requirement. Furnish and install PTS monitoring system capable of reporting signal location, battery voltage and system default. The monitoring system shall have the ability to communicate system default via text or email to responsible individuals. As specified in GP-2.04 verify available communications at the site, e.g., cellular or satellite, and select an appropriate PTS monitoring system that works with that communication method. Coordinate the installation of monitoring system with the ADE-T to develop an acceptable plan for monitoring signal operations and reporting on system default.

Actuation Requirements. The PTS systems shall be capable of utilizing non-invasive detectors for traffic actuation. Acceptable non-invasive detectors include microwave motion sensors and video detection cameras. Acceptable PTS systems shall have the capability of being operated with both a motion and true presence actuation system.

Communication Requirements. The PTS systems shall have the capability of being operated using hardwired or wireless communication. Field conditions will determine the method used for interconnection of the PTS system. The communication cable shall be deployed in a manner that will not intrude in the direct work area of the project or obstruct vehicular and pedestrian traffic. If a radio link communication option is utilized, a clear line of sight must be maintained between PTS units. The radio system shall conform to the applicable Federal Communication Commission requirements and all applicable state and local requirements. Should there be a failure in the communication link between the two signals, both signals shall be display solid red indications.

Default Requirements. PTS systems shall have the capability of reverting to a solid red, red flash, or yellow flash mode upon system default. The default setting shall be solid red unless otherwise stated in the project specifications or as directed by the Engineer. Upon default the PTS system shall immediately contact a minimum of three responsible individuals via the remote monitoring system described in the Operational Requirement section. The PTS system repairs shall be the responsibility of the contactor and rendered in a manner that will return to PTS to full operation condition in the most expeditious manner.

Field Operations. Set up, program, relocate, and maintain the PTS as per the Contract Documents or as directed by the Engineer, as recommended by the PTS manufacturer. Notify the Assistant District Engineer Traffic and the Office of Traffic and Safety at least three weeks prior to starting work. There will be no programming or timing changes to the PTS without written approval from the Office of Traffic and Safety.

The contractor shall adjust or reconfigure the PTS operation only as directed by the Engineer, with approval from the Office of Traffic and Safety and the Assistant District Engineer Traffic.

Operate the PTS as noted on the Maintenance of Traffic signalization plans, when available.

Provide SHA with the name and telephone number of an emergency contact person to maintain and operate or repair the signals. Make provisions to have certified flaggers who have completed the SHA approved flagger training course and make provisions to have appropriate signing in place to maintain traffic at the PTS location in case of a PTS failure. Notify the Engineer, the Statewide

Operations Center (SOC), and the ADE-T in the event of a failure. Maintain daily log at the signal site and record equipment malfunction.

104.30.04 MEASUREMENT AND PAYMENT

The Portable Traffic Signal will be measured and paid for at the Contract price per unit day. A unit day will consist of any approved usage within a normal work shift, regardless of start time or whether the shift runs into another calendar day. Each portable traffic signal will be paid for only once per unit day. When a portable traffic signal is used for part of a day, it will be measured and paid for as a unit day. When operations require continuous 24 hour use of a portable traffic signal, the unit day will be measured as 24 hour periods from start to finish.

The payment will be full compensation for the provision, installation, operation, interconnection, monitoring system, maintenance, reconfiguration, adjustments, flaggers, signing, repair technicians, relocation as required by the Traffic Control Plan or as directed by the Engineer, and for all materials, labor, equipment, tools, training by the portable traffic signal manufacturer, and incidentals necessary to complete the work. Where other Contract pay items for Maintenance of Traffic are specified in the Contract Documents, measurement and payment shall conform to the pertinent items.

CATEGORY 100
PRELIMINARY

SECTION 104.31 — ACCESSIBLE PEDESTRIAN MAINTENANCE OF TRAFFIC

104.31.01 DESCRIPTION

Provide and maintain an accessible pedestrian route, to the "maximum extent feasible", throughout the project's limits. When an existing pedestrian access route within the public right of way is blocked by construction, alteration, or maintenance activity, an alternate accessible pedestrian route shall be provided.

The phrase, "maximum extent feasible", applies in areas where the nature of an existing facility or site conditions makes it virtually impossible to comply fully with applicable accessibility standards through a planned alteration. In these circumstances, the alternate accessible pedestrian route shall provide the maximum physical accessibility that is feasible, or a design waiver must be approved by SHA's Office of Highway Development.

104.31.02 MATERIALS

Not applicable.

104.31.03 CONSTRUCTION

Consider the following items when addressing accessible pedestrian maintenance of traffic:

(a) All pedestrians, including persons with disabilities, shall be provided with a reasonably safe, convenient and accessible path that replicates as much as practicable the existing pedestrian facilities.

(b) The width of the existing pedestrian facility should be maintained if practical. When it is not possible to maintain a minimum width of 60 in. throughout the entire length of the pedestrian route, a minimum width of 36 in. shall be provided with 60 in. x 60 in. passing zones at least every 200 ft, to allow individuals in wheelchairs to pass.

(c) Traffic control devices and other construction materials and features shall not intrude into the usable width of the sidewalk, temporary pathway or other pedestrian facility.

(d) Signs and other devices mounted lower than 7 ft above the temporary pedestrian pathway shall not project more than 4 in. into accessible pedestrian route.

(e) A smooth, continuous hard surface shall be provided throughout the entire length and width of the pedestrian route throughout construction. There shall be no curbs or vertical elevation changes greater than 1/4 in. in grade or terrain that could cause tripping or be a barrier to wheelchair use. Vertical elevation differences between 1/4 in. and 1/2 in. shall be beveled at a maximum 2:1 slope.

(f) When channelization is used to delineate a pedestrian pathway, a continuous detectable edging should be provided throughout the length of the facility such that pedestrians using a white cane can follow it. Edging should protrude at least 6 in. above the surface of the sidewalk or pathway with the bottom of the edging a maximum of 2.5 in. above the surface.

(g) Temporary ramps shall be provided when an alternate pedestrian route crosses a curb, and no permanent ramps are in place. The width of the ramp shall be a minimum of 36 in. and the slope of the ramp shall not exceed 12:1. Temporary detectable warning mats must be installed at street crossings and signalized entrances.

(h) When possible, an accessible pedestrian route shall be provided on the same side of the street as the disrupted route. When it is not feasible to provide a same-side accessible pedestrian route an accessible pedestrian detour route shall be provided.

(i) Information regarding closed pedestrian routes, alternate crossings, and sign and signal information shall be communicated to pedestrians with visual disabilities by providing devices such as audible information devices, accessible pedestrian signals or barriers and channelizing devices that are detectable to the pedestrians traveling with the aid of a white cane or who have low vision.

(j) It is desirable that pedestrians cross to the opposite side of the roadway at intersections rather than mid-block. Appropriate signing shall be placed at the intersections.

(k) Access to transit stops shall be provided and maintained at all times.

104.31.04 MEASUREMENT AND PAYMENT

Unless otherwise specified, Accessible Pedestrian Maintenance of Traffic will not be measured but the cost will be incidental to the Lump Sum item for Maintenance of Traffic. The payment will be full compensation for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 100
PRELIMINARY

SECTION 104.32 — STATIC AUTOMATED SPEED ENFORCEMENT

104.32.01 DESCRIPTION

Coordinate with the Administration and its Automated Speed Enforcement Contractor for Automated Speed Enforcement (ASE) in the work zone. Provide work zone signage, workers present trailer(s), speed display trailer(s), and protection devices to accommodate ASE in the work zone. Contact the Office of Traffic and Safety Traffic Development and Support Division (OOTS TDSD) ASE program representative (410-787-5860) at least two weeks prior to fabricating and installing ASE signs to determine exact locations for the ASE unit(s), ASE signs, workers present trailer(s), and speed display trailer(s).

104.32.02 MATERIALS

Temporary Concrete Traffic Barrier (TCB) for Maintenance of Traffic	104.04.02
Temporary Traffic Signs (TTS)	104.08.02
Temporary Traffic Barrier End Treatments	104.09.02
Temporary Crash Cushion Sand Filled Plastic Barrels (SFPB)	104.10.02
Drums for Maintenance of Traffic	104.12.02
Cones for Maintenance of Traffic	104.14.02
Protection Vehicle (PV)	Section 104.23
Speed Display Trailer (SDT)	104.28.02
Aggregate for Maintenance of Traffic	105.02
Reflectorization	950.03
Workers Present Trailer (WPT)	104.24.02

104.32.03 CONSTRUCTION

104.32.03.01 General. Refer to Standard No. MD 104.06-26A. Static Automated Speed Enforcement (ASE) will be used in the work zone to enhance safety for the workers and traveling public. The Administration will provide a mobile ASE system, including speed enforcement equipment, ASE unit(s), and labor for ASE system operation. The Contractor will provide (furnish, install, relocate and remove) all of the applicable ASE signing, the workers present trailer(s), the speed display trailer(s), and protection devices as required.

Coordinate and cooperate with the Project Engineer and the ASE program representative to implement the ASE system on this project throughout construction. The ASE program representative is located in the Office of Traffic and Safety, Traffic Development and Support Division. Obtain approval from the ASE program representative for the ASE unit location(s), ASE sign locations and sizes, workers present trailer location(s), and speed display trailer location(s).

At least two weeks prior to the start of the project, arrange a field meeting with the Project Engineer and the ASE program representative to verify the sign types, sizes and locations. At this meeting, jointly identify locations for the ASE unit(s), workers present trailer(s), and speed display trailer(s) with the ASE program representative.

Contact the Project Engineer and the ASE program representative a minimum of two weeks prior to all phase changes or construction activities that require relocation of the ASE unit(s). When activities occur that require relocation of the ASE unit(s), arrange a field meeting with the Project Engineer and the ASE program representative to verify the suitability of existing and/or identify new location(s) for the ASE unit(s), advance warning signs, workers present trailer(s), speed display trailer(s), and all required protection devices.

Where feasible, provide bathroom facilities in a location that can be used by construction personnel and the ASE unit operators. Make the bathroom facilities available and accessible to the ASE unit operators twenty-four hours a day, seven days a week. Provide the bathroom facilities at a location within a reasonable walking distance of the ASE unit deployment location and where the ASE unit operator does not have to cross travel lanes to access the facilities.

Inform the Administration within 30 minutes of starting and ending work the exact start time(s) and exact end time(s) when workers are present in the work zone.

104.32.03.02 Temporary Traffic Signs for ASE. Refer to 104.08.03. Provide automated speed enforcement advanced warning signs on each approach to the work zone, including ramps. These signs shall consist of ASE advance notice signs and ASE speed limit signs, as shown on the plans and/or as directed by the ASE program representative. Additional ASE signs may be requested by the ASE program representative based on project needs. Prior to sign acquisition, coordinate with the Project Engineer and the ASE program representative a minimum of two weeks in advance to verify the sign types, colors of sign background and legend, materials, sizes, and locations of signs. Relocate and/or install new ASE signs as needed throughout construction.

104.32.03.03 Aggregate for Maintenance of Traffic. Refer to 105.03. Where the ASE unit deployment location is not on hard surface, construct a level stone entrance and pad adjacent to the roadway for the ASE enforcement unit. Provide a safe means for the ASE unit operators to enter/exit the enforcement area.

104.32.04.04 Temporary Traffic Barrier. Refer to 104.04.03. Provide protection for the ASE unit, either behind temporary concrete barrier or existing W-beam.

104.32.03.05 Speed Display Trailer. Refer to 104.28.03. Furnish, install, maintain, relocate and remove a speed display trailer(s) as shown on the plans and/or as directed by the ASE program

representative. Construct a level area adjacent to the shoulder for placement of the speed display trailer(s) as needed. Periodically inspect the speed display trailer(s) and make adjustments as needed to ensure proper function. Relocate and/or install new speed display trailer(s) as needed throughout construction.

104.32.03.06 Maintenance of Traffic. Conduct maintenance of traffic as specified in 104.02.03 where required for installation, relocation, or removal of temporary traffic control devices for ASE activities.

104.32.03.07 Temporary Traffic Barrier End Treatments. Refer to 104.09.03.

104.32.03.08 Temporary Crash Cushion Sand Filled Plastic Barrels. Refer to 104.10.03.

104.32.03.09 Drums for Maintenance of Traffic. Refer to 104.12.03.

104.32.03.10 Cones for Maintenance of Traffic. Refer to 104.14.03.

104.32.03.11 Workers Present Trailer. Refer to 104.24.03.

Provide a workers present trailer(s) (furnish, install, maintain, relocate and remove) as shown on the plans and/or as directed by the ASE program representative. Construct a level area adjacent to the shoulder for placement of the workers present trailer(s) as needed. Periodically inspect the workers present trailer(s) and make adjustments as needed to ensure proper function. Relocate and/or install additional workers present trailer(s) as needed throughout construction. Activate the flashing lights on the workers present trailer(s) when workers are present in the work zone. Deactivate the flashing lights on the workers present trailer(s) when workers are not present in the work zone.

104.32.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work including relocating, turning, completely covering and uncovering or removing and resetting, maintaining in like new condition, and cleaning existing and temporary traffic signs and other traffic control devices related to the operation of the Automated Speed Enforcement.

The pay item will include the following items unless otherwise specified.

104.32.04.01 Maintenance of Traffic for Automated Speed Enforcement will not be measured but will be paid for at the Contract lump sum price. The payment will be full compensation for relocating, turning, completely covering and uncovering or removing and resetting, maintain in like new condition, and cleaning existing and temporary traffic signs and other traffic control devices related to the operation of the Automated Speed Enforcement. Included is the treatment of any other traffic control device not included in these Specifications but necessary for the fulfillment of the Contract requirements, and for all material, labor, equipment, tools and incidentals necessary to complete the work. Payment of the Contract lump sum price will be

prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating will be the number estimated to complete the work.

104.32.04.02 Temporary Concrete Traffic Barrier and Reset Temporary Concrete Traffic Barrier shall be measured and paid for as specified in 104.04.04. Reflective Barrier Markers and Vertical Panels shall be measured and paid for as specified in 104.04.04.

104.32.04.03 Temporary Traffic Signs will be measured and paid for as specified in 104.08.04.

When ASE advance warning and speed limit signs are furnished by the Administration or by the Administration's ASE Contractor, the Contractor will be responsible for set-up, take down and relocation of these signs. Signs shall be placed per the direction of the ASE program representative and in accordance with the requirements of Section 104.08. Signs furnished by the Administration or by the Administration's ASE Contractor and provided to the Contractor will be measured and paid for at the Contract unit price per square foot as specified in 104.08.04. The payment will be full compensation for furnishing the supports, installation, relocation, maintenance, cleaning, removal, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

104.32.04.04 Temporary Traffic Barrier End Treatments, Remove and Reset Temporary Traffic Barrier End Treatments and Repairing Temporary Traffic Barrier End Treatments will be measured and paid for as specified in 104.09.04.

104.32.04.05 Temporary Crash Cushion Sand Filled Plastic Barrels shall be measured and paid for as specified in 104.10.04.

104.32.04.06 Drums for Maintenance of Traffic shall be measured and paid for as specified in 104.12.04.

104.32.04.07 Cones for Maintenance of Traffic shall be measured and paid for as specified in 104.14.04.

104.32.04.08 If requested, the Protection Vehicle shall be measured and paid for as specified in 104.23.04.

104.32.04.09 Speed Display Trailer will be measured and paid for as specified in 104.28.04.

104.32.04.10 Supply of materials for, installation of, and removal of stone construction entrance(s) and pad(s) for ASE units will be measured and paid for as specified in 105.04.

104.32.04.11 Workers Present Trailer will be measured and paid for as specified in 104.24.

CATEGORY 100
PRELIMINARY

SECTION 104.33 — FLEXIBLE AUTOMATED SPEED ENFORCEMENT

104.33.01 DESCRIPTION

Flexible Automated Speed Enforcement (ASE) deployments are used when work activity is 60 days or less and may include different ASE deployment locations for each work shift. Projects using flexible ASE generally require set up and removal of maintenance of traffic items at the start and end of each shift. Example projects include resurfacing, restoration and rehabilitation projects, maintenance projects, etc.

Coordinate with the Administration and its Automated Speed Enforcement Contractor for ASE in the work zone. Provide work zone signage, workers present trailer(s), speed display trailer(s), and protection devices to accommodate ASE in the work zone. Contact the Office of Traffic and Safety Traffic Development and Support Division (OOTS TDSD) ASE program representative (410-787-5860) at least two weeks prior to fabricating and installing ASE signs to determine exact locations for the ASE unit(s), ASE signs, workers present trailer(s), and speed display trailer(s).

104.33.02 MATERIALS

Temporary Traffic Signs (TTS)	104.08.02
Drums for Maintenance of Traffic	104.12.02
Protection Vehicle (PV)	Section 104.23
Speed Display Trailer (SDT)	104.28.02
Reflectorization	950.03
Aggregate for Maintenance of Traffic	105.02
Workers Present Trailer (WPT)	104.24.02

104.33.03 CONSTRUCTION

104.33.03.01 General. Refer to Standard No. MD 104.06-26B. Flexible Automated Speed Enforcement (ASE) will be used in the work zone to enhance safety for the workers and traveling public. The Administration will provide a mobile ASE system, including speed enforcement equipment, ASE unit(s), and labor for ASE system operation. The Contractor will provide, furnish, install, maintain, relocate, and remove all the applicable ASE signing, the workers present trailer(s), the speed display trailer(s), and protection devices including the protection vehicle(s) for ASE activities as required.

Coordinate and cooperate with the Project Engineer and the ASE program representative to implement the ASE system on this project throughout construction. The ASE program representative is located in the Office of Traffic and Safety, Traffic Development and Support Division. Obtain approval from the ASE program representative for the ASE unit location(s), protection vehicle location(s), ASE sign locations and sizes, workers present trailer locations(s), and speed display trailer location(s).

At least two weeks prior to the start of the project, arrange a field meeting with the Project Engineer and the ASE program representative to jointly identify locations for the ASE unit(s), the protection vehicle dedicated to ASE, the workers present trailer(s), and the speed display trailer(s). During the project, contact the Project Engineer and the ASE program representative a minimum of 48 hours prior to any changes not approved during the initial field meeting or due to unforeseen changes. Contact the Project Engineer and the ASE program representative a minimum of four hours before any work cancellations.

Inform the Administration within 30 minutes of starting and ending work the exact start time(s) and exact end time(s) when workers are present in the work zone.

104.33.03.02 Maintenance of Traffic. Conduct maintenance of traffic as specified in 104.02.03 where required for installation, relocation, or removal of temporary traffic control devices for ASE activities.

104.33.03.03 Temporary Traffic Signs for ASE. Refer to 104.08.03. Provide automated speed enforcement advanced warning signs on each approach to the work zone, including ramps. These signs shall consist of ASE advance notice signs and ASE speed limit signs, as shown on the plans and/or as directed by the ASE program representative. Additional ASE signs may be requested by the ASE program representative based on project needs. Prior to sign acquisition, coordinate with the Project Engineer and the ASE program representative a minimum of two weeks in advance to verify the sign types, colors of sign background and legend, materials, sizes, and locations of signs. Relocate and/or install new ASE signs as needed throughout construction.

104.33.03.04 Drums for Maintenance of Traffic. Refer to 104.12.03. When delineation of the speed display trailer(s) or workers present trailer(s) is needed, provide 7 drums to form the shoulder taper to delineate the trailer(s) per MD 104.01-22. When the speed display trailer(s) or workers present trailer(s) is within the lane closure, additional delineation is not needed.

104.33.03.05 Protection Vehicle Dedicated to ASE Deployment. Refer to Section 104.23. Provide a protection vehicle with a truck or trailer-truck mounted attenuator as specified in Section 104.23 dedicated to protecting each ASE unit. Coordinate placement of the protection vehicle with the ASE program representative. Position the protection vehicle prior to the arrival of the ASE operator. The protection vehicle must remain in place until the end of the automated speed enforcement and the ASE unit has left the enforcement location. Ensure that the appropriate roll ahead distance (per manufacturer's recommendation) between the protection vehicle and the ASE unit is always maintained and access/egress for the ASE operator is provided.

104.33.03.06 Speed Display Trailer. Refer to 104.28.03. Furnish, install, maintain, relocate, and

remove a speed display trailer(s) as shown on the plans and/or as directed by the ASE program representative. Construct a level area adjacent to the shoulder for placement of the speed display trailer(s) as needed. Periodically inspect the speed display trailer(s) and adjust it as needed to ensure proper function.

104.33.03.07 Aggregate for Maintenance of Traffic. Refer to 105.03. Where the ASE unit deployment location is not on hard surface, construct a level stone entrance and pad adjacent to the roadway for the ASE enforcement unit. Provide a safe means for the ASE unit operators to enter/exit the enforcement area.

104.33.03.08 Workers Present Trailer. Refer to 104.24.03. Provide a workers present trailer(s) (furnish, install, maintain, relocate and remove) as shown on the plans and/or as directed by the ASE program representative. Construct a level area adjacent to the shoulder for placement of the workers present trailer(s) as needed. Periodically inspect the workers present trailer(s) and make adjustments as needed to ensure proper function. Relocate and/or install additional workers present trailer(s) as needed throughout construction. Activate the flashing lights on the workers present trailer(s) when workers are present in the work zone. Deactivate the flashing lights on the workers present trailer(s) when workers are not present in the work zone.

104.33.03.09 Temporary Traffic Barrier. Refer to 104.04.03. Provide protection for the ASE unit, either behind a temporary concrete barrier or existing W-beam.

104.33.03.10 Temporary Traffic Barrier End Treatments. Refer to 104.09.03.

104.33.03.11 Temporary Crash Cushion Sand Filled Plastic Barrels. Refer to 104.10.03.

104.33.04 MEASUREMENT AND PAYMENT

If the Automated Speed Enforcement Representative has scheduled a deployment but the Automated Speed Enforcement unit does not show up at the scheduled deployment the Contractor will still get paid as specified in this section.

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work including relocating, turning, completely covering and uncovering or removing and resetting, maintaining in like new condition, and cleaning existing and temporary traffic signs and other traffic control devices related to the operation of the Automated Speed Enforcement.

The pay item will include the following items unless otherwise specified.

104.33.04.01 Temporary Traffic Signs for Automated Speed Enforcement. The signs will be measured and paid for as specified in 104.08.04.

104.33.04.02 Drums for Maintenance of Traffic. Drums will be measured and paid for as specified in 104.12.

104.33.04.03 Protection Vehicles dedicated to Automated Speed Enforcement deployment. The Contractor will be responsible for providing a dedicated protection vehicle for the protection of the Automated Speed Enforcement unit for the duration of the deployment shift. The protection vehicle shall be as specified in Section 104.23. Provide a licensed protection vehicle operator to drive and position the protection vehicle at the start of the deployment location and to remove the protection vehicle at the end of the shift. The protection vehicle operator does not need to remain in the vehicle for the duration of the deployment shift. The protection vehicle will be measured and paid per for per unit day. A unit day will consist of one shift of Automated Speed Enforcement deployment (not to exceed 9 hours). A deployment shift crossing midnight into the following calendar day will be paid for as one unit day (e.g., 9 PM to 5 AM counts as one unit day).

The payment will be full compensation for the complete protection vehicle, including the truck mounted attenuator/trailer truck mounted attenuator and arrow panel, licensed work vehicle operator, relocating the protection vehicle, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

104.33.04.04 Speed Display Trailer. The Contractor will be responsible for the set-up, operation, and removal/relocation of the speed display trailer(s) at the start and end of each deployment shift. The speed display trailer(s) will be measured and paid for as specified in Section 104.28.

104.33.04.05 Maintenance of Traffic. The Contractor will be responsible for providing maintenance of traffic as specified in 104.02.03 where required for installation, relocation, or removal of temporary traffic control devices for Automated Speed Enforcement activities.

104.33.04.06 Supply of materials for installation of, and removal of pad(s) for Automated Speed Enforcement units will be measured and paid for per 105.04.

104.33.04.07 Temporary Concrete Traffic Barrier and Reset Temporary Concrete Traffic Barrier shall be measured and paid for as specified in 104.04.04. Reflective Barrier Markers and Vertical Panels shall be measured and paid for as specified in 104.04.04.

104.33.04.08 Temporary Traffic Barrier End Treatments, Remove and Reset Temporary Traffic Barrier End Treatments and Repairing Temporary Traffic Barrier End Treatments will be measured and paid for as specified in 104.09.04

104.33.04.09 Temporary Crash Cushion Sand Filled Plastic Barrels shall be measured and paid for as specified in 104.10.04.

104.33.04.10 Refusal of Payment. The Contractor will not be paid as specified in this section under these circumstances:

(a) No Automated Speed Enforcement deployment is scheduled by the Automated Speed Enforcement program representative.

(b) The Automated Speed Enforcement program representative cancels a scheduled Automated Speed Enforcement deployment. The Automated Speed Enforcement

representative will communicate the cancellation to the Project Engineer who will notify the Contractor a minimum of 8 hours in advance.

(c) Automated Speed Enforcement deployment is cancelled prior to the scheduled time due to inclement weather. The Automated Speed Enforcement representative will communicate the cancellation to the Project Engineer who will notify the Contractor a minimum of 4 hours in advance.

(d) The Contractor cancels work prior to the start of maintenance of traffic set up. The Contractor shall notify the Project Engineer and the Automated Speed Enforcement program representative of the cancellation in advance.

(e) The Contractor fails to provide and comply with any of the requirements outlined and noted below in (1) through (5), then payment will be withheld for each day of nonconformance.

(1) Working Speed Display Trailer.

(2) All required Automated Speed Enforcement advance warning signs (properly displayed).

(3) Dedicated protection vehicle for the Automated Speed Enforcement unit.

(4) The Contractor fails to provide access and egress for the Automated Speed Enforcement operator.

(5) Workers Present Trailer with functioning yellow beacons.

104.33.04.11 Workers Present Trailer. The Contractor will be responsible for the set-up, operation, and removal/relocation of the workers present trailer(s) at the start and end of each deployment shift. The Workers Present Trailer(s) will be measured and paid for as specified in Section 104.24.

CATEGORY 100
PRELIMINARY

SECTION 105 — AGGREGATE FOR MAINTENANCE OF TRAFFIC

105.01 DESCRIPTION

Place aggregate material for the maintenance of traffic.

105.02 MATERIALS

Crusher Run Aggregate CR-6	901.01
Bank Run Gravel Subbase	901.01
Graded Aggregate Base	901.01

105.03 CONSTRUCTION

Refer to 501.03.

105.04 MEASUREMENT AND PAYMENT

Crusher Run Aggregate CR-6 for Maintenance of Traffic, Bank Run Gravel Subbase for Maintenance of Traffic, and Graded Aggregate Base for Maintenance of Traffic will be measured and paid for at the Contract unit price per ton. The payment will be full compensation for all aggregate, hauling, placing, compacting, removal, rehandling, reworking, disposal, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

When Graded Aggregate Base is part of any base or pavement course used for the construction and maintenance of temporary detours, approaches, crossings, and widenings, the item of work will be measured and paid for as specified in Section 501.

Aggregate for maintenance of traffic when used for temporary and permanent patching at pipe culverts and utilities will not be measured but the cost will be incidental to the Contact unit price for Pipe Culvert or Utility item.

CATEGORY 100
PRELIMINARY

SECTION 106 — ASPHALT MIXES FOR MAINTENANCE OF TRAFFIC

106.01 DESCRIPTION

Place asphalt mix for maintenance of traffic.

106.02 MATERIALS

Tack Coat (Rapid Setting)	904.03
Asphalt mix	904.04
Crack Filler	911.01 & 911.01.01
Production Plant	Section 915

106.03 CONSTRUCTION

Refer to 504.03.

106.04 MEASUREMENT AND PAYMENT

Asphalt Mixes for Maintenance of Traffic will be measured and paid for at the Contract unit price per ton. The payment will be full compensation for all tack coat, crack filler, hauling, placing, compacting, maintaining, removal, rehandling, reworking, disposal, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

When an asphalt mix is part of any base or pavement course used for the construction and maintenance of temporary detours, approaches, crossings, and widenings, the item of work will be measured and paid for as specified in Section 504. For payment of temporary tie-ins, refer to 504.04. Removal will be measured and paid for as specified in 206.04.02.

Asphalt mixes for maintenance of traffic when used for temporary and permanent patching at pipe culverts and utilities will not be measured but the cost will be incidental to the Contract unit price for Pipe Culvert or Utility item.

CATEGORY 100
PRELIMINARY

SECTION 107 — CONSTRUCTION STAKEOUT

107.01 DESCRIPTION

Furnish, place, and maintain construction layout stakes that demarcate the Limit of Disturbance (LOD) and protected resource areas including but not limited to, wetlands, wetland buffers, waters of the United States (WUS), stream protection zones (SPZs), floodplains, and tree preservation areas.

107.01.01 Limit of Disturbance (LOD). The allowable limit of earth disturbance as specified in the Contract Documents.

107.02 MATERIALS

107.02.01 Wetland Ribbon. Pink vinyl ribbon having a width no less than 1-1/2 in. and having the word “Wetland” in black letters.

107.02.02 Demarcation Ribbon. Vinyl ribbon of various colors having a width no less than 1-1/2 in.

107.03 CONSTRUCTION

107.03.01 Line and Grade. The Engineer will provide the following.

(a) Roadway Temporary Access Road, and Maintenance Access Road Stakeout.

(1) A staked center line of the roadway with stations not over 100 ft apart.

(2) Appropriately spaced benchmarks and necessary references, including all points of curvature (PC) and points of tangency (PT), for the preservation and control of the center line.

(3) Except for temporary access roads and maintenance access roads, two sets of prints of the cross sections. Use the cross sections as a guide only. Dimensions or elevations scaled from the cross sections are not sufficiently precise for use in construction. Cross sections will not be provided for temporary access roads nor for maintenance access roads.

(b) Structure Stakeout.

(1) A staked center line or working line, whichever applies, with stations not over 100 ft apart and extending at least 100 ft beyond each end of the structure.

(2) When the structure is on a curve, a staked center line or working line, whichever applies, consisting of stations not over 100 ft apart and including the PC, PT, and at least one point on the tangents beyond each end of the curve.

(3) At least two benchmarks, one on each end of the structure.

107.03.02 Workmanship. Set and maintain the specified elevations and dimensions.

107.03.03 Control Markers. Preserve the center line and benchmarks set by the Engineer. Replace disturbed, damaged, or destroyed control markers.

107.03.04 Control Stakes. As specified in 107.03.01(a), furnish, set, and preserve stakes at each station along each side of the project on the right-of-way or easement line, whichever is farther from the center line of construction. Where only part of an ultimate dual highway is to be constructed, set the stakes on the side of the future improvement 10 ft beyond the construction limits. On each of the stakes, mark the offset distance from the center line and its top elevation, or the cut or fill to the profile grade line. Place additional stakes as necessary and as directed to ensure the correct layout of the work.

For stormwater management (SWM) facilities, furnish, set, and preserve stakes at each station along each side of the maintenance access road and at grading points. Place additional stakes as necessary and as directed to ensure the specified layout of the work.

107.03.05 Layout. For structures, proceed with the layout work as specified in 107.03.01(b). Before any actual construction begins, verify the lines and grades provided by the Engineer, then establish all center line or working line intersections with the center line or center of bearing of all piers, bents, and abutments. From these field layouts, check the proposed span lengths by either electronic distance measurement or chaining from the field layouts. When chaining, compensate for temperature, sag, and horizontal alignment. Verify the location of the structure to affirm its correct location with relation to existing structures, roads, and existing conditions that are to remain. If discrepancies are found, immediately notify the Engineer in writing. Ensure all lines established on the ground are preserved or referenced, marked, and available at all times.

Ensure field elevations of all bridge seats are correct and that are finished to proper grade. When steel beams or girders are incorporated in the project, determine the deflection of each member by running elevations over the tops of the beams or girders after they are in place and before attaching any forms. Apply this information to the deflection diagram to determine the corrected elevation of bottom slab forms and screed supports. The Engineer will check the assembled information. Make necessary adjustments prior to placing concrete.

For SWM facilities, proceed with the layout work as specified. Verify the locations of drainage structures to affirm the correct location with relation to the SWM facility layout, grading points, maintenance access road, roads, and existing conditions that are to remain. If discrepancies are found, immediately notify the Engineer in writing. Ensure that all lines established on the ground are preserved of referenced, marked, and kept available for the duration of the Contract. Ensure that the field elevations are correct and are finished to the proper grade.

107.03.06 Utilities. Upon request, furnish references to control points, alignment, and grade data to the utility companies or agencies working within the limits of the project so that they may properly locate and coordinate their work and improvements.

Intersection Utility Stakeout. Notify the appropriate agencies at least 72 hours (excluding weekends and holidays) prior to the anticipated time for beginning underground work.

(a) Request a MISS UTILITY stakeout and possess a valid MISS UTILITY clearance ticket number for any underground work.

(b) Contact all utilities within the limits of the project who are not a member of MISS UTILITY and obtain a stakeout of their respective facilities.

(c) Request the Administration's Office of Traffic & Safety's Signal Operations Section to stakeout Administration maintained traffic signal facilities.

(d) Request the District Engineer to stakeout Administration lighting facilities.

Stakeout the proposed construction as indicated in the Contract Documents. Allow the Engineer to verify the location of the proposed facilities.

107.03.07 Right-of-Way and Easement Lines. Upon request, define the right-of-way and easement lines for adjacent property owners.

107.03.08 Subgrade, Subbase, and Base Controls. When placing subgrade, subbase, and base courses, furnish a string line and grade with fixed controls having longitudinal and transverse spacing of no more than 25 ft. Along each form line for cement concrete pavement, provide the line and grade with fixed controls not to exceed 25 ft.

(a) Automated Machine Control. When approved by the Engineer, construction equipment guided by Global Positioning System (GPS) or Robotic Total Station (RTS) equipment may be used in the placement of subgrade, subbase, base courses, and other roadway materials. Preserve the stakeout established by the Engineer and set additional controls as directed.

(1) When using GPS and RTS equipment, develop and submit a Digital Terrain Model (DTM) for review. When using the Contract Documents and Administration furnished DTM data, develop a DTM independently. The

Administration and its designers shall be released from all liability for the accuracy of the data and its conformance to the Contract Documents.

(2) Establish primary control points at appropriate intervals along the length of the project. Where project work is performed beyond the project limits, establish control points at intervals not to exceed 1000 ft. Determine the horizontal position of these points by static GPS sessions or by traverse connection from the original baseline control points. Establish the elevation of these control points using differential leveling from the project benchmarks, forming closed loops where practical. Prior to construction activities, provide a copy of all new control point information to the Engineer.

(3) Provide control points and conventional grade stakes at critical points such as PCs and PTs, super elevation points such as begin full super and half-level plane inclined, and other critical points required for construction of structures and utility relocation or coordination. The Engineer will determine when additional stakeout and control points are necessary.

(4) Provide adequate control points, stationing, and stakes for coordination activities involving environmental agencies, utility companies, and other entities on adjacent projects or work areas.

(b) Real-Time Kinematic (RTK) GPS. May be used to control equipment where the grade tolerance is ±0.1 ft or greater.

(c) RTS Positioning. RTS shall be used where grade tolerances are less than ±0.1 ft. Verify the index error of the vertical circle of the RTS and adjust as necessary prior to operations each workday. Begin and end each work session by checking between adjacent control points.

(d) Automated Controlled Equipment. When automated controlled equipment is used, furnish a GPS Rover instrument for Administration use during the project, along with 8 hours of formal training on GPS/RTS and used systems. Provide a surveyor to perform verification when discrepancies arise.

(e) Test Sections. Perform test sections for GPS and RTS systems to demonstrate the capability, knowledge, equipment, and experience to properly operate the systems and achieve acceptable tolerances. If this ability is not satisfactorily demonstrated to the Engineer, conventional stakeout procedures shall be required.

107.03.09 Demarcation. Demarcate as specified and as directed and preserve until no longer applicable. When necessary and as directed, replace disturbed, damaged, destroyed, or otherwise missing demarcation. If demarcation is not re-established within 48 hours, the Engineer may proceed to demarcate. Demarcate wetland areas using 107.02.01. Demarcate LOD and other areas as specified using 107.02.02 and label as directed. Remove all demarcations when they are no longer needed.

Establish tree preservation areas as specified in Section 120.

107.03.10 Traffic Control Devices, Lighting and ITS Devices. For installation of Traffic Control Devices, Lighting and ITS Devices, arrange a meeting with the Engineer and representatives from the Traffic Operations Division to stakeout all items indicated on the sketches, plans, and in the Special Provisions. This meeting shall occur prior to any Traffic Control Device, Lighting or ITS work.

107.04 MEASUREMENT AND PAYMENT

Construction Stakeout will not be measured but will be paid for at the Contract lump sum price. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. Payment of the Contract lump sum price will be prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating will be the number estimated to complete the work.

Replacement of control markers with undamaged control markers and replacement of missing or damaged demarcations with undamaged demarcations will be at no additional cost to the Administration. Demarcation replaced by the Engineer will be deducted from monies due under the Contract.

Corrections to deficiencies in primary control points for subgrade, subbase, and base controls resulting from construction activities will be at no additional cost to the Administration.

Corrections to grade busts and all associated quantity adjustments or errors resulting from construction activities will be at no additional cost to the Administration.

CATEGORY 100
PRELIMINARY

SECTION 108 — MOBILIZATION AND DEMOBILIZATION

108.01 DESCRIPTION

Construction preparatory and closing (clean-up) operations that include the movement of personnel, supplies, materials, tools, equipment, and incidentals to, within, and away from the project site collectively for the project and for individual work operations; and the establishment and removal/decommissioning of the Contractor's offices, buildings, and other facilities necessary to commence, continue, and conclude the work. Perform final clean-up as specified in GP-4.09.

108.02 MATERIALS

Not applicable.

108.03 CONSTRUCTION

Not applicable.

108.04 MEASUREMENT AND PAYMENT

Mobilization and Demobilization will not be measured but will be paid for at the Contract lump sum price. The cost of all required insurance and bonds will be incidental to this item. Payment of the Mobilization and Demobilization item will be made according to the following payment schedule.

(a) 25 percent of Mobilization and Demobilization, up to a maximum of 2.5 percent of the adjusted Contract amount, will be paid in the first monthly estimate after the Contractor has established the necessary facilities.

(b) 25 percent of Mobilization and Demobilization, up to a maximum of 2.5 percent of the adjusted Contract amount, will be paid in the second monthly estimate after the Contractor has established the necessary facilities.

(c) 50 percent of Mobilization and Demobilization, up to a maximum of 5 percent of the adjusted Contract amount, will be paid upon completion of 30 percent of the adjusted Contract amount.

(d) Any remaining amount will be paid when the Contract has been accepted for maintenance as specified in GP-5.13.

The adjusted contract amount is defined as the total Contract amount less the lump sum bid for Mobilization and Demobilization.

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Payment of the Mobilization and Demobilization item will not be made more than once, regardless of the fact that the Contractor may have, for any reason, shut the work down on the project or moved their equipment away from the project and then back again.

If the Mobilization and Demobilization item is not provided, the cost of mobilization and demobilization, including the required insurance and bonds, will be incidental to the other items specified in the Contract Documents. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 100
PRELIMINARY

SECTION 109 — PROJECT SCHEDULE

109.01 DESCRIPTION

The Administration will classify projects by complexity and cost to determine the Project Schedule requirements. Project Classification Type B shall apply unless designated differently in the Invitation for Bids (IFB). Project classifications are:

Type A—Bar Chart (BC) Schedule,

Type B—Critical Path Method (CPM) Schedule for Typical Projects, or

Type C—CPM Schedule for Complex Projects.

CPM Schedule techniques used in the Project Schedule to monitor the work specified in the Contract documents will use retained logic. The Administration will use the Project Schedule as a tool for monitoring progress and evaluating any schedule impact from change orders during the Project duration.

See GP-8.04 PROGRESS SCHEDULE for additional provisions regarding the submission and the failure to adhere to the project progress schedule requirements.

109.01.01 Definitions.

Activity. A distinct component of work performed during the project with estimated duration, estimated cost, and estimated resource requirements. Schedule activities are connected to other activities or milestones with logical relationships and are decomposed from work packages.

Actual Start Date (AS). At the activity level, the Actual Start date represents the point in time that meaningful work actually started on an activity.

Actual Finish Date (AF). At the activity level, the Actual Finish date represents the point in time that work actually ended on an activity so that follow-on work could start.

Calendar Day. A Calendar Day consists of every day shown on the calendar, beginning and ending at midnight.

Completion Date.

(a) Substantial Completion Date.

(1) The date specified in the Contract Documents, subject to revision resulting from an authorized time adjustment, or the date the Administration could have or did take possession of all constructed work as it can be safely and effectively used for the intended purpose without delays, disruptions, or other impediments to the end user; or

(2) The date time charges will be suspended (subject to reinstitution upon Contractor failure to achieve Final Completion Date); or

(3) The date the Engineer determines the Administration will issue a Partial Acceptance for Maintenance subject to requirements of GP-5.13(a).

(b) Final Completion Date.

(1) The date specified in the Contract Documents, subject to revision resulting from an authorized time adjustment; or the date the Contractor has completed all physical work within the project limits, including any punch-list items, all warranty and landscaping requirements, and any Contractually required submissions (e.g., as-built plans);

(2) The date any reinstitution of time charges terminates; and

(3) The date the Engineer determines the Administration will issue a Final Acceptance subject to the requirements of GP-5.13(b) and (c).

Critical Path. The sequence of activities that determines the longest duration for the project when the longest path has zero or less total float. At this point, the longest path becomes the critical path.

Critical Path Method (CPM) Schedule. Project modeling technique to construct a project that uses activities, durations, and dependencies between activities to determine the longest path to the Substantial Completion Date. Dependencies are based on technical relationships and preferential activity sequence.

Data Date. The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."

Float. Float is the amount of time between when an activity "can start or finish" and when an activity "must start or finish" to complete the project within the specified Contract Time. Float is a shared commodity for the use of the Administration and the Contractor and is not for the exclusive use or benefit of either party. Both parties have the full use of the float until depleted.

Joint Review Conference (JRC). A JRC is a meeting in person or by phone, where representatives from the Administration and the Contractor discuss comments and questions regarding schedules.

Longest Path. The sequence of interdependent activities that determine the minimum duration of a project.

Milestone. An activity with zero duration that typically represents a significant event, such as the beginning and end of the project, milestones set forth in the Contract, construction stages, a major work package, any Contract interim time-related clauses, Substantial Completion Date, and Final Completion Date.

Project Classification Type. A determination by the Administration that establishes the type of schedule requirements that apply to a Contract based on Contract complexity, cost, and any special requirements.

Project Schedule. A project Schedule as defined by this Specification.

> **Initial Project Schedule.** As specified in 109.03.01;
>
> **Updated Project Schedule.** As specified in 109.03.02;
>
> **Revised Project Schedule.** As specified in 109.03.03.

Scheduling Representative. The person primarily responsible for development and maintenance of the CPM schedule for the Contractor. The Contractor shall designate an experienced scheduling representative as part of the written narrative of the Initial Critical Path Method (ICPM) Project Schedule.

Schedule Time Impact Analysis. A process of analyzing a schedule to determine the impact on the project schedule of a change in the Work or conditions, or of a delay event, for the purposes of quantifying and apportioning the effects to the party responsible for the impact.

Start Date.

> **Projected Start Date.** The date when the NTP or a limited NTP is to be issued as advertised by the Administration, which is entered as a Start milestone activity in the schedule;
>
> **Project Actual Start Date.** The date that field activities begin as stipulated in the NTP (or limited NTP), issued as specified in GP-8.02 and TC-5.02, as allowed by requirements found in the Contract, and designated as a start milestone in the first Update schedule.

Time Impact Analysis. A forward-looking prospective schedule impact analysis method that adds a modeled delay to the current schedule (where all activities are updated to immediately prior to the time of a change or delay) to determine the possible time impact of the change or delay as it affects the Contract Substantial Completion Date.

Work Breakdown Structure (WBS). A deliverable oriented hierarchical decomposition of work to be executed for the project. The structure is to be determined by the Contractor. The Contractor may elect to use the WBS to track resources and costs within each work element.

Work Day. Every day except Saturdays, Sundays, State holidays, adverse weather days or other weekdays where Work is restricted as identified explicitly in the Contract Documents.

Written Narrative (WN). A descriptive report submitted with the initial Project Schedule or ICPM and each Project Schedule update.

109.02 MATERIALS

Not applicable.

109.03 CONSTRUCTION

109.03.01 Initial Project Schedule. Prepare and submit the initial BC (IBC) Schedule for Type A Projects; or an initial CPM (ICPM) Schedule for Type B and Type C Projects; or the elected preliminary ICPM for a Type C Project; and the WN within 20 days of Notice of Award (NOA).

No work may start on the Project until the IBC or ICPM Schedule is accepted or unless otherwise directed in writing by the Engineer.

109.03.01.01 Initial Project Schedule – Type A Project – Requirements. Prepare an IBC Schedule as a bar chart, using spreadsheets, CPM scheduling software, or other means. The IBC Schedule shall include the requirements of paragraphs (a)-(d) and be submitted according to paragraph (e).

(a) Milestones. The IBC Schedule shall include the following major milestones:

(1) Notice to Proceed (NTP).

(2) Substantial Completion Date.

(3) Final Completion Date.

The IBC Schedule may include other milestones for planning work including major interim Contract requirements, starting or ending of Phases of Construction, or other milestones necessary to monitor the work.

(b) Project Duration. The overall project schedule duration used in the IBC Schedule shall be from the anticipated NTP date through the Contract Substantial Completion Date as identified in the IFB.

(c) Activities. Activity original durations shall be limited to a reasonable duration necessary to complete the work required. The Administration reserves the right to

specify the number of activities and to require additional breakdown of the activities at any time. Activities shall be listed in chronological order of the proposed start date and include Activity ID numbers for referencing purposes.

(d) Written Narrative (WN). Prepare and submit a unique WN with the IBC Schedule. The WN shall explain the Contractor's plan to construct the project in accordance with the Contract requirements. The WN shall include, at a minimum, the following elements:

(1) Sequence of Work. Explain the sequence of work, project phasing, and the longest path as planned for the project including interim completion dates, if any, required by Contract;

(2) Crew Composition. Explain the crew composition, including labor and equipment, as anticipated to fulfill activities in the schedule network; and

(3) Access Restrictions. Explain any restrictions on access to the work including: coordination with other entities, coordination with all utility companies, coordination with other public contractors, land access requirements, environmental permit requirements, special non-work days or periods, weather restrictions expected as considered in the planning of the schedule, and planned winter shutdowns.

(e) Submittal Requirements. Submit the IBC Schedule to the office designated by the Procurement Officer in the NTP document, with a copy to the on-site Engineer, to include the WN and a printed activity bar chart on ledger size paper. Submit electronic files in native file format, if used, along with the printed IPS graphic and WN.

109.03.01.02 Initial CPM Project Schedule –Type B Project – Requirements. Prepare an Initial CPM (ICPM) Schedule using acceptable scheduling software that is capable of export to compatible version of Oracle Primavera used by the Administration's reviewer, in .xer format.

CPM schedule techniques used in the Project Schedule to monitor the work specified in the Contract documents will comply with the precedence diagramming method using retained logic.

The ICPM Schedule shall indicate work activities and major material submittals required to complete the project as shown in the Contract plans. The schedule shall include all activities of subcontractors, utilities, railroads, the Administration, and all other parties associated with the construction of the Project.

All work including, but not limited to, submittals, major procurement, delivery, and construction activities shall be included. All activities reasonably necessary to plan the scope of work shown in the Contract plans shall be included. Concurrent work by others, including any indicated in the Contract Utilities Statement, shall also be included. The ICPM schedule shall be based upon the entirety of the Contract Documents.

The ICPM Schedule shall include the requirements of paragraphs (a)-(g) and be submitted in accordance with paragraph (h).

(a) Milestones. Include the following major milestones in the ICPM Schedule:

(1) NOA.

(2) NTP.

(3) Substantial Completion Date.

(4) Final Completion Date.

The ICPM Schedule may include other milestones for planning work including major interim Contract requirements, starting or ending of Phases of Construction, or other milestones necessary to monitor the work.

(b) Project Duration. Include time from Bid Opening to NTP in the ICPM Schedule as 70 days to allow time for administrative Contract execution requirements. Requests for variation of the 70 day period shall be submitted to the administrative office in advance of the ICPM Schedule submittal.

The overall project schedule duration used in the ICPM Schedule shall be from the anticipated NTP date through the Contract Substantial Completion Date as identified in the IFB.

(c) Activity Codes and Work Breakdown Structure. Include activity codes for organizing activities in the schedule. The minimum activity codes shall be:

Project Area (Location of Work).

Project Phase (Construction Phase for Project, if applicable).

Responsibility (e.g., SHA, Contractor, Subcontractor, Utility, Third Party).

Crew Type (defined in WN by trade for Project).

Other activity codes used for planning and organizing activities should be explained in the WN.

Include a work breakdown structure (WBS) for planning and organizing project activities. Explain the WBS in the WN.

(d) Activities. Activities should include tasks necessary to perform the scope of project work and milestones defined in various specifications. Task activities shall include

definable work packages that require manpower, materials, and/or equipment to perform.

Activities may include periods of wait time as defined in the specifications for various purposes and milestones. Original durations of tasks shall be limited to a reasonable duration necessary to complete the work required.

Activities with durations of more than 10 work days shall be explained in the narrative for each occurrence.

Third party or Administration submittal review activities shall be included with durations according to relevant specifications, but not be less than 30 days.

The Administration reserves the right to specify the number of activities and to require additional breakdown of the activities at any time.

(e) Relationships and Constraints. Relationships should generally guide the sequence of work on the project by Finish-to-Start type relationships. Explain the use of other type relationships in the WN.

Negative lag shall not be used, and the use of other lag types shall be explained in the WN. Each activity shall have at least one predecessor relationship and one successor relationship, except Milestones, and the first and last activity in the network.

Constraints shall be used to impose restrictions on an activity if defined in the Contract and shall not be used for other reasons.

(f) Calendars. Calendars used in the ICPM Schedule network shall be designated as Project Calendars by a unique naming system. The schedule shall include a Calendar Day calendar and a Work Day calendar. Other Specialty Calendars (for weather sensitive work, permit stream restrictions, etc.) may be used, if necessary to plan the project.

The Work Day calendar shall include restrictions preventing work as defined in the Contract requirements. Work day restrictions include as a minimum weekend, holidays, day before and day after holidays, and an estimate of anticipated bad weather days, with the residual work days as indicated in the table below.

Include estimates for expected work days in the work day calendar as per the minimum days indicated in the following table unless the table is specifically modified in the IFB.

Table 1

	Western MD District 6	Central MD Districts 3, 4, 5, 7	Eastern MD Districts 1, 2
January	3	8	5
February	3	8	7
March	10	13	11
April	15	17	15
May	15	17	14
June	18	18	19
July	18	17	17
August	18	19	18
September	18	18	18
October	18	17	18
November	10	13	13
December	6	10	9
Total	**152**	**177**	**164**

Non-work days included in Specialty Calendars shall be explained in the WN. Activities that are temperature sensitive (e.g., placement of hot mix asphalt, concrete placement/curing, painting/staining, plantings, vegetation establishment, temporary/permanent roadway markings) shall be assigned to specialty calendars that are consistent with their calendar imposed, seasonal temperature restrictions for the regional location of the work and shall be prohibited during the time periods that may be explicitly identified in the Contract documents. Reasoning for any exceptions shall be noted in the WN.

(g) Written Narrative. Submit a complete and unique WN with the ICPM Schedule. The WN shall explain the Contractor's plan to construct the project according to Contract requirements without reference to the schedule file or activity chart. Include, at a minimum, the following elements identified as separate paragraphs:

(1) Sequence of Work. Explain the sequence of work, project phasing, and the longest path as planned for the project including interim completion dates, if any, required by Contract or by Contractor's choice;

(2) Access Restrictions. Explain any restrictions on access to the work including: coordination with other entities, coordination with all utility companies, coordination with other public contractors, environmental permit requirements, special non-work days or periods, anticipated weather restrictions, and planned winter shutdowns;

(3) Modification to Specification. Explain any exceptions or additions to the requirements stated in 109.03.01.02, related to relationships, durations, activity codes, constraints, milestones, or calendars used in the ICPM Schedule network;

(4) Crew Composition. Explain the crew composition, including labor and equipment, as anticipated to fulfill the crew activity code used in the schedule network;

(5) Unique Schedule Features. Explain unique schedule features necessary to understand the construction plan represented by the schedule.

(6) Schedule Representative. Designate a Schedule Representative with at least five years of experience for the Project. The Contractor may replace the schedule representative at any time by designating the change in the WN for any schedule submittal. The Administration may request a replacement schedule representative be designated for any project where the Administration deems it necessary.

Include a PDF file as an appendix for printing the activity chart for all activities. The PDF print size shall be 11 in. x 17 in. and organized by Phase and Area for the project.

(h) Submittal Requirements. Submit the ICPM Schedule to the office designated by the Procurement Officer in the NTP document, with a copy to the on-site Engineer. The submittal shall include an electronic schedule file in native format, the WN, a printed schedule activity chart on ledger size paper (see 109.03.01.02(g)), and all other items as detailed above for a Type B Project.

109.03.01.03 Initial CPM Project Schedule –Type C Project – Requirements. Prepare an ICPM Schedule that meets all the requirements of 109.03.01.02 including paragraphs (a) to (g), and paragraph (a) below. A Preliminary ICPM Schedule meeting the requirements of paragraph (b) below may be submitted in advance of the ICPM.

CPM Schedule techniques used in the Project Schedule to monitor the work specified in the Contract documents will comply with the precedence diagramming method using retained logic.

(a) Resources. Prepare a project specific resource dictionary and include assignment of labor and equipment resources to each construction activity. Assign resources through the resource tracking module of the scheduling software.

Provide resource labor names by labor classification (skilled, unskilled, foreman), and resource equipment names (loader, backhoe, paver). Additional resource assignments for Contract pay item numbers (e.g., 3001, 3002) may be included.

Administrative activities, such as submittal preparation and review, and material fabrication for long lead items, are exempted from resource loading. Third party activities not under the Contractor’s control, concrete curing activities, or other Contract required wait periods are exempted from resource loading.

Explain in the WN any resource limitations that may affect planning the project. Resource related relationships used to sequence activities should be explained in the WN. The Administration reserves the right to request modification to resource relationships, if jointly determined to be in the best interest of the project.

(b) Preliminary ICPM Schedule. A Preliminary ICPM Schedule, although not required, may be submitted prior to submission of the full ICPM Schedule to expedite the start of project Work. The Preliminary ICPM Schedule shall include all the requirements of 109.03.01.02, paragraphs (a) to (g), and paragraph (a) above, except as noted below:

(1) Administrative activities may include only submittals or other project requirements planned for the first 90 days of project time;

(2) Activities planned for the first 90 days of project time shall be detailed and complete. Activities beyond 90 days may be planned on a summary level that uses all Contract Time through the required Substantial Completion Date;

(3) Organization and composition of the Preliminary ICPM Schedule shall be sufficient to relate the Contractor's overall project plan for construction to complete the scope of work required by the Contract within the Contract Time;

The Administration will review the Preliminary ICPM Schedule within 10 business days. If the Preliminary ICPM Schedule is conditionally accepted by the administering office, project Work may begin but can only continue through a 90 day period commencing with the NTP date.

The full ICPM Schedule meeting all the requirements of 109.03.01.02 must be submitted and accepted by the administering office within that 90-day period. Failure to achieve acceptance of the complete ICPM Schedule will result in a suspension of Contract work and suspension of any pending or future Contract-wide progress payment(s). Such action may not be used as grounds for filing a request for equitable adjustment.

(c) Submittal Requirements. Submit the Preliminary ICPM Schedule to the office designated by the Procurement Officer in the NTP document, with a copy to the on-site Engineer. The submittal shall include an electronic schedule file in native format, the WN, a printed schedule activity chart on ledger size paper (see 109.03.01.02(g)), and all other items as detailed above for a Type C Project.

109.03.01.04 Review and Acceptance of the IBC or ICPM Schedule. The following shall apply to Type A, B, and C projects.

The administrating office may allow Contract work to start after submission of an IBC/ICPM Schedule but prior to the schedule acceptance if there is reasonable benefit to the project. However, all work and any pending or future Contract-wide progress payments will be withheld if the IBC/ICPM Schedule is not accepted within 90 days of the NTP.

The Administration will designate the schedule status of the IBC/ICPM Schedule within 20 days after submittal as follows.

Reviewed and Accepted. The IBC/ICPM Schedule is accepted as submitted and becomes the BC Schedule of Record (BCR), or CPM Schedule of Record (CPMR) - Project work may begin;

Accepted as Noted. The IBC/ICPM Schedule comments must be addressed in the first progress update - Project work may begin;

Conditionally Accepted. The IBC/ICPM Schedule must be re-submitted - Project work may begin;

Revise and Resubmit. The IBC/ICPM Schedule must be re-submitted - No project work may begin.

If necessary, a JRC will be convened to make corrections and adjustments to the proposed IBC/ICPM Schedule. If a revision is necessary due to the JRC or Administration's review, submit the proposed revision within seven days after receiving the Administration's review comments, or within seven days after the date of the JRC, whichever is the latest.

The Revised IBC/ICPM Schedule will be re-designated within seven days after receipt. Any delay caused by the Administration's response to the Revised IBCM/ICPM Schedule may not be used as grounds for filing a request for equitable adjustment.

Project delay due to failure to submit or resubmit the IBCM/ICPM Schedule as required and the withholding of payment due to that failure shall not be used as grounds for filing a request for equitable adjustment.

109.03.02 Project Schedule Updates. Submit Monthly Project Schedule Updates within seven days of the mutually agreed upon data date for the Project, unless the Administration agrees in writing to a different submittal schedule. Discuss the Project Schedule Update during the project progress meetings, or other meetings, to agree on progress through the data date. Submit Project Schedule Updates of the BCR/CPMR regardless of receiving comments on previous Schedule Updates or Schedule Revisions.

Submit updates as agreed until the day after Substantial Completion of the project.

109.03.02.01 Project Schedule Updates - Type A Project – Requirements. Submit monthly updates to the BCR to indicate progress made to date.

(a) Progress. The Contractor's Scheduling Representative and the Administration's on-site Engineer will meet to review, mutually agree to, and sign-off on the information required to update the schedule (AS and AF dates). For activities in progress, the Schedule Representative shall estimate the remaining duration and percent of completion. The Engineer may suggest a differing estimate of completion. The

agreements and comments made by the Engineer at the monthly review meeting shall be included as part of the WN for the update submittal.

(b) Written Narrative. A complete WN shall be submitted with the Project Schedule Update. The WN shall describe at a minimum, the following elements:

(1) Progress. Explain the progress made on activities planned for the update period;

(2) Delays or Potential Delays. Explain any delays encountered or potential delays that may affect work in the future (e.g., differing site conditions); this requirement does not relieve the Contractor of the notice provisions found in other various portions of the Contract;

(3) Resource Revisions. Explain any crew composition changes in labor or equipment for the next update period to achieve the planned schedule network;

(4) Longest Path. Explain the critical path for the next update period and, if different, why the critical path is different.

Include a PDF file as an appendix for printing the activity chart for all activities. The PDF print size shall be 11 in. x 17 in. and organized by Phase and Area for the project.

109.03.02.02 Project Schedule Updates - Type B and Type C Project – Requirements. Submit monthly Project Schedule Updates to the CPMR describing progress made to date. Submit a WN discussing issues or delays encountered during the update period. There should be no revisions to the schedule other than to show progress accomplished.

(a) Progress. The Contractor's Scheduling Representative and the Administration's on-site Engineer will meet to review, mutually agree to, and sign-off on the information required to update the schedule (AS and AF dates). For activities in progress, the Schedule Representative may estimate remaining duration and percent of completion. The Engineer may offer a differing estimate of completion. The agreements and comments made by the Engineer at the monthly review meeting shall be included as part of the WN for the update submittal.

Update the schedule by inserting the agreed AS and AF dates for any activities that started and/or finished during the update period. In addition, the remaining duration of activities in progress shall be updated as agreed by converting the remaining duration to a percentage of the original duration and update the duration percent complete or linked percent complete.

Remaining Durations that exceed the original duration of the activity should be explained in the WN.

Expected Finish. Dates may only be used on activities for submittal reviews, fabrication of long lead materials, third party work that impacts Contract work, and utility relocations by third parties.

(b) Written Narrative. A complete WN shall be submitted with the Project Schedule Update. The WN shall be unique to each schedule update and include, at a minimum, the following elements:

(1) Progress. Explain the progress made on activities planned for the update period;

(2) Delays or Potential Delays. Explain any delays encountered or potential delays that may affect work in the future (e.g., differing site conditions); this requirement does not relieve the Contractor of the notice provisions found in other various portions of the Contract;

(3) Scope Revisions. Explain any changes in scope or differing site conditions encountered during the update period;

(4) Resource Revisions. Explain any crew composition changes in labor or equipment for the next update period to achieve the planned schedule network; and

(5) Longest Path. Explain the current critical path for the next update period and, if different, why the critical path is different.

Include a PDF file as an appendix for printing the activity chart for all activities. The PDF print size shall be 11 in. x 17 in. and organized by Phase and Area for the project.

(c) Out-of-Sequence Progress. Explain in the WN the circumstances that caused performance of work out-of-sequence. Out-of-sequence activities that do not resolve within 30 days of starting shall be corrected through a schedule revision submitted as specified in 109.03.03.

109.03.02.03 Review and Acceptance of the Project Schedule Updates. The Administration may withhold payment for the entire Contract if Project Schedule Updates are not submitted as required. Upon request, the Contractor shall concurrently submit updates directly to the Administration and the Administration's designated schedule reviewer. Project delay due to failure to submit the updates as required and the withholding of Contract-wide progress payment(s) due to that failure shall not be used as grounds for filing a request for equitable adjustment.

The Administration will respond to project Schedule Updates within 20 days after receipt as follows:

(a) Reviewed and Accepted. The Schedule Update is accepted as submitted and becomes the new BCM Schedule of Record (BCR) or new CPM Schedule of Record (CPMR); or

(b) Accepted as Noted. The Schedule Update comments must be addressed in the next progress update; or

(c) Revise and Resubmit. The Schedule Update must be revised and re-submitted.

Any delay in response by the Administration is not a reason to not comply with future update submittal requirements.

The Administration may request a schedule revision (recovery schedule) if the calculated Substantial Completion Date of the project schedule update is more than 30 days beyond the Contract Substantial Completion Date. The recovery schedule shall meet all the requirements of a schedule revision shown in 109.03.03. The Contractor may request a time extension, when warranted in accordance with this specification, in lieu of a recovery schedule.

Failure to submit a recovery schedule, or request a time extension, compliant with timeliness requirements in the Contract may be cause for denial of a time extension.

109.03.03 Project Schedule Revisions. The Contractor may submit project Schedule Revisions when changes in the plan for construction are due to changes directed by the Administration, or due to changes in the Contractor's approach to construction. Schedule Revisions may be submitted at any time.

Schedule Revision submittals made with Project Schedule Updates shall include all progress information of the schedule update and include a separate WN meeting the requirements below.

109.03.03.01 Project Schedule Revisions – Type A Project – Requirements. Submit the proposed revision in the same format and with the same requirements used for the IBC Schedule.

(a) Revisions. Discuss any proposed revision to the BCR verbally with the Administration. Revisions are defined as one or more of the following:

(1) A change to revise planning.

(2) A change to revise duration of an activity.

(3) A change to add or delete work due to changed requirements.

(b) Written Narrative. Submit a complete and unique WN with the proposed Project Schedule Revision. The WN shall explain the reasons for the revision and include the following elements:

(1) Describe the reason for the schedule revision;

(2) Describe the new longest path;

(3) Explain any changes to the method or manner of work;

(4) Explain any changes in labor or equipment due to deletion or addition of work; and

(5) Explain any acceleration of the work.

Include a PDF file as an appendix for printing the activity chart for all activities. The PDF print size shall be 11 in. x 17 in. and organized by Phase and Area for the project.

109.03.03.02 Project Schedule Revisions –Type B, and Type C Projects – Requirements. Submit the proposed revision in the same format and with the same requirements used for the ICPM Schedule.

(a) Revisions. Discuss any proposed revision to the CPMR verbally with the Administration. Revisions are defined as one or more of the following:

(1) A change in the logic of the schedule due to revised planning.

(2) The deletion or addition of an activity.

(3) Change to resources or assignment of resources.

(4) A change to, addition of, or deletion of a time constraint.

(5) A change to, addition of, or deletion of an activity code assignment or work breakdown structure.

(b) Written Narrative. A complete and unique WN shall be submitted with the Project Schedule Revision. The WN shall be a stand-alone document that explains the reasons for the revision. The WN shall include, at a minimum, the following elements:

(1) Describe the reason for schedule revision;

(2) Describe the new longest path;

(3) Explain any changes to method or manner of work;

(4) Explain any changes in labor or equipment due to deletion or addition of work; and

(5) Explain any acceleration of the work.

Include a PDF file as an appendix for printing the activity chart for all activities. The PDF print size shall be 11 in. x 17 in. and organized by Phase and Area for the project.

109.03.03.03 Review and Acceptance of the Project Schedule Revisions. The Administration will complete the review of Project Schedule Revisions within 20 days after submittal. If required, a JRC will be convened at which time the Administration and Contractor may discuss corrections and adjustments to the proposed Revision. If a revision is necessary due to the JRC's or the Administration's review, the Contractor shall submit the proposed revision within seven days after receiving the Administration's review comments or within seven days after the date of the JRC, whichever is the latest.

Upon written acceptance of the revisions the revised schedule is the new BCR or CPMR.

109.03.04 Extensions of the Substantial Completion Date or Incentive/Disincentive Date. All requests for extension of the Substantial Completion Date shall be in writing and subject to the notice and timeliness of submission provisions as provided for elsewhere in the Contract. Requests for time extension shall be submitted separately from the Project Schedule Update WN. Only delays to activities that affect the Substantial Completion Date or an Incentive/Disincentive Date will be considered for an extension of Contract time.

109.03.04.01 Requirements. The extension of the Substantial Completion Date or Incentive/Disincentive Date will be based upon the number of calendar days the Substantial Completion Date or Incentive/Disincentive Date is impacted as determined by a Time Impact Analysis submitted by the Contractor. The Contractor shall prepare a Schedule Time Impact Analysis of sufficient detail to describe the methodology used, cause for the alleged delay, as well as partnering efforts taken by the Contractor to mitigate any and all Contract delays.

The time extension request shall include a description of the events and the alleged impacts to the critical path that affect the Substantial Completion Date or Incentive/Disincentive Date. A time extension requested for changes in project requirements issued by the Administration shall be submitted separately from time extensions requested due to other alleged delays. Each time extension request shall include a Time Impact Analysis and documentation of all supporting facts.

Any time extension for weather related delays shall justify entitlement as specified in GP-8.08(d)(1). The Contractor shall explain the impact of adverse weather using a Time Impact Analysis and provide support documentation. Deviations from the underlying weather assumptions as framed in the work day table in 109.03.01.02(f), or other assumptions in the schedule will not be used as justification for time extensions.

109.03.04.02 Review and Acceptance of Time Extension Requests. Requests for an extension of the Substantial Completion Date or change in an Incentive/Disincentive Date due to changes directed by the Administration (see GP-4.06) will be evaluated by the Administration's analysis of the BCR or CPMR and any proposed Revised Project Schedule submitted. Any request for time extension for weather delays will be analyzed by the Administration to determine if there was direct impact to work activities that are on the longest path and not analyzed based solely on the number of bad weather days actually encountered. Any time extensions for other reasons will be

evaluated based on the time impact analysis, accompanying description, supporting documentation, and other project documents.

109.04 MEASUREMENT AND PAYMENT

The accepted initial bar chart schedule for a Type A project, project schedule revisions, project schedule updates, and any necessary incidentals will not be measured but the cost will be included in other pay items contained in the contract documents.

The accepted Initial Critical Path Method schedule for Type B and Type C projects, project schedule revisions, and all accepted project schedule updates will be paid for at the Contract lump sum price for the Critical Path Method Project Schedule item. 50 percent of the lump sum price will be paid upon acceptance of the Initial Critical Path Method Project Schedule (except when the bid price exceeds half of one percent of the total Contract bid price). The balance will be paid as a monthly, prorated sum based upon the specified Contract duration. This monthly payment will be made on the next progress payment following the Administration's acceptance of the required Project Schedule updates.

When the bid price for the Type B and Type C project schedule item exceeds half of one percent of the total Contract bid price, the total progress payments for the schedule item will be limited to half of one percent of the total Contract price. Any remaining balance (over half of one percent of the total Contract price bid) will be paid upon final Contract payment.

CATEGORY 100
PRELIMINARY

SECTION 111 — SAMPLING DEVICES, TESTING AND SAFETY EQUIPMENT

111.01 DESCRIPTION

Furnish and maintain Sampling Devices and Testing and Safety Equipment with accessories that are required to sample and test materials used on the project. The sampling and testing and safety equipment will be used by Administration employees as directed by the Engineer. All equipment shall be as approved by the Office of Materials Technology. Furnish the sampling devices and testing equipment to the Engineer at least five days prior to commencement of work on the project. All equipment shall remain in the Engineers' possession until completion of all sampling and testing on the project. Unless otherwise specified, all testing equipment, accessories, and unused sampling devices and safety equipment will be returned to the Contractor at the completion of the project.

111.02 MATERIALS

Furnish all applicable sampling devices and containers required by the Administrations' Materials Manual, including all inserts, Sample Testing and Frequency Guide, and this Specification. Quantities will be designated by the Engineer at the preconstruction meeting.

111.03 CONSTRUCTION

Testing Equipment Requirements. Maintain the equipment in good working condition and submit a written certification to the Administration stating when the testing equipment was last calibrated or inspected by an Administration approved testing agency. Ensure that the equipment is calibrated at the frequency required for that type of equipment according to the test method and AASHTO R18.

If any testing equipment or accessories are stolen, become defective, or for any other reason do not function as intended, replace with an equal or better unit at no additional cost to the Administration within eight hours after notification.

Sampling Devices and Testing Equipment with Accessories. The following is a general list for sampling devices and testing equipment to be furnished by the Contractor for the specified testing. Contact the Office of Materials Technology, Materials Management Division with any questions concerning the requirements for Sampling Devices, Testing Equipment, and Accessories. The devices, testing equipment, and accessories will be randomly inspected during Independent Assurance Audits.

(a) Sampling Devices from the Administration's Materials Manual.

(1) Soil bags (able to hold at least 35 lb).

(2) Screw top cans – 1 qt.

(3) Friction top cans – 1 qt and 1 gal.

(4) Plastic jar – 1 gal.

(5) Flow panels for joint sealer.

(b) Testing Equipment and Accessories from the Administration's Materials Manual - Determination of Moisture Content of Aggregates (MSMT 251).

(1) Electric hot plate or a gas burner, including bottle and fuel.

(2) Scale or balance conforming to M 231, Class G2.

(3) Metal container, such as large frying pan or equivalent.

(4) Pointing trowel or large spoon.

(c) Field Determination of the Amount of Stabilization Agent in Bases and Subbases (MSMT 254).

(1) Scale or balancing conforming to M 231, Class G 100 having a capacity of at least 100 lb/sample containers.

(2) Bench brush.

(3) Dustpan.

(4) Sampling mat consisting of a sheet of plywood or canvas with a surface of at least 1 yd^2.

(5) Tape measure.

(d) Field Determination of Moisture Density Relations of Soils (MSMT 351). Refer to MSMT 350.

(e) Hot Applied Joint Materials Sealer and Crack Filler (MSMT 404). Flow panels (brass panel may be used in lieu of a tin panel).

(f) In-Place Density of Embankment, Subbase, Base, Surface and Shoulder Material (T 99, T 180, T 191, and MSMT 350).

(1) Cylindrical compaction molds, 1/30 ft^3 and 1/13.33 ft^3.

(2) Compaction rammers, 5.5 lb and 10 lb.

(3) 12 in. straightedge.

(4) Scale or balance conforming to M 231, Class G 100, having a capacity of at least 100 lb.

(5) Two 10 in. pie pans.

(6) 12 in. frying pan.

(7) 12 in. Rocker-type field-testing sieve complete with pan.

(8) One each of the following sieve screens conforming to M 92:

SIZE (in.)	SHAPE	SIZE OPENINGS
12	Square	2 in.
12	Square	3/4 in.
12	Square	No. 4
12	Square	No. 10
*8	Round	No. 10

*For density sand.

(9) Field density plate with recess to accommodate sand cone apparatus.

(10) Steel pan, 12 in. x 30 in.

(11) Electric plate or gas burner, including bottle and fuel.

(12) Soil density pick.

(13) Calibrated sand cone density apparatus.

(14) Spatula, 3 in.

(15) Two water pails.

(16) Bag of density sand.

(17) Stencil brush, bench brush, sprinkling can, large spoon, and sample shovel.

(g) Sampling Asphalt Mixtures prior to Compaction (MSMT 457).

(1) A 25 ft measuring tape.

(2) Random selection cards numbered from 1 ft to width of the paving lane in 1 ft increments.

(3) 10 in. x 6 in. x 12 in. sample boxes.

(4) One-gallon plastic wide-mouth jugs.

(5) Core storage containers.

(6) Spatula.

(7) Spray paint or other suitable marking material.

(8) GPS equipment.

(9) Infrared Surface thermometers, NIST Traceable Calibration, backlit, handheld/pistol grip (-4 F to minimum 400 F, 1.5 percent accuracy).

(10) Square end shovel, fire shovel, or grain shovel.

(11) Scoop.

(12) 24 ft of 18-gauge mechanical wire or equivalent to tie through each hole of the plate template.

(13) Masonry nails or equivalent according to MSMT 457, Method A.

(h) Concrete Tests.

TEST	METHOD
Sampling	R 60
Making and Curing Concrete Test Specimens	T 23
Slump	T 119
Air Content - Pressure Method	T 152
Air Content - Volumetric Method	T 196
Temperature	T 309

(1) Air meter, pressure type for conventional concrete and volumetric air meter (Roll-a-Meter) for lightweight Concrete.

(2) Air Bulb.

(3) Air pump.

(4) Rubber mallet.

(5) Slump cone with rod.

(6) Steel straight edge.

(7) Large and small scoop.

(8) Trowel.

(9) 3/8 in. diameter tamping rod.

(10) Unit weight bucket for light weight concrete.

(11) Sprinkle can or bucket for water.

(12) Postal scale (only for lightweight concrete).

(13) Thermometer (0 F to 220 F).

(14) 4 in. x 8 in. cylinder molds (for compressive strength specimens).

(15) 3 in. x 6 in. cylinder molds for latex concrete.

(16) 6 in. x 12 in. cylinder molds for density (unit wt) of lightweight concrete and when otherwise specified.

(17) Isopropyl alcohol for light weight concrete.

(18) Protective gloves.

(i) Survey Equipment.

(1) Automatic Level Class 3.

(2) Tripod with adjustable legs.

(3) 25 ft fiberglass level rod.

(j) Other Measuring Devices.

(1) Handheld pile driving monitoring device as specified in 410.03.02(b) (as approved by the Engineer).

(k) Field determination of the Volumetric Pavement Macrotexture Depth (MSMT 413).

(1) Type 1 Glass beads conforming to M 247.

(2) A Class B or better, style III, 250 mL capacity graduated cylinder per E 1272 used to measure the volume of glass beads for the test.

(3) A flat, stiff hard disk with a diameter of 2.5 in. to 3.0 in. and a thickness of 1.0 in. is used to spread the glass beads.

NOTE: An ice hockey puck is considered suitable for use as a spreader for this test.

(4) A stiff wire brush or a soft bristle brush to clean the pavement.

(5) A small container with a secure and easily removable cover in order to store 200 ml (12.2 in^3) of glass beads.

(6) A shield to protect the test area from air turbulence by the wind or traffic.

(l) Field determination of Pavement Texture Drainage using an Outflow Meter (ASTM E2380).

(1) Outflow Meter.

(2) A broom or a handheld wire brush to clean the test area.

(3) Supply of clean water used to operate the outflow meter.

111.03.01 Safety Equipment. Approved Safety Equipment.

(a) Fall Protection Devices for SHA Inspection Personnel.

(b) Life vests where applicable.

111.04 MEASUREMENT AND PAYMENT

Sampling devices, testing equipment, and safety equipment will not be measured but the cost will be incidental to items of work for which they are required.

CATEGORY 100
PRELIMINARY

SECTION 114 — TRUCK STAGING AREAS AND IDLING REQUIREMENTS

114.01 DESCRIPTION

Locate truck staging areas and avoid unnecessary idling of construction equipment in order to reduce engine emissions and to provide air quality benefits to those who live or work in or adjacent to the construction site.

114.02 MATERIALS

Not applicable.

114.03 CONSTRUCTION

Establish truck staging areas for all vehicles waiting to load or unload materials at the job site. Subject to review and approval by the Administration, locate staging areas where emissions will have the least impact on sensitive areas and the public.

Sensitive areas include, but are not limited to, hospitals, schools, residences, motels, hotels, daycare facilities, and elderly housing and convalescent facilities. All sources of emissions shall be located as far away as possible from fresh air intakes, air conditioners, and windows.

Idling of all mobile construction equipment, including delivery trucks, shall be limited to five minutes except under any of the following circumstances:

(a) When forced to remain motionless because of traffic conditions or mechanical difficulties over which the operator has no control.

(b) When necessary to operate defrosting, heating, or cooling equipment to ensure the safety or health of the driver or passenger.

(c) When necessary to operate auxiliary equipment that is located in or on the mobile source to accomplish the intended use of the mobile source.

(d) To attain the recommended operating temperature.

(e) When the outdoor temperature is below 32 F.

(f) When undergoing maintenance that requires operation for more than five consecutive minutes.

The above requirements do not prohibit the operation of an auxiliary power unit or generator set as an alternative to idle the main engine of a motor vehicle operating on diesel fuel.

114.04 MEASUREMENT AND PAYMENT

All methods and procedures required to comply with these requirements will not be measured for payment but will be incidental to the pertinent Contract items.

CATEGORY 100
PRELIMINARY

SECTION 120 — TREE PRESERVATION

120.01 DESCRIPTION

Establish and maintain a Tree Preservation Area (TPA).

120.02 MATERIALS

Temporary Orange Construction Fence	104.20.02
Fertilizer	920.03.01

120.02.01 Tree Preservation Program (TPP). The Administration will develop a TPP to establish the goals and specify the procedures for tree branch pruning, brush removal, tree felling, tree root pruning, tree fertilizing, and other tree preservation operations to protect trees and vegetation within the TPA.

120.03 CONSTRUCTION

120.03.01 Maryland Licensed Tree Expert (LTE). A LTE shall perform or directly supervise the operations specified in the Contract Documents and the TPP in conformance with the Maryland Roadside Tree Law, the Forest Conservation Act, and accepted arboricultural practices.

120.03.02 Delineation. Delineate the perimeter of the TPA as specified in the Contract Documents.

120.03.03 Temporary Orange Construction Fence (TOCF). Ensure that the delineated TPA is approved prior to installing the TOCF. Perform installation and maintenance as specified in 104.20.03. Complete installation of the TOCF before:

(a) Beginning clearing and grubbing operations.

(b) Installing erosion and sediment controls.

(c) Conducting the Tree Preservation Meeting.

(d) Performing tree preservation operations.

120.03.04 Tree Preservation Meeting. Prior to beginning work, meet at the TPA with the Engineer, the Landscape Programs Division, and the LTE to review the TPP.

120.03.05 Tree Preservation Operations. Maintain the TPA as specified in the TPP and the Contract Documents. Perform the following operations, as specified in the TPP.

(a) Tree Branch Pruning. Section 712.

(b) Brush Removal. Section 713.

(c) Tree Felling. Section 714.

(d) Tree Root Pruning. Section 715.

(e) Tree Fertilizing. Section 716.

120.03.06 Prohibited Activities within the TPA.

PROHIBITED ACTIVITES	
a	Felling, removing, or harming any tree or plant designated for preservation.
b	Removing wood, soil, stones, and other natural materials.
c	Any kind of foot or vehicular traffic.
d	Driving, storing, washing, or maintaining trucks or construction equipment.
e	Placing backfill, stacking or storing supplies.
f	Grading, trenching, draining, dewatering, and burning activities.
g	Dumping waste or storing toxic or hazardous materials.

120.03.07 Restricted Activities. The following activities are restricted in the area near the TPA unless authorized by the Engineer.

RESTRICTED ACTIVITES	
a	Felling trees.
b	Grading that will disrupt drainage patterns.
c	Draining and dewatering activities.
d	Storing construction equipment.
e	Truck washing and maintenance activities.
f	Dumping waste and storing toxic or hazardous materials.
g	Burning and trenching activities.

120.03.08 Cleanup and Restoration. When construction activities are complete, remove the TOCF, construction materials, and debris without damaging trees in the TPA and adjacent areas. Grade the perimeter of the TPA to blend with nearby areas. Seed as specified in Section 705.

120.03.09 Damage Repair. Refer to 712.03.11.

120.03.10 Damage Compensation. Refer to 712.03.12.

120.04 MEASUREMENT AND PAYMENT

Work performed as specified in the Tree Preservation Program or Contract Documents will be measured and paid for one or more of the items listed below. Payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

120.04.01 Temporary Orange Construction Fence. Refer to 104.20.04.

120.04.02 Tree Branch Pruning. Refer to 712.04.

120.04.03 Brush Removal. Refer to 713.04.

120.04.04 Tree Felling. Refer to 714.04.

120.04.05 Tree Root Pruning. Refer to 715.04.

120.04.06 Tree Fertilizing. Refer to 716.04.

120.04.07 The licensed tree expert services will not be measured but the cost will be incidental to the Contract unit price for the Clearing and Grubbing item.

CATEGORY 100
PRELIMINARY

SECTION 121 — ELECTRONIC TICKETING (E-TICKETING)

121.01 DESCRIPTION

The work shall consist of supplying electronic material ticket data (e-tickets) of material deliveries consisting of asphalt, Portland cement concrete (PCC), and aggregates, to the Administration's portal. Only the materials delivered to the project site for placement will require e-tickets. The Contractor/Supplier can utilize a plant ticketing system of their choice to create the material ticket data. The State Highway Administration (SHA) e-ticket portal vendor will provide a direct connection option for the Contractor/Supplier's existing plant ticketing system. If this connection method is not utilized, an API key specific to each contractor will be provided by the SHA e-ticket portal vendor or directly from the Administration. The work shall also create an end-to-end solution to produce e-tickets, distribute those e-tickets, provide sorting features, and record field measurements such as test results and/or inspector remarks. Ownership of material ticket data shall be provided to the Administration.

121.02 MATERIALS

Not applicable.

121.03 CONSTRUCTION

121.03.01 Requirements.

121.03.01.01 Electronic Ticketing Preconstruction Meeting. A preconstruction e-ticketing meeting shall be held and the following meeting topics are required to be discussed 14 days prior to any material deliveries received at the project of the materials mentioned in this section.

E-Ticketing Preconstruction Meeting Topics:

(a) Identify the Technical Support Responsible Party.

(b) Supplier Test data confirmation.

(c) Project Location Connectivity.

(d) Method of material acceptance/rejection.

(e) Calculating Waste Material.

(f) Suppliers to be confirmed with additional integration testing.

(g) Identify Customer Support Points of Contact of Contractor and Project.

(h) Other ticketing requirements within the specification that are relevant to the project.

121.03.01.02 General MDOT e-ticketing vendor's software requirements. Any software that produces an automated method for producing e-tickets must provide electronic ticket data that meets all FHWA and State regulations and standards.

121.03.01.03 Material Producer/Supplier Requirements. The Contractor's producer/supplier must be able to upload electronic material data to SHA's e-ticketing vendor.

121.03.01.03.01 Electronic Ticket Date File. The Contractor's uploaded e-ticket data will provide the project's SHA representative access to, within the Administration's portal, a digital file containing the individual delivery tickets, a daily summary sheet and the ability to export reports containing a separate line for each load delivered to the project during that production run.

The electronic tickets are transmitted in real time from loadout systems directly to field inspection staff. The electronic ticket serves as a source document and must be securely stored and archived in electronic form. Please note - Image files of hardcopy tickets are not acceptable or federally approved for use as e-tickets, as they are paper ticket source documents that are converted into an image form, such as a photo, portable document format, scan, or fax, to enable electronic transmittal.

121.03.01.03.02 Preconstruction Electronic Ticket Data Feed Testing. Conduct a test of each intended supplier's ability to feed data into the Administration's software 30 days prior to any work on the project commencing, this test must be completed prior to the e-Ticketing Preconstruction Meeting, refer to 121.03.01. This test will ensure that each supplier's solution is integrated with the Administration's portal prior to shipping any materials. All associated tickets with the test shall be deleted from the Administration's portal after the Engineer confirms receipt and accuracy of the test, with the reason for deletion as "Ticket Integration Test."

121.03.01.03.03 Latency Requirements. All ticket data must be transmitted within 5 minutes of creation or of any change to that electronic document. The minimum level of service expected to receive tickets no later than 5 minutes or less of ticket creation is 99.5 percent. Tickets shall not be accepted after the delivery vehicle leaves the Project site prior to updating of ticket status by SHA Inspector without documented approval by the Engineer.

121.03.01.03.04 Weight Ticket. Use an approved plant automatic weighing and printing system. Prepare an electronic file containing a separate record of each delivery ticket with the cumulative total weight of the mix for that production run.

121.03.01.03.05 Reissuing an Electronic Ticket. Any ticket shall not be reissued after that ticket has been changed to a status of Delivered or Rejected without documented approval by the Engineer.

121.03.01.04 Alternative Means Ticket of Collection at Project Sites with Low or No Connectivity. At Project locations where mobile devices cannot achieve consistent connectivity with the SHA's chosen software solution then alternative means of material ticket collection may be necessary at the discretion of the Engineer. This alternate means must be discussed and agreed upon prior to any material being delivered to the site. The Contractor and Engineer are to visit the site and test the connectivity of mobile devices 30 days prior to any expected delivery to the Project. Alternative methods may be software offline modes or hardcopy paper ticketing. All ticket data is to be reconciled and uploaded to the SHA software at the end of the shift. The Administration holds the right to request hardcopy paper tickets at any time due to system failures, connectivity issues, or inconsistency found in the data provided.

All Contractors providing e-ticket data to the Administration for the first time shall maintain paper tickets for a minimum of one year of service after the first accepted ticket by the administration. At the end of this year of service, the Contractor can request to no longer maintain paper tickets for projects that do not have connectivity issues at the e-ticket preconstruction meeting.

121.03.01.05 Ticket Data Requirements. The following data is required to be captured for each e-ticket within the e-ticketing software provided by the producer/supplier's chosen solution: (All weights and cubic yardage data values shall be to the nearest hundredth (0.01) in decimal precision)

(a) General ticket information:

(1) Ticket number/ID.

(2) Contract/Project number.

(3) Contract/Project description.

(4) FAP number.

(5) Item number.

(i) Use Item Number Associated with the work that the majority of the material is planned to be used for.

(6) Item Category Code.

(7) Item description.

(8) Material description.

(9) Producer/Supplier name.

(10) Producer/Supplier location (address and phone number).

(11) Producer/Supplier ID number.

(12) Weighmaster name.

(13) Weighmaster number.

(14) Customer name (Contractor's name who ordered material).

(15) Date and time of ticket generation at producer/supplier.

(16) Date and time the truck was loaded.

(i) Geolocation data of loading source location.

(17) Date and Time of Delivery.

(i) Geolocation data Load at delivery location.

(18) Total Daily truck load counts.

(19) Total Project truck Load counts.

(20) Delivery Vehicle Information:

(i) Truck License Plate Number.

(ii) Truck ID number.

(iii) Gross weight of truck (in lbs.).

(iv) Tare weight of truck (in lbs.).

(**v)** Net weight of material (in lbs.).

(21) Reviewed/Accepted/Rejected by.

(22) SHA inspection date and time stamps.

(23) Inspection notes.

(b) Additional requirements for Asphalt e-tickets:

(1) Mix Design ID.

(2) Wasted material quantity.

(3) Date and time of delivery.

(4) Load Tonnage.

(5) Total Daily tonnage (per material).

(6) Total Project tonnage (per material).

(7) Material Temperature at time of placement.

(c) Additional Requirements for Portland Cement Concrete e-tickets:

(1) Approved mix number.

(2) Time Batched.

(3) Date and time unloaded.

(4) Load volume in cubic yards.

(5) Total daily cubic yardage.

(6) Total project, to-date cubic yardage.

(7) Batch report: (can be part of the ticket and doesn't need to be an additional report).

(i) Volume of Mix, use design weights for the total volume loaded.

(ii) Design and loaded weights (in lbs.) of each constituent material

(aggregates, cement, slag, fly ash, etc.).

(iii) Type and amounts of admixtures (design and loaded).

(iv) Percentage Moisture of aggregate.

(v) Volume of water (in gal) from aggregate.

(vi) Amount of water (in gal.) designed and loaded.

(vii) Water/cement ratio (design and loaded).

(viii) Allowable water (in gal) to be added on site.

(8) Plant and or Field Inspection test results.

(i) Temperature.

(a) Mix.

(b) Air.

(ii) Percentage Air Entrainment (to the tenth – 00.0 percent).

(iii) Slump (in inches).

121.04 MEASUREMENT AND PAYMENT

Electronic Ticketing (e-Ticketing) is to be considered normal business practices and all ticket data collected by the Administration in any e-ticketing format will not be measured but the cost will be incidental to the item in which the material is associated.

D CATEGORY 200
GRADING

SECTION 201 — ROADWAY EXCAVATION (CLASS 1, CLASS 1-A, CLASS 2)

201.01 DESCRIPTION

Excavate and grade for roadways and appurtenances to the lines and grades specified.

201.01.01 Classification

CLASS 1 — All excavation where the width of the bottom of the cut is 15 ft or more.

CLASS 1-A — All excavation of unsuitable material below the lowest excavation limits established.

CLASS 2 — All excavation where the width of the bottom of the cut is less than 15 ft. Excavation for flumes, ditches outside cut or fill slopes, and stream and channel changes are included in this classification unless otherwise specified.

201.01.02 Excavation. Excavation includes the following:

(a) Cut areas within the boundary faces of the typical cross sections specified, including ditches within the cut sections, entrances, approach roads, streets, intersections, gutters, ditches, berm ditches, and flumes.

(b) Topsoil salvaged within the specified limits of excavation or as directed.

(c) The removal and disposal of existing pavement, sidewalks, curb, combination curb and gutter, and Monolithic Median when within the limits of Class 1 or Class 2 excavation. Perform this work as specified in Section 206.

(d) The removal and disposal of below grade structures other than as specified in Section 102 and Section 207.

201.02 MATERIALS

Not applicable.

201.03 CONSTRUCTION

201.03.01 Grading Units. Each unit is the surface area of erodible earth that can be exposed to construction operations without undue erosion or sedimentation. Refer to 101.03.01 for the size and number of units that can be opened at one time.

201.03.02 Use of Excavated Materials. Refer to TC-3.03 and Section 203. Do not waste excavated material without prior approval. Do not use borrow unless provisions have been made for utilizing all available suitable excavated material in embankments.

201.03.03 Broken Pavement Material. Existing pavement, sidewalks, gutter, curb, and combination curb and gutter within the excavation may be broken and used in embankments provided that the materials conform to 204.02.01. If the Engineer determines that the material is unsuitable, dispose of it as excess or unsuitable material.

201.03.04 Rock Excavation.

(a) Boulders and Rock. Boulders and rock from the excavation may be broken and used in embankment if the materials conform to 204.02.01.

(b) Blasting. Refer to TC-6.07. Where rock encountered in cuts requires drilling and blasting, finished slopes shall remain reasonably straight and clean.

(c) Presplitting When presplitting of rock slopes is specified, perform the presplitting operation prior to the primary blasting. Apply the knowledge gained from excavation of the presplit face to subsequent presplitting operations. Do not drill any portion of any primary blast hole closer to the proposed finished slope than half the spacing of the drilling pattern.

Submit a plan for the proposed presplitting operations for approval. Include the drill size, lift height, explosive and detonator specifications, loading pattern, stemming materials, stemming depth, charge size, and charge timing.

Limit the initial presplit shot to a length of 100 ft. Drill 2 in. to 3 in. diameter holes on the same plane along the slope line and at the slope angle specified in the Contract Documents. Unless otherwise directed, drill holes on maximum 3 ft centers and to a maximum depth of 20 ft. If the vertical depth of cut to be presplit is greater than the maximum permissible depth of holes as determined by the Engineer, perform the blasting in two or more lifts. In this case, set back the first line of drill holes a sufficient distance from the slope line to allow for a 1 ft offset for each succeeding line of drill holes.

Before proceeding, excavate the initial presplit shot for inspection by the Engineer. If the results are found to be satisfactory, continue the presplitting using the approved drilling and loading pattern. Whenever the presplitting is found to be unsatisfactory,

make adjustments in the operations and repeat the inspection procedure used for the initial presplit shot.

Ensure that the presplit face is within 6 in. from the front of the line of drill holes and 1 ft from the back of the line of drill holes, except where the character of the material (badly broken rock, vertical seams, etc.) will result in irregularities.

Extend the line of presplit holes at least 30 ft beyond the limits of the primary blast holes or to the end of the cut.

Use cartridged explosives that are manufactured for presplitting and that are no more than half the diameter of the presplit hole. Do not use bulk explosives.

The Engineer may stop the presplitting operations wherever the rock is of a character that no apparent advantage is gained.

201.03.05 Frozen Material. Do not place frozen material in embankments. Stockpile the material outside the construction limits and reserve it for future use. Replace any material that is wasted. Rehandling of excavated material and replacement of wasted material shall be at no additional cost to the Administration.

201.03.06 Serrated Slopes. Serrated cut slopes have continuously benched faces. Construct serrated slopes as specified or as directed. Construct the benches as the excavation progresses, parallel to each other, level, and not graded to drain.

201.03.07 Drainage. Construct all drainage as specified in Section 308. Maintain the roadbed in a well-drained condition at all times. Do not place excavated material within 3 ft of the edge of the ditch or channel. Do not allow material to obstruct normal surface drainage into the ditch or channel. Construct ditches draining from cuts to embankments or otherwise to avoid damage to embankments by erosion. Prior to placing any surface material, install all drainage necessary to provide free and uninterrupted flow of surface and underground water. When stabilized side and outlet ditches provide the principal means for drainage, cut and stabilize ditches as the first order of work in the grading operation.

201.03.08 Excavation Beyond Specified Limits. Except by written authorization, do not widen cut or excavation sections beyond the limits of the typical cross section specified. When authorized, the procurement of additional material for embankments, unless otherwise specified under Borrow Excavation, will be as follows:

(a) Finished Excavation. Finish the widening of cut sections so that the completed flat and slope areas are uniform in appearance. Do not cut slopes steeper than specified or as directed.

(b) Roadway Excavation Limits.

(1) If the Engineer directs the Contractor to excavate beyond the limits of the typical cross section originally proposed, prior to starting roadway excavation in a cut section, all material within the limits will be classified as Class 1 Excavation.

(2) If the Contractor, with approval of the Engineer, elects to obtain additional material by widening cuts beyond the limits of the typical cross section originally proposed and within the right of way or easement, the excavation of the materials will be classified as Class 1 Excavation.

(c) Borrow Excavation Beyond Specified Limits. If the Engineer directs the Contractor to excavate beyond the limits of the typical cross section originally proposed, after the Contractor has substantially completed the roadway excavation in a cut section, all material removed beyond the limits of the typical cross section will be classified as Borrow Excavation.

201.03.09 Unsuitable Material. Remove unstable or other unsuitable material encountered at or below the specified typical section to the extent directed by the Engineer as Class 1-A Excavation. In rock areas, the limit of measurement for excavation will be the bottom of the typical section. Except when rock is encountered at subgrade, backfill all voids created by the removal of unsuitable material using the material specified.

201.03.09.01. Furnish and place backfill material immediately below top of subgrade as specified in Section 211.

201.03.09.02. Furnish and place backfill material for embankment foundation as specified in Section 204.

201.03.10 Coal Deposits. Notify the Bureau of Mines when coal is encountered. Send the notice to the Director, Bureau of Mines, Maryland Department of Natural Resources. Dispose of any coal encountered on the project as directed by the Engineer.

201.03.11 Widening for Staged Roadway Construction. Limit the area to be excavated for widening to the extent that the excavated area can be backfilled within the same working day using the excavated material or common borrow to form a temporary wedge. Refer to Standard No. MD 104.01-28 for the area to be backfilled. Maintain the 4:1 or flatter fill slope. Compact the material as directed and leave it in place until placement of the graded aggregate base course.

201.04 MEASUREMENT AND PAYMENT

Roadway excavation will be measured and paid for at the Contract unit price per cubic yard for the pertinent class of excavation. The payment will be full compensation for all excavation and hauling, blasting, formation and compaction of embankments and backfills, disposing of excess and unsuitable materials, preparation and completion of subgrade and shoulders except as

otherwise specified, serrated slopes, rounded and transition slopes, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Payment will not be made for excavation of any material used for purposes other than those designated.

When only one bid item for either Class 1 or Class 2 Excavation is established in the Contract Documents, all roadway excavation (except Class 1-A Excavations) shall be included in the unit bid price, regardless of the width of the excavation.

201.04.01 Limits of Measurement.

(a) Roadway Excavation. The lower limit of measurement will be the surface upon which roadway materials, including base course, surfacing, or selected capping material is to be placed in either pavement or shoulder areas.

(b) Concrete Pavements. Measurement will be taken to 1 foot outside of the outer edge of the pavement on each side. Where concrete curb or combination concrete curb and gutter is built contiguous to the pavement, measurement for excavation will be the outer limits of the concrete curb or combination curb and gutter.

(c) Rocks and Boulders. If ledge rock, scattered rock, or boulders of 1/2 cubic yard or larger volume are removed, any resulting undercutting approved by the Engineer will be measured for payment.

(d) Slides or Breakages. Slides or breakages not attributable to the Contractor's negligence, as determined by the Engineer, will be measured and included in the final quantities for Class 1 Excavation.

(e) Topsoil and Root Mat. Measurement will be made for the removal of topsoil and root mat when it is required to be removed from fill areas. In the case of removal of root mat, Class 1 Excavation shall only apply when the strata underlying the root mat are suitable for supporting embankment. If material is unsuitable for supporting embankment, then removal of root mat and unsuitable material will be measured as Class 1-A Excavation.

Excavation will always be measured in its original position. No liquids will be included in any measurement.

No measurement will be made for any additional excavation required to construct new curb, curb and gutter, paved ditch, paved gutter, paved flume, or sidewalk paving.

201.04.02 Template Method of Measurement. Unless otherwise specified, excavation will be computed using the template from preliminary cross sections of the original ground surface combined with templates of the typical cross sections. If this method is used, the following volumes will be excluded.

(a) Undercutting for cushion over rock.

(b) Entrances and intersections for which details are not specified in the Contract Documents and for which no quantity was allowed in the Contract Documents.

(c) Salvaged topsoil from under embankments.

(d) Removal of root mat from under embankments.

The template method will not be used:

(a) Where there are approved changes in design and typical section.

(b) Where there are approved deviations from planned slope faces in rock cuts.

(c) Where the original ground conditions upon which preliminary cross sections were taken have been changed before the Contractor begins work.

(d) For Class 1-A Excavation.

(e) When the work of the Contractor does not conform to the line, grade, or cross section specified in the Contract Documents or as changed by subsequent written authorization by the Engineer. Unless corrective action is required, payment will be based on the changed quantities as determined by the cross section method in 201.04.03.

201.04.03 Cross Section Method of Measurement. When specified, quantities for payment of Excavation will be computed by average end areas from the cross sections of the original ground combined with cross sections of the completed work. Class 1 Excavation will be allowed in median areas of cut sections only where 4 inches or greater of topsoil is to be placed. This method will also apply to Class 1-A and Class 2 Excavation unless otherwise specified.

201.04.04 Presplitting will not be measured but the cost will be incidental to the Contract unit price per cubic yard for the pertinent class of excavation in which it occurs.

201.04.05 Removal of existing pavement, sidewalk, paved ditches, curb, or combination curb and gutter, monolithic median, and full depth saw cuts outside the limits of any class of excavation will be measured and paid for as specified in 206.04.02.

201.04.06 Full depth saw cuts, removal of existing pavement, sidewalk, paved ditches, curb, and combination curb and gutter, and monolithic median within the limits of any class of excavation

will not be measured but the cost will be incidental to the Contract unit price per cubic yard for the pertinent class of excavation in which it occurs.

201.04.07 The Contractor or the Administration may elect to recompute quantities in any section where it is believed the planned quantities are incorrect. When recomputation reveals an error, the corrected quantity will be used.

201.04.08 The excavated material or common borrow required to fill the temporary wedge area as specified in 201.03.11, maintaining the 4:1 or flatter slope, compaction, and removal of the material will not be measured but the cost will be incidental to the Contract unit price for the pertinent class of excavation. Refer to 104.12.04 for measurement and payment of Drums.

201.04.09 Backfill for unsuitable material will be measured and paid for at the Contract unit price for the pertinent item specified in the Contract Documents.

CATEGORY 200

GRADING

SECTION 202 — CHANNEL OR STREAM CHANGE EXCAVATION (CLASS 5)

202.01 DESCRIPTION

Excavate for changes in channels or streams when specified. Use all suitable material for the construction of the project. Dispose of unsuitable material as directed.

202.02 MATERIALS

Not applicable.

202.03 CONSTRUCTION

Refer to Section 201.

202.04 MEASUREMENT AND PAYMENT

Class 5 Excavation will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all excavation and hauling, formation and compaction of embankments and backfill, backfilling old stream beds or otherwise disposing of excess and unsuitable materials, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Material will be measured in its original position and the volume computed by the Method of Average End Area. The cross-sectional area measured will not include liquids. Measurement for Class 5 Excavation excludes any material removed outside the limits of payment as specified in the Contract Documents.

CATEGORY 200
GRADING

SECTION 203 — BORROW EXCAVATION

203.01 DESCRIPTION

Furnish, excavate, haul, and place approved materials for embankments and backfills when sufficient quantities of suitable materials are not available from other excavations specified in the Contract Documents. This includes all work prescribed for backfills, embankments, subgrade, and earth shoulders, all necessary clearing and grubbing, the removal and disposal of overburden or other unsuitable spoil material, and the trimming, shaping, dressing, draining, and reclamation of the pit or location from which borrow material is secured. Refer to 201.03.02 before securing borrow.

203.01.01 Contractor's Options. As a duly authorized agent of the Administration, select one of the following three methods to obtain borrow material for use on public highway contracts:

OPTION 1 - Acquire material from a licensed commercial operating supplier.

OPTION 2 - Make application to the Maryland Department of the Environment under the Annotated Code of Maryland, Environment, Title 15, Subtitle 8, entitled "Surface Mining".

OPTION 3 - Make application to the Administration to operate under the standard adopted in conformance with the Annotated Code of Maryland, Environment, Title 15, Subtitle 8, Surface Mining, Subsection 15-834 entitled "Exemptions." If this option is selected, submit an application to the Administration fulfilling all the requirements of the cited subtitle.

Provide notification of the option selected to the Administration.

203.01.02 Notice to Contractor—Borrow Pits. If proposed, a borrow pit may be established on privately owned property. The Administration may grant an "Exemption for a Surface Mining Permit" normally issued by the Maryland Department of the Environment, Water Management Administration (WMA). Before a permit can be granted, submit written proof to the Administration that all local permits or approvals have been secured for the borrow pits.

An exemption under Option 3 will require approval of an excavation and reclamation plan along with the drainage patterns and methods of attaining satisfactory drainage and soil conservation as the work progresses. The plan shall provide for surface restoration suitable for the proposed subsequent land use after reclamation is completed and the proposed method of accomplishment.

203.01.03 Borrow Pits Within Jurisdictional Resources. Borrow pits located within tidal or nontidal wetlands, waterways, and 100 year floodplains require approval by the appropriate Federal and State Authorities. Obtain and provide all required permits.

If the pit is in operation and the Administration discovers that the work does not meet these regulations, the Administration will notify the contractor to make the necessary corrections, and all other operations shall cease until the work is in compliance.

203.02 MATERIALS

Refer to Section 916.

203.03 CONSTRUCTION

203.03.01 Clearing and Grubbing. Refer to Section 101.

203.03.02 Borrow Pit Material. Notify the Engineer at least 30 days in advance of the opening of any borrow pit so that soil analysis, elevations, and measurements of the ground may be made. After the pit is opened, use the excavated material only for the project intended. Do not excavate additional material for other purposes until a final survey is made of the pit.

203.03.03 Borrow Pit After Excavation. Meet the requirements of the Reclamation (Permit) Plan after the necessary quantity of materials has been removed. Avoid steep slopes and sheer faces. Seed and mulch all disturbed areas as specified in Section 705, at no additional cost to the Administration. Shaping and seeding requirements do not apply to commercial borrow pits.

203.03.04 Borrow Excavation Beyond Specified Limits. Refer to 201.03.08.

203.03.05 Compaction. Refer to 204.03.04.

203.04 MEASUREMENT AND PAYMENT

Borrow excavation will be measured and paid for at the Contract unit price per cubic yard for the pertinent Borrow item. The payment will be full compensation for clearing and grubbing, furnishing, excavating and hauling, sloping, draining and reclamation of pits (if Option 2 or 3 is selected), the formation and compaction of embankments, backfills, subgrade, manipulation and additives for select borrow, all work and materials for earth shoulders except as otherwise specified, disposing of all unsuitable spoil material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

When requested by the Contractor in writing, the Engineer may approve an alternate method of measurement for the computation of borrow excavation quantities. This alternate method will not be considered for approval unless the Contractor can show that the cross section method computed by average end area is not a feasible method of measurement. When approved in writing, this alternate method will consist of measuring the borrow excavation in approved hauling vehicles. Refer to TC-7.01 and the following:

(a) Prior to the start of hauling operations, provide the identification number of each vehicle to be used. The Engineer will determine the water level capacity of each vehicle. The measured capacity will be multiplied by a factor of 0.85 to determine the pay volume.

(b) Furnish a delivery ticket to the Engineer for each load of borrow material delivered to the project with the information listed below. Only tickets signed by the Engineer will be used in the computation of the borrow quantity.

(1) The supplier's name.

(2) The Administration’s Contract number.

(3) The date and ticket number.

(4) Vehicle identification number.

(5) Type of material delivered.

(6) Pay volume computed as specified in (a).

CATEGORY 200
GRADING

SECTION 204 — EMBANKMENT AND SUBGRADE

204.01 DESCRIPTION

Construct embankment and subgrade using suitable material obtained from roadway, structure, borrow, and other excavation included in the Contract. Place, process, and compact material to the specified line and grade.

204.02 MATERIALS

Unless otherwise specified, use soils and soil aggregate mixtures that meet the common borrow requirements specified in Section 916.

204.02.01 Rock. Rock may be used in embankments, if individual pieces do not exceed 24 in. in any dimension. Larger size rocks may be wasted with the approval of the Engineer.

204.02.02 Frozen Material. Refer to 201.03.05. In addition, do not cover any material that freezes after being placed in the embankment until it has thawed.

204.02.03 Embankment Adjacent to Structures. The Engineer may require the use of specially selected material adjacent to structures to protect the structure from damage. Do not use rock. At locations of pile supported foundations, use embankment material that will allow piles to be easily driven.

204.02.04 Geotextile Inclusions. Refer to 919.01 Class SD Type II Non-Woven.

204.03 CONSTRUCTION

204.03.01 Embankment Foundation

(a) Foundation Material. The Engineer will inspect and approve the area prior to construction of the embankment. Remove topsoil, root mat, and unsuitable material to the depth directed.

(b) Embankment Over Existing Pavement. When embankment is being placed in an area of existing pavement, remove the bound asphalt or concrete pavement materials prior to placing embankment material. Leave the unbound pavement materials in place to aid in maintaining the stability of the area.

(c) Test Rolling. Unless exempted by the Engineer, test roll embankment foundation with a 35 ton pneumatic tired roller, hauling units with a weight of 35 tons, or other equipment as approved. In case of a failed test roll, undercut unstable areas and backfill with Select Borrow or other suitable material; bridge with a thick embankment lift of Select Borrow or other suitable material and provide drainage; or other suitable treatment as determined by the Engineer at the time of construction.

Embankment foundation areas that may be exempted from test rolling include areas that do not require grubbing and areas impractical to access with test rolling equipment.

204.03.02 Placing and Spreading. Place the material in horizontal layers across the full width of the embankment. Maintain an adequate crown to provide drainage at all times. Maintain side slopes at the specified slope throughout the progress of the work.

(a) Embankment on Unstable Ground. When embankment is to be constructed on ground that will not support the weight of the construction equipment, the first layer of the fill may be constructed by depositing material in a layer no thicker than that required to support the equipment. Place subsequent layers as specified in (b).

(b) Earth Embankment. Except when specified, do not place layers exceeding 8 in. compacted depth.

(c) Rock Embankment

(1) Determine the thickness of layers by the size of the rock or a 24 in. maximum depth, whichever is less. Where the embankment is less than 6 ft below the subgrade at the profile grade line, place the material in layers not exceeding 8 in. compacted depth. Solidly fill and choke these layers with spalls, rock dust, or earth. Fill and compact each layer before placing the next layer.

(2) Place the rock material to a uniform top surface, determined by connecting with straight lines the points on the typical cross section that are 9 in. below any median ditch invert and 9 in. below the bottom of the pavement structure and then sloping downward and outward under the shoulders at the rate of 3/4 in. per ft to the outer slope of the embankment.

(3) Unless otherwise specified, construct the remaining upper portion of the embankment, using suitable earth that is free from stones retained on a 3 in. sieve.

204.03.03 Benching. When placing and compacting embankment on hillsides or against existing embankments, continuously bench the slopes where the slope is steeper than 4:1 when measured at right angles to the roadway. Perform the benching operation as the embankment is constructed in layers. Maintain a bench width of at least 5 ft. Begin each horizontal cut at the intersection of the original ground and the vertical sides of the previous cut. If the material cut from the benches meets embankment requirements, compact this material along with the new embankment material.

204.03.04 Compaction. Immediately after spreading each layer of fill, compact the material with approved equipment. Perform all rolling in a longitudinal direction along the embankment. Begin at the outer edges and progress towards the center. Vary the travel paths of traffic and equipment over the width of the embankment to aid in obtaining uniform compaction.

Compact the material that is 1 ft below the top of subgrade to at least 92 percent of the maximum dry density according to T 180. Compact the top 1 ft to at least 97 percent of the maximum dry density. Determine in-place density according to MSMT 350 or MSMT 352. When necessary, add water or dry the layer in order to compact to the required density. When finally compacted to the required density, the resultant moisture content of embankment material shall be within two percentage points of optimum.

Provide a portland cement concrete compaction block having dimensions 18 in. x 18 in. x 9 in., weighing at least 200 lb, and with one 18 in. x 18 in. level and broomed working surface.

204.03.05 Stability of Embankments. Remove and replace with acceptable material any embankment or portion thereof that has been constructed with unsuitable material. Remove and replace unstable material and remove and replace portions of the embankment that become unstable or displaced as the result of the construction operations.

204.03.06 Protection of Structures and Utilities During Construction. Protect all structures and utilities from any damage in the handling, processing, or compacting of embankment or backfill material. Exercise caution near arches, retaining walls, culverts, and utility trenches to prevent undue strain or movement. In areas where rollers cannot be used, refer to Section 210.

204.03.07 Subgrade. After all cuts, embankment, and backfilling have been substantially completed, construct and shape the subgrade to the specified cross section. Test roll the subgrade with a 35 ton pneumatic tired roller, or hauling units with a weight of 35 tons, or other equipment as approved. Undercut unstable areas and backfill with Geosynthetic Stabilized Subgrade Using Graded Aggregate Base as specified in Section 211, or other specified material.

204.03.08 Maintenance. Maintain the embankment and subgrade until final acceptance. Use acceptable material from excavation or borrow to replace embankment and subgrade material that may be lost or displaced as a result of natural causes such as storms and cloudbursts, or as a result of unavoidable movement or settlement of the ground or foundation upon which the embankment and subgrade is constructed. Maintain ditches and drains at all times. Keep all traffic on the embankment and subgrade to a minimum. Remove ruts that are 2 in. or more in depth by reshaping and recompacting.

204.03.09 Placement of Geotextile Inclusions. Furnish and install geotextile inclusions as a compaction aid in fill embankments where the embankment is at least 10 ft high and 10 ft wide to the lines and grades shown on the Contract Documents or as directed. Install according to the manufacturers' recommendations. Geotextile inclusions shall be minimum 12 ft in width. The vertical spacing of the geotextile inclusions shall be 3 ft. Place geotextile inclusions concurrently with the embankment material.

Unroll the geotextile onto the horizontal fill surface such that the edge of the geotextile is within 1 ft of the finished slope face. Pull the geotextile tight prior to backfilling. Secure the geotextile in position by suitable means according to the manufacturer's recommendations until the subsequent soil layer can be placed.

Do not allow tracked construction equipment to operate on the exposed geotextile. Place a minimum of 6 in. of uncompacted fill on the geotextile before operating tracked vehicles on it. Minimize turning of tracked vehicles to prevent displacement of the geotextile or the fill. Rubber-tired equipment may pass over the exposed geotextile at speeds of less than 10 mph. Avoid sudden braking and sharp turns.

204.04 MEASUREMENT AND PAYMENT

Embankment, subgrade, and all necessary work will not be measured but the cost will be incidental to the Contract unit price per cubic yard for the pertinent Class of Excavation. The payment will be full compensation for the formation, sprinkling, compacting, test rolling, shaping, scarifying, breaking or removing of the existing pavement, sloping, trimming, finishing, maintaining embankments and subgrade, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

204.04.01 Replacement of material lost as a result of natural causes will be measured and paid for at the Contract unit price per cubic yard for the pertinent Class of Excavation item or as directed.

204.04.02 Compaction by means of mechanical tampers or vibratory compactors will not be measured but the cost will be incidental to the pertinent Class of Excavation item.

204.04.03 Removal of bound pavement materials will be paid for as Class 1 Excavation.

204.04.04 Geotextile inclusions will be measured and paid for at the Contract unit price per square yard of geotextile placed.

204.04.05 Undercutting will be paid for as specified in Section 201 as Class 1-A excavation.

204.04.06 Backfill will be measured and paid for as specified in Section 203.

CATEGORY 200
GRADING

SECTION 205 — TEST PIT EXCAVATION

205.01 DESCRIPTION

Excavate and backfill test pits to determine the location of underground structures and utilities.

205.02 MATERIALS

Not applicable.

205.03 CONSTRUCTION

Determine the location of underground structures and utilities by test pit excavation prior to excavation operations.

Excavate test pits at the location and to the size and depth authorized. Backfill test pits as specified in Section 210.

205.04 MEASUREMENT AND PAYMENT

Test Pit Excavation will be measured and paid for at the Contract unit price per cubic yard for the material actually removed from within the limits specified. The payment will be full compensation for all excavation, tamped backfill, and all material, labor, equipment, tools, and incidentals necessary to complete the work. Any pavement to be replaced will be measured and paid for as specified in Section 106.

CATEGORY 200
GRADING

SECTION 206 — REMOVAL OF EXISTING PAVEMENT, SIDEWALK, PAVED DITCHES, CURB, OR COMBINATION CURB AND GUTTER, AND MONOLITHIC MEDIAN

206.01 DESCRIPTION

Remove to full depth and dispose of existing pavement, sidewalk, paved ditches, curb, or combination curb and gutter and monolithic median.

206.02 MATERIALS

Not applicable.

206.03 CONSTRUCTION

206.03.01 Full Depth Saw Cut. Saw cut to full depth the existing pavement, sidewalk, paved ditches, curb, or combination curb and gutter along the lines specified or as directed.

206.03.02 Use of Removed Pavement, Sidewalk, Paved Ditches, Curb, or Combination Curb and Gutter and Monolithic Median. When approved, removed materials may be broken and used in the work. Refer to 204.02.01.

206.03.03 Protection of Retained Pavement, Sidewalk, Paved Ditches, Curb, or Combination Curb and Gutter and Monolithic Median. Protect all sections designated to remain from being damaged. Repair or replace damaged areas.

206.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

206.04.01 Full depth **s**aw cuts, removal and disposal of existing pavement, sidewalk, paved ditches, curb or combination curb and gutter, and monolithic median within the limits of any class of excavation will be incidental to the Contract unit price for the Class of Excavation in which it occurs.

206.04.02 Saw cuts, removal and disposal of existing pavement, sidewalk, paved ditches, curb or combination curb and gutter, and monolithic median outside the limits of any class of excavation will be measured in the original position and paid for as follows:

(a) Saw Cuts per linear foot when an item is included in the Contract Documents.

(b) Removal of Existing Pavement, Sidewalk, and Paved Ditches per cubic yard.

(c) Removal of Existing Curb or Combination Curb and Gutter per linear foot.

(d) Removal of Existing Monolithic Median per square foot.

When any material included in (b), (c), or (d) is removed but not replaced, backfilling with common borrow, subsoil, topsoil, temporary stabilization, and permanent stabilization as directed by the Engineer will not be included in Contract Unit Price. Payment for this work will be made using the applicable items included in the Contract Documents.

CATEGORY 200
GRADING

SECTION 207 — REMOVAL OF EXISTING MASONRY

207.01 DESCRIPTION

Remove all or part of existing concrete, concrete block, brick, or stone structures (headwalls, toe walls, etc.), including concrete piles. Refer to Section 405 for removal of existing bridge structures, box culverts, retaining walls, and noise barriers.

207.02 MATERIALS

Not applicable.

207.03 CONSTRUCTION

207.03.01 Removal. Unless otherwise specified, remove material to at least 1 ft below subgrade or existing ground. Except with written approval, do not use blasting. Piles, grillages, and cribbing under removed masonry shall be cut off to the above limit.

207.03.02 Use of Removed Masonry. Masonry material may be broken and used as specified in 204.02.01. Material determined to be unsuitable shall be disposed of as excess or unsuitable material.

207.03.03 Protection of Retained Masonry. Repair or replace retained sections that are damaged due to the construction operations. Cut connecting edges and surfaces to the line and grade specified or as directed.

207.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, backfill, disposal of excess or unsuitable material, blasting, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

207.04.01 Removal of Existing Masonry will be paid for at the Contract lump sum price.

207.04.02 When specified in the Contract Documents, Removal of Existing Masonry will be measured and paid for at the Contract unit price per cubic yard.

207.04.03 When a new structure is placed in the location of an existing structure, the removal of the existing structure will be incidental to the new structure, unless otherwise specified.

CATEGORY 200
GRADING

SECTION 208 — SUBGRADE PREPARATION

208.01 DESCRIPTION

Prepare, protect, and maintain the subgrade prior to the construction of succeeding courses.

208.02 MATERIALS

Refer to Section 916.

208.03 CONSTRUCTION

After roadway excavation and embankments are completed in conformance with Section 204, fine grade and compact the subgrade to at least 97 percent of the maximum dry density according to T 180.

208.03.01 Removal and Replacement of Unsuitable Material. Remove and dispose of all soft and unstable material and any other portions of the subgrade that will not properly compact. Replace with suitable material and compact.

208.03.02 Subgrade Control. Bring the subgrade surface to line and grade and shape it to the specified cross section. Set grade for subgrade control both longitudinally and transversely with fixed controls not exceeding 25 ft spacing. Limit the finish subgrade deviation to 1/2 in. from the established grade. Compact and smooth the subgrade over its full width by the use of an approved smooth faced, steel-wheeled roller approved by the Engineer. Use mechanical tampers and vibratory compactors if rolling is not feasible.

208.03.03 Bleeder Ditches. Maintain adequate open bleeder ditches along the subgrade at all times to keep it thoroughly drained. Maintain erosion and sediment control practices as specified in Section 308.

208.03.04 Subgrade Maintenance. Prevent damage by heavy loads or equipment. Repair or replace any defects or damage.

208.03.05 Subgrade Approval. Do not place subsequent cover material upon a frozen subgrade or any subgrade until it has been checked and approved.

208.04 MEASUREMENT AND PAYMENT

Subgrade preparation, including bleeder ditches and any mechanical tamping will not be measured but the cost will be incidental to the pertinent items specified in the Contract Documents.

CATEGORY 200
GRADING

SECTION 209 — TRIMMING EXISTING DITCHES

209.01 DESCRIPTION

Trim, slope, and shape existing ditches within the limits and to the lines and grades specified. Clearing and grubbing and the removal and disposal of surplus or unsuitable materials are included in the work.

209.02 MATERIALS

Not applicable.

209.03 CONSTRUCTION

Clear and grub as specified in Section 101. Trim, slope, and shape existing ditches to a uniform grade and cross section. Maintain a constant side slope having a maximum slope of 1:1 unless otherwise specified. Dispose of excess and unsuitable materials as specified in Section 201.

209.04 MEASUREMENT AND PAYMENT

Trimming Existing Ditches will be measured and paid for at the Contract unit price per linear foot of trimmed ditch. Measurement will be along the center line of the ditch.

The payment will be full compensation for all clearing, grubbing, excavation, disposal of surplus and unsuitable materials, and for all labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 200
GRADING

SECTION 210 — TAMPED FILL

210.01 DESCRIPTION

Compact the embankment and backfill materials by means of mechanical tampers or vibratory compactors. Use this method of compaction wherever materials cannot be adequately compacted by other approved methods.

210.02 MATERIALS

Refer to Section 916.

210.03 CONSTRUCTION

After approval has been given by the Engineer, place approved material in horizontal layers not exceeding 6 in. loose depth over the entire area. Tamp and uniformly compact the material using mechanical tampers or vibratory compactors. Refer to 204.03.04 for moisture and compaction.

When backfilling around abutments, retaining walls, culverts, utilities, or other structures, prevent any wedging action against the structure. When placing backfill against existing slopes, excavate benches or steps. Place the backfill in horizontal layers as described above and wide enough that there is a horizontal berm of thoroughly compacted material behind the structure at all times for a distance at least equal to the height of the structure remaining to be backfilled, except insofar as undisturbed material protrudes into this space. Tamping may be required over additional widths when the material cannot be adequately compacted by other methods. When installing structures below subgrade in embankments, place the tamped fill to a depth of 1 ft over the top of the structure. In excavation sections, extend the tamped fill to the surface of the finished earthwork.

210.04 MEASUREMENT AND PAYMENT

Compacting embankments and backfills by mechanical tampers or vibratory compactors will not be measured but the cost will be incidental to the pertinent items specified in the Contract Documents.

CATEGORY 200
GRADING

SECTION 211 — GEOSYNTHETHIC STABILIZED SUBGRADE USING GRADED AGGREGATE BASE

211.01 DESCRIPTION

Furnish and place a layer of geotextile and 12 in. of graded aggregate base to bridge unstable material and minimize the use of undercutting. Use this item only when specified or directed. In extremely unstable areas, the Engineer may increase the thickness of the graded aggregate base material.

211.02 MATERIALS

Graded Aggregate Base	901.01
Geotextile for Subgrade Stabilization-Class ST	Section 919
Securing Pins or Staples	919.03

211.03 CONSTRUCTION

211.03.01 Test Strip. In extremely unstable areas, the Engineer may direct that a test strip be constructed to determine the thickness of aggregate layer required to stabilize the area. The Engineer will determine the depth of aggregate to be used in the test strip. Construct the test strip at least 100 ft in length and at least one lane wide. The results of the test strip will be used to determine the thickness of aggregate required for subsequent construction.

211.03.02 Grade Preparation. Cut the area where the geotextile is to be placed to the depth shown or as directed. Bring the area to the specified line, grade, and cross section. Provide a grade that is smooth as practical and free of debris. Minimize construction traffic on the grade. Remove ruts by reshaping, but do not overwork the grade. Have the grade approved prior to placement of the geotextile. Maintain adequate surface drainage as specified in 208.03.03.

The Engineer may waive compaction and moisture requirements for the underlying soil.

211.03.03 Geotextile Placement. Place geotextile on the prepared surface for the full width of the area to be treated. In areas where longitudinal underdrain is to be placed, place the geotextile up to the edge of the proposed longitudinal underdrain trench, but not where the trench is to be excavated.

Unroll the geotextile parallel to the baseline. Do not drag the geotextile across the grade. Remove wrinkles and folds by stretching and pinning.

Overlap the geotextile at least 30 in. at roll edges and ends. Overlap the end of the roll in the direction of aggregate placement, with the roll being covered by aggregate on top of the next roll. Pin all roll ends and roll end overlaps a maximum of 5 ft on center. Pin roll edges and roll edge overlaps a maximum of 50 ft on center.

For curves, fold or cut the geotextile and overlap in the direction of the turn. Pin folds in the geotextile a maximum of 5 ft on center. Immediately repair or replace damaged geotextile as directed. Overlap geotextile patches at least 3 ft into undamaged geotextile.

Do not allow traffic, including construction equipment, on the bare geotextile.

211.03.04 Aggregate Placement. Place the graded aggregate base as specified in Section 501, with the following exceptions:

(a) Placement and Spreading. Place the graded aggregate base within three working days of geotextile placement. Use the end dumping and spreading method. Place a single lift parallel to the baseline and at the thickness required to provide the specified compacted depth. Keep the turning of construction equipment on the graded aggregate base to a minimum.

(b) Density Requirements. Immediately after placement, compact the graded aggregate base material to the required density. Unless otherwise directed, compact the top 6 in. to at least 95 percent of maximum dry density within 2 percent optimum moisture. Use T 180 to determine the optimum moisture content and maximum dry density. Use MSMT 350 or MSMT 352 to measure the in-place density. Compaction requirements will be waived for the graded aggregate base material below the top 6 in.

(c) Vibration. Unless otherwise specified or directed, do not vibrate graded aggregate base.

211.04 MEASUREMENT AND PAYMENT

Geosynthetic Stabilized Subgrade Using Graded Aggregate Base will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for the test strip, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 200
GRADING

SECTION 212 — SUBGRADE DRAINAGE BLANKET

212.01 DESCRIPTION

Construct subgrade drainage blankets (SDB). Do not construct SDB in stormwater management (SWM) facilities or as drainage blankets for SWM facility embankments.

212.02 MATERIALS

Graded Aggregate Base	901.01
No. 57 Aggregate	901.01
Securing Pins or Staples	919.03
Geotextile	919.01, Class SD Type II

212.03 CONSTRUCTION

212.03.01 Preparation. In the area where the SDB is to be placed, excavate 12 in. below the elevation of the proposed bottom of the Graded Aggregate Base or as directed. If directed, adjust the depth or footprint of the SDB beyond the limits shown in the Contract Documents. Establish the grade to the line, grade, and cross section specified on the plans and to the satisfaction of the Engineer. Construct the grade as smooth as practical and free of debris. Minimize construction traffic on the grade. Remove ruts and reshape areas affected by construction traffic to the satisfaction of the Engineer. Do not overwork the grade to avoid causing further saturation or pumping of the subgrade. Maintain adequate surface drainage as specified in 208.03.03.

Compaction and moisture requirements for the underlying soil on which the SDB is to be placed will be waived.

212.03.02 Geotextile Placement. Place a bottom layer of geotextile Class SD Type II on the prepared surface prior to placement of 12 in. of No. 57 aggregate. Place a top layer of geotextile Class SD Type II after the No. 57 aggregate has been placed. Place the geotextile for the full width of the area to be treated. Unroll the geotextile on the grade parallel to the baseline. Do not drag the geotextile across the grade. Remove wrinkles and folds in the geotextile by stretching and pinning.

Overlap the geotextile at roll edges and ends. Overlaps at the end of the roll are to be in the direction of aggregate placement with the previous roll on top. The minimum overlap is to be

30 in. Pin roll ends and roll end overlaps a minimum of 5 ft on-center. Pin roll edges and roll edge overlaps a minimum of 50 ft on-center. Provide enough material at each edge of the geotextile to allow a 36 in. fold over the top layer of geotextile.

For curves, fold or cut and overlap the geotextile in the direction of the turn. Pin the folds in the geotextile a minimum of 5 ft on center. Repair any damage to the geotextile immediately at no additional cost to the Administration. Repair geotextile as directed by the Engineer. Overlap geotextile patches a minimum of 3 ft into undamaged geotextile.

Do not allow traffic, including construction equipment, on the bare geotextile.

212.03.03 No. 57 Aggregate Placement. Place 12 in. of No. 57 aggregate as specified in Section 501 with the following exceptions:

(a) Spreading. Place No. 57 aggregate the same working day as the geotextile placement. Place the No. 57 aggregate as a single lift in the thickness required to provide the specified full depth of material thickness. Increase the thickness of the No. 57 aggregate if the excavation depth was increased in the Grade Preparation. Place the No. 57 aggregate by end dumping and spreading. Construct parallel to the baseline. Keep the turning of construction equipment on the No. 57 aggregate to a minimum.

(b) Density Requirements. Compaction requirements will be waived for the No. 57 aggregate.

(c) Roll. Roll with a static steel drum roller prior to placing the top layer of geotextile.

212.03.04 Graded Aggregate Base Placement. Place the pavement section graded aggregate base course after the top layer of geotextile has been placed and as specified in Section 501 with the following exceptions:

(a) Spreading. Place the graded aggregate within three working days of geotextile placement. Place the graded aggregate base as separate lifts in the thickness required to provide the specified compacted depth. Place the graded aggregate base by end dumping and spreading. Construct parallel to the baseline. Keep the turning of construction equipment on the graded aggregate base to a minimum.

(b) Density Requirements. Immediately after placement, compact the graded aggregate base material to the required density. Compact the top lift of the graded aggregate base to a minimum of 95 percent of maximum dry density according to T 180. When compacting, maintain the resultant moisture content within two percentage points of optimum. Measure in-place density according to MSMT 350 or MSMT 352. Compaction requirements will be waived for the graded aggregate base material below the top lift.

(c) When directed, do not use vibratory compaction on the graded aggregate base.

212.04 MEASUREMENT AND PAYMENT

Subgrade Drainage Blanket will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for furnishing and placing geotextile; furnishing, placing, and spreading No. 57 aggregate; compaction; and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Excavation will be measured and paid for at the pertinent class of excavation as specified in 201.04.

Graded Aggregate Base course will be measured and paid for at the Contract unit price per square yard as specified in Section 501.

CATEGORY 300
DRAINAGE

SECTION 301 — CLASS 3 EXCAVATION FOR INCIDENTAL CONSTRUCTION

301.01 DESCRIPTION

Excavate below the specified elevation when unsuitable subgrade material is encountered.

301.02 MATERIALS

Not applicable.

301.03 CONSTRUCTION

Excavate to the length, width, and depth at authorized locations. Handle excavated material as specified in 402.03.01.

301.04 MEASUREMENT AND PAYMENT

Class 3 Excavation for Incidental Construction will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

SECTION 302 — SELECTED BACKFILL

302.01 DESCRIPTION

Place selected backfill material and compact.

302.02 MATERIALS

No. 57 Aggregate	901.01
Crusher Run Aggregate CR-6	901.01

302.03 CONSTRUCTION

Place selected backfill on suitable subgrade material that has been prepared in as specified in Section 208 and compact the selected backfill as specified in Section 210. When unsuitable subgrade material is encountered, notify the Engineer to inspect the material. Excavate unsuitable material as specified in 208.03.01 and Section 301 before placing selected backfill.

302.04 MEASUREMENT AND PAYMENT

Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

SECTION 303 — PIPE CULVERTS

303.01 DESCRIPTION

Furnish and install pipe culverts, make connections to miscellaneous structures and other pipe culverts, reinstall existing pipes, remove existing pipe culverts, abandon existing pipes, and clean existing pipes.

303.02 MATERIALS

No. 57 Aggregate	901.01
Crusher Run Aggregate CR-6	901.01
Curing Compound	902.07.03
Portland Cement Concrete	902.10, Mix No. 2
Grout	902.11
Controlled Low Strength Material	902.16
Brick	903.03
Mortar	903.06
Pipe	Section 905
Select Borrow	916.01
Common Borrow	916.01
Stormwater Management (SWM) Facility Embankment Clay Core Borrow	916.01
Water	921.01
Detectable Utility Marking Tape	921.11

Bedding. Use earth meeting the requirements of M 145, A-1, A-2-4, A-2-5 or A-3. The maximum particle size is 1.25 in. Do not use organic material, stones larger than 1.5 in., or frozen lumps. Selected Backfill may be used.

Backfill. Use material meeting the requirements for Select Borrow, Selected Backfill or Controlled Low Strength Material (Flowable Backfill). Large lumps, clods, frozen material, or rocks are not acceptable. For plastic pipe installations, use backfill materials meeting the requirements of M 145, A-1, A-2-4, A-2-5, or A-3.

303.03 CONSTRUCTION

303.03.01 Pipe Culvert Installation

When endwalls are visible from the roadway, construct them parallel to the roadway with the askew pipe protruding through the end wall. If not visible, construct them normal to the center line of the pipe.

Clean existing pipes and dispose of the material.

Trench Excavation. When a pipe is to be laid on existing ground, on or under fill, construct embankment to a height of at least 9 in., but not more than 3 ft above the proposed top of the pipe.

Excavate to a depth at least 4 in. below the bottom of pipe. When rippable rock is encountered, remove rocks, boulders, and other hard, lumpy, or unyielding material to a depth of at least 12 in. below the bottom of the outer diameter of the pipe. When non-rippable rock is encountered, remove it to a depth of at least 8 in. below the outer diameter of the pipe. Handle excavated material as specified in 402.03.01.

Ensure trench width is at least twice the outside diameter of the pipe or the outside diameter plus 18 in. on each side, whichever is less. Ensure trench sides are vertical up to at least the midpoint of the pipe to be installed.

(a) Prepare Trench Subgrade. Fine grade and compact the subgrade to at least 97 percent of the maximum dry density according to T 180. Remove and dispose of all soft and unstable material and all other portions of the subgrade that will not properly compact as specified in Section 301. Replace with selected backfill and compact. Obtain subgrade approval as specified in 208.03.05.

(b) Bedding. After preparing the trench subgrade, place pipe bedding backfill and compact. Ensure that the moisture content is in the range of optimum content to obtain thorough compaction.

Place bedding for culverts that are 48 in. or more in nominal horizontal diameter in an approved foundation, shaped using a template that supports the pipe for at least 10 percent of its overall height.

For pipe culverts installed in stormwater management (SWM) facility embankments, place pipe culverts on bedding matching the type and quality conforming to that specified for the surrounding fill material. Ensure pipe culverts are firmly and uniformly bedded throughout the entire length. Perform the work in the presence of the SWM facility As-Built (AB) Inspector.

(c) Laying of Pipes. Lay pipes with hubs upgrade. A single lay hole through the shell of concrete pipe is acceptable with an approved lifting device. Ensure the lay hole is cast in the pipe during fabrication or core it without damaging or exposing any

reinforcement. After installation, permanently seal the lay hole by filling with mortar, rubber plug, or other approved means. Wood plugs may not be used. Lay holes that expose any reinforcement are not acceptable. Do not lay pipe in standing water or when weather conditions are deemed unsuitable by the Engineer.

(d) Joints. Seal pipe joints in a manner appropriate for the applicable pipe material.

(1) Reinforced Concrete Pipe. Seal circular pipe joints using rubber gaskets meeting C433. Seal elliptical pipe joints using preformed flexible joint sealants meeting C990.

(2) Metal Pipe. Use bell and spigot joints with integral rubber gaskets or butt pipes and seal using rubber gaskets with an approved coupling band meeting 905.01.

(3) Plastic Pipe. Use integral bell and spigot joints with flexible elastomeric seals meeting D3212.

(e) Backfill. Ensure all joints have been sealed and are water-tight before placing backfill material. When pipe culverts are installed through SWM facility embankments, use material matching the type and quality conforming to that specified for the surrounding fill material. The presence of large lumps, clods, frozen material, or rocks in the backfill are unacceptable.

Place backfill material along the side of the pipe for the full width of the trench in layers not exceeding an uncompacted depth of 6 in. Compact each layer simultaneously on both sides of the pipe using an approved mechanical tamper and as specified in Section 210. Compact thoroughly under the haunches of the pipe. Continue this method of filling and compacting until the compacted backfill material is at least 9 in. above the top of the pipe for concrete and metal pipe and at least 12 in. above the top of the pipe for plastic pipe. Prevent damage by heavy loads, equipment, and vehicular traffic. Replace any defective or damaged pipe.

Where specified or directed, backfill using Flowable Backfill as specified in Section 314.

For pipe culverts installed through SWM facility embankments with a clay core, place backfill around pipe culverts concurrently with clay core and embankment material adjacent to the pipe trench. Place backfill along the sides of the pipe in layers not exceeding an uncompacted depth of 4 in. Compact each layer simultaneously on both sides of the pipe and with core and embankment materials. Compact material around the pipe using hand tampers or approved mechanical tampers and ensure thorough compaction of material under pipe haunches. Continue this method of filling and compacting until the backfill is completed to at least 8 in. above the top of pipe. Perform the work in the presence of the SWM facility As-Built (AB) Inspector.

Protect pipes from damage due to construction activities. Do not drive equipment within 4 ft when measured horizontally from the pipe nor drive equipment over the pipe until at least 24 in. of compacted fill is over the pipe.

Place detectable utility marking tape in the trench immediately above the structural backfill. Demark the tape as to its purpose, i.e., "STORM DRAIN".

(f) Inspection and Acceptance. Within 30 days following installation, and in the presence of the Engineer, visually inspect all pipe culverts. Any cracks, differential movement, efflorescence, rust stains, spalls, exposed reinforcement, slabbing, dents, buckling, holes, damaged coating, obstructions, improperly engaged joints, improper gasket placement, excessive joint gaps, misaligned joints, excessive deflection, or undue horizontal or vertical misalignment will be cause for repair or replacement. Video inspect pipe which cannot be physically accessed for inspection. Ensure that thermoplastic pipe deflection does not exceed 5 percent.

303.03.02 Mid-Pipe Pipe Culvert Connections. Pipe connections may be either prefabricated or constructed in the field. Use a prefabricated connection unless specified or directed.

For reinforced concrete pipes connecting to other reinforced concrete pipes, a field pipe connection includes cutting a hole in one pipe, inserting and trimming the connecting pipe, and placing a concrete collar using Concrete Mix No. 2 at the connection. Finish the connection to provide a smooth surface.

For corrugated metal pipes, a welded connection may be substituted for the concrete collar when the connection is to other corrugated metal pipes. Coat the weld with a zinc rich paint coating according to M 36. For connections to drainage structures, refer to 305.03.05.

For plastic pipes, use a prefabricated plastic connection matching the pipe material.

When dissimilar pipe materials are encountered, use a junction box as specified in Section 305.

303.03.03 Pipe Culvert Encasement. When specified, encase pipes using Concrete Mix No. 2.

303.03.04 Removal of Existing Pipe Culverts. When specified, remove and dispose of existing pipe culverts. Use backfill material that is similar to the adjacent material and compact as specified in Section 208, Section 210, or Section 701, whichever is applicable.

303.03.05 Reinstallation of Existing Pipe Culverts. When specified, remove, salvage, and reinstall pipe culverts as specified in 303.03.01.

303.03.06 Abandoned Pipe Culverts. Plug abandoned pipe culverts using Concrete Mix No. 2 or brick masonry as specified in 463.03. Fill pipes with Flowable Backfill as specified in Section 314.

303.03.07 Clean Existing Pipe Culverts. When specified, clean existing pipe culverts, removing all sediment and debris without damaging the pipe, pipe joints, or connecting structures. Remove and dispose of sediment and debris as specified in Section 308.

303.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all applicable excavation, sheeting, shoring, dewatering, hauling, storing, rehandling of material, removal and disposal of excess and unsuitable material, tamped fill, forming bed, foundation, grouting, masonry, bedding, pipe, backfill, compaction, inspection, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

303.04.01 New pipe culverts will be measured complete in place and paid for at the Contract unit price per linear foot for the pertinent size and type of pipe. When a new pipe is installed in the same location as an existing pipe, the cost of removal and disposal of the existing pipe, including end walls and end sections, will not be measured but the cost will be incidental to the Contract price of new pipe.

Detectable utility marking tape will not be measured but will be incidental to the Contract price of pertinent pipe item.

303.04.02 Pipe connections will be measured and paid for at the Contract unit price per each for the pertinent size and type of pipe connection. No deduction from the new pipe measurement will be made for pipe connections. Connections to drainage structures with prefabricated holes in which the pipe will be connected with grout or mortar will not be measured, but the cost will be incidental to the pertinent pipe culvert item.

303.04.03 Pipe elbows will be measured and paid for at the Contract unit price per each for the pertinent size and type of pipe elbow.

303.04.04 Excavation required below the planned elevation will be measured and paid for as specified in 301.04.

303.04.05 Selected Backfill will be measured and paid for as specified in Section 302.04.

303.04.06 Flowable Backfill will be measured and paid for as specified in Section 314.04.

303.04.07 Select Borrow will be measured and paid for as specified in Section 203.04.

303.04.08 Common Borrow will be measured and paid for as specified in Section 203.04.

303.04.09 Pipe Bedding Backfill will be measured and paid for at the Contract unit price per cubic yard.

303.04.10 Stormwater Management (SWM) Facility Embankment Clay Core Borrow will be measured and paid for at the Contract unit price per cubic yard.

303.04.11 Pipe culvert encasement will be measured and paid for at the Contract unit price per cubic yard of Mix 2 Concrete for Miscellaneous Structures.

303.04.12 Removal of Existing Pipe will be measured and paid for at the Contract unit price per linear foot. The size and type of pipe will not be measured but will be incidental to the Contract unit price. Removal of existing end walls and existing end sections associated with the pipe will not be measured but the cost will be incidental to the Contract price.

303.04.13 Reinstallation of existing pipe culverts will be measured and paid for at the Contract unit price per linear foot for Relaid Existing Pipe Culverts Any Size. The size and type of pipe will not be measured but will be incidental to the Contract price.

303.04.14 Abandoned pipe culverts will be measured and paid for at the Contract unit price per cubic yard for Flowable Backfill for Pipe Abandonment.

303.04.15 Plugs for abandoned pipe culverts and plugs to create a permanent blockage of the flow of water will be measured and paid for at the Contract unit price per cubic yard of Mix 2 Concrete for Miscellaneous Structures or Brick Masonry for Miscellaneous Structures.

303.04.16 Cleaning existing pipe culverts will be measured and paid for at the Contract unit price per linear foot for Clean Existing Pipe Any Size. The size and type of pipe will not be measured but will be incidental to the Contract price. Removal of construction debris and sediment will not be measured for payment.

CATEGORY 300
DRAINAGE

SECTION 304 — STRUCTURAL PLATE PIPE AND STRUCTURAL PLATE PIPE ARCH CULVERTS

304.01 DESCRIPTION

Furnish and install structural plate pipe and structural plate pipe arch culverts.

304.02 MATERIALS

No. 57 Aggregate	901.01
Crusher Run Aggregate CR-6	901.01
Curing Compound	902.07.03
Portland Cement Concrete	902.10, Mix No. 2
Structural Plate for Pipe and Pipe Arches	Section 905
Detectable Utility Marking Tape	921.11

304.03 CONSTRUCTION

304.03.01 Fabrication. Submit working drawings, including erection diagrams and strutting tables, for approval. Include proposed lengths and lifting locations of preassembled sections in the erection diagrams. Upon approval, shop fabricate the plates, including all required holes, to the required dimensions. Ship the plates complete, with proper markings and all necessary connection devices.

Ensure the plate configurations have radii and curvature according to AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications. When bottom plates of circular pipes are specified to the thicker than top and side plates, cover at least 25 percent of the periphery of the circle with the thicker plate. For pipe arches, the thicker plates include corner plates as well as bottom plates. Lay these culverts on a firm bed, true to the specified line and grade.

Along those edges of the plates that will form longitudinal seams in the finished structure, stagger bolt holes in rows 2 in. apart, with one row in the valley and one in the crest of the corrugations unless otherwise specified. Along those edges of the plates that will form circumferential seams in the finished structure, provide a bolt spacing of not more than 12 in. Ensure the diameter of the bolt holes in the longitudinal seams do not exceed the diameter of the bolt by more than 1/8 in.

Shop cut all edges to line and grade and keep them free from oxide and burrs. Stagger connections so that no more than three plates come together at any one point. Form plates to provide lap joints.

304.03.02 Excavation. When a structural plate pipe or structural plate pipe arch is to be laid on existing ground, on or under fill, construct embankment to a height of at least 18 in., but not more than 3 ft above the proposed top of the pipe. Then excavate the trench to a width of twice the outside diameter of the pipe or the outside diameter plus 18 in. on each side, whichever is less. Handle excavated material as specified in 402.03.01.

304.03.03 Foundation Preparation. Provide bedding as specified in 303.03.01(b). Set rails and then screed the foundation to the exact shape of the bottom plates immediately prior to erection.

304.03.04 Erection. When strutting is required, ensure it is uniform from end to end. Keep struts in place until backfilling is complete. Tighten nuts and bolts to between 100 ft lb and 200 ft lb of torque.

When washers are specified, place them under the turned element. Distribute bolts over the section being assembled. Align holes by shifting the plates. For bottom plates, place the nuts inside the structure. Do not draw the nuts tight until the section is assembled. Before placing backfill, tighten all nuts and test to ensure it meets specified torque requirements.

304.03.05 Backfill

The presence of large lumps, clods, frozen material, or rocks in the backfill are unacceptable.

Place backfill material along the side of the pipe for the full width of the trench in layers not exceeding an uncompacted depth of 6 in. Compact each layer simultaneously on both sides of the pipe using an approved mechanical tamper and as specified in Section 210. Compact the backfill thoroughly under the haunches of the pipe.

Continue this method of filling and compacting until the compacted backfill material is at least 18 in. above the top of the structure. For structures without headwalls, begin placing backfill at the center of the structure. If the structure includes headwalls or spandrel walls, begin placing backfill at one wall and work toward the opposite side. When batteries or multi-barrel installations are specified, elevate backfill between cells equally on each side of each pipe or pipe arch.

Protect pipes from damage due to construction activities. Do not drive equipment within 4 ft when measured horizontally from the pipe nor drive equipment over the pipe until at least 24 in. of compacted fill is over the pipe.

Place detectable utility marking tape in the trench immediately above the structural backfill. Demark the tape as to its purpose, i.e., "STORM DRAIN".

Inspection and Acceptance. Within 30 days following installation, and in the presence of the Engineer, visually inspect all pipe culverts. Any cracks, differential movement, efflorescence, rust stains, spalls, exposed reinforcement, slabbing, dents, buckling, holes, damaged coating,

obstructions, improperly engaged joints, improper gasket placement, excessive joint gaps, misaligned joints, excessive deflection, or undue horizontal or vertical misalignment will be cause for repair or replacement. Video inspect pipe which cannot be physically accessed for inspection. Ensure that thermoplastic pipe deflection does not exceed 5 percent

304.03.06 Concrete Invert. When specified, pave the pipe or arch pipe invert using Concrete Mix No. 2. Place and cure the concrete as specified in Section 420.

304.03.07 End Treatment. Shop fabricate the ends of structural plate pipes and structural plate pipe arches on a bevel to fit and be flush with the slope and alignment of the surface through which they protrude, except that where an end wall or masonry slope protection is specified, shop fabricate the ends to fit that construction. Ensure the ends of all structural plate pipes and structural plate pipe arches that require an end treatment (end wall or slope protection) contain hook bolts for anchorage into the concrete.

Furnish and install headwalls for structural plate pipes and pipe arches as specified in Section 305. Unless otherwise specified, construct these structures parallel to the proposed outer edge of the roadway shoulder.

304.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all applicable fabrication, assembly, excavation, sheeting, shoring, strutting, dewatering, hauling, invert paving, storing, rehandling of material, removal and disposal of excess and unsuitable material, tamped fill, foundation preparation, backfill, bedding, compaction and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

304.04.01 Structural Plate Pipe and Structural Plate Pipe Arch Culverts will be measured and paid for at the Contract unit price per linear foot. The basis of measurement and payment will be as follows: measure the top length and the bottom length and average. The average length will be the pay length for each pipe in the structure. For multiple pipes, the length will be totaled to obtain the total pay length.

304.04.02 Excavation required below the planned elevation will be measured and paid for as specified in 301.04.

304.04.03 Selected backfill will be measured and paid for as specified in 302.04.

304.04.04 Headwalls will be measured and paid for as specified in 305.04.

V CATEGORY 300
DRAINAGE

SECTION 305 — MISCELLANEOUS STRUCTURES

305.01 DESCRIPTION

Construct miscellaneous cast in place concrete or masonry drainage structures, furnish and install precast concrete drainage structures, and clean existing drainage structures including but not limited to inlets, manholes, junction boxes and risers.

Apply integral color admixture to concrete structures when specified. Apply sandblast finish to the completed, colored drainage structures.

305.02 MATERIALS

No. 57 Aggregate	901.01
Mortar Sand	901.01
Curing Compound	902.07.03
Portland Cement Concrete	902.10, Mix No. 2, 3, or 6
Grout	902.11
Brick	903.02
Mortar	903.06
Reinforcement Steel	Section 908
Steel	909.02
Castings for Frames, Covers, Gratings and Steps	909.04
Zinc Coating	A153
Precast Concrete End Walls, Inlets, and Manholes	M 199

305.03 CONSTRUCTION

Refer to Section 420 for Portland cement concrete, Section 463 for brick masonry, and 402.03.01 for excavated material.

305.03.01 Construction Sequence. Complete the underground drainage structures before placing the roadway surfacing. Manholes, catch basins, and inlets shall not be completed to final grade until the grading has been finished and all necessary arrangements have been made to ensure suitable connections and tie ins at proper grade and alignment with pavements, gutters, and curbs.

305.03.02 Castings. Set frames for grates and covers for inlets and manholes, in full beds of mortar and rigidly secure them in place to the specified grade and alignment.

305.03.03 Pipe Connections. Set or cut inlet and outlet pipes flush with the inside face of the structure. Extend them a sufficient distance beyond the outside face of these walls to provide for making proper connections. Completely and neatly close the joint around the pipe in the structure wall with mortar or other specified materials.

305.03.04 Inverts. When drainage structures contain two or more pipes, construct channeled inverts conforming to the Contract Documents.

305.03.05 Drainage Structures. Provide two blockouts, each at least 8 in. diameter, in inlets and manholes for underdrains. Backfill with No. 57 aggregate for a width of 1.5 ft outside of the structure and extended from the bottom of the structure to the subgrade.

305.03.06 Precast Drainage Structures. For structures not detailed in the Contract Documents, submit working drawings for approval.

Certification. Certification from the manufacturer is required for each shipment of precast units. Provide a copy of the certification to the Engineer, the Laboratory, and the Contractor with each shipment. One copy shall remain at the plant. Include the name and address of the manufacturer, the type of structure, the identification number, the date of manufacture, the date of shipment, a statement indicating conformance with the Specifications, and the signature of the quality control manager. Mark the unit with the station number and designation, the identification number, the name or trademark of the manufacturer, the date manufactured, and stamp indicating conformance with the Specifications.

Do not ship any precast unit without complete documentation showing that all materials meet specifications as specified in 305.02 or the Contract Documents; or without complete identification markings as specified in Section 440, Section 905, and Section 915.

Place and consolidate at least 6 in. of No. 57 aggregate bedding under the unit.

Integral Colored Concrete Structures. Where specified, cast storm water management structures using integral concrete color pigment admixture. Add pigment admixture to the concrete according to the manufacturer's recommendations. Ensure uniform coloration throughout the structure.

Sandblasted Finish. Apply sandblast finish to colored drainage structures. Allow concrete to cure to sufficient strength so that is will not be damaged by blasting but not less than seven days. Apply Class 1 (Brush) finish involving a one pass brush blast which will remove the cement matrix and expose the fine aggregates only. No exposed coarse aggregate is allowed. Meet all local air pollution regulations. Ensure the safety of the workers. Equip each blaster with an air-fed helmet. Ensure that areas immediately adjacent to the sand-blasting operation are cleaned-up.

Sample Panel. Prior to casting drainage structures with integral concrete color pigment admixture, provide a sandblasted 2 ft x 2 ft x 4 in. sample panel at the construction site for color and finish approval. Ensure subsequent structures requiring integral color match the sample panel. Maintain the sample at the construction site as a basis for comparison with the structures.

305.03.07 Clean Existing Drainage Structures. Clean existing drainage structures and dispose of the material. Reset and anchor existing grates as directed.

305.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, concrete, masonry, special or precast units, reinforcement, ladder rungs, drip stones, No. 57 aggregate, underdrain stubs, frames, grates and covers, grade and slope adjustments, backfill, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

305.04.01 Standard Inlets and Manholes will be measured and paid for at the Contract unit price per each. When a structure exceeds the standard minimum depth an additional payment will be made for the excess depth at the Contract unit price per linear foot for the pertinent Vertical Depth item.

305.04.02 Standard End Walls, Headwalls, End Sections, and Special Structures will be measured and paid for at the Contract unit price per each.

305.04.03 Nonstandard End Walls and other miscellaneous structures such as steps, spring boxes, and junction boxes, constructed using brick masonry or concrete will be measured and paid for at the Contract unit price per cubic yard, unless otherwise specified.

305.04.04 Stormwater Management Risers will be measured and paid for at the Contract unit price per cubic yard of Concrete Mix 3 which includes gasket, watertight seals, trash racks, orifice plates, low flow and dewatering pipe stubs and safety rails.

305.04.05 No separate or additional measurement will be made for any precast concrete units, metal, or castings used in the construction of any of the items noted above.

305.04.06 Cleaning Existing Drainage Structures will be measured and paid for at the Contract unit price per each, regardless of type, size, or depth of the structure.

305.04.07 When an existing drainage structure is to be removed and replaced with a new drainage structure in the same location, the cost to remove the existing drainage structure and a section of the existing pipe will be incidental to the cost of the new drainage structure.

305.04.08 Integral colored concrete will not be measured but will be incidental to the applicable precast or cast in place concrete item. The payment will include integral concrete color pigment admixture, sandblast finish, clean-up and all material, labor, equipment, tools and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

SECTION 306 — UNDERDRAINS, SUBGRADE DRAINS, AND SPRING CONTROL

306.01 DESCRIPTION

Construct underdrains, subgrade drains, underdrain for spring control, underdrain pipe outlets, and blind drains using pipe, geotextile, and granular material. Clean existing underdrain outlets.

306.02 MATERIALS

No. 57 Aggregate	901.01
Portland Cement Concrete	902.10, Mix No. 2
Pipe	Section 905
Geotextile, Class as specified	Section 919
Securing Pins or Staples	919.03
Flexible Delineator Post and Rodent Screens	As approved by the Office of Materials Technology

306.03 CONSTRUCTION

Coordinate the field installation of traffic barrier, signs, lighting, and landscaping with the Engineer to avoid any damage to the underdrains, subgrade drains, or outlet pipes. Correct any damage to the underdrains, subgrade drains, or outlet pipes.

306.03.01 Excavation. Excavate trenches to the specified dimensions and grade. Ensure that the sides and bottom of trenches are smooth and uniform to prevent tearing of the geotextile when backfilling. For excavated material, refer to 402.03.01.

306.03.02 Geotextile. Place geotextile when specified. Place it with the machine direction parallel to the longitudinal direction of the trench. Ensure that it is of sufficient width to completely enclose the underdrain trench, including specified overlaps.

Place the geotextile tightly against the underdrain trench to eliminate voids beneath the geotextile. Avoid wrinkles and folds. Maintain at least a 24 in. overlap at joint ends or breaks. Pin joints and overlaps to securely hold the geotextile in place until placement of the cover material. Pin longitudinal joints, overlaps, and edges no more than 50 ft on center.

Replace or repair damaged geotextile.

306.03.03 Pipe Placement. Slope the underdrain pipe to maintain positive drainage toward the outlet. Place perforated pipes with the perforations down and arranged symmetrically about the vertical axis. Plug the ends of trunk lines, wyes, tees, or ells as directed. Make joints and connections in accordance with the manufacturer's recommendations.

306.03.04 Outlets. Outlet the underdrains into drainage structures whenever possible. Outlets that empty into a drainage structure shall be at least 9 in. above the normal flow line in the structure and be constructed of normal underdrain outlet pipe. Maintain at least 18 in. of cover over the pipe. Rodent screens are not required when an underdrain outfalls into a drainage structure.

When outfalled into a slope or ditch, slope the outlet pipe at least three percent. Use Type 'S' (smooth interior wall) polyethylene (PE), or smooth-wall polyvinyl chloride profile wall (PPWP) pipe as specified in Section 905. Construct a sloped concrete headwall with a removable rodent screen at the end of the outlet pipe. Place a flexible delineator post on the slope headwall.

Space outlets for longitudinal underdrains at intervals no more than 250 ft and at the lowest elevation on all vertical curves. When changing the direction of the longitudinal underdrain or outlet pipe, ensure all bends have a radius of at least 3 ft.

306.03.05 Backfill. Backfill trenches to the specified dimensions and grades. Backfill underdrain and outlet trenches as the work progresses.

(a) Underdrain. Lightly tamp aggregate backfill, and screed or rake to provide proper thickness and grade.

(b) Outlets. Backfill as specified in Section 210.

Replace geotextile, underdrain pipe, and outlet pipe damaged by excessive tamping.

Cover longitudinal underdrain with the next pavement layer within 72 hours. Cover all other underdrain within 48 hours. Protect underdrain, including the geotextile, from contamination by soil fines. Replace or repair clogged geotextile and any underdrain trench that becomes contaminated.

306.03.06 Video Inspection and Acceptance. Perform a video inspection of all new longitudinal underdrain and outlets in the presence of the Engineer, as part of final acceptance. Correct all damage as directed.

306.03.07 Cleaning Existing Outlets. Clean existing underdrain pipe outlets and dispose of the material. Remove and replace existing rodent screens. Where there are no screens, install them as directed.

306.03.08 Permanent Subgrade Drains. Construct permanent subgrade drains when specified. Subgrade drains consist of trenches excavated through the shoulder and roadside grading from the edges of the road pavement to a side ditch, embankment slope, or other approved outlet and filled with aggregate. Locate subgrade drains at low points, and space them at 25 ft intervals for a

distance of 125 ft on each side of the low point, then at intervals of 100 ft to within 125 ft of the high point. Before placing the road pavement and before completion of the shoulder paving or final roadside grading areas, cut and shape trenches to a width of 24 in. Place No. 57 aggregate to the underside of the shoulder material and to the underside of the specified topsoil thickness in the roadside grading area. The portion of the trench within the roadside grading area shall be completely wrapped in geotextile. The bottom of the trench at the end adjacent to the road pavement shall be at least 2 in. below the subgrade.

306.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, pipe, coupling bands, aggregate, backfill, geotextile, video inspection, and all material, labor, equipment, tools, and incidentals necessary to complete the work.

306.04.01 Underdrains, Underdrain Pipe Outlets, Subgrade Drains, and Underdrain Pipe for Spring Control will be measured and paid for at the Contract unit price per linear foot.

Slope headwalls, rodent screens, and marker posts will not be measured but will be incidental to the cost of the Underdrain Outlet.

306.04.02 When an underdrain pipe is not used for spring control, all excavation and backfill for spring control will be measured and paid for at the Contract unit price per cubic yard for Class 3 Excavation for Incidental Construction and Aggregate Backfill for Underdrain.

306.04.03 When directed by the Engineer, excavation for underdrains, subgrade drains, and underdrain for spring control required to lower the trench to an elevation deeper than specified in the Contract Documents will be measured and paid for at the Contract unit price per cubic yard for Class 3 Excavation for Incidental Construction and Aggregate Backfill for Underdrain.

306.04.04 When measuring the length of a manufactured connection (tee, elbows, etc.) other than coupling bands, each actual linear foot will be doubled and payment made at the Contract unit price per linear foot for the appropriate underdrain pipe item specified in the Contract Documents.

306.04.05 Cleaning Existing Underdrain Outlets will be measured and paid for at the Contract unit price per each. The payment will be full compensation for locating outlets, removing and replacing the existing rodent screens, removal and disposal of material removed from the pipe, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

SECTION 307 — PREFABRICATED EDGE DRAINS

307.01 DESCRIPTION

Construct prefabricated edge drain systems and underdrain pipe outlets.

307.02 MATERIALS

Outlet Pipe	Section 905
Select Borrow	Section 916
Prefabricated Edge Drain and Fittings	Section 922

307.03 CONSTRUCTION

Install prefabricated edge drains according to the manufacturer's recommendations. For drains with support on only one side, place the support side away from the pavement edge. For excavated material, refer to 402.03.01.

307.03.01 Trenches for Prefabricated Edge Drains. Excavate using a trencher. Make the trenches as narrow as possible, but no more than 10 in. Ensure that the drain is in direct contact with the pavement. Perform the excavation of the trench, placement of the edge drain, and placement of the first lift of backfill in a single continuous operation.

307.03.02 Splices. Make splices prior to placement in the trench; in accordance with the manufacturer's recommendations and as approved by the Engineer.

Solid Central Cores (unconnected two sided flow). Use crossover couplings at all splices and at 200 ft intervals.

307.03.03 Connections to Outlets. Use fittings recommended by the manufacturer.

Space outlets at 200 ft intervals and at the lowest elevation on all vertical curves. Construct outlets as specified in 306.03.04.

307.03.04 Backfilling of Trenches. Unless otherwise specified, use approved material generated from the trenching operation. Use Select Borrow whenever additional backfill material is needed.

Backfill in two layers, with the first layer being placed simultaneously with the drain, holding the drain flush against the side of the pavement. Use a vibratory shoe compactor.

307.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for excavation, backfill, compaction, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

307.04.01 Prefabricated Edge Drains and Outlet Pipe will be measured and paid for at the Contract unit price per linear foot.

307.04.02 Additional backfill material authorized by the Engineer will be measured and paid for at the Contract unit price per cubic yard for Select Borrow Excavation.

CATEGORY 300
DRAINAGE

SECTION 308 — EROSION AND SEDIMENT CONTROL

308.01 DESCRIPTION

Install and maintain erosion and sediment control (ESC) measures and best practices throughout the duration of the Contract as specified in the Contract Documents, regulations, associated regulatory approvals, and associated regulatory permits.

308.01.01 ESC Approved Plans. The portion of the Contract Documents consisting of the ESC plans bearing the pertinent regulatory approvals from the Administration's Plan Review Division (PRD), the Anne Arundel Soil Conservation District (AASCD; applies to the Severn River Watershed area only), and inclusive of all approved revisions and modifications thereto.

308.01.02 Training, Certifications, and Accounts. The Erosion and Sediment Control Manager (ESCM) and the Superintendent shall have valid certification of successful completion of the Maryland Department of the Environment (MDE) "Responsible Personnel Certification Training for Erosion and Sediment Control" and the Administration's "Erosion and Sediment Control Certification Training for Contractors and Inspectors." The ESCM and the Superintendent shall hold valid certifications throughout the duration of the Contract.

The ESCM and the Superintendent shall maintain active accounts in the Quality Assurance (QA) Toolkit, as specified in 308.01.06, throughout the duration of the Contract.

308.01.03 Conformance Requirements. In addition to the Contract Documents, conform with the latest applicable regulations, regulatory approvals, regulatory permits, installation details, and other documents, including but not limited to, the following.

(a) Annotated Code of Maryland and the Code of Maryland Regulations (COMAR) 26.17.01 (Erosion and Sediment Control), 26.17.02 (Stormwater Management), 26.17.04 (Construction on Nontidal Waters and Floodplains), and 26.17.06 (Water Appropriation or Use).

(b) Title 9 of the Environment Article, Annotated Code of Maryland and COMAR 26.08.04.

(c) The provisions of the Federal Clean Water Act (CWA), 33 U.S.C. §1251 et seq., as amended by the Water Quality Act of 1987, and its implementing regulations at 40 Code of Federal Regulations (CFR) Parts 122, 123, 124, 125 and 127.

(d) 23 CFR §I.G. Part 650 Subpart B.

(e) 23 U.S.C. 109 Standards (2020) Subsection (g).

(f) 40 CFR Part 110, 40 CFR Part 117, and 40 CFR Part 302.

(g) 40 CFR part 112 and Section 311 of the CWA.

(h) 40 CFR 122.26(a)(1)(v) or 40 CFR 122.26(b)(15)(ii).

(i) 40 CFR 122.26(b)(14)(x) or 122.26(b)(15)(i).

(j) 40 CFR 122.44(i)(1)(iv).

(k) 40 CFR 144 -147.

(l) General Permit for Stormwater Discharge Associated with Construction Activity General National Pollutant Discharge Elimination System (NPDES) Permit Number MDRC0000 State Discharge Permit Number 20CP0000 and all updates and revisions thereto.

(m) ESC Handbook, which refers to the handbook codified in COMAR 26.17.01 titled "2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control", or its successor.

(n) MDE "2000 Maryland Stormwater Design Manual," Volumes I and II or its successor.

(o) MDOT SHA "Field Guide for Erosion and Sediment Control" and all updates and revisions thereto.

(p) MDE Waterway Construction Guidelines.

308.01.04 Erosion and Sediment Control Manager (ESCM). The ESCM is responsible for the implementation of the ESC measures and methods of operations, including but not limited to the implementation of corrective actions. The ESCM shall have the authority to implement ESC, schedules, and methods of operation for both on-site and off-site activities.

When the Contract Documents indicate a limit of disturbance (LOD) greater than or equal to 1 acre, the ESCM shall also be a member of the Stormwater Team as specified in 308.01.07.

ESCM duties include the following.

(a) Attend the pre-construction meeting.

(b) Attend the initial ESC field meeting and periodic field meetings to evaluate the effectiveness of ESC measures installed and to plan for the implementation of additional measures for subsequent areas of soil disturbance, which includes developing a list of activities and schedules to ensure compliance with the Contract

Documents and conformance requirements as specified. Must be on site at a frequency and duration to ensure compliance and as specified in 308.03.03.

(c) Perform daily inspections of the installed ESC measures and ensure they are always in place and functioning.

(d) Maintain a daily log of the ESC inspections that includes documenting steps taken for corrective actions, and submit a daily written report to the Engineer at the end of each calendar day.

(e) Conduct inspections after a storm event of 0.25 inches and greater, within 24 hours, either the same day the rainfall event concludes or the next day, concurrently with the Engineer, submitting a written report documenting observations and corrective actions, to the Engineer.

(f) Authorize mobilization of crews 24 hours a day each calendar day to make immediate repairs and implement corrective actions to ESC measures. Coordinate with the Engineer and the Regional Environmental Coordinator (REC) to ensure that all deficiencies are immediately corrected, and that Contract remains in compliance.

(g) When requested, accompany the Engineer and REC during compliance inspections and inspections made by regulatory agency personnel.

(h) Ensure prohibited discharges per 308.01.03(l) are not released and measures are in place to prevent prohibited discharges from occurring.

(i) Ensure dewatering activity and turbidity monitoring is performed, recorded, documented, and ensure documentation includes corrective actions taken.

308.01.05 Severe Weather Event. A weather event in which measured rainfall exceeds 3 in. in a continuous 24 hour period based upon rainfall data obtained from the nearest official National Weather Service (NWS) gauge station in proximity to the specific location of construction activities or from a gauge used on the project site as specified in 308.03.02 (c), or as otherwise determined by the Administration.

308.01.06 Quality Assurance (QA) Toolkit. A web-based system that contains Contract and permit information, ESC inspection reports, stormwater management (SWM) facility as-built certification package submittals and tracking and may be used to submit requests for field modifications to the ESC Approved Plans, as well as track the status thereof, as instructed by the Administration's "Quality Assurance Toolkit Construction Field Manual." (https://apps.roads.maryland.gov/epd.qatoolkit/frmLogin.aspx)

308.01.07 Stormwater Team. When the Contract Documents indicate an LOD greater than or equal to 1 acre, the Administration will establish a stormwater team. The stormwater team is not involved with permanent stormwater management (SWM) facilities in any way and is instead a team focused on ESC and pollution prevention during construction activities.

The stormwater team includes personnel who are responsible for the following.

(a) Compliance with the installation, maintenance, and repair of ESC measures and pollution prevention.

(b) Conducting inspections as specified.

(c) Taking corrective actions.

The stormwater team shall have sufficient knowledge of requirements associated with the installation, maintenance, and removal of ESC measures, stabilization, locations of ESC measures and how they are to be maintained, procedures to follow, and when and how to conduct inspections, record applicable findings, and take corrective actions. The stormwater team shall have ready and easy access to the specified documents and reports.

308.02 MATERIALS

Riprap	901.02.01
Stone for Channels and Ditches	901.03
Stone for Slopes	901.04
Stone for Gabion	901.05
4 in. to 7 in. Stone	901.05
Asphalt Mixes	Section 904
Pipe	Section 905
Gabion Wire	Section 906
Steel Plate	909.02
Welding Material	909.03
Fence Fabric for Super Silt Fence	914.01.01
Geotextile, Woven and Non-Woven	919.01, Class E
Geotextile, Woven Slit Film	919.01, Class F
Soil Amendments	920.02
Compost	920.02.05, Type C
Fertilizer	920.03
Mulch	920.04
Soil Stabilization Matting	920.05
Seed and Turfgrass Sod	920.06
Straw Bales	921.08
2 in. to 3 in. Stone	M 43, No. 2
3/4 in.to 1-1/2 in. Stone	M 43, No. 4
No. 57 Stone	M 43, No. 57

308.02.01 Filter Log Casing. Produced from 5 mils thick continuous high-density polyethylene or polypropylene, woven into a tubular mesh netting material with openings in the knitted mesh of 1/8 in. to 3/8 in.

308.02.02 Metal Posts for Super Silt Fence. Galvanized steel or aluminum posts having 2-3/8 in. diameters and are 84 in. long.

308.03 CONSTRUCTION

308.03.01 Preliminary Activities. Prior to beginning construction activities, complete the following.

(a) Attend the Pre-Construction Meeting and present a general overview of how ESC measures shall be implemented for the Contract.

(b) Assign an Erosion and Sediment Control Manager (ESCM) and submit to the Engineer the name and credentials of the ESCM for approval. The ESCM shall hold valid certifications as specified in 308.01.02.

308.03.02 Erosion and Sediment Control (ESC) Preparation. Prior to establishing staging (heavy use) areas or stockpile areas, and prior to beginning grading and other earth disturbing activities, complete the following.

(a) Attend the Initial ESC Meeting with the Engineer and the Regional Environmental Coordinator (REC) to discuss, at a minimum, ESC for the project, responsibilities, corrective action procedures, and modification procedures. When the Contract Documents indicate an LOD greater than or equal to 1 acre, the meeting shall include an invitation to a representative from the Maryland Department of the Environment's (MDE's) Compliance Program (MDE Compliance Inspector and the establishment of the Stormwater Team.)

(b) When the Contract Documents indicate an LOD greater than or equal to 1 acre, post at a safe, publicly accessible location in proximity to the construction area(s), a notice of National Pollutant Discharge Elimination System (NPDES) permit coverage for stormwater discharges associated with construction activities.

Locate the notice such that it is visible from the public right of way that is nearest to the construction activities. (For linear work zones that extend over several miles and for which a posting may be insufficient to provide notice of permit coverage, submit proposed alternatives of notification to the Engineer, who will coordinate with the REC and the MDE Compliance Inspector for approval.)

The notice shall include the following, be accessible to the public, and be a minimum of 24 in. by 36 in.

(1) The Contract Number and project name as listed on the permit.

(2) The permittee as MDOT SHA.

(3) The words "General Permit for Stormwater Associated with Construction Activity" and the permit authorization number.

(c) Submit, to the Engineer and REC for acceptance and approval, the location of the nearest official National Weather Service (NWS) gauge station or submit a proposal to install a gauge station for the specific location(s) of work. Proposals shall include detailed information regarding the type, location, accuracy, methodology, and security of the rain gauge.

The rain gauge shall meet NWS large 20 in. gauge standards and have a measuring stick, overflow can, collector funnel, and an inner measuring tube that holds 2 in. of precipitation. The rain gauge shall use aluminum supports and be installed to where the bottom of the gauge is approximately 10 in. to 15 in. above the ground.

(d) Demarcate all wetlands, wetland buffers, 100-year floodplains, waters of the United States (WUS), tree protection areas, stream protection zones (SPZs), special protection areas, and LOD as specified in Section 107. Ensure the demarcations are inspected and accepted by the Engineer.

308.03.03 ESCM and Superintendent. Do not commence work without an approved ESCM and a Superintendent meeting the certification requirements as specified in 308.01.02. (The Contractor may elect to have the Superintendent serve as the ESCM.)

Do not perform excavation, grading, or dewatering activities without the presence of the ESCM. When excavation, grading, or dewatering activities require an alternate ESCM, submit to the Engineer for approval the name and credentials of an alternate ESCM meeting the certifications as specified in 308.01.02. Inform the Engineer when the alternate ESCM will be responsible.

If the certifications for the ESCM expire or are revoked, cease construction activities and immediately submit to the Engineer for approval the name and credentials of a new ESCM meeting the certifications as specified in 308.01.02. Resume construction activities when directed by the Engineer.

The Administration reserves the right to require reassignment of the ESCM duties to another individual at any time with detailed justification.

If the certifications for the Superintendent expire or are revoked, cease construction activities and immediately replace the Superintendent with another meeting the requirements as specified in 308.01.02. Resume construction activities when directed by the Engineer.

Proactively prevent deficiencies. Promptly resolve deficiencies identified by the Regional Environmental Coordinator (REC) and maintain compliant quality assurance ratings. Refer to 308.03.07.

308.03.04 Off-Site Waste Areas. Obtain approvals and permits from the appropriate jurisdictional authority for off-site waste areas that are not included in the Contract Documents

and coordinate with the Engineer. Provide a copy of the approvals and permits to the Engineer, who will place in the Contract records.

308.03.05 MDE Inspections. All areas associated within the Contract are subject to routine, periodic, scheduled, unscheduled, and random field inspections by one or more MDE Compliance Inspectors. If non-compliance is found, the MDE Compliance Inspector will immediately notify the Engineer and require corrective actions. The non-compliance and/or corrective actions may require a shutdown of construction activities until the non-compliance is satisfactorily resolved.

308.03.06 Field Modifications. Alternatives or variations to the ESC Approved Plans, including but not limited to changes to the ESC sequence of construction, location and placement of ESC measures, type of ESC measures, additional or redundant ESC measures, location of staging (heavy use) areas within the LOD, and location of stockpiles within the LOD, may be submitted, at the option of the Contractor, to the Administration for approval. Such alternatives are known as ESC field modifications.

Submit modification requests to the Administration using the Quality Assurance (QA) Toolkit at least 14 days prior to the desired time to implement the change. When an ESC field modification request changes the LOD for projects in which the LOD is greater than or equal to 1 acre, submit modification requests at least 30 days prior to the desired time to implement the change. Requests to change the total LOD for projects in which the total LOD is less than 1 acre but will equal or exceed 1 acre as a result of the ESC field modification are unacceptable.

Submit ESC field modifications overlaid on the pertinent ESC Approved Plans. Ensure requested ESC field modifications to the ESC Approved Plans are submitted in PDF format, that changes are blue in color, and are overlayed on the pertinent full-size ESC Approved Plans, typically 36 in. x 24 in. in size. Ensure the ESC field modifications adhere to the standard symbology and names of ESC measures used in the Contract Documents and conform to 308.01.03. Ensure the request is legible, clear, and easily understood.

The Administration reserves the right to require ESC field modifications to be prepared, stamped, and sealed by a Professional Engineer, licensed in the State of Maryland.

Do not implement ESC field modifications until they have been approved via the QA Toolkit; however, if MDE or another regulatory authority directs ESC field modifications, or if the Engineer determines a modification is needed to prevent discharges, immediately implement the direction and follow up with a submission in the QA Toolkit.

308.03.07 Quality Assurance Ratings. The REC will routinely inspect the project to ensure compliance with the Contract Documents with regards to ESC and Stormwater Management (SWM). The REC will assign scores based on these inspections. The scores will be reported on Form No. OOC61/QA-1: Erosion/Sediment Control and Stormwater Management Field Investigation Report. The REC will use the scores to determine the following ratings.

QUALITY ASSURANCE RATING TABLE	
SCORE	**RATING**
≥90.0	A
80.0 - 89.9	B
70.0 - 79.9	C
60.0 - 69.9	D
< 60.0	F

(a) Rating A. A project complies. Corrections to deficiencies may be necessary.

(b) Rating B. A project generally complies. Corrections to deficiencies are necessary.

(c) Rating C. A project marginally complies. Corrections to deficiencies are necessary. Shutdown conditions may arise quickly. The REC will reinspect within 72 hours. If the deficiencies have not been satisfactorily corrected, a 'D' rating will be issued. Inspection frequency may increase.

If a consecutive 'C' rating is issued, the REC will reinspect after 72 hours. Failure to achieve a 'B' or better rating will result in a 'D' rating.

(d) Rating D. A project is in non-compliance. Corrections to deficiencies are necessary. The Administration will shut down earthwork operations and will impose liquidated damages for each day of a 'D' rating. The REC will reinspect within 72 hours. Inspection frequency may increase.

Failure to achieve a 'B' or better rating will result in an 'F' rating and the entire project will be shutdown. Liquidated damages will be imposed for each day of a 'F' rating. Inspection frequency may increase.

(e) Rating F. A project is in non-compliance. Corrections to deficiencies are necessary. An 'F' rating indicates one or more of the following.

(1) A score of less than 60.

(2) Required permits and approvals have not been obtained or have expired.

(3) The approved LOD has been exceeded.

(4) Sensitive areas as specified have been encroached upon without prior necessary and adequate approval.

(5) The work is not proceeding in conformance with the Contract Documents.

The Administration will shut down earthwork operations until all deficiencies are satisfactorily corrected and ’B’ or better rating is achieved. The Administration will impose liquidated damages for each day of a 'F' rating. Inspection frequency may increase.

Following an initial ‘F’ rating, subsequent ‘F’ ratings will result in the following until a ‘B’ rating or better is achieved.

(i.) The Administration will shut down the entire project.

(ii.) The ESC Training Certificate (Yellow Card) issued by the Administration will be immediately revoked from the Superintendent, and the ESCM responsible at the time of the subsequent rating, for no less than six-months and during which time access to the QA Toolkit will be restricted, after which time the individual may be eligible to take the Administration’s “Erosion and Sediment Control Certification Training for Contractors and Inspectors” (Yellow Card) again. Upon meeting 308.01.02, they may resume their former roles on the project.

(iii.) If degradation to a sensitive area, protected resource, or Waters of the State occurs or has already occurred, or if corrective actions have not been taken, the Administration may elect to have corrective actions performed by another contractor or by Administration personnel.

308.03.08 Severe Weather Event. Maintain, repair, remove and reset, or replace damaged or dysfunctional ESC measures, and install missing ESC measures, beginning within 24 hours following a severe weather event, and as safe conditions prevail as determined by the Engineer.

308.03.09 Prohibited Discharges. Prevent the release of prohibited discharges throughout the duration of the Contract.

308.03.10 Stabilization Requirements. Following initial soil disturbance, complete temporary or permanent stabilization as specified.

308.03.11 Stabilized Construction Entrance (SCE). Construct stabilized construction entrances (SCEs) as specified. Rehabilitate SCEs with periodic top dressing using additional aggregate, replacing the drainage pipe beneath the SCE when one is installed, or making other repairs to the SCE and sediment trapping devices.

When necessary and as directed, place wash racks to prevent tracking of mud and sediment.

308.03.12 Side or Berm Ditches and Culverts. Construct side ditches in fill areas and berm ditches in cut areas. Protect linings from sediment deposits. Place silt fence along the banks of existing streams as specified prior to placing culverts. To help avoid sedimentation during construction, divert the streams around the location of the culvert until the p**r**oposed culvert and channel are stabilized as specified.

308.03.13 Erosion and Sediment Control Original Excavation. Excavate, construct embankments, grade, and backfill for sediment traps, sediment basins, and other pertinent ESC measures.

308.03.14 Erosion and Sediment Control Cleanout Excavation. Remove accumulated sediment from ESC measures and other areas during routine inspection and maintenance of ESC measures when necessary and as directed, per the ESC Handbook.

Dispose of removed sediment as excess or unsuitable material. Alternatively, removed sediment may be reused once it is dried and if it meets embankment requirements unless otherwise specified.

308.03.15 Heavy Use Areas. Heavy use areas may be used for staging and for storage of equipment and non-erodible materials. Locate heavy use areas using optional areas that may be identified for use in the Contract Documents. For locations within the approved LOD, these areas may not be shared with other entities not directly performing work on the Contract.

Alternatively, obtain property owner permission and appropriate regulatory approvals and permits for off-site locations from the appropriate jurisdictional authority(ies) and coordinate with the Engineer. Provide copies of documented permission, approvals, and permits to the REC and Engineer, who will keep copies of the documents with the Contract records. Do not allow approvals and permits to expire for the duration of the Contract or as long as the location(s) is (are) needed.

308.03.16 Stockpile Areas. Stockpile areas may be used for the storage of erodible materials, including but not limited to sand and soils. Locate stockpile areas using the optional areas that may be identified for use in the Contract Documents. For locations within the approved LOD, these areas may not be shared with other entities not directly performing work on the Contract.

Alternatively, obtain property owner permission and appropriate regulatory approvals and permits for off-site locations from the appropriate jurisdictional authority(ies) and while coordinating with the Engineer. Provide copies of documented permission, approvals, and permits to the REC and the Engineer who will keep copies of the documents with the Contract records. Do not allow approvals and permits to expire for the duration of the Contract or as long as the location(s) is (are) needed.

308.03.17 Onsite Concrete Washout Structures. Locate onsite concrete washout structures and cleanout activities as far away as practical from sensitive areas, Waters of the State, stormwater inlets, and stormwater conveyances. Direct wash water into an approved leak-proof container or leak-proof and lined pit designed so that no overflows occur due to inadequate sizing or precipitation.

Do not dump washout or cleanout wastes, solid and liquid, in storm sewers or Waters of the State. Dispose of at an approved facility.

308.03.18 Earth Dike (ED). Do not use sod as vegetative stabilization unless directed.

308.03.19 Temporary Swale (TS). Do not use sod as vegetative stabilization unless directed.

308.03.20 Perimeter Dike/Swale. Do not use sod as vegetative stabilization unless directed.

308.03.21 Pipe Slope Drain. When slope drain is placed on grade, construct interceptor berms to direct flow into the flared end section.

308.03.22 Riprap Inflow Protection. Construct as specified in Section 312.

308.03.23 Rock Outlet Protection (ROP). Construct as specified in Section 312.

308.03.24 Gabion Outlet Protection. Construct as specified in Section 313.

308.03.25 Gabion Inflow Protection. Construct as specified in Section 313.

308.03.26 Super Silt Fence (SSF). Use a 7-gauge top tension wire continuously between posts.

308.03.27 Filter Berms (FB). Use wood chips and up to 50 percent compost.

308.03.28 Filter Log. Use compost for filter media. Drive stakes perpendicular to water flow at a maximum of 8 ft intervals. Restrict vehicular and construction traffic from crossing filter logs. Once the drainage areas to filter logs are permanently stabilized with vegetation, with concurrence of the Engineer and the REC, remove stakes. Filter logs may remain in place and vegetated or removed. If remaining in place, cut filter log casings open, remove all non-biodegradable material, spread the compost as a soil supplement, and perform the pertinent vegetative establishment.

308.03.29 Temporary Stone Outlet Structure (TSOS). Permanently stabilize the area immediately after removal of the structure.

308.03.30 Temporary Gabion Outlet Structure (TGOS). Construct as specified in Section 313. Grade and stabilize the area beneath the structure, immediately upon removal.

308.03.31 Dewatering. Dewater only when conditions facilitate successful operations and does not alter stream clarity. When dewatering discharges flow to Tier II stream or Waters of the State indicated as having an impairment of sediment or a sediment-related parameter, comply with benchmark monitoring for turbidity.

Minimize the discharge of pollutants from dewatering operations as follows.

(a) Route dewatering water through ESC measures designed to minimize discharges of pollutants and prevent discharges from altering visual turbidity or clarity.

(b) Do not discharge visible floating solids or foam.

(c) To the extent feasible, use well-vegetated, upland areas of the site to infiltrate dewatering water before discharge. Do not use Waters of the State as part of the treatment area.

(d) Use stable, erosion-resistant surfaces, including but not limited to well-vegetated grassy areas, clean filter stone, or geotextile underlayment, to discharge from dewatering controls.

(e) Do not place dewatering operations on steep slopes.

(f) At all points where dewatering water is discharged, use velocity dissipation measures.

(g) With backwash water, either remove and dispose or return it to the beginning of the treatment process.

(h) For filter bags, determine filter bag dimensions necessary to provide the required storage volume, determine pump and hose sizes, and install. Do not place filter bags on steep slopes.

(i) For portable sediment tanks, determine the dimensions necessary to provide the necessary storage volume.

308.03.32 Sediment Traps. Excavate and grade sediment traps to the specified length, width, and depth.

When grading and paving operations are complete and permanent vegetative stabilization within the drainage areas to sediment traps, including slopes and channels, have been applied and those areas are vegetated with at least a 3 inches of growth, with the concurrence of the Engineer and the REC refill sediment traps with suitable materials, shape, and permanently stabilize as specified.

308.03.33 Stone for Sediment Control. Place No 57 aggregate, 3/4 in. to 1-1/2 in. stone, 2 in. to 3 in. stone, 4 in. to 7 in. stone, and riprap as specified.

308.03.34 Maintenance of Stream Flow. Maintain the continuous flow of waterways as specified. Ensure that all excavation performed within the protected stream area is performed in a dewatered condition, which may require additional pumps, sheeting, shoring, cofferdams, and other measures.

With concurrence of the Engineer and REC, adjust stream diversion as necessary to ensure satisfactory performance of the diversion, using additional ESC measures and equipment as appropriate.

Always securely anchor the stream diversion system in place to prevent movement during high water and storm events. Submit to the Engineer for approval the method of anchoring before implementing. Do not install anchors beyond the LOD or infringe on the available channel area for stream flow.

Upon completion of construction and when temporary drainage devices are no longer necessary, with the concurrence of the Engineer and the REC, remove the stream diversion.

308.03.35 Removal of ESC Measures. Do not remove ESC measures until all disturbed areas have been permanently stabilized, vegetation is at least 4 inches tall, exhibits dark green color, and has achieved at least 95 percent groundcover. Do not remove ESC measures without concurrence from the REC and the Engineer.

308.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Replacement of Erosion and Sediment Control measures that are damaged and replaced as a result of a Severe Weather Event will be measured and paid for at the Contract unit prices provided that a Quality Assurance Rating of "B" or better was obtained in the previous rating. Other damages as a result of an event are subject to TC-7.03.

Maintenance, repairs, rehabilitation, removal, and corrective actions of and to ESC measures will not be measured, but the cost will be incidental to the Contract price for the pertinent item.

The cost of posting a notice of National Pollutant Discharge Elimination System (NPDES) permit coverage for stormwater discharges associated with construction activities will be measured and paid per the temporary sign item.

Corrective actions, due to one or more 'F' ratings or are otherwise necessary due to degradation to sensitive areas, protected resources, or Waters of the State due to the Contractor's action or in-action, directly or indirectly, or performed by Administration personnel or another contractor under the direction of the Administration will be at the Contractor's expense.

308.04.01 Erosion and Sediment Control Manager (ESCM). The Erosion and Sediment Control Manager will not be measured but the cost will be incidental to the Erosion and Sediment Control items. Replacement of the Erosion and Sediment Control Manager with a new Erosion and Sediment Control Manager will be at no additional cost to the Administration.

308.04.02 Claims. No claims against the Administration will be considered due to a shutdown of the grading operations or the entire project that resulted from non-compliance. When corrective actions are performed by another contractor or by the Administration, all costs associated with the work will be billed to the original Contractor.

308.04.03 Incentive Payments and Liquidated Damages Amounts. Applicable amounts as specified.

308.04.04 Incentive Payments. When incentive payments are specified payment schedule is as follows, beginning at the Notice to Proceed.

(a) Rating Quarters and Quarterly Incentive Payments. A rating quarter is a three-month period in which at least 4 inspections are performed by the Regional Environmental Coordinator. An average score of at least 85.0 for the entire quarter is necessary to receive the quarterly incentive amount. Payment will be made within 60 days from the end of the quarter. No incentive will be paid for partial quarters or for three-month periods with less than 4 inspections by the Regional Environmental Coordinator. Time extensions approved by the Administration that increase the number of eligible rating quarters will be drawn from the Final Incentive Payment.

(b) Disqualification for Incentive Payments. Ratings quarters in which a 'D' or 'F' rating occurs and/or a Maryland Department of the Environment enforcement action is issued are disqualified from the quarterly incentive for the quarter(s) in which they occurred, regardless of the average score for those entire quarter(s) and no payment will be made.

(c) Final Incentive Payment. When no 'D' or 'F' ratings have been received, the average score for the Contract is at least 85.0, and no Maryland Department of the Environment enforcement actions have been issued, the final incentive payment will be made at Final Closeout in the amount specified or the remaining amount if additional eligible rating quarters were added by time extensions approved by the Administration.

308.04.05 Liquidated Damages. When 'D' or 'F' ratings are received, liquidated damages will be assessed, and deductions imposed.

308.04.06 Stabilized Construction Entrance (SCE). Stabilized Construction Entrance will be measured and paid for at the Contract unit price per each.

When drainage pipe under the Stabilized Construction Entrance is specified, the pipe will not be measured but the cost will be incidental to the Stabilized Construction Entrance item.

308.04.07 Wash Racks for Stabilized Construction Entrance. Wash Racks for Stabilized Construction Entrance will be measured and paid for at the Contact unit price per each.

308.04.08 Erosion and Sediment Control Original Excavation. Erosion and Sediment Control Original Excavation will be measured and paid for at the Contract unit price per cubic yard.

308.04.09 Erosion and Sediment Control Cleanout Excavation. Erosion and Sediment Control Cleanout Excavation will be measured and paid for at the Contract unit price per cubic yard.

308.04.10 Temporary Mulch. Temporary Mulch will be measured and paid for as specified in 704.04.01.

308.04.11 Temporary Seed. Temporary Seed will be measured and paid for as specified in 704.04.02.

308.04.12 Turfgrass Sod. Turfgrass Sod will be measured and paid for as specified in 708.04.01.

308.04.13 Soil Stabilization Matting (SSM). Soil Stabilization Matting will be measured and paid for as specified in 709.04.

308.04.14 Heavy Use Area Protection. Heavy use area protection will not be measured but the cost will be incidental to the pertinent Erosion and Sediment Control measures.

308.04.15 Stockpile Areas. Stockpile areas will not be measured but the cost will be incidental to the pertinent Erosion and Sediment Control measures.

308.04.16 Earth Dike (ED). Earth Dike will be measured and paid for at the Contract unit price per linear foot. 4 inch to 7 inch. stone, temporary seeding, and soil stabilization will be measured and paid for as specified in 308.04.60, 704.04, and 709.04, respectively.

308.04.17 Temporary Swale (TS). Temporary Swale will be measured and paid for at the Contract unit price per linear foot. 4 inch to 7 inch stone, temporary seeding, and soil stabilization matting will be measured and paid for as specified in 308.04.60, 704.04, and 709.04, respectively.

308.04.18 Perimeter Dikes/Swales. Perimeter Dikes/Swales will be measured and paid for at the Contract unit price per linear foot. Temporary seeding and soil stabilization matting will be measured and paid for as specified in 704.04 and 709.04, respectively.

308.04.19 Temporary Storm Drain Diversion. Temporary Storm Drain Diversion will be measured and paid for at the Contract unit price per linear foot of the size specified.

308.04.20 Temporary Asphalt Berm. Temporary Asphalt Berm will be measured and paid for at the Contract unit price per linear foot for 5 inch Asphalt Berm.

308.04.21 Clear Water Diversion (CWD). Clear Water Diversion will be measured and paid for at the Contract unit price per linear foot of the size specified. The payment will include pipe, connections, anchors, sandbags, sheeting, dewatering, and turbidity monitoring when monitoring is required.

308.04.22 Temporary Barrier Diversion. Temporary Barrier Diversion will be measured and paid for at the Contract unit price per linear foot. The payment will include barrier, sandbags, sheeting, dewatering, and turbidity monitoring when monitoring is required.

308.04.23 Mountable Berm. Mountable Berm will be measured and paid for at the Contract unit price per each.

308.04.24 Diversion Fence. Diversion Fence will be measured and paid for at the Contract unit price per linear foot.

308.04.25 Pipe Slope Drain (PSD). Pipe Slope Drain will be measured and paid for at the Contract unit price per linear foot of the size specified. The payment will include excavation, backfill, flared end section, geotextile, anchors, coupling bands, and pipe elbows.

308.04.26 Stone Check Dam. Stone Check Dam will be measured and paid for at the Contract unit price for one or more of the pertinent items from the following. The payment will include geotextile, excavation, and backfill.

(a) 4 Inch to 7 Inch Stone for Sediment Control. 4 Inch to 7 Inch Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

(b) Washed Aggregate. Washed aggregate will be measured and paid for at the Contract unit price per ton for 3/4 inch to 1-1/2 inch Stone for Sediment Control.

308.04.27 Riprap Inflow Protection. Riprap Inflow Protection will be measured and paid for per ton for Riprap for Sediment Control.

308.04.28 Gabion Inflow Protection. Gabion Inflow Protection will be measured and paid for per cubic yard.

308.04.29 Rock Outlet Protection. Rock Outlet Protection will be measured and paid for at the Contract unit price per square yard for Riprap Slope and Channel Protection.

308.04.30 Plunge Pool. Plunge Pool will be measured and paid for at the Contract unit price per square yard for Riprap Slope and Channel Protection.

308.04.31 Silt Fence (SF). Silt Fence will be measured and paid for at the Contract unit price per linear foot.

308.04.32 Silt Fence on Pavement. Silt Fence on Pavement will be measured and paid for at the Contract unit price per linear foot for Silt Fence.

308.04.33 Super Silt Fence (SSF). Super Silt Fence will be measured and paid for at the Contract unit price per linear foot.

308.04.34 Clear Water Pipe Through Silt Fence or Super Silt Fence. Clear Water Pipe Through Silt Fence or Super Silt Fence will not be measured but the cost will be incidental to the pertinent clear water diversion and silt fence items.

308.04.35 Filter Berm. Filter Berm will be measured and paid for at the Contract unit price per linear foot.

308.04.36 Filter Log. Filter Log will be measured and paid for at the Contract unit price per linear foot for the size specified.

308.04.37 Temporary Stone Outlet Structure (TSOS). Temporary Stone Outlet Structure will be measured and paid for per ton for 2 inch. to 3 inch Stone for Sediment Control. The payment will include the baffle board, stakes, and geotextile.

308.04.38 Temporary Gabion Outlet Structure. Temporary Gabion Outlet Structure will be

measured and paid for at the Contract unit price per each.

308.04.39 Standard Inlet Protection. Standard Inlet Protection will be measured and paid for at the Contract unit price per each for Inlet Protection.

308.04.40 At Grade Inlet Protection. At Grade Inlet Protection will be measured and paid for the Contract unit price per each for Inlet Protection.

308.04.41 Curb Inlet Protection. Curb Inlet Protection will be measured and paid for at the Contract unit per each for Inlet Protection.

308.04.42 Median Inlet Protection. Median Inlet Protection will be measured and paid for at the Contract unit per each for Inlet Protection.

308.04.43 Median Sump Inlet Protection. Median Sump Inlet Protection will be measured and paid for at the Contract unit per each for Inlet Protection.

308.04.44 Combination Inlet Protection. Combination Inlet Protection will be measured and paid for at the Contract unit per each for Inlet Protection.

308.04.45 Gabion Inlet Protection. Gabion Inlet Protection will be measured and paid for at the Contract unit per each for Inlet Protection.

308.04.46 Catch Basin Insert. Catch Basin Insert will be measured and paid for at the Contract unit price per each for Inlet Protection.

308.04.47 Dewatering Practices. Dewatering Practices will be measured and paid for at the Contract unit price for the pertinent dewatering item. The payment will include turbidity monitoring when monitoring is required.

(a) Removable Pumping Station. Removable Pumping Station will be measured and paid for at the Contract unit price per each. The payment will include excavation, pipe, geotextile, wire mesh, steel plate, stone, hose, pump, and connections.

(b) Sump Pit. Sump Pit will be measured and paid for at the Contract unit price per each. The payment will include excavation, pipe, geotextile, wire mesh, steel plate, stone, hose, pump, and connections.

(c) Portable Sediment Tank. Portable Sediment Tank will be measured and paid for at the Contract unit price per each. The payment will include pipe, geotextile, wire mesh, steel plate, hose, pump, and connections.

(d) Filter Bags. Filter Bags will be measured and paid for at the Contract unit price per each. The payment will include pump, hoses, connections, mulch, compost, woodchips, sand, and straw bales.

308.04.48 Sediment Traps. Sediment Traps, including ST-I, ST-II, and ST-III, will be measured and paid for at the Contract unit price for one or more of the pertinent items as follows.

(a) Erosion and Sediment Control Original Excavation. Erosion and Sediment Control Original Excavation as specified in 308.04.08.

(b) Pipe. Pipe as specified in 303.04.

(c) Stone and Aggregate. Stone and Aggregate will be measured and paid for at the Contract unit price for one or more of the pertinent items from the following. The payment will include geotextile, excavation, and backfill.

(1) Riprap for Sediment Control. Riprap for Sediment Control will be measured and paid for at the Contract unit price per ton.

(2) No. 57 Stone for Sediment Control. No. 57 Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

(3) 3/4 Inch to 1-1/2 Inch Stone for Sediment Control. 3/4 Inch to 1-1/2 Inch Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

(4) 2 Inch to 3 Inch Stone for Sediment Control. 2 Inch to 3 Inch Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

(5) 4 Inch to 7 Inch Stone for Sediment Control. 4 Inch to 7 Inch Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

(d) Geotextile. Geotextile will not be measured but the cost will be incidental to the Contact unit price for the pertinent stone and aggregate item(s).

(e) Inflow Protection. As follows.

(1) Riprap Inflow Protection. Riprap Inflow Protection will be measured and paid for per ton for Riprap for Sediment Control.

(2) Gabion Inflow Protection. Gabion Inflow Protection will be measured and paid for per cubic yard.

(f) Baffle Board and Stakes. Baffle board and Stakes will not be measured but the cost will be incidental to the Contract unit price for the pertinent inflow protection item(s).

(g) Temporary Risers. Temporary Risers will be measured and paid for at the Contract unit price per each.

(h) Anti-Seep Collars. Anti-Seep Collars will be measured and paid for at the Contract

unit price per each.

308.04.49 Sediment Basins. Sediment Basins will be measured and paid for at the Contract unit price for one or more of the pertinent items as follows.

(a) Erosion and Sediment Control Original Excavation. Erosion and Sediment Control Original Excavation as specified in 308.04.08.

(b) Pipe. Pipe as specified in 303.04.

(c) Stone and Aggregate. As specified in 308.04.48(c).

(d) Geotextile. Geotextile will not be measured but the cost will be incidental to the Contract unit price for the pertinent stone and aggregate item(s).

(e) Baffle Board and Stakes. Baffle Board and Stakes will not be measured but the cost will be incidental to the Contract unit price for the pertinent stone and aggregate item(s).

(f) Temporary Risers. Temporary Risers will be measured and paid for at the Contract unit price per each. The payment will include trash racks, draw down devices, concrete bases, projection collars, and riser connectors.

(g) Modifying Stormwater Management Riser Structures. Modifying Stormwater Management Riser Structures will be measured and paid for at the Contract unit price per each for Convert Stormwater Management Riser for Sediment Control. The payment will include installing and removing dewatering pipe systems and restoring stormwater management riser structures to the original condition.

(h) Anti-Seep Collars. Anti-Seep Collars will be measured and paid for at the Contract unit price per each.

308.04.50 Temporary Access Bridge. Temporary Access Bridge will be measured and paid for at the Contract lump sum price.

308.04.51 Temporary Access Culvert. Temporary Access Culvert will be measured and paid for at the Contract unit price per linear foot.

308.04.52 Onsite Concrete Washout Structures. Onsite Concrete Washout Structures will not be measured but the cost will be incidental to the pertinent concrete mixes. The payment will include implementation of controls associated with pollution prevention activities.

308.04.53 Vegetative Stabilization. Vegetative Stabilization will be measured and paid for at the Contract unit price for one or more of the pertinent temporary and permanent item(s). Reapplication of the pertinent stabilization to vegetated areas that have been permanently stabilized and are disturbed or re-disturbed as a result of failure to maintain controls, general

negligence, or due to other activities not specifically authorized by the appropriate approval authority will be at no additional cost to the Administration.

308.04.54 Stone and Aggregate for Sediment Control. As follows. Geotextile, excavation, and backfill will not be measured but the cost will be incidental to the Contract price.

(a) Riprap for Sediment Control. Riprap for Sediment Control will be measured and paid for at the Contract unit price per ton.

(b) Class I Riprap for Slope and Channel Protection. Class I Riprap for Slope and Channel Protection will be measured and paid for at the Contract unit price per square yard.

(c) Class II Riprap for Slope and Channel Protection. Class II Riprap for Slope and Channel Protection will be measured and paid for at the Contract unit price per square yard.

(d) No. 57 Stone for Sediment Control. No. 57 Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

(e) 3/4 Inch to 1-1/2 Inch Stone for Sediment Control. 3/4 Inch to 1-1/2 Inch Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

(f) 2 Inch to 3 Inch Stone for Sediment Control. 2 Inch to 3 Inch Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

(g) 4 Inch to 7 Inch Stone for Sediment Control. 4 Inch to 7 Inch Stone for Sediment Control will be measured and paid for at the Contract unit price per ton.

308.04.55 Maintenance of Stream Flow. Maintenance of Stream Flow will not be measured but will be paid for at the Contract lump sum price. Diversion structures necessary to satisfactorily divert the stream flow, anchoring of the system, excavation, backfill, dewatering the site and excavation within the stream diversion area, sandbags, polyethylene sheeting, diversion pipes, pumps, hoses, connections, portable sediment tanks, maintenance, repairs, rehabilitation, removal, removal and resetting, relocation, corrective actions of and to ESC measures, turbidity monitoring when required, and implementation of controls associated with pollution prevention activities especially with regards to stream clarity, cleanup, and restoration of the stream diversion area that is damaged will not be measured, but the cost will be incidental to the Contract lump sum price.

Payment will not be adjusted for alternative stream diversion systems regardless of changes in quantities from that shown in the Contract Documents. No payment adjustments will be made for corrective actions to meet stream clarity discharge requirements.

Cleanup and restoration of the stream diversion area that is damaged and replaced as a result of a Severe Weather Event will not be measured but paid for as specified in TC-7.03.

308.04.56 Sandbags. When Sandbags are specified for use other than when incidental to 304.04.21, 304.04.22, 308.04.55 or otherwise specified as incidental, sandbags will be measured and paid for per cubic yard.

CATEGORY 300
DRAINAGE

SECTION 309 — CONCRETE DITCHES

309.01 DESCRIPTION

Construct concrete ditches and incidental toe walls.

309.02 MATERIALS

Crusher Run Aggregate CR-6	901.01
No. 57 Aggregate	901.01
Curing Materials	902.07
Form Release Compounds	902.08
Portland Cement Concrete	902.10, Mix No. 2
Joint Sealer	911.01
Preformed Joint Filler	911.02
Borrow	Section 916
Soil Stabilization Matting	920.05

309.03 CONSTRUCTION

309.03.01 Excavation. Excavate and prepare the subgrade as specified in Section 602. For excavated material, refer to 402.03.01.

309.03.02 Forms. Use steel or wooden forms meeting Section 603.

309.03.03 Concrete. Mix and place as specified in Section 603.

309.03.04 Joints. Place joints no more than 15 ft apart. Use either bulkhead or weakened plane construction joints. Either tool or saw weakened plane joints to a depth of at least 3/4 in. Place expansion joints no more than 90 ft apart and seal.

309.03.05 Cold Weather Construction and Curing. Refer to 520.03.02 for cold weather construction and to 520.03.12 for concrete curing.

309.03.06 Backfill. After the forms have been removed, place and compact the backfill.

309.03.07 When the existing concrete ditch is removed but not replaced, regrade and stabilize the area as directed.

309.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all concrete, excavation, forms, backfill, curing, disposal of excess or unsuitable material, toe walls, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

309.04.01 Concrete Ditches will be measured and paid for at the Contract unit price per square yard.

309.04.02 The removal and disposal of unsuitable material below the subgrade will be measured and paid for at the Contract unit price per cubic yard for Class 2 Excavation.

309.04.03 When Borrow or Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 is approved by the Engineer as replacement material for the Class 2 Excavation, it will be measured and paid for at the Contract unit price per cubic yard for the pertinent items as specified in the Contract Documents.

309.04.04 Concrete Ditches removed but not replaced will be paid for at the Contract unit price per square yard. The payment will include the cost to dispose of the material, regrading, topsoil, and soil stabilization matting.

CATEGORY 300
DRAINAGE

SECTION 310 — CONCRETE SLOPE AND CHANNEL PROTECTION

310.01 DESCRIPTION

Protect slopes and channels with cast in place concrete and cutoff walls.

310.02 MATERIALS

Crusher Run Aggregate CR-6	901.01
No. 57 Aggregate	901.01
Curing Materials	902.07
Form Release Compound	902.08
Portland Cement Concrete	902.10, Mix No. 2
Welded Steel Wire Fabric	908.05
Joint Sealer	911.01
Preformed Joint Fillers	911.02
Roofing Paper	911.07
Borrow	Section 916

310.03 CONSTRUCTION

310.03.01 Excavation. Excavate, including excavation for cutoff walls, as specified in Section 602. Refer to 402.03.01 for excavated material.

310.03.02 Cast In Place Concrete. Construct cast in place concrete slope protection in alternate strips so that construction joints are all in one direction and that tooled joints run perpendicular to the construction joints. The result shall be a checkerboard pattern having squares of at least 3 ft but not more than 5 ft. The Engineer will determine the size of the squares and the size of squares around curved surfaces. Construct joints and cutoff walls as specified.

310.03.03 Forms. As specified in Section 603.

310.03.04 Concreting. Mix concrete as specified in 915.03.04. Volumetric batching and continuous mixing will be permitted. Prior to placing the concrete, use acceptable methods to dewater areas that are subject to the infiltration of water. Spread and tamp, or otherwise

consolidate the concrete. Strike it off with an approved screed and give the surface a broomed finish. Do not plaster the surface. Use a 1/4 in. edging tool on all edges and joints.

310.03.05 Cold Weather Construction and Curing. Refer to 520.03.02 and 520.03.12 respectively.

310.03.06 Backfill. After removing the forms, place and compact the backfill.

310.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all concrete, forms, excavation, curing, joint sealer and filler, backfill, compaction, disposal of excess or unsuitable material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

310.04.01 Concrete Slope and Channel Protection and Concrete Slope Protection for Streams will be measured and paid for at the Contract unit price per square yard of finished surface.

310.04.02 Cutoff Walls will be measured and paid for at the Contract unit price per linear foot.

310.04.03 The removal and disposal of unsuitable material below the subgrade will be measured and paid for at the Contract unit price per cubic yard for Class 2 Excavation.

310.04.04 When Borrow or Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 is approved by the Engineer as replacement material for the Class 2 Excavation, it will be measured and paid for at the Contract unit price per cubic yard for the pertinent item specified in the Contract Documents.

CATEGORY 300
DRAINAGE

SECTION 311 — RIPRAP DITCHES

311.01 DESCRIPTION

Construct riprap ditches and riprap ditches with capping.

311.02 MATERIALS

Riprap	901.02 and 901.03
Geotextile	Section 919, Class as specified
2 in. to 4 in. Stone	M 43, No. 1

311.03 CONSTRUCTION

311.03.01 Excavation. Excavate to the specified line and grade. Ensure that ditch sides and bottom are smooth and firm, free from protruding objects that would damage the geotextile, and constructed in an acceptable manner. For excavated material, refer to 402.03.01.

311.03.02 Geotextile Placement. Place geotextile on the prepared subgrade with the adjacent edges overlapped at least 2 ft. Replace or repair damaged geotextile as directed.

311.03.03 Riprap Placement. Place stones by mechanical or other acceptable methods to produce a reasonably graded mass of stone. Methods that cause extensive segregation are unacceptable. Place the riprap to the specified depth.

311.03.04 Backfill. Backfill any excavation voids existing along the edges and ends of the placed riprap. Use suitable material to blend in with contiguous slopes, ditch lines, and existing ground. Cap riprap placed in the clear recovery area with a layer of 2 in. to 4 in. stone.

311.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, geotextile, stone, backfill, disposal of excess material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

311.04.01 Riprap Ditches and Riprap Ditches with Capping will be measured and paid for at the Contract unit price per square yard of finished surface.

311.04.02 Bottom Cutoff Walls and Side Cutoff Walls will be measured and paid for at the Contract unit price per linear foot.

CATEGORY 300
DRAINAGE

SECTION 312 — RIPRAP SLOPE AND CHANNEL PROTECTION

312.01 DESCRIPTION

Protect slopes and channels with a covering of geotextile and riprap or an aggregate filter blanket.

312.02 MATERIALS

Aggregate Filter Blanket	901.01, CR-6
Riprap	901.02
Geotextile	Section 919, Class as specified

312.03 CONSTRUCTION

312.03.01 Excavation. Excavate for riprap and cutoff walls to the specified lines and grades. Ensure that the subgrade is smooth and firm, free from protruding objects that would damage the geotextile, and constructed in an acceptable manner. For excavated material, refer to 402.03.01.

312.03.02 Geotextile. Place geotextile on the prepared subgrade with the adjacent edges overlapping at least 2 ft. Replace or repair damaged geotextile as directed.

312.03.03 Aggregate Filter Blanket. When an aggregate filter blanket is specified, construct it to the specified lines and grades and compact it in an acceptable manner.

312.03.04 Riprap Placement. Ensure that the underlying surface is free of brush, trees, and stumps, and is acceptable to the Engineer.

Place the first section of riprap consisting of at least 5 tons, which will be inspected by the Engineer for conformance to gradation and placement requirements. If approved, this section will be used to evaluate quality control for the remainder of the project. If the material is rejected, remove it from the project and place additional sections, each at least 5 tons.

Begin the placement of the riprap with the bottom cutoff walls or toe sections. Place the larger stones in the cutoff walls and along the outside edges of the limits of slope and channel protection. Place the riprap with equipment that produces a uniformly graded mass of stones.

Ensure that the surface elevation of completed riprap installations is flush with adjacent channel bed or bank slope elevations and does not create an obstacle to the flow. Ensure that the outer

riprap surfaces are even and present a generally neat appearance. The plus or minus tolerance of the surface of the finished riprap installation is 3 in. for Class I Riprap and 6 in. for Class II and III Riprap from the lines and grades shown on the Contract Documents when measured perpendicular to the exterior surface of the stonework.

Place and distribute the stone so the resulting layer will contain a minimum of voids and there will be no pockets of same size material. Place the stone to its full course thickness in one operation in a manner that the underlying material is not be displaced or worked into the course of riprap being placed. When an aggregate filter blanket is used, proceed with the placement of the riprap in a controlled manner to avoid disruption or damage to the layer of bedding material.

312.03.05 Backfill. Backfill any excavation voids existing along the edges of the completed slope and channel protection, and compact it in an acceptable manner.

312.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, geotextile, riprap, backfill, compaction, disposal of excess material, prewashing when required, preparation of quality control section, and for all material, labor, equipment, tools and incidentals necessary to complete the work.

312.04.01 Riprap Slope and Channel Protection will be measured and paid for at the Contract unit price per square yard. Area measurements will be actual surface measurements.

312.04.02 Cutoff Walls will be measured and paid for at the Contract unit price per linear foot.

312.04.03 Riprap for Scour Protection will be measured and paid for at the Contract unit price per ton for the item Class II Riprap For Scour Protection.

312.04.04 Aggregate Filter Blanket will be measured and paid for at the Contract unit price per square yard for the depth specified.

CATEGORY 300
DRAINAGE

SECTION 313 — GABIONS

313.01 DESCRIPTION

Protect slopes and channels by placing stone filled wire baskets.

313.02 MATERIALS

Stone for Gabions	901.05
Wire for Gabions	906.01
Geotextile	Section 919, Class as specified

313.03 CONSTRUCTION

313.03.01 Excavation. Excavate, including excavation for cutoff walls, to the specified lines and grades. Ensure that the subgrade is smooth, firm, and free from protruding objects or voids that would affect the proper placement of the wire baskets or damage the geotextile. For excavated material, refer to 402.03.01.

313.03.02 Geotextile. Place geotextile on the prepared subgrade. Overlap adjacent strips at least 2 ft. Replace or repair geotextile damaged during placement of the wire baskets.

313.03.03 Wire Baskets. Begin placement with the cutoff walls. Set the empty units on the geotextile and bind the vertical ends together with wire ties or interlocking fasteners spaced to permit stretching of the units to remove kinks. Use stretching methods that do not damage the baskets. Use stakes, pins, or other approved methods to ensure proper alignment.

313.03.04 Stone. Carefully fill the basket units with stone placed by hand or machine to ensure good alignment with a minimum of voids between stones. Avoid bulging of the mesh. Do not drop the stone from a height greater than 36 inches. Place the stone to provide a minimum of two courses. Place the top layer of stone to a uniform surface. Avoid any bulging of the lid mesh. After a basket unit is filled, bend the lid over until it meets the ends of the unit. Secure the lid to the sides and ends with wire ties or interlocking fasteners. When a complete basket unit cannot be installed because of space limitations, cut the basket unit to fit as directed.

313.03.05 Backfill. Backfill any excavation voids existing along the edges of the completed gabions and compact in an acceptable manner.

313.04 MEASUREMENT AND PAYMENT

Gabions, including cutoff walls will be measured and paid for at the Contract unit price per cubic yard of stone filled wire baskets complete in place. The payment will be full compensation for all excavation, geotextile, stone, ties or fasteners, backfill, compaction, disposal of excess material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

SECTION 314 — FLOWABLE BACKFILL

314.01 DESCRIPTION

Furnish, haul, and place flowable cement stabilized backfill material. When specified, use for utility cut backfill, pipe backfill, or for filling abandoned pipes.

314.02 MATERIALS

Controlled Low Strength Material 902.16

314.02.01 Fillers. When required, fillers shall be natural aggregates with a maximum size of 3/4 in. and may include sands. Bottom ash shall not be used as filler.

314.02.02 Components. Toxic and deleterious components shall not be used in the backfill mixture. The mixture shall have a 28 day, unconfined compressive strength of at least 100 psi based on the manufacturer's certification. Certification shall include the actual test data for each mixture to be used.

314.02.03 Analysis. Chemical analysis of the fly ash used in the mixture shall conform to U.S. EPA EP Toxicity Standards. Whenever the coal source is changed or replenished, and when fly ash from a different source is used, conduct an analysis of the fly ash from each stockpile. Submit the results of the analysis to the Engineer for approval prior to using the mixture.

314.03 CONSTRUCTION

Place the material according to the manufacturer’s recommendations or as directed by the Engineer. Backfill utility trenches full depth to the top of the subgrade. Fill all voids during the backfill operation.

Protect the backfilled utility cut from freezing and traffic for 24 hours. Wait at least 24 hours after backfilling is complete and approved by the Engineer before beginning the paving operations.

Fill abandoned pipes with backfill after each end of the pipe has been adequately plugged. Refer to 303.03.06. Cut two holes into the plug at the upstream end and pump backfill into the pipe through one of the holes until the pipe is filled.

Keep and submit detailed records of all flowable backfill placed. Include the source of the fly ash, the date placed, the location, depth, and the quantity used.

314.04 MEASUREMENT AND PAYMENT

Flowable Backfill will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

SECTION 315 — INFILTRATION TRENCHES

315.01 DESCRIPTION

Install infiltration trenches as specified.

315.02 MATERIALS

Riprap	901.02, Class I
Geotextile	Section 919, Class as specified
Polyvinyl chloride profile wall drain pipe	Section 905
Stone	M 43, No. 2

315.03 CONSTRUCTION

Do not place infiltration trenches in service until all of the contributing drainage area has been stabilized and approved. Restrict heavy equipment and traffic from the proposed infiltration trench location.

315.03.01 Excavation. Remove excavated material from the trench site. Ensure that trench walls and bottom are free of protruding objects that could damage the geotextile. When necessary, slope the trench walls. Ensure that the bottom dimensions and stone depth are as specified. Roughen the side walls of the trench. Grade the bottom of the trench flat. For excavated material, refer to 402.03.01.

315.03.02 Installation. Place geotextile on the sides of the trench and the top of the No. 2 stone. Do not cover the bottom of the trench. The geotextile for the sides of the trench shall overlap the top geotextile by 6 in. to 8 in. Extend the top geotextile the full width and length of the trench. All longitudinal joints in the top geotextile shall overlap at least 6 ins. The upstream roll shall overlap the downstream roll by at least 2 ft, for a shingled effect.

Place an observation well vertically in the longitudinal center of each infiltration trench. Use 6 in. diameter slotted perforated polyvinyl chloride profile wall drainpipe (PPWP). Place the pipe on a base plate at the bottom of the trench. Cap the well using a threaded PVC fitting and a vandal proof sewer cap. Set the cap 6 in. above ground, and mark the depth of the trench on the cap. Provide a plastic collar with ribs to prevent rotation of the well when removing the cap. When soil capping is used, construct the observation well using perforated PPWP within the No. 2 stone and non-perforated pipe through the soil capping.

All stone shall be clean and free of all soil and fines. Place the No. 2 stone in 12 in. lifts with no compaction. Avoid any intermixing of the soil and fines with the stone aggregate. Remove and replace contaminated aggregate. Cap the trench with at least 12 in. of stone or soil as specified.

315.04 MEASUREMENT AND PAYMENT

Infiltration Trenches will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all excavation, stone, capping, riprap, geotextile, pipe, fittings, cap, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 300
DRAINAGE

SECTION 316 — STORMWATER MANAGEMENT (SWM) FILTRATION FACILITIES

316.01 DESCRIPTION

Construct stormwater management (SWM) filtration facilities as specified.

SWM Filtration Facilities Identification. SWM filtration facilities are identified by unique six-digit inventory numbers and include the following designations.

(a) Bioretention.

(b) Micro-Bioretention.

(c) Organic Filters.

(d) Surface Sand Filters.

(e) Submerged Gravel Wetlands.

(f) Landscape Infiltration.

(g) Rain Gardens.

(h) Infiltration Berms.

(i) Bio-swales.

316.02 MATERIALS

No. 57 Aggregate	901.01
No. 7 Aggregate	901.01
No. 2 Aggregate	M 43, No. 2
Portland Cement Concrete	902.10, Mix No. 2
Topsoil	920.01.01 and 920.01.02
Bioretention Soil Mix (BSM)	920.01.05
Coarse Sand	920.01.05(a)(1)

Fertilizer	920.03.01
Shredded Hardwood Bark (SHB) Mulch	920.04.03
Soil Stabilization Matting (SSM)	920.05
Seed and Turfgrass Sod	920.06
Plant Materials	920.07
Water	920.09.01
Geotextile	Section 919, Class PE, Type III
Securing Pins or Staples	Section 919

Aggregate. Ensure aggregate has been adequately washed and is free of soil and fines.

316.02.01 Subdrain Pipe, Fittings, and Geotextile Sock. Subdrain pipe shall include slotted perforated and solid-wall (non-perforated) pipe. Perforated subdrain pipe shall have only two rows of perforations. Use fittings matching the same material as the subdrain pipe and is otherwise compatible with the subdrain pipe. Use subdrain pipe, fittings, and geotextile sock for subdrain, cleanouts, and observation wells.

(a) Subdrain Pipe. Pipe material for perforated subdrain pipe may be one of the following.

(1) Polyvinyl chloride (PVC) profile wall drain pipe (PPWP) with soiltight joints, slotted perforations not to exceed 0.12 in. in width with a minimum water inlet area of 1 $in.^2/ft$ (for pipe diameters 6 in. to 10 in.) or 1.5 $in.^2/ft$ (for 12 in. diameters), and meeting M 304.

(2) Corrugated polyethylene drainage pipe (CPP) Type SP with Class 2 slotted perforations having a minimum water inlet area of 1 $in.^2/ft$ (for pipe diameters 3 in. to 10 in.), and meeting M 252.

(b) Subdrain Pipe Cleanouts. Pipe material for non-perforated or solid wall subdrain pipe used for cleanouts may be one of the following and compatible with the subdrain pipe used in 316.02.01(a).

(1) Polyvinyl chloride (PVC) profile wall drain pipe (PPWP) with soiltight joints and meeting M 304.

(2) Corrugated polyethylene drainage pipe (CPP) Type S and meeting M 252.

(c) Observation Wells. Pipe material used for observation wells shall be as specified in 316.02.01(a) for the perforated portion of observation wells and 316.02.01(b) for the solid-wall portion of observation wells. Use the geotextile sock recommended and supplied by the subdrain pipe manufacturer and use only to cover the perforated pipe portion of observation wells.

316.03 CONSTRUCTION

316.03.01 Site Protection. Prior to constructing SWM filtration facilities, ensure that the SWM facility site areas are protected from vehicular traffic and are not used for erosion and sediment controls, stockpiles or equipment storage.

316.03.02 Site Preparation. Unless facilities are off-line and will receive no runoff, construct facilities only after all surrounding and adjacent areas are permanently stabilized. Divert flow from entering the SWM filtration facility areas unless same-day stabilization is specified for the SWM filtration facility location. Prevent trash, debris and sediment from entering SWM filtration facilities during construction.

316.03.03 Schedule. Perform SWM filtration facility activities during dry weather and when soil moisture conditions are suitable and unless the facility is off-line or flow diversions are in place. Only work with soil that is friable and not in a muddy or frozen condition. Cease operations when soil and overall conditions are otherwise unsuitable.

316.03.04 Excavation. Use methods of excavation that minimize compaction of the underlying soils. Where feasible, operate equipment from locations adjacent to SWM filtration facilities rather than within the facility area. Use only wide-track or marsh-track equipment, or light equipment with turf-type tires to excavate, grade, and place materials. Do not use equipment with narrow tracks or narrow tires, rubber tires with large lugs, or high-pressure tires.

316.03.05 Excavation Area Bottom Preparation. Only work with soil that is friable and not in a muddy or frozen condition. When present, remove any standing water from the excavation area. Prepare the bottom of the excavated area as follows.

(a) Submerged Gravel Wetlands. Rake surface to loosen soil.

(b) All Other SWM Filtration Facilities. Till to a minimum depth of 8 in. to loosen soil.

316.03.06 Geotextile. Place tightly against the vertical sides of the excavation area, pulling tight to eliminate wrinkles and folds and pin securely. Eliminate any voids between the geotextile and the underlying soil and avoid wrinkling and folding the geotextile. Maintain a minimum 12 in. overlap at the geotextile joint ends or breaks. Pin longitudinal joints, overlaps and edges securely with pins spaced no greater than 10 ft on center. Do not place geotextile on the bottom of the excavated area.

316.03.07 Miscellaneous Structures. Furnish and install as specified in Section 305.

316.03.08 Aggregate. Place aggregate in layers as specified. Prevent soil, fines, and other debris from contaminating the aggregate. Remove contaminated aggregate and replace with clean aggregate.

316.03.09 Subdrain Pipe. Cap the ends of all subdrain pipe not terminating in a cleanout, vent, or drainage structure unless otherwise specified. Ensure perforations are placed on the bottom of the horizontal subdrain pipe runs.

(a) Cleanouts. Install solid-wall pipe vertically and connect to horizontal subdrain with approved manufactured connections. Provide a counter-sunk screw cap on the exposed ends.

(b) Vents. Install solid-wall pipe vertically and connect to the horizontal subdrain with approved manufactured connections. Provide a ventilated screw cap on the exposed ends. Ventilation holes or slots shall be no larger than 1/4 in. in diameter or width. The sum total area of the openings shall be no less than 1 in^2. Ensure that the ventilation openings are above the maximum specified water surface elevation.

(c) Observation Wells. Use perforated and solid-wall pipe. Place the geotextile sock over the perforated pipe portion and secure at both ends. Provide a screw cap on the exposed end extending 2 in. above the surface. When a concrete collar is specified, ensure the top of the well is flush with the surface of the concrete collar.

316.03.10 Coarse Sand. Place coarse sand in horizontal layers not exceeding 12 in. After each lift, spread the coarse sand to provide a uniform surface then spray or sprinkle water to saturate the lift until water flows from the subdrain outlet. Use an appropriate sediment control device to capture any discharged sediment-laden water from the subdrain outlet. Place, spread, and water coarse sand to uniform surface true to depth, line, cross section, and elevation to ensure the completed work is as specified after settlement. Prevent soil, fines, and other debris from contaminating the coarse sand. Remove contaminated coarse sand and replace with clean coarse sand.

316.03.11 Bioretention Soil Mix (BSM). Place BSM in horizontal layers not exceeding 12 in. After each lift, spread the BSM to provide a uniform surface and spray or sprinkle water to saturate the entire area of BSM until water flows from the subdrain outlet. Use an approved sediment control device to capture any discharge sediment-laden water. Place, spread, and water BSM to uniform surface true to depth, line, cross section, and elevation to ensure the completed work is as specified after settlement. Prevent soil, fines, and other debris from contaminating the BSM. Remove contaminated BSM and replace with uncontaminated BSM.

316.03.12 Topsoil. Place topsoil as specified. Do not blend topsoil into BSM when topsoil is placed on top of BSM.

316.03.13 Check Dams.

(a) Topsoil Check Dams. Construct topsoil check dams to the dimensions, grades, and depths specified.

(b) Concrete Check Dams. Furnish and install concrete check dams as specified and as specified in Section 305.

316.03.14 Soil Stabilization Matting (SSM). As specified in Section 709.

316.03.15 Vegetation Installation and Establishment. Unless facilities are off-line or flow diversions are in place, install seed, sod, trees, shrubs, perennials, and annuals within SWM filtration facility areas immediately after final grading. In the event that vegetation cannot be installed and established due to time-of-year or weather restrictions, keep diversion controls in place until such time that permanent vegetation may be established. Do not use machinery other than hand held within the BSM footprint.

(a) Turfgrass Establishment. As specified in Section 705.

(b) Meadow Establishment and Wildflower Seeding. As specified in Section 707.

(c) Turfgrass Sod Establishment. As specified in Section 708.

(d) Tree, Shrubs and Perennial Installation and Establishment. As specified in Section 710.

(e) Annuals & Bulb Installation and Establishment. As specified in Section 711.

316.03.16 Soil Amendments and Fertilizer. Apply as specified in Sections 705, 706, 707, 708, 710, or as specified. Use the following for plant materials installed in BSM.

(a) Non-Vegetated BSM. Do not apply compost, other soil amendments, or fertilizer to non-vegetated BSM.

(b) Trees, Shrub, and Perennials in BSM. Do not apply compost or other soil amendments to backfill soil or to planting beds.

Apply fertilizer to each planting pit as specified in 710.03.04 when trees, shrubs, perennials, perennial plugs, or other plant materials are installed in BSM as specified in Section 710.

(c) Seeded or Sodded BSM. Do not apply compost or other soil amendments.

Uniformly apply either of the fertilizers in Table 1 at the rate specified over the installed surface of the BSM when BSM will be permanently vegetated with Turfgrass Establishment, Shrub Seeding Establishment, Meadow Establishment, Turfgrass Sod Establishment, or other seeded or sodded vegetation establishment as specified.

BIORETENTION SOIL MIX TABLE 1 - FERTILIZER APPLICATION RATES		
FERTILIZER	**LB PER SY**	**LB PER ACRE**
20-16-12 (83% UF with MAP and SOP)	0.052	200
14-14-14 polymer coated or granular	0.062	275

(d) Nutrient Management Reporting. Record the fertilizer analysis, the square yards covered, and the pounds of fertilizer applied on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying fertilizer.

(e) Fertilizer. Refer to 316.03.16(b). Rake fertilizer that is broadcast over the surface of the BSM for seeding or sodding to a depth of 1/8 in. to 1/2 in. Raking may be performed as part of seeding or sodding operations. Complete raking before soil stabilization matting or sod is installed.

316.03.17 Shredded Hardwood Bark (SHB) Mulch. As specified in 710.03.13.

316.03.18 Inspection and SWM Facility As-Built Certification. Inspect and document each step of construction of SWM filtration facilities and complete the applicable checklists and furnish the SWM facility as-built certification according to the Contract Documents and Section 317.

316.04 MEASUREMENT AND PAYMENT

Payment will be full compensation for all control of discharge from subdrain pipe, geotextile, watering, sheeting, shoring, dewatering, hauling, storing, re-handling of material, removal and disposal of excess and unsuitable material, tilling, grading and slope adjustments, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Excavation. Excavation will be measured and paid for as specified in Section 201.

Miscellaneous Structures. Miscellaneous Structures will be measured and paid for per cubic yard of the specified mix concrete.

Aggregate. Aggregate will be measured and paid for at the Contract unit price for one or more of the following.

(a) No. 2 Aggregate for Stormwater Management Facilities per cubic yard.

(b) No. 7 Aggregate for Stormwater Management Facilities per cubic yard.

(c) No. 57 Aggregate for Stormwater Management Facilities per cubic yard.

Removal of contaminated aggregate and replacement with clean aggregate will be at no additional cost to the Administration.

Geotextile. Geotextile will not be measured but the cost will be incidental to the excavation.

Subdrain Pipe. Perforated and solid-wall subdrain pipe will be measured and paid for at the Contract unit price per linear foot for the specified size of subdrain pipe. Fittings, caps, geotextile sock, cleanouts, vents, observation wells, and other incidentals will not be measured but the cost will be incidental to the subdrain pipe.

Coarse Sand. Coarse Sand will be measured and paid for at the Contract unit price per cubic yard for Coarse Sand for Stormwater Management Facilities.

Removal of contaminated coarse sand and replacement with uncontaminated coarse sand will be at no additional cost to the Administration.

Check Dams. Check dams will be measured and paid for at the Contract unit price for one or more of the following.

(a) Topsoil Check Dams per each.

(b) Concrete Check Dams per each.

Bioretention Soil Mixture (BSM). Bioretention Soil Mixture will be measured and paid for at the Contract unit price per cubic yard.

Removal of contaminated Bioretention Soil Mixture and replacement with clean Bioretention Soil Mixture will be at no additional cost to the Administration.

Water. Water used for saturation of coarse sand and Bioretention Soil Mixture will not be measured but the cost will be incidental to the pertinent items.

Shredded Hardwood Bark (SHB) Mulch. Shredded Hardwood Bark Mulch will be measured and paid for at the Contract unit price per square yard for Shredded Hardwood Bark Mulching, 3 in. depth.

Sediment Control for Discharge from Subdrain Pipe Outlets. Control for any sediment-laden discharge from subdrain pipe outlets will not be measured but will be incidental to the pertinent Erosion and Sediment Control items.

Topsoil. As specified in 701.04.

Vegetation Installation and Establishment. Vegetation installation and establishment will be measured and paid for at the Contact unit price for the pertinent landscaping items as specified in 705.04, 707.04, 708.04, 710.04 and 711.04.

Soil Stabilization Matting. As specified in 709.04.

Stormwater Management (SWM) Facility As-Built Certification. As specified in 317.04.

CATEGORY 300
DRAINAGE

SECTION 317 — STORMWATER MANAGEMENT (SWM) FACILITY AS-BUILT CERTIFICATION

317.01 DESCRIPTION

Submit a certification package that affirms that stormwater management (SWM) facilities and practices are constructed as specified or are functionally equivalent to the designs in the approved SWM Report, revising the certification package as needed until final acceptance.

317.01.01 SWM As-Built Engineer. The SWM As-Built Engineer (ABE) is responsible for assembling and certifying the SWM certification package. Duties include adequately documenting that the SWM facilities have been constructed as specified, and performing inspections during pertinent construction activities for SWM facilities and practices. The ABE shall be a Professional Engineer (P.E.) registered and licensed in the State of Maryland and who has at least three years of experience in SWM facility design and SWM facility construction. Submit one copy of the ABE's resume to the Engineer. The resume shall include the following.

(a) Full name of the ABE, License No. and expiration date.

(b) Name of employing company or firm.

(c) Contact information.

(d) Relevant work experience.

(e) Proof of valid certification of the Maryland Department of the Environment (MDE) Responsible Personnel for Erosion and Sediment Control training course (formerly "Green Card"). Note: All certifications for the former course MDE Responsible Personnel Training for Erosion and Sediment Control ("Green Card") expired on December 31, 2016 and are no longer valid.

The ABE shall have the option to use designees, who are under the direct supervision of the ABE, to perform the following duties on behalf of the ABE.

(a) Documenting that the SWM facilities have been constructed as specified, including writing activity inspection reports, taking photographs, and obtaining copies of material approvals and material test results.

(b) Performing inspections during pertinent construction activities for SWM facilities and practices, completing the pertinent portions of the SWM facility as-built certification data tables.

When the ABE elects to use designees, submit the names and resumes indicating their experience in the design and inspection of SWM facilities, of those designees authorized by the ABE to represent the ABE to the Engineer. Only authorized designees may represent the ABE for the limited duties specified.

317.01.02 SWM Facility As-Built Certification Package. The SWM facility as-built certification package contains documentation that verifies that that all SWM facilities and practices on the Contract have been constructed as specified or are functionally equivalent to the designs in the approved SWM Report.

The SWM facility as-built certification package shall include the following for each SWM facility in the Contract, presented neatly and legibly, and organized in an easy-to-follow format.

(a) SWM facility construction inspection reports. The inspection reports shall include the following.

(1) The SWM facility identification number (BMP No. or SWM Fac. No.) and type of SWM facility or practice.

(2) The date and location of the activity.

(3) Photographs, taken during inspections, that clearly show the construction activities as listed on the pertinent SWM facility as-built data tables, with narrative descriptions of what appears in the photographs, the dates the photographs were taken, and the locations.

(4) Verification of whether SWM facility as-built construction is as specified, noting any deviations from the Contract Documents and how the deviations have been addressed.

(b) Photographs of SWM facilities and practices after all landscaping has been installed and established, with narrative descriptions of what appears in the photographs.

(c) Copies of pertinent material approval forms.

(d) Copies of pertinent material and installation test reports and results.

(e) Completed as-built certification data tables.

(f) Green line as-built surveys of the SWM facilities and practices signed and sealed by a Professional Land Surveyor (PLS) who is registered and licensed in the State of Maryland. The as-built survey data shall be overlaid on the appropriate Contract plan

sheet(s) and profile sheets, at the same scale and datum, and are coordinately correct. The as-built survey data shall be green in color, clearly legible and easily distinguishable from the Contract Document information. The SWM facility as-built surveys shall include the following.

(1) Contours. One-foot contour intervals or otherwise match the contour intervals shown in the Contract Documents. Contours shall cover the entire footprint of the SWM facility or practice as well as inflow and outflow conveyances when ditches or similar features convey runoff into or out of SWM facilities and practices.

(2) Drainage Structures. Includes all drainage structures within the footprint of the SWM facility, including but not limited to inlets, manholes, flow splitters, risers, weirs, end sections, headwalls, and end walls. As-built data shall include but is not limited to top of structure elevations, structure lengths, and structure widths; pipe inverts; pipe sizes, materials, and flow directions; orifice elevations; opening sizes; weir dimensions and elevations; check dam locations and dimensions; grates; and trash racks.

(3) Riprap and Aggregate. Includes dimensions of riprap and other areas within the footprint of the SWM facility and practice that show a surface layer of aggregate or riprap, including forebays.

(4) Embankment Information. Includes embankment heights, widths, and elevations; clay core locations, dimensions, and elevations; cut-off trench locations, dimensions, and elevations; pertinent filter diaphragm information; and pertinent pipe cradle information. Data that cannot be obtained from a field survey shall be provided by the ABE for inclusion with the SWM facility as-built survey.

(5) SWM Facility Maintenance Access Roads.

(6) Fences. Includes fence that surrounds the footprint of the SWM facility or practice.

(7) SWM Facility Profiles. Includes an overlay of green line as-built data on SWM facility profiles and typical sections including but not limited to check dam spacing, check dam top elevations, check dam dimensions, invert elevations, subdrain sizes, subdrain materials, aggregate and soil thicknesses, material types, clay core dimensions, and cut-off trench dimensions. Data that cannot be obtained from a field survey shall be provided by the ABE for inclusion with the SWM facility as-built survey.

(8) Certification. Seal, signature, license number, and date of license expiration of the PLS who completes the SWM facility as-built survey.

(g) Applicable supporting computations demonstrating that the functionality of the SWM facilities and practices meet the approved designs as presented in the approved SWM Report. This is only necessary when tolerances are not met and shall include but is not limited to water surface elevations, freeboard, storage volumes, depths, and other pertinent SWM functionality data that demonstrates the SWM facility performances meets the approved design.

(h) A narrative of justification for as-built deviations in SWM facilities and practices. This is only necessary when 317.01.02 (g) applies.

(i) A copy of Final Acceptance from the Administration's Landscape Programs Division for the landscaping establishment.

(j) Seal, signature, license number, and date of license expiration of the ABE.

317.01.03 Information Supplied by the Administration. Upon written request, the Administration will provide CADD files in DGN format and the approved Final SWM Report in PDF format to facilitate completion of the SWM facility as-built certification package. Submit requests to the Engineer.

317.01.04 Submittals and Approval Process. Partial submittals of the SWM facility as-built package may be made as construction of each individual SWM facility and practice is completed. Otherwise, submit the entire SWM facility as-built package within 45 days of completion of construction activities associated with all SWM facilities and practices but not including establishment of the specified landscaping items. The landscaping phase of SWM facilities and practices need not be completed to submit the SWM facility as-built certification package for Structural Acceptance but is required for Final Approval.

Resubmit the SWM facility as-built package with responses to all Administration comments that may be received. Resubmit as many times as necessary, updating the SWM facility as-built package as needed to address all Administration comments, and making any field adjustments as needed to correct deficiencies, until Structural Acceptance is issued. Some SWM facility types require approval from the Maryland Department of the Environment (MDE) in addition to approval from the Administration. Resubmit the SWM facility as-built package with responses to all MDE comments that may be received. The Administration will coordinate reviews and correspondence with MDE.

Concurrent with the Administration review of the SWM facility as-built certification package for Structural Acceptance, ensure establishment of landscaping items continues and ensure the area is permanently stabilized. Once landscaping is established, ensure the remaining data table information is completed and submit the SWM facility as-built certification package for Final Approval.

Submit the SWM facilities as-built package through the Quality Assurance (QA) Toolkit.

317.02 MATERIALS

Not applicable.

317.03 CONSTRUCTION

Designate an ABE prior to beginning construction of SWM facilities and practices.

Failure to receive approval for the ABE, failure to submit information about the ABE designees, or failure of the ABE, or the ABE designees, to adequately monitor the specified construction activities will be grounds for replacement of the ABE and reconstruction of all work on SWM facilities and practices that may have already been performed.

Perform all construction activities on SWM facilities and practices only in the presence of the ABE or the ABE designee. Failure to perform work in the presence of the ABE or the ABE designee will be grounds for removal and replacement of the ABE, and reconstruction of all work that may have already been performed.

Prior to beginning or continuing construction activities of SWM facilities and practices, ensure the ABE or the ABE designee is present. If the ABE or ABE designee is not present, suspend work on SWM facilities and practices and do not resume until the ABE or ABE designee is present for the activities.

Whenever the ABE or the ABE designee indicates that SWM facilities and practices under construction do not match the Contract Documents, immediately correct the deficiencies before moving to the next construction activity associated with SWM facilities and practices. If it is not possible to correct deficiencies due to the site conditions or constraints and not due to negligence and inadequate quality of work, cease work on SWM facilities and notify the Engineer.

Upon completion of constructing SWM facilities and practices, perform an as-built survey of the completed facility as specified in 317.01.02 (f). Complete installation and establishment of landscaping items need not be completed to perform the as-built survey of SWM facilities and practices.

Submit the SWM facility as-built certification package as specified in 317.01.04. Update SWM facilities as-built surveys when adjustments are made to address comments that may be received.

317.03.01 ABE Responsibilities. Ensure that the ABE performs the following.

(a) Is present for all activities specified on the SWM facilities as-built certification data tables, performs duties as specified, and records requisite information for the SWM facility as-built certification package. The ABE may elect to use a designee as specified in 317.01.01. Ensure the data is available at the Site and on-demand.

(b) Prepares written inspection reports for construction activities associated with SWM facilities and practices. The ABE may elect to use a designee as specified in 317.01.01.

(c) Takes photographs during construction activities of the SWM facilities and practices and of the completed SWM facilities, including photographs with completed landscape planting installation and establishment. The ABE may elect to use a designee as specified in 317.01.01.

(d) Obtains copies of material approvals for items associated with the SWM facilities and practices. The ABE may elect to use a designee as specified in 317.01.01.

(e) Obtains copies of compaction test results for SWM facility embankments. The ABE may elect to use a designee as specified in 317.01.01.

(f) Alerts the Contractor when SWM facilities and practices under construction do not match the Contract Documents. The ABE may elect to use a designee as specified in 317.01.01.

(g) When necessary, performs all computations that demonstrate SWM facilities and practices function in the manner as presented in the approved Final SWM Report, including with all revisions to the report that may result from Redline Revisions. At a minimum, the parameters examined by the ABE shall include but are not limited to storage volumes, discharge rates, velocities, detention times, water surface elevations, freeboard, and all other information as recommended by the ABE and as requested by the Administration.

(h) Obtains copies of as-built surveys for the SWM facilities and practices.

(i) Prepares the SWM facility as-built certification package.

317.03.02 Construction Tolerances. As follows. Values outside of tolerance may require computations as specified in 317.03.01 (g).

(a) Earthwork. Elevations within 3 in. (0.25 ft) of values specified or as otherwise noted on the pertinent SWM facility as-built data table.

(b) Embankments, Clay Cores, and Cut-Off Trenches. Elevations not less than the values specified.

(c) Drainage Structures. Elevations within 1.25 in. (0.10 ft) of values specified.

(d) Pipe Inverts. Elevations within 1.25 in. (0.10 ft) of values specified.

(e) Riprap. Dimensions within 3 in. (0.25 ft) of values specified.

(f) Freeboard. Not less than the values specified.

(g) Aggregate, Sand, Bioretention Soil Mix (BSM), and Mulch Thicknesses. Not less than values specified.

When construction tolerances cannot be met due to unforeseen site conditions or constraints, ensure that calculations are performed by the ABE as specified in 317.03.01 (g) before proceeding with the next construction activity associated with SWM facilities and practices. If, after performing computations, the ABE determines that the SWM facilities do not meet the functional parameters in the approved Final SWM Report as constructed, reconstruct the SWM facilities to meet the functional parameters. If this is not possible due to the site conditions or constraints and not due to negligence and inadequate quality of work, cease work on SWM facilities and notify the Engineer.

317.04 MEASUREMENT AND PAYMENT

Stormwater Management (SWM) Facility As-Built Certification will not be measured but will be paid for at the Contract lump sum price and incrementally distributed per the payment schedule. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. No additional compensation will be considered for addressing comments received on the submitted stormwater management facilities as-built certification package, revisions to the stormwater management facility as-built certification package, or any construction activities necessary to address comments that may have been received or necessary to revise the stormwater management facility as-built certification package.

No adjustment to the payment schedule will be made for partial submittals of the stormwater management facility as-built certification package.

317.04.01 Payment Schedule. Payments will be made for the stormwater management facility as-built certification package as follows.

PAYMENT SCHEDULE	
ACTIVITY	**PERCENTAGE OF PAYMENT**
Initial submission of the entire Stormwater Management Facility As-Built Certification Package.	60
Structural Acceptance from the Highway Hydraulics Division and the Approving Authority.	30
Final Approval from the Highway Hydraulics Division and the Approving Authority.	10
TOTAL	100

317.04.02 Forfeiture of Payment. Failure to meet the requirements of the payment schedule will result in forfeiture of that percentage of payment.

CATEGORY 400
STRUCTURES

SECTION 401 — MAINTAINING EXISTING BRIDGE DECK DURING LIFE OF CONTRACT

401.01 DESCRIPTION

Patch the existing bridge deck as required for maintenance of traffic.

401.02 MATERIALS

Rapid Hardening Cementitious Material for Concrete Pavement Repairs	902.14

Select patching material from the prequalified list of rapid hardening cementitious materials maintained by the Office of Materials Technology.

401.03 CONSTRUCTION

Periodically evaluate the existing deck with the Engineer to determine if any patching is necessary. Patch all holes over 1 in. deep having an area greater than 2 ft^2. Locations and limits of all patch areas shall be as approved.

The Traffic Manager shall confer with the Engineer before patching begins to decide on a plan for diverting or detouring traffic. Meet all traffic safety and traffic control requirements.

Areas requiring patching shall be clean and free of loose material and conform to the manufacturer's recommendations.

Protect waterways and roadways under the structure from falling debris. Do not dispose of removed material in waterways.

Place patching material to the top of the existing bridge deck surfaces.

Furnish and install new reinforcement when directed.

When opening to traffic prior to the patch achieving sufficient strength, cover the patch with steel plates as specified in 522.03.13. Build up areas around the plates with asphalt material.

401.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

401.04.01 Patching for Maintaining Existing Bridge Deck will be measured and paid for at the Contract unit price per square foot. The payment will also be full compensation for the removal and disposal of material required to prepare the patch area, including chipping and hand cleaning, as well as furnishing and placing reinforcing steel, forming, providing protective structures, floodlighting, and furnishing, placing, and removing any steel plates. Patches performed day or night will be paid for at the Contract unit price.

401.04.02 All work, materials, sequence of operations, equipment, protection vehicle and channelization devices required to maintain traffic during each occurrence of patching including removal after patching is complete will be measured and paid for at the Contract unit price per each for the pertinent Maintenance of Traffic for Bridge Deck Patching Operation item. When more than one patch is made under one movement of traffic for patching, the item will be paid for only once, regardless of the number of patches made or the length of time traffic is rerouted. If traffic is maintained more than once for a particular patching operation, the work will be measured and paid for only once.

CATEGORY 400
STRUCTURES

SECTION 402 — STRUCTURE EXCAVATION (CLASS 3)

402.01 DESCRIPTION

Excavate and backfill for construction of bridges, box culverts, and other major structures.

402.02 MATERIALS

Crusher Run Aggregate CR-6	901.01
Subfoundation Concrete	902.10, Mix No. 1

402.03 CONSTRUCTION

Sheet, shore, brace, and support all excavation contiguous to existing pavements and structures to prevent settlement, movement, or damage to the pavement or structure. Place excavated material in a manner to prevent damage to adjacent structures and incursion into waterways.

402.03.01 Backfill and Embankment Material. Use all suitable excavated material for backfill or store for future use. Do not waste excavated material without approval. Prior to using excavated material as backfill, remove boulders, logs, and other unsuitable material. Dispose of unsuitable material in an approved disposal area.

402.03.02 Footing Elevations. The elevations for the bottom of the footings specified in the Contract Documents are approximate only; the Engineer may direct changes in dimensions or elevations of footings to secure a satisfactory foundation during the period of construction.

402.03.03 Footing Foundations. Place footings on suitable foundations. Do not drive piles or place concrete until the foundations are approved.

Clean all rock and other hard foundation material of loose material and cut to a firm surface, either level or stepped, as directed. Clean out and grout all seams and crevices. Remove all loose and disintegrated rock and thin strata. When concrete will rest on an excavated surface other than rock, do not disturb the bottom of the excavation. Perform final removal of the foundation material to grade just prior to placement of reinforcement steel and concrete. When an item is included for Subfoundation Investigation (Section 419), use the item as directed to verify the character of the foundation.

Place faces of footings plumb against undisturbed material, rock, sheeting, shoring, or forms. Faces of footings in rock shall bear against a minimum 1 ft depth of rock. If the excavation will

not stand plumb, install sheeting, shoring, or forms as required. When specified, sheeting used to construct spread footings shall be left in place and cut off as specified in 410.03.10. When not specified, or when sheeting is used to construct pile-supported foundations, the sheeting may be removed.

Design all required sheeting and shoring. When the material retained by the sheeting and shoring is greater than 6 ft high, submit the details, procedures, and computations the same as specified for falsework details in TC-4.01 and Section 499. The experience specified under TC-4.01 will be waived.

After removing the forms, backfill the void between the footing and the embankment with subfoundation concrete or tamped fill utilizing crusher run aggregate CR-6. Compact the material to a density of 92 percent of the maximum density as tested according to T 180, Method C. Use subfoundation concrete for backfill when footings are submerged. If the footings are below the water table, adjacent to railroad tracks, or more than 6 ft thick, submit footing form working drawings for approval.

Where foundation piles are used, excavate each pit to the as planned bottom of footing elevation before driving the piles. After driving is complete, remove loose and displaced material without damaging the piling. Leave a suitable bed to receive the footing concrete. For tremie seal, the displaced material may remain provided the minimum thickness of footing concrete, pile embedment, and the required sealing of the foundation seal is maintained.

Where foundation piles are not used on substructure units, other than box culverts, and excavation is required below the as planned bottom of the foundation, backfill the additional excavation with subfoundation concrete or lower the footing elevation and deepen the footing as directed. Provide a rough finish to rock foundations that are to receive footing concrete. For box culverts, backfill additional excavated spaces under the barrels with selected backfill.

402.03.04 Cofferdams and Foundation Seals. When cofferdams or foundation seals are required, submit working drawings and a complete description of the process as specified in Section 499. Timber or bracing left in the cofferdams or cribs shall not extend into the substructure concrete. Construct cofferdams in a manner that protects the concrete from damage.

(a) Foundation Seal. Refer to 420.03.05. When the foundation cannot be dewatered, the Engineer may require the construction of a concrete foundation seal. If a mud wave is created during the placement of the tremie seal, remove the displaced material to preserve the full foundation cross section specified. Then pump out the foundation and place the footing in the dry. When weighted cribs are employed and the crib's weight is utilized to overcome a part of the hydrostatic pressure acting against the bottom of the foundation seal, provide special anchorage such as dowels or keys to transfer the entire weight of the crib into the foundation seal. When a foundation seal is placed under water, vent or port the cofferdam at low water level as directed.

(b) Pumping. Do not pump from the interior of the enclosure during the placing of concrete. Do not begin pumping from a sealed cofferdam until the seal has set sufficiently to withstand the hydrostatic pressure.

(c) Removal of Cofferdams or Cribs. Remove cofferdams or cribs after the completion of, and without damage to the substructure.

(d) Stability of Foundation. Stabilize the foundation area so that the concrete footing can be constructed in the dry.

402.03.05 Backfilling. Use suitable material for backfill. Continue backfilling to the surface of the surrounding ground or specified grade. Do not use Borrow until available project excavation is exhausted. Neatly grade the top surface of the backfilled areas. Compact as specified in Section 204 or Section 210.

Backfilling Against Structures. Backfill against various structures as follows:

(a) Brick Masonry. Backfill no earlier than seven days after completion of the section.

(b) Concrete Structures. Backfill when curing is completed and the concrete has achieved 80 percent of the specified compressive strength.

(c) Footings, Culverts, and Piers. Deposit fill on both sides to approximately the same elevation at the same time.

(d) Abutments, Retaining Walls, Culverts, or Other Structures. Place backfill in horizontal layers so that at all times there is a horizontal berm of uniformly compacted material behind the structure for a distance at least equal to the height of the abutment or wall remaining to be backfilled, except where undisturbed material protrudes into this area. Compact the berm as specified in 204.03. Jetting of fills or other hydraulic methods involving liquid or semiliquid pressure within the berm area are prohibited.

402.04 MEASUREMENT AND PAYMENT

Class 3 Excavation will be measured and paid for at the Contract unit price per cubic yard for the volume of material actually removed from within the limits specified.

Excavation for pipe culverts, culvert end walls, inlets, and manholes is excluded from Class 3 Excavation.

Payment will be full compensation for all excavation, backfill, filling void around footings due to removing forms, blasting, grout, dewatering, removal and disposal of excess or unsuitable material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. When a Class 3 Excavation item is not included in the Contract Documents, the excavation will not be measured but the cost will be incidental to other pertinent items.

No measurement or payment will be made for removing any liquids.

Class 3 Excavation will extend a maximum of 18 in. to vertical planes outside of the structure. Where blasting is required, a maximum of 6 in. will be allowed below the planned elevation.

The upper limits on existing ground or embankments will be the existing groundline or the lower limit of roadway excavation. The lower limit of the two will control.

The upper limits on preliminary embankments will be the bottom of the as planned footing elevation. For stepped footings, the upper limits will be the bottom of the as planned footing elevation of the highest portion of the footing. If the preliminary embankment has a surcharge, the upper limits will be the lower limit of roadway excavation.

402.04.01 Additional excavation required below the elevation specified in the Contract Documents and necessitated by the lowering or deepening of footings, or the placing of subfoundations or underpinning, will be measured and paid for at the Contract unit price for Class 3 Excavation.

402.04.02 Sheeting, bracing, and shoring either removed or left in place, will not be measured but the cost will be incidental to other pertinent items unless otherwise specified.

402.04.03 Excavation necessary to expose or remove piles, grillages, sheeting, cribbing, masonry, or other obstructions will not be measured nor paid for if the excavation occurs outside the limits of excavation. Removal and disposal of obstructions within the limits of excavation will not be measured separately but the cost will be included in the Contract unit price for Class 3 Excavation.

CATEGORY 400
STRUCTURES

SECTION 403 — TEMPORARY SUPPORT OF EXCAVATION OR FILL

403.01 DESCRIPTION

Provide temporary support of excavation or fill, as provided in the Contract Documents, for staged construction and as needed for safety and for the support of adjacent pavements and existing structures.

403.02 MATERIALS

Not applicable.

403.03 CONSTRUCTION

Sheet, shore, brace, and support all excavation or fill contiguous to existing or proposed pavements and existing structures to prevent settlement, movement, or damage to the pavement or structure. See Section 402 for support requirements for Class 3 Excavation and Section 405 for support requirements for the Removal of Existing Structures.

Design all temporary supports, retained earth structures, sheeting, and shoring by a professional engineer registered in the State of Maryland. When material retained by the temporary support of excavation or fill is greater than 6 ft high, submit details, procedures, and computations the same as specified for falsework details in TC-4.01 and Section 499. The experience specified under TC- 4.01 will be waived.

Do not attach bracing for temporary support of excavation to permanent existing or proposed structures, unless specified in the plans or approved in writing by the Office of Structures. Requests should include calculations prepared by a professional engineer registered in the State of Maryland, showing that the temporary bracing will not affect the stability, maintenance, and the long term performance of the permanent structure.

Do not extend any temporary support structures directly under any portion of proposed structures and pipes or within 5 ft of proposed pile locations, unless specified in the plans or approved in writing by the Office of Structures. Contractors should consider the configuration of the batter on piles when installing the supports.

Remove temporary support of excavation or fill when no longer needed. Remove supports in their entirety or as specified in Section 405.

403.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, backfilling, materials, shipping, installation, complete or partial removal of temporary support of excavation or fill, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

403.04.01 Support of Excavation or Fill will not be measured but will be paid for at the Contract lump sum price.

403.04.02 Support of Excavation or Fill will be measured and paid for at the Contract unit price per linear foot, for the actual installed quantity measured.

403.04.03 Support of Excavation or Fill will be measured and paid for at the Contract unit price per square foot as measured vertically from the ground line on the front face (lower face) of the support to the groundline on the back face of the support and measured horizontally along the front face of the temporary support structure.

CATEGORY 400
STRUCTURES

SECTION 404 — PROTECTION OF EXISTING STRUCTURES

404.01 DESCRIPTION

Protect existing structures due to open excavation, pile placement, sheet pile installation, blasting, removal of existing bridge, or any other item that may affect the existing structures, at locations specified in the Contract Documents.

404.02 MATERIALS

Not applicable.

404.03 CONSTRUCTION

404.03.01 Preconstruction Survey. Retain an approved, experienced seismologist for monitoring and registering vibrations in adjacent and nearby structures as specified. This protection shall be for any structure that may be liable to any damaging effects of any construction activity operations.

Retain an approved commercial photographer.

Retain an approved professional engineer registered in Maryland who is experienced in the field of building inspection surveys. This professional engineer will be referred to hereinafter as "Building Inspector."

Prior to beginning any work, the Contractor, the insurer, photographer, building inspector, seismologist, and the Engineer, shall make a detailed inspection of each structure to record the condition of all walls, and other structural elements, as well as its contents and equipment that may be in place, and pavements and sidewalks that may become subject to possible damage claims.

Before any inspections are performed, notify the owners of the structures involved, which have been approved by the Engineer, requesting their permission to enter upon the properties for the purpose of making these inspections for the protection of the owner.

In the event that access for the purpose of determining the condition of the buildings and structures is refused by any owner, the Contractor shall notify the Engineer in writing and may there upon be relieved of the responsibility for making the survey with respect to the property to which access is denied.

Where possible, have the owner or a representative of the owner present during these inspections and secure the signature of the owner/representative on the completed documents, submitting a copy to the owner/representative.

Provide a record of the pre-construction survey. The record shall consist of a written report including measurements, sketches, and photographs as required to fully delineate the extent of or lack of deficiencies.

Photographs shall be 8 in. x 10 in. size, in color, and include views inside and outside of the existing structures.

A notarized statement certifying the date that each preconstruction survey was made shall be furnished by the Contractor, the building inspector, the seismologist, and the photographer to the Engineer. This certification shall include a statement that the preconstruction survey was made in the presence of and to the satisfaction of the respective owners.

Furnish the written report and photographs to the Engineer at least two weeks prior to beginning any vibration producing work. The written report shall state acceptable levels of vibrations at the various existing structures together with the Contractor's procedures proposed for use for the various construction activities so as not to exceed the acceptable levels of vibrations. The seismologist shall submit to the Engineer the proposed methods for monitoring construction activities effects on adjacent structures, including work plans that indicate the type and layout of sensing devices. The proposed methods and plans shall be approved by the Engineer prior to any construction activity.

Forward a copy of all data relative to existing conditions of each respective property as found by the preconstruction survey to each property owner. Submit two identical copies to the Engineer.

404.03.02 Construction Vibration Surveillance. During construction the seismologist shall record vibrations, during structure pile installation and any sheet piling operations, blasting, removal of existing structure, or any other activity that may cause excessive vibrations near any adjacent structure.

The seismologist shall record the vibrations and direct the construction activities operations in order to eliminate the occurrence of damage due to the construction activities.

If any construction activity has an adverse effect on adjacent structures as determined by the seismologist or the Engineer, the construction activity operations may be suspended while corrective action is being taken. The surveillance shall continue as long as required by the Engineer.

Do not exceed the acceptable vibration levels contained in the preconstruction written report.

404.03.03 Post-construction Inspection. Upon completion of the work, and prior to final acceptance of the project, the Contractor with their insurer, building inspector, and with the Engineer and property owner, shall re-examine each property to determine any changes from the original conditions established by the preconstruction survey.

404.04 MEASUREMENT AND PAYMENT

The protection of existing structures including all costs of the preconstruction and post-construction surveys, seismologist, building inspector, photographer, preparation and submission of written reports, and all material, labor, equipment, tools and incidentals necessary to complete the work will be measured and paid for as specified in the Contract Documents. The work under this item will be excluded from the 50 percent subletting clause as specified in GP-8.01.

When specified in the Contract Documents, the protection of existing structures will not be measured but will be paid for at the Contract lump sum price for the Protection of Existing Structures item.

CATEGORY 400
STRUCTURES

SECTION 405 — REMOVAL OF EXISTING STRUCTURES

405.01 DESCRIPTION

Remove and dispose of or recycle, reclaim, reuse, wholly or in part, designated structures.

The Contractor is advised that prints of plans of the existing pertinent structure(s) may be included in the Contract Documents. No responsibility for their accuracy or completeness is assumed by the Administration. Dimensions, details, etc. as shown thereon may not be as built.

405.02 MATERIALS

Not applicable.

405.03 CONSTRUCTION

Protect from any damage all portions of the existing structure scheduled to remain in the rehabilitated structure, and the remaining portions of the existing structure used to maintain traffic, and are scheduled to be removed at a later stage, including bridge deck, the beams, abutments, piers, or any other structure members.

Prior to the start of removal operations, submit a list of the proposed equipment and removal methods for approval. Approval does not relieve the Contractor of responsibility for preserving those portions of the structure designated to remain and be incorporated into the rehabilitated structure or used to maintain traffic.

Immediately halt removal operations if any of these existing elements that are to remain permanently or temporarily are damaged by the Contractor's operation. Submit the material and work methods proposed to be used to repair or replace the damaged elements to the Office of Structures for approval. Perform the approved method of repair or replacement of the damaged elements to the full satisfaction of the Engineer and the Office of Structures at no additional cost to the Administration. Any delays due to the required repair or replacement shall not be a cause for any claim.

During construction only approved equipment and material (for maximum weight, size, and location) required for a particular operation will be allowed on the existing or newly constructed portion of new bridge. Refer to TC-6.14 and 420.03.15 for additional requirements.

When a structure contains existing protective shields (sheeting or planking) that have been previously placed to contain debris from a deteriorating deck, remove and dispose of the debris and shields at no additional cost to the Administration.

Sheeting and shoring required for the removal of existing structures or portions thereof shall meet 402.03.03.

Unless otherwise specified, the limits of removal shall be 1 ft below the proposed groundline or to the limits necessary to avoid conflict with the proposed construction.

When remaining portions of an existing structure will be exposed to view in the final structure, make a neat 1 in. deep saw cut to separate the removal operations from the remaining concrete. Protect existing reinforcing steel as specified in 421.03.07.

Regardless of whether or not an asphalt mix overlay is depicted in the Contract Documents, or if it is depicted but the actual thickness varies from what is shown, no additional compensation or credit will be made. The provisions of GP-4.05 will not apply.

405.03.01 Removal of Bridge Deck Slabs and Parapets. Protect the public against injury and damage from demolition operations. Erect temporary protective shields to prevent any material or debris from entering roadways, railroads, or waterways. Provide the underclearance specified in TC-6.12. Refer to 405.03.02 and 405.03.03 for additional requirements.

Submit protective shield working drawings as specified in TC-4.01(b). Ensure that flooring and siding have no cracks or openings through which material particles may pass. Ensure that the shields are able to support over their entire area 150 lb/ft^2 in addition to their own dead weight.

The preceding weight requirement will be waived when the span to be removed is not over any of the following, or within range of rolling debris reaching any of the following:

(a) Roadway, pedestrian walkway, bikeway, equestrian trail, parking area, navigable water, railroads and railroad property, or other traveled way.

(b) Exposed utilities that are either aerial utilities crossing under the span or utilities located between stringers.

(c) Environmental features such as historic ruins, endangered species habitat, etc.

When the weight requirement is waived but the deck slab is to be sawn into sections and removed by lifting from above, provide protection to prevent any loose particles from reaching restricted areas. In addition, place a temporary construction fence under the area of demolition to prohibit accidental access by employees and pedestrians.

After the Engineer determines that the protective shields have served their purpose, remove and properly dispose of them.

405.03.02 Removal of Bridge Deck Slabs to be Replaced. Refer to the Contract Documents for deck removal restrictions, including sequence of locating and delineating structural elements that will remain in the completed structure, obtaining elevations, saw cutting, and equipment restrictions.

405.03.03 Removal of Existing Bridge. Refer to 405.03.01. Remove existing bridges (including piles) as specified, and from any area that will interfere with proposed construction as specified in 207.03.01.

405.03.04 Reporting Requirements. Recycle, reuse, reclaim as much of the removed structure material (structural steel, rebar, concrete, asphalt, bearings, fencing, etc.) as practical. Report the disposition of all removed structure components to the Project Engineer. Indicate the item description, amount (by weight, linear feet, cubic yard, or each), disposition (recycled, reused, reclaimed, disposed of, stockpiled for future recycling or use), place where material was taken (company name, phone number and address), and date. Report all like items using the same unit of measurement.

405.04 MEASUREMENT AND PAYMENT

The removal of existing bridges and structures or portions thereof will be measured and paid for as specified. The payment will be full compensation for all excavation, backfill, saw cuts, professional engineer services, removal of existing shields and debris, temporary protective shields, temporary sheeting and shoring, hauling, recycling, reuse, reclamation, storage or disposal, reporting and for all material, labor, equipment, tools, and incidentals necessary to complete the work. On deck replacement projects, payment also includes outlining the locations of the flange and floor beams, obtaining all deck elevations specified to determine rebound, computations necessary to place the new deck at the required elevation, and submitting all data for review.

Construction fence used to restrict access under demolition areas will not be measured but the cost will be incidental to the pertinent Removal of Existing Structure item. When an item for construction fence is included in the Contract Documents, that portion of the construction fence used to protect demolition areas will be excluded from the measurement and payment for that item.

405.04.01 Removal of Existing Structures will not be measured but will be paid for at the pertinent Contract lump sum price.

405.04.02 Removal of existing traffic barriers (parapets, railings, etc.) from bridges, including end posts, wing walls, and retaining walls will not be measured but will be paid for at the Contract lump sum price for the pertinent Removal of Existing Traffic Barrier item.

405.04.03 Removal of existing structures for which no specific pay item is included in the Contract Documents will not be measured but the cost will be incidental to other pertinent items specified.

CATEGORY 400
STRUCTURES

SECTION 406 — DRILLED HOLES IN MASONRY AND STRUCTURES

406.01 DESCRIPTION

Drill holes for grouting of bars, bolts, or anchorages. In portions of masonry structures that will remain in the final structure, the drilling of holes for temporary construction purposes is prohibited, unless approved in writing by the Director or Deputy Director of the Office of Structures. Do not drill holes for temporary construction purposes in new or existing masonry structures without a prior written approval from Director or Deputy Director of Office of Structures.

406.02 MATERIALS

Grout 902.11(c)

406.03 CONSTRUCTION

Drill holes only in the solid portion of masonry. Do not drill where cracks exist. Drill holes at least 1/2 in. larger than the insert and at least 6 in. from all non-intersecting masonry surfaces. When dowel bars are used, use at least No. 6 dowel bars. Clean the holes and fill two thirds full of grout. Place the insert, keep it in place and allow to set at least 24 hours, until it reaches a compressive strength of at least 3 000 psi, or until it is set to achieve the strength required for the contract application, obtaining the required strength according to the manufacturers' specifications.

If grouted bar, bolts, or anchorages for temporary construction are no longer needed, remove them as specified in 420.03.02(n).

406.04 MEASUREMENT AND PAYMENT

Drilled Holes in Masonry and Structures will be measured and paid for at the Contract unit price per linear foot of drilled hole. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Inserts will not be measured but the cost will be incidental to other pertinent items.

Drilled holes and removal of temporary items for which no specific pay item is included in the Contract Documents will not be measured but the cost will be incidental to the other pertinent items.

CATEGORY 400
STRUCTURES

SECTION 410 — PILING

410.01 DESCRIPTION

Furnish and install piling, including performing wave equation analysis. Perform Dynamic Pile Monitoring using Pile Driving Analyzer (PDA) and Case Pile Wave Analysis Program (CAPWAP) as specified. When drilled shafts (caissons) are specified, refer to Section 412. When a Load Test item is included in the Contract Documents, conduct and record load tests.

410.02 MATERIALS

Sand	901.01
Concrete for Steel Pipe	902.10, Mix No. 3 Slump 4-6 in.
Tremie Concrete for Steel Pipe Piles	902.10, Mix No. 4
Timber Piles	907.01
Timber Sheet Piles	907.01
Resin and Fiberglass Caps	907.01.01
Steel Pipe Piles	907.02
Steel H Piles	907.03
Steel Sheet Piles	907.04
Reinforcing for Steel Pipe Piles	908.01
Hardware	909.10
Water	921.01
Timber Preservatives	921.06

410.03 CONSTRUCTION

410.03.01 WEAP Analysis and Hammer Approval. At least one month prior to the start of pile driving operations submit the Pile and Driving Equipment Data sheet and a Wave Equation Analysis of Pile (WEAP) for the tested piles. Submit, for approval, to the Director, Office of Structures, the hammer name, model, and manufacturer's data for each pile hammer and procedure proposed to be used for pile driving, including any special operational and site or pile preparation requirements, Manufacturer's Catalog Information and a completed Pile and Driving Equipment Data Form provided in the Contract Documents.

Drive all test and production piles with impact hammers. Vibratory hammers are prohibited, except for the driving of sheet piling.

Furnish for each test pile, a Wave Equation Analysis of Pile (WEAP), sealed and signed by a professional engineer, registered in the State of Maryland, experienced in such work. The analysis shall demonstrate that the pile hammer and driving procedure proposed by the Contractor has sufficient power to drive the piles to the Minimum Driving Load and Estimated Tip Elevation shown on the plans without exceeding the maximum permitted driving stress values stated in AASHTO LRFD Bridge Design Specifications, Section 10.7.8.

The analysis shall, at a minimum, include the following:

(a) Analysis methodology.

(1) The ultimate soil resistance used in the analysis shall be not less than the Minimum Driving Load shown on the Plans. The proportioning of the tip resistance and the distribution of the side resistance shall be based on the soil boring data using either static analysis or other strength correlations.

(2) For hammers with an adjustable energy range, analysis shall demonstrate that minimum energy used within the range can mobilize the ultimate soil resistance, and that the maximum energy used within the range will not exceed the maximum permitted driving stresses during driving operations.

(3) The analysis shall demonstrate that with the hammer used, the required ultimate soil resistance shall be attained using hammer blows in the range of 2 to 15 blows per in.

(b) Interpretation of Soil Boring Data necessary to determine the resistance the pile will develop during driving to the estimated pile tip elevation.

(c) Computer input and output sheets and graphs showing soil resistance versus blow counts, and maximum tensile and compressive stresses in the pile versus blow counts.

(d) Provide for each hammer, at each test pile, charts of Driving Load versus Energy (blow/minute) and Pile Set (blow/in. and blow/ft) based on the WEAP analysis.

(e) Provide maximum driving stresses allowed in the piles during installation.

(f) Provide recommended hammer speeds or speed range to achieve required pile hammer energy.

410.03.02 Test Piles and Dynamic Pile Monitoring. Test pile driving operations shall not commence until approval of the WEAP and pile hammer has been received in writing for each applicable test pile or structure/substructure location.

Drive test piles to determine the actual depth of penetration and the length of piling to be ordered for each structure and substructure location. Based off of test pile results, ensure that the piling ordered and delivered to the site is of correct type and length.

Acceptance of the pile hammer and driving equipment will not relieve the Contractor's responsibility for properly driving piles, in satisfactory condition, to the driving resistance and tip elevations indicated in the plans in accordance with the approved WEAP analysis.

Drive test piles in permanent vertical position. Test piles found to be satisfactory shall be utilized as permanent piles.

(a) Dynamic Pile Monitoring Independent Testing Firm. Secure and provide the services of an independent testing firm to furnish and operate all equipment necessary to perform dynamic Pile Driving Analyzer (PDA) and CAPWAP tests. These tests shall be performed on all piles indicated in the plans as a test pile or on production piles designated by the Engineer. The independent testing firm shall be experienced in the use of the test equipment described herein and shall be subject to approval. All incidental labor and material necessary to make the work area accessible and to operate the equipment shall be supplied by the Contractor.

The independent testing firm shall direct the progress of the testing work, obtain and record the test data, perform monitoring of the stresses on the tested piles during initial driving and restrike (if required), and evaluate the driven pile capacity. The independent testing firm shall be responsible for conducting the actual tests of the test piles.

Prior to being driven with the pile-driving hammer, each pile to be tested shall be instrumented with force and acceleration transducers by the independent testing firm with the aid of the Contractor’s personnel.

Dynamic measurements resulting from the pile hammer blows shall be automatically recorded electronically. The independent testing firm shall operate all the equipment that analyzes the data from the sensors installed on the piles to capture pile stresses, pile-soil capacity, and the hammer efficiency.

The independent testing firm shall prepare a hand written daily field report summarizing the dynamic testing results. In addition to the PDA printout information to be provided below, the daily reports shall include the calculated driving stresses, transferred energy, and estimated pile capacity at the time of testing. Variations from previous trends in the dynamic test data shall also be noted. Daily field reports shall be hand-delivered or faxed to the Engineer.

Upon determination by the independent testing firm that valid data have been secured, the independent testing firm with the assistance of the Contractor’s crew shall remove the instrumentation from the piles.

(b) PDA Equipment. Perform the dynamic monitoring using a GC, GCPC, or PAK Model PDA. The independent testing firm shall furnish all equipment necessary for the dynamic monitoring such as gauges, cables, etc. The equipment shall conform to the requirements of D4945.

Provide the power supply to the tested pile locations for the dynamic testing duration. The power supply shall consist of a regular power source providing 110 volt AC power with a frequency of 60 Hz. Direct current welders or non-constant power sources are unacceptable.

Dynamic testing involves attaching two strain transducers and two accelerometers near the pile head. The dynamically tested piles shall be of sufficient length so that gauges are not driven below the water surface, pile template, or into the ground. Cables connecting the gauges near the pile head with the PDA located at the ground or water level shall be of sufficient length to reach 50 ft to 100 ft from the pile.

Maintain a stock of at least four working accelerometers and strain transducers at the job site whenever dynamic testing is being performed.

All repair or replacement costs shall be performed at no additional cost to the Administration.

(c) PDA Driving and Testing Procedures. Drive the pile based on the recommendations provided in the WEAP Approval Letter. Conduct dynamic testing according to D4945 "Standard Test Method for High Strain Dynamic Testing of Piles."

Prior to lifting the pile to be dynamically tested, provide a 3 ft minimum clear envelope around the pile so the dynamic testing consultant can access and prepare the pile for testing. Holes shall then be drilled and prepared for gauge attachment.

Test piles shall be driven to achieve the Minimum Driving Load and the Minimum Penetration Elevation as shown on the plans. For cohesionless soils, once pile driving begins, the driving shall be continuous until refusal has been achieved. For cohesive soils, if the estimated tip elevation is surpassed and the Minimum Driving Load is not achieved, the pile driving should stop and pile restrike shall be required. Pile restrike shall occur no sooner than three days (72 hours) after the tested pile, or any pile within a 25 ft radius, has been driven and approved.

(d) Test Piles Failing to Meet Design Requirements. If tested piles fail to achieve the required capacity on restrike, pile driving shall be stopped and the Office of Structures consulted for further direction.

Propose a new pile driving system, modifications to the existing system, or new pile installation procedures if the pile installation stresses calculated by the PDA exceed the maximum values stipulated in the approved WEAP analysis. Submit revised WEAP analysis, driving procedure, hammer and hammer configuration for approval.

(e) PDA Daily Printout Reports. The results of the dynamic testing shall be printed by the PDA daily and shall include, for each blow count selected by the Engineer, the following information:

(1) Bearing capacity for the Case Goble method.

(2) Input and reflected values of force and velocity.

(3) Maximum transferred energy.

(4) Maximum compression force.

(5) Velocity and displacement.

(6) Blows per minute.

(7) Value of upward and downward traveling force wave.

(8) Ram stroke and corresponding blow sequence.

All of the above information shall be supplied to the Engineer within one day (24 hours) of the testing. All recorded signals from the pile sensors captured electronically shall be stored and shall be made available upon request by the Engineer at a later date for additional analysis.

(f) Case Pile Wave Analysis Program (CAPWAP) Pile Analyses. All PDA dynamically tested piles shall be evaluated using the Case Pile Wave Analysis Program (CAPWAP).

Within three days (72 hours) of completion of driving a test pile and the conducting of the final CAPWAP restrike, furnish the Engineer with a written report containing all computer print-outs and graphs from the CAPWAP. A copy of the written report shall be furnished to the Office of Structures and the results be approved in writing prior to driving any remaining test pile(s) or production piles at any location within the project site.

Each CAPWAP analysis report shall include the following information:

(1) Graph showing the bearing capacity versus blow count and pile stress versus blow count.

(2) Simulated static load test curves for the tip and the top of the pile.

(3) Evaluation of the soil parameters based on the matching of the measured and computed values of forces, velocities and displacements.

(4) Static resistance distribution along the length of the pile.

410.03.03 Storage and Handling. Store and handle piling to avoid damage. Repair or replace damaged piling as directed.

410.03.04 Preparation for Driving. Do not drive piling until completing embankment, soil improvements and excavation in the area of the pile driving operation.

Provide templates or other approved means to ensure that the piles are properly aligned and positioned.

Provide a cap or cushion so that hammer energy is transmitted to the pile evenly without damaging the top or butt. Ensure that the top of the pile, irrespective of type, is normal to the axis of the moving parts of the hammer.

410.03.05 Pile Tips.

(a) Provide pointed timber piles where driving conditions require. The point shall be symmetrical and at least 4 in. diameter. Shod timber pile tips or bottoms with a metal shoe or point when specified.

(b) Drift sharpen or bevel the bottom of timber sheet piling to wedge continuous piles in tight contact.

(c) Drive steel H piles without any special tip reinforcement unless otherwise specified.

(d) Drive steel pipe piles open ended, unless otherwise specified.

410.03.06 Splicing. Do not splice timber piles. If an isolated timber pile penetrates below planned elevation, thereby resulting in the top being below planned elevation, the Engineer will determine when replacement is required, whether to supplement it with an additional pile, or when the structure can be changed without detriment.

When splicing steel H piles and steel pipe piles is necessary, use electric arc welding conforming to the AWS Structural Welding Code for the full periphery and the welding criteria in AWS D1.1 for 24 in. or less diameter pipe piles or AWS D1.5 8.26 and Table 8.1 for over 24 in. diameter pipe piles and H piles. The number of splices permitted shall be compatible with driving conditions at the site and the standard lengths of piling produced by manufacturers; however, only one section of each pile shall be less than 20 ft.

If the plans show separate steel pipe pile moment splice details that are to be used above a designated elevation, weld these splices as specified in 430.03 excluding the submerged arc welding requirement. Field welders shall be qualified to 430.03.19(a).

All welding above these limits shall receive 100 percent Magnetic Particle Inspection (MT) on the root pass and completed weld, and 100 percent Radiographic Inspection (RT), in accordance with AWS D1.5. Inspectors shall be approved by the Office of Materials and Technology (OMT) as specified for certification testing in accordance with AWS D1.5.

Inspectors certified by an accredited/certified American Society for Non-Destructive Testing (ASNT), Level III in the inspection discipline, may submit certifications to OMT for review.

Where a manufactured pile type is designed to be spliced by screwing two pieces together or by the use of coupling or collars, and the details for the splice are not specified, submit the device for approval.

Drive piles in a continuous operation, and make splices prior to approaching the estimated tip elevation.

410.03.07 Pile Driving. Drive the permanent piles with the same hammer used to drive the test piles. If the hammer is changed, even if the energy ratings of the hammers are identical, drive additional test piles at no additional cost.

Operate hammers at speeds specified in approved WEAP analysis. The manufacturer’s manual for the hammer employed shall be available to the Engineer at the project site.

Use pile-driving equipment of an acceptable type, mass (weight), and capacity as determined by WEAP analysis and approved by the Administration. Use air compressors of sufficient capacity to provide 25 percent more air than shown in the manufacturer's specifications for air-driven hammers. Do not use capblocks or cushions containing asbestos.

Use either drop-steam, air, diesel, or hydraulic actuated pile-driving hammers. Hammers shall be capable of developing at least the energy shown on the plans.

Equip hammers with a suitable drive head that accurately and securely holds the top of the pile in correct position, with reference to the hammer, and that distributes the blows from the ram over the entire top area of the pile or mandrel.

Use a hammer of a type and size that enables piles to be driven to the required driving resistance without pile damage due to driving stresses, as indicated by the WEAP. Acceptance of a hammer relative to driving stress damage will not relieve the Contractor's responsibility for piles damaged because of misalignment of the leads, failure of capblock or cushion material, failure of splices, malfunctioning of the hammer, or other improper construction methods.

Construct pile driver leads to allow free movement of the hammer. Hold the leads in true vertical or inclined positions, as required, by guys or stiff braces to ensure support of the pile during driving. Provide leads of sufficient length so a follower will not be necessary under normal conditions.

Construct leads or spuds to afford freedom of movement of the hammer during the driving phases. Drive the piles within the tolerance as specified without damaging the piles. Remove any leads that do not produce satisfactory results from the project.

Do not drive with the hammer out of leads.

On all special, marine or water projects and pile bents, use leads of sufficient length that a follower will not be necessary. Provide guides and additional support to prevent excessive bending or

buckling under the hammer blow when driving long piles and batter piles. Hold piles in place and alignment by templates or other approved means.

Do not perform external jetting of any pile. If it is necessary to remove material from within a pile shell to advance the pile tip or merely to obtain room for concreting, leave at least 10 ft soil plug undisturbed at the tip of the pile. Install turbidity curtain around piles being cleaned when appropriate.

Auger or drill holes through strata that resist driving. Use an approved auger or drill that is no larger than the nominal diameter of a circle in which an H pile will fit.

After the hole is completed, insert the pile and fill voids between the pile and the walls of the hole with dry sand. Complete the driving and then fill remaining voids with dry sand.

410.03.08 Steel Pipe Piles. driving, remove soil plugs to the specified elevation. Prior to placing filling (when specified) or reinforcing, use a suitable light to inspect the interior for the entire unplugged length. Do not fill or place reinforcing until the pile is approved.

Provide all required equipment for inspection including oxygen, light, boatswain's chair, and lift. Comply with Federal, State, and local safety regulations.

For requirements for micropiles or pin piles, see the Contract Documents.

410.03.09 Concreting Steel Pipe Piles. Perform concreting as specified in Section 420. Perform reinforcing work as specified in Section 421. Securely fasten the reinforcing together to form a cage, positioned and held at a uniform distance from the shell.

Except as specified herein, use tie wire to secure tie bars and bands of cage reinforcing. For foundation (footing) piles, tack welding may be used, provided it is performed by an Administration certified welder.

For bents and column piles, tie bars, bands, and spacer lugs shall not be welded to the main reinforcing bars, except that a bend may be placed at the top and bottom of the pile cage and all main bars welded to the band. Use tie wires to fasten the reminder of the intersections of ties and main bars.

Clean the areas in the top portion of the pile that are to be filled with reinforced concrete and tremie concrete. Place and cure tremie concrete prior to dewatering the top of the pile shell. Place the reinforcing unit in the top portion of the pile prior to filling with Mix No. 3 concrete.

Do not place concrete in any pile until completing driving within a radius of 15 ft or until all the piles for any unit of structure (pier, bent, or abutment) have been driven to their final penetration and accepted. If this procedure is not feasible, discontinue driving within the above limits until the concrete in the last pile placed has set at least 72 hours.

Immediately prior to concreting remove water and other foreign substances. Deposit the concrete in one continuous operation.

The restriction in Section 420 for dropping concrete more than 5 ft does not apply.

Set and fasten reinforcing steel cages in proper position in the pile before filling with concrete, except when the reinforcing steel cage extends 6 ft or less below the top of the pile, the concrete filling may be placed before installing the reinforcing. Thoroughly consolidate using mechanical vibrators from the bottom of the reinforcing steel cages to the pile top.

Do not disturb or apply loads to concreted piles until all concrete has been in place and cured at least 72 hours.

410.03.10 Pile Cutoff and Removal. Cut off the tops of piles and pile casing, except timber piles that support timber caps, at the elevations specified. Make cuts on a true plain perpendicular to the axis of the pile unless otherwise specified. Cut off timber piles that support timber caps to ensure that the plane of the bottom of the cap will bear fully on the pile head. Shims shall not be placed between the timber cap and pile head.

Cut off piles used for sheeting and shoring to at least 1 ft below existing grade, channel bottom, or mud line as applicable. When specified, these piles may be removed. Dispose of all removed material.

410.03.11 Treatment for Timber Pile Heads. Use an approved asphalt treatment to paint timber pile heads that are not to be embedded in concrete. After the asphalt has sufficiently cured, cover it with a glass resin composite shield. Apply the first coat of resin to the top and down the side at least 1 in. beyond the limits of the woven glass. Apply precut woven glass cloth using a 3 in. grooved aluminum roller to achieve "wet out." Neatly wrap woven glass cloth over the top of the pile, drape it down the side at least 2 in., and secure using copper nails. When the first coat of resin has taken a tack free set, apply a second coat of resin to seal the entire application.

410.03.12 Pile Driving Tolerances.

(a) General. Do not use foundation piles out of the specified position by more than 6 in. in any direction after driving, regardless of the length of piles. Variation from the vertical or from the batter shall not be more than 1/4 in./ft.

(b) H Piles. Limit rotation of the pile to 25 degrees from the as planned axis.

(c) Bents. Drive piles so that the cap may be placed as specified.

410.03.13 Unacceptable Piles. Take one or more of the following actions or propose other actions for approval:

(a) Withdraw and replace the pile with a new pile.

(b) Drive a second pile adjacent to the unacceptable pile.

(c) Splice or build up the pile (except timber piles).

(d) Extend a sufficient portion of the footing to properly embed the pile.

410.03.14 Unanticipated Driving Conditions. Should unanticipated driving conditions occur, such as when resistance on the pile results in hammer blows per inch in excess of 20 with the hammer operated at its maximum fuel or energy setting, or at a reduced fuel or energy setting recommended by the Engineer based on pile installation stress control, stop driving and contact the Office of Structures for further guidance.

410.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

410.04.01 Piling (permanent and test) will be measured and paid for at the Contract unit price per linear foot for the pertinent Piling item. The measured length of all piling will be from its tip up to final cutoff, unless otherwise specified. For test piles not utilized as permanent piles, the measurement for cutoff will be at the same elevation as the nearest proposed permanent pile or to actual top of test pile, whichever is lower. Where piling designated as test piles is accepted for use in the permanent structure, measurements will be made as test piles, and no additional allowance will be made in other piling items.

410.04.02 Furnishing and set up of pile driving equipment for pile driving operations, including test piles, will not be measured but the cost will be incidental to the Contract unit price for the pertinent Pile item.

No additional compensation will be paid for any setup required for redriving or any additional driving of any pile no matter what reason the particular pile may require redriving or additional driving.

When an item for Setup for Driving Pile is included in the Contract Documents, the furnishing and setup of pile driving equipment will be measured and paid for at the Contract unit price per each for the pertinent Setup for Driving Pile item. The unit price per each for the setup required for driving each pile for the proposed structure will be used regardless of the distance that the equipment is moved for each pile setup. A maximum of one setup will be paid per pile location.

410.04.03 Pile points for steel H piles will be measured and paid for at the Contract unit price per each for the pertinent Pile Point for Steel H Pile item.

410.04.04 Timber sheet piling will be measured and paid for at the Contract unit price per 1000 board foot (MBM) for the pertinent Timber Sheet Piling item. Computation of quantities will be based on nominal thickness of lumber, the length of the sheet piling, and the average depth

of the sheet piling from cutoff at the top to the tip of the sheet piling in the completed structure. No allowance will be made for waste.

410.04.05 Steel sheet piling will be measured and paid for at the Contract unit price per square ft as measured along the plane of surface for the pertinent Steel Sheet Piling item.

410.04.06 The following will not be measured but the cost will be incidental to other pertinent items:

(a) When specified, tips for steel pipe piles.

(b) Test pieces of sheet piling (timber or steel).

(c) Dewatering, clean out, filler, reinforcement, and concrete used in steel pipe piles.

(d) Pile splices.

(e) Auguring, including sleeve and backfill when required.

(f) Cleaning, painting, or coating of piling.

(g) Piling or sheet piling for temporary structures, piles or sheet piling driven for the Contractor's convenience, or for any piles or sheet piling not specified.

(h) Piling not approved by the Engineer, such as piles not properly driven, piles with questionable safe bearing values, piles damaged during driving, or piles driven below planned cutoff or the removal of any pile rejected by the Engineer as unsatisfactory.

(i) Glass resin composite shield used on timber piles.

410.04.07 WEAP analysis and report will not be measured, but the cost will be incidental to the Contract unit price for the pertinent Test Pile item.

410.04.08 Dynamic Pile Monitoring will be measured and paid for at the Contract unit price per each. The payment will be full compensation for furnishing, installing, operating, maintaining, and removing the PDA and for the preparation of reports.

410.04.09 CAPWAP analysis will be measured and paid for at the Contract unit price per each. The payment will be full compensation for performing the analysis and preparation of reports.

CATEGORY 400
STRUCTURES

SECTION 411 — PILE LOAD TEST

411.01 DESCRIPTION

When a Load Test item is included in the Contract Documents, conduct and record load tests.

411.02 MATERIALS

Not applicable.

411.03 CONSTRUCTION

Ensure that the load test setup, the measuring system, the loading device, the loading procedure, the frequency of measuring the movement of piles, and the record keeping meet D1143, unless otherwise specified.

At each load test location, the Engineer will provide driving criteria for the test pile. Then drive and load test the pile to the test load specified. If the pile fails to achieve this capacity, perform an additional load test on a second test pile. Locate this pile adjacent to the initial test pile and drive it in accordance with the revised driving criteria provided by the Engineer. When directed, redrive piles not meeting the required penetration resistance.

Use the same equipment and methodology for driving the load test piles that will be used for driving the permanent piles.

At each load test location, construct a test enclosure to protect all of the equipment including dial gauges, load cells, loading apparatus, and the personnel taking readings. When necessary, maintain a temperature of at least 50 F within the enclosure. Illuminate the test enclosure to allow taking readings at all times of the day. Ventilate the enclosure to prevent fogging or frosting of gauges.

At least seven days prior to the start of the first pile load test, submit drawings showing all details of the proposed load test setup. Include the method of applying the load, the reaction frame and reaction pile configuration (if used), and the placement and support of measuring devices. Revise the load test setup if directed.

Obtain the services of a professional engineer experienced in structural design and registered in the State of Maryland to design the reaction frame.

Ensure that the load test setup is capable of supporting the test load for the duration of the test.

Maintain a clear distance from reaction piles to the test pile of at least 10 times the distance from the midpoint of web to end of flange for H piles, and at least 10 times the pile top radius for pipe piles and timber piles.

Where necessary or if directed, brace the unsupported length of load test piles to prevent buckling and without influencing the test results.

Use dial gauges having an accuracy of 0.001 in. and a minimum travel of 2 in. as the primary instrument for measuring movement. Place three dial gauges spaced 120 degrees apart as the primary system to measure movement of the top of the pile. Use a scale, mirror, and piano wire as a secondary system.

Ensure that the load apparatus has a capacity of 150 percent of the test load and meets D1143. Ensure that no jack is loaded in excess of 85 percent of the total capacity of the jack. If more than one hydraulic jack is used, provide jacks that are of the same piston diameter, connected to a common manifold and pressure gauge, and operated by a single hydraulic pump.

Apply loads uniformly without impact. If hydraulic jacks are used, equip them with automatic regulators so that constant pressure can be maintained for the duration of the test without frequent manual adjustment.

Unless weights of known magnitude are used to load the test piles, use a load cell having an accuracy tolerance within plus or minus 2 percent of the applied load as the primary method of measuring the test load. Calibrate the load cell prior to the test and submit a copy of the calibration report. Provide a pressure gauge as a secondary system. Calibrate the pressure gauge, hydraulic ram, and hydraulic pump as a unit to an accuracy within 5 percent of the applied load (a single high capacity jack is preferred over multiple jacks). When a multiple jacking system is used, fit each jack with a pressure gauge in addition to the master gauge in order to detect malfunctions.

Recalibrate load measuring devices if required by observed performance.

Cut off the load test pile perpendicular to the longitudinal axis to allow for full bearing. Place a steel plate at least 1 in. thick over the cutoff surface in a manner that facilitates axial loading and even bearing on the test pile.

For all test piles driven to the embedded depths specified, use the standard loading procedure according to D1143 or as directed. Continue loading to the specified test load or to failure, whichever occurs first.

Provide a scale attached to the reaction piles that can be monitored with a transit to determine if the piles are moving.

If at any stage during the test, the Engineer detects malfunctioning of any furnished apparatus, or the load is being eccentrically applied, or the anchor piles are yielding, abandon the test and replace

it with another test at no additional cost to the Administration. Ensure that all necessary personnel are present at the site at all times during the performance of the test to maintain the required load.

After the pile test program is complete, remove or cut off reaction piles as specified in 410.03.10.

Perform load tests on steel pipe piles prior to filling.

411.04 MEASUREMENT AND PAYMENT

Load tests will be measured and paid for at the Contract unit price per each for the pertinent Load Test item. The payment will be full compensation for furnishing and installing all equipment, drawings, monitoring, recording, removal of all devices at the completion of the tests, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. In the event that a properly conducted load test fails to achieve the designated capacity, the additional tests will be measured and paid for at the Contract unit price per each under the Load Test item.

CATEGORY 400
STRUCTURES

SECTION 412 — DRILLED SHAFTS (CAISSONS)

412.01 DESCRIPTION

Construct drilled shafts (caissons) as specified.

412.02 MATERIALS

Refer to 420.02 except as modified herein.

Portland Cement Concrete	902.10, Mix No. 4
Reinforcing Steel	Section 908
Steel Casings	A252, Grade 2 or A36

412.03 CONSTRUCTION

Refer to 402.03, 419.03, and 420.03, except as modified herein.

412.03.01 Subfoundation Investigation. When the Contract Documents include an item for Subfoundation Investigation, conduct a subfoundation investigation program prior to ordering or fabricating reinforcement for drilled shafts. Use this program to determine the elevation of suitable bearing stratum and the required depth of the drilled shafts. Select approximately a third of the drilled shaft locations spread over the total number of locations, and drill test holes at least 10 ft below the estimated drilled shaft length. After drilling the test holes, the Engineer will evaluate the data to determine the uniformity of the foundation materials. If the evaluation determines that more test holes are required, drill additional test holes at approved locations.

412.03.02 Shaft Installer. Obtain the services of a shaft installer having a proven record of experience and having successfully completed at least three projects with similar subsurface conditions, shaft sizes, depths, and minimum volumes of work as contained in the project. Submit evidence of pertinent experience for approval before proceeding with drilling shafts.

Furnish a Certified Drilled Shaft report containing the following information for each drilled shaft:

(a) Top and bottom elevations.

(b) Final center line location at top.

(c) Variation of shaft from plumb.

(d) Results of tests performed.

(e) Levelness of bottom.

(f) Seepage of water.

(g) Top and bottom elevation of any casings left in place.

(h) Any unusual conditions.

(i) Variation of dimensions from planned.

(j) Dates of start and completion of excavation.

(k) Inspection, testing, and placement of concrete (including any delays in concreting and location of construction joints in shafts).

(l) Reinforcing steel.

(m) Any additional information relevant to the as-built drilled installation.

Record and maintain information pertinent to each drilled shaft and provide required data to other testing and inspection personnel.

Provide all facilities required for the safe and convenient conduct of the Engineer's inspection and testing procedures.

412.03.03 Geotechnical Engineer. When specified, employ the services of a qualified geotechnical engineer for inspection and testing for installation of drilled shafts. Ensure that the geotechnical engineer is a professional engineer registered in the State of Maryland, has a demonstrated record of experience with similar drilled installations, and is approved prior to beginning auguring for the drilled shafts.

The geotechnical engineer shall submit a plan containing the proposed methods to be used to inspect the drilled shafts as specified herein.

The geotechnical engineer shall visually inspect the bottom of each drilled shaft and perform tests as necessary to verify the bearing capacity. Drilled shafts shall be founded in material having the specified minimum design bearing capacity. The geotechnical engineer shall provide certification that the drilled shafts were properly drilled to a satisfactory depth and bearing.

412.03.04 Shaft Requirements. Excavate shafts by auguring, drilling, or hand excavation as necessary to reach the required bearing strata. When earth walls cannot be maintained without spilling into the shaft, install casings or slurry as excavation proceeds. Ensure that the casings are full-length and watertight. The casings shall be of sufficient thickness to withstand compressive,

displacement, and withdrawal stresses; and to maintain the shaft walls. Withdraw casings as concrete is placed unless otherwise specified.

The geotechnical engineer shall determine the final bottom elevation of drilled shafts when the services are required. All holes shall be inspected and approved.

Do not excavate holes for successive drilled shafts until adjacent holes are filled with concrete and allowed to set.

Drilled shaft tolerances:

(a) Maximum permissible variation of center line locations is not more than $1/24^{th}$ of the shaft diameter or 3 in., whichever is less.

(b) Maximum out of plumb is 1.5 percent of the depth, 12.5 percent of the shaft diameter, or 15 in., whichever is less.

(c) The top of the shaft or concrete cut-off elevation shall be within 1 in. of the design elevation.

If the specified tolerances are exceeded, provide corrective construction to compensate for excessive eccentricity at no additional cost to the Administration. Submit proposed methods of corrective construction for approval.

Excavate the bottom of drilled shafts to an undisturbed, level plane. Remove all loose material prior to placing concrete.

Dewater drilled shafts as required to facilitate excavation, inspection, and concreting.

Ensure that each drilled shaft has been inspected before placing concrete.

Reinforcing Steel. Fabricate and place reinforcing steel cages for each drilled shaft as one continuous unit. Place reinforcement accurately and symmetrically about the axis of the hole, and keep securely in position during concrete placement.

Protect exposed ends of extended reinforcement from damage.

Concrete. Fill drilled shafts with concrete immediately after inspection and approval by the geotechnical engineer and the Engineer.

Place concrete in one continuous operation, in a smooth flow without segregating. Use mechanical vibration for consolidation of at least the top 25 ft of each shaft. Concrete may be free dropped up to 25 ft provided that the procedures ensure that the concrete falls vertically without hitting the inside walls of the hole or falling directly on the reinforcing steel. When the Engineer determines that the concrete placement procedures are unsatisfactory, place concrete by means of bottom

discharge bucket, flexible drop chute, elephant trunk hopper, tremie, or pumping. Use chutes, tremies, or pumping where a drop of more than 25 ft is required.

Place concrete in the dry insofar as practicable. If excessive water occurs and it is not feasible to dewater the drilled pier shaft for concreting, place concrete by the tremie method as specified in 420.03.05. Control tremie placement operations to ensure that tremie is not broken during continuous placing from bottom to top. If approved, other methods of depositing concrete underwater may be used.

Maintain a sufficient head of concrete to prevent any reduction in the diameter of the drilled shaft by earth pressure and to prevent extraneous material from mixing with the concrete. Coordinate the withdrawal of temporary casings with concrete placement operations to maintain a head of concrete approximately 5 ft above the casing bottom.

Stop concrete placement at the top cut-off elevations shown on the Contract Documents. Screed the tops of drilled shafts level and give them a roughened surface finish. Where the cut-off elevation is above ground elevation, form the top section to extend the shaft to the required elevation.

Construction joints are permitted in drilled shafts if concrete placement operations must be interrupted, as accepted by the Engineer. Screed the surface of the construction joint level and give it a roughened surface. Apply an approved bonding compound prior to placing additional concrete.

The Engineer may require full-depth continuous coring of drilled concrete shafts where observations of temporary casing removal and concrete placement operations indicate cause for suspicion of quality of concrete, presence of voids, segregation, or other defects. Perform this work at no additional cost to the Administration.

Defective Drilled Shafts. Repair or replace defective drilled shafts as directed.

412.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

412.04.01 Drilled shafts including furnishing and setup of auguring equipment, auguring, drilling, excavating, dewatering, inspection, testing, services of the shaft installer and geotechnical engineer, sleeves, reinforcement, concrete, and disposal of excess and unsuitable material will be paid for at the Contract unit price per linear foot for the pertinent Drilled Shaft item.

412.04.02 When subfoundation investigation is specified, it will be measured and paid for as specified in 419.04.

CATEGORY 400
STRUCTURES

SECTION 413 — MICROPILES

413.01 DESCRIPTION

Design, furnish, install, and test micropiles capable of supporting loads as indicated in the Contract Documents. Furnish all submittals, materials, products, accessories, tools, equipment, services, transportation, labor and supervision, and installation techniques required for installing and testing micropiles as shown on the Plans, specified herein, and as directed by the Engineer. The micropile design capacity, size, and length in the Contract Documents is a minimum requirement for bidding purposes. The actual design capacity, size, and length submitted by the Contractor may be different from that shown but shall be at no additional cost to the Administration. Work also includes survey/layout and record keeping of the micropile installation according to the Contract Documents.

413.02 MATERIALS

All materials shall be new and furnished without defects. Defective materials shall be removed from the jobsite at no additional cost to the Administration.

Water	921.01
Concrete Admixtures	902.06
Portland Cement or Blended Hydraulic Cement	Section 902
Grout	902.11(c), 915.03
Reinforcement Steel	908.01
Structural Steel Plates and Shapes	A 709, Grade 36 or 50

413.02.01 Admixtures for Grout. Conform to the requirements of ASTM C494/AASHTO M 194. Admixtures that control bleed, improve flowability, reduce water content, and retard set may be used in the grout, subject to the review and acceptance of the Engineer. Admixtures shall be compatible with the grout and mixed in accordance with the manufacturer's recommendations. Expansive admixtures shall only be added to the grout used for filling sealed encapsulations and anchorage covers. Accelerators and chloride containing admixtures are not permitted.

413.02.02 Centralizers. Fabricate from material nondetrimental to the reinforcing steel and grout. Wood and aluminum shall not be used. Securely attach to the reinforcement; size to position the reinforcement within 0.5 in. of plan location from center of micropile; size to allow grout tremie pipe insertion to the bottom of the drill hole; and size to allow grout to freely flow up the drill hole and steel casing and between adjacent reinforcing bars.

413.02.03 Steel Casings. Use steel casings with an outside diameter and minimum wall thickness as shown on the Plans, or as submitted by the Contractor and approved by the Office of Structures. Use steel casings connected by means of threaded joints to provide a flush connection; welding or splicing of the casing is prohibited. The threaded joint connection shall develop the required design strength of the pile as specified in the Contract Documents. Conform to the tensile requirements of A 252 Grade 3, except that the minimum yield strength shall be 50 000 psi.

413.03 CONSTRUCTION

413.03.01 Submittals. Submit the following qualifications, drawings, plans, and information for accomplishing the work. Make the qualifications submittal listed in 413.03.01(a) below to the Office of Construction's procurement team. Make all other submittals including any changes to those listed in 413.03.01(a) after award to the Office of Structures through the Engineer. Do not proceed with the work until all submittals are approved by the Administration. The Engineer will accept or reject each submittal within 15 calendar days after receipt of a complete submission. Additional time required due to incomplete or unacceptable submittals will not be the cause for time extension, impact, or delay claims. All costs associated with incomplete or unacceptable submittals shall be at no additional cost to the Administration.

(a) Qualification Submittal. After the bid opening but before the contact award, submit an electronic PDF version of the qualification package, as listed below, to the Engineer for review and acceptance. If any changes are needed to this submittal, they must be made in writing at least 60 days before micropile construction. Micropile design is prohibited until the Contractor's qualification submittal has been received and approved in writing. The qualification package shall include the following:

(1) Micropile Installer Qualifications. Submit proof of the Contractor's, or specialty sub-contractor's proven record of experience with micropile installation, including at least three projects with similar subsurface conditions, micropile sizes, depths, and minimum volumes of work as contained in the project. Submit a brief description of each project with the owner's name, address, and current telephone number.

(2) Micropile Design Engineer Qualifications. Submit the resume of a professional engineer experienced in micropile design and registration in the State of Maryland (hereinafter referred to as the micropile design engineer). The micropile design engineer shall have experience of at least three projects of similar size and scope, one of which needs to be completed within the last five years. Submit the resume with sufficient information for the Engineer to make a determination of the micropile design engineer's qualifications and experience, to include a listing of micropile projects completed and references.

(b) Design criteria. Design the micropiles in accordance with the AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications edition shown on the plans. Steel micropiles are the only acceptable augered or drilled pile types. No other augered or drilled pile type, including helical piles, will be considered. Design the piles

to meet the minimum uncased or bond zone lengths shown on the plans and extend below the lowest ground elevation that the structure crosses. Meet or exceed the minimum micropile design capacity, size, and length in the Contract Documents. The number, location, and spacing of micropiles shown on the plans cannot be altered.

(c) Working Drawings Submittal. As part of the working drawing submission, include all information required for the construction and quality control of the micropiles; including, but not limited to, the following:

(1) Design parameters and applicable codes based on the Contract Documents.

(2) General notes for constructing the micropiles including construction sequencing or other special construction requirements.

(3) A listing of the summary of quantities for each substructure unit showing pay item estimated quantities.

(4) Micropile typical sections; pipe casing and reinforcing bar sizes and details; and connection details to the substructure footing, anchorage, plates, etc.

(5) Minimum drillhole diameter, splice types and locations, centralizer and spacer types and locations, grout bond zone and casing plunge lengths, and corrosion protection details.

(6) A typical detail of verification test micropiles defining the micropile length, minimum drillhole diameter, micropile casing, steel reinforcement, and load test bonded and unbonded test lengths.

(7) Details, dimensions, and schedules for all micropiles, casing, and reinforcing steel, including reinforcing bar bending details.

(8) Details for constructing micropiles around drainage facilities (if applicable).

(d) Micropile Installation Procedure Submittal. At least 30 calendar days before construction, submit an electronic PDF version of the micropile installation procedure package to the Engineer for review and acceptance. Drilling, installing, and testing of micropiles is prohibited until the Contractor's construction submittal has been received and approved in writing. The Engineer may suspend the work if the Contractor uses non-approved personnel. If work is suspended, it shall be at no additional cost and no adjustment in Contract time. The micropile installation procedure package shall include the following:

(1) Geotechnical Engineer. Employ the services of a qualified geotechnical engineer and geotechnical engineer technician for inspection and testing for installation of micropiles. Ensure that the geotechnical engineer is a Professional Engineer registered in the State of Maryland and that the

geotechnical engineer technician works for the same company under the direct supervision of the geotechnical engineer. Ensure that both the geotechnical engineer and geotechnical engineer technician have a demonstrated record of experience with similar micropile installations, and are approved prior to beginning drilling for the micropiles. One or both of these people are hereinafter referred to as the geotechnical engineer in this specification.

(2) Detailed systematic description of the proposed micropile construction procedure, including personnel, testing, and equipment to ensure quality control. This systematic procedure shall be shown on the working drawings in sufficient detail to allow the Engineer to monitor the construction and quality of the micropiles.

(3) A schedule indicating the proposed start date, duration of micropile installation and micropile installation schedule including a plan sheet with each micropile sequentially labeled.

(4) Information on headroom and space requirements for installation equipment that verify proposed equipment can perform at the site.

(5) Containment plan describing how surface water, drill flush, and excess waste grout will be controlled and disposed.

(6) Certified mill test reports for the reinforcing steel and steel casing which shall include the ultimate strength, yield strength, elongation, and material property composition. For API N-80 pipe casing, coupon test results for the above data may be substituted in lieu of mill certification.

(7) Grouting procedures that include complete descriptions, details, and supporting calculations for the following:

(i) Method of placing reinforcing steel, which shall include a catalog cut of a sample centralizer for approval by the Engineer.

(ii) Grout mix designs and type of materials to be used in the grout including certified test data and trial batch reports.

(iii) Methods and equipment for accurately monitoring and recording the grout depth, grout volume, and grout pressure as the grout is being placed.

(iv) Grouting rate calculations when requested by the Engineer. The calculations shall be based on the static head of the grout and losses throughout the placing system including anticipated head of drilling fluid (if applicable) to be displaced.

(v) Procedure and equipment for mixing, placing, and monitoring of grout quality.

(vi) Theoretical volume of grout for each micropile installation.

(vii) Procedure to be followed for cases where the actual amount of grout used exceeds two times the theoretical volume.

(8) Load testing plan and calculations, signed and sealed by the micropile design engineer, that include the following:

(i) Load test procedures and acceptability criteria for the verification and proof test micropiles, including creep test criteria. Minimum strength acceptance criterion for verification load tests shall be at 2.0 times the design load test loading. Minimum strength acceptance criterion for proof load tests shall be at 1.6 times the design load test loading. The creep test shall hold 1.33 times the design load for at least 1 hour. For the creep test, the maximum criteria for movement shall be 0.04 inches after the first 10 minutes and an additional maximum of 0.08 inches over the last 50 minutes.

(ii) Description of the test setup and jack, pressure gauge, and load cell calibration curves.

(iii) Method and accuracy of the hydraulic jack for applying the load. Jack ram travel shall be sufficient to allow the test to be done without resetting the equipment. The hydraulic jack calibration report shall be submitted if requested by the Engineer. The calibration tests shall have been performed by an independent testing laboratory and tests shall have been performed within one year of the date submitted.

(iv) Type and accuracy of the pressure gauges for measuring load. The pressure gauge shall be graduated in 100 psi increments or less. The jack and pressure gauges shall have a pressure range not exceeding twice the anticipated maximum test pressure. The calibration tests shall have been performed by an independent testing laboratory and tests shall have been performed within one year of the date submitted.

(v) Type and accuracy of the apparatus for measuring top of micropile deformation, including placement and support of measuring devices. The top pile movement measurement apparatus shall include three dial gauges equally spaced 120 degrees apart around the pile reading to 0.001 in.; a wire, mirror, and scale system suitably mounted on the pile; and an independent measurement frame as an auxiliary monitoring device. The dial gauges shall have a travel sufficient to allow the test to

be done without having to reset the gauges. Support the gauges independently from the jack, pile, and reaction frame.

(vi) Type and capacity of the reaction frame. Design the reaction frame to be sufficiently rigid and of adequate dimension so that excessive deformation of the testing equipment does not occur.

(vii) Reaction frame piles and configuration.

413.03.02 Pre-construction Meeting. A pre-construction meeting will be scheduled by the Engineer and held prior to the start of micropile construction. The Engineer, prime Contractor, micropile specialty Contractor, micropile design engineer, geotechnical engineer, excavation Contractor, and geotechnical instrumentation specialist (if applicable) shall attend the meeting. Attendance is mandatory. The pre-construction meeting will be conducted to clarify the construction requirements for the work, to coordinate the construction schedule and activities, and to identify contractual relationships and delineation of responsibilities amongst the prime Contractor and the various subcontractors specifically those pertaining to excavation for micropile structures, anticipated subsurface conditions, micropile installation and testing, micropile structure survey control, and site drainage control.

413.03.03 Utilities. Adhere to the requirements in Section 875 Utility Statement. If not already stated in a utility statement, the Contractor is responsible for field locating and verifying the location of all utilities shown on the Plans prior to starting the Work. Maintain uninterrupted service for those utilities designated to remain in service throughout the Work. Notify the Engineer of any utility locations different from shown on the Plans that may require micropile relocations or structure design modification.

413.03.04 Site Drainage Control. Control and properly dispose of drill flush and construction related waste, including excess grout, in accordance with the standard specifications and all applicable local codes and regulations. Provide positive control and discharge of all surface water that will affect construction of the micropile installation. Maintain all pipes or conduits used to control surface water during construction. Repair damage caused by surface water at no additional cost. Upon substantial completion of the Work, remove surface water control pipes or conduits from the site. Alternatively, with the approval of the Engineer, pipes or conduits that are left in place, may be fully grouted and abandoned or left in a way that protects the structure and all adjacent facilities from migration of fines through the pipe or conduit and potential ground loss.

Immediately contact the Engineer if unanticipated existing subsurface drainage structures are discovered during excavation or drilling. Suspend work in these areas until remedial measures meeting the Engineer's approval are implemented.

413.03.05 Micropile Installation. Install micropiles in accordance with approved micropile working drawings and installation procedures.

Use drilling equipment and methods suitable for drilling through the conditions to be encountered, without causing damage to any overlying or adjacent structures or services. The drillhole must be

open along its full length to at least the design minimum drillhole diameter prior to placing grout and reinforcement.

When appropriate, use a down hole hammer drilling method. Use the grouting procedure for micropile installation in accordance with the approved micropile submittals. Advance the steel casing with the hole. Open hole drilling is prohibited except in the bond zone shown on the plans. The use of drilling fluid containing bentonite is prohibited.

Fill out a Micropile Installation Log sheet for each micropile installed. Install micropiles to the minimum depth shown on the Plans, or as directed by the Engineer. The geotechnical engineer shall complete the Pile Drilling portion of the Micropile Installation Log sheet for each production micropile and load test pile. The micropile design engineer, in consultation with the the geotechnical engineer and the Engineer, shall determine if satisfactory material has been encountered.

After drilling to the required depth, adjust steel casing (as needed), and flush the hole with water. If necessary, blow clean with compressed air until the hole is clear of all cuttings as evidenced by clean water overtopping the steel casing. If clean water does not overtop the casing within a reasonable amount of time or if satisfactory material is not encountered at the specified elevation or depth, the geotechnical engineer, with the approval of the Engineer, will direct the Contractor to lower the micropile tip by extending the steel casing downward and maintaining the specified bond zone length. The geotechnical engineer shall amend the drill log as appropriate.

Final tip elevation will be determined by the micropile design engineer, in consultation with the geotechnical engineer and the Engineer, and will be governed by drilling the required bond zone in satisfactory material as indicated by drilling response (e.g., hammer sound, penetration rate, etc.) similar to the test piles and by the flushing of clean water that overtops the steel casing. The Engineer will determine when the satisfactory material requirements have been met.

If, during drilling of the bond zone, unsatisfactory material such as soil, voids, or weathered rock are encountered, the following actions are to be taken. For unsatisfactory material of:

(a) Less than 6 in., the bond zone remains unchanged.

(b) Greater than 6 in. but less than 1 ft, extend the bond zone length 1 ft.

(c) Greater than 1 ft, recount from the bottom of the unsatisfactory material to conform to either (a) or (b).

Continually test the bottom of the steel casing for running material and take all measures necessary to prevent disturbance of the subsoil or loss of ground.

Observe the conditions near the micropile construction site daily for signs of subsidence or ground heave. Immediately notify the Engineer if signs of movement are observed. Immediately suspend or modify drilling or grouting operations if ground heave or subsidence is observed, if the micropile structure is adversely affected, or if adjacent structures are damaged from the drilling or

grouting. If the Engineer determines that the movements require corrective action, take corrective action necessary to stop the movement or perform repairs. When the Engineer determines that the adverse conditions are due to the Contractor's methods or operations, or failure to follow the specified/approved construction sequence, the corrective actions shall be at no additional cost. Reinforcement may be placed either prior to grouting or placed into the grout-filled drillhole before temporary casing (if used) is withdrawn. The geotechnical engineer shall provide certification with their Professional Engineer stamp that the micropiles were properly drilled to a satisfactory depth in bearing materials.

Reinforcement surface shall be free of deleterious substances such as soil, mud, grease, or oil that might contaminate the grout or coat the reinforcement and impair bond. Pile cages and reinforcement groups, if used, shall be sufficiently robust to withstand the installation and grouting process and the withdrawal of the drill casings without damage or disturbance.

Check pile top elevations and adjust all installed micropiles to the planned elevations.

Place a minimum of two centralizers on the central reinforcement, with the upper most centralizer located a maximum of 4 ft from the top of the central reinforcement. Maintain a maximum spacing of 15 ft between all additional centralizers. Centralizers shall permit the free flow of grout without misalignment of the reinforcement. The central reinforcement steel with centralizers shall be lowered into the stabilized drill hole to the desired depth without difficulty. Do not drive partially inserted reinforcing bars into the hole.

Secure lengths of casing and reinforcing bars to be spliced in proper alignment and in a manner to avoid eccentricity or angle between the axes of the two lengths to be spliced. Threaded pipe casing joints shall be located at least two casing outside diameters from a splice in any reinforcing bar. When multiple bars are used, bar splices shall be staggered at least 12 inches.

Provide means and methods of measuring the grout quality through field and laboratory sample testing, quantity, and pumping pressure (if applicable) during the grouting operations. Complete the Pile Grouting portion of the Micropile Installation Log sheet, to show quantities, test data, and grout pressures (if applicable) for inspection by the Engineer.

Grout the micropiles on the same day that the load transfer bond length drilling is completed. Produce a colloidally mixed grout, free of lumps and undispersed cement. Grout shall be mixed for a minimum of two minutes and then kept in a continuous slow agitation until the grout is pumped to the micropile. Place grout that is manufactured off-site and delivered in a freshly mixed and unhardened state in conformance with M 157 and 915.03.05.

Equip the grout pump with a pressure gauge to monitor grout pressures. The pressure gauge shall be capable of measuring pressures of twice the actual grout pressures used. Size the grouting equipment to enable the grout to be pumped in one continuous operation.

Place primary grout by pumping the grout through a tremie pipe exiting at the bottom of the borehole. Ensure that the grout is not diluted or contaminated during placement. The grout shall

progressively displace water and other fluid debris out of the hole. Embed the tremie pipe in the grout column at all times a minimum of 10 ft. and remove upon the completion of grouting.

Use the tremie method to place grout along the full depth of the micropile. If more than two times the theoretical volume of grout is used, see measurement and payment for the payment of excess grout.

Complete the Micropile Installation Log sheet. The geotechnical engineer shall sign and seal the Micropile Installation Log sheet with their Professional Engineer stamp, and submit it to the Engineer, upon completion of each micropile installation.

Grout within the micropiles shall be allowed to attain the required design strength prior to load testing and application of superstructure loads. Grout strength shall be determined as specified in 413.03.06.

413.03.06 Field Quality Control. Make grout cubes as specified in 902.11(c) in the presence of the Engineer and deliver them to the Office of Material Technology to test the compressive strength at the following frequencies:

(a) One set of four specimens for each work shift.

(b) Test one specimen after 7 days.

(c) Test two specimens after 28 days.

(d) Retain one specimen in reserve in case later testing is required.

If testing passes all criteria in 902.11(c) after 7 days, do not test the remaining cubes.

413.03.07 Tolerances. Micropile construction tolerances are as follows:

(a) Center line of piling shall not be more than 3 in. from specified Plan location.

(b) Variation from the vertical or from the batter shall be within 2 percent of total length Plan alignment.

(c) Top elevation of pile shall be plus 1 in. or minus 2 in. maximum from specified Plan vertical elevation.

(d) Center line of reinforcing steel shall not be more than 0.5 in. from specified location.

(e) Joint connections shall not permit eccentricities or kink angles.

When micropiles are installed with dimensions outside of the specified tolerances, with grout not conforming to the specified strength, or with any other nonconforming condition, the Engineer will make a determination regarding the proper corrective measures to be taken. Corrective

measures may include the removal and replacement of defective micropiles, the installation of additional micropiles at nearby locations, modification of the foundation over the micropyles, additional testing and engineering including the evaluation and redesign or other measures the Engineer deems appropriate, at no additional cost.

413.03.08 Pile Load Tests. Perform verification and proof testing of the micropiles in tension at the locations specified or designated by the Engineer. The Quick Load Test procedure with creep test and the apparatus for measuring load and movement, both specified in ASTM D3689, shall be used for the verification and proof tests in tension, except as modified herein.

Submit load test results to the Engineer. The report shall be reduced and presented in an appropriate tabular and graphical form, signed and sealed by the micropile design engineer, and shall also include time, load, and displacement data. Obtain the Engineer's approval of the load test results before installing the remaining production micropiles. The Engineer will notify the Contractor of acceptance, or if modification to the micropile design is required, within 3 working days from receipt of the load test report.

If a micropile fails to meet the applicable acceptance criteria, submit to the Engineer a written plan of remedial action for approval modifying the design, the construction procedure, or both to correct the problem and prevent its reoccurrence. Any modification that necessitates changes to the structure shall require the Engineer's prior review and acceptance. Any modifications of design or construction procedures, or cost of additional verification test micropiles and verification and/or proof load testing, or replacement micropiles, shall be at no additional cost to the Administration.

(a) Verification Load Tests. Verification load tests shall be performed on one non-production test micropile per substructure unit, installed near each substructure unit but outside of the footing using method specified in ASTM D3689 (Tension Testing). If there is no location shown on the plan for this test, the Engineer shall find a suitable location within the limit of disturbance that is between 10 and 20 feet away from the footprint of each substructure unit. The verification test micropile shall be loaded to the verification test load established in 413.03.01(d). Do not load the verification test micropile to more than 80 percent of its structural capacity. The verification test micropile's structural capacity shall be designed by the micropile design engineer and shall not be less than the proof test and production micropile's structural capacity shown in the Plans. Any required increase in strength of the verification test micropile elements above the strength required for the production micropile elements shall be provided for in the Contractor's bid price. The verification test shall be performed prior to installation of the proof load test micropiles and any other production micropile.

The drilling and grouting method, casing length and outside diameter, reinforcing bar lengths, and depth of embedment for the verification test micropiles shall be identical to those specified for the production piles at the given locations. The verification test micropile structural steel sections shall be sized to safely resist the maximum load test.

Verification load tests shall be performed to verify that the Contractor installed micropiles will meet the required compression load capacities and load test acceptance

criteria and to verify that the length of the micropile bond zone is adequate. The micropile verification load test results must verify the micropile design and the Contractor's installation methods.

At the completion of verification testing, verification test micropiles shall be removed down to the elevation specified by the Engineer.

(b) Proof Load Tests. Perform proof load tests using method specified in ASTM D3689 (Tension Testing) on the production test micropiles installed at each substructure unit during each stage of construction, as specified on the Plans, prior to the installation of any other production micropiles in that unit during that stage. The installation of the proof loaded test micropiles shall be identical to the production micropiles, except that the center bar can be increased in size to handle the additional tensile force from the proof load test.

(c) Testing Equipment and Data Recording. Provide testing equipment, including dial gauges, dial gauge support, jack and pressure gauges, and reaction frame in accordance with approved micropile installation submittal.

The jack, bearing plates, and stressing anchorage shall be aligned so that unloading and repositioning of the equipment will not be required during the test.

Apply and measure the test load with a hydraulic jack and pressure gauge. Monitor the creep test load hold during verification tests with both the pressure gauge and the electronic load cell. Use the load cell to accurately maintain a constant load hold during the creep test load hold increment of the verification test.

Visually align the gauges of the top of micropile movement system to be parallel with the axis of the micropile.

The required load test data shall be recorded by the geotechnical engineer.

413.03.09 Site Clean Up. Clean and remove from the project site all surplus and discarded materials and equipment and remove all debris and objectionable materials of any kind from areas used or disturbed by the construction operation.

413.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all design, material, labor, equipment, tools, and incidentals necessary to complete the work.

413.04.01 Micropiles. Micropiles (production and proof load test) will be measured and paid for at the Contract unit price per linear foot for the pertinent Micropile item. The measured length of all piling will be taken from the bottom of the bond zone to the final cutoff, measured along the axis, unless otherwise specified in the Contract Documents. The payment will be full compensation for design, setup, drilling, steel casings, steel plates, reinforcement steel,

centralizers, geotechnical engineering services, and grouting up to two times the theoretical volume. No additional compensation will be made for if the Contractor's design exceeds the design standard from what is shown in the original contract documents.

413.04.02 Excess Grout. Grout ordered and accepted by the Engineer that is greater than two times the theoretical volume will be measured and paid for at the Contract unit price per cubic yard for the Excess Grout item per each individual micropile installation. This is a contingent item just to establish a unit cost for the excess grout and GP-4.04 will not apply to this item.

413.04.03 Proof Load Tests. Proof load tests satisfactorily performed and completed will be measured and paid for at the Contract unit price per each for the pertinent Micropile Proof Load Test item. Payment will also include full compensation for furnishing, removal, and disposal of the load frame, reaction piles, instrumentation and all items required to complete the testing work with the exception of the micropile itself. In the event that the properly conducted load test fails to achieve the designed capacity, the additional tests will be completed at no additional cost to Administration.

413.04.04 Verification Load Tests. Verification load tests satisfactorily performed and successfully achieving the verification test load will be measured and paid for at the Contract unit price per each for the Micropile Verification Load Test Item. Payment will also include full compensation for furnishing, removal and disposal of the load frame, reaction piles, installation and removal of micropile, instrumentation and all items required to successfully complete the testing work. In the event that the properly conducted verification load test fails to achieve the verification test capacity, the micropile shall be abandoned and the Contractor shall not be paid for the micropile or testing.

CATEGORY 400
STRUCTURES

SECTION 418 — PROTECTIVE JACKETS FOR PILES

418.01 DESCRIPTION

Install protective jacket for piles.

418.02 MATERIALS

Fine Aggregate	901.01
Portland Cement	902.03, Type II
Concrete Admixture	902.06
Water	921.01
Welded Wire Fabric	908.08
Fiberglass Protective Pile Jackets	921.10 and 418.02.01
Anchor/Standoff Devices	A185
Stainless Steel Screws	A193, Type 303

418.02.01 Jackets. Fabricate jackets for new piles in one solid piece with no longitudinal joint. Closure joints on jackets for existing piles need not be self-locking provided the joint can be field formed with fiberglass and is approved. Ensure that the field formed closure joint meets the tensile strength of the jacket. All jackets shall be at least 3/16 in. thick. Ensure that the surfaces of the fiberglass are free of bond inhibiting agents.

For steel and concrete piles, provide noncorrosive standoffs on the inside face of jackets to maintain the jackets in the required position.

418.02.02 Closure Joint Warranty. When closure joints are used for existing piles, furnish the Administration a written 5 year warranty against installation defects, and ensure that the manufacturer submits a similar warranty against manufacturing defects. Submit both prior to starting the installations.

418.02.03 Grout. Submit the proposed grout mix design and method of installation for approval.

Steel and Concrete Piles. Use grout consisting of at least 845 lb./yd^3 of cement, 6 ± 1 percent of air entrainment by volume, and proportioned with fine aggregate and water to provide a pumpable mixture. The minimum 28 day compressive strength shall be 3500 psi.

Ready mixed grout will be permitted by written permission of the Engineer, and shall be from a manufacturer approved by the Office of Materials Technology.

Timber Piles. Submit grout consisting of water insensitive epoxy and fine aggregate mixed according to the manufacturer's recommendations.

418.03 CONSTRUCTION

Prepare and submit working drawings for approval showing equipment, installation procedure including location of tremie pipes, injection port, method of sealing the bottom of the jacket, and method of support during grout placement. Refer to Section 499.

418.03.01 Cleaning Piles. Clean the piles of all surface contamination such as grease, oil, tar, loose rust, loose coatings, and marine organisms.

Water blast steel and concrete piles with a nozzle pressure of 8000 psi to 20 000 psi, and timber piles with a nozzle pressure of 3000 psi to 3500 psi. Clean the piles within 24 hours prior to placing the grout. Do not place jackets until the cleaning is approved.

418.03.02 Preparation of Protective Jackets. Clean and abrasive blast the inside faces of the jackets to remove any agents that will inhibit attachment of anchor devices and bonding of the grout. The Engineer may require these procedures to be repeated if they are not acceptable at the time of placement.

The Engineer will inspect the protective jackets prior to placement. Repair loose or damaged anchor devices and replace protective jackets deemed unsatisfactory.

Seal the space between the pile and the jacket at the bottom. Use only external temporary support devices to position the protective jackets during installation. Remove supports before final acceptance.

418.03.03 Filling Void. Fill the void between the pile and the protective jacket with grout placed by the tremie method using two tremie pipes or by pumping using an injection port located at the bottom of the protective jacket. Equip tremie pipes with hopper tops. Do not use bottom dump buckets.

Use approved mixing equipment in preparation and handling of the grout. Remove oil and other rust inhibitors from the mixing drums, stirring mechanisms, and other portions of the equipment in contact with the grout before the mixers are used. Accurately measure all materials by volume or weight as they are fed into the mixer. Mix for at least one minute. The continuously agitated grout may be held in the mixer or agitator no more than one hour, or for 1-1/2 hours when the temperature falls below 70 F.

Place grout as one continuous operation for each pile. Take care in the placement of grout to obtain a sufficient flow to ensure proper distribution and bonding to the pile.

If emergency interruptions of continuous grout pumping become necessary, stop the operation and remove the jacket and the grout. Thoroughly clean the pile as specified in 418.03.01 prior to continuing the operation. Do not reuse the pile jacket unless it is removed prior to initial setting of the grout and is approved.

Finish the top of grout sloped to drain away from the pile. Remove all excess grout from the outside of the piles and jackets after filling.

418.03.04 Protective Jacket Inspection. The installation operations will be observed during all phases of construction. In the presence of the Engineer, remove the first two protective jackets installed to provide visual evidence that the desired results are being obtained. Do not begin removal until the grout has set sufficiently to maintain its shape. The Engineer will examine the grout for cavities, honeycombing, and other defects.

(a) If the grout is satisfactory, the installation operations will be approved. Remove all grout as directed, and clean and reinstall a new jacket in conformance with these Specifications. Do not reuse the original protective jacket.

(b) If the grout on only one of the installations is unsatisfactory, remove the third protective jacket installed, and inspect. If this inspection is satisfactory, the installation operations will be approved. Reinstall the protective jackets as specified in (a).

(c) If the grout is unsatisfactory upon removal of the protective jacket on both of the first two piles inspected, or on two out of the three piles inspected as specified in (b), submit modifications to the operations for approval before continuing. Continue these procedures until the installation operations are satisfactory.

(d) Additional inspections will be performed whenever required.

418.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for fabricating, furnishing, and installing protective jackets including welded steel wire fabric, grout, excavation, and all material, labor, equipment, tools, and incidentals necessary to complete the work.

418.04.01 Protective jackets will be measured and paid for at the Contract unit price per each for the pertinent Protective Jacket for Pile item.

418.04.02 Protective jackets will be measured and paid for at the Contract unit price per linear foot (depth) for the pertinent Protective Jacket for Pile item.

418.04.03 Protective jacket inspections that are satisfactory and accepted, will be measured and paid for at the Contract unit price per each for the pertinent Protective Jacket Inspection item. Payment will also be full compensation for removal of the jacket, removal of the grout, cleaning, and reinstalling a protective jacket, welded steel wire fabric, and grout.

418.04.04 Protective jacket inspections that are unsatisfactory and rejected will not be measured or paid for. The Contractor shall remove the protective jacket, grout, and welded steel wire fabric, and clean the existing structure.

CATEGORY 400
STRUCTURES

SECTION 419 — SUBFOUNDATION INVESTIGATION

419.01 DESCRIPTION

Conduct an investigation to verify the character and suitability of the subfoundation material for foundation purposes.

419.02 MATERIALS

Not applicable.

419.03 CONSTRUCTION

Drill test holes per T 206 and T 225 at least 10 working days prior to excavation or pile driving in that area. Notify the Engineer at least 10 working days prior to drilling. Drill holes at the locations and to the depths specified. Record all information on the Administration's boring log Form No. SHA 73.0-46, available from the Office of Materials Technology. Provide an approved geologist or a geotechnical engineer that is a professional engineer registered in the State of Maryland to ensure that the test holes conform to these Specifications.

Submit the drilling results within two working days after drilling any given hole. Within five working days after receipt, the Engineer will evaluate the subfoundation investigation to determine if any change in the as-planned excavation is necessary. Do not begin excavation until the Engineer's evaluation is received for that particular foundation.

419.04 MEASUREMENT AND PAYMENT

Subfoundation Investigation will be measured and paid for at the Contract unit price per linear foot for the actual total length of holes drilled. The payment will be full compensation for the geologist or geotechnical engineer services, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 400
STRUCTURES

SECTION 420 — PORTLAND CEMENT CONCRETE STRUCTURES

420.01 DESCRIPTION

Furnish, place, finish, and cure concrete bridges, culverts, and miscellaneous structures including cofferdams, forms, and falsework.

420.02 MATERIALS

Curing Materials	902.07
Form Release Compound	902.08
Concrete Mixes	902.10 and 420.02.04
Grout	902.11
Linseed Oil	902.12
Drains, Downspouts, Weep Holes, and Pipes	Section 905
Reinforcement	908.01
Cast Iron Scuppers	909.04
Anchor Bolts	909.06
Steel Forms Which Remain in Place	909.11
Joint Sealer	911.01
Preformed Joint Fillers	911.02
Preformed Elastomeric Joint Seals	911.04
Water Stops and Flashing	911.08 and 913.05
Production Plants	Section 915
Fusion Bonded Epoxy	917.02
Water	921.01
Epoxy Bonding Compound	921.04

420.02.01 Admixtures. Do not use calcium chloride or other admixtures containing chloride salts in concrete placed on steel bridge deck forms.

420.02.02 Requirements for Accessories. Ensure that accessories such as inserts and ties that will remain in completed superstructures within the top 5 in. of final deck slab concrete are either epoxy coated or made of material other than aluminum that will not rust. These same requirements

pertain to accessories that will remain in parapets, sidewalks, or other portions of the structure designated to have epoxy coated reinforcing steel. Do not use inserts in the top half of slabs exposed to vehicular traffic unless specified.

420.02.03 Precast Reinforced Concrete Box Sections. Meet M 259 or M 273 including concrete design strength. All details shall be as specified. Construction joints between the walls and the bottom and top slabs are optional. Certify as specified in 305.03.06.

420.02.04 Composition of Concrete Mixes for Slip Form. For construction of parapets and median barriers on bridges, use Mix No. 6 with a 1 in. maximum slump. Measure the slump at the placement point as the concrete is charged into the slip form machine. Use crushed stone meeting M 43, size No. 7 for the coarse aggregate, proportioned to be 63 percent of the total aggregate in the mix. Other size coarse aggregate may be used provided the slip form results are acceptable.

420.03 CONSTRUCTION

Produce concrete at the work site or away from the work site by an approved central mixing plant, or by approved truck mixing as specified in Section 915.

When specified, remove portions of existing parapets or end posts as specified in 405.03.

420.03.01 Equipment. Use equipment of sufficient capacity to complete any unit or section of concrete between construction joints in one continuous operation consistent with approved placement operations. With written approval, hand mixing may be permitted for small volumes of concrete used in isolated portions of the structure where structural integrity is not critical and the volume does not exceed 1 yd^3.

420.03.02 Forms.

(a) Design Criteria.

(1) Design Loads. According to AASHTO LRFD Bridge Construction Specifications, Temporary Works. Assume the lumber in the forms to weigh 50 lb/ft^3.

(2) Design Stresses.

Timber Design. According to ACI Standard Recommended Practice for Concrete Formwork (ACI 347). Deflections for form members shall not exceed 1/270 of the span or 1/4 in. Unit stresses stipulated in AASHTO for treated timber may be increased by 25 percent, but shall not exceed the values listed below.

Compression Perpendicular to Grain	450 psi
Compression Parallel to Grain	1600 psi
Flexural Stress	1800 psi
Horizontal Shear	
Beams up to 6 in. deep	200 psi
Beams over 6 in. deep	150 psi
Axial Tension	1200 psi

Plywood. For plywood without backing, calculate the strength of plywood based on the grain of the face plies running parallel to its span. Install the plywood in this manner.

Steel Members for Forms. According to AASHTO LRFD Design Specifications and AASHTO LRFD Bridge Construction Specifications. For design where no dynamic loading is involved, the AISC Standard Manual of Steel Construction, Allowable Stress Design may be used as the accepted design code.

Steel Forms Which Remain in Place. The maximum deflection shall not exceed 1/180 of the span and not in excess of 1/2 in. Do not use camber to compensate for deflection in excess of these limits. The design spans of the form sheets shall be the clear distance between beam or girder flanges less 2 in.

The unit working stress in the steel sheet and supporting members shall not be more than 0.725 of the specified minimum yield strength of the material furnished but not to exceed 36 000 psi. Compute physical design properties according to the American Iron and Steel Institute Specification for Design of Cold Formed Steel Structural Members.

(b) Working Drawing Approval. Submit detail, form, falsework, and centering plans and design loads for approval as specified in Section 499. Working drawings for forms shall include all members proposed for use as well as form ties and bracing. Do not submit details for form ties separately; incorporate them in the general working drawings submittal. The rate of placing concrete shall be noted on the working drawings. Approval of the working drawings does not relieve the Contractor of responsibility as specified in TC-4.01. The provisions of 430.03.28 also apply when working drawings are submitted for falsework and centering.

(c) Forms at Construction Joints and Corners. Provide ties or bolts 3 in. to 6 in. from each side of construction joints for tightening the forms against the hardened adjacent concrete prior to placing fresh concrete. At joints where forms have been removed and reconstructed, extend the form over the concrete already in place; and draw tightly against the previously placed concrete. Provide fillets at all sharp corners, except when otherwise specified, and provide a bevel or draft in the case of all projections. Chamfer

all exposed corners of concrete with 3/4 in. x 3/4 in. milled chamfer strips, except on unexposed footings or where specified.

(d) Form Scaffolds and Platforms. Build form scaffolds and platforms along the outside of bridge deck fascias during construction of forms for bridge decks. Design and construct them as integral parts of the form supports. Furnish separate design calculations with the working drawing submission. Assume the responsibility of TC-4.01 even after approval of the working drawings.

(e) Forms for Unexposed Surfaces. Ensure that sheathing, studs, and bracing are of sound material, and that studs and wales are straight, true, and surfaced on two edges to a uniform width. Ensure that the inside faces of the forms are constructed sufficiently smooth so that the resulting concrete surfaces are accurately formed.

(f) Forms for Exposed Surfaces. Unless otherwise specified in the Contract Documents, support the bridge deck concrete between stringers with steel forms which remain in place, except in panels where a longitudinal deck construction joint is located between stringers. Ensure that forms used for widening and rehabilitation provide exposed finished concrete surfaces that match the existing structure.

(1) Lined Forms for Exposed Surfaces. Use approved composition board, sanded plywood, or metal for contact surfaces of lined forms for surfaces exposed to weather or view. Ensure that all studs are surfaced two edges to a uniform width. The studs and backing shall be solid, straight, and free of detrimental defects. However, the backing need not be of the quality used for contact forms for unexposed surfaces.

Sheathing for form backing shall be surfaced two sides to a uniform thickness of at least the dimension approved on the working drawings. Ensure that form sheathing is built solidly, securely nailed to studs, and placed to prevent any bulging of the lining.

(2) Unlined Forms for Exposed Surfaces. Use five ply sanded plywood of the specified thickness for surfaces exposed to weather or view. Use plywood manufactured especially for concrete formwork using waterproof glue. All studs and wales shall be surfaced two edges to a uniform width.

Use full size sheets of plywood except where smaller pieces cover an entire area. Solidly back joints to prevent leakage, and nail the edges of abutting sheets to the same stud or blocking with sixpenny nails not more than 8 in. apart. Where rustication occurs, construct horizontal plywood joints behind a rustication strip. Otherwise, place horizontal joints at the same respective elevations in all portions of the structure. Where vertical rustication occurs, construct vertical joints in the lining behind a rustication strip. Otherwise, keep vertical joints to a minimum, butted tightly together and sealed with crack filler as the plywood is nailed in place.

(g) Steel Forms Which Remain in Place.

(1) Installation. The surface in contact with concrete shall be smooth and free of surface irregularities. Ensure that working drawings specify the grade of steel, the physical and sectional properties, and a clear indication of where the forms are supported by steel beam flanges subject to tensile stresses.

Do not weld form supports to flanges of steel that are not considered weldable or to portions of flanges that are subject to tensile stresses.

Welding and welds according to AWS Bridge Welding Code pertaining to fillet welds.

Unless otherwise specified, use steel forms between stringers to support bridge deck concrete, except where a longitudinal deck construction joint is located between stringers.

(2) Procedure Check and Inspection. Remove at least one section of the forms at a location and time selected by the Engineer from each span of each bridge in the Contract. If the bridge has a longitudinal joint, remove a form on each side of the joint from each span. Do this as soon after placing the concrete as practical to provide visual evidence that the concrete mix and the placement procedures are obtaining the desired results. Remove an additional section if the Engineer determines that there have been any changes in the concrete mix or in the placement procedures that warrant additional inspection.

At locations where sections of the forms are removed, replacement of the forms will not be required, but the adjacent metal forms and supports shall be repaired to present a neat appearance and ensure their satisfactory retention. As soon as the form is removed, the concrete surfaces will be examined for cavities, honeycombing, and other defects. If the Engineer finds irregularities but determines that the irregularities do not justify rejection of the work, repair the concrete as directed.

Give the concrete an ordinary surface finish as specified in 420.03.07(a). If the concrete where the form is removed is unsatisfactory, remove additional forms, as necessary, to inspect and repair the slab. Modify the method of construction as required to obtain satisfactory concrete. Remove all unsatisfactory concrete and replace or repair as directed.

Provide facilities required for the safe and convenient conduct of the Engineer's inspection procedures.

(h) Steel Forms Which Do Not Remain in Place. The contact surface shall be smooth and free of bolts, bolt heads, nuts, rivet heads, welding seams, and surface irregularities. Forms that produce unacceptable results will be rejected, and shall not be reused.

(1) For Round Columns and Piers. Use steel forms that are at least 10 gauge, have a minimum number of horizontal joints, and are column height.

(2) For Pier Caps and Crash Walls. Prefabricated girder type steel forms may be used for forming pier caps or crash walls. Use one piece where practical for each element of these forms including side, bottom, and end. Arrange splices to provide a symmetrical pattern.

(3) For Reinforced Concrete Box Culverts and Rigid Frames. Use steel forms or forms constructed of wood or composition wood panel sheathing set in metal frames. Steel forms for box culverts and rigid frames shall be at least 10 gauge.

(i) Fiber Column Forms. Fiber column forms shall only be used for round columns. The forms shall produce columns truly round and straight. Protect forms from dampness before concrete is placed. Do not splice fiber forms.

(j) Release Agents. Apply form release compound immediately before placing concrete.

(k) Temporary Supports. Build temporary supports used for centering and falsework on good firm foundations. Unless otherwise provided, ensure that they bear upon strata at or below the frost line unless rock is available. Where required, drive piling for support. Ensure that the strength and bracing of the temporary supports will provide a completed structure having the shape specified. Use jacks or hardwood wedges in connection with the temporary supports to take up settlement either before or during placing of concrete. Set temporary supports to give the structural camber specified, and allowance for shrinkage and settlement. If during construction, any weakness, settlement, or distortion develops, stop the work and remove any masonry affected. Strengthen the temporary structures before resuming. Construct centering to permit gradual and uniform lowering.

(l) Defective Forms. Use an approved device for removing or modifying steel forms which remain in place. Burning is prohibited.

(m) Form Ties. Use approved form ties. Ensure that ties leave no metal closer than 2 in. from the surface. They shall not be fitted with lugs, cones, washers or other devices that act as spreaders within the form or for any purpose that leaves a hole larger than 7/8 in. diameter. When prefabricated steel girder forms are used, use tapered ties no greater than 1-1/2 in. diameter. Ensure that ties are clean and free of rust. When ties are removed, pressure grout the holes with a nonshrink mortar mixed to match the color and texture of the concrete.

Coat the removable portions of ties with a clear lubricant or other approved material.

During removal of form ties, avoid spalling the concrete on the exposed surface. Do not cut the ties back from the surface.

(n) Form Support Brackets or Devices. Devices attached to previously placed concrete may be used, provided all parts are acceptable. No metal part of an insert, threader, or anchor that remains in the concrete shall be within 2-1/2 in. of the surface. Do not attach brackets or other devices until the concrete is cured and it has attained a compressive strength of at least 3000 psi. All voids left in the concrete after removal of brackets and other devices shall be no greater than 2 in. diameter. Fill them with mortar and finish the surface as specified in 420.03.07(a).

(o) Form Removal. For determining the time when falsework and forms may be removed, backfill placed, and when loads may be applied to structures, make an adequate number of concrete test specimens in addition to those required to check the quality of the concrete being produced. After meeting all formwork requirements, remove and dispose of all forms except those specified to remain in place.

Do not use methods of form removal likely to cause overstressing of the concrete. Do not remove forms and their support without approval. Remove supports in a manner that permits the concrete to uniformly and gradually take the stresses due to its own weight.

(p) Year Built Marking. Supply the correctly sized forms and molds, and cast the year of completion into each structure, as determined by the Engineer.

420.03.03 Anchor Bolt Placement. Place anchor bolts as specified in 430.03.31.

420.03.04 Concreting. Clean forms before placing concrete. Ensure that temporary struts, stays, and braces holding the forms in correct shape and alignment are not buried in the concrete. If faces of completed or proposed excavated footing areas are disturbed prior to concreting, extend the footings to bear on acceptable undisturbed faces at no additional cost to the Administration.

Place all concrete (except tremie concrete) in the dry.

(a) Foundations. Assume responsibility for any reinforcement fabricated prior to approval of foundations. If bearing material varies more than assumed in design, the Engineer may direct the footing be lowered, raised, or deepened; subfoundation placed; piles used; or a combination of these methods used to best obtain bearing. If planned footings are changed vertically, revise reinforcing steel as required. Use plain nonreinforced Concrete Mix No. 1 to construct subfoundation concrete for bridges, retaining walls, and wing walls of box culverts or rigid frames. This concrete need not be vibrated, and the usual curing and cold weather requirements may be reduced to three days. Selected backfill using No. 57 aggregate may be used for subfoundation for box culvert barrels, headwalls, and miscellaneous structures.

(b) Concrete Placement. Avoid segregation of the material and the displacement of the reinforcement. The use of troughs, chutes, and pipes for conveying concrete more than 15 ft from the mixer to the forms will be permitted only when approved. Open troughs

and chutes shall be metal or metal lined. Where segregation occurs due to steep slopes, equip chutes with baffles.

Where placing operations involve dropping the concrete more than 5 ft, deposit it through a tube made of sheet metal, canvas, or other approved material. Do not use aluminum hoppers or tubes. Keep lower ends as close as possible to the newly placed concrete but not more than 3 ft above the concrete. All tubes shall be at least 6 in. diameter unless otherwise directed. Do not disturb the forms after initial set of the concrete, and do not place any strain on the projecting ends of the reinforcement.

Place concrete in horizontal layers not more than 12 in. high except as provided herein. When less than the complete area of a layer is placed in one operation, terminate it in a vertical bulkhead. Place and vibrate each layer before the preceding layer has taken initial set.

Place concrete in columns and walls in one continuous operation unless otherwise directed. Allow concrete to set at least 12 hours before placing the caps.

Where walls, piers, columns, struts, and posts have horizontal construction joints, do not place succeeding lifts until the lower placement has set for 12 hours.

Prior to subsequent placement, clean all accumulations of mortar splashed upon the reinforcement. Avoid damaging the concrete seal bond near and at the surface of the concrete while cleaning the reinforcing steel.

(c) Superstructure Placement.

(1) Grade Controls for Bridge Deck Slabs. Place bridge deck slabs supported by new stringers to the specified line and grade. Take all necessary precautions, including a check on all new bridge seat elevations as the last order of work before setting stringers. Complete any adjustments resulting from this check before starting additional work. After the structural steel is set, make a final check of elevations of all the steel stringers at points corresponding to those for dead load deflection and finished roadway elevations. Make computations and have them approved. Set controls at proper elevations to produce finished tops of concrete bridge decks that will be true to the planned line and grade of the roadway.

Perform grade control for bridge deck slab replacements as specified in 405.03.02.

(2) Superstructure Placement Restrictions. Do not erect the superstructure until the substructure forms have been sufficiently stripped to determine the character of the concrete in the entire substructure. In all spans, use plywood forms to cast the concrete bridge deck slabs outside of the stringers.

Unless otherwise specified, pump concrete for deck slabs whenever the volume of concrete in the pour exceeds 50 yd^3.

Place all superstructure concrete according to the following schedule:

SUPERSTRUCTURE CONCRETE PLACEMENT SCHEDULE		
DATES	BEGIN CONCRETE PLACEMENT AFTER	FINISH BURLAP PLACEMENT BEFORE
May 15 - June 15	7:00 PM	11:00 AM
June 16 - Aug. 14	9:00 PM	7:00 AM
Aug. 15 - Sept. 15	7:00 PM	11:00 AM
Sept. 16 - May 14	No time restrictions	

Do not place or work superstructure concrete in any manner when the temperature in an unshaded location at the placement site is above 80 F. Use floodlighting when existing light is less than 20 average horizontal ft-c over the construction area.

Submit a Situation Plan showing the locations and aiming of floodlights. After reviewing this plan, the Engineer will witness a test of the floodlighting system at the proposed construction area. The floodlighting system shall be capable of maintaining 20 ft-c without producing a glare on traffic. Floodlighting systems shall be as approved. When portable generators are used, have an emergency backup system available at all times on the job site.

(3) Rate of Concreting for Bridge Deck Slabs. Make provisions to ensure that the placement rate of concrete is at least 35 yd^3/hour per crew. Under special circumstances, the Engineer may give written approval to lower this requirement.

Submit evidence of an adequate source of concrete and placing and finishing equipment capable of meeting the minimum rate of placement while providing the intended quality finish. Submit this evidence at least one week prior to the proposed placement of the bridge deck slab.

Place concrete in slab spans in one continuous operation and in one layer for each span.

Do not mound concrete on forms supported by beams, stringers, or girders. Distribute the concrete to a depth not exceeding the planned slab thickness plus 6 in. before spreading, consolidating, and finishing.

Follow the placing sequence in the numerical order specified without modification. Allow at least 40 hours between the completion of one placement and the start of the next numbered placement.

(d) Box Culverts. If the top slab is the roadway riding surface, place as specified in 420.03.04(c). Construct box culverts by casting in place or use precast reinforced concrete box culvert sections. Whichever method is indicated in the Contract Documents, the alternate method may be used unless otherwise specified. However, all time constraints such as maintenance of traffic, curing, and completion date shall be met.

Show lifting devices on the working drawings. Fill lifting holes with nonshrink grout after the precast units are in place. Set the precast reinforced concrete box sections tightly together, and seal the joints according to the manufacturer's recommendations.

Place the bottom slabs of cast in place concrete box culverts for their full depth in one mass or layer and allow to set at least 12 hours before performing any additional work.

Do not place the top slab on single cell box culverts spanning in excess of 10 ft and on multiple cell box culverts until the concrete in the sidewalls has set for at least 12 hours. Construction joints at the top of sidewalls may be omitted in some cases provided the top slabs are placed as follows:

(1) For single cell box culverts spanning 10 ft or less, the sidewall construction joint may be omitted and the top slab placed on the sidewalls, provided the concrete in the sidewalls is allowed to set for approximately two hours before starting to place the top slab.

(2) Regardless of size or number of cells, a written request may be made to place the top slab on the walls of box culverts according to (1) above. Submit the proposed plan, including rate and method of placement, and type and size of equipment. With initial approval, the first section of the structure will serve as a demonstration to confirm that there is no excessive cracking or any other detriment, and that satisfactory results will be obtained. After receiving final approval, continue placing the remainder of the box culvert. If at any time the Engineer determines that the results are no longer satisfactory, revert to placing the concrete with the 12 hour delay as specified above.

(e) Forming Concrete Parapets and Median Barriers on Bridges. Use the conventional fixed form method for parapets and median barriers, unless special slip forming details for parapets or other slip forming notes are included in the Plans. When slip forming is allowed, it is the Contractor's responsibility to determine whether this method of construction will work within the limitations of their own equipment at no additional cost to the Administration. Do not use the slip form method on bridges maintaining traffic in stages when any portion of the superstructure remains connected to the portion of deck where slip forming will occur or on parapets when railing is specified

If the slip form method is proposed, demonstrate ability to produce acceptable results. If the demonstration is unacceptable or acceptable results are not maintained during production, stop the slip form operation, remove the unacceptable work, and modify

the construction methods. If construction modifications do not produce acceptable results, use the fixed form method. No additional compensation will be made, and no increase will be made in any Contract price. Nor will any revisions be made to the amount of time to complete the Contract as a result of any required removals, modifications, or changes in the method of placing parapets or barriers.

Notify the Engineer in writing of the proposed method of constructing the parapets and median barriers prior to beginning superstructure work.

The following shall apply to the consideration of slip forming:

(1) Submit evidence of being capable of producing high quality slip formwork. Prior to beginning any slip form construction, submit a detailed work plan. Include the type of equipment, materials, and procedures to be used, subcontractors involved in the construction, key personnel who will be performing the work (names, training, experience, etc.), as well as detailed information on the proposed process to satisfactorily complete the work.

(2) When possible, include reference in the work plan to at least three other similar projects completed in the State of Maryland or surrounding states. As far as practical, these projects shall have been built using the same equipment, personnel, material, and procedures proposed for the project. The Engineer may visit these completed projects to evaluate the acceptability of the finished product.

If the Engineer determines that satisfactorily slip formed parapets or median barriers have been demonstrated at the locations submitted in the work plan, the requirements of the off bridge test site specified below may be waived, and the first 50 ft of slip forming on the bridge will be considered the test section for the structure. This test section shall be completed and approved prior to placing the remaining portions of parapet or bridge median barrier.

(3) Do not begin any slip forming operation without written approval of the work plan.

Any proposed revisions or deviations to the approved work plan shall be submitted and approved prior to making the change.

If (2) above is not met, complete an acceptable off bridge test section prior to placing any portion of the parapet or bridge median barrier. Place the appropriate test section of parapet or median barrier using the same equipment, sensor line, support spacing, material, personnel, and procedures described in the work plan. This test section shall match the structure's horizontal curve as much as practical, be at least 50 ft long, and be placed at a location selected by the Contractor near the bridge site.

Place the off bridge test section with vertical irregularities varying upward and downward at least 3/4 in. Demonstrate that the method of slip forming can compensate for this deviation and provide a top of parapet or median barrier that is true to the proposed line and grade and not necessarily parallel to top of bridge deck. This necessitates that the equipment provide for variations in height of vertical face of parapet where it intersects the top of deck slab.

Position, support, and space the sensor line in the same manner that will be used on the bridge decks, with no stakes, holes, etc., used to support it. Use the sensor support spacing recommended by the slip form machine manufacturer and as necessary to maintain the planned line and grade. Use the same rate of slip forming proposed for the bridge. Saw cut joints in the test section at the same approximate spacing and in the same manner as proposed for the finished bridge. The Engineer will evaluate the procedure, material, equipment, and appearance of the test section.

Take three test cores from the test section at directed locations to determine the concrete quality. Honeycombing, sags, tears, or other evidence of poor quality concrete will be cause for rejection of the test section. If the test section is rejected, either place additional test sections until approved, or use the fixed form method.

Do not remove the accepted test section until all parapets or median barriers on the bridges are complete. The slip forming on the bridges will be compared to the approved test section to ensure that similar acceptable structures are being achieved. Following completion and acceptance of all bridge parapets and median barriers, remove and dispose of the off bridge test section.

The entire testing procedure, including removing and disposing of test units, regardless of whether the procedure is approved or rejected, shall be at no additional cost to the Administration.

When dual bridges are separated by a joint, construct the two parapets that make up the median barrier in separate operations; not simultaneously. Allow the first median parapet section to cure for at least 40 hours prior to constructing the second section of median parapet. Place additional reinforcing steel to brace the parapet against displacement during the extrusion process. A detail will be included in the Contract Documents. The alignment and rigidity of the reinforcing steel will be strictly enforced to ensure that the minimum clearances specified for concrete cover are maintained.

Ensure that an uninterrupted flow of concrete is provided to the slip form machine. Once the slip form machine is set in motion, keep it advancing until it reaches the proposed stopping point. Organize and schedule the operations in a manner that the next concrete truck will be able to move into position at the slip form machine as soon as the previous truck pulls away without interrupting

the machine's uniform advancement. Under no circumstances may the slip forming be operated in a manner that requires removal of a concrete truck from the bridge before moving another truck into place.

Except for the slip form machine and its concrete supply trucks, do not allow any other construction vehicles on the bridge while slip forming operations are in progress and at least 24 hours after the slip formed concrete has been placed.

After setting up the slip form machine and placing the sensor wire, perform a dry run of the equipment in the presence of the Engineer. Demonstrate that the parapet or median barrier will envelop preset embedded obstacles and will meet with flush surfaces such as pull boxes, expansion joint plates, etc.

Use concrete of a consistency that the shape of the structure is maintained without support after extrusion. The surface shall be free of surface pits larger than 3/16 in. diameter. Finish the concrete with a light brushing with water only. Finishing with brush applications of grout is prohibited.

If a tear occurs at the top of the parapet or median barrier during the slip forming operation, remove it immediately. Make the repair using acceptable concrete practices. Blend the repair into the barrier to the extent that there is no distinguishable difference in the wall face or top. The rate at which the slip form machine is advanced shall be the same as used on the approved test section.

The shape of the finished parapet or median barrier shall conform to the dimensions specified. The vertical face at the bottom of the concrete safety shaped parapets and median barriers shall not exceed 3-1/2 in. Ensure that the finished parapet or median barrier does not deviate from the proposed grade and alignment in excess of 1/4 in./10 ft.

Use a diamond blade to saw cut joints in the finished parapet or median barrier. Make cuts and space joints as specified. The trapezoidal shaped control joints on the outside of parapets will not be required if slip forming is used. Terminate slip form placements only at a parapet control joint. Saw cut the joints as soon as possible after initial concrete set and after the concrete has set sufficiently to preclude raveling during the sawing. Complete the sawing the same day the concrete is extruded and before any shrinkage cracking occurs. Do not leave concrete overnight without saw cutting the joints.

When portions of the bridge are superelevated, produce the configuration specified, i.e., level top surface, wall normal to deck surface, etc.

(f) Temperature Controls. Ensure concrete temperatures meet 902.10. Heat concrete below these temperatures by one of the following methods:

(1) When the method of heated mixing water is used, do not introduce water above 170 F into the mix.

(2) When the method of heated aggregates is used, heat aggregates containing frozen lumps separately. Do not allow materials containing frozen lumps, ice, or snow to enter the mixer. Heat aggregates by steam coils or other dry heat but do not discharge live steam or hot water into them. Do not use a flamethrower or any direct flame.

When the ambient air temperature is below 40 F, raise the temperature of the air in contact with the reinforcement to 40 F prior to placing concrete. When the ambient air temperature is above 70 F and the reinforcement or steel forms are exposed to the direct rays of the sun, cool the reinforcement and forms to 70 F or less by means of a water spray prior to placing concrete.

When abnormal wind or storms are forecast locally by the National Weather Service, do not place superstructure concrete during the period covered by the forecast.

(g) Pumping. Provide approved equipment that is suitable and adequate in capacity for the work. Arrange the equipment so that no vibrations result that might damage freshly placed concrete. Do not use pumps or discharge lines containing parts made of aluminum.

(h) Use of Conveyors. Concrete may be moved from the mixer to its final position by conveyors. Use conveyors in sections, by which concrete is deposited from one conveyor belt onto the next through a hopper. Limit the maximum rise on any individual section of the conveyor to 30 degrees from the horizontal. For concrete slumps less than 2 in., limit the belt travel speed to 900 ft/minute. Decrease this speed for slumps exceeding 2 in. Conveyers used for placement of decks shall be supported by main load carrying members. Place polyethylene or other acceptable material under the conveyor line to contain any spillage.

420.03.05 Depositing Concrete Under Water. Refer to 402.03.04. Do not deposit concrete in water or expose it to the action of water before setting, unless specified or approved. Use a tremie pipe that is at least 10 in. diameter and equipped with a watertight plug.

Equip the bottom of the pipe with a baffle or deflector plate. The number and location of pipes will be dependent on the size of the pour. Do not disturb the tremie concrete after placement, nor place successive layers on top until the previously placed concrete has developed the necessary strength as determined by the Engineer. Do not deposit concrete in water that is less than 35 F. When concrete is deposited in water 36 F to 45 F, heat the concrete and place it at a temperature of 60 F to 80 F. Do not pump water during concrete placement. Regulate the consistency of the concrete to prevent segregation. Cut down portions of tremie concrete that project more than 6 in. above the top of the as-planned elevation.

(a) Cofferdams. Where cofferdams are used, construct separate forms within the cofferdams except where footing concrete is to be placed against a base of undisturbed material and where the cofferdam is to remain in place and act as the concrete form. In the space between form and cofferdam, keep the water level below the bottom elevation of concrete for at least 12 hours.

(b) Concrete Seals. When feasible, concrete seals for parts of structures under water shall be placed continuously from start to finish to avoid horizontal construction joints. Keep the surface of the concrete as nearly horizontal as practicable at all times to ensure thorough bonding. In these cases, place each succeeding layer of the seal before the preceding layer has taken its initial set. Maintain the slump of tremie concrete between 4 in. and 8 in. but as close to 4 in. as possible. After dewatering and prior to placing any succeeding layers of concrete, thoroughly clean the top of the foundation seal (tremie concrete).

(c) Concrete Exposed to Saline Water. Do not allow saline water to come in direct contact with the concrete until it conforms to the following table:

CONCRETE IN SALINE WATER	
SALINE CONTENT OF WATER BY WEIGHT IN PARTS PER THOUSAND	SALINE WATER SHALL NOT CONTACT CONCRETE UNTIL FOLLOWING MINIMUM TIME IN DAYS HAS ELAPSED AFTER INITIAL SET*
0 to 10	0
10+ to 15	7
15+ to 20	14
20+ to 25	21
Over 25	30
* The Engineer may approve a waiver in writing.	

Unless otherwise specified, wet cure the concrete for at least seven days while being maintained at 50 F or above.

420.03.06 Consolidation. Except for concrete deposited under water, consolidate concrete by means of internal vibrators. These provisions also apply to precast members or units.

Apply vibration at points uniformly spaced and not further apart than twice the radius over which the vibration is visibly effective.

(a) Internal Vibration. Internal vibrators shall be of an approved type and design. The intensity of application shall visibly affect a mass of concrete of 1 in. slump over a radius of at least 18 in. and have a frequency of vibration of at least 4500 impulses per minute.

(b) External Vibration. External vibrators shall be of an approved type and design. Use external vibration as directed for the following sections: very thin, very heavily

reinforced, numerous inserts, or where form surfaces are sharply inclined or battered. For steel grid floors, consolidate filler concrete by applying external vibration to the steel grid.

420.03.07 Finishing Concrete Surfaces. Concrete surfaces shall be finished using one of the following types. However, use an ordinary surface finish as described in (a) below unless otherwise specified.

(a) Ordinary Surface. Immediately following the removal of forms, remove all fins and irregular projections from all surfaces except those that are not to be exposed or not to be waterproofed. On all surfaces, thoroughly clean broken corners or edges and cavities. After having kept them thoroughly moist, point and true them with a mortar of cement and fine aggregate mixed in the proportions used in the grade of the concrete being finished. Remove any excess mortar, and cure the mortar patches as specified in 420.03.09. Carefully tool and clean construction and expansion joints. Ensure that joint filler is exposed for its full length with clean and true edges. Resulting surfaces shall be true and uniform. If the surface cannot be repaired in an acceptable manner, apply a special surface finish as described in (b) below.

(b) Special Surface. Remove fins and projections. Then saturate the surface with water and keep it wet for at least two hours. Thoroughly rub a grout mix of the same proportions as the concrete onto the surface by section using burlap pads or cork floats completely filling all voids, pits, and irregularities. After this grout has dried sufficiently, wipe off the excess using dry, clean burlap. Cure the surface as specified in 420.03.09(f), except use a colorless liquid curing compound. Apply this finish to the exterior faces of cast-in-place superstructures and end posts for bridges over highways, and all interior faces of cast-in-place parapets, bridge median barriers, and end posts. Do not apply this finish to members constructed by the slip form method.

(c) Horizontal Surfaces. Finish all upper horizontal surfaces such as the tops of parapets, copings, and bridge seats by placing an excess of concrete material in the forms and striking off even with a wood template. Apply a steel trowel finish to the tops of handrail (posts and caps), headwalls, parapets, wing walls, and barriers.

Finish the bridge seat bearing areas of the substructure masonry to the elevations specified. Check the elevation of each bearing area prior to finishing to ensure conformance. Ensure that each area is level in all directions, and make adjustments prior to the setting of the concrete. Steel trowel the area. Grind bearing areas that are not flat after final finishing to achieve an acceptable surface.

Bearing areas will be rejected whenever the elevation is below that of the surrounding masonry.

(d) Bridge Deck Slabs. Use an approved power operated cylinder or roller finishing machine. Set the finishing machine and transverse construction joints parallel to the nearest support lines (abutment or pier). If the skew angle changes at supports, adjust

the angle of the screed accordingly as the finishing machine progresses across the deck slab. Place the concrete so that the front edge of the newly placed concrete is as nearly as possible parallel to the skew of the finishing machine. Place the concrete uniformly but not more than 10 ft ahead of the finishing machine, and not more than 6 in. above the top elevation of the finished deck slab.

Do not span the finishing machine greater than the length recommended by the manufacturer. Combine machines or use two machines in which both use a common rail. The proposed method and the location and anchorage of accessories that will remain in the completed superstructures as a result of this requirement are subject to the approval of the Engineer and shall meet 420.02.02.

After the concrete has been struck off, check the surface with a long handled 10 ft straightedge operated in a position parallel to the center line of the structure. The straightedge shall be as light weight as possible to avoid distortion of the slab surface, and have a working face no more than 2 in. wide.

Progress longitudinally in overlapping 5 ft increments and transversely in 2 ft increments to locate any irregularities in the surface.

Finish the concrete surface with a full width strip of burlap, mechanically or manually dragged across the surface.

(1) Slab Grooving. Groove all bridge decks including slab bridges and box culverts built to grade. Start the grooving operation after the bridge deck slab has been cured as specified in 420.03.10, and attained a minimum compressive strength as specified in 420.03.15. Groove the bridge deck perpendicular to the center line.

Use a mechanical saw device to cut grooves that are 1/8 in. wide, 3/16 ± 1/16 in. deep, and variably spaced from 5/8 in. to 7/8 in. apart. Extend the grooves across the slab to within 1 ft of the gutter lines. Do not cut across armored joints or any joint in which an existing joint seal may be damaged; stay clear by 2 ± 1 in. on each side. On joints skewed 70 degrees or less, make one pass parallel to the armored joint unless otherwise directed. Remove the residue resulting from grooving operations from all surfaces in an acceptable manner. Leave all surfaces in a washed, clean condition.

(2) Deck Slab Tolerances. Any slabs found to have deficient thickness may be rejected. Limit surface deviation in a transverse or longitudinal direction to 1/8 in./10 ft from a straight line. For vertical curves, limit deviation (from the curve specified) to 1/8 in./10 ft in a longitudinal direction. Do corrective work prior to grooving.

(e) Sidewalks and Safety Curbs. Use an approved screed to strike off the concrete to the elevation and slope specified. Wood float the concrete to give a gritty surface free from

depressions or high spots. Then edge the joints with the appropriate edging tool. Strip curbs and finish as soon as possible.

(f) Culvert Slabs. When the tops of culvert slabs are the roadway riding surface, finish them according to (d) above. If invert slabs and the tops of culvert slabs are not part of the roadway, or when they are to be overlaid with an asphalt mix, screed them by hand or machine and apply a float finish. Maintain the surface within 1/4 in. of the grade specified.

Inverts of culverts having a span less than 10 ft need not be straightedged.

420.03.08 Curing. These requirements apply to curing of all concrete surfaces except bridge deck slabs or top surfaces of culverts with integral wearing surfaces, which shall be cured as specified in 420.03.10.

Start curing as soon as the concrete has set sufficiently.

Keep the surfaces wet, even in areas where there is no ready water supply.

(a) Cure culvert invert slabs and all footings for five days using the method specified in 420.03.09(a), 420.03.09(b), 420.03.09(c), or 420.03.09(d).

(b) Cure vertical surfaces in the forms for seven days. However, the forms may be removed after 24 hours for structural elements 6 ft or less in height, or after 48 hours for structural elements greater than 6 ft high, with the provisions specified herein. Cure the surface as specified in 420.03.09(d) for the remainder of the seven day curing period. Do not remove the forms when cold weather protection is required. Forms carrying loads shall remain in place for at least seven days and until the concrete has attained a compressive strength of 3000 psi. Internal bulkheads may be removed after the concrete has been in place for 24 hours, if it is necessary to do so to continue the work without interruption. When a higher strength concrete than specified is used, forms carrying loads shall remain in place for at least three and a half days and until the concrete has attained a compressive strength of 3000 psi.

Fiber column forms may be removed at times specified above, but no later than 10 days after placing concrete.

When parapets or median barriers on structures are formed by the slip form method, begin curing as specified in 420.03.09(f) using a fugitive dye liquid membrane-forming compound immediately after the concrete is finished. Immediately after each joint is saw cut, cure the concrete surfaces for the remainder of the seven days of cure as specified in 420.03.09(d).

(c) Cure tops of end walls, end support walls, headwalls, etc., for three days with burlap or cotton mats as specified in 420.03.09(b) or 420.03.09(d), respectively.

(d) Cure horizontal surfaces for seven days as specified in 420.03.09(b), 420.03.09(c), 420.03.09(d), or 420.03.09(e).

420.03.09 Curing Methods.

(a) Flooding. Structure units that will be below water in the completed structure may be gradually flooded when approved after the concrete is 12 hours old, provided the curing water meets 921.01. Maintain the water at 35 F or above for the specified curing duration.

(b) Burlap. Use two layers. Overlap successive strips at least 6 in. Place the second layer at least 45 degrees to the first layer, or in lieu of this, the 6 in. overlap of the second layer may be placed midway between the first layer. Thoroughly saturate by immersion in curing water for at least 24 hours prior to placement, and keep it saturated throughout the specified curing duration.

(c) White Opaque Polyethylene Backed Nonwoven Fabric. Use one layer. Overlap successive strips at least 6 in. Thoroughly saturate by immersion in curing water for at least 24 hours prior to placement and keep it saturated throughout the specified curing duration.

(d) Cotton Mats. Use one layer thoroughly saturated with curing water prior to placement and kept saturated throughout the specified curing duration. Keep the material in tight contact with the concrete.

(e) White Opaque Burlap Polyethylene or White Opaque Polyethylene Film. Place white opaque burlap polyethylene sheeting, with the burlap side of the sheeting facing down, on at least one layer of wet burlap. When white opaque polyethylene film is used, place it on at least two layers of wet burlap. Only one layer of cotton mats is required in any usage. These materials may only be used atop the wet burlap or cotton mats on unobstructed flat and reasonably level surfaces.

Lap adjacent mats or sheets at least 1 ft. Bring the ends down around the sides of the concrete being cured and securely fasten to make an airtight seal.

Leave both of these materials in place for the same length of time as required for burlap or cotton mats. These protective coverings need not be wetted down; however, keep the covered burlap or cotton mats wet for the specified duration.

(f) Liquid Membrane. Apply this material according to the manufacturer's recommendation or as directed. Apply by sprayers and keep it thoroughly agitated before and during use.

420.03.10 Bridge Deck Slabs. Cure bridge deck slabs and culvert top slabs with integral wearing surfaces, including sidewalks, as specified herein.

Have misting equipment available. Prior to placing concrete, operate the misting equipment for the Engineer to verify that the equipment and procedure are capable of misting the entire placement area without damaging the fresh concrete. Do this at the location of proposed use each day that a deck placement is to be made. Keep ample spare parts, water, fuel, etc. readily available. Keep an approved unit available for backup.

Cover the finished concrete with wet burlap as specified in 420.03.09(b). Progress by covering the concrete immediately after the concrete has been finished, but do not leave any portion of the concrete uncovered for more than 45 minutes after placement. Use mist spraying when directed and when the concrete is not covered with wet burlap within 30 minutes after placement. Misting does not relieve the requirement for covering the concrete within the 45 minutes after placement. Once misting is started, continue until wet burlap is complete in place.

After the concrete is covered with wet burlap, cure it as specified in 420.03.09(b) for the remainder of the seven day period. Keep the two layers of burlap continuously and uniformly saturated throughout the curing period. White opaque burlap polyethylene sheeting and white opaque polyethylene film or clear polyethylene film shall not be used over wet burlap except when approved for cold weather protection. Use a sufficient quantity of soaker hoses to meet these requirements. Take immediate action to remedy improper saturation of any area throughout the entire curing period.

Provide a sufficient number of experienced personnel and necessary equipment to ensure proper placement, protection, and curing of the concrete according to these Specifications.

Provide temporary troughs, dams, etc., necessary to keep runoff water from reaching any traveled roadway, shoulder, or sidewalk. Submit the proposed methods of controlling runoff water in these areas. Include locations of all troughs and dams, as well as the proposed methods of attaching them to any portions of the structure. Do not weld or drill holes in any portion of a permanent member of the structure.

The approved procedure will be evaluated after it is underway. If any areas are not functioning in an acceptable manner, modify them to satisfy the requirements for retaining and directing the flow of water.

In rehabilitation construction, where the full use of temporary troughs, dams, etc., is not practical, make approved modifications to the provisions for controlling the runoff water.

420.03.11 Construction Joints. Construction joints are permitted only where specified or authorized in writing.

Clean the surface of the hardened concrete and keep it moist until the additional concrete is placed. Use a grade strip to level the top surface of concrete. At chamfers, steel trowel the top surface of the concrete adjacent to the chamfer.

Where a featheredge might be produced at a construction joint, as in the sloped top surface of a wing wall, use an inset form to produce a blocked in addition to the preceding placement. Ensure

that the inset form will produce at least a 6 in. edge thickness of concrete in the succeeding placement.

Place epoxy bonding compound on the surface areas of concrete that existed prior to the beginning of the Contract that will be in contact with new concrete. Apply epoxy bonding compound to the entire face of all deck slab construction joints. Ensure that the surfaces to be coated are clean, sound, and dry. Mix and apply the bonding compound per the manufacturer's recommendations.

420.03.12 Linseed Oil Protective Coating. Apply to the integral concrete bridge deck slabs, box culvert wearing surfaces, and sidewalks on bridges and box culverts, when the pertinent Linseed Oil Protective Coating item appears in the Contract Documents.

Prior to the application of the linseed oil protective coating, ensure that the concrete surfaces to be treated are cured, dried, and thoroughly cleaned of all dust, dirt, and deleterious material; and that required permanent paint or tape lane markings have been applied on the structures.

If the concrete is wet, allow it to dry for one to two days at a temperature of at least 60 F. If the concrete surfaces are extremely dry, take the following actions as directed, and at no additional cost to the Administration:

(a) Wet the concrete thoroughly and allow it to dry for one or two days.

(b) Apply a third protective coating at the same rate per gallon as the second coat.

Ensure that the ambient temperature at the time of application is at least 50 F. Ensure that the ambient air temperature following the second application is at least 40 F. Apply two coats on all top surfaces that are not grooved. Apply the first coat at a rate of 40 yd^2/gal. Apply the second coat at a rate of 67 yd^2/gal. On bridge decks and top slabs of box culverts that are grooved, apply the first coat at a rate of 25 yd^2/gal. Apply the second coat at a rate of 45 yd^2/gal. Do not apply the second coat until the first coat is dry. If additional coats are required, allow at least 24 hours between them. The drying time may be increased as the ambient temperature falls below 70 F.

420.03.13 Cold Weather Protection. Protect and heat concrete after it has been placed when the air temperature in the shade and away from artificial heat drops to 40 F or lower at the time of placing or at any time within the number of days specified herein. Provide protection and heating as follows:

(a) Protect ordinary concrete and maintain a temperature of at least 50 F for at least seven days following placement.

(b) Do not heat concrete to more than 100 F. At the end of the heating period, cool the concrete surfaces to the temperature of the outside air by slowly reducing the artificial heat at a uniform rate until the temperature of the outside air is reached within a 24 hour period.

Have tarpaulins, insulating devices, and other suitable materials at the site to enclose or protect portions of the concrete requiring protection. Have materials as close as possible before placing the concrete, and install them as rapidly as possible to keep exposure to cold weather to a minimum. Where heating is required, completely enclose the spaces to be heated and use approved heaters to keep the temperature at required levels.

Provide a sufficient number of maximum/minimum thermometers to record temperatures in each concrete placement undergoing cold weather protection.

The curing period for all structure concrete requiring cold weather protection shall meet the cold weather protection period except when the normal curing period is longer.

420.03.14 Underpinning Old Foundations. If underpinning is required, perform the work as directed. Restore or lower the old foundations with Mix No. 6 concrete having a maximum slump of 1-1/2 in. Perform excavation and underpinning operations in part section, so as not to remove more than 10 percent of the supporting area under the old foundation at one time. When directed, install underpinning by hand, pneumatic, or pumping processes. The usual curing and cold weather requirements will be deleted for the underpinning with other provisions for curing and protection improvised on the job as may be directed.

420.03.15 Loads on Concrete Structures. Refer to GP-5.10, TC-6.13 and TC-6.14. Do not erect structural steel or concrete superstructures on concrete substructures until curing is complete, all forms are removed, and substructure concrete has reached a compressive strength of 3000 psi.

Do not apply loads to any new portion of bridge deck or box culvert built to grade until the final section of that unit of the deck has completed its specified curing period. No vehicles, including heavy construction equipment, will be permitted on any new portion of bridge deck or box culvert built to grade until the concrete cylinder breaks for the final section of that unit of the deck has attained a compressive strength of 4500 psi. However, loads such as stored materials, lightweight equipment, concrete safety parapets, sidewalks, and median curbs, may be placed upon the concrete slab via crane or other lifting device when the concrete in the final section of that unit of the deck has attained a compressive strength of 3000 psi.

Do not place backfill on any new portion of box culverts not built to grade until the final section of that unit of the slab has completed its specified curing period and the concrete in that section has attained a compressive strength of 3000 psi.

420.03.16 Prevention and Removal of Stains on Concrete. Prevent rust from structural steel, and staining by asphalt materials or any other substance from discoloring any portion of the concrete. Use construction procedures that prevent staining of any of the concrete. Where unpainted structural steel is specified, protect the pier caps, columns, and abutments with a wrapping of reinforced polyethylene or similar material, and leave it in place to prevent staining until after the structure is completed. If any portion of the concrete is stained, remove the stain and restore the original color without damaging the concrete. Do the work as directed and at no additional cost to the Administration. Do not use chemical solvents without approval.

420.03.17 Safety Hazards. Perform gas detection in and ventilation of confined spaces as specified in TC-3.04.

420.03.18 Defective Work. Within 24 hours of removing the forms, remove and repair defective work as directed.

(a) At the edges of material remaining in place, make a cut perpendicular to the finished surface to the full depth of the material removed, but not less than 1 in. If the removal of defective concrete affects the structural requirements, remove and replace the member as directed.

(b) Clean defective areas.

(c) Coat defective areas with an epoxy bonding compound.

(d) Patch defective areas with concrete mortar or epoxy matching the color, contour, and texture of surrounding concrete as close as possible.

420.04 MEASUREMENT AND PAYMENT

Portland cement concrete structures will be measured and paid for as specified. The payment will be full compensation for all forms and form removal, reinforcement steel, curing and misting, scuppers, grooving, mechanical, and electrical work, all cost incidental to the conducting of tests for oxygen content and presence of gases and applying mechanical ventilation to confined spaces, year built markings, and all material, labor, equipment (including safety equipment), tools and incidentals necessary to complete the work.

The construction of drainage and weep holes, any pipe necessary, expansion material, flashing, dampproofing, membrane waterproofing, epoxy bonding compound, joints and their placement will not be measured but the cost will be incidental to the concrete item. No deduction in concrete quantities will be made for pipes or conduits having diameters less than 8 in., reinforcement steel, anchors, or any other appurtenances.

420.04.01 Portland cement concrete for Footing Concrete, Subfoundation Concrete, and Tremie Concrete will be measured and paid for at the Contract unit price per cubic yard.

420.04.02 Portland cement concrete for Substructure Concrete for Bridge, Superstructure Concrete for Bridge, and Reinforced Concrete Box Culverts will not be measured but will be paid for at the Contract lump sum price. When an Epoxy Coated Reinforcing Steel Bars item for the pertinent structure is included in the Contract Documents, the cost for epoxy protective coated reinforcement steel will be excluded from the Contract lump sum price for Superstructure Concrete for Bridge. When a bridge deck rehabilitation project, other than bridge widenings, requires modification to the backwalls and wing walls and there is no substructure concrete item, the concrete will be incidental to the Superstructure Concrete item.

420.04.03 Wing walls and footings for reinforced concrete box culverts will not be measured but the cost will be incidental to the Reinforced Concrete Box Culvert item.

420.04.04 Parapets (including end posts) on bridges, wing walls, reinforced concrete box culverts, and retaining walls; or concrete median barriers on bridges and top slabs of reinforced concrete box culverts will not be measured but will be paid for at the Contract lump sum price for the pertinent Concrete Parapet or Concrete Median Barrier items.

420.04.05 Parapet and end post modifications on bridges, wing walls, reinforced concrete box culverts, and retaining walls; or concrete median barriers on bridges and top slabs of reinforced concrete box culverts will not be measured but will be paid for at the Contract lump sum price for the pertinent Parapet Modification item. The payment will also include saw cutting, removal of portions of the existing parapet or end post, drilling, and grouting.

420.04.06 Floodlighting for placement of concrete (including superstructure concrete and concrete overlays) will not be measured but the cost will be incidental to the pertinent Concrete item. The payment will also be full compensation for fuel, backup generator, setup, relocation, and removal.

420.04.07 Linseed oil protective coating will be measured and paid for at the Contract unit price per square yard for the pertinent Linseed Oil Protective Coating item. The payment will be full compensation for all coats including time and cost when a third coat or the application of water is required on dry surfaces.

420.04.08 Cofferdams, temporary supports, or piling will not be measured but the cost will be incidental to the formwork.

420.04.09 Retaining walls will be measured and paid for as specified in 450.04.

CATEGORY 400
STRUCTURES

SECTION 421 — REINFORCING STEEL

421.01 DESCRIPTION

Furnish and place uncoated and epoxy coated reinforcing steel.

421.02 MATERIALS

Grout	902.11(c)
Deformed Steel Bars	908.01
Plain Round Steel Bars for Column Spirals	908.02
Wire Mesh	908.05 and 908.06
Fusion Bonded Epoxy Powder Coating for Steel and Touch Up System	Section 465 and 917.02
Galvanizing	
Reinforcing Steel	A123
Hardware	A153
Stainless Steel Bars	908.03
Low Carbon Chromium Bars	908.13

421.02.01 Supports. Use approved coated metal, plastic, plastic tipped, or galvanized material. Aluminum is unacceptable. All materials are subject to approval.

For epoxy coated steel, use wire supports completely covered with 1.5 mils to 9.0 mils of adherent epoxy coating except for minimum necessary contact marks. Hold the reinforcing steel in place with plastic coated tie wires fabricated for this purpose.

Steel bars used as supports for epoxy coated steel shall be coated in the same manner as reinforcing steel.

421.03 CONSTRUCTION

421.03.01 Working Drawings. Submit working drawings for approval prior to the start of any fabrication, unless otherwise specified. Refer to Section 499.

421.03.02 Plan Dimensions. All dimensions related to reinforcing steel are out to out measurement except the spacing is measured center to center.

421.03.03 Cutting and Bending. Cut and bend reinforcing bars at the mill or shop to the shapes specified before shipment to the job site. Bending shall not be performed in the field except to correct errors, damage by handling and shipping, or minor omissions in shop bending.

Saw or shear epoxy coated reinforcing bars on skewed bridges and in other locations that are specified to be cut in the field; flame cutting is prohibited.

Ensure that all bending conforms to the tolerances specified in the Contract Documents.

421.03.04 Shipping, Handling, and Protection of Material. Ship reinforcing steel bars in standard bundles; tagged and marked in accordance with the provisions of the Code of Standard Practice of the Concrete Reinforcing Steel Institute. Keep bundles intact, undamaged, and properly identified until ready for use.

Bundle coated steel together for shipment using excelsior or other approved materials, and banded using plastic or padded metal bands. Perform all lifting with a lifting beam and multiple supports consisting of a sufficient quantity of straps or slings to prevent abrasion within the bundle from excessive bending or distortion.

Store bundles at the site on suitable blocking or platforms at least 4 in. above any type of surface and vegetation. Keep free from vegetation growth, accumulations of dirt, oil, or other foreign material. Keep blocking sufficiently close to avoid bending and distortion of the bars. Correct any distortion of the bars or damage to epoxy coating as directed. Touch up any damage to the epoxy coating as specified in 465.03. Adequately cover epoxy coated bars for protection from ultraviolet rays from the time of delivery when they are to be stored outside for more than 90 days.

421.03.05 Placing and Fastening. Accurately place all reinforcing steel, including dowel bars, in the position specified in the Contract Documents or working drawings, and hold firmly during the depositing and setting of the concrete. Do not insert into the plastic concrete.

Tie all intersections, except alternate intersections need not be tied where spacing is less than 1 ft in each direction. On bridge decks and the top slabs of box culverts, tie all intersections in the top mat of reinforcing. Do not bend reinforcing steel bars after embedment in concrete.

Before placing concrete, clean all mortar from the reinforcing. Do not place concrete until the reinforcing bars are inspected and approved. Approval shall not relieve the Contractor of the responsibility for correcting problems caused by any shifting of the bars during the placement of concrete.

Support reinforcing bars and maintain their distances from faces of forms by using approved templates, blocks, ties, hangers, or other supports. Support bars in the bottom of footings on approved precast concrete blocks with embedded tie wires or suspend in place. Support bars in the tops of footings by using approved supports.

Do not use metal, metal with plastic tipped legs, or plastic chairs against formed surfaces that will be exposed in the finished structure.

The Engineer will perform a final visual inspection of epoxy coated steel at the construction site after the steel is in place and immediately prior to placing the concrete. Patch designated repair areas using epoxy as specified in 465.03. Do not place concrete on a patched area until the patching material has cured for one hour. Allow four hours of normal working time after the reinforcing and forms are in place for the inspection.

421.03.06 Splicing. Furnish bar lengths and splices as specified in the Contract Documents, and as detailed in the working drawings stamped as accepted by the Administration. Do not perform additional splicing without approval. Make lap splices with the bars in contact and wired together. Do not weld reinforcing steel or weld attachments to reinforcing steel without approval. Perform welding according to AWS D1.4.

421.03.07 Tying New Concrete into Existing Concrete. On all projects where portions of existing structures are to be used in the finished structure and existing concrete is to be removed, straighten, clean, and protect the existing reinforcing steel to be incorporated in the final structure.

For exposed existing reinforcing steel that is to be incorporated into the final structure:

(a) Cut out any that has lost 20 percent or more of its original cross sectional area as determined by the Engineer. Provide and place a new bar of the same diameter so as to have the minimum required lap at each end of the new bar, or modified as per (c).

(b) Where the required bar lap length is available, use it as a dowel.

(c) Where the required bar lap is not available or limits of concrete removal to achieve bar lap are too great, make a welded or approved mechanical splice.

When existing reinforcing steel extends into an area in which epoxy coated reinforcing steel is required, abrasive blast clean and epoxy coat using the touch up system. Refer to Section 465.

If expected reinforcing steel is missing, or a pattern differing from that shown on the existing Contract Documents is uncovered, contact the Office of Structures for evaluation.

Where dowel bars are required to tie new concrete into an existing structure, install as specified in 406.03.

421.03.08 Substitution. Low carbon chromium or stainless steel reinforcing may be substituted on a one-for-one basis for the specified epoxy coated or non-epoxy coated deformed steel bar reinforcing, at the option of the Contractor, as approved by the Engineer. Welding of low carbon chromium bars is prohibited. No adjustment shall be allowed in the size, number, spacing, laps and configuration of the reinforcing for any increase in strength or other properties provided by the substitute reinforcing bars.

There will be no additional compensation for bars of differing material composition in lieu of the bars specified.

421.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for cleaning, coating, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

421.04.01 Reinforcing steel bars or epoxy coated reinforcing steel bars will not be measured but the cost will be incidental to other pertinent items specified unless a Reinforcing Steel Bars or Epoxy Coated Reinforcing Steel Bars item appears in the Contract Documents.

421.04.02 Reinforcing Steel Bars or Epoxy Coated Reinforcing Steel Bars will not be measured but will be paid for at the pertinent Contract lump sum price.

421.04.03 Reinforcing Steel Bars or Epoxy Coated Reinforcing Steel Bars will be measured and paid for at the Contract unit price per pound based on the original approved overall lengths of bars computed on the basis of the nominal unit weight per linear foot.

421.04.04 Incorporating existing reinforcing steel in the final structure including straightening, bending, splicing, and removal and replacement will not be measured but the cost will be included in the pertinent Concrete item.

CATEGORY 400
STRUCTURES

SECTION 422 — DAMPPROOFING AND MEMBRANE WATERPROOFING

422.01 DESCRIPTION

Furnish and apply dampproofing and waterproofing to concrete surfaces.

422.02 MATERIALS

Asphaltic Materials	913.01
Asphalt Primer	913.02
Fabric for Use with Asphalt	913.03
Membrane Waterproofing and Dampproofing	913.04

422.03 CONSTRUCTION

Apply dampproofing and waterproofing using asphaltic materials, primers, and fabric; or by the roll or sheet method as specified in 422.03.07.

422.03.01 Storage. Store waterproofing fabrics and membranes in a dry protected place. Keep containers of asphalt materials closed when not in use.

422.03.02 Surface Preparation. Do not apply dampproofing or membrane waterproofing until curing is complete and surfaces are protected from the cold. Ensure that all surfaces are dry, smooth, and free from projections and holes.

When dampproofing and membrane waterproofing are both specified for application, apply the membrane waterproofing first. Do not apply dampproofing or membrane waterproofing when the temperature is less than 40 F.

422.03.03 Dampproofing. If asphaltic coatings are used for dampproofing, use two prime coats and one seal coat. Apply dampproofing to the following concrete surfaces that will be in contact with backfill:

(a) Rear face of abutments and abutment wing wall stems.

(b) Rear faces of headwalls and wing walls for pipes 36 in. in diameter or larger and for culverts.

(c) Rear face of retaining wall stems.

(d) The following areas pertain to reinforced concrete box culverts:

(1) Top of top slabs when not built to grade.

(2) Entire outside surfaces of side walls.

(3) Additionally, bottom of bottom slabs of precast units.

422.03.04 Waterproofing. If asphaltic coatings are used, use a prime coat, three mop coats, and two layers of fabric.

Apply waterproofing to construction joints that are next to backfill above normal water surface when backfill is on one side and atmosphere on the other side. Apply a width of at least 16 in., centered on the joint.

422.03.05 Application of Dampproofing. Confine coatings to the areas to be covered. Prevent coating of parts of the structure exposed to view in the completed structure. Apply dampproofing to the full face of all contraction joints.

Apply the dampproofing according to the manufacturer's recommendations. When no recommendations are provided, apply the dampproofing material to the cured, cleaned, and dry surfaces as follows:

(a) Paint with two coats of primer for absorptive treatment at a rate of 1/8 gal/yd^2 per coat. Do not apply the second coat until the first coat has thoroughly dried. Do not heat this material.

(b) After the second prime coat has thoroughly dried, apply one seal coat by brush or roller at a rate of 1/8 gal/yd^2. When necessary, this material may be heated, but not in excess of 150 F.

422.03.06 Application of Membrane Waterproofing. Coat the cured, cleaned, and dry surfaces with a prime coat. Cover with mop coats and layers of fabric.

Coating Procedure. Coat with a primer at a rate of 1/8 gal/yd^2. Apply the prime coat 24 hours in advance of applying any mop coats and ensure that it is dry before applying the first mopping. Do not heat the primer.

Heat asphalt for mop coats to a temperature between 300 F and 350 F. Stir frequently to avoid local overheating. Provide heating kettles equipped with thermometers.

Begin the waterproofing at the low point, so that water will run over and not against or along the laps.

Make the first strip of fabric half width. Make the second full width, lapping the full width of the first sheet. Make the third and each succeeding strip thereafter full width and lapped so that there will be two layers of fabric at all points and three layers with laps not less than 2 in. wide at edges of strips. Make all laps at ends of strips at least 12 in. wide. Thoroughly seal down the cloth at all laps.

Beginning at the low point, mop a section 20 in. wide for the full length of the surface with the hot asphalt. Immediately after the mopping, press the first strip of fabric into place eliminating all air bubbles. Mop this strip and an adjacent section of the surface to a width equal to slightly more than half the width of the fabric, and press a full strip and a full width of the fabric into place as before. Then mop the forward or upper half of this second strip and mop an adjacent section of the concrete surface with hot asphalt. Apply the third strip of fabric shingled on so as to lap the first strip at least 2 in. Continue this process until the entire surface is covered. Then give the entire surface a final mopping of hot asphalt. Ensure that there is a complete coating of asphalt between all layers of fabric.

In all cases, ensure that the mopping on concrete covers the surface so that no gray spots are visible, and on cloth is sufficiently heavy to conceal the weave. Apply asphalt at the rates of 1.2 gal/yd^2 on horizontal surfaces and 1.4 gal/yd^2 on vertical surfaces. Regulate the work so that at the close of a day's work, all cloth in place has received the coatings required for that stage of completion.

422.03.07 Roll or Sheet Waterproofing Membrane. An alternate system of waterproofing or dampproofing consisting of rolls or sheets of membrane material may be used in lieu of the above coatings. Apply the rolls or sheets according to the manufacturer's recommendations.

422.03.08 Membrane Care. At the edges of the membrane and at points punctured by appurtenances such as drains or pipes, flash it in an acceptable manner to prevent water from getting between the waterproofing and the waterproofed surface. Repair any damage to the membrane. Extend repairs beyond the outermost damaged portion, and extend the second ply at least 3 in. beyond the first.

422.04 MEASUREMENT AND PAYMENT

Dampproofing and membrane waterproofing will not be measured but the cost will be incidental to other pertinent items specified.

CATEGORY 400
STRUCTURES

SECTION 423 — REPAIRS TO CONCRETE STRUCTURES

423.01 DESCRIPTION

Furnish all materials, labor, and equipment necessary to perform the repair of the existing concrete bridge elements. Remove existing unsound concrete; clean and apply protective coating to existing reinforcing steel, replace reinforcing steel; place, finish and cure concrete, grout, and mortar.

All requirements of Section 405, Section 420, and Section 421 shall apply except as stated herein.

423.02 MATERIALS

Aggregates	Section 901
Curing Materials	902.07
Reinforcing Steel	908.01, 908.02, 908.05 and 908.07
Epoxy Protective Coating	917.01, Match Existing Color
Epoxy Bonding Compound	921.04
Anchor Bolts	909.06
Water	921.01

423.02.01 Trowel Grade Mortar.

Synthetic Fibers	902.06.06
Mortar for Grout	902.11(a) or (b), 4500 psi

Trowel grade mortar for concrete repairs shall be fiber reinforced, trowel-able, patching mortar designed for overhead use. Color shall match existing.

423.02.02 Concrete for Structural Repairs (Not Including Bridge Decks).

Mix No. 5 Concrete	902.10
Non-shrink Grout	902.11(c), QPL

The non-shrink grout may contain pea gravel (No. 8 Stone) conforming to the gradation of the following table. The quality and laboratory test methods shall conform to 901.01 except that the plasticity index shall not exceed 9.

SIEVE SIZE	PERCENT PASSING
3/4 in.	100
1/2 in.	85-100
3/8 in.	70-100
No. 4	0-55
No. 8	0-15
No. 16	0-8

If the quantity of concrete to be used in a single day is low (less than 2 cubic yards) or in areas where concrete delivery is impractical, the contractor has the option to mix the concrete on site in lieu of receiving it from a ready-mix plant. Mix No. 5 concrete can be replaced with a mixture of non-shrink grout and pea gravel proportioned and mixed in accordance with the manufacturer's recommendations. This substitution is subject to the approval of the Engineer and is at no additional cost to the Administration.

423.02.03 Concrete for Bridge Deck Repairs.

Mix No. 6 Concrete	902.10
Rapid Hardening Cementitious Material for Concrete Pavement Repairs	902.14, QPL

423.03 CONSTRUCTION

Submit the proposed methods of protecting the public against injury and damage from demolition operations. When required, protective shields shall meet 405.03.01.

Provide safe access to all areas of the existing structure to be repaired. Prior to the start of any repair work, conduct a thorough inspection in the presence of the Engineer. The purpose of this inspection will be to identify the location and extent of concrete deterioration and repair. The Engineer will establish the extent of removal and determine when sound concrete is encountered.

Restrictions. Wait at least 72 hours after the placement of concrete, grout, or mortar before chipping on any section that has a common side or point.

Except for bridge deck sections that are not directly over beams or stringers, immediately stop concrete removal and notify the Engineer and the Office of Structures, if at any time an area is identified as having deteriorated concrete beyond the following limits:

(a) More than 6 in. beyond the original finish surface.

(b) More than 3 in. beyond the reinforcing steel.

(c) More than 1 in. beneath the bearing.

Do not resume work until after obtaining approval from the Office of Structures. The Engineer and Office of Structures will determine any extraneous damage to the existing bridge caused by

the Contractor's operations, which the Contractor shall repair at no additional cost to the Administration.

423.03.01 Equipment. Ensure that all equipment is calibrated and capable of thoroughly mixing all material. Use only approved mixing and placing equipment in the preparation and handling of the concrete. This includes the use of on-site batch plants, volumetric mix trucks, or portable tilt drum mixers.

Use a self-cleaning mixer capable of discharging all mixed material without any carryover from one batch to the next. Remove oil and other rust inhibitors from all equipment in contact with the concrete before the mixes are used. Clean the mixing equipment at least once a day.

When applicable, submit to the Engineer a drawing showing details of forms and support system(s) with appropriate dimensions prior to placing concrete. Do not drop concrete or grout from a height which could result in the separation of the mix. Refer to 420.03.04 (b).

423.03.02 Storage. Store and handle cement as specified in 902.01. Store sand to prevent segregation or contamination of the material.

Store all reinforcing bundles at the site on suitable blocking or platforms at least 4 in. above all type of surfaces and vegetation. Keep the reinforcing free of dirt, oil, grease, paint, and other foreign matter.

423.03.03 Surface Preparation. Provide a vertical or horizontal perimeter having a shoulder perpendicular to the surface of the structure for a depth of at least 1 in. Feathered edges are not permitted.

Remove deteriorated areas of concrete to sound concrete with a chipping hammer that is not heavier than a nominal 65 lb. class on bridge decks and a 30 lb. class on all other areas. For bridge superstructures, do not use chipping hammers heavier than a nominal 15 lb. class for concrete removal beneath any reinforcing bars. Do not operate mechanical chipping tools at an angle greater than 45 degrees measured from the surface of the concrete. Continue chipping to at least 1 in. behind the reinforcing steel and until there is no sudden change in the depth of the cavity.

After the Engineer has determined that all concrete is sound, abrasive blast the cavity surface. Just prior to applying the concrete, grout, or mortar, thoroughly clean all surfaces by air blast or vacuum as determined by the Engineer followed by wetting and damp drying. Mix and apply an epoxy bonding compound on the sound concrete repair areas per the manufacturer's recommendations.

Contain all blast waste and loose concrete, and promptly remove it to an approved disposal site. Keep blast waste and loose concrete out of waterways.

423.03.04 Reinforcement. If sound concrete is encountered before the reinforcing steel is exposed, remove sound concrete to a depth of 1 in. behind the reinforcing steel. Exercise care to prevent cutting, stretching, or damaging any exposed reinforcing steel. If sound concrete is found beyond 3-1/2 in. of the proposed finished surface but no reinforcing is encountered, dowel

additional No. 4 reinforcing bars installed at 12 in. center to center horizontally and vertically, 2 in. clear of proposed finished surface. Dowel as specified in Section 406 except use any type of grout specified in 902.11.

Ensure that existing reinforcing steel to be incorporated into any repair work meets 421.03.07. Abrasive blast all exposed existing reinforcing steel that will be incorporated in the new work to a near white finish to remove all rust, dirt, scale, and loose concrete. The Engineer will establish if reinforcing steel is to be reused or replaced.

Regardless of whether the reinforcement was previously coated, coat all exposed existing reinforcement steel with epoxy touch-up system in conformance with Section 465. The Engineer may waive this requirement if there is not enough time for the system to properly cure.

For anchoring additional reinforcing to masonry surfaces, set at least 3/8 in. diameter expansion bolts in drilled holes, or set plain round No. 4 bars in approved dry packed grout tightly driven in drilled holes. Ensure that the drilled holes are at least 3 in. deep. All bolts and bars shall be set in solid masonry (not in mortar, joints, or cracks) and have heads or hooks on their outer ends.

Where formwork is not being installed, reinforce vertical repair areas with additional welded wire reinforcement in addition to the refurbished reinforcing steel. The fabric may be wired to existing reinforcement without the use of expansion bolts, etc., where approved by the Engineer. Cut welded wire reinforcement into sheets of proper size. Bend the separate sheets over templates to follow the outlines of the member or surface to be covered. Securely hold in a uniform position by tying to the bolts or bars with 14 gauge black annealed wire. Space ties at no more than 12 in. Overlap adjacent sheets of welded wire reinforcement at least two squares. Tie them together with a 14 gauge black annealed wire at intervals not exceeding 18 in.

423.03.05 Guides. In areas where there is no formwork, use sufficient guides to obtain the full thickness of mortar specified and to ensure uniform and straight lines.

423.03.06 Repairs to Bearing Areas. In areas where beams or girders are directly bearing on the deteriorated concrete, jack the beams as specified in Section 478 prior to concrete removal.

Unless otherwise specified, epoxy coat the repaired bearing area as specified in Section 464.

423.03.07 Bridge Deck Repairs. Do not remove any portion of the existing bridge deck that cannot be patched, cured, and open to traffic within the timeframe specified in specified maintenance of traffic restrictions. If required, remove any asphalt wearing surface as specified in Section 475. Remove deteriorated areas of the existing concrete bridge deck down to sound concrete by use of power-driven hand tools. After removal of deteriorated concrete is complete, remove all rust, oil, or other foreign materials detrimental to achieving bond followed by abrasive blasting and air blast or vacuum as determined by the Engineer. Repairs shall be Type I, Type II, or Type III as noted below:

(a) Type I Deck Repairs. This repair includes cavities less than 1 in. deep. The cavity may require hand chipping that does not extend below the existing reinforcement. Fill the void with the asphalt mix wearing surface while the final surface is being placed.

(b) Type II Deck Repairs. This repair includes areas where the depth of deck removal is over 1 in. deep but not full depth. Make sure that the limits of concrete removal extend below the reinforcement as specified in 423.03.04. Fill the cavity with rapid hardening cementitious material.

(c) Type III Deck Repairs. This repair includes areas where the depth of deck removal is full depth. Fill the cavity with rapid hardening cementitious material for deck repairs up to 9 ft^2. For repair areas larger than 9 ft^2, use Mix No. 6 concrete or as otherwise directed by the Engineer. In large areas, supply formwork, which may be suspended from or supported by the stringers, to enable the placement of the concrete. In small areas, supply formwork, which may be suspended from existing reinforcing bars by wire ties, to enable the placement of the concrete. The Engineer will determine the method used.

Ensure that the top surface of all deck repairs is even with the top surface of the existing concrete deck. Take all necessary precautions to produce smooth riding bridge deck by placing the concrete in a manner that meets the grade of the proposed adjoining portions of the existing bridge deck. The location of longitudinal joints will be determined by the Engineer based on avoiding joints in the vehicular wheel path as much as practical. For concrete patches over 6 ft in any direction, give the top surface of all patch areas a final textured finish consisting of 1/8 in. wide by 1/8 in. deep transverse corrugations spaced approximately 1/4 in. apart. For concrete patches less than 6 ft in any direction, provide a roughened broom finish on the top surface. The method of texturing shall be approved by the Engineer prior to placing the material in the patch.

Mix, place, and cure the rapid hardening cementitious material according to the manufacturer's recommendations.

423.03.08 Curing and Cold Weather Protection. Refer to Section 420. Except for rapid hardening cementitious material, keep concrete and grout repairs continuously wet for at least seven days after application. Liquid membrane forming compound will be permitted with prior approval.

423.03.09 Finishing. Finish the area of repair to match the existing structure.

423.04 MEASUREMENT AND PAYMENT

The payment for Repairs to Concrete will be full compensation for all completed repair areas, and will include scaffolding, installing and removing debris shields, removal of existing deteriorated concrete, inspections, cleaning and epoxy touch up of existing reinforcement steel, furnishing and placing new reinforcement steel as required, drilling and grouting holes, furnishing and installing welded steel wire fabric, surface preparation, furnishing and placing epoxy bonding compound, forming, furnishing and placing mortar, grout, or concrete, making and transporting test cubes or

cylinders, curing, removing formwork, applying epoxy protective coating, and any other material, labor, equipment, tools, and incidentals necessary to repair the concrete.

423.04.01 Trowel Grade Mortar for Structure Repairs will be measured and paid at the Contract unit price per cubic foot.

423.04.02 Rehabilitation of Concrete Structures will be measured and paid for at the Contract unit price per cubic foot of concrete in place.

423.04.03 Type II and Type III Bridge Deck repairs will be measured and paid for at the Contract unit price per cubic foot for the pertinent Type Deck Repair.

423.04.04 If removal of debris is needed for Type 1 Deck Repairs, it will be measured and paid for at the Contract unit price per square foot for the Type I Deck Repair. Any asphalt used for Type 1 Deck Repair areas will be measured and paid for at the Contract unit price per ton for the pertinent Asphalt Mix for Bridge Deck item as specified in Section 475.

CATEGORY 400
STRUCTURES

SECTION 425 — LIGHTWEIGHT SUPERSTRUCTURE CONCRETE

425.01 DESCRIPTION

Furnish and install lightweight concrete.

425.02 MATERIALS

Lightweight Concrete	902.10, Mix 10

425.03 CONSTRUCTION

Conform to 420.03 and as specified herein.

Handle lightweight aggregates in a manner that provides a thorough sprinkling of the aggregates during the stockpiling to produce damp aggregate. Sprinkle to obtain uniform distribution of moisture. Then permit the aggregates to drain as long as necessary to produce a uniform moisture content. Maintain the moisture content as much as practical until the aggregate is used. Add the admixtures to the mix according to the manufacturer's recommendations.

425.03.01 Existing Structures. Remove existing bridge decks as specified in 405.03.02. Note that the deck replacement material may be lighter than the existing deck and the deflection caused by the lighter material will be less than the material removed. Therefore, compute modified rebound figures to be used in lieu of dead load deflections to establish grade controls to produce finished tops of concrete bridge decks that will be true to as planned line and grade.

425.04 MEASUREMENT AND PAYMENT

Lightweight concrete structures will be measured and paid for as specified. The payment will be full compensation for all forms and form removal, reinforcing steel, curing and misting, scuppers, mechanical and electrical work, all cost incidental to the conducting of tests for oxygen content and presence of gases and applying mechanical ventilation to confined spaces, year built markings, and for all material, labor, equipment (including safety equipment), tools, and incidentals necessary to complete the work.

The construction of drainage and weep holes, any pipe necessary, expansion material, flashing, dampproofing, membrane waterproofing, epoxy bonding compound, joints and their placement will not be measured but the cost will be incidental to the lightweight concrete item. No deduction in lightweight concrete quantities will be made for pipes or conduits having diameters less than 8 in., reinforcing steel, anchors, or any other appurtenances.

425.04.01 Lightweight Superstructure Concrete will not be measured but will be paid for at the Contract lump sum price unless otherwise specified.

425.04.02 Lightweight concrete parapets and median barriers will not be measured but will be paid for at the Contract lump sum price for the pertinent Lightweight Concrete Parapet or Lightweight Concrete Median Barrier items.

425.04.03 Floodlighting will be measured and paid for as specified in 420.04.06.

425.04.04 Linseed Oil Protective Coating will be measured and paid for as specified in 420.04.07.

CATEGORY 400
STRUCTURES

SECTION 426 — LATEX MODIFIED CONCRETE OVERLAY FOR BRIDGE DECKS

426.01 DESCRIPTION

Remove the specified amount of the existing bridge deck material mechanically and through hydro-demolition, remove additional areas of deteriorated concrete as directed by the Engineer, clean surface areas to be overlaid. Clean scuppers, downspouts and joint troughs, replace deteriorated reinforcing steel, and place latex modified concrete (LMC).

Restrictions. Do not place LMC in Allegany, Garrett, and Washington counties between November 1 and April 30. In all other Counties, do not place LMC between December 1 and April 30. Do not remove any portion of existing bridge deck that will not be overlaid and cured per these restrictions.

426.02 MATERIALS

Fine Aggregate	901.01
Coarse Aggregate	901.01, Size No. 7
Portland Cement Type I	902.03
Concrete for Patching	902.10
Latex Modified Concrete	902.13
Reinforcement	Section 908
Water	921.01

426.03 CONSTRUCTION

Dispose of removed material at an approved spoil area.

426.03.01 Collection and Containment of Effluent. Collect and contain all liquid and/or solid effluent from the high pressure water jet method of concrete removal and ensure that no such effluent reaches any traveled roadway, waterway, or other drainage facilities. The effluent shall be disposed at a site with an MDE approved industrial discharge permit appropriate for the effluent collected. Failure to collect and contain all liquid and/or solid effluent from the high pressure water jet concrete removal will be cause for immediate shut down of high pressure water jet concrete removal operations until corrective actions are taken. Any additional costs associated with a failure to collect and contain the effluent shall be at no additional cost to the Administration

and is the sole responsibility of the Contractor. All costs associated with collecting and containing the effluent from the high pressure water jet method of concrete removal shall be incidental to the pertinent removal items in the Contract.

426.03.02 Equipment. Ensure that all proposed equipment meets the requirements specified herein, and is approved.

Deck Removal Equipment

(a) Existing Wearing Surface Removal. This equipment is only required when the existing bridge contains an asphalt mix wearing surface. Provide equipment that is capable of removing the wearing surface without damaging armored joints that are to remain or the existing concrete surfaces beyond the specified minimum removal depth. When pavement breakers are proposed, use broad faced chisel blades operated at a slight angle with the horizontal to peel the wearing surface off.

(b) Concrete Deck Surface Removal. Power operated mechanical type and high pressure water jet type equipment shall be capable of uniformly removing the specified minimum depth from the existing concrete surface. A minimum of one inch of concrete deck removal shall be completed using the High Pressure Water Jet Type.

(1) Mechanical Type. This equipment may be used to remove the concrete deck to a specified depth measured from the top of the concrete deck to provide a roughened surface for the high pressure water jet equipment. Take sufficient pacometer readings to verify the depth to the top layer of deck reinforcement and operate the equipment so as not to damage the reinforcing bars. All additional concrete deck removal shall be completed using high pressure water jet, power driven tools, or hand tools as specified in the Contract.

(2) High Pressure Water Jet Type. Hydro-demolition using high pressure water jet type equipment shall be used to remove unsound concrete deck material to the specified depths. This method shall leave roughened, highly bondable deck surface with all the unsound concrete removed. Unsound concrete is defined as existing bridge deck concrete that is deteriorated, de-bonded from the reinforcement, spalled, or determined by the Engineer to be unsound.

The high pressure water jet hydro-demolition equipment shall be a computerized, self-propelled machine that utilizes a high pressure water jet stream to provide a rough and bondable surface while removing all unsound concrete and rust and concrete particles from any exposed reinforcement with one pass over the concrete deck surface.

Prior to the commencement of the hydro-demolition operations, calibrate the hydro-demolition equipment over a 6 ft x 6 ft area of sound deck concrete as designated by the Engineer to demonstrate proper removal to the minimum specified depth and desired surface finish to bond with the overlay in one pass

of the equipment. Move the hydro-demolition equipment to a second 6 ft x 6 ft area of unsound deck concrete as designated by the Engineer to demonstrate proper removal to the minimum specified depth, removal of all unsound concrete, and provide the desired surface finish to bond with the overlay. All construction debris, milling debris, and dust are to be completely removed from the bridge deck surface prior to calibration and commencement of the hydro-demolition operations.

If the equipment or end results of the calibration tests are deemed unsatisfactory by the Engineer, remove the hydro-demolition equipment from the project site and provide another high pressure water jet unit for calibration. No additional compensation or Contract time will be provided for this recalibration process if required.

Provide verification of the following equipment settings to the Engineer:

(a) Water Pressure Gauge.

(b) Machine staging control (step).

(c) Nozzle size.

(d) Nozzle speed (travel).

Production hydro-demolition operations may begin after the Engineer has approved the second calibration and has been provided verification of the above equipment settings. Provide the Engineer with the calibration and production settings prior to and during hydro-demolition surface preparation operations.

The hydro-demolition operations will be stopped if it is determined that sound concrete is being removed beyond specified limits or unsatisfactory results are being obtained as determined by the Engineer. Perform appropriate recalibration or make the necessary changes in equipment and methods prior to resuming the operation.

The specified calibration procedure is required each time the hydro-demolition operation is performed and as required to achieve the specified results. Provide a non-working technical field representative on the project site during the calibration and the hydro-demolition surface preparation operation.

(c) Power Driven Hand Tools. Use this equipment for removal of unsound concrete and for removal in areas inaccessible to hydro-demolition. This equipment is permitted with the following restrictions:

(1) Do not use pavement breakers heavier than nominal 30 lb class.

(2) Do not operate pavement breakers or mechanical chipping tools at an angle greater than 45 degrees measured from the surface of the deck.

(3) Do not use chipping hammers heavier than a nominal 15 lb class for concrete removal beneath any reinforcing bars.

(d) Hand Tools. Use hand tools such as hammers and chiseled for removal of remaining particles of unsound concrete from beneath any reinforcing bar to achieve the required depth.

(e) Abrasive Blasting. Provide equipment capable of removing rust scale and old concrete from reinforcing bars and of removing small chips of concrete partially loosened by the removal operation.

LMC Proportioning and Mixing Equipment. Equipment used for mixing shall be self-contained, mobile, continuous mixing, and shall be:

(a) Self-propelled and be capable of carrying sufficient unmixed dry bulk cement, sand, coarse aggregate, latex modifier, and water to produce at least 6 yd^3 of concrete. Do not store aggregate in the mixing equipment overnight.

(b) Capable of positive measurement of cement being introduced into the mix, have a recording meter visible at all times, and be equipped with a ticket printout that indicates the quantities being mixed.

(c) Calibrated to accurately proportion the mix. Certification of the calibration by an approved testing authority will be accepted as evidence of the accuracy if the yield is shown to be true within a tolerance of 1.0 percent in conformance with MSMT 558.

(d) Capable of providing positive control of the flow of water and latex emulsion into the mixing chamber. Water flow shall be indicated by flow meter and be readily adjustable to provide for minor variations in aggregate moisture.

(e) Capable of being calibrated to automatically proportion and blend all components of indicated composition on a continuous or intermittent basis as required by the finishing operation. It shall discharge mixed material through a conventional chute directly in front of the finishing machine.

(f) Capable of spraying water over the entire placement width as it moves ahead to ensure that the surface is wetted to receive the LMC.

Placing and Finishing Equipment. The combination of labor and equipment for proportioning, mixing, placing, and finishing LMC shall meet the following minimum requirements except when otherwise specified:

TOTAL OVERLAY AREA PER BRIDGE SQUARE YARDS	MINIMUM OVERLAY RATE PER HR CUBIC YARDS
0-328	1.0
329-492	1.5
493-656	2.0
over 656	2.5

(a) Placing and finishing equipment includes hand tools for placement and for distributing it to approximately the correct level for striking off with the screed.

(b) Use an approved finishing machine for finishing all areas of work. The finishing machine shall be self-propelled and capable of forward and reverse movement under positive control. Provisions shall be made for raising all screeds to clear the screeded surface for traveling in reverse. Use a rotating cylinder type finishing machine. It shall span the placement transversely, and be equipped with one or more rotating steel cylinders, augers, and vibratory pans.

(c) The finishing machine shall be designed so that when LMC is being mixed and placed under normal operating conditions at the minimum rate, the elapsed time between depositing the LMC on the concrete deck and final screeding does not exceed 10 minutes.

(d) Ensure that construction is supervised by the LMC mixture's representative or as directed by the Engineer.

426.03.03 Deck Removal and Repairs. Remove material to the specified limits as shown on the Contract plans using mechanical type, high pressure water jet, power driven tools, hand tools, and abrasive blasting as required by the specification. The Engineer will inspect the entire exposed portion of the deck and determine if any repairs are required. The Engineer will specify the type and extent of the repairs. Repair any extraneous damage to the existing bridge that the Engineer deems to have been caused by the removal and cleaning operations, at no additional cost to the Administration.

After completion of the initial pass using high pressure water jet, and the deck is dry and frost free, resound the deck to ensure that all unsound material has been removed. Remove unsound concrete as determined by the Engineer using high pressure water jet type method at no additional cost to the Administration.

Clean the high pressure water jet and milling debris with a vacuum system equipped with fugitive dust control devices and capable of removing wet debris and water all in the same pass. Blow dry the deck with air to remove excess water. Perform cleaning in a timely manner, before the debris and water are allowed to dry on the deck surface.

Provide shielding, as required, to ensure containment of all dislodged concrete within the removal area in order to protect the traveling public from flying debris on, adjacent to, and below the worksite. See 426.03.01 for additional containment requirements.

During and after the high pressure water jet type method removal operation (regardless of the depth of concrete deck removal) vehicular traffic, equipment and material storage are strictly prohibited on that portion of bridge deck, whether or not the reinforcement is exposed. These restrictions will be lifted after the LMC has been properly placed and cured as specified in 426.03.07.

Ensure that the existing concrete around the reinforcing bars is sound and not debonded especially when more than 1/2 diameter is exposed. Where the bond between existing concrete and reinforcing steel has been destroyed, remove the concrete adjacent to the bar to a depth that will permit concrete bond to the entire periphery of the exposed bar. Ensure that this clearance is at least 1 in. unless lower bar mats make it impractical.

Existing reinforcing steel utilized in the finished deck shall meet 421.03.07. Take measures to prevent cutting, stretching, or damaging any exposed reinforcing steel. Regardless of whether it was previously coated, abrasive blast clean and apply epoxy coat touch up system to all exposed reinforcement as specified in Section 465. Use epoxy powder coating touch up material from the Administration's Approved List. If the Contractor believes that there is not enough time to allow the system to properly cure, request a waiver for this requirement to the Office of Structures prior to the start of removal operations. Replace the reinforcing steel that is damaged or deteriorated with the same diameter bars using epoxy coated bars for all existing reinforcing steel regardless of whether it was previously coated. Refer to 426.03.04 for additional requirements.

Keep all areas from which unsound concrete has been removed free of slurry produced by hydro-demolition of concrete in adjacent areas. Remove slurry from prepared areas before proceeding with the surface preparation and properly dispose of at the approved area as specified in 426.03.01.

Repair spalled concrete, voids, and other defects that are located within the proposed LMC overlay area according to the methods specified herein. Each repair includes the removal of the additional deck material, all hand-chipping, and filling the repair area voids with LMC overlay while applying the overlay.

(a) For cavities less half the deck thickness, no additional work required.

(b) For cavities over half the deck thickness but not full depth, furnish and erect temporary protective shields as specified in 405.03.01. If utilized in the original construction of the structure, existing stay in place forms that are in good condition will be sufficient to meet this requirement.

(c) For areas where the depth of removal is full depth, meet the following in addition to the requirements of (b):

(1) In large areas, supply forms to enable placement of the LMC overlay and support them by blocking from the stringers. If utilized in the original construction of the structure, existing stay in place forms that are in good condition will be sufficient to meet this requirement.

(2) In small areas, supply forms to enable placement of the LMC overlay. Forms may be suspended from existing reinforcing bars by wire ties. If utilized in the original construction of the structure, existing stay in place forms that are in good condition will be sufficient to meet this requirement.

Clean all bridge scuppers, downspouts, joint troughs, end of bridge inlets, pipes and outfalls of all debris.

426.03.04 Surface Preparation for LMC Overlay. Thoroughly clean the entire milled deck surface with a high pressure water wash (minimum 7500 psi) within 24 hours before placing the overlay to clean all reinforcement bars of visible rust and clinging concrete detached from the deck and all areas of concrete against which the overlay is to be placed. High pressure water washing may be required on the day the overlay is to be placed so that reinforcing bars are free of visible rust, unless the Engineer determines that a thin coating of flash rust will be acceptable.

426.03.05 Proportioning and Mixing LMC Materials. Mixers shall be clean and the ingredients accurately proportioned.

Mix LMC materials at the site according to the specified requirements for the equipment used. Ensure that the LMC discharged from the mixer is uniform in composition and consistency. Mixing shall enable finishing operations to proceed at a steady pace, with final finishing completed before the formation of the plastic surface film.

426.03.06 Placing and Finishing LMC Overlay. The LMC overlay will be the riding surface of the bridge. Place the top of the LMC overlay to the true as planned line and grade of the roadways. Produce a finished top of LMC overlay that is smooth riding by placing the LMC overlay in a manner that meets the grade of the proposed adjoining portions of the new bridge decks and adjoining roadways.

Place and fasten screed rails in position to ensure finishing the new surface to the required profile. Anchorage for supporting rails shall provide horizontal and vertical stability. Do not treat screed rails with any compound to facilitate their removal.

The location of longitudinal joints (if not shown on the Contract Documents) will be determined by the Engineer based on avoiding joints in the vehicular wheel path as much as practical.

Review inspection procedures to ensure coordination between contractor, subcontractors, suppliers and the Administration to ensure all understand the procedures to be used. Prior to placement operations, review the equipment, procedures, personnel, and previous results with the Engineer. Revise operations as needed to provide a smooth riding bridge deck meeting 420.03.07(d).

Completely clean all surfaces by air blast followed by flushing with water. Prior to placing the LMC overlay, wet the surface and keep it wet for at least one hour. Remove puddles of free water.

Place the LMC mixture to approximately 1/4 in. above grade and then screed with an approved power operated finishing machine to the specified line and grade. Use a suitable portable lightweight or wheeled work bridge behind the finishing operation. Hand finishing may be required along the edge. Edge tool joints, except when next to metal expansion dams, curbs, and previously placed lanes.

Separate the screed rails and construction bulkheads from the newly placed material by passing a pointing trowel along their inside face. Make the trowel cut for the entire depth and length of screed rails and bulkheads, after the mixture has stiffened sufficiently. Do not separate metal expansion dams from the overlay.

426.03.07 Curing. Cover the surface of the LMC overlay with a single layer of clean, wet burlap as soon as the surface will support it without deformation. Follow immediately with a layer of 4 mil polyethylene film on the top of burlap and cure the surface for 48 hours. Whenever cold weather protection is required, the polyethylene film shall be covered with R 12 insulating blankets. Provide a sufficient number of maximum/minimum recording thermometers to record temperatures in each LMC placement and ensure that all requirements outlined in 426.03.09 are satisfied.

After 48 hours, remove the wet burlap and 4 mil polyethylene film and air cure the LMC for an additional 72 hours. White opaque burlap polyethylene sheeting may be substituted for the polyethylene film with approval of the Engineer, but shall not replace the wet burlap.

Plastic shrinkage cracks and cold joints between overlay placements shall be filled with an approved gravity fill polymer such as high molecular weight methacrylate (HMWM), prior to placing traffic on the overlay and in accordance with the manufacturer's recommendations. Apply sufficient polymer to fill the cracks and once the cracks are filled, excess polymer should be brushed off so that it does not harden in the valleys of the grooves in the finished overlay surface. Apply a light application (approximately 1 lb/yd^2) of an approved sand as needed for improved skid resistance. The polymer must be hard prior to being subjected to traffic. There will be no separate payment for this work. The cost will be incidental to the item for Latex Modified Concrete Overlay.

426.03.08 Grooving. Groove as specified in the applicable portions of 420.03.07(d)(1), but start after the LMC has been cured as specified in 426.03.07. When a deck is overlaid in staged construction, wait until the whole bridge deck within the stage is overlaid, properly cured, and the minimum compressive strength of 3000 psi has been obtained, and then groove the entire overlay area of the bridge deck prior to allowing traffic to use the area. Additional MOT required for this work will be paid as specified in 426.04.04.

426.03.09 Limitation of Operations. LMC placement includes the applicable deck placement restrictions specified in 420.03.04.

Do not apply loads to the bridge deck overlay until the final section of the overlay placed in the structure's staged construction has completed its specified air curing period as specified in 426.03.07. No vehicles, including heavy construction equipment, will be permitted on bridge

deck overlay until the concrete cylinder breaks have attained a compressive strength of 3000 psi. However, loads such as stored materials, lightweight equipment, and concrete safety parapets, may be placed upon the concrete slab via lifting devices after the air curing period. Do not open the bridge deck overlay to traffic until concrete cylinder breaks have attained a compressive strength of 3000 psi, the air curing period is complete, the cracks are filled with an approved gravity fill polymer as specified in 426.03.07, and the overlay is grooved as specified in 426.03.08.

Do not place LMC and concrete adjacent to an LMC surface course less than 96 hours old. This restriction does not apply to a continuation of placement in a lane or strip beyond a joint in the same lane or strip.

Do not grind or chip existing concrete pavement within 6 ft of LMC or between the same bridge joint as the LMC placement until the LMC has cured for at least 48 hours.

Do not place LMC at temperatures below 45 F. The LMC may be placed at 45 F, if rising temperature is predicted and anticipated for at least 8 hours.

Suspend all LMC placements if the surface evaporation rate exceeds 0.10 lb/ft^2/hour as shown in ACI 308, Figure 1. LMC placement may continue at the Contractor's risk upon approval by the Engineer of measures to be taken to prevent deleterious effect of high surface evaporation rates.

At curing temperatures below 55 F, the Engineer will require a longer curing period and conformance with applicable portions of 420.03.13.

Any day during which the curing temperature falls below 50 F will not be counted as a curing day. When during the curing period the curing temperature falls below 35 F, the work may be considered as being unsatisfactory and rejected. Remove and replace unsatisfactory LMC at no additional cost to the Administration.

During delays up to one hour, several layers of wet burlap may be used to protect the end of the placement from drying. If the delay exceeds one hour, construct a dam or install a bulkhead and wait 12 hours before resuming placement operations. However, placement may continue provided a gap of sufficient length for the finishing machine to clear the previously placed LMC overlay is left in the lane or strip.

Protect freshly placed LMC overlays from sudden or unexpected rain. Stop all placing operations when it starts to rain. Remove and replace material damaged by rainfall, as determined by the Engineer, at no additional cost to the Administration.

Do not place linseed oil on LMC finished deck surfaces.

426.04 MEASUREMENT AND PAYMENT

The payment for removal operations and latex modified concrete overlay items will be full compensation for all surveys, removing and cleaning, collection, containment, and disposal of all liquid and/or solid effluent, protective shielding, abrasive blasting, high pressure water washing, air blasting, flushing with water, forming, cleaning scuppers, downspouts, joint troughs, end of bridge inlets, pipes and outfalls, disposal of removed material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

426.04.01 Removal and Disposal of Existing Bituminous Wearing Surface from Bridge regardless of depth will be measured and paid for at the Contract unit price per square yard for the actual surface area removed from the bridge deck.

426.04.02 Removal of Portion of Existing Concrete Deck by mechanical type, high pressure water jet, power hand tools, or hand tools will be measured and paid for at the Contract unit price per cubic yard for the Removal of Portions of Existing Concrete Deck item. The payment will be full compensation for removing and cleaning existing concrete deck to include the collection, containment, and disposal of all liquid and/or solid effluent from the high pressure water jet method of concrete removal.

The estimated cubic yard quantity for this item is based on an estimated removal depth, as specified, measured from the top of the existing concrete deck to the centerline of the top layer of the existing deck reinforcement plus additional removal required as specified in the Contract plans. For structures with a bituminous wearing surface, the estimated removal depth is measured from the top of the existing concrete deck after the entire existing bituminous wearing surface is removed. The minimum price bid for this item shall be as specified in the Schedule of Items.

426.04.03 Additional removal of unsound portions of existing concrete deck regardless of depth or method will be measured and paid for at the Contract unit price per cubic yard for the Additional Removal of Portions of Existing Concrete Deck. This item is for additional cubic yard quantity of removal in excess of the estimated concrete removal depth specified in 426.04.02. The basis for measurement of this item shall be determined by subtracting the estimated cubic yard quantity of Latex Modified Concrete Overlay, as shown in the Schedule of Items, from the actual cubic yard quantity of Latex Modified Concrete Overlay placed. No payment shall be made under this item if the actual cubic yard quantity of Latex Modified Concrete Overlay placed is less than the estimated quantity as shown in the Schedule of Items. The price of this item shall be fixed at 1.4 times the price bid for Removal of Portions of Existing Concrete Deck.

426.04.04 Latex Modified Concrete Overlay will be measured and paid for at the Contract unit price per cubic yard for the Latex Modified Concrete Overlay item. Measurement for the volume of concrete will be based on the meter readings on the mixers dispensing the latex modified concrete excluding the calculated volume of any waste. Placing, finishing, curing, sealing, and grooving of the latex modified concrete overlay, and repair of epoxy coating for existing deck reinforcing, and additional maintenance of traffic for grooving operations will not be measured but the cost will be incidental to Latex Modified Concrete Overlay item.

426.04.05 Repair Bar for Deck Reinforcement will be measured and paid for at the Contract unit price per linear foot. Repair of damaged reinforcement steel, epoxy coating for repair reinforcement steel, and furnishing and placing welded wire fabric for deck repairs will be incidental to the Repair Bar for Deck Reinforcement item.

426.04.06 Furnishing and installing any formwork required for full depth deck repairs will be measured and paid for at the Contract unit price per square foot for the pertinent Formwork for Full Depth Deck Repairs item. The measurement will be based upon the exposed opening at the bottom of the deck. The cost for form work extending beyond these limits will be incidental to the item.

CATEGORY 400
STRUCTURES

SECTION 430 — METAL STRUCTURES

430.01 DESCRIPTION

Furnish, fabricate, transport, and erect steel beams, plate girders, trusses, grillages, columns and bents, shoes, pedestals, castings, beam retrofit plates and angles, miscellaneous steel, and all incidental structural steel as specified in the Contract Documents or as directed by the Engineer. Refer to Section 432 for bearings and Section 435 and Section 436 for cleaning and painting new and existing structural steel, respectively.

Substitutes for Rolled Members. Fabricated shapes may be substituted for the specified rolled shape, provided the substitution is at no additional cost to the Administration and the fabricated shape meets the following requirements:

(a) The moment of inertia is equal to or greater than the rolled shape for the full length of the member.

(b) The depth is greater than or equal to the rolled shape and does not decrease the designated minimum underclearance.

(c) The web or leg thickness is at least 1/2 in.

(d) The flange thickness is at least 1 in., the flange width is at least 12 in., and the width to thickness ratio does not exceed 12.

(e) It is made of the same material specified for the rolled shape.

(f) All normal criteria for creating a welded member are adhered to.

430.02 MATERIALS

Paint	Section 435, Section 436, and 912.05
Grout	902.11(c), 902.11(d), 902.11(e)
Metals	Section 909
Metal Reinforced Epoxy Filler	909.12
Bolts	F3125 Grade A325, A490
Nuts	A563 Grade C, D, and DH
Washers	F436
Direct Tension Indicating Washers (DTI)	F959

430.03 CONSTRUCTION

Unless otherwise specified, all welding and dimensional tolerances shall meet AWS D1.5.

430.03.01 Working Drawings. Refer to Section 499. If lateral bracing is required for shipping or erection, specify the details on the working drawings.

430.03.02 Work Scheduling. Refer to Section 499. At least two weeks prior to beginning shop work, notify the Engineer when and where to allow for inspection. Do not fabricate any materials unless otherwise directed. Provide weekly work schedules prior to and during fabrication as directed.

430.03.03 Facilities for Shop Inspection. Furnish all facilities for the inspection of material and workmanship in the shop. Allow the inspector free access to the required areas of the premises and provide an approved office area.

430.03.04 Material Identification. Identify main member material by heat number.

430.03.05 Mill Orders. Furnish copies of mill orders and test reports.

430.03.06 Testing. Furnish sample specimens as directed without charge.

430.03.07 Defective Material and Workmanship. The acceptance of any material and workmanship will not deter subsequent rejection. Replace or repair rejected material and workmanship as directed.

430.03.08 Marking and Shipping. Paint or mark each member with an erection mark for identification. Furnish an erection diagram with erection marks clearly delineating the orientation of diaphragms.

Erection marks for field identification of members and weight marks for members weighing over 6000 lb shall be painted on surface areas previously painted with the shop coat. Material may be

loaded for shipment when the shop coat is thoroughly dry, but not less than 24 hours after the paint has been applied.

Where unpainted steel is specified for a finished structure, do not place any company's name on the structural steel. Erection marks and inspection stamps shall appear only on the top surface of the top flange of girders, beams, and diaphragms unless otherwise directed.

Do not apply paint after the materials have been loaded for transport.

Furnish copies of material orders, shipping statements, and erection diagrams. Show the weight of the individual members on the shipping statements.

Load, transport, unload, and store structural material so that the metal is kept clean and does not become excessively stressed, deformed, or otherwise damaged.

When handling long steel members, place handling devices at approximately the quarter points. When storing and shipping members, place blocking at intervals that prevent sag and distortion. Keep beams and girders in an upright position during shipping, storage, and handling. For other members, keep the stronger axis vertical.

All girders having stiffeners the full height of the web on both sides of the web shall be adequately blocked before shipment. Locate this blocking at the quarter points and midpoint of the girder and at additional locations to ensure that the blocking interval does not exceed 25 ft.

For members too long to fit inside a truck or trailer, limit the cantilever to one quarter of the length of the member. Support members too long to comply with this requirement on dollies, additional vehicles, or other vehicles that fully support the long pieces as approved.

430.03.09 Storage of Material. Store fabricated material off the ground and protected from rust producing conditions. Keep materials free of dirt accumulation, oil, or other deleterious matter.

430.03.10 Changes and Substitutions. Do not make changes or substitutions in any approved drawing unless approved in writing by the Director, Office of Structures.

430.03.11 Fabrication. Use bolted or welded fabrication and construction as specified or as directed.

When girders are to be curved by the heat shrinkage method, submit the proposed method.

430.03.12 Holes.

(a) Punched Holes. The diameter of the die shall not exceed the diameter of the punch by more than 1/16 in. Ream holes requiring enlargement. Provide holes that are clean cut with no torn or ragged edges. Ensure that holes punched full size or subpunched are punched so that after the steel is assembled and before any reaming is done, a cylindrical pin 1/8 in. smaller in diameter than the nominal size of the punched hole

can be entered perpendicular to the face of the member, without drifting, in at least 75 percent of the contiguous holes in the same plane. If this requirement is not met, the nonconforming punched pieces will be rejected. Holes not passing a pin 3/16 in. smaller in diameter than the nominal size of the punched hole will be rejected. Drifting done during assembling is permitted only to bring the parts into position but not to the extent that holes are enlarged or distorted. If the required accuracy cannot be obtained otherwise, holes for connections shall be subpunched and reamed with the members assembled instead of being punched full size.

(b) Reamed or Drilled Holes. Holes shall be cylindrical, perpendicular to the member, and not more than 1/16 in. larger than the nominal diameter of the bolts. Where practical, direct the reamers by mechanical means. Remove burrs on the surface. Poor matching of holes will be cause for rejection. Use twist drills for reaming and drilling. If directed, take assemblies apart and remove burrs caused by drilling. Assemble connecting parts that require reamed or drilled holes, and securely hold them while reaming and drilling. Match mark them before disassembling. After holes are reamed or drilled, 85 percent of the holes in any contiguous group shall show no offset greater than 1/32 in. between adjacent thicknesses of metal.

(c) Subpunching and Reaming. Subpunch and ream holes in all field connections and field splices of main truss or arch members, continuous beams, plate girders, and rigid frames while assembled in the shop unless otherwise specified. The assembly, including camber, alignment, accuracy of holes, and milled joints shall be acceptable to the Engineer before reaming is started.

Subpunch and ream holes for floor beam and stringer field end connections utilizing a template or ream while assembled.

If specified, do additional subpunching and reaming as required. The accuracy of subpunched holes shall be the same as required for punched holes.

(d) Computer Numerically Controlled (CNC) Drilling. Instead of reaming sub-sized holes or drilling full-sized holes while assembled, the contractor may use CNC drilling or punching equipment to drill or punch full-sized holes in unassembled pieces, connections, and templates for use with matching sub-sized and reamed holes. The contractor may use CNC equipment to either drill or punch holes through individual pieces or drill through any combination of pieces held tightly together. Full-size punched holes shall meet the requirements of 430.03.12(a).

430.03.13 Shop Assembly. Clean surfaces of metal that will be in contact after assembly. Ensure that parts of a member are assembled, well pinned, and firmly drawn together with bolts before starting reaming or tightening of fasteners. Provide members free from twists, bends and other deformations. Ream material that has been punched full size, if necessary, prior to tightening of fasteners. Refer to 430.03.12(c).

Secure parts not completely fastened in the shop with bolts to prevent damage in shipment and handling. Members assembled in the shop for reaming of field connections shall remain assembled until the Engineer's shop inspection.

When using Computer Numerically Controlled (CNC) Drilling, furnish a check assembly for each major structural type of each project unless otherwise indicated or specified in the special provisions. Provide check assemblies consisting of at least three contiguous shop sections or, for a truss, all members in at least three contiguous panels but not less than the number of panels associated with three contiguous chord lengths (i.e. length between field splices). Base check assemblies on the proposed order of erection, joints in bearings, special complex points and similar considerations. Special complex points include the portals of skewed trusses.

Use the first sections of each major structural type to be fabricated as the check assemblies.

Obtain approval for each CNC drilled check assembly before reaming or dismantling the assembly. If a check assembly fails to demonstrate that the required accuracy is being obtained for camber, alignment, accuracy of holes and fit of milled joints, the Administration or our shop inspector may require additional check assemblies. Additional check assemblies will be at no additional cost to the Administration.

430.03.14 Camber Diagram. Furnish a camber diagram showing the camber at each panel point for each truss, taken from actual measurements during truss assembly. For all beams and girders, furnish a camber diagram showing the camber at all splice points, points of dead load inflection, and any other points designated by the Engineer.

Camber stringers to the specified dimensions, when measured after completion of all shop welding. The maximum tolerance for camber is zero under to 3/4 in. over.

Make provisions for dead load deflections, fabricating tolerances, and irregularities at all points along all stringers so that the superstructure concrete may be placed to match the profile grade line.

430.03.15 Match Marking. Match mark connecting parts assembled in the shop for the purpose of reaming holes in field connections. Furnish a diagram showing these marks.

430.03.16 Use of High Strength Bolts and Lock-Pin and Collar Fasteners. Use high strength bolts and lock-pin and collar fasteners unless otherwise specified. Unfinished bolts or machine bolts may be used for the temporary erection of structural steel. Replace them with high strength bolts, lock-pin and collar fasteners, or welding for final erection. Use turned bolts only when specified. Draw the heads, nuts, and washers tightly against the work. Where bolts or lock-pin and collar fasteners are used in beveled surfaces, provide beveled washers to give full bearing to the head, nut, or collar except as otherwise specified in 430.03.17. Where high strength bolt assemblies are used for joint connections, perform the additional testing specified by the Office of Materials Technology.

430.03.17 High Strength Bolt Joint Requirements.

(a) Use only one grade of bolts, nuts, and washers in a structure. Bolts may be supplied from various manufacturers provided that each bolt of a given length and diameter is made by the same manufacturer. Nuts and washers may be supplied from different manufacturers provided that the same manufacturers make all the respective nuts and washers to be used throughout the structure on all bolts having the same diameter. All bolts, nuts, and washers used with A709, Grade 50W steel shall meet F3125 Grade A325, Type 3.

(b) The slope of surfaces of bolted parts in contact with the bolt head and nut shall not exceed 1:20 with respect to a plane normal to the bolt axis. Where an outer face of the bolted parts has a slope of more than 1:20 with respect to a plane normal to the bolt axis, use a smooth beveled washer to compensate for the lack of parallelism. When assembled, bolted parts shall fit solidly together and shall not be separated by gaskets or any other compressible material. The holes shall be truly cylindrical and at right angles to the surface of the metal so that both head and nut bear squarely against the metal. When assembled, all joint surfaces including those adjacent to the bolt heads, nuts, or washers, shall be free of scale (except tight mill scale), dirt, burrs, and other deleterious material and defects that would prevent solid seating of the parts. Contact surfaces within joints shall be free of oil, lacquer, and rust inhibitor. Refer to 435.01.01 for contact surfaces to be painted.

(c) When all bolts in the joint are tight, every bolt shall conform to the minimum installation tension specified for its size by the Office of Material Technology. When field conditions prevent tightening at the nut, bolts may be tightened at the head, provided that the nut is prevented from turning. Place a washer under the element (nut or bolt head) turned in tightening. Tighten threaded bolt connections by the turn-of-nut method unless DTI's are opted for use. If impact wrenches are used, they shall be of adequate capacity and have a sufficient supply of air to perform the required tightening of each bolted connection.

(d) To provide the bolt tension specified in 430.03.17(c), first bring enough bolts to a snug tight condition ensuring that the parts of the joint are in full contact with each other. Snug tight is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Place bolts in any remaining holes in the connection and bring to snug tightness. Then additionally tighten all bolts in the joint with tensioning progressing systematically from the most rigid part of connection to the free edges. Ensure that there is no rotation of the part not turned by the wrench during this operation.

After all bolts in the joint have been tightened to a snug tight condition as described above, tighten the joint by the applicable amount of nut rotation specified in the Nut Rotation from Snug Tight Condition table below. All bolt assemblies in the completed structure shall have full thread engagement, which is accomplished when the end of the bolt is flush with or extends beyond the outer face of the nut.

NUT ROTATION FROM SNUG TIGHT CONDITION			
DISPOSITION OF OUTER FACES OF BOLTED PARTS			
Bolt length (as measured from underside of head to extreme end of bolt)	Both faces normal to bolt axis	One face normal to bolt axis and other face sloped not more than 1:20 (beveled washer not used)	Both faces sloped not more than 1:20 from normal to bolt axis (beveled washers not used)
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters	2/3 turn	5/6 turn	1 turn

Note 1: This table is for coarse thread, heavy hexagon structural bolts of all sizes and lengths and heavy hexagon semifinished nuts.

Note 2: Nut rotation is rotation relative to bolt regardless of the element (nut or bolt) being turned. Tolerance on rotation: ±30 degrees for bolts installed by 1/2 turn or less, and ±45 degrees for bolts installed by 2/3 turn or more.

(e) Inspection. The Engineer will be present during the installation and tightening of bolts to determine that the tightening procedure is followed and all bolts are properly tightened.

Provide a sufficient number of safe working platforms at splices for checking torque requirements. Maintain the platforms until all checking is complete and the splice is accepted.

Turn of Nut Method. Provide a calibrated, dial torque wrench to be used as the inspection wrench and a calibrated bolt tension calibrator. Calibrate both devices annually or as necessary. Both shall be as approved.

Conduct the following inspections unless otherwise specified.

(1) Three bolts of the same size, length, and condition as those under inspection shall be placed individually in the bolt tension calibration device. Place a washer under the part turned in tightening each bolt.

(2) Tighten each of the three bolts in the calibration device by any convenient means to the tension specified for its size. Then use the inspecting wrench to further tighten the bolt and determine the torque necessary to turn the nut or head 5 degrees (approximately 1 in. at 12 in. radius). Use the average torque measured in the tests of three bolts as the job inspecting torque to be used in the manner specified in (3).

(3) Use the inspecting wrench to inspect bolts represented in the sample above that have been tightened in the structure. Apply the job inspecting torque in the tightening direction to 10 percent of the bolts but not less than two bolts selected at random in each connection. If no nut or bolt head is turned, the connection will be accepted as properly tightened. If any nut or bolt head is turned, apply the job inspecting torque to all bolts in the connection; and tighten and reinspect all bolts whose nut or head is turned. Alternatively, the fabricator or erector may opt to retighten all of the bolts in the connection and then resubmit the connection for the specified inspection.

(f) Do not reuse bolts, nuts, or washers that were previously torqued to installation tension as described in (d) or (e) above.

430.03.18 Lock-Pin and Collar Fastener Requirements.

(a) Ensure that lock-pin and collar fasteners meet 430.03.17 for one manufacturer, weathering characteristics, sloped surfaces, and applicable inspection.

(b) A representative sample of at least three sets of lock-pin and collar fasteners of each diameter, length, and grade shall be checked at the job site in a device capable of indicating bolt tension. The test assembly shall include flat hardened washers, if required in the actual connection, arranged as in the actual connections to be tensioned. The calibration test shall demonstrate that each assembly develops a tension at least 5 percent greater than the tension required for the comparable F3125 Grade A325 or A490 bolt. Follow manufacturer's installation procedure for installation of bolts in the calibration device and in all connections. Perform periodic retesting when directed.

(c) Install fasteners in all holes of the connection and initially tighten sufficiently to bring all plies of the joint into firm contact but without yielding or fracturing the control or indicator element of the fasteners. Then additionally tighten all fasteners, progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize relaxation of previously tightened fasteners. In some cases, proper tensioning of the fasteners may require more than a single cycle of systematic partial tightening prior to final twist off of the control or indicator element of individual fasteners.

430.03.19 Welding. Provide welding of structures and welding qualifications according to American Welding Society (AWS) Bridge Welding Code D1.5 (AWS D1.5) unless otherwise directed. These provisions apply to both shop and field welding.

Ensure that all welders, welding machine operators, and tackers employed to work on Administration projects are qualified as follows:

(a) AWS Qualifications. Welders shall take tests approved by the Office of Materials Technology according to either AWS D1.1 or D1.5 depending on the applicable size and shape of the material being welded as administered by an AWS Accredited Test Facility (ATF).

(b) Fabricator Qualifications. Fabricators performing work for Administration projects shall be qualified under the American Institute of Steel Construction (AISC) Certification Program for Steel Bridge Fabricators or Bridge and Highway Metal Component Manufacturers and the following:

(1) Meet certification requirements of the Standard for Steel Bridges and Bridge and Highway Metal Components and,

(2) Possess certification in either Simple, Intermediate or Advanced Bridges or as a Manufacturer of Components, depending on type of structural item required.

(3) Fabricators producing fracture-critical members or intermediate or advanced bridges shall meet specific supplemental requirements as determined.

(4) Approved fabricators may issue in-house welder qualifications for shop and field welding.

(c) Steel Stud Shear Developer Qualifications. Steel Stud Shear Developer welders will be inspected and approved at the time of installation according to above.

All field welders shall possess a current AWS welder's qualification card or a fabrication facility qualification card approved by the Office of Materials Technology (OMT). This card shall be available for inspection at all times.

Welding members carrying primary stress shall be by the submerged arc method (SAW) unless otherwise specified. For material thickness 2 in. and greater, the narrow gap electro slag welding process (ESW) may be substituted. Members carrying primary stress are specified in 909.01.

After fabrication, welding will not be permitted on tension flanges for attachments (e.g, metal forms, ty screws) except for steel stud shear developers. Welding transversely across tension flanges of beams or girders will be cause for rejection, unless otherwise specified.

When field welds area required, mask 1-1/2 in. back from the weld area and do not paint.

430.03.20 Inspection of Fabricated Metal Structures. Meet AWS D1.5 and the following:

An approved Quality Control Plan (QCP) must be on file with OMT prior to receiving source approval. The Administration requires 30 days to review quality control plans not previously on file. The QCP shall include:

(a) Method for providing documentation.

(b) Method and frequency of performing quality control inspections.

(c) Qualifications of personnel performing quality control inspections.

Ensure that the inspection frequency is at least the minimum specified. Keep complete and current records and make available for inspection at all times.

430.03.21 Planing. Plane the top and bottom surfaces of steel slabs, base plates, and cap plates of columns and pedestals; or have the plates or slabs heat straightened. Ensure that parts of members in contact with them are faced. In planing the flat surfaces of expansion bearings, the cut of the tool shall be in the direction of expansion.

430.03.22 Abutting Joints. Ensure that abutting joints in compression members and in tension members where specified, are faced and brought to an even bearing. Where joints are not faced, limit the opening to no more than 1/8 in.

430.03.23 End Connection Angles. Floor beams, stringers, and girders having end connection angles shall be built to the exact length back-to-back of connection angles. If end connections are faced, ensure that the finished thickness of the angles is not less than specified.

430.03.24 Main Members. Fabricate principal portions of main members carrying primary stress (refer to 909.01) so that the direction of stress and rolling are the same.

430.03.25 Web Plates. At web splices, ensure that the clearance between the ends of the web plates is not more than 3/8 in. Ensure that the clearance at the top and bottom ends of the web splice plates is not more than 1/4 in.

430.03.26 Bent Plates. Take unwelded, cold bent, load carrying, rolled steel plates from the stock plates so that the bend line will be at right angles to the direction of rolling, except that cold bent ribs for orthotropic deck bridges may be bent in the direction of rolling if approved and shall meet the following:

MINIMUM COLD-BENDING RADII				
A 709 Grades	Thickness, in. (t)			
	Up to 3/4	Over 3/4 to 1, incl.	Over 1 to 2, incl.	Over 2
36	1.5t	1.5t	1.5t	2.0t
50	1.5t	1.5t	2.0t	2.5
50W	1.5t	1.5t	2.0t	2.5
HPS70W	1.5t	1.5t	2.5	3.0t
100	1.75t	2.25	4.5t	5.5t
100W	1.75t	2.25	4.5t	5.5t

(a) Bend so that no cracking of the plate occurs. Minimum bend radii, measured to the concave face of the metal shall meet the following.

(b) For brake press forming, the lower die span should be at least 16 times the plate thickness. Multiple hits are advisable.

(c) If a shorter radius is essential, bend the plates at a temperature no greater than 1200 F. Take hot bent plates from stock so that the bend line will be at right angles to the direction of rolling.

(d) Before bending, round the corners of the plate to a radius of 1/16 in. throughout the portion of the plate where the bending is to occur.

430.03.27 Erection Plan. Submit an erection plan for approval outlining erection procedure of the main members. Submit the erection plan as specified in Section 499 and to the Director, Office of Structures, at least 30 days prior to beginning erection. Include the numbers and types of equipment to be used including crane capacity, location of crane for lifting, falsework when required, and main member erection sequence and weight.

Ensure that all wheels and outriggers of a crane or wheels of a structural steel delivery truck are at a minimum distance from the rear face of an abutment equal to the vertical distance from the top of a spread footing or to the original groundline if the footing is on piles. Ensure that no other heavy construction equipment operates within this distance from the rear face of abutments.

Erect bridges with continuous main members in a manner providing the proper reactions, and avoiding overstressing main members.

When preparing erection plans and procedures, take into account the restrictions imposed by the Water Resources Administration relative to pollution or disturbance of existing waterways.

430.03.28 Falsework. Comply with the provisions specified in TC-4.01 and Section 499. Build and maintain the falsework according to the approved falsework plans. Any changes subsequent to initial approval shall be proposed through the Contractor's professional engineer and be as approved.

Before permitting any loads to be placed on falsework, the Engineer shall receive written certification by the Contractor's professional engineer that the falsework system has been assembled in conformance with the approved falsework drawings. This certification shall be accompanied by a Certificate of Compliance stating that all manufactured materials and assemblies fully comply with the falsework design and plans. The Engineer may either accept the certificate or invoke any provision of GP-5.08. Perform all tests required at no additional cost to the Administration.

In addition to protective measures shown on the falsework plans, the Engineer may direct that further protection of falsework be provided against accidental collision by highway or construction traffic and equipment, traffic vibration, flood waters or high winds, etc., that are necessary for public safety and protection of the work.

430.03.29 Damaged or Defective Material. Submit a written procedure for correcting damaged or defective material to the Director, Office of Structures. Do not proceed with corrections until approved. The Engineer will inspect damaged or defective material before and after correction. Make corrections in the presence of the Engineer.

430.03.30 Assembling Steel. Carefully handle material without bending, breaking, or otherwise damaging parts. Before assembly, clean the bearing surfaces and those to be in permanent contact. Before beginning field bolting and welding, adjust the structure to correct grade and alignment, and properly regulate the elevations of panel points (ends of floor beams). Fill half the holes in splices and field connections using bolts and cylindrical erection pins (40 percent bolts and 10 percent pins) before torquing high strength bolts. If the member will carry traffic during erection, fill three fourths of the holes before torquing. Cylindrical erection pins shall be 1/32 in. larger than the diameter of the fasteners.

430.03.31 Anchor Bolts. As specified in 909.06. Do not cast anchor bolts in the concrete. Create a template to locate the anchor bolt holes and use it to shift the reinforcement prior to placing the concrete to eliminate conflicts between the reinforcement and the anchor bolt holes.

Set anchor bolts in round holes drilled or cast in the concrete. Accurately position bolts by using templates set to correct location and alignment to ensure proper span lengths, and carefully set tops of bolts to proper elevation. Unless otherwise noted, install bolts plumb or normal to the finished bearing surface of the masonry.

Bolts shall have the portion below the bridge seat swedged. Drill or cast holes to a diameter at least 1 in. larger than the bolt diameter.

Do not paint anchor bolts, nuts, and washers.

After anchor bolts are finally and correctly positioned, completely fill the holes with grout; however, do not grout until all structural steel is set in its final position. After the masonry plates or shoes are set, use the same grout to fill the space between the bolts and the round holes of fixed plates and shoes. Do not fill slotted holes in expansion devices unless specified.

Maintain an air temperature of at least 40 F around the mortar surface for a period of three days unless otherwise recommended by the manufacturer.

When mortar filling is used, first check the depth of the hole by inserting and withdrawing the bolt. Then partially fill the hole with mortar, and immediately insert the bolt by forcing with uniform pressure or light blows from a hammer (flogging and running is prohibited) so that excess mortar is pushed out at the top of the hole. Remove excess mortar.

Set the bolt to project approximately 1/2 in. above the nut and ensure that it is threaded to approximately 1/2 in. below the nut in their final position.

Set rockers or expansion plates with slotted holes with the proper tilt or offset as determined by the temperature prevailing at the time and so that they will be in their midway position at 68 F or as specified.

430.03.32 Maintenance of Concrete. Keep all exposed concrete surfaces free from stains and discoloration. Prevent staining of the finished concrete surfaces where unpainted structural steel is specified. Remove any stains and restore the concrete to its original color.

430.03.33 Safety Hazards. Perform gas detection in and ventilation of confined spaces as specified in TC-3.04.

430.03.34 Beam Retrofit Operations. As a first order of work, take measurements of the existing retrofit locations. Alert the Engineer of any major differences between the existing conditions and Contract Plans. There will be no payment of retrofit elements that do not fit snug against the existing steel. Provide shop drawings of all elements as specified in 430.03.01.

Clean all new steel used for steel beam retrofits as specified in 436.03.10(h). Retrofits which are shop fabricated shall be coated with Paint System B as specified in Section 435. Retrofits which are field fabricated shall be coated with Paint System C as specified in Section 436.

If needed, refer to Section 480 for jacking beam operations.

If there are no other cleaning and painting operations specified in the Contract Documents other than that which is needed to complete the retrofit repairs, the Contractor need not be SSPC-QP1 or SSPC-QP2, Category A certified to perform the field cleaning and painting in the steel repair areas. If the Contract Documents state that the connection is slip critical, perform the cleaning of the existing steel repair area as specified in 436.03.10(f) or 436.03.10(h) or a combination thereof. Perform cleaning of all other existing steel repair areas as specified in 436.03.10(d) or 436.03.10(e) or a combination thereof.

In areas where bolted connections are used, apply metal reinforced epoxy filler to areas of section loss and pitting prior to installing the new steel plates. Apply the metal reinforced epoxy filler in accordance with the manufacturer’s recommendations and ensure that it remains workable immediately prior to placing the new steel plate. Apply a sufficient quantity of the filler so that

excess material will be squeezed out during the installation of the bolts. Properly dress excess material in a workmanlike manner prior to hardening.

Unless otherwise specified, complete the last two System B or C coats of paint in the field. Perform all field painting as specified in Section 436.

430.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all high strength bolt and lock-pin and collar fastener assembly testing and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

430.04.01 Fabricated Structural Steel will not be measured but will be paid for at the Contract lump sum price.

430.04.02 Fabricated Structural Steel will be measured and paid for at the Contract unit price per pound computed on the theoretical weight.

Where measurement and payment of Fabricated Structural Steel is based on weight, the weight will be computed on the basis of the net finished dimensions of the parts as shown on the approved working drawings, deducting for copes, cuts, clips, and all open holes.

Computations will be made on the basis of the following:

MATERIAL	POUNDS PER CUBIC FOOT
Aluminum, cast or wrought	173.0
Bronze, cast	536.0
Copper alloy	536.0
Copper, sheet	558.0
Iron, cast	445.0
Iron, malleable	470.0
Lead, sheet	707.0
Steel, rolled, cast, copper bearing, silicone, nickel and stainless	490.0
Zinc	450.0

The weight of rolled shapes will be computed on the basis of their nominal weight per foot as specified in the Contract Documents or listed in handbooks.

The weight of rolled shapes will be computed on the basis of their nominal weight for their width and thickness as specified, plus an estimated overrun computed as half the permissible variation in thickness and weight as tabulated in A 6.

The weight of all shop weld metal (not included in weighed unit) and field weld metal will be computed on the basis of the theoretical volume from dimensions of the welds.

The weight of temporary erection bolts, shop and field paint, boxes, crates and other containers used for shipping, and materials used for supporting members during transportation and erection is excluded from the calculation of weight for payment.

Structural members or materials which fail to conform to requirements of tests and all materials rejected as a result of these tests will not be measured or paid for under any method of payment.

430.04.03 When a pay item for Fabricated Structural Steel is not specified, the fabricated structural steel will not be measured but the cost will be incidental to other pertinent items.

430.04.04 Rotational capacity testing for high strength bolt assemblies will not be measured but the cost will be incidental to the Contract price for the Fabricated Structural Steel item or other pertinent items specified.

430.04.05 The retrofit repairs for the lengths specified in the Plans will be measured and paid for at the Contract unit price per each for the pertinent Structural Steel Beam Retrofit item. The payment will also be full compensation for the cleaning, painting, and application of metal reinforced epoxy filler.

CATEGORY 400
STRUCTURES

SECTION 431 — STEEL STUD SHEAR DEVELOPERS

431.01 DESCRIPTION

Furnish, fabricate, and install steel stud shear developers.

431.02 MATERIALS

Steel Stud Shear Developers 909.05

431.03 CONSTRUCTION

Erect all structural steel and install all applicable forming and decking in a particular span before attaching shear developers to the structural steel. Install shear developers according to AASHTO/ AWS Bridge Welding Code D1.5. All studs will be inspected according to AWS D1.5 immediately after welding is completed. Correct defects as directed.

431.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

431.04.01 Steel Stud Shear Developers will not be measured but will be paid for at the Contract lump sum price.

431.04.02 Steel stud shear developers for which there is no specific pay item included in the Contract Documents will not be measured but the cost will be incidental to other pertinent items specified.

431.04.03 Steel Stud Shear Developers will be measured and paid for at the Contract unit price per each.

CATEGORY 400
STRUCTURES

SECTION 432 — BEARINGS

432.01 DESCRIPTION

Furnish and install bearings fabricated as specified in Section 430. Perform welding according to AWS D1.5.

432.02 MATERIALS

Nonshrink Grout	902.11(c)
Steel Plates	909.02
Bronze or Copper Alloy Bearing and Expansion Plates	910.01
Elastomeric Bearing Pads	910.02
Preformed Fabric Pads	910.02.03
Epoxy Adhesives	921.04

432.03 CONSTRUCTION

432.03.01 Storage and Handling. Store all types of bearings at the site under cover and on suitable blocking or platform at least 4 in. above all types of surfaces and vegetation. Protect from damage at all times and, when placed, keep them dry, clean, free of dirt, oil, grease, and other foreign substances.

432.03.02 Installation. Place preformed fabric pad on surfaces meeting 420.03.07(c) prior to installing the masonry bearing plate.

Ensure that all bearings and pedestals of truss, stringer spans, and the center and end bearing of swing spans are rigidly and permanently located to correct alignments and elevations.

Refer to the applicable portions of Section 430 for the attachment of bearings or plates to steel superstructures.

For bearing retrofit and replacement projects, inspect anchor bolts for deterioration and structural integrity at each existing beam end to be jacked. Only remove and replace those anchor bolts as indicated in the Contract Documents or designated by the Engineer. Use anchor bolts of the same diameter and length as the existing or as detailed in the Contract Documents.

Replace existing bearing assemblies in kind by fabricating to the existing dimensions or as detailed in the Contract Documents.

432.03.03 Steel, Bronze, or Copper Bearings. When steel, bronze, or copper alloy bearings are specified, thoroughly clean the machined bearing surfaces immediately before installation. As soon as practicable after installation, apply one prime coat to all unpainted exposed surfaces of the bearings scheduled for painting. Then proceed with the application of the specified field coats.

432.03.04 Elastomeric Bearing Pads. Prior to installation, give the pads and abutting surfaces a final cleaning to ensure that they are free of dust, dirt, oil, grease, moisture, and other foreign substances. Use an approved solvent that is compatible with the adhesive prior to application of the epoxy adhesive. Mix and apply the epoxy adhesive according to the manufacturer's recommendations.

When elastomeric pads are used without masonry bearing plates, grind the masonry bearing surfaces to remove all laitance before applying the adhesive. Apply the adhesive to the surfaces of the masonry bearing areas that will be in contact with the bearing pads and to the full contact area of the bearing pad. After the pads are in place, use blocking or other approved mechanical methods to secure the pads in their final position until the adhesive sets.

Set the beam on its bearing before the epoxy adhesive sets. Ensure that the elastomeric pad does not shift while the beam is being set on its bearing.

Surface temperatures and predicted ambient air temperature for the next four hours shall be 50 F or higher at the time of application unless otherwise specified or recommended by the epoxy adhesive manufacturer and approved.

432.04 MEASUREMENT AND PAYMENT

Bearings will not be measured but the cost will be incidental to other pertinent items specified.

432.04.01 All replacement bridge bearing assemblies required for the bridge will be measured and paid for at the Contract unit price per each on the pertinent Remove and Replace Bridge Bearing item. The payment will be full compensation for the jacking existing beams, removal of the existing bearing, installation, cleaning, and painting of the new bearing, removal of jacking system, and all material, labor, equipment, tools, and incidentals necessary to complete the work.

432.04.02 All replacement anchor bolts required for the bridge will be measured and paid for at the Contract unit price per each for the pertinent Anchor Bolt Replacement item. The payment will be full compensation for jacking existing beams (if needed), coring the holes, grout, replacement anchor bolts, installation, removing jacking system (if needed), and all material, labor, equipment, tools, and incidentals necessary to complete the work.

432.04.03 Replacement bearing pads will be measured and paid for at the Contract unit price per each on the pertinent Replacement of Elastomeric Bearing Pads item. The payment will be full compensation for jacking existing beams, removal, furnishing, fabricating, installing, etc., of

elastomeric bearing pads including surface preparation, adhesive, cleaning and painting the sole plate, removal of jacking system, and all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 400
STRUCTURES

SECTION 433 — BRIDGE MOUNTED SIGN SUPPORTS

433.01 DESCRIPTION

Furnish and construct bridge mounted sign support and sign luminaire supports. This work does not include sign panels, electrical work, or luminaires.

References to Grade 50W structural steel shall be construed to include similar structural steel having weathering characteristics.

433.02 MATERIALS

Epoxy Grout	902.11(d)
Structural Steel	909.01
Anchor Bolts, Nuts, and Washers	909.06
High Strength Bolts, Nuts, and Washers	909.07
Paint	912.05, Paint System B

On new structures, construct the sign support using the same structural steel and fasteners used for the fabrication of the structure. When A709, Grade 50W structural steel is used, make the vertical supports from material meeting A709, Grade 36 or Grade 50.

On existing structures, use structural steel meeting A709, Grade 36 or Grade 50 for the sign support. When the existing structure consists of A709, Grade 50W structural steel, construct the sign support from steel meeting A709, Grade 50W, except make the vertical supports from steel meeting A709, Grade 36 or Grade 50. Use fasteners meeting 909.07 and use Type 3 when used with A709, Grade 50W.

Galvanize vertical supports for the sign panels according to A123. Hot dip galvanize all bolts, nuts, and similar fasteners in contact with the galvanized material, meeting the thickness, adherence, and quality requirements of A153.

433.03 CONSTRUCTION

Construct the sign support according to the applicable portions of Section 430. Paint according to Section 435, except as specified herein.

Set the anchor bolts by epoxy grouting or casting in place when applicable.

On new structures, clean and paint the nongalvanized portions of the sign support using the same system specified for the structure. Clean and paint portions of the sign support mounted on structures constructed with Grade 50W steel and attached to areas designated to be painted.

On existing structures not constructed with Grade 50W steel, either the entire sign support may be galvanized or those areas not designated to be galvanized may be painted. Refer to Section 435 for cleaning and painting nongalvanized portions of the sign support. Blast clean to a surface condition of Near White SSPC SP 10 prior to painting. Unless otherwise specified, refer to 436.03.25 for repair of damaged coatings on existing structures.

Portions of the sign support mounted on existing structures constructed with Grade 50W steel and attached to areas that are painted shall also be cleaned and painted.

433.04 MEASUREMENT AND PAYMENT

Bridge Mounted Sign Supports will not be measured but will be paid for at the Contract lump sum price. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 400
STRUCTURES

SECTION 435 — CLEANING AND PAINTING NEW STRUCTURAL STEEL

435.01 DESCRIPTION

Clean and paint new structural steel used for work such as new construction, deck widening, and repairs that require installation of new structural steel. When the existing steel is not scheduled for repainting, this work will include repairing existing coatings damaged during the Contractor's operations and areas where new steel ties into existing steel. When the existing steel is scheduled for repainting, refer to Section 436. When the new or existing steel is prepared by abrasive blast cleaning in the field, refer to Section 436 for containment and environmental monitoring requirements.

435.01.01 Areas to be Coated. Areas of shop cleaning and priming, and field cleaning and painting pertain to the following surfaces:

(a) Nonweathering Steel - All surfaces. Refer to 436.01.01(a).

(b) Weathering Steel.

(1) The outside facing surfaces of the fascia stringers for all structures over roadways and for structures over water that contain curb openings. For dual structures, this includes the median fascia. These surfaces include the underside of the top flange, the web facing away from the structure, the top of the bottom flange, the outside edge of the bottom flange, the underside of the bottom flange, the inside edge of the bottom flange, and the top of the bottom flange on the inside facing surface up to and including the fillet weld. A sharp well defined transition between the new paint on the flange and the bare steel above the fillet is not required. Overspray onto the web is acceptable. All attached bearings are included in the cleaning and painting.

(2) At abutments, the end 10 ft of all stringers and all other structural steel within the 10 ft area (e.g., stiffeners, cross bracing, and bearings).

(3) At piers, 10 ft in each direction from the center line of the pier (giving a total length at each pier of 20 ft) and all other structural steel within the area.

(4) At bolted field splices, 12 in. beyond the longest splice plate for each particular splice and all splice material.

(5) All steel surfaces when specified. Refer to 436.01.01(a)

(c) Roadway Joints.

(1) New Roadway Joints. Prior to any shop painting operations, clean all surfaces of the expansion dam and backwall angles. Apply the prime coat in the shop to the entire area of the backwall and expansion dam angles including those areas in contact with concrete, except the portion that is masked to receive adhesive for the seal.

(2) Existing Roadway Joints and New Portions. Prior to any painting operations on existing expansion joints and new steel used to modify them, all surfaces of the expansion dam angles and backwall angles to be painted or receive adhesive for the seal shall be thoroughly cleaned. The area that will be in contact with the seal shall then be completely masked for full length and depth of seal.

The backwall and expansion dam angles shall have all coats applied to the entire area that will be exposed in the finished structure, both above and below the seal.

435.01.02 General. Refer to 436.01.02.

435.01.03 Minimum Contracting Requirements for Field Painting. Refer to 436.01.03.

435.01.04 Minimum Contracting Requirements for Shop Painting. To be eligible to perform the work of removing and applying paint in a shop environment, certification as specified in (a) or (b) is required. All certificates shall be effective prior to Award of Contract and shall remain in effect for the duration of the Contract. Refer to 436.01.03.

(a) SSPC-QP3. Standard Procedure for Evaluating of Qualifications of Painting Contractors; Shop Application to Complex Structures.

(b) AISC 420-10. Certification Standard for Shop Application of Complex Protective Coating Systems.

435.01.05 Definition of Bridge. Refer to 436.01.04.

435.02 MATERIALS

Paint Systems 435.02.01 and 912.05

435.02.01 Paint Systems. Refer to 436.02.01.

New Steel (Includes New Structures, Repairs, and Widenings). The paint shall meet Paint System B. Touch up paint for the shop primer prior to Coats II and III shall conform to Coat I of

Paint System C as approved by the coating manufacturer. The color of the finish coat shall match AMS-STD-595A, exact color as specified.

Existing Coatings Damaged Due to Steel/Deck Repairs or New Connections. Use spot coats of Coat I of Paint System H, and Coats II and III of Paint System B.

Bolts and Field Welds. Prime all bolts and field welds with Coat I of Paint System C prior to the application of Paint System B, Coats II and III.

Roadway Joints. The color of the finish coat shall conform to AMS-STD-595A, Color No. 26440.

(a) New Roadway Joints. Refer to 912.05, System B.

(b) Existing Roadway Joints and New Portions. Refer to 912.05, System E.

435.02.02 Abrasives. Refer to 436.02.02.

435.03 CONSTRUCTION

435.03.01 Submittals. Refer to 436.03.01.

435.03.02 Inspection Equipment. The shop and field Contractor shall provide for the exclusive use of the Engineer, the equipment for the QA observations of the Contractor's cleaning and painting operations. Refer to 436.03.04.

435.03.03 Paint Quality Assurance (QA) Inspector Notification.

(a) Field. Refer to 436.03.05.

(b) Shop. Notify the Office of Materials Technology at least 5 working days prior to beginning cleaning and painting.

435.03.04 Floodlighting. Refer to 436.03.06.

435.03.05 Shop Priming of New Steel. Solvent clean, abrasive blast clean, and prime all new structural steel in the shop with Coat I of Paint System B. Perform blast cleaning and painting after all shop fabrication is complete.

435.03.06 Field Cleaning and Painting. Solvent clean, pressure wash, and hand/power tool clean the surfaces of the shop primed steel after it is erected. Follow with touch up using Coat I of Paint System C. Apply Coats II and III of Paint System B to all exposed structural steel in the completed structure. Follow the stripe coat schedule as specified in 436.03.21.

When new steel is added to existing steel and the existing steel is not scheduled for repainting, repair the existing coating at new steel connection points and at locations where the existing

coating is damaged by the steel installation work. Solvent clean and hand/vacuum-shrouded power tool clean the surfaces. Follow with the spot application of the penetrating sealer of Paint System H and the spot application of Coats II and III of Paint System B.

435.03.07 Painting Sequence. Refer to 436.03.08.

435.03.08 Surface Preparation. Prepare surfaces as specified in 435.03.09(a) through (h), the pertinent SSPC Specifications, and the Contract Documents. Surface conditions shall meet the pertinent SSPC VIS Standards. Surface preparation performed in the shop shall also meet 435.03.12.

435.03.09 Methods of Cleaning. Methods shown in the following table apply to both shop and field cleaning, and shall be performed in the order shown. The methods are invoked based on the paint system specified. Refer to 436.03.10 for methods of cleaning.

SUBSTRATE CONDITION	PAINT SYSTEM	METHODS OF CLEANING
Abrasive Blast Cleaned Steel.	B (Coat I, II, and III)	Shop coating - (a) and (h)
		Shop touch up of damaged primer: Damage extending to substrate - (f) Damage not extending to substrate - (d) and (e)
		Field coating of shop primed steel - (a) and (b), followed by localized repair of damage: Damage extending to steel substrate - (f) Damage not extending to substrate - (d) and (e)
Bolts and Field Welds	C (Coat I) B (Coat II and III)	Field - (a) followed by (d) and (e)
Existing Coatings Damaged Due to Steel Repair, New Connection, or Contractor's Operations.	H (Coat I) B (Coat II and III)	Field - (a) followed by (d) and (e)
Existing Roadway Joints and Modified Portions	E (Coat I, II, and III)	Field - (a) followed by (f) or (h)

435.03.10 Base Metal Readings (BMR). BMR shall be obtained in the fabrication shop on the bare steel in conformance with SSPC-PA 2. Report this reading along with the dry film thickness readings from the shop for the shop applied coatings. If not obtained or reported, field inspectors will assume a 1.0 mil BMR in conformance with SSPC-PA 2.

435.03.11 Repair of Surface Imperfections. Refer to 436.03.13.

435.03.12 Surface Condition Prior to Painting. Refer to 436.03.15.

435.03.13 Paint Storage and Mixing. Refer to 436.03.16.

435.03.14 Paint Representative. Refer to 436.03.17.

435.03.15 Shop Priming and Field Finish Painting. Meet SSPC-PA 1 for painting application and 435.03.16 through 435.03.21.

435.03.16 Restrictions for Shop and Field Painting.

(a) Apply shop paint at any time in an enclosed facility under controlled environmental conditions and according to the manufacturer's recommendations.

(b) For field painting, refer to 436.03.18.

435.03.17 Weather Requirements for Painting. Refer to 436.03.19.

435.03.18 Shop Application of Prime Coat. Apply the prime coat in the shop from agitated containers and as recommended by the manufacturer in a single application employing multiple spray passes. Apply the dry film thickness specified in 912.05, except reduce the thickness to approximately 1.0 mil within the areas of field welding and on the top and both edges of the top flange where steel stud shear developers will be attached. Measurements shall be according to SSPC-PA 2.

Remove all dry spray, runs, mud cracking, and damaged primer. Feather the area prior to touch up so that the repainted surface has a reasonably smooth appearance. Use organic zinc primer to touch up the inorganic zinc primer coat in the shop and field unless otherwise approved by the manufacturer and the Engineer. Ensure that touch ups have the same dry film thickness as the coat being repaired. Organic zinc may be applied by brush.

Primer used for areas designated as slip critical shall have been tested and approved for Slip B by an AASHTO National Transportation Product Evaluation Program (NEPEP) approved independent testing laboratory according to the Research Council on Structural Connections' "Specification for Structural Joints Using High-Strength Bolts." Provide certification for all thinners used in the primer.

435.03.19 Field Application of Prime, Intermediate, and Finish Coats. Prior to field coating, pressure wash the surfaces of the steel with potable water as specified in 436.03.10(b) to remove dirt and contaminants as described in 436.03.15.

Unless otherwise specified, apply Coats II and III after all field welded areas, bolted areas, and damaged primer coatings are cleaned and primed as specified or as directed.

Apply all paint according to the manufacturer's recommendations except the dry film thickness shall conform to 912.05. Spray painting will be permitted provided the Engineer approves the location and method of spray application. Paint all areas adjacent to machinery and mechanical components, etc., by brush application unless the Engineer approves spray application. Paint surfaces inaccessible for painting by regular means by using sheepskin daubers or other means as necessary to ensure coverage of the proper coating thickness.

Maintain, calibrate, and adjust the thickness measuring instruments and take measurements according to SSPC-PA 2. Stripe coat all edges, outside corners, crevices, welds (including welds of fabricated members), rivets, bolts, nuts, and washers. Apply a stripe coat of the intermediate coat prior to the application of the full intermediate coat. Apply a stripe coat of the finish coat prior to the application of the full finish coat. Apply stripe coats by brush, dauber, or roller.

Ensure that each coat is free of shadow-through, skips, misses, and thin or heavy coating thickness. Repair defects prior to the application of the next coat. Keep the surface to be coated dust free during painting operations, and protect newly coated surfaces from the cleaning operations. If a previously cleaned area becomes soiled, contaminated, or rusted, reclean the area to the specified condition and completely recoat at no additional cost to the Administration.

Apply the finish coat within 30 days after the intermediate coat unless approved in writing by the paint manufacturer. If the recoat window is exceeded, reclean the surface as approved by the paint manufacturer and the Engineer.

435.03.20 Bolts and Field Welds. Do not shop coat bolts for field assembly. After field welding and prior to applying Coat II (first field coat) clean these bolts, field welds, and adjacent areas as specified in 435.03.09. Apply the first field coat (Coat II) within 24 hours of cleaning. Before Coat II is applied, solvent clean any prime coat stained from rusted bolts according to SSPC-SP 1.

435.03.21 Control of Overspray and Spills. Refer to 436.03.22.

435.03.22 Caulking. Refer to 436.03.23.

435.03.23 Defective Work. Refer to 436.03.24.

435.03.24 Repair of Coatings. Refer to 435.03.09.

435.03.25 Final Identification. Refer to 436.03.26.

435.03.26 Field Cleaning Waste Containment. Refer to 436.03.27.

435.03.27 Field Cleaning Containment System Plan Guidelines. Refer to 436.03.28.

435.03.28 Containment System Requirements by Method of Preparation. Refer to 436.03.29.

435.03.29 Worker Protection. Refer to 436.03.30.

435.03.30 Environmental Protection. Refer to 436.03.32.

435.03.31 Environmental Protection Plan of Action. Refer to 436.03.33.

435.03.32 Methods for Assessing Emissions. Refer to 436.03.34.

435.03.33 Field Cleaning Waste Disposal. Refer to 436.03.35.

435.03.34 Waste Handling Plan of Action. Refer to 436.03.36.

435.03.35 Waste Sampling and Analysis. Refer to 436.03.37.

435.03.36 Hazardous Waste Transportation and Disposal. Refer to 436.03.40.

435.03.37 Nonhazardous Waste Disposal. Refer to 436.03.41.

435.04 MEASUREMENT AND PAYMENT

The Contract unit price for the item specified will be full compensation for all cleaning and painting, scaffolding, platforms, containment systems, permits, working drawings, daily quality control records, professional engineer's services used for containment, industrial hygienist services, air monitoring, sampling and testing of materials for toxic metal content, including any revisions and resubmissions that may be required during the execution of the work, providing safe access for inspections, hand wash station/clean up area, floodlighting, test plates, drums, collection and storage at the temporary storage site, hauling and disposal at an approved industrial waste site or hazardous waste site, removing and replacing planking, removal of debris, and all material, labor, equipment (including test equipment), tools, and incidentals necessary to complete the work.

435.04.01 Cleaning and painting new structural steel will not be measured but the cost will be incidental to the pertinent Fabricated Structural Steel item.

435.04.02 All costs associated with repair of existing coatings due to new connections and existing coatings damaged during steel/deck repairs will not be measured but will be incidental to the pertinent Repair, Structural Steel, or Cleaning and Painting items.

CATEGORY 400
STRUCTURES

SECTION 436 — CLEANING AND PAINTING EXISTING STRUCTURAL STEEL

436.01 DESCRIPTION

Clean and paint existing structural steel, and repair existing coatings damaged during repairs or by the Contractor's operations. Refer to Section 435 for cleaning and painting new structural steel.

436.01.01 Definitions of Areas to be Cleaned and Painted. The following terms designate the specific areas to be cleaned and painted:

(a) All Steel Surfaces. Steel superstructure elements including but not limited to steel beams, girders, rockers, bearing assemblies, trusses, floor beams, stringers, joists, purlins, cross-bracings, lateral-bracings, diaphragms, sway-bracings, scupper downspouts, and support brackets for utilities, light poles, and sidewalks. It does not include substructure elements, railings, sign structures, utilities, or light poles.

(b) Outside Facing Surfaces of Beams. The exterior/fascia beams of the structure, including the underside of the top flange and the web facing away from the structure, the top of the bottom flange, the outside edge of the bottom flange, the underside of the bottom flange, the inside edge of the bottom flange, and a portion of the top of the bottom flange on the inside facing surface. The transition between the existing and new coating on the top of the bottom flange shall occur approximately half way between the edge of the flange and the fillet. A sharp well-defined transition between the new and existing coating is not required, but the existing coating shall be feathered. Clean and paint all attached bearings.

(c) Inside Facing Surfaces of Beams. Beams adjacent to longitudinal joints including the underside of the top flange and the web facing toward the longitudinal joint, the top of the bottom flange, the inside edge of the bottom flange, the underside of the bottom flange, the outside edge of the bottom flange, and a portion of the top of the bottom flange on the outside facing surface. The transition between the existing and new coating on the top of the bottom flange shall occur approximately half way between the edge of the flange and the fillet. A sharp well-defined transition between the new and existing coating is not required, but the existing coating shall be feathered. Clean and paint all attached bearings.

(d) Bearings and Beam Ends. Bearing assemblies and structural steel for the specified distance from the ends of the beams at the abutments, and the specified distance in each direction from the center line of the piers for a total of twice the specified distance.

(e) Roadway Joints. All roadway joint steel on the outside, top, and inside surfaces of the parapets, and from the parapet to the first pavement marking.

Clean and paint each structure using the paint system, finish coat color, and areas according to the Cleaning and Painting Table included in the Contract Documents.

436.01.02 General. Perform the work according to SSPC Standards and the manufacturer's recommendations.

Notify the Engineer of structural defects including cracks, missing bolts or rivets, and deterioration detected during cleaning and painting.

Protect utility pipes, conductors, light fixtures, and conduits from these operations. Do not clean and paint them unless specified.

Perform Quality Control (QC) inspections to ensure that each phase of the work meets Specification requirements.

All maintenance of traffic required for corrective action shall be at no additional cost to the Administration. When a railroad is included in the project, all railroad fees shall be as specified, except that any additional impact on the railroad and associated fees due to corrective actions or additional inspections shall be at no additional cost to the Administration.

Ensure that all operations meet the requirements of OSHA, including exposure to lead, arsenic, and cadmium. Comply with 29 CFR 1926 construction standards and the applicable Federal, State, and local laws, including COMAR 26.16.01.

Existing paint systems and abrasives used for blast cleaning may include toxic metals such as lead, arsenic, cadmium, and chromium. Consider them as hazardous waste when removed, unless tests conducted as specified in the Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311 prove otherwise.

Prior to bidding, become familiar with the current environmental regulations and safety procedures. According to EPA's Resource Conservation and Recovery Act (RCRA) regulation, the Administration shall be considered the "Waste Generator" of the paint wastes generated by the work on existing structures.

The Contractor shall be considered the "Hazardous Waste Generator" of all other waste associated with the work. These include wastes produced such as petroleum waste, solvent related waste, unapplied waste paints, used rags, used protective clothing, and other personal protective clothing (PPE) determined to be wastes. Obtain an EPA Hazardous Waste Generator ID Number, and dispose of waste under manifest as required by RCRA (40 CFR 260 through 265, and 271).

Prevent waste from entering into the environment by containing, collecting, storing, testing, and disposing of all waste in accordance with Federal, State, and local regulations.

436.01.03 Minimum Contracting Requirements for Field Painting. Certify the Contractor/subcontractor removing or applying paint as specified in (a) below. When the paint being removed contains toxic metals, certify the Contractor/subcontractor removing the paint as specified in (b) below. All certificates shall be effective prior to Award of Contract and shall remain in effect for the duration of the Contract. Refer to 436.03.01.

(a) SSPC-QP1. Standard Procedure for Evaluating Qualifications of Painting Contractors: Field Application to Complex Structures. The Society for Protective Coatings (SSPC) QP-1 Certified Applicator Specialist (CAS) requirements are waived.

(b) SSPC-QP2, Category A. Standard Procedure for Evaluating Qualifications of Painting Contractors to Remove Hazardous Paint.

436.01.04 Definition of Bridge. The definition of the word "Bridge" as defined in TC-1.03 does not apply to this Specification. References to "Bridges" in this Specification shall mean any structure carrying traffic, regardless of their length.

436.02 MATERIALS

Paint Systems	436.02.01 and 912.05

436.02.01 Paint Systems. Provide all coats within the paint systems specified herein from the same manufacturer. When more than one paint system is used, provide all overlapping paint systems from the same manufacturer. The color of the touch up finish coat on existing steel shall match the existing finish coat. The color of the finish coat shall be as specified.

436.02.02 Abrasives. Provide material safety data sheets (MSDS) for the abrasives and a letter, from the abrasive supplier, indicating that expendable abrasives meet SSPC-AB 1 and recyclable abrasives meet SSPC-AB 3. Verify the cleanliness of recycled abrasives according to SSPC-AB 2.

436.03 CONSTRUCTION

436.03.01 Submittals. Submit the following drawings, plans, and information for accomplishing the work. Except for (e) below, submit electronic versions in Portable Document Format (PDF) on company letterhead to the Office of Structures, Structure Inspection, and Remedial Engineering Division via email at: oospaintcontracts@mdot.maryland.gov. Do not proceed with the work until the submittals are approved by the Administration.

(a) Copy of SSPC-QP Certification. Refer to 435.01.04 for shop painting and 436.01.03 for field painting.

(b) Personnel Qualifications. Provide applicable personnel qualifications to the Project Engineer prior to using the personnel on site. Refer to 436.03.02.

(c) Quality Control (QC) Plans. Refer to 436.03.03 for detailed submittal requirements for shop and field Quality Control Plans. Send all shop QC Plan submittals to the Office of Materials Technology. Submittals shall meet 900.01 and 912.01. Submit all field QC Plans as specified in 436.03.01.

(d) Paint Manufacturer Certifications and Letters. Submit the following information as specified in 900.01 and 912.01 to the Office of Materials Technology:

(1) When detergents or additives are proposed to be incorporated into the water used for washing, provide MSDS and a letter from the coating manufacturer that approves the use of the detergents with their coating.

(2) The manufacturer shall provide a letter that approves any proposed solvents for use in solvent cleaning prior to painting or between coats. Provide MSDS for the solvents.

(3) Provide the paint manufacturer's application and thinning instructions, MSDS, and product data sheets.

(4) When caulking is used, provide a letter from the coating manufacturer identifying the recommended caulking material, the application sequence for integrating the caulking into the coating system between Coats II and III, and the minimum cure time prior to paint application.

(5) If the only portion of bridge to be painted is the roadway joint, the paint need not be tested by the Laboratory if, prior to use, a copy of the certified test results has been furnished to the Engineer specifying that the paint conforms to Section 912.

(e) Containment Plans. Refer to 436.03.28 and 436.03.29. Make submittals as specified in Section 499.

(f) Worker Protection Compliance Program. Required when abrasive blast cleaning is conducted in the field or paint containing toxic metals is being disturbed. Refer to 436.03.31.

(g) Environmental Protection Plan of Action. Required when abrasive blast cleaning is conducted in the field or paint containing toxic metals is being disturbed. Refer to 436.03.33.

(h) Waste Handling Program. Required for the handling of all hazardous waste regardless of the presence of toxic metals. The Waste Handling Program shall also include disposal of unused paint and solvent. Refer to 436.03.36. A written program is not required for the handling of nonhazardous waste.

Do not construe approval of the submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Approval of the proposed plans shall not remove the responsibility to conduct the work in accordance with Federal, State, or local regulations, this Specification, or to protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor remains responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

436.03.02 Personnel Qualifications and Responsibilities. Provide documentation that all applicable project personnel meet the training and accreditation requirements of COMAR 26.16.01.

(a) QC Inspectors. A QC inspector shall be on site full time during cleaning and painting operations. Provide documentation that personnel performing quality control related functions are experienced and qualified to perform the work, and have completed the training specified for SSPC-QP1, and when paint containing toxic metals is being disturbed, SSPC-QP2.

(b) Competent Person. A competent person as specified in SSPC-QP2 shall be on site full time when paint containing toxic metals is being disturbed. This person shall perform all quality control related functions involving the oversight of worker and environmental protection, containment performance, and waste handling. Provide documentation of qualifications, including experience and records of training as specified in SSPC-QP2. This person shall hold a current SSPC-C3 Competent Person Certificate or current C5 refresher, a certificate of completion of 29 CFR 1926.62(l) Lead in Construction Training, and shall be accredited in accordance with COMAR 26.16.01.

(c) Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP). Provide the services of a CIH or CSP when the work involves the disturbance or removal of paint containing toxic metals. Provide evidence that the CIH or CSP has the following qualifications and insurance requirements:

(1) Valid certification by the American Board of Industrial Hygiene or Board of Certified Safety Professionals.

(2) Field sampling and oversight experience involving removal of paint that contains toxic metals from structures.

(3) Errors and omissions insurance coverage of not less than $1 000 000 for the type of work specified.

All field sampling and testing shall be performed by the CIH, CSP, or by an employee working under the direct supervision of the CIH/CSP, and shall be witnessed by the Engineer. Notify the Structures Inspection and Remedial Engineering Division at least 24 hours prior to sampling and testing.

The CIH or CSP shall review all results of sampling and testing performed on the project. The CIH, CSP, or a person working under the direction of the CIH/CSP, shall prepare written reports interpreting these results for compliance to the applicable regulations. Submit a copy of all reports, analysis, etc., to the Engineer within five working days after sampling.

Submit a written certification within five days after the end of each month stating compliance with the Plans of Action and Compliance Programs specified within this Specification for worker protection, environmental protection, and waste handling; and all deficiencies found have been addressed. The certification shall be prepared and signed by the CIH, CSP, or a person working under their direction.

436.03.03 Quality Control (QC) Plan, Inspection Procedures, and Recording Systems. Submit a Quality Control Plan for providing daily job quality control according to SSPC-QP1 for surface preparation and painting operations. The Quality Control Plan shall include the following:

(a) Records of standards and specifications for coating inspection work and their utilization.

(b) System for filing inspection reports.

(c) Demonstration that inspection equipment and calibration standards and procedures for calibrating the inspection equipment are available.

(d) Procedures to stop nonconforming work.

(e) Procedures for verifying proper coating application.

(f) Procedures to ensure that each major operation is inspected and the inspection results documented. Contractor QC inspections shall include:

(1) Effectiveness of protective coverings to control project debris, paint spatters, overspray, drips, paint spills, etc., while painting over roadways, waterways, machinery areas, and areas in the vicinity of abutments and private properties.

(2) Ambient conditions.

(3) Compressed air cleanliness and, if required, acceptability for breathing.

(4) Surface preparation (solvent cleaning, pressure washing, hand/ power tool or abrasive blast cleaning, etc.).

(5) Coating application (specified materials, mixing, thinning, and wet film thickness).

(6) Dry film thickness per coat.

(7) Recoat times and cleanliness between coats.

(8) Coating continuity and coverage (free from runs, sags, overspray, dryspray, pinholes, shadow-through, skips, etc.).

Maintain on-site copies of the daily job quality control records and make them available to the Engineer upon demand. Submit records from on-site audits and inspections from SSPC, MOSH, OSHA, EPA, and MDE.

436.03.04 Inspection Equipment. Provide for the exclusive use of the Engineer, the following equipment and reference manuals for the QA observations of the cleaning and painting operations. Maintain, calibrate, and verify the equipment is in a condition that is satisfactory to the Engineer. The equipment will remain the property of the Contractor at the conclusion of the Contract.

(a) The latest editions of SSPC Vis 1, SSPC Vis 3, or SSPC Vis 4, as applicable to the project, or other approved visual standards.

(b) SSPC Manual Volumes 1 and 2 (Latest Editions).

(c) Spring Micrometer with Coarse and Extra Coarse Surface Profile Replica Tape.

(d) Electric or Sling Psychrometer, 32 F to 106 F.

(e) U.S. Weather Bureau Psychrometric Tables.

(f) Surface Thermometer, 0 F to 150 F.

(g) Probe Thermometer for Paint Temperature.

(h) High/Low Thermometer for Paint Storage Area.

(i) Wet Film Thickness Gauge.

(j) Digital Magnetic Dry Film Coating Thickness Gauge (SSPC-PA 2, Type 2) capable of transferring data to a laptop, tablet, or similar device through a wireless connection (i.e., “Bluetooth”), and storing at least 1000 readings.

(k) Plastic Calibration Shims for Digital Magnetic Dry Film Thickness Gauge.

(l) Inspector’s Mirror.

(m) Wind Meter.

(n) Clean, White, Lint-Free, Absorbent Rags.

(o) Light Meter for measuring light intensity during surface preparation, painting, and inspection work.

(p) Putty Knife at least 40 mils thick and 1 in. to 3 in. wide.

(q) Blotter Paper.

(r) Dry film thickness calibration plates traceable to the National Institute of Standards and Technology.

(s) Measuring stick or pole to measure platform under clearance. The stick or pole shall be collapsible and have a minimum measuring height of 20 ft.

436.03.05 Paint Quality Assurance (QA) Inspector Notification. Notify the Structure Inspection and Remedial Engineering Division at least five working days prior to beginning field cleaning and painting of new and existing steel. A paint inspector will be provided to assist the Engineer in performing the QA observations of the cleaning and painting portion of the work. Failure to comply with this notification shall be cause for not accepting the work performed. Paint applied without QA acceptance may be required to be removed and reapplied at no additional cost to the Administration. Any test to determine acceptance shall be at no additional cost to the Administration. Do not perform additional work until a determination has been made.

436.03.06 Floodlighting. Provide floodlighting, including power sources, to supply adequate illumination to all surfaces being prepared, painted, or inspected, including the underside and inside of the containment system, when containment is employed. Floodlighting shall meet SSPC-Technology Guide No. 12, be maintained in good working condition, and be of an approved design. Adjust the floodlighting to avoid glare to marine and vehicular traffic.

436.03.07 Field Cleaning and Painting. Refer to the Contract Documents for the appropriate cleaning and painting requirements.

436.03.08 Painting Sequence. Do not paint the outside facing surfaces of beams until all concrete has been placed and parapet form brackets removed. However, the primer coat may be applied to these areas prior to placing the form brackets provided that it is properly touched up prior to placing the next coat of paint. Protect concrete from being stained by painting operations. Restore painted or stained concrete surfaces to originally intended color without damaging the concrete.

Proceed with cleaning and painting by sections, bays, or other readily identifiable part of the work as approved.

Start the work at the top and proceed toward the bottom.

436.03.09 Surface Preparation. Prepare surfaces as specified in the pertinent SSPC Specifications and the Contract Documents. Surface conditions shall meet the pertinent SSPC-VIS Standards, and the test plates/sections as specified in 436.03.11.

436.03.10 Methods of Cleaning. Methods shown in the following table apply to both shop and field cleaning and shall be performed in the order shown. The methods are invoked based on the Paint System specified.

PAINT SYSTEM	SUBSTRATE	METHOD OF CLEANING
C, D, I & J	Abrasive blast cleaned steel	Existing Paint to be Removed - Localized (a) and (b) and complete (h)
E & H	Overcoating existing paint	Existing Paint to be Overcoated - Localized (a) and complete (c) followed by (d) and (e)

(a) Solvent Cleaning. Use solvents, emulsions, cleaning compounds, steam cleaning, or similar approved materials and methods in accordance with SSPC-SP 1 to remove grease, oil, diesel smoke residue, soot, and similar surface contaminates. Use soap steam cleaning for steel open grid decks and walkways and machinery areas of drawbridges. Before it evaporates, remove contaminated solvent by wiping or rinsing with clean solvent to prevent a film of contaminants from remaining on the surface. Solvent wiping may be required between coats. Use solvent approved in writing by the paint manufacturer.

(b) Low Pressure Water Cleaning (LPWC). Use potable water on all bearings, transverse and longitudinal joints, and beam ends prior to abrasive blast cleaning to remove salts, bird droppings, dirt, and debris. At beam ends, wash to the limits defined in 436.01.01(d). Use LPWC as necessary between coats to remove surface contamination.

Perform LPWC according to SSPC-SP 12, except use a nozzle pressure of 2000 psi to 2500 psi together with a rotating tip 12 in. to 18 in. from the surface. Equip the pressure washer with easily accessible gauges and a pressure regulator. Perform LPWC no more than 96 hours prior to blast cleaning. Use this method to remove concrete spatter, dirt, debris, salt contaminants, grease, oil, and similar surface interference material from newly coated structures prior to the application of additional coats. Should the surface not be blast cleaned within 96 hours after LPWC, the Engineer will determine if additional preparation is required.

When the water is to be recycled and the coating being cleaned contains toxic metals, test for toxic metals before reuse. Do not reuse water that exceeds the threshold value for any toxic metal.

(c) High Pressure Water Cleaning (HPWC). Use potable water prior to hand and power tool cleaning in preparation for overcoating to remove loose paint, loose rust, loose mill scale, salts, bird droppings, dirt, debris, grease, oil, hydrocarbons, diesel smoke residue, soot, chalk, and similar surface interference material.

Perform HPWC according to SSPC-SP 12, WJ 4, except use nozzle pressures of 4000 psi to 6000 psi and a rotating tip. A biodegradable detergent may be added to the water for the removal of grease, oil, and hydrocarbons if approved. Equip the pressure

washer with easily accessible gauges and a pressure regulator. Perform the cleaning at close range to the surface, approximately 6 in., using a pattern of overlapping drops followed by cross-hatching with the same overlap. At the end of cleaning, ensure that the swirling patterns created by the rotating tip are not visible on the surface. Perform the HPWC within 96 hours of applying the first coat. Should the surface not be painted within 96 hours, the Engineer will determine if additional preparation is required.

When the water is to be recycled, and the coating being cleaned contains toxic metals, test for toxic metals before reuse. Do not use water that exceeds the threshold value for any toxic metal.

(d) Power Tool Cleaning. Perform according to SSPC-SP 3 and as depicted in SSPC-Vis 3. The use of 40 grit sanding discs is recommended. Refer to (e) for inaccessible areas.

(e) Hand Tool Cleaning. Perform according to SSPC-SP 2. The use of 60 grit sanding paper is recommended.

Restrict the use of this method to areas that are inaccessible for power tool cleaning.

(f) Power Tool Cleaning to Bare Metal. Perform according to SSPC-SP 11 and as depicted in SSPC-Vis 3, with a surface profile of at least 1.0 mil.

(g) Brush Off Blast Cleaning. The end surface condition shall meet SSPC-SP 7, Brush Off Blast Cleaning and as depicted in SSPC-Vis 1. Ensure that abrasives are dry and free of oils, grease, and other harmful materials such as lead dust, at the time of use.

(h) Near White Metal Abrasive Blast Cleaning. Do not use steel shot in the field. When using steel shot in the shop, add the appropriate amount of steel grit and maintain the mixture to produce an etched surface texture and not the peened surface texture that results when blast cleaning with shot alone. The end surface condition shall meet SSPC-SP 10, Near White, and as depicted in SSPC-Vis 1. Ensure that abrasives are dry and free of oils, grease, and other harmful materials such as lead dust at the time of use. Abrasive media shall produce blasted surfaces having a surface profile height of 1.5 mils to 4.0 mils as determined according to D4417 Method C.

Whenever the surface profile exceeds 4.0 mils, apply the primer in no less than two coats to achieve the minimum dry film thickness specified above the peaks of the profile.

436.03.11 Test Plates/Sections. When abrasive blast cleaning is specified, furnish two 12 in. x 12 in. x 1/4 in. steel test plates and clean them to meet SSPC VIS Standards and the Contract Documents. Apply a clear protective coating to these standard test plates and use them as a job sample standard for cleaning operations. When approved as an alternative to the test plates, portions of an actual work piece may be used in order to reach agreement on the degree of cleaning before production surface preparation begins. When the SSPC VIS Standards accurately depict the agreed upon degree of cleaning on the test section, the prepared section does not have to be sealed and retained for future reference. When the SSPC VIS Standards do not accurately depict the degree of cleaning, the test section shall be sealed and retained, or the test plates utilized. For the production cleaning operations, the written requirements of this Specification, the SSPC definitions, the test plates, and the SSPC VIS Standards shall be used in that order for determining compliance with the Contractual requirements.

436.03.12 Removal of Vegetation, Planking, Signage, and Cleaning of Drainage Troughs. Prior to surface preparation, remove vegetation overhanging or fouling the structure and remove any accumulations of debris from inside the drainage troughs.

When the structure has planking (timber or plywood) between the beams, carefully remove it in the areas of work operations. Existing planking that is in good condition may be used in the proposed planking operations. Store and maintain in good condition the existing planking that is to be reused. Dispose of all debris on the planking and any planking that is not to be reused. Unless otherwise directed, install the proposed planking after the cleaning and painting operations are complete. The Engineer may direct that the existing planking be reinstalled, or the proposed planking be installed before opening lanes to traffic during that same working day. The Engineer may also request that planking be installed or reinstalled during periods of work stoppage. Reinstall the existing planking or install new planking in the same locations as the existing by following the details in the Contract Documents. Cut any existing planking to fit the details as necessary. Add any missing elements (additional plywood, timber beams, etc.) or replace poor elements with new timber as specified in 921.05. When the fascia webs of the structure contain street identification signs, remove them prior to starting cleaning operations in the area. Clean and paint areas exposed by the sign removal, including bolt holes. Whenever a sign is removed, notify the Engineer. The Engineer will notify the Office of Traffic and Safety's Chief, Traffic Operations Division. Street signs may be reinstalled by the Office of Traffic and Safety utilizing the Contractor's maintenance of traffic. They will coordinate this work with the Contractor.

If drainage troughs are present, conduct a survey of the troughs prior to construction and document the condition of all trough materials. Notify the Engineer of the locations where trough materials are in poor condition. Clean all drainage troughs on the structure unless otherwise directed by the Engineer. Replace drainage troughs as directed by the Engineer. Support the weight of the trough material to prevent tearing during removal. Remove any hardware used to attach the trough to the structure (e.g.- nuts, bolts, brackets, and fittings). Store and maintain the hardware so that it may be reused when reinstalling the troughs. Remove and properly dispose of any accumulations of debris from inside the trough. Upon completion of cleaning, re-attach the trough material in the same manner it was removed. Overlapping pieces of trough material must maintain the same pattern of overlap as when they were removed. Regardless of whether troughs are removed,

replaced, or cleaned, ensure that no paint related debris is present within the troughs at the completion of painting operations.

436.03.13 Repair of Surface Imperfections. Regardless of the method of cleaning, remove surface imperfections such as sharp fins and slivers, rust scale, weld spatter, and pack rust by a combination of cleaning procedures such as using hand or power impact tools (chipping hammers or scaling hammers), blast cleaning, etc., without scarring good steel.

436.03.14 Feathering and Removal of Defects in Existing Coating. For projects involving the touch up or overcoating of newly installed steel or existing coatings in the field, regardless of the method used for cleaning, feather the edges of old paint permitted to remain. Remove portions of paint on previously painted surfaces that are chalky, powdered, cracked, or otherwise unacceptable. Remove runs and sags in the existing paint on the outside facing surfaces of fascia beams over highways. Ensure a smooth appearance after application of the new coating.

436.03.15 Surface Condition Prior to Painting. Remove residual dust, dirt, and grease from the surface as the final procedure prior to painting and between coats whenever the coating is contaminated. Cleaning includes the removal of all dust, puddles, grease, oil, exhaust from trucks, debris, concrete spatter, and other foreign matter on the surfaces being painted. Also remove debris on surfaces adjacent to those being painted. Concrete spatter stains that discolor the primer need not be removed provided material is not dislodged when wiping the surface with a cloth. Cleaning involves vacuuming, solvent cleaning, hand/power tool cleaning, and pressure washing as appropriate. Should an area of previously cleaned steel become soiled, contaminated, or rusted, reclean the area prior to painting at no additional cost to the Administration.

Prior to the application of paint in the shop and field, the QC personnel shall inspect the surfaces and establish that they have been prepared according to the Specifications. Upon QC acceptance, obtain approval that the surfaces to be painted during that day have been cleaned as specified.

Move all hooks, cables, beam clamps, and outriggers during cleaning operation to allow the underlying surfaces to be cleaned. Any containment attachments that cannot be moved during cleaning and painting must be power tool cleaned to SP-11 Bare Metal and coated using Paint System H.

436.03.16 Paint Storage and Mixing. Store paints and thinners in well ventilated areas that are not subject to excessive heat, open flames, electrical discharge, and direct rays of the sun. Adhere to the manufacturer's recommendations. Store materials in heated areas when necessary. Use materials on a rotating stock basis, and leave containers closed until used. Do not use paints that cannot be stirred to normal consistency. Store paint in tightly covered containers at an ambient temperature of at least 45 F. Maintain containers in a clean condition, free of foreign materials and residue.

Remove and discard thin skins formed in the container. Do not use material that is livered, gelled, thick skinned, or otherwise questionable.

Mix paints according to manufacturer's instructions and as approved. Do not thin the paint unless authorized by the paint manufacturer and approved. The Engineer shall be present whenever the paint is thinned. Do not use materials that are beyond their pot life or shelf life. For multiple component paints, only complete kits shall be mixed and used. Partial kit mixing is prohibited.

Remove waste chemical solutions, oily rags, and other waste daily. Take precautionary measures to ensure protection of workers and work areas from fire hazards and health hazards resulting from handling, mixing, and applying materials.

436.03.17 Paint Representative. The representative shall be a technical representative of the paint manufacturer. During initial execution of the work the Engineer may require the paint representative to be on site to approve with the Engineer the degree of cleanliness prior to painting and the method of application of the coating system. The Engineer may stop paint operations for failure to meet this requirement regardless of the reason for failure. Areas cleaned prior to ceasing paint operations shall be recleaned if required.

436.03.18 Field Painting. Meet SSPC-PA 1 for painting application and 436.03.19 through 436.03.22.

436.03.19 Weather Requirements for Painting. All surfaces to be painted shall be sound and cleaned as specified. Painting is allowed when:

(a) There is no presence of rain, snow, fog, or mist dampening or condensing on the surface.

(b) The relative humidity does not exceed the maximum humidity specified by the paint manufacturer.

(c) The ambient temperature in the shade is above 40 F or the minimum temperature specified by the manufacturer, whichever is greater, and will be constant or higher until the paint cures to readiness for recoating by meeting the manufacturer's requirements.

(d) The surface temperature is above 35 F or the minimum temperature specified by the manufacturer, whichever is greater, and will be constant or higher until the paint cures to readiness for recoating.

(e) The surface temperature is a minimum of 5 F above the dew point and will be constant or higher until the paint cures to readiness for recoating as specified by the manufacturer.

(f) The surface temperature is below 120 F or the temperature recommended by the paint manufacturer, whichever is less.

Whenever it is suspected that moisture is condensing upon the surface, the psychrometer will be used to check dew point, etc. If the conditions measured by the psychrometer are marginal, the Engineer may permit a well-defined area of the surface to be lightly moistened with a damp cloth

and observed. If the dampness evaporates within 15 minutes, the surface will be considered satisfactory for the application of paint. Regardless of any environmental test results, when fresh paint is damaged, replace or repair the paint at no additional cost to the Administration.

Schedule the operations so that all cleaned surfaces are painted within 24 hours. If rust bloom appears or the air or steel temperature falls below five degrees above the dew point after cleaning and prior to application of the primer coat, reclean the affected areas to the satisfaction of the Engineer at no additional cost to the Administration.

436.03.20 Artificial Climate Controls

(a) Minimum temperature (substrate, air, and material) and all other environmental restrictions shall be maintained as specified. Refer to 436.03.19.

(b) If heat is to be used to reach environmental conditions, use only an indirect heat source that will disperse the heat evenly throughout containment area.

(c) Maintain heat according to the manufacturer's recommendations or time at recoat, whichever is greater, after the coating is completed in the desired areas.

(d) Install an operational automatic temperature data recorder inside the containment area until time to recoat, or manufacturer's recommendations, whichever is greater. The placement will be determined by the Engineer.

(e) Artificial Climate Controls will be at no additional cost to the Administration and no additional time will be added to the contract.

(f) Failure to maintain artificial climate controls will be cause to be denied work until weather dictates that artificial climate controls are not needed.

436.03.21 Application of Prime, Intermediate, and Finish Coats. All surfaces shall meet the specified degree of preparation prior to the application of the paint system.

Apply all paint according to the manufacturer's recommendations except the dry film thickness shall conform to 912.05. Spray painting will be permitted provided the Engineer approves the location and method of spray application. Paint all areas adjacent to machinery and mechanical components, etc., by brush application unless the Engineer approves spray application. Surfaces inaccessible for painting by regular means shall be painted using sheepskin daubers or by other means as necessary to ensure coverage of the proper coating thickness.

Move hooks, cables, beam clamps, and outriggers whenever possible to allow cleaning and application of all three coats of paint to these areas.

Maintain, calibrate, and adjust the thickness measuring instrument, and take measurements according to SSPC-PA 2. Apply stripe coats using brush, dauber, or roller to all edges, outside

corners, crevices, welds, rivets, bolts, nuts, washers, and rough and pitted surfaces prior to the application of coatings according to the following schedule:

SYSTEM	COAT
B	II & III
C	I* & II
E	I & II
H	II & III
I	I* & II

*Striping of Coat I is permitted after the application of Coat I if the stripe coat is tinted according to manufacturer's recommendation.

Ensure that each coat is free of shadow-through, skips, misses, and thin or heavy coating thickness. Repair defects prior to application of the next coat. Keep the surface to be coated dust-free during painting operations, and protect newly coated surfaces from the cleaning operations. When a previously cleaned or painted area becomes soiled, contaminated, or rusted, reclean the area to the specified condition and completely recoat at no additional cost to the Administration.

Apply each coat within 30 days after the prior coat, unless approved in writing by the paint manufacturer. If the recoat window is exceeded, reclean the surface as approved by the paint manufacturer and the Engineer.

At project completion, all fascia beams shall have a smooth and uniform appearance throughout. Should any fascia have runs, sags, heavy film build, blisters, bubbles, orange peel or any other coating defect which does not give the appearance of a smooth uniform surface, reclean and paint specific areas or the entire fascia as directed by the Engineer.

436.03.22 Control of Overspray and Spills. Protect the environment from paint droplets, overspray, and spills by providing containment for the paint application area. Assume responsibility for any damage resulting from wind and cleaning and painting operations. Up to 2 in. of overspray will be permitted onto the adjacent surface of the bridge deck next to the top flange. No other overspray will be permitted. Whenever the method of protection fails to function at the required level of efficiency, immediately suspend all operations except those associated with minimizing adverse impact to the environment. Do not resume operations until modifications have been made to correct the cause of the failure. Use fire retardant containment screens, curtains, and tarpaulins.

Paint operations may be stopped by the Engineer due to wind. However, operations shall stop if the wind velocity exceeds 20 mph, unless specific and approved precautions are taken to prevent the escape of paint droplets and overspray.

436.03.23 Caulking. Caulk the following areas with a material approved by the paint manufacturer. Install caulking between the intermediate and finish coats:

(a) Areas of plate delamination that are 1/8 in. or greater that cannot be cleaned and sealed during the application of the coatings.

(b) Gaps between steel members that are 1/8 in. or greater that cannot be cleaned and sealed during the application of the coatings.

(c) Interface between the steel and concrete surfaces where through-girders penetrate the concrete. Apply caulking to the surfaces above the deck only. Do not caulk surfaces below the deck.

(d) Gaps at the interface of steel and concrete surfaces that cannot be cleaned and painted.

436.03.24 Defective Work. Neither conditions during application nor Laboratory acceptance of paint shall remove the responsibility of obtaining a satisfactory paint system. When rusting occurs or a paint coat lifts, blisters, wrinkles, or shows evidence of having been applied under unfavorable conditions, the workmanship is poor, impure or unauthorized paint has been used, or for any other reason the painting is unsatisfactory, remove the affected paint and thoroughly clean the steel and repaint. Ensure that there is a uniform appearance throughout the structure.

436.03.25 Repair of Damaged Coatings due to Contractor Operations. Notify the Structure Inspection and Remedial Engineering Division to determine the methods of cleaning and painting to be used.

436.03.26 Final Identification. Once the final coat of paint has cured, apply as many as two "paint system" stencils for each paint system which was applied. On the paint system stencil, identify the paint system letter designation used, the product manufacturer of the paint system, the specification numbers in Section 912 for each coat of paint, and the month and year in which the application was completed. Use black numbers and letters which are 2 in. to 2-1/2 in. high that are made of a material which is compatible with the paint system and which will not run, fade, or otherwise become illegible due to atmospheric exposure. Apply the paint system stencils to the inside surfaces of fascia beams near the abutments at specific locations selected by the Engineer. When more than one paint system is used, apply additional paint system stencils.

If the existing coating system was not fully removed from the entire bridge, ensure that the existing coating information (when available) is visible on the bridge after all work is complete. This may require installing new stencils for the existing system in areas designed by the Engineer.

When bridge identification details are included in the contract documents, apply the bridge identification number to the bridge in accordance with Section 495 at the specific locations selected by the Engineer.

436.03.27 Field Cleaning Waste Containment. Meet the SSPC Guide 6 containment levels specified in 436.03.28 and 436.03.29. Applicable portions of these requirements apply to shops when existing steel coated with hazardous material is cleaned in the shop. With the exception of paint removal on the top flanges of members in preparation for deck replacement, provide a written Containment System Plan as specified in 436.03.28 unless otherwise directed.

436.03.28 Field Cleaning Containment System Plan Guidelines. Unless otherwise directed, the following submittal requirements apply when a containment system is specified, regardless of the presence of toxic metals. Even if a written Containment Plan is not required, meet the technical requirements listed below when containment is used. Provide all submittals to the Office of Structures, Working Drawing Review Section. Provide the following:

(a) Working drawings of the proposed containment system, showing the design of the paint removal, containment, rigging, and ventilation system (if applicable), including all calculations and assumptions. The working drawings shall:

(1) Indicate which structures are covered by the plans submitted. Show the containment system in plan and elevation views, including details of clips and hangers.

(2) Identify all containment system components on the plan sheets.

(3) Indicate the type and size of scaffolding or rigging to be used.

(4) Indicate sizes of the containment areas, and when ventilation is specified, the capacity of the dust collectors, equipment data sheets, and types of airflow systems to be provided including volume of air from ventilation fans and minimum velocity of air movement.

(b) The containment system and equipment shall not encroach upon the minimum structure clearances specified.

(c) Secure all curtains, screens, and tarpaulins used for containment. Make connections to the steel work of the structure with clamps or other approved devices. Do not drill holes into the existing structure or weld to the existing steel work. Do not make permanent attachments or fastenings to the structure. Do not attach any load to the structure railings unless details and calculations showing loading have been approved.

(d) Use fire retardant containment curtains, screens, and tarpaulins.

(e) Indicate maximum waste load permitted on the containment system, expressed in inches of debris.

(f) Indicate all restrictions on the structure, and if it is posted.

(g) When the containment or rigging system or methods of erection will apply a load to the structure (e.g., suspended platform) the submittals shall include an analysis of the load that will be added to the existing structure, including blast waste. When vehicles containing surface preparation materials or waste will be stationed on the structure, indicate allowable load and location. The load analysis shall be performed, signed, and sealed by a professional engineer registered in the State of Maryland. The analysis shall ensure that the system will not affect the structural integrity of the structure.

When the containment or rigging system does not impose a load to the structure (e.g., tarpaulin materials suspended from the structure at an abutment or cables and picks used for access), a professional engineer analysis and review of the drawings is not required.

(h) Prepare and submit all drawings requiring a professional engineer review and seal as defined in (g) above as specified in Section 499. Submit electronic versions of drawings in Portable Document Format (PDF). Provide the submittal on company letterhead. Drawings not requiring a professional engineer review and seal may be formatted for printing on standard paper size (8- 1/2in. x 11 in.). Drawings that do require a professional engineer review and seal shall be submitted by the engineer responsible for its design and be formatted for printing on paper which is 11 in. x 17 in. or greater. When a professional engineer stamp is required, sign and seal each sheet by the professional engineer.

(i) When the structure is over water, show a skimming boom for emergency backup.

(j) All steel corrugated decking containment materials shall have either fire retardant plastic, impermeable screen or tarpaulins laid on top to prevent the leaking of grit, dust, toxic metals and debris during blast cleaning activities.

(k) When the structure is over another road, and the road below the work area is open to traffic, provide details in the drawings to show the specific measures which will be taken during the installation and removal of the containment system to prevent tools, equipment, and materials from falling to the roadway below. Demonstrate the effectiveness of the proposed measures before performing the work. Immediately stop work if the proposed measures become ineffective.

436.03.29 Containment System Requirements by Method of Preparation. Refer to 436.03.10.

(a) Washing. When pressure washing newly installed steel coated only with inorganic zinc primer, the surfaces may be washed without any containment or collection of the water. Prevent spray and runoff water from entering traveled areas such as roadways, walkways, and railroads.

Whenever pressure washing is being performed on other painted surfaces, prevent paint chips from falling into rivers, streams, wetlands, wetland buffers, or other bodies of water, and when specified, from falling onto the ground. Should inadvertent spills or releases of paint chips occur, clean them up before the end of the shift, or immediately if directed.

(1) When pressure washing paint containing toxic metals or inorganic zinc/vinyl systems, the containment shall meet SSPC Class 2W. Collect and dispose of all wash water and debris according to the applicable regulations and 436.03.27 and 436.03.35, respectively. Prevent paint chips from falling onto the ground.

(2) When pressure washing all other systems (systems other than inorganic zinc, inorganic zinc/vinyl, or systems that contain toxic metals), collect all dislodged paint chips, but the water need not be captured. When dislodged chips are collected on suspended containment screens, the maximum mesh opening shall be 17 mils. When working over ground, chips may be collected from the ground in lieu of utilizing containment screens, provided all chips are collected before the end of the shift. Dispose of collected paint chips and debris according to applicable regulations and 436.03.35.

(b) Power Tool and Hand Tool Cleaning. Prevent paint chips from falling onto the ground or into rivers, streams, wetlands, wetland buffers, or other bodies of water. Should inadvertent spills or releases of paint chips occur, clean them up before the end of the shift, or immediately if directed.

(1) If paint system contains toxic metals, the containment for open power tool cleaning shall meet SSPC Class 2P. Dispose of collected paint chips and debris according to the applicable regulations and 436.03.35.

(2) If paint system does not contain toxic metals, the containment for open power tool cleaning shall meet SSPC Class 3P. Dispose of collected paint chips and debris according to the applicable regulations and 436.03.35.

(3) For roadway joints and other small areas approved by the Engineer, High Efficiency Particulate Air (HEPA) filter vacuum shrouded power tools may be used in lieu of containment in areas of paint containing toxic or nontoxic metals. Vacuum-shrouded power tools may eliminate the need for containment if it can be demonstrated that all paint chips and debris are sufficiently collected by the vacuum.

(c) Spot Abrasive Blast Cleaning or Brush Off Blast Cleaning. Prevent paint chips from falling onto the ground or into rivers, streams, wetlands, wetland buffers, or other bodies of water. Should inadvertent spills or releases of abrasives or paint chips occur, clean them up before the end of the shift, or immediately if directed.

With the exception of new steel installed with inorganic zinc primer, the containment for spot abrasive blast cleaning or brush off blast cleaning (regardless of the presence of toxic metals) shall meet SSPC Class 2A. Dispose of collected paint chips and debris according to the applicable regulations and 436.03.35.

Containment for spot abrasive blast cleaning or brush off blast cleaning of newly installed inorganic zinc primer shall meet SSPC Class 3A. Dispose of collected paint chips and debris according to the applicable regulations and 436.03.35.

(d) Total Paint Removal by Abrasive Blast Cleaning. Prevent paint chips from falling onto the ground or into rivers, streams, wetlands, wetland buffers, or other bodies of

water. Should inadvertent spills or releases of abrasives or paint chips occur, clean them up before the end of the shift, or immediately if directed.

When totally removing any coatings by abrasive blast cleaning (regardless of the presence of toxic metals), the containment shall meet SSPC Class 2A. Dispose of collected paint chips and debris according to the applicable regulations and 436.03.35.

Meet ambient air and worker exposure requirements established by the Maryland Department of the Environment and MOSH.

Maintain containment systems while work is in progress. Do not deviate from the approved working drawings. Deny public access to all rigging, scaffolding, containment systems, and work sites at all times.

When cleaning structures over water, provide a skimming boom for emergency backup consisting of a float with a skirt or other approved system and employ it immediately to collect floating debris. Clean the skimming boom at least once a day. Upon completion of the project, clean the skimming materials or if cleaning is not possible or practical, dispose of as hazardous or nonhazardous waste as applicable.

436.03.30 Worker Protection and Exposure Monitoring. In addition to complying with all applicable OSHA and MOSH regulations, when the project involves coatings that contain toxic metals, provide the services of a CIH or CSP as specified in 436.03.02(c) and submit a Worker Protection Compliance Program as specified in 436.03.31. The CIH or CSP, or a technician working under the direction of the CIH/CSP shall monitor worker exposures during paint disturbance operations at each structure and provide worker protection oversight.

Regardless of whether or not toxic metals are present, provide a hand wash station with soap and towels at each work site. As dictated by the monitoring results and the applicable OSHA standards, provide a cleanup area with a shower, soap, hot and cold potable pressurized water; a change area with a locker; and an approved container for collecting and disposing of waste at each work site.

Ensure that the hand wash and shower facilities are available to all site personnel. Hygiene facilities shall meet 29 CFR 1926.51, Sanitation Standard.

436.03.31 Worker Protection Compliance Program. The Worker Protection Compliance Program shall be on company letterhead and meet OSHA and the MOSH - Lead in Construction Standards, and other applicable toxic metal standards. The Worker Protection Compliance Program shall be reviewed, signed, sealed and submitted by the CIH or CSP who conducted the review. The Worker Protection Compliance Program shall include a commitment for the CIH or CSP, or a person working under the direction of CIH/CSP, to provide written certification each month of compliance with the Worker Protection Compliance Program, including biological monitoring. Provide a copy of the letter within 6 working days after the end of the month.

A Worker Protection Compliance Program is not required when the coatings being disturbed do not contain toxic metals.

436.03.32 Environmental Protection. At the end of the shift each day and upon completion of all project activities, clean the surrounding property and the entire project area so that it is free of visible debris from the cleaning and painting activities.

436.03.33 Environmental Protection Plan of Action (EPPA). An EPPA confirming that the environment is protected from contamination is required when the coatings are being abrasive blast cleaned (regardless of the presence of toxic metals), or the coating being disturbed contains toxic metals (regardless of the method of preparation). When an EPPA is required, it shall be reviewed, signed, sealed, and submitted by the CIH or CSP who conducted the review and shall include procedures for monitoring air, soil, and water.

Include a location plan showing the type and location of high volume ambient air monitors if applicable, and the procedures that will be followed for visible emissions assessments and inspections of the soil, water, surrounding property and structures, and pavement. Submit 6 copies of each plan signed and sealed by the CIH or CSP. All submittals shall be in writing and on company letterhead. At least one copy shall have an original seal. Address the proposed procedures that will be implemented for the following as defined in 436.03.34:

(a) For any paint disturbance using dry methods of preparation, address the daily visual emissions observations that will be performed and the corrective action that will be implemented in the event emissions or releases occur.

(b) When paint containing toxic metals is being disturbed, address the provisions for high volume ambient air monitoring (TSP-Monitoring); monitor citing, calibration, and operation; filter handling and shipping; and laboratory analysis, including the name and qualifications of the laboratory. Test results shall be reviewed and summarized by the CIH. Provide copies to the Engineer within 6 work days of sample collection by CIH or CSP.

(c) For any paint disturbance, address the visual assessments for soil/water/sediment that will be undertaken each day throughout the Contract, together with the proposed clean up activities.

(d) Provide a commitment from the CIH or CSP, or a person working under the direction of the CIH/CSP, that within 6 work days after the end of the month a written certification will be furnished to the Engineer certifying that the Contractor has complied with the EPPA.

436.03.34 Methods for Assessing Emissions. Unless otherwise specified, the following requirements apply to all projects, regardless of the presence of toxic metals:

(a) SSPC Level 1 Visible Emissions. The following Level 1 visible emissions criteria apply when any dry method of surface preparation is performed, such as dry abrasive blasting or power tool cleaning.

Level 1 Emissions are defined as random visible emissions of a cumulative duration of no more than 1 percent of the workday or approximately five minutes in an eight-hour day. Level 1 is required for all structures. The Contractor's QC person, or Competent Person in the case of toxic metals projects, shall perform at least two 15 minute documented observations during each work shift. In addition to the 15 minute observations, direct all Contractor personnel to routinely observe the work area and to report unacceptable emissions to QC or supervisory personnel, or to the Competent Person. When unacceptable emissions are detected, locate and immediately correct the source of the emissions. Retain the records on site, and make them available to the Engineer.

The visible emissions criteria are not required when the paint is cleaned or disturbed using water. When water is used on existing coatings that contain toxic metals or on inorganic zinc/vinyl systems, collect all water and emissions are prohibited. When water is used to clean all other coating systems, the water need not be collected and emissions are not restricted.

(b) Ambient Air Monitoring. Unless otherwise directed, ambient air monitoring is required when any dry method of surface preparation is performed, such as dry abrasive blasting or power tool cleaning. Ensure monitoring starts one half hour before blast cleaning or power tool cleaning begins and continues for the entire duration of the cleaning activity or seven (7) hours, whichever is greater.

(1) Abrasive Blast Cleaning. Begin daily ambient air monitoring at least one day prior to beginning work at each structure where abrasive blast cleaning is to occur. Continue daily ambient air monitoring during the first 10 days of productive abrasive blast cleaning operations. When the results indicate that the containment is controlling emissions, full-time monitoring may be discontinued unless otherwise directed. At the conclusion of every 30 calendar day period from the last day of monitoring, repeat monitoring for 2 consecutive days of productive abrasive blast cleaning. Except for on the first day of monitoring, conduct ambient air monitoring only during the work shift while blast cleaning or other dust producing operations are underway.

Monitor the ambient air full-time if the results of the monitoring during the initial 10 days, or from the periodic 30 calendar days are found to be unacceptable. When the results indicate the containment is controlling emissions and when approved, periodic 30 calendar days monitoring may be initiated or resumed. Resume full-time monitoring when unacceptable visible emissions or residues are observed on the ground or water and as directed.

(2) Hand and Power Tool Cleaning. Begin daily ambient air monitoring at each structure one day prior to beginning work and during the first five days of hand tool cleaning and power tool cleaning. When the results indicate that the containment is controlling emissions, full-time monitoring may be discontinued unless otherwise directed. Resume monitoring when visible residues are

observed on the ground or in the water, or visible dust is observed exceeding the visible emissions criteria established above.

(3) Monitor Placement and Reporting. Place total suspended particulate (TSP) monitors in areas of potential public exposure, including but not limited to adjacent to homes, businesses, parks, and pedestrian walkways, that are within 500 ft of each project site during cleaning operations in conformance with Method D of SSPC Guide 6. The CIH or CSP shall provide for Engineer acceptance, the proposed monitoring locations in advance, together with the rationale for the selection of each site. All TSP monitoring samples shall be analyzed using Method 40 CFR 50 Appendix B and G by a laboratory approved by the American Industrial Hygiene Association.

The CIH or CSP shall use an Adjusted Daily Allowance (ADA) as described in SSPC Guide 6 (not an average daily allowance) for evaluating the TSP monitoring results. The CIH or CSP, or a person working under the direction of the CIH/CSP, shall provide a written report and analysis of monitoring results, including the relevant acceptance criteria based on the ADA, within five days of sample collection. Provide a copy of the results to the Engineer the following work day after receipt.

(c) Removal of Visible Project Debris. At the end of the shift each day and upon completion of all project activities, clean the surrounding property, structures, and the entire project area so that it is free of visible project debris.

Prevent paint chips, abrasives, dust, and debris from being deposited onto surrounding property, vehicles, concrete, pavement, slope protection, soil, water, sediment, etc. When there are spills or releases of such material, immediately shut down the operations producing the emissions and clean up the debris. Change work practices, modify the containment, or take other appropriate corrective action as needed to prevent similar releases from occurring in the future. Contain and collect water used for washing paint containing toxic metals or existing inorganic zinc/vinyl systems. Water used to wash all other paint systems need not be contained and may contact the ground and water.

436.03.35 Field Cleaning Waste Disposal. Store all project waste, regardless of whether or not toxic metals may be present, in sealed 55 gallon drums. Drums shall be labeled with the structure number, Contract number, Contractor's name, contents, and the date. Refer to 436.03.36 through 436.03.41.

When the waste is hazardous, comply with SSPC Guide 7. Each day, collect clothing and other waste material and seal them in 55 gallon drums. The drums shall be sealed 55 gallon open head type drums meeting I.C.C. Specification 17-H. All drums shall be in new condition.

436.03.36 Waste Handling Plan of Action. Required for the handling, storage, and disposal of all hazardous waste, regardless of the presence of toxic metals. When the project involves the

removal of paint containing toxic metals, the program shall be reviewed, signed, sealed and submitted by the CIH or CSP who conducted the review.

The Plan of Action shall address the following:

(a) Names, addresses, and licenses for the proposed hazardous waste transporters and disposal facilities.

(b) Hazardous waste handling and storage procedures.

(c) Waste and waste water sampling and analysis procedures.

(d) Provide all test results to the Engineer within five days of sample collection.

436.03.37 Waste Sampling and Analysis. When the project involves hazardous waste, the CIH or CSP, or an employee working under the direct supervision of the CIH or CSP, shall take at least four samples of the accumulated residues of each waste stream collected at each structure or a sample from every third drum, whichever is greater. All sampling shall be random and representative.

Analyze the samples for TCLP as outlined in COMAR 26.13.02 and the EPA Test Procedure Manual, SW-846 for all RCRA 8 Metals. Waste shall not accumulate for more than 30 days before sampling. Analyze the representative samples collected by an approved laboratory and return the results to the Engineer within five working days of collection. Additional samples may be required if the average test results exceed 3.5 mg/l for lead, or exceed the threshold levels for other toxic metals allowed by COMAR and EPA procedures. The disposal method will be based on the results of these analyses, except handle, store, and dispose of waste generated using steel abrasives as hazardous waste regardless of the test results.

436.03.38 Temporary Waste Storage Site. Obtain an approved temporary storage site, and haul the waste material away from the work site at the end of each working day. Ensure that the storage site prevents the migration of the contaminated material into the environment and that it is protected from vandalism and unauthorized access by the general public. Remove the waste from the temporary storage site within 75 days from the initial date of accumulation or before the completion of work, whichever comes first. When the Contract Documents specify that the waste containers shall be stored at a particular facility owned by the Administration, contact that facility to schedule delivery.

436.03.39 Waste Water Disposal. Test the waste water collected from bridge washing and hygiene facilities for toxic metals. Perform tests using EPA Method 6010 by a laboratory approved by the American Industrial Hygiene Association.

Provide the Engineer with the test results and written plans for the disposal of the water, including the name and address of the licensed transporter and disposal facility. If the local publicly owned treatment works (POTW) authorizes the disposal of the water down the sanitary sewer system, provide a letter from the POTW authorizing the disposal.

436.03.40 Hazardous Waste Transportation and Disposal. Maryland law provides that when samples tested using TCLP exceed the threshold value (5 mg/l for lead), they shall be considered hazardous waste and be removed under manifest by a licensed hazardous waste transporter to a permitted disposal facility. When tested waste material is determined to be hazardous waste, request through the Administration an EPA identification number according to COMAR 26.13.03.03. Provide the Engineer with written plans for the transportation and disposal of the waste, including the name and address of the licensed transporter and disposal facility.

Dispose of waste containing less than the threshold value by the TCLP test, including the confidence interval, as specified in 436.03.41 for RCRA 8 Metals.

Prepare a manifest for hazardous waste to be transported from the approved temporary storage site. Manifests shall contain information stipulated in COMAR 26.13.03.04 and as otherwise required by State regulations. Forward the manifests to the Structure Inspection and Remedial Engineering Division.

Individually sample drums of other wastes, such as solvent contaminated rags, disposable protective clothing, disposed dust collector filters, and other contaminated substances, and test appropriately.

COMAR 26.13.03.05 stipulates the "Pre-Transport" requirements and the amount of time permitted for the accumulation of hazardous waste. Transport Waste by a certified waste hauler to a landfill permitted to accept this material.

Obtain a list of certified haulers and other information regarding handling and disposal of blast waste by contacting the Department of Environment, Hazardous Waste Administration.

436.03.41 Nonhazardous Waste Disposal. Waste containing less than the threshold value (refer to 436.03.40) by the TCLP test, including the confidence interval, may be disposed of as an industrial waste at a landfill permitted to accept this material. Dispose of all waste according to Federal, State, County, and local regulations.

Cover waste containers/dumpsters when not in an active filling process.

436.03.42 Health and Safety Plan. Submit a site specific Health and Safety Plan on all projects where coatings removal or application occurs. The Health and Safety Plan shall address all anticipated project specific hazards, the policies implemented to address the hazards, identify the contractor's on-site competent person, and provide emergency procedures to be followed, including emergency contact requirements and directions to the nearest emergency care facility. Provide concepts and calculations for fall protection systems which are manufactured or assembled on site.

436.04 MEASUREMENT AND PAYMENT

The Contract unit price for the item specified will be full compensation for all cleaning and painting, scaffolding, platforms, containment systems, permits, working drawings, daily quality

control records, professional engineer's services used for containment, industrial hygienist services, air monitoring, sampling and testing of materials for toxic metal content, including any revisions and resubmissions that may be required during the execution of the work, providing safe access for inspections, hand wash station/clean up area, floodlighting, test plates, drums, collection and storage at the temporary storage site, hauling and disposal at an approved industrial waste site or hazardous waste site, removal of debris, installing paint system stencils and bridge identification number, and all material, labor, equipment (including test equipment), tools, and incidentals necessary to complete the work.

436.04.01 Cleaning and painting existing structural steel will not be measured but will be paid for at the Contract lump sum price for the pertinent cleaning and painting items.

436.04.02 All costs associated with the repair of existing coatings due to new construction, structural repairs, and damage caused by the Contractor's operations will not be measured but will be incidental to the pertinent repair items, structural steel items, or cleaning and painting items.

436.04.03 Cleaning of Drainage Troughs will not be measured but will be incidental to the pertinent cleaning and painting items. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

436.04.04 Repair and Replacement of Existing Drainage Troughs will be measured and paid for at the Contract unit price per linear feet. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

436.04.05 Timber Planking will be measured and paid for at the Contract unit price per square foot. The payment will be full compensation for the removal of existing planking, removal, and disposal of debris on existing planking, storage of existing planking materials to be reused, modification to existing planking, new planking, construction and installation of proposed planking and all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 400
STRUCTURES

SECTION 440 — PRESTRESSED CONCRETE BEAMS AND SLAB PANELS

440.01 DESCRIPTION

Furnish and place prestressed concrete beams and slab panels, elastomeric bearing pads, bearing plates and other embedded items, all steel strands, jacks, and other required devices. The concrete overlay riding surface for slab panel bridges is included in this work.

440.02 MATERIALS

Fine Aggregate	901.01
Coarse Aggregate	901.01
Fine Aggregate for Overlay Bonding Grout	901.01, Fine Aggregate/Sand Mortar and Epoxies
Cement	902.03 and 902.04
Admixtures:	
Air Entraining	902.06.01
Retarding	902.06.02
Water Reducing	902.06.02, 902.06.03
Pozzolans	902.06.04, 902.06.05
Concrete Overlay	902.10, Mix No. 8
Nonshrink Grout	902.11(c)
Self-Consolidating Concrete	902.17
Reinforcing Steel	908.01
Welded Steel Wire Fabric	908.05
Prestressing Strand	908.11
Elastometric Bearing Pads	910.02
Closed Cell Neoprene Sponge Elastomer	911.10
Production Plants	Section 915
Fusion Bonded Epoxy Powder Coating for Steel	917.02
Water	921.01
Epoxy Adhesive	921.04

Threaded Tie Rods	A722
Tie Rod Heavy Hex Nuts	Supplied by tie rod manufacturer; shall provide full tensile strength of tie rod
Concrete Protective Coatings	Contract Documents
Concrete Chloride Content	Contract Documents
Chloride Ion Content	Contract Documents
Epoxy Protective Coatings	917.01
Epoxy Grout	902.11(d)

440.02.01 Self Consolidating Concrete, (SCC). The Contract Documents shall specify cylinder strength of the concrete at 28 days, required cylinder strength of the concrete at transfer of the tensioning load and the time when forms may be removed. Ensure that the composition, proportioning, and mixing of concrete produces a homogeneous concrete mixture of a quality that meets the specified material and design requirements.

Prior to start of fabrication submit all SCC mix design sources for approval. The manufacturer shall furnish certifications as specified in TC-1.03.

(a) Trial Batch. As specified in 902.10.04. Proportion the concrete, by weight, with the exception of water and chemical admixtures. Water and chemical admixtures may be proportioned by volume or by weight. The mixture must meet the minimum requirements as specified in 902.17.

(b) Sampling and testing. As specified in 902.17. All acceptance testing will have modifications to Specifications to include filling of the testing apparatus in one lift without consolidation or vibration, unless outlined in the Contract Documents.

Perform all sampling and testing of SCC by Concrete Field Testing Technician, Grade 1, certified by American Concrete Institute or personnel holding an equivalent or higher level certification as specified in Section 915 and supervised by a Quality Control Manager certified as a Precast/Prestressed Concrete Institute Quality Control Personnel Level 2, or a Precast/Prestressed Concrete Institute Quality Control Personnel Level 3 in the case of plants producing beams with deflected strands.

All fabrication facilities producing SCC shall have adequate equipment and staff to perform the specified tests. An independent laboratory or inspection agency may perform the testing for the producer only in the event the independent laboratory or inspection agency is named in the Quality Control Manual and approved by the Administration.

The Engineer will take six test cylinders from each member or members cast and to be cured with the member as a unit for the purpose of checking the quality of the concrete being produced; for determining the time when the forms may be removed, and for determining the time when prestressing forces may be applied to a member.

The manufacturer shall provide metal or plastic molds for all test cylinders. The manufacturer's quality control technician shall make at least three cylinder specimens to be cured under laboratory conditions as specified in R 39 to determine the 28-day compressive strengths. The technician shall make and test the cylinders at the manufacturing site according to T 22 and in the presence of the Engineer. A test is defined as the average strength of three companion cylinders.

(c) Fabrication. During fabrication the manufacturing facility shall maintain a continuous placement of SCC to eliminate possibility of formation of a cold joint. This process shall be outlined in the Quality Control Manual.

(d) Mechanical Consolidation. Do not internally or externally vibrate, rod or otherwise mechanically consolidate SCC without prior written approval.

440.02.02 Reinforcing Steel and Tie Rod Tubes. Except for prestressing strands, epoxy coat all reinforcing steel in and extending from beams and slab panels, and in the concrete overlay.

Tie rod tubes shall consist of corrugated, rigid or semi-rigid type, galvanized steel sheathing, or rigid plastic sheathing.

440.02.03 Debonding Material. Use solid or split plastic sheathing having a thickness of at least 0.025 in. for debonding of pretensioning steel strands.

440.02.04 Joint Sealers. According to the manufacturer's specifications.

440.03 CONSTRUCTION

440.03.01 Working Drawings. Refer to Section 499. Address reinforcing, anchorages, steel strand profiles, lifting inserts, and all other pertinent information.

If methods other than specified are proposed, submit changes as specified in Section 499. When proposed changes are accepted or rejected, construct members accordingly at no additional cost to the Administration.

440.03.02 Prestressed Concrete Plants. The prestressed concrete manufacturing plant shall be registered and certified under the Precast/ Prestressed Concrete Institute Program. Submit a valid certificate to the Engineer prior to the start of production.

440.03.03 Beds and Forms. Support casting beds on unyielding foundations. Clean the beds and forms after each use. Prevent accumulation of bond breakers.

Prior to stringing steel strands, inspect the bottom of forms for cleanliness and alignment. Coat the contact surfaces of forms with bond breaker that dries to a surface hardness. Ensure that the coating is dry to prevent contamination of the steel strand.

440.03.04 Meetings. Conduct a pre-pour meeting prior to beginning any prestress concrete work. Ensure a representative of the prestress concrete plant is present.

440.03.05 Protection of Prestressing Steel Strand. Store under shelter and keep it free of deleterious material such as grease, oil, wax, dirt, paint, loose rust, or other similar contaminants. Do not use steel showing corrosion, etching, pitting, or scaling. A light coating of surface rust is acceptable if it can be removed completely from the steel by wiping with a cloth.

Do not store on a surface that contributes to galvanic or battery action.

Do not use steel strand as a ground for electric welding. Protect it from electric welding sparks.

440.03.06 Reinforcing Steel, Inserts, and Chairs. Place reinforcing steel within the specified tolerances, and secure it to beds and forms using chairs, blocking, or ties. Fabricate cages of bars by tying only. Do not support cages by tensioned strands. Bend tie wire ends into the slab panel. Show the type and placement of inserts on the working drawings.

Except for stainless steel accessories, recess form ties, chairs, and inserts in the concrete by at least 1 in.

440.03.07 Methods of Force Measurement. Use one of the following methods as the primary measuring system. Check it by using one of the other methods as a secondary measuring system:

(a) Curves. Use current stress-strain or elongation curves furnished by the strand manufacturer. An average modulus may be used if acceptable to the Engineer. Provide means for measuring the elongations of the strands to at least 1/8 in.

(b) Pressure Gauges. Use gauges to measure force by the pressure applied to hydraulic jacks. Furnish gauges with dials calibrated with the jacking system.

(c) Dynamometers. Dynamometers connected in tension to the stressing system for the initial force may be used.

Gauging System. Use tensioning systems equipped with accurately calibrated hydraulic gauges, dynamometers, load cells, or other devices for measuring the stressing load to an accuracy of reading within 2 percent. Have a qualified testing laboratory calibrate and issue a certified calibration curve with each gauge. Recalibrate a gauging system whenever it shows erratic results; at intervals not exceeding six months, and when directed. Gauges for single strand jacks may be calibrated by an acceptable and calibrated load cell. Calibrate gauges for large multiple strand jacks, acting singly or in parallel, by proving rings or by load cells placed on either side of the movable end carriage. Calibrate all jacks and gauges by an independent laboratory at no additional cost to the Administration and documentation forwarded to the Engineer.

Provide pressure gauges and dynamometers preferably with full pressure and load capacities of approximately twice their normal working range. Limit loads to within 25 to 75 percent of the total graduated capacity, unless calibration data establishes consistent accuracy over a wider range.

Each gauge shall indicate loads directly in pounds or be accompanied by a chart with which the dial reading can be converted into pounds.

Equip tensioning systems employing hydraulic gauges with appropriate bypass pipes, valves, and fittings so the gauge reading remains steady until the jacking load is released.

Gauge readings, elongation measurements, and calculations for elongation shall include appropriate allowances for operational losses in the tensioning system due to strand slippage, movement of anchorages and abutments, elongation of abutment anchorage rods, strand rotation, temperature variation, friction, bed shorting, and other forces and influences acting on the strand.

In multiple strand tensioning systems, clean and lubricate the sliding surfaces to minimize friction. Establish a force override (compensatory operational loss correction) for standard strand pattern series.

Thermal Effects. Increase the design prestress force by 0.5 percent for each 5 F ambient temperature below 80 F. No adjustment is required when the ambient temperature is above 80 F. Do not stress steel strands when the ambient temperature is below 40 F. After the steel strands are tensioned, maintain the temperature of the air surrounding the steel strands at 40 F or more until the prestress force is transferred to the concrete.

Control of Jacking Force. Use either manual or automatic pressure cutoff valves for stopping the jacks at the required load. Use automatic cutoffs capable of adjustment to ensure that the jacking load corresponds to the required load. Verify the setting accuracy for the automatic cutoff valves whenever there is reason to suspect improper results and at the beginning of each day's operation.

440.03.08 Stringing Steel Strands. Do not reuse strands containing former vise grip points unless the points are outside the new vise locations. Do not reuse strands that have been draped.

All steel strands shall have the same lay or direction of twist. Use shears or abrasive cutting wheels to cut the ends. Position over chairs to eliminate sagging of strands in the bottom rows.

440.03.09 Steel Strand Splices. Only one splice is permitted per strand. For single strand tensioning, the number of strands that may be spliced in each bed is not restricted. For multiple strand tensioning, either splice all strands and adjust the elongation for average slippage, or no splices are permitted.

440.03.10 Steel Strand Vises. Use vises capable of anchoring stressing loads positively with minimum slippage and which are cleaned, lubricated, and inspected between each use. Do not use grips that show wear or distortion, or that allow slippage in excess of 1/4 in. Clean and inspect the full set of vises before starting each prestressing operation.

The maximum permissible time for holding tensioned strands in the bed before placing concrete is 72 hours.

440.03.11 Wire Failure in Steel Strands. Remove and replace any seven wire steel strand that contains a broken wire. Check all strands for wire breakage before placing concrete.

440.03.12 Pretensioning. Apply the specified total load to each strand. Apply the load as a total of two loading stages. The initial load shall straighten the strand, eliminate slack, and provide a starting or reference point for measuring elongation.

Limit the initial load to 10 percent of the specified tensioning force. Receive approval from the Engineer for any initial loading exceeding 10 percent (i.e. multiple bed casting). Measure the initial load within a tolerance of ± 100 lb. Do not use the initial elongation measurement to determine the initial force.

In all stressing operations, keep the stressing force symmetrical about the vertical axis; however, in tensioning single strands, the initial and final loads may be applied in immediate succession to each strand.

Use jack mounted pressure gauges as the primary system of force measurement for the final tensioning of straight single strands. Check elongation against pressure gauge readings on all strands. Check vise slippage. The computed elongation, including operational losses and equivalent elongation for the initial tensioning force, shall agree with the pressure gauge reading within 3 percent.

Use jack mounted pressure gauges as the primary system of force measurement for the final tensioning of multiple strands. For uniform application of load to the strands, place the position of the face of the anchorage at final load parallel to its position under initial load. Verify parallel movement by measurement of equal movement on opposite anchorage sides and by checking the plumb position of the anchorage before and after final load application. Check vise slippage.

After stressing the steel strands as specified and placing all other reinforcement, cast the concrete member to the specified length. Maintain strand stress between anchorages until the concrete has reached the specified compressive strength.

440.03.13 Steel Strand Tensioning. In all methods of tensioning, measure the stress induced in the strands both by jacking gauges and by elongation.

Recalibrate any jack or gauge that appears to be giving erratic results or gauge pressures and elongations indicate materially different stresses during manufacturing. Provide means for measuring elongation to the nearest 1/8 in.

For differences in indicated stress between jack pressure and elongation of up to 5 percent, place the difference so that the discrepancy will be on the side of a slight overstress rather than understress. For discrepancies in excess of 5 percent, carefully check the entire operation and determine the source of the discrepancy before proceeding.

Thoroughly seal split plastic sheathing for debonded steel strands with tape prior to placing concrete.

440.03.14 Surface Finish and Curing.

440.03.14.01 Surface Finish.

(a) Slab Panels. Rough finish the top surface of all members with a rake, wire brush, or other approved means to a full amplitude of 1/4 in. Prior to shipping the slab panels, abrasive blast the shear key surface to provide an exposed aggregate finish.

(b) Beams. Rough finish the top surface of all members with a rake, wire brush, or other approved means to a full amplitude of 1/4 in.

440.03.14.02 Curing.

(a) Initial Curing. Begin initial curing of all members by fogging, wet burlap, or other approved methods as soon as the concrete is hardened sufficiently to withstand surface damage. Continue the initial curing until the concrete has attained its initial set, but at least three hours; however, when a retarding agent is used, continue the initial curing for at least five hours. Following the initial curing, resume curing using an accelerated curing method.

(b) Accelerated Curing. Use one of the following methods to accelerate curing of the concrete:

(1) Low Pressure Steam Curing. Use a suitable enclosure to contain the live steam and minimize moisture and heat loss. Ensure that the concrete has attained initial set before application of the live steam.

Do not permit live steam to be directed on the concrete or the forms so as to cause localized high temperatures. Maintain the temperature of the interior of the enclosure at 80 F to 160 F. During initial application of the steam, increase the ambient air temperature within the enclosure at a rate not to exceed 40 F per hour. Hold the maximum temperature until the concrete has reached the required release strength. Maintain the steam temperature and the curing temperature uniformly throughout the extremities of the prestressed member. At the end of curing, reduce the concrete temperature at an average of 40 F per hour.

Ensure that the producer furnishes at least one recording thermometer for each enclosure. If the enclosure is longer than 300 ft, furnish an additional recording thermometer for each additional 300 ft of length or fraction thereof. The temperature at any point within the enclosure shall not vary more than 10 F from that of the recording thermometer or the average of the recording thermometers if more than one is used.

(2) Radiant Heat Curing. Radiant heat may be applied by means of pipes circulating steam, hot oil, or hot water, or by electric heating elements. Provide

a suitable enclosure to contain the heat. Minimize moisture loss by covering all exposed concrete surfaces with plastic sheeting or by applying an approved liquid membrane curing compound to all exposed surfaces. Uniformly maintain the heat application throughout the extremities of the member. Apply the same temperature constraints as outlined for low pressure steam curing.

440.03.15 Detensioning.

(a) Slab Panels. Do not transfer the tension force to the prestressed slab panel until the concrete strength as indicated by cylinder strengths meets the specified transfer strength. Do not ship slab panels before the 28 day design strength is met.

Prior to detensioning, remove or loosen forms, ties, inserts, hold downs, and other devices that restrict longitudinal movement along the bed, or use a method and sequence to minimize longitudinal movement.

Detension strands in the presence of the Engineer using a method that minimizes sudden or shock loading.

Single strand detensioning may be accomplished by heat cutting the strands. The sequence shall maintain prestressing forces nearly symmetrical around the slab panel's vertical axis.

Eccentricity around the vertical axis shall be limited to one strand. Obtain approval of the cutting pattern prior to use.

Multiple strand detensioning may be accomplished by gradually reducing the force applied to each strand equally and simultaneously.

(b) Beams. The schedule for detensioning of beams having deflected steel strands shall incorporate the following:

(1) Follow approved manufacturer's sequence of releasing deflected steel strands and uplift points.

(2) Disengage all hold down devices for deflected steel strands, and remove all hold down bolts from the beams.

(3) Follow approved manufacturer's sequence of releasing the remaining straight steel strands.

All hold down devices may be released prior to release of tension in deflected steel strands if:

(i) The weight of the prestressed beam is more than twice the total of the forces required to hold the steel strands in the low position.

(ii) The weight or other approved vertical restraints are applied directly over the hold down points to counteract the uplifting forces, at least until the release of deflected steel strands has proceeded to a point that the residual uplifting forces are less than half the weight of the beam. Follow all procedures for releasing prestressing forces of deflected steel strands. Failure to follow these procedures may result in the rejection of the beams.

Adequately separate all beams in storage immediately following removal from the bed to facilitate the repair of surface blemishes and to allow inspection of the finished surfaces.

(c) Cutting and Protecting Strand Ends. After the beams or slab panels have been detensioned, clean the ends of the strands to remove all foreign material such as rust, slag, grease, etc until the surface is visibly clean and water break free. Use wire brushing or abrasive blast cleaning to remove all dirt and residue that is not firmly bonded to the metal and concrete surfaces. Work a protective coating into all voids of the strands using the following methods:

(1) Where strands in beam or slab ends are to ultimately be encased in a concrete deck or end section, cut the strands flush with the concrete end. Prepare the surface and apply an epoxy protective coating to the strands and adjacent concrete as specified in Section 464. Extend the limits of the coating a minimum of 1 inch beyond the strand perimeter at each strand location.

(2) Where strands in beam or slab ends are to be exposed to the air, recess the cuts a minimum of 1/2 inch into the end of the beam. Fill the recessed area with an approved epoxy grout conforming to 902.11(d) in accordance with the manufacture's recommendations. Match the surface finish of the epoxy gout to that of the beam end. Prepare the surface and coat the entire end of the beam with an epoxy protective coating as specified in Section 464.

(3) If the end of the beam or slab will bear on a substructure unit directly under a bridge deck joint, protect the ends as specified in 440.03.15(c)(2). Prepare the surfaces and coat the bottom of the top flanges, the web, and bottom flanges for an additional five feet beyond the end of the concrete member with the same epoxy protective coating as specified in Section 464.

440.03.16 Camber. Clearly and permanently identify all beams so that the camber readings taken as indicated below can be associated with the proper beam.

Take camber readings as follows, in the presence of the Engineer.

(a) Just prior to detensioning.

(b) Immediately after detensioning.

(c) At two weeks after detensioning.

(d) At one month after detensioning.

(e) In the event any camber measurements, at two weeks or one month, exceed plan camber tolerances, continue to take camber readings at two week intervals until the Engineer determines otherwise, or just prior to shipment from the casting yard to the job site.

(f) Continue camber determinations at two week intervals if the beams are stored or stockpiled at the job site.

Furnish two copies of the camber reports to the Engineer prior to erecting the beam.

440.03.17 Tolerances. The tolerances for each beam or slab panel shall be as shown in Tables 440.03.17 A or B, respectively unless otherwise specified:

TABLE 440.03.17A

PRESTRESSED CONCRETE BEAM	TOLERANCE
Depth (overall)	± 1/4 in.
Width (flanges & fillets)	± 1/4 in.
Width (web)	± 1/4 in.
Length of Beam	± 1/8 in. per 10 ft or 1/2 in. whichever is greater
Exposed Beam Ends (deviation from square or designated skew)	Horizontal ± 1/4 in. Vertical ± 1/8 in. per ft of beam height
Side Inserts (spacing between center of inserts and from the centers of inserts to the ends of the beams)	± 1/2 in.
Bearing Plate (spacing from the centers of bearing plates to the ends of the beams)	± 1/2 in.
Stirrup Bars: Average of all bars Individual bar longitudinal spacing	 ± 1/2 in. ±1 in.
Horizontal Alignment (deviation from a straight line parallel to the center line of beam)	1/8 in. per 10 ft max
Camber Differential between adjacent beams of same type and steel strand pattern	1/8 in. per 10 ft at time of erection or 1/2 in. max
Center of Gravity of steel strand group	± 1/4 in.
Center of Gravity of depressed group steel strand at end of beam	± 1/2 in.
Position of hold down points for depressed strand	± 6 in.
Camber deviation from plan camber, as measured at release or at beginning of beam storage at the fabricating plant	±50% of plan camber or ±1/2 in. whichever is greater

TABLE 440.03.17B

PRESTRESSED CONCRETE SLAB PANEL	TOLERANCE
Depth (overall)	±1/2 in., -1/4 in.
Width (overall)	±0 in., -1/2 in.
Slab Panel Length @ center line (based on design length specified)	±1/2 in.
Horizontal Alignment (deviation from a straight line parallel to the slab panel center line)	¼ in. max
Horizontal Misalignment of adjacent panel sections	½ in. max
Camber Deviation from specified camber, as measured at prestress transfer or at the beginning of slab panel storage at the fabrication plant	±1/2 in.
Location of each strand	±1/8 in.
Center of Gravity of strand group	±1/4 in.
Stirrup Bars (longitudinal spacing)	±1 in.
Longitudinal Position of handling devices	±3 in.
Concrete Bearing Area (variation from plane surface when tested with a straightedge through middle half of slab panel	±1/8 in.
Tie Rod Tubes (spacing between the tube centers and from tube centers to slab panel ends)	±1/2 in.
Tie Rod Tubes (spacing from tube center to slab panel bottom)	±3/8 in.
Threaded Inserts (spacing between the center of inserts and from center of inserts to ends of slab panels)	±1/2 in.
Skew Ends (deviation from designated skew)	±1/2 in.
Vertical ends (deviation from specified dimension)	±3/8 in.
Camber deviation from plan camber, as measured at release or at beginning of beam storage at the fabricating plant	±50% of plan camber or ±1/2 in. whichever is greater

440.03.18 Slab Panel Plant Assembly. Before shipping the slab panel units to the job site, assemble all slab panels in the presence of the Engineer for the entire bridge width. This requirement is essential to ensure that the overall bridge width is within the specified tolerances and that there is no misalignment. Any misalignment of the holes will be cause for rejection of the affected slab panels. Do not drill or core holes into the slab panels.

440.03.19 Marking, Handling, Shipping, and Storage. Mark each member with an erection mark for identification, weight marks for beams 6000 lb or more, and inspection stamps. For beams, paint the erection marks on the top surface of the top flange. Do not place markings of any kind on any surface of a beam that will be visible in the completed structure.

Mark slab panels with an individual, consecutive identification mark at a permanently exposed location. The identification mark shall match that shown on the approved working drawings.

Furnish an erection diagram clearly indicating erection marks that show the position of the member in the structure.

Utilize the cast-in-place lifting devices and a sufficient number of cranes and spreader beams whenever the prestress concrete members are lifted.

Furnish copies of material orders and shipping statements. Show the weight of each individual prestress concrete member.

During shipment, ensure that blocking is placed at intervals that will prevent sag and distortion. Ship all members in the upright position, adequately braced and supported to dampen vibrations during transport as shown on the working drawings. Members too long to fit inside of a truck or trailer shall not cantilever beyond the bed more than one quarter of their length. Support members too long to comply with this requirement on dollies, additional vehicles, or other vehicles that will support the long pieces as approved.

Load restrictions are as specified in GP 5.10. Do not ship prestress members until approved, at least five days have elapsed since the prestress transfer, and the minimum 28 day compressive strength has been attained.

Store beams off the ground in an upright position. Protect them as far as practical from surface deterioration, and keep them free of accumulations of dirt, oil, and other deleterious material.

440.03.20 Erection. Refer to 430.03.27, 430.03.28, 430.03.29, 430.03.31, 430.03.32, and 430.03.33.

Slab Panels. Follow the following sequence of operations for the erection of slab panel units.

(a) Immediately prior to erecting slab panels, clean the abrasive blasted shear key surfaces with compressed air, stiff bristle fiber brushes, or vacuuming.

(b) Pull the slab panels together and field tighten in the transverse direction using tie-rods to the initial tensioning force as specified in the contract plans. For beams with more than two lateral tie-rods, tension lateral tie-rods near mid-span first and then progress towards the ends of the beam. Alternate left and right of mid-span for beams with five lateral tie-rods.

(c) Isolate lateral tie-rods from shear key grout by installing expandable spray foam sealant at all tie-rods locations, following the manufactures guidelines and as detailed in the Contract Documents.

(d) Seal the joint below the shear keys using an approved method.

(e) Once the expandable spray foam sealant has met the manufacture's curing requirements, procedures for placement of the shear key grout may begin.

(f) Clean the shear key surface with compressed air and keep it moist until the grout is placed.

(g) Grout the shear keys by overfilling the joints. Drive the grout or compactly tamp it into the keyways; do not vibrate. After 5 minutes, strike off the excess grout flush with the top of the panels. Follow the manufacturer's recommendations for grouting in cold or hot weather.

(h) Start curing of the shear key grout immediately after the grout has been finished, but do not leave any portion of the grout uncovered for more than 45 minutes after placement.

(i) Keep the surfaces wet, even in areas where there is no ready water supply.

(j) Cure the shear key grout for three days with burlap or cotton mats as specified in 420.03.09(b) or 420.03.09(d), respectively.

(k) Allow a minimum of 24 hours between grouting of shear keys and final tensioning of lateral tie rods provided temperature is 70 F and above when shear key grout is placed. If temperature is below 70 F during the initial 24 hours, cure for a total of 72 hours or according to the approved manufacturers specifications. Contractor has the option to provide cold weather protection to ensure temperature does not fall below 70 F during the initial 24 hours.

(l) Tension lateral tie-rods to final tensioning force according to the Contract Documents following procedure details above for beams with more than two lateral tie-rods.

(m) Perform field tightening by placing the washer and nut on the tensioning end of the tie-rod and running them down to the recessed concrete face. Attach a jacking assembly or other type of loading apparatus to the threads extending beyond the nut. Provide the Engineer with certification that the gauge or other load measuring device has been calibrated within one year; however, the Engineer may require the load measuring device to be recalibrated if it appears to have been damaged or mishandled. Use a loading apparatus capable of applying a load to the tie-rod nut equal to 120 000 lb. Maintain the load until the tie rod nut is snug tight as specified in 430.03.17(d). Do not use a torque wrench to apply the tensioning load.

Equipment may be placed on the slab unit prior to placing the concrete overlay if all slab units are in place, the tie-rods have been tensioned to the final tensioning force according to the Contract Documents, and the shear key grout has met the curing requirements.

440.03.21 Bearing Pads. Store them at the site on suitable blocking or platforms at least 4 in. above all surfaces and vegetation. Keep free from vegetation growth and accumulations of dirt, oil, and other foreign material.

Coat the surfaces of the concrete bearing areas that will be in contact with the bottom of the bearing pads and the full contact area of the bottom of the bearing pads with epoxy adhesive. Adhere to the manufacturer's recommendations for mixing and applying the epoxy adhesive material. Applying epoxy adhesive when surface temperatures are at least 50 F with a predicted ambient

temperature for the next four hours of 50 F or above. Ensure that the surfaces are clean, dry, and sound. Be prepared to use water jets, abrasive blasting, and air blasting, for satisfactorily cleaning the surfaces.

Accurately set the bearing pads in the epoxy adhesive and secure them in place by blocking or other mechanical means until the adhesive sets.

440.03.22 Placing and Finishing Concrete Overlay. Place and finish the overlay as specified in 420.03 including superstructure placement restrictions.

Unless otherwise noted on the contract plans, place the entire bridge slab overlay in one continuous pour. No transverse or longitudinal joints will be permitted.

Place the finishing machine's supporting rails outside the overlay limits. Do not use hold down devices that are shot or drilled into the concrete. Submit plans for anchoring support rails and the concrete placing procedure for approval.

Take precautions to secure a smooth riding surface as specified in 420.03.07(d). Prior to placement operations, review the equipment, procedures, and personnel with the Engineer. Place the concrete overlay using the following sequence of operations.

(a) Placement of the overlay may occur once the parapet and curbs have cured for 24 hours. Concrete curbs and parapets may be placed once the lateral tie rods have been tensioned to the final tensioning force and the shear key grout has met the curing requirements.

(b) Before placing the reinforcing steel mat, thoroughly clean and water blast the entire surface that will be in contact with the overlay then clean the surface with air blast.

(c) Place and tie the support chairs to the underside of the reinforcing mat to locate the reinforcing mat 2 -1/2 in. clear of the top of the deck overlay.

(d) Set-up the finishing screed and make a dry run of the finishing operation to verify that the reinforcing is properly located and the finished deck elevation shown on the plans can be achieved.

(e) Prior to concrete placement, air blast the surface to receive the overlay to remove any foreign material that may have collected since the water blasting. Following the air blast, moisten the entire surface with a misting operation for at least 1 hour immediately prior to the placement of the concrete overlay. Keep the top surface of the prestressed slabs moist until the placement of the overlay and throughout the placement operation and remove any puddling of water prior to and throughout the concrete placement.

(f) Allow no vehicular traffic on the prepared deck surface before overlay placement.

440.04 MEASUREMENT AND PAYMENT

Prestressed concrete members will not be measured but will be paid for at the Contract lump sum price for the pertinent Prestressed Concrete Beams or Prestressed Concrete Slab Panels item. The payment will be full compensation for all concrete, forms, reinforcing, bearing pads, steel strands, sheathing, steel components, steel rods, inserts, tensioning, grout, bearing assemblies, epoxy adhesive, testing, furnishing, and applying concrete protective coatings when specified, transporting, storage, erection, and for all material, labor, equipment, tools and incidentals necessary to complete the work.

440.04.01 Concrete overlay for the precast concrete slab bridge deck will not be measured but will be paid for at the Contract lump sum price for the pertinent Superstructure Concrete item. The payment will be full compensation for surface preparation, overlay bonding grout, furnishing, placing, finishing, curing and grooving the concrete overlay; fabricating, coating and placing the epoxy coated welded steel wire fabric or reinforcing steel within the concrete overlay, roadway angle, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 400
STRUCTURES

SECTION 450 — RETAINING WALLS

450.01 DESCRIPTION

Construct cast-in-place reinforced concrete footings and stems conforming to the AASHTO definitions of rigid retaining walls. When retaining wall mounted noise barriers are specified, the anchorage assemblies are included in the retaining wall. All components shall be as specified unless prior approval for alternatives is obtained from the Administration.

When piles or drilled shafts (caissons) are specified, refer to Sections 410 and 412, respectively.

450.01.01 Preapproved Alternate Retaining Walls. Alternate retaining walls may only be used when specified. Only those retaining walls specified will be permitted. All other retaining walls, even though they are preapproved or have been previously used on Administration projects, are prohibited for use. The Administration will not consider any other alternate retaining walls as a value engineering change proposal.

Enforcement. These requirements will be enforced on all projects.

Preapproved Alternate Retaining Wall List. Alternate retaining walls are selected from the list of Preapproved Alternate Retaining Walls, which is maintained by the Office of Structures. Procedures for adding products to the prequalified list may be obtained from the Office of Structures.

Alternate retaining walls that have been previously used on Administration projects without complying with the preapproval requirements shall be formally submitted through these procedures before they will be added to the Preapproved Lists for consideration to be used on future projects. These and other retaining wall systems may be submitted for addition to the Preapproved Lists, but the Administration will not permit these submittals to be used on an advertised or awarded project.

Deviations. Submit any proposed deviation in materials, post size or shape; panel size or shape; reinforcing type, size, or placement from what is shown in the Contract Documents or from the preapproved alternate retaining wall details on file in the Administration's Office of Structures. All costs for reviews, whether the details are accepted or rejected, shall be borne by the Contractor. Any fabrication or creation of any retaining wall element that is a deviation and is made prior to written approval of the Administration shall be at the risk of the Contractor.

Contract Documents for Preapproved Alternates. If electing to use preapproved alternate retaining wall systems, only one type retaining wall may be constructed throughout the Contract. Submit substitute plans, design calculations, and specifications. Plans shall be similar in size and detail to advertised documents. Working drawings from the fabricator are not acceptable as substitute plan submissions. Include drainage details and all revisions required to construct the alternate retaining wall system. A professional engineer registered in the State of Maryland, and who has experience in design of the proposed alternate retaining wall system shall prepare, sign, and seal all plans, calculations, and specifications. The substitute plans shall bear the Administration's title block and be furnished on reproducible paper, linen, or mylar. Contract Documents for construction of alternate retaining walls shall conform to the practices and procedures of the Office of Structures. These plans will be issued as a Contract revision replacing the Administration's plans and be kept by the Administration as permanent records. All work pertaining to Contract Documents for preapproved alternates shall be at no additional cost to the Administration.

After substitute plans are approved and issued as a redline revision, submit working drawings bearing the fabricator or supplier's title block for review and approval to the Administration or directly to the consulting engineer as specified in Section 499.

450.02 MATERIALS

Refer to 420.02. When retaining wall mounted noise barriers are specified, refer to 455.02 for the anchorage materials.

Sample Panel. Refer to Section 456 and the Contract Documents for Architectural Treatment specifications.

Some projects may require a specified surface such as an ashlar stone pattern, or matching a similar structure or stonework in the area. The Contractor may request or the Engineer may direct that the sample of the texture be submitted for approval prior to submission of the sample panel containing the specified stain.

450.02.01 Reinforcement. Epoxy coat reinforcing bars and welded wire fabric in retaining walls that are less than 10 ft from the edge of paved surface (includes shoulders). Coat supports for epoxy coated reinforcement the same as the reinforcing steel.

450.02.02 Backfill for Preapproved Alternates. Use size No. 57 stone as backfill for all preapproved alternate retaining walls, regardless of the type backfill recommended or specified by the retaining wall manufacturer. Use geotextile when specified.

450.02.03 Concrete Stain. Refer to 902.18. When a color is specified for the exposed surfaces of the retaining wall, select the producer of the stain from the Qualified Products List (QPL) maintained by the Office of Materials Technology. The color number shall meet AMS-STD-595A.

450.02.04 Textures.

(a) Unless otherwise specified, the exposed surfaces of the retaining wall shall receive a special surface treatment as specified in 420.03.07(b).

(b) When a special texture is specified, produce it using an approved form liner.

450.02.05 Preapproved Alternate Retaining Wall. Match the materials and details as approved and on file in the Office of Structures.

450.03 CONSTRUCTION

Construct retaining walls as shown on the Plans, as specified in 420.03, and herein. Construct alternate retaining walls according to the details and specifications that are on file with the Office of Structures. Should any detail or specification change, the retaining wall firm shall submit the revision for review and approval prior to using that revision on Administration projects. Do not submit revisions for projects that are already bid.

Do not apply any loading to retaining wall concrete until the concrete in that portion has attained a compressive strength of at least 3000 psi. In addition, complete the backfilling prior to placing any other loads on the wall.

450.03.01 Concrete Stain. When stain is specified, apply two coats according to the manufacturer's recommendations or as directed. Before application, ensure that all surfaces are structurally sound, clean, dry, fully cured, and free from dust, curing agents, form release agents, efflorescence, scale, and other foreign materials.

450.03.02 Anchor Bolt Assemblies. When required, install as specified. Refer to Section 455. Complete all holes and welding required in the assemblies before galvanizing. Keep all assemblies free of oil and mill coatings.

450.04 MEASUREMENT AND PAYMENT

Retaining walls will not be measured but will be paid for at the Contract lump sum price for the pertinent Retaining Wall item. The payment will be full compensation for all piles, caissons, footings, forms and form removal, architectural treatment, reinforcement steel, concrete, curing, anchorage assemblies, stains and coatings, excavation, sheeting and shoring, drainage systems, backfill (including size no. 57 stone and geotextiles for alternate retaining walls), and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

When specific items for Piles for Retaining Walls are included in the Contract Documents, they will be measured and paid for as specified in 410.04.

When specific items for Drilled Shafts (Caissons) for Retaining Walls are included in the Contract Documents, they will be measured and paid for as specified in 412.04.

CATEGORY 400
STRUCTURES

SECTION 455 — NOISE BARRIERS

455.01 DESCRIPTION

Construct noise barriers. The Standard Noise Barrier System consists of precast concrete panels, steel or concrete posts, concrete foundations, fire hose connections, doors, and hardware necessary to construct a noise barrier. Either steel or concrete posts may be used but use the same type of post throughout an entire noise barrier system.

When drilled shafts (caissons) are specified, refer to Section 412.

Bidders may view samples of the proposed panel finishes by contacting the Office of Highway Development, Director's Office.

455.01.01 Special Bidding Instructions. When the Contract Documents permit optional post spacings, place the bid in the appropriate items for the post spacing selected. Only bid the items pertaining to the selected post spacing. Fill in as "$0.00" all remaining items pertaining to the alternate post spacings not selected. Only one alternate post spacing may be bid per barrier.

455.01.02 Preapproved Alternate Noise Barriers. Alternate noise barriers may only be used when specified. Only those noise barriers specified will be permitted. All other noise barriers, even though they are preapproved or have been previously used on Administration projects, shall not be used on the project. The Administration will not consider any other alternate noise barriers as a value engineering change proposal.

Enforcement. These requirements will be enforced on all projects.

Preapproved Alternate Noise Barrier List. Alternate noise barriers are selected from the list of Preapproved Alternate Noise Barriers, which is maintained by the Office of Structures. Procedures for adding products to the prequalified list may be obtained from the Office of Structures.

Alternate noise barriers that have been previously used on Administration projects without complying with the preapproval requirements shall be formally submitted through these procedures before they will be added to the Preapproved Lists for consideration to be used on future projects. These and other noise barrier systems may be submitted for addition to the Preapproved Lists, but the Administration will not permit these submittals to be used on an advertised or awarded project.

Deviations. Any proposed deviation in materials, design, post size or shape; panel size or shape; reinforcing type, size, and spacing; or placement from what is shown on the Plans or from any preapproved alternates allowed on this project will be reviewed by the Administration's noise barrier consultant. All costs for these reviews, whether the details are accepted or rejected, shall be at no additional cost to the Administration and the costs will be deducted from monies due to the Contractor. Any fabrication or creation of any noise barrier element that is a deviation and is made prior to written approval of the Administration is not acceptable.

455.01.03 Contract Documents for Preapproved Alternate Systems or Alternate Post Spacing. When the Contract Documents permit and the Contractor elects to use preapproved alternate noise barrier systems or alternate post spacing not shown on the Plans, the Administration will furnish substitute plans and specifications to the Contractor within 30 days after issuing Notice to Proceed. Only one type noise barrier may be used per barrier.

The substitute Plans may include other pertinent modifications and aesthetic changes necessitated by the selection such as: requiring tapered panels; grade beams or offset brackets; doublewide panels; larger or smaller caissons; additional grade beams and offset brackets or doublewide panels; or higher panels, if the changes in elevation between adjacent panels are determined to be too severe. No additional compensation will be given to the Contractor due to revisions detailed in the substitute Plans and specifications.

The substitute Plans will be issued as a Contract revision replacing the advertised Plans. All work under this Section, including any changes required in grading, drainage, paving, utility locations, and permits that are a direct result of the substitute Plans, shall be done at no additional cost to the Administration.

After substitute Plans are issued as a redline revision, submit working drawings bearing the fabricator or supplier's title block as specified in Section 499.

455.02 MATERIALS

Concrete Structure	Section 420
Production Plants	Section 915
Reinforcing for Concrete Structure	421.02
Concrete Stain	902.18, Color No. as specified
Concrete	Section 902
Pretensioning Strand	908.11, 1/2 in. diameter seven wire
Elastomeric Bearing Pads	910.02.01
Elastomeric Shims	911.12
Fusion Bonded Polyester Powder Coating	917.03, Color as specified for stain on highway side of roadway

Anchor Assembly	
Plate	A36
Rods	F1554, Grade 55, S 1 (Chemical Composition and Carbon Equivalent)
Nuts	A563
Washers	F436
Steel Posts (Including Plates and Shapes)	A709, Grade 50W
Organic Zinc Rich Paint	912.05
Galvanizing	A123
Galvanizing Repair	A780
Aggregate	M 43

Concrete Stain. Select the stain from the Qualified Products List (QPL) maintained by the Office of Materials Technology.

Supply fire hose connections, fire doors, miscellaneous hardware, etc., as specified.

Quality Control. The manufacturer is solely responsible for all aspects of quality control and the delivery of products meeting specification to the jobsite, regardless of any inspections made by the Administration. The manufacturer is required to notify the Office of Materials Technology (OMT), any time there is a non-compliance in manufacturing procedures or a test failure of any material or product. The manufacturer must not deviate from or alter any terms of their plant Quality Control Plan (QCP) without the written approval of the Administration's Engineer and OMT. Failure to obtain approval may result in rejection of any products produced during the period in which the plant was out of compliance with the approved QCP.

Records. The manufacturer must keep complete and accurate records of all material approvals, materials delivered, samples and tests taken, materials produced, and production units fabricated. In addition, the manufacturer must make, and keep, complete and accurate records of all pre- and post- pour inspections. All records must be available for inspection by the Administration's Engineer and OMT representative immediately upon request. Any failure to maintain such records may result in the rejection of any units produced during the period for which the records are unavailable.

Quality Control Technician. The manufacturer must have on site during all phases of production at least one employee holding a minimum of a Level I Plant Quality Control Technician from the Precast/Prestressed Concrete Institute (PCI LI). The PCI LI technician will be responsible for ensuring that all production complies with the QCP and the Specifications, Plans and other relevant Contract Documents.

Sources. All materials must be obtained from approved sources. Approval of a source does not indicate approval of a specific material originating from that source. All materials must be submitted for approval by the Administration's Engineer and OMT prior to use.

Mix Designs. All mix designs must be trial batched and approved by the Administration's Engineer and OMT.

No changes may be made to any materials or mix designs without the approval of the Administration's Engineer and OMT. Submit material change requests to the Administration in writing. Do not implement any changes without written approval from the Administration.

455.02.01 Hardware. No material substitutions will be permitted for anchor rods, nuts, and washers. Hot dip galvanize per A153.

455.02.02 Epoxy Organic Zinc Rich Primer. As specified in 465.03.01(b)

455.02.03 Precast Concrete Panels. Cast each panel with an embossed or impressed, legible, unique, permanent, indelible identification number located on a portion of the panel that will not be visible in the completed structure. A sample identification number will be included on each sample panel for approval by Administration's Engineer and OMT. Panels will be rejected at any phase if identification numbers appear to have been tampered with or altered in any manner. Use Mix No. 6 concrete, except use a design compressive strength of 5000 psi.

The layout of stacked noise barrier panels shall ensure that the seams/joints between panels are consistent with the specified aesthetic design. This applies to all panels within the proposed noise barrier system, not just the panels between two posts. Do not alternate full height panels and stacked panels on a continuous section of a noise barrier. If full height panels are required at certain locations adjacent to stacked panels, provide a false joint to give the appearance of stacked panels.

Form liner seams/joints shall be as specified and shall not be visible in the noise barrier system unless they are an integral part of the noise barrier system's aesthetic design. This applies to all components of the noise barrier system (panels, posts, etc.) and applies to both full height and stacked panel designs.

Caulking and coating material shall be compatible with the aesthetic aspects and acoustical requirements of the proposed noise barrier system.

Textures. Consider all panel surfaces as having architectural finishes and carefully produce a consistent, high quality finish as specified in Section 456. When stacked panel systems are used, ensure that the panels stacked within a single frame match in quality and appearance. Make aesthetic inspections for all panels in outdoor lighting conditions as specified in 456.03.03. Panels failing to conform to these requirements may be rejected.

Unless otherwise specified, the finishes for the panels shall be as follows:

(a) Produce exposed aggregate finishes on the bottom side of each panel in the precast form.

(b) Produce double rake finishes on the top side of each panel.

Sample Panels. Refer to Section 456 - Architectural Treatment for preliminary sample panel requirements. Provide a unique identification number on each sample panel.

Review and approve the concrete mixture by the Engineer prior to the production of the sample panel(s).

Additionally, after the small sample panels and working drawings are approved, erect a full-size frame set panel (a single full height panel or a complete set of stacked panels assembled full height) between two posts at the precasting site, and prepare them for visual inspection. The frame set panel will be used to determine conformance with the Contract Documents for finishes, and to determine the quality of the fit and finish. This frame set panel shall have the textures specified in (a) and (b) above on the appropriate highway and residential sides as well as caps or any other specified finishes. Make the frame set panel available outdoors with both sides visible for inspection. Provide a second full-frame set panel, equal in appearance to the approved sample panel at the precasting site, and place it at the construction site as a visual quality control reference device. Upon written approval by the Administration, produce all subsequent panels equal in appearance to the approved panel at the plant. Transport the plant full-frame set panel to the project site and use it and the project full-frame set as panels in the noise barrier after all other panels have been accepted.

Supply sample panels and frame set panels for inspection for each barrier finish type on the project.

Sample Panel Digital Photograph Inspection. Refer to Section 456 - Architectural Treatment.

Reinforcement. All deformed steel reinforcing bars used in the production of noise barriers must be Grade 60 epoxy coated. Use supports for epoxy coated reinforcing steel as specified in 420.02.02.

455.02.04 Concrete Posts. Use Mix No. 6 concrete except use a design compressive strength of 5000 psi. When concrete posts include base plates, galvanize plates and all hardware to meet A123 and A153.

Textures. Unless otherwise specified, finish the posts as follows:

(a) Produce exposed aggregate finish on the bottom side of posts in the precast form.

(b) Produce Double Rake finish on the top side of posts.

Sample Posts. When concrete posts are used, submit a 24 in. long sample of the concrete post to the construction site for approval. Submit the sample with the panel samples as specified in 455.02.03. Ensure that the sample post exhibits the specified finishes.

Reinforcing. All deformed steel reinforcing bars used in the production of noise barrier posts must be Grade 60 epoxy coated.

455.03 CONSTRUCTION

Refer to Section 450 for additional requirements for noise barriers mounted on top of retaining walls. Perform all welding according to AWS D1.1.

455.03.01 Galvanizing. As specified in 465.03. Complete all holes and welding required in the hardware before galvanizing.

455.03.02 Anchor Assemblies. Assemble anchor assemblies and place them at the specified elevation and spacing. Use templates for proper alignment and spacing of all anchor assemblies prior to concrete placement. Ensure that the threads of the anchors are long enough to provide room for a 1 in. concrete encasement, leveling nuts, washers, base plate, and at least a 1/2 in. protrusion through the top of the top nut when the noise barrier is properly installed.

455.03.03 Posts. Erect all posts plumb at the specified alignment, and at the appropriate spacing.

Embedded Concrete Posts. Erect posts using a temporary support system to ensure the vertical and horizontal alignment and specified elevation. Temporary support systems shall include fixed ties between the post being set and a previously set post. Submit the design of the temporary support on the concrete post working drawings prior to erection. Leave the support system in place for at least 40 hours after completing the concrete placement for the drilled shaft that encases the post.

Polyester Powder Coated Steel Posts. As specified in 465.03.01(b). Completely fabricate steel posts, including base plates and all holes drilled, before application of the polyester coating system.

455.03.04 Precast Concrete Panels. Fabricate and install precast concrete panels as specified.

Submit working drawings that provide for all accessories, additional reinforcing steel, materials, and methods not specifically indicated, but that are essential for transportation, handling, installation, or construction of the panels.

Show the size, shape, and location of all panels and include complete reinforcement and connection details. When specified, show the method and sequence of erection, method of plumbing panels and adjusting connections, and the loads and movements due to erection.

Provide lifting devices and inserts used externally, or installed in the panel, that are 4 times stronger than the loads anticipated during the course of manufacture, storage, delivery, and erection. Include all inserts on the working drawings. When no longer needed, remove lifting inserts, grout insert areas and install elastomeric pad according to the Contract Documents.

Place concrete as specified in 420.03.04. When placing concrete, the temperature conditions of 420.03.04(f) apply. Cure all concrete as specified in 420.03.08. Provide cold weather protection as specified in 420.03.13. Panels that have not been cured per specification may be subject to rejection regardless of appearance or test result. In addition, do not remove panel and appurtenance forms until the concrete has achieved at least 75 percent of design strength, or as specified by the

Engineer. Provisions of 420.03.02(o) apply. Panels that have not been stripped per specification may also be subject to rejection regardless of appearance or test result.

When steel posts are used, protect the inner-coated steel surfaces from being scratched, marred, or chipped during panel installation. The protective material shall not be visible in the finished structure. Do not use grease or similar lubricants.

Defects and Tolerances. Place concrete in a manner so that there are no cold joints. Cracked panels or panels determined by the Engineer to be non-repairable or do not conform to the following tolerances will be rejected, and replaced with acceptable panels.

(a) Within 3/16 in. for panel dimensions except for panels with an effective thickness of less than 4 in. where the thickness shall be within 1/8 in.

(b) Within 1/2 in. for panel squareness for rectangular panels.

(c) Panel surface defects on textured-finished surfaces shall not exceed 5/16 in. per 5 ft.

(d) Within 1/8 in. of the dimensions specified for tongue and groove joints.

Shipping, Handling, and Erection. The Engineer and the manufacturer's Quality Control representative shall review the panels for initial/shipping acceptance. Mark panels clearly for acceptance or rejection. The Engineer shall make the final determination regarding acceptance or rejection of panels. Clearly mark rejected panels as "rejected" and destroy or store in predetermined area in the manufacturer's yard. List and document all rejected panels with a unique identification number. Storage for rejected components will not be paid by the Administration.

Protect panels by padding or other means to prevent cracking, staining, chipping, or spalling of the concrete during handling, storage, transporting, and erection. Support or brace panels during installation to ensure safety. Maintain bracing or supports until proper alignment and adequate permanent support has been provided. Do not leave any panel in an unsafe support condition.

The Engineer will evaluate damaged panels to determine whether they can be used. If acceptable, repair damaged panels in an approved manner.

Erect panels centered between posts. Where a panel cannot be erected within the tolerances assumed in the connection design, notify the Office of Structures. The structural adequacy of the installation will be checked by the Office of Structures, and the connection design shall be modified as required. Make changes, other than adjustments within the specified tolerances, only after approval.

Panels will be inspected again after erection for final aesthetic approval and to determine if they have been damaged. Damaged panels will be evaluated for structural integrity and reparability. The producer will submit a repair procedure to the Engineer for review and approval determination. Perform all repairs at no additional cost to the Administration. Panels that are determined to be unrepairable will be removed and replaced at no additional cost.

455.03.05 Concrete Stain. Apply prior to backfilling. For concrete posts, use water blasting or other mechanical means to provide a surface for improved adhesion. Apply two coats according to the manufacturer's recommendations and as directed. Apply to the top and full height of the panels, but do not apply to exposed aggregate surfaces. Before application, ensure that all surfaces are defect free, structurally sound, clean, dry, fully cured, and free from dirt, dust, curing agents and form release agents, efflorescence, scale, and other foreign materials.

455.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. Modifications such as an increase or decrease in the size or number of grade beams, drilled shafts (caissons), or retaining walls, special anchorages, conflicts with utilities or other obstructions when the utilities or obstructions were noted in the Contract Documents, or any other modifications required due to the Contractor's selection of an alternate spacing, or a preapproved alternate noise barrier when permitted, will be incidental to the item.

455.04.01 Noise Barrier System will be measured and paid for at the Contract unit price per square foot of barrier including posts and panels and samples thereof, architectural and noise absorptive finishes, stains and coatings, base plates, anchor assemblies (except when noise barriers are mounted on retaining walls), construction templates, temporary supports, steel post protection during panel installation, doors, fire hose connections, excavation, backfill, caulking, double wide panels, earth retaining panels, special panels and posts, cast in place portions of noise barriers, block wall portions of noise barriers, underwall gabions and associated drainage systems, stairs, noise wall access door and hydrant signs, and hardware. Measurement will be based on the as-planned dimensions, using the length along the face of the barrier times the panel height. The cost of any reviews for proposed deviations as specified in 455.01.02 will be deducted from the monies due the Contractor.

455.04.02 Grade Beams and Offset Brackets will not be measured but will be paid for at the pertinent Contract lump sum price, which also includes excavation, reinforcement, concrete, and backfill.

455.04.03 Drilled Shafts (Caissons) will be measured and paid for as specified in 412.04.

455.04.04 Retaining walls will be measured and paid for as specified in 450.04.

CATEGORY 400
STRUCTURES

SECTION 456 — ARCHITECTURAL TREATMENT

456.01 DESCRIPTION

Provide architectural treatment on structures such as bridge end post, parapets, abutments, piers, retaining walls, and noise barriers. The type of architectural treatment shall be as specified. Apply form release agents, form stripping methods, patching materials, and construction procedures that are mutually compatible with the surface finish and concrete stain. Architectural treatments not requiring form liners or stain shall conform to all applicable requirements including sample panels.

456.02 MATERIALS

Form Liners	As specified
Form Release Compound	902.08
Concrete Stain	902.18

456.02.01 Form Liner. Match the form liner finish to the textured finish as specified.

The form liner shall attach easily to the forming system, and shall not compress more than 0.021 ft when poured vertically at a rate of 10 ft/hour. Provide liners capable of withstanding anticipated concrete pour pressures without leakage causing physical or visual defects. Provide liners that do not cause concrete surface deterioration or weakness in the substrate when removed.

456.02.02 Form or Wall Ties. When form or wall ties are used that result in a portion of the tie permanently embedded in the concrete, submit the type of form ties for approval prior to use in this work.

456.02.03 Form Release Compound. Provide release agent that is compatible with the surface finish and concrete stain to be applied.

456.02.04 Concrete Stain. Provide the color of the concrete stain for the Color No. specified according to AMS-STD-595A or match an existing structure where specified. Provide a penetrating stain mix coloring agent with compatible color finish designed for exterior application on new or old concrete with field evidence of resistance to moisture, alkali, acid, mildew, mold and fungus discoloration or degradation. Provide breathable coloring agent that allows moisture and vapor transmission. Select the stain from the Qualified Products List (QPL) maintained by the Office of Materials Technology.

456.03 CONSTRUCTION

Furnish and install form liners and provide aesthetic treatment as specified. When form liners are specified, submit actual form liner to be used for tentative approval. Final approval of the form liner will be dependent on how a particular form liner is to be placed throughout the entire structure to achieve the desired aesthetic for the project.

456.03.01 Contractor Uniformity Responsibility. When a project specifies that the same architectural treatment be applied to multiple structures and portions of various structures such as parapets, abutments, piers, retaining walls, and noise barriers that will be in close proximity of each other, ensure that the same architectural treatment or manufacturer's form liner is used by all subcontractors and that any staining requirements are uniform throughout those structures. The Administration's form liner approval process ensures that the specific form liner produces a product that conforms to the specified results; it does not relieve the Contractor of the responsibility for uniformity throughout the project. Apply architectural treatments as to not provide a detectable repeating pattern for the length of the element, unless this effect is desired by the Administration.

456.03.02 Inspection of Architectural Treatments. Inspect all elements to be used in the final structure for aesthetic treatment acceptability at the fabrication plant prior to loading on shipping vehicle, when applicable. Inspections shall also be conducted upon delivery of elements at the project site and prior to final acceptance of the structure for maintenance.

456.03.03 Outdoor Lighting Conditions. Make aesthetic treatment inspections for all elements in outdoor lighting conditions. "Outdoor lighting conditions" is defined as during daylight hours in direct sunlight or under artificial lighting providing a minimum illumination of 20 ft candles (20 ft-c) across the entire inspection area. The Contractor or producer shall provide certified test results by a professional lighting expert acceptable to the Administration that any artificial lighting arrangements meet a minimum of 20 ft-c across the entire inspection area. Elements failing to conform to these requirements will be rejected.

456.03.04 Sample Panels. When applicable, sample panels are not to be fabricated until the form liner has been approved by the Administration for use on the project. Prior to fabrication or construction of elements to be used in the final structure, demonstrate workmanship by constructing an approved sample panel for the architectural treatment specified using approved form lining materials, surface coloring, aggregate, and/or absorptive finish. Provide sample panels at the project site for inspection and approval. Use the same formwork including form or wall ties proposed for use and concrete placement for the sample panel as that used for the finished structure.

The form liner used shall produce the same pattern that is intended for use on the finished structure. When the finished structure will contain vertical or horizontal form liner seams/joints, the sample panel shall include the same appropriate seams/joints. Provide sample panel of unreinforced concrete cast in the same position (vertically or horizontally) as will be the finished product to determine the surface texture resulting by use of the form liner. The minimum size of concrete sample panel shall be 6 in. thick, 4 ft wide and 4 ft high.

Remove rejected samples from the project and submit a new sample at no additional cost to the Administration. The approved sample panel shall remain on the site as a basis for comparison to the structure.

456.03.05 Preliminary Sample Panel Digital Photograph Inspection. Provide digital photographs of the small sample panel (4 ft x 4 ft). Supply the photographs by email or CD at the time the Administration is notified of panel delivery to the project site. The photographs will be used in evaluating the acceptance of the finish, but will not replace or supersede the delivery of sample panels as required in the specifications. The Administration reserves the right to make an on-site inspection at any time, or to request additional photographs.

Use a digital camera with a minimum resolution of 6.1 megapixels, and take all photographs without the use of the camera's zoom features. Take all photographs with the camera's line of sight being approximately perpendicular on the horizontal to the surface of the sample panel. Heed this requirement throughout this procedure regardless of the orientation of the sunlight. Take multiple photographs with variations in the angle of the sunlight shinning on the sample panel. This may be accomplished by rotating the sample panel so that the sunlight shines from almost directly behind the camera (90 degrees from the sample panel face), to a side lighting view where the sunlight shines on the surface from about 170 degrees from the sample panel face. Take photographs in approximately 15 degree increments, and be free of shadows from the camera and other foreign objects. The camera may be required to be plus or minus perpendicular to accomplish this requirement when the sun is shining on the sample panel at a 90 degree angle.

Submit additional photographs depicting the relief, colors, etc., provided that they conform to these requirements.

Take photographs so that the top and bottom of the sample panel fills the camera's view screen without the use of the zoom feature. Place a card adjacent to the sample panel in each photograph identifying the Administration's Contract Number, the supplier, the casting date for each panel; and a 1 in. x 6 in. black bar, a ruler, or other means of showing scale that is legible when viewing the photograph.

Take all photographs in the presence and at the direction of the Administration's Inspector, and submit electronic copies made directly from the camera's memory device to them at the time of the inspection (enhancing or modifying the photographs in any way is prohibited). The Inspector will forward the photographs and the information below to the Office of Structures, Office of Highway Development, and the Landscape Programs Division, as appropriate. Provide certification of the photographs at the same time that the photographs are submitted. The certification with the photographs shall contain the following information:

(a) Casting date.

(b) Contract Number.

(c) Description of the sample with file names for each sample.

(d) Number of images sent.

(e) Date and time the images were shot.

(f) Panel serial numbers, or other identifying markings.

(g) A certification that the panel has not been used on a previous project, that the panel is uniquely marked, and that the photographs were taken in their presence.

Failure to produce legible electronic photographs in accordance to these requirements will be cause to delay the evaluation of sample panels/posts, at no additional cost to the Administration or any Contract time extension.

456.03.06 On-site Inspection. Following submittal of acceptable photographs, and at the discretion of the Administration, the Office of Structures, Office of Highway Development or the Landscape Programs Division will conduct an on-site inspection of the sample panels for approval of aesthetic treatment for use on the final structures. The inspection will include the staining and final finish of the sample panels.

456.03.07 Production Requirements. Carefully blend form liner butt joints into the approved pattern and finish off the final concrete surface. There shall be no visible vertical or horizontal seams or conspicuous form marks created by butt joining form liners. The finished texture, pattern, and color shall conform to the approved sample panel, and shall be continuous without visual disruption. The Engineer may reject portion of the structure for failure to comply with these requirements. Remove rejected portions of the structure completely from the project at no additional cost to the Administration.

Prior to each pour, clean the form liners to be free of build up. Visually inspect each liner for blemishes and tears. Make repairs according to the manufacturer's recommendations and at no change in the appearance of the final product.

Securely attach form liners to forms according to the manufacturer's recommendations, and with less than a 1/4 in. seam.

Apply the release agent according to the manufacturer's recommendations so as not to be detrimental to the final structural appearance or the application of stain or other surface treatments.

When the concrete is at least 28 days old, pressure wash surfaces to be stained with a pressure washer set at 3000 psi to remove laitance. Hold the fan nozzle perpendicular to the surface at a distance of 1 ft to 2 ft. Abrasive blasting is prohibited. Provide a completed surface free of blemishes, discolorations, surface voids, and conspicuous form marks as approved. Correct any surface problems at no additional cost to the Administration.

Unless otherwise specified, apply two coats of concrete stain according to the manufacturer's recommendations and as directed.

When the Contract Documents include expansion joints, finish the joint material so as to visually continue the simulated stone/brick pattern uninterrupted. Include a sample of the colored expansion joint material in the sample panel for approval.

456.03.08 Final Aesthetic Inspection and Approval. Obtain final aesthetic approval when project is complete. Contractor is responsible for structural aesthetic appearance until the project is accepted for maintenance by the Administration.

456.04 MEASUREMENT AND PAYMENT

Architectural Treatment will not be measured but the cost for development and preparation of working drawings, the development and furnishing of all form liners, the construction and finishing of all sample panels, the application of the form liner finish including application of colors, and all material, labor, equipment, tools, and incidentals necessary to complete the work will be incidental to the Contract price for the pertinent Concrete or Structure item.

CATEGORY 400
STRUCTURES

SECTION 458 — ORNAMENTAL FENCING ON STRUCTURES

458.01 DESCRIPTION

Fabricate, furnish, and erect ornamental fences on bridges and retaining walls.

458.02 MATERIALS

Apply these requirements for fences and anti-climb shields.

458.02.01 Base Plate. Steel conforming to A 709, grade 50. Ensure that the ornamental fence manufacturer is aware of the actual grade at the location of each fence post so that the post will be plumb, and the base plate will match the grade. The fabricator shall have the option of attaching the base plate to the bottom of the post after the post has been cut off/ground to the appropriate angle or using thicker base plates and beveling the bottoms to match the grade. Assemble base plates and posts prior to the application of the protective coatings.

458.02.02 Post and Pickets. Hot rolled steel conforming to A 787, G 90. The minimum tensile strength shall be 50 000 psi.

(a) Posts shall be 2 in. square with a 14 gauge (~0.080 in.) minimum wall thickness.

(b) Pickets shall be 1 in. square with a 16 gauge (~0.060 in.) minimum wall thickness.

458.02.03 Longitudinal Rails. Rolled "U" channels conforming to A 653, G 90, 1-3/8 in. wide by 1-1/2 in. deep with a 0.120 in. minimum wall thickness, pre-punched to receive pickets and rivets.

458.02.04 Rail Attachment Brackets. Die cast zinc conforming to B 86, 83Z 33521. Provide a ball and socket design capable of swiveling 30 degrees up and down and right and left. Fully encapsulate the rail end in an aesthetically pleasing manner, as determined by the Engineer.

458.02.05 Rings. Cast aluminum conforming to B 85 or B 686, when specified. Fit rings between pickets and longitudinal rails as shown on the Plans.

458.02.06 Caps. Provide watertight caps per the design shown on the Plans.

(a) Post Caps. Formed steel or cast from malleable iron or aluminum. Provide flat type post caps, or shapes as specified.

(b) Picket Caps. When finials, pressed steel points, or longitudinal rail type caps are not specified, provide flat top picket caps with a polymer plug.

(c) Finials. Cast iron conforming to A 48, Class 20B, when specified.

458.02.07 Protective Coatings. Galvanize undercoat all structural steel and gray iron casting ornamental fence members both inside and outside as specified in Section 465.

All die cast zinc members and galvanized members shall be given the four-stage wash pretreatment process outlined below prior to the application of the polyester finish coat. The process and materials used shall conform to the manufacturer's specifications and recommendations but shall be approved by the Office of Materials Technology (OMT) before commencing the process.

(a) Stage 1. Rinse all metal in warm water so that surface is water break free.

(b) Stage 2. Apply an iron phosphate pretreatment at 130 mg/square foot.

(c) Stage 3. Thoroughly rinse in deionized water to remove chemicals.

(d) Stage 4. Apply a non-chromated seal, baked to ensure the best surface for painting.

After pretreatment, apply a polyester resin-based powder coating by the electrostatic spray process to a thickness of 2.5 mils as specified in Section 465. Bake the finish in a 450 F (metal temperature) oven for 20 minutes.

Unless otherwise specified, the finished color shall conform to AMS-STD-595A, Color No. 17038 (black).

458.02.08 Fasteners. Use 1/4 in. industrial drive rivets to attach pickets, finials, rings, rails, and post attachments. Use 1/4 in. bolts to attach rail brackets to posts.

458.02.09 Anchor studs or bolts. Hot finished and annealed stainless steel conforming to A 276, Type 430, or Type 304 with and ultimate strength of 70 000 psi and 20percent minimum elongation. Threads may be rolled or cut.

458.03 CONSTRUCTION

Prior to the start of fabrication, submit shop drawings that include elevations and slopes of the barrier at each post location and the selected method to make the post plumb.

Attach all fence posts to the top of the concrete parapets or retaining walls by the means of cast in place anchor studs or bolts and ensure that all posts are plumb with tops properly aligned. Whenever the fence is attached to an existing structure (structure that existed prior to the Contract), the proposed anchorage methods shall be approved by the Office of Structures prior to beginning work. Regardless of the method proposed, locate the existing reinforcement near the post locations with non-destructive methods (i.e. pacometer, etc.) and include these measured locations in anchorage proposal.

Set all posts and pickets plumb. Set all longitudinal rails parallel to the top of the parapet or wall. If the rails are set to an angle more than 10 degrees off level, the contractor has the option to omit the rings.

Use rivets for picket, finial, ring, rail, bracket, and post attachments except that rails for anti-climb shields shall be welded to posts. Attach each picket to each longitudinal rail with rivets. Use brackets to attach the rails to the posts except for anti-climb shields.

Securely attach post caps to all posts per the manufacturer's specifications and as approved by the Engineer.

Install fence and accessories in accordance with the Contract Documents and in a workmanlike manner. Repair welds or replace elements from any defective items uncovered by the inspection at no additional cost to the Administration.

458.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

458.04.01 Ornamental fence will not be measured but will be paid for at the Contract lump sum price for the pertinent Ornamental Fencing item.

458.04.02 Anti-climb shields will be measured and paid for at the Contract unit price per each for the pertinent Ornamental Anti-Climb Shield item.

CATEGORY 400
STRUCTURES

SECTION 460 — EXPANSION JOINTS IN STRUCTURES

460.01 DESCRIPTION

Furnish, fabricate and install pourable joint seals, joint fillers, preformed joint seals, structural steel components, metal plates, bridge roadway finger joints including structural steel components, and foam seals to be utilized in providing expansion and contraction capabilities in structures.

Furnish, fabricate, and install drainage troughs, catch basins, and downspouts and appurtenances.

This work also includes the replacement of joint seals and the repair or modification of existing joints.

Refer to Sections 435 and 436 for painting requirements.

460.02 MATERIALS

460.02.01 Pourable Joint Sealant.

Pourable Silicone Sealant for Structures	911.01.03
Non-Sag Silicone Sealant for Vertical Joints in Structures	911.01.06

Use a backer rod that is made of closed cell polyethylene foam. Ensure the backer rod used is flexible, compressible and non-shrinking with a surface that will not bond with the joint seal, and that is capable of uniformly containing the sealer within the desired shape factor. Do not use hard rubber or materials that swell when wet or deform at seal application temperatures.

460.02.02 Preformed Joint Seals.

Preformed Silicone Joint Seal	911.01.04
Silicone Adhesive	911.01.05
Preformed Joint Filler	911.02
Performed Polychloroprene Elastomeric Compression Seal	911.04.02
Lubricant Adhesive	911.04.03

Use a joint seal primer conforming to the manufacturer’s recommendations.

460.02.04 Drainage Troughs.

Structural Steel	909, A 709, Grade 36 or Grade 50
Drainage Trough	911.11
Fiberglass Catch Basins	921.10
Polyvinyl Chloride Downspouts	905.01, Schedule 80
Non-Shrink Grout	902.11(c)

All structural steel for drainage troughs shall be hot-dip galvanized to meet A123.

All hardware for drainage troughs shall be stainless steel meeting F593, Type 304 with stainless steel nuts meeting F594 and SS304 washers.

Ensure that drainage trough fabric meets the thickness requirements for the type of material supplied. Place joints and splices for drainage troughs only where specified.

460.02.05 Paint. Refer to 435.01.01(c), 435.02.01, and 436.01.01(e). Unless otherwise specified, finish coat on all exposed steel portions shall match AMS-STD-595A, Color No. 26440.

460.02.06 Concrete Repair Materials. Refer to Section 423.

460.02.07 Finger Joints.

Anchor Studs	909.05
High Strength Bolts	F3125, Grade A325, Type 1
Traffic Plates, Support Plates and Angles, and Parapet Plates	A 709, Grade 36 or 50 with supplementary toughness requirements per M-270, Zone 2 for Traffic Plates
Closed Cell Foam Joint Seal	911.13.01
Adhesive	911.13.02

Use a foam seal capable of handling 50 percent compression, 25 percent tension, 200 percent elongation. Ensure the preformed joint material be the size shown on the Plans within a tolerance of plus 10 percent to minus 3 percent.

Use a foam seal capable of sealing the deck surface and curbs through the total range of joint movement as shown on the Plans. Install the joint seal in one continuous length for each joint to be sealed unless otherwise specified. Use the heat welding method to make splices in joint seal material in accordance with the manufacturer's recommendations at direction changes such as vertical placement at the intersection of the deck and parapet or at the limits of staged construction.

460.03 CONSTRUCTION

Store expansion joint materials delivered to the bridge site under cover, on platforms at least 4 inches above all types of surfaces and vegetation. Protect materials from damage and keep clean of dirt, oil, grease and other foreign substances. All materials and standard installation methods from catalog cuts shall be approved by the Engineer before any materials may be ordered or fabricated.

Meet AWS D1.1 or D1.5 for all welding, unless otherwise specified.

460.03.01 Preconstruction Meeting. A preconstruction meeting shall be conducted prior to beginning work on the replacement of joint seals in existing bridges. The meeting shall be attended by a minimum of the Contractor's installation crew, a manufacturer's representative knowledgeable in field installation of the product(s) specified, and the Engineer. Topics discussed shall include surface preparation, primers, temperature restrictions, pot life, cure time, access, maintenance of traffic, tools, equipment and installation techniques.

460.03.02 Joint Modification. Where the Contract Documents specify modification or repair of existing expansion joints in bridges on which traffic must be maintained, secure a supply of steel roadway plates available at least 4 ft x 8 ft and 1 in. thick to be placed over the joints if traffic must be restored before new concrete has cured or anytime work cannot be completed within one traffic closure period.

Remove concrete as specified in Section 423. Cut all existing steel armor with a saw and drill all holes and slots. Torch cutting is not permitted.

Thoroughly clean existing drainage troughs and remove all debris.

460.03.03 Surface Preparation. Remove the existing seal materials and debris, if applicable, and clean both sides of the joint opening as specified below:

(a) Steel Surfaces. Abrasive blast clean steel surfaces to which joint seal materials will be affixed to SSPC-SP10, near white metal, with a surface profile of 1 mil to 4 mils. For existing steel surfaces, contain the blast media so it doesn't fall below the bridge deck and perform abrasive blasting in at least two passes, one pass per joint face. For new steel surfaces, perform these operations in the shop before the material is delivered to the site. Refer to 460.02.05 and 460.03.09 for steel primer.

(b) Concrete Surfaces. Clean all dirt, grease, laitance, and all other contaminants from the concrete surfaces to which the joint seal material(s) will be affixed using hand/power tools, abrasive blasting, or water jetting to an International Concrete Repair Institute (ICRI) concrete surface profile (CSP) between 3 and 6.

Just prior to installing the joint seal, ensure that all surfaces are free of any dust, dirt, oil, water or residue that could act as a bond breaker. Contain concrete laitance, debris, abrasive and wash water in accordance with 426.03.01 and 436.03.27.

460.03.04 Joint Seal Primer. Apply VOC compliant joint seal primer in accordance with the manufacturer's recommendations. Uniformly coat the entire surface to which joint seal materials will be affixed. Over application may cause premature failure of joint seal materials.

460.03.05 Pourable Silicon Joint Sealant Installation. Unless otherwise specified, do not use pourable joints when the expected movement due to thermal expansion from 0 F to 120 F is more than 1/2 inch. For horizontal applications, furnish the two components of pourable joint sealant material from the manufacturer in premeasured units. Use only full units of each component for mixing the pourable joint sealant. For vertical applications, furnish the non-sag pourable joint sealant material from the manufacturer. The manufacturer's technical representative must be present during the initial installation of pourable joint sealant. Provide equipment approved by the seal manufacturer's representative.

Install a circular backer rod, sized approximately 25 percent larger than the joint opening, into the joint opening to provide 1 in. clearance below the roadway surface. If two pieces of backer rod must be used, tape the ends together to prevent any pourable joint sealant from leaking between them.

Install silicone sealant as soon after cleaning and backer rod placement as reasonably possible to ensure the joints remain clean and dry. In the event the joint becomes contaminated or wet prior to installing the sealant, remove the backer rod, clean and dry the joint, and install a new backer rod.

Install pourable joint sealant as per manufacturer's recommendations and to the shape and dimensions specified as shown on the Plans. If site conditions justify a change to the manufacturer's recommendations, proceed as directed by the Engineer. Use the multiple pass technique with the initial passes along the joint edges. Make all passes in the same direction to minimize air entrapment. The pourable joint sealant must be recessed a minimum 1/2 in. below the pavement surface to prevent traffic abrasion or snowplow damage. Provide a smooth and even finished surface of the joint seal across the joint opening.

When vertical joint openings are to be sealed at curbs, parapets, and outside edges the bottom and outside edges of the joint opening must be dammed to prevent pourable joint sealant from leaking out. Position the damming material so that the installed pourable joint sealant is sandwiched between the backer rod and the damming material. Allow the pourable joint sealant to cure prior to removal of damming material. The damming procedure shall be as recommended by the manufacturer. In lieu of damming, use a non-sag pourable silicone sealant or preformed silicone joint seal at these locations.

460.03.06 Preformed Silicone Joint Seal Installation. Install the preformed Silicone Joint Seal in accordance with the manufacturer's recommendations, as shown on the Plans. If site conditions justify a change to the manufacturer's recommendations, proceed as directed by the Engineer. The manufacturer's technical representative must be present during the initial installation of the preformed silicone joint seal. Provide equipment approved by the seal manufacturer's representative.

Furnish the preformed silicone joint seal material in the longest possible lengths to minimize field splices. Shop splices are prohibited. Use the longest seal pieces as practicable when installing the bridge joints. When field splicing is necessary, obtain the Engineer's approval of the location and number of splices prior to installing any lengths of the joint. Do not use lengths less than 4 ft long. Make field cuts and splices along straight lines and flush edges.

Clean the preformed Silicone Joint Seal immediately prior to installation by wiping with a solvent saturated cloth.

Install preformed silicone joint seal in accordance with the manufacturer's recommendations, to the depth and dimensions shown in the plans, and as directed by the Engineer.

Apply a bead of silicone adhesive to each side of the joint opening, position the preformed silicone joint seal in the joint opening and press down to the indicated depth. The preformed silicone joint seal must be recessed a minimum 1/2 in. below the pavement surface to prevent traffic abrasion or snowplow damage. When the preformed silicone joint seal is in position, apply silicone adhesive along each side of the preformed silicone joint seal to the top of the serrations.

Tool the silicone adhesive twice to ensure complete contact between the joint opening and the preformed silicone joint seal.

460.03.07 Preformed Polychloroprene Elastomeric Compression Seal Installation. Install preformed polychloroprene elastomeric (neoprene) compression seals at the locations specified in the Contract Document. The neoprene compression seals shall be sized in accordance with the manufacturer's recommendations, as shown on the Plans. If site conditions justify a change to the manufacturer's recommendations, proceed as directed by the Engineer.

Furnish the preformed polychloroprene elastomeric (neoprene) compression seal material in the longest possible lengths to minimize field splices. Shop splices are prohibited. Use the longest seal pieces as practicable when installing the bridge joints. When it becomes necessary to field splices, obtain the Engineer's approval of the location and number of splices prior to installing any lengths of the joint. Do not use lengths less than 4 ft long. Make field cuts and splices along straight lines and flush edges. Splice joint elements using the heat fusion method.

Clean the neoprene compression seals prior to installation by wiping with a solvent saturated cloth.

Apply lubricant adhesive in accordance with the manufacturer's recommendations. If the seal is stretched more than 5 percent, remove it and reinstall it with a new segment of joint material.

460.03.08 Finger Joint Installation. Refer to the Plans.

Ensure that all surfaces to receive application of the adhesive are completely dry, clean, free of sharp edges, and free of laitance. Immediately prior to application of the adhesive, blast clean the faces of the steel that will receive the adhesive to meet SSPC-SP 10, Near White. Protect adjacent painted and concrete surfaces from the blasting operations by masking or other appropriate measures.

Apply the adhesive and the foam joint seal in accordance with the manufacturer's recommendations and as directed by their technical representative. Use hand operated equipment as recommended by the seal manufacturer for applying the adhesive and installing the foam joint seal. The foam seal manufacturer shall have a technical representative present during surface preparation and installation and furnish a written certification that each was properly installed.

Do not use any equipment that will puncture or damage the foam seal material in any manner.

Placement of the foam joint seal is prohibited when the surface or ambient temperatures are 35 F or below, or when the temperatures are expected to fall below 35 F at any time during the 12 hour period following the placement. Placement will be permitted if the entire expansion device is heated in an enclosure and maintained to at least 35 F for the installation and the following 12 hour period.

460.03.09 Clean and Paint. Clean and paint steel armor in new and existing roadway joints as specified in Section 435 and Section 436.

460.03.10 In-Place Testing. When requested by the Engineer, subject completed joints to a water test to detect any leakage. Conduct test at least five days after completing the joint. Provide all facilities required for the Engineer's inspections of the underdeck areas. Cover the roadway section of the joint from curb to curb, or parapet to parapet, with at least 1 in. of water. If this is not possible, perform the water test in part section along the joint. When testing subsequent part sections, overlap at least 1 ft of the joint previously tested.

Maintain the ponding for a period of five hours for the entire roadway or each section of joint being tested. During and at the conclusion of the test, examine the underside of the joint for leakage. The expansion joint seal will be considered watertight if no obvious wetness is visible. If the joint system exhibits evidence of water leakage at any point, locate and repair any leaks.

When repairs are required, perform a subsequent water test. If the joint leaks after the second test, replace and retest the seal.

460.03.11 Joint Seal Warranty. Any failure of joint seals due to lack of adhesion, improper or unsatisfactory workmanship by the Contractor, or damage by the Contractor's operations will be cause for rejection, and the joint seal shall be repaired to the satisfaction of the Engineer at no additional cost to the Administration.

460.03.12 Drainage Troughs, Catch Basins, and Downspouts. Furnish and install new drainage troughs, catch basins and downspouts at the locations shown on the plans, as specified in the Contract Documents or as directed by the Engineer.

When specified in the Contract Documents, or directed by the Engineer, damaged portions of existing drainage troughs, catch basins and downspouts shall be removed and replaced to the limits specified. This work shall include unfastening trough fabric, cleaning and disposing of debris from the existing drainage troughs, catch basins and downspouts. Also, replace any damaged or

corroded hardware as needed to reattach drainage troughs, catch basins and downspouts as required.

Slope drainage troughs at 1 minimum under finger joints, and 1/4 in./ft minimum under all other roadway joints.

Repair deteriorated concrete end diaphragms as specified in Section 423.

Set threaded rods for hangers in cored holes at least 4 in. deep and 1/2 in. larger than the diameter of the hanger using non-shrink grout.

Repair areas of the existing coatings damaged during drainage trough installation as specified in 436.03.25.

460.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for furnishing, fabricating, placing, cleaning, and painting all joint materials including the structural steel, roadway seals, backer rods, adhesive, closed cell foam joint seals for finger joints, drainage troughs, catch basins, downspouts, hangers, and all hardware. Payment will also include the preconstruction meeting, arrangements to have all manufacturer's representatives on the project site, temporary roadway plates, testing, and all material, labor, equipment, tools, and incidentals necessary to complete the work.

460.04.01 Unless otherwise noted and no other pertinent items appear in the contract documents, joints including finger joints, drainage troughs, catch basins, and downspouts in structures will not be measured but the cost will be incidental to the pertinent Superstructure Concrete item.

460.04.02 Modifying or repairing existing roadway joints, to include finger joint repairs, will be measured and paid for at the Contract unit price per linear foot for the pertinent Joint Modification item. In addition to the first paragraph in 460.04, payment will be full compensation for modifying or repairing the existing joint openings in bridges including saw cutting, removal of existing steel and seal material, cutting, drilling, welding, and otherwise modifying existing steel, and furnishing and installing replacement anchor studs or rivets.

The measurement for modified transverse joints will be the horizontal distance along the roadway joint from the inside face to inside face of parapets plus the vertical distance of the curb faces and parapets.

460.04.03 Pourable joint sealant will be measured and paid for at the Contract unit price per linear foot for the pertinent Pourable Joint Sealant item, for replacement seal items of work. In addition to the first paragraph in 460.04, payment will be full compensation for the removal of existing seal materials, cleaning the existing joint surfaces, surface preparation, primer, furnishing and placing new pourable silicone joint seals, damming, and coating repair.

The measurement for pourable transverse joints will be the horizontal distance along the roadway joint from the inside face to inside face of parapets plus the vertical distance of the curb faces and parapets.

460.04.04 Preformed silicone joint seal will be measured and paid for at the Contract unit price per linear foot for the pertinent Preformed Silicone Joint Seal item, for replacement seal items of work. In addition to the first paragraph in 460.04, payment will be full compensation for the removal of existing seal materials, cleaning the existing joint surfaces, surface preparation, primer, furnishing and installing new preformed silicone joint seal, and coating repair.

The measurement for preformed silicone transverse joints will be the horizontal distance along the roadway joint from the inside face to inside face of parapets plus the vertical distance of the curb faces and parapets.

460.04.05 Preformed polychloroprene elastomeric (neoprene) compression seals will be measured and paid for at the Contract unit price per linear foot for the pertinent Neoprene Compression Seal item, for replacement seal items of work. In addition to the first paragraph in 460.04, payment will be full compensation for the removal of existing seal materials, cleaning the existing joint surfaces, surface preparation, lubricant adhesive, furnishing and installing new neoprene compression seal and coating repair.

The measurement for preformed polychloroprene elastomeric transverse seals will be the horizontal distance along the roadway joint from the inside face to inside face of parapets plus the vertical distance of the curb faces and parapets.

460.04.06 When an item for Drainage Trough for Bridge appears in the Contract, installation of new drainage troughs will be measured and paid for at the Contract unit price per linear foot for the pertinent Drainage Trough Item. Payment will be full compensation for removing existing drainage troughs including fabric, structural steel, hardware, hangers, catch basins, and downspouts; capping the bottom of the existing downspout pipes in pier columns and filling existing trough drain holes in piers with non-shrink grout. The payment will also include fabricating, furnishing and installing new drainage troughs including galvanized structural steel, stainless steel hardware, fabric, PVC downspouts, catch basins, welding, drilling and coring holes in existing steel and concrete, and attaching to existing structure.

The measurement of drainage trough will be the centerline distance from end to end of the installed drainage trough fabric.

460.04.07 Repair of existing drainage troughs will be measured and paid for at the Contract unit price per linear foot for the pertinent Drainage Trough Repair item. Payment will be full compensation for removing portions of existing drainage troughs including fabric, structural steel, hardware, hangers, catch basins, and downspouts. The payment will also include fabricating, furnishing and installing portions of new drainage trough including galvanized structural steel, stainless steel hardware, fabric, PVC downspouts, catch basins, welding, drilling and coring holes in existing steel and concrete, and attaching to existing structure.

The measurement of repairs will be the centerline distance from end to end of the installed drainage trough fabric.

460.04.08 When a Testing Expansion Joints in Structures item is included in the Contract Documents, it will be measured and paid per each joint included in a successful test. The payment will include furnishing and applying all water, providing full access to all areas tested, and all material, labor, equipment, tools, and incidentals necessary to complete the work. There will be no payment for a tested joint that failed its test.

460.04.09 Repair of deteriorated concrete in abutments, piers, and deck end diaphragms will be measured and paid as specified in 423.04.

CATEGORY 400
STRUCTURES

SECTION 461 — METAL RAILING

461.01 DESCRIPTION

Furnish, fabricate, coat, and install metal or polyester coated steel railings.

461.02 MATERIALS

Refer to Contract Documents.

Square Structural Tubing for Rail Elements	909, A500, Grade B, or A618 or A501
Steel Posts and Plates	909, A36
Anchor bolts	909.08
Fusion Bonded Polyester Powder Coating	917.03, Color shall match AMS-STD-595A, Color No. 20040 or as specified
Hot Dip Galvanized Zinc	A123, A153
Galvanizing Repair	465.03.05(c)

461.02.01 Structural Steel. Grind all welds of the railing system smooth, and remove all weld spatter. Ensure that all components are free of oil and any mill coating, burrs, pits, rust, or other foreign matter or surface blemishes.

Galvanize all structural steel including fasteners and anchor bolts. Oversize the threads of the nuts according to A563.

When specified, after fabrication and galvanizing, coat all structural steel for the railing with the polyester coating system as specified in 465.03.01 and 465.03.02, except as noted.

Completely fabricate each component of the railing system including drilling of all holes prior to galvanizing and/or applying the polyester coating system.

461.02.02 Bolts, Nuts, and Washers. When specified, coat bolts, nuts, and washers with the polyester coating system. Tap the nuts with oversize threads according to A563. The coating manufacturer shall ensure that the polyester coated bolts, nuts, and washers fit together without damaging their respective coatings.

461.02.03 Anchor Bolts and Assemblies. When the polyester coating is specified, the coating manufacturer shall ensure that the polyester coated nuts and washers for attaching the bridge railing to the structure fit together without damaging their respective coatings. Do not polyester coat (only galvanize) portions of anchor bolts and assemblies to be embedded in concrete.

461.03 CONSTRUCTION

Fabricate and install all railings according to the Contract Documents to the horizontal and vertical alignment of the structure. Posts shall be normal to grade.

Furnish working drawings for approval.

461.03.01 Production, handling and Shipment. All components shall be wrapped to ensure safe arrival at the project site. Handle carefully metal railings and incidental parts and store them on blocking, racks, or platforms to elevate them at least 4 in. above the ground and surrounding surfaces. The material shall be protected from corrosion or damage, and shall be kept free from dirt, oil, grease, and other foreign matter. Wrapping shall remain until the component is to be incorporated into the work. Repair or replace damaged material as directed.

461.03.02 Anchor Bolts. Ensure that galvanized anchor bolt threads are free of all dirt, grease, oil, or other deleterious substances prior to roughening with a wire brush or other approved method prior to installation of the railing. Submit the proposed procedures prior to installation of the railing.

After the installation of the railing, touch up the exposed portions of the anchor bolt threads and any portions of the nuts, washers, or railing components as specified in 465.03.05. Perform the work according to the manufacturer's recommendations. When the Engineer determines that a damaged area is beyond repair, remove, discard, and replace it at no additional cost.

461.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools and incidentals necessary to complete the work.

461.04.01 Metal Railing will be measured and paid for at the Contract unit price per linear foot.

461.04.02 Metal Railing will not be measured but will be paid for at the Contract lump sum price.

461.04.03 Metal railing for which no specific item is included will not be measured but the cost will be incidental to other pertinent items.

CATEGORY 400
STRUCTURES

SECTION 462 — TIMBER STRUCTURES

462.01 DESCRIPTION

Construct structures or portions of structures using timber, including fabricating, erecting, treating, and coating of the timber elements.

For timber piling refer to Section 410. For concrete refer to Section 420. For structural steel refer to Section 430.

462.02 MATERIALS

Asphalt Cement	Section 904
Structural Steel	909.01
Gray Iron Castings	909.04
Bolts and Hardware	909.10
Structural Timber	921.05
Preservative Treatments for Timber	921.06
Metal Timber Connectors	According to manufacturer and as approved
Galvanizing	A153
Fire Stops and Galvanized Sheet Metal	A653, Coating Designation G90

462.03 CONSTRUCTION

462.03.01 Storage and Handling. Store timber in open stacked piles at the site on suitable blocking or platform at least 12 in. above any type of surface or vegetation in a manner to shed water and prevent warping. Protect it from weather by a suitable covering. Clear the storage site of weeds and rubbish before placing material and throughout the storage period. Ensure that the site selected is not subject to flooding. Handle using rope or nylon slings to prevent the breaking of outer fibers, bruising, or penetrating the surface.

462.03.02 Cutting and Boring. When practical, cut and bore treated timbers before pressure treatment. Brush coat all cuts in treated timbers and all abrasions (after being carefully trimmed) with two applications of an approved wood preservative before installing the timber in the structure. When it is determined that treated timbers are damaged beyond repair, remove them from the project and replace them.

When forms or temporary braces are attached to treated timber with nails or spikes, fill the holes by driving galvanized nails or spikes flush with the surface.

462.03.03 Bolt Holes. When holes are bored after treatment, fill them with asphalt cement applied with a caulking gun, or as directed, before inserting bolts. Place asphalt cement coated plugs in holes that are not to receive bolts.

462.03.04 Coating Untreated Surfaces. In untreated timber structures, coat all contact surfaces between members (except adjacent flooring members) with two coats of an approved preservative before assembly. Similarly coat the back faces of bulkheads and all surfaces of timber that will come in contact with earth, metal, or other timber. Coat the ends of timber members in the same manner.

462.03.05 Protection of Ends of Caps, Wales, and Planks. Cover the ends of all caps, wales, and planks with resin glass composite shields as approved. Apply the shields as follows:

(a) Remove all dirt and other loose material from area to be capped.

(b) Apply the first coat of resin to the top and 4 in. down the side of the member.

(c) Apply precut glass cloth, using a 3 in. grooved aluminum roller to achieve “wet-out”, and anchor using brass staples.

(d) When the initial coat of resin has taken a tack free set, apply a second coat of resin to seal the entire application.

462.03.06 Diameter of Holes. Holes bored in timber structures shall meet the following for the listed connectors:

(a) Round drift bolts, spikes, and dowels - 1/16 in. less than the diameter of the device.

(b) Square drift bolts, spikes, and dowels - equal to the smallest dimension of the device.

(c) Machine bolts - same as the diameter of the bolts.

(d) Rods - 1/16 in. larger than the diameter of the rods.

(e) Lag screws - equal to the diameter of the screw at the base of the thread.

(f) Connector bolts - 1/16 in. larger than the diameter of the connector bolts.

462.03.07 Bolt Assemblies. Fit bolt heads and nuts that come in contact with the timber with a washer of the size and type specified. After all nuts are adequately tightened, burr the bolt threads.

462.03.08 Countersinking. Countersink wherever smooth faces are required. In treated timber, paint recesses formed in horizontal surfaces with an approved preservative. After the bolt or screw is in place, fill recesses with an approved asphalt coating.

462.03.09 Connectors. Bore connector holes through members to be connected. Bore perpendicular to the face of the timber. When spike grids or split ring connectors are specified, install them according to manufacturer's recommendations.

462.03.10 Framing. Accurately cut and frame all timber to provide even bearing over the entire contact surface. When making joints, shimming and open joints are prohibited.

462.03.11 Sills. Ensure that sills have true and even bearing on mudsills or concrete pedestals. Remove all earth from contact with sills.

462.03.12 Timber Caps. Place timber caps to secure an even and uniform bearing over the tops of the supporting posts or piles and to secure an even alignment of their ends. Secure all caps by drift bolts or as specified. Locate the drift bolts in the center of the post or pile.

462.03.13 Bracing. Bolt the ends of bracing through the pile, post, or cap. Bolt intermediate intersections. Use spikes or nails in addition to bolts. When bracing intersects, use filler blocks with a bolted connection.

462.03.14 Stringers. Place stringers in position so that knots near edges are in the top portions of the stringers. Size bottom edges of stringers to provide uniform depth at bearings.

Outside stringers may have butt joints with the ends cut on a taper, lap interior stringers to take bearing over the full width of the floor beam or cap at each end. Separated the lapped ends of untreated stringers at least 1/2 in. and securely fastened by drift bolts where specified. When stringers are two panels long, stagger the joints. Toenail cross bridging between stringers with at least two nails in each end. Leave the lower ends of all bridging and one side of each diaphragm disconnected and free to move until after the deck above is securely fastened to the stringers.

462.03.15 Floor Planking. Unless otherwise specified, use S1S1E floor planking, hit or miss, and have a uniform thickness with a maximum tolerance of 1/8 in. Where necessary to maintain traffic, lay planks in half-of-bridge width sections. Always accompany timber plank floors with suitable hold down devices. Spike the planks to every stringer, joist, and nailer with at least two spikes. Provide spikes with a length of at least twice the thickness of the plank. Where planks will be under wheel guards or hold down devices, carefully select planks of as near equal thickness as possible. Before any hold down or wheel guard is bolted, firmly drive treated shims or wedges between low planks and either the hold down or the wheel guard so that all planks are held down with equal pressure. The shims shall occupy at least 50 percent of the area between the bottom of either the hold down or wheel guard and the top of the plank.

462.03.16 Bridge Railings and Wheel Guards. Bridge railings shall meet a minimum of Test Level 1 (TL-1) according to AASHTO LRFD Bridge Design Specifications, Railings. All dimensions for timber rail, posts, and spacers shall be the actual dimensions of the timber.

Locate bridge rail and wheel guard splices so that rail and guard members are continuous over at least two posts. Install bridge railings and wheel guards in sections not less than 12 ft long. Shiplap splices with the lap equal to 8 in. or the greater side of the piece, whichever is larger.

462.04 MEASUREMENT AND PAYMENT

Piles are excluded. The payment will be full compensation for all timber (treated or untreated) storage and handling, finishing of pile bents and abutments, preservative, composite shields, asphalt cement, metal components, drilling holes, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

462.04.01 Timber structures will be measured and paid for at the Contract unit price per 1000 board feet (MBM). The computation of quantities will be based on the nominal sizes specified and the exact overall net length of pieces remaining in the completed structure. No allowance will be made for waste.

462.04.02 Timber structures will not be measured but will be paid for at the Contract lump sum price.

CATEGORY 400
STRUCTURES

SECTION 463 — BRICK MASONRY

463.01 DESCRIPTION

Construct brick masonry as specified.

463.02 MATERIALS

Curing Compound	902.07.03
Brick	Section 903
Mortar	903.06
Fusion Bonded Epoxy Powdered Coatings	917.02
Water	921.01
Dove Tail Anchors	As specified

Sample Panel. When specified, prepare and deliver a sample panel measuring at least 24 in. x 24 in. to the construction site for approval prior to beginning work. Provide a panel that is typical of the brickwork to be used on the project. Receive the Administration's approval of the panel before beginning the brickwork on the project. Keep the sample panel on the project site. Construct all subsequent brickwork to equal the appearance of this approved panel.

463.03 CONSTRUCTION

Unless otherwise specified, lay all brick masonry in level courses with faces plumb, square, and true to the dimensions specified. Ensure that all exposed surfaces are smooth. Lay brick masonry for parapets and end posts parallel to the roadway or barrier.

Construct brick facing as specified.

463.03.01 Bond. Unless otherwise specified, lay brick masonry in running bond. Lay adjoining courses to break joints by half brick as nearly as practical.

463.03.02 Bricklaying. Spray all brick with water to dampen the surface prior to laying. Only use fresh plastic mortar that is soft and workable when placed on the wall. Spread a layer of mortar on the beds and make not more than a shallow furrow in it that can be readily closed by the laying of the brick. Solidly fill all bed and head joints with mortar. Fully butter end joints of stretchers and side or cross joints of headers with mortar and make a shoved joint so that mortar is squeezed out at the top of the joint. Ensure that no brick is jarred or moved after it has been fully bedded in

the mortar. Remove and clean bricks loosened after the mortar has taken its set. Relay bricks with fresh mortar. Do not use broken or chipped bricks in the face. Do not use spalls or bats except where necessary to shape around irregular openings or edges. Place full bricks at ends or corners where possible. Use the bats in the interior of the course. In making closures, do not use bricks shorter than the width of a whole brick. Use only whole brick as headers.

463.03.03 Joints. Slush all joints with mortar at every course, slushing alone will not be considered adequate for making an acceptable joint. Lay exterior faces in advance of backing. Back plaster or parge exterior faces with a coat of mortar at least 3/8 in. thick before the backing is laid up. Prior to parging, cut flush all joints on the back of face courses. Joints shall be 1/4 in. to 1/2 in. wide. Uniformly maintain whatever width is adopted throughout the work.

463.03.04 Pointing. Tool all exterior head and bed joints with a round tool, slightly larger than the joint, pressed tight against the plastic mortar for a concave finish. When nails or line pins are used, plug the holes with mortar and point them immediately upon removal.

463.03.05 Cleaning. Upon completion of the work, clean all exterior surfaces by scrubbing and washing down with water. If necessary, clean with a 5 percent solution of muriatic acid, then rinse off with liberal quantities of clean fresh water.

463.03.06 Curing. After the work has been laid up and pointed, cure the exposed surfaces using one of the following methods:

(a) Cover with two layers of burlap and keep wet for three days.

(b) Apply a non-asphalt colorless liquid curing compound using an approved hand or motor driven spray operated at a pressure of 40 psi to 60 psi. Apply uniformly at a rate of 27 yd^2/gal. Ensure that the surface is completely coated and sealed in one application. Where there is evidence of insufficient coating, apply additional material as directed.

463.03.07 Cold Weather Protection. Do not perform brick masonry work and pointing when there is frost in the brick or when the air temperature is below 50 F, unless suitable housing and heating devices are provided as necessary to keep the atmosphere surrounding the masonry at a temperature of at least 50 F for the curing period.

463.03.08 Backfill. Do not backfill before seven days after completion of the section.

463.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all sample panels, dove tail anchors, curing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

463.04.01 Brick Masonry for Structures will be measured and paid for at the Contract unit price per square foot.

463.04.02 Brick Masonry for Structures will be measured and paid for at the Contract unit price per cubic yard.

463.04.03 Brick Masonry for Structures will not be measured but will be paid for at the Contract lump sum price.

463.04.04 Brick Masonry Facing will be measured and paid for at the Contract unit price per square foot.

463.04.05 Brick Masonry Facing will not be measured but will be paid for at the Contract lump sum price.

CATEGORY 400
STRUCTURES

SECTION 464 — EPOXY PROTECTIVE COATINGS FOR CONCRETE

464.01 DESCRIPTION

Furnish and apply epoxy protective coatings to concrete surfaces.

464.02 MATERIALS

Sand	901.01
Epoxy Protective Coatings	917.01

464.03 CONSTRUCTION

Coatings shall not be applied until 30 days after removal of the forms. Abrade all surfaces to be coated by abrasive blasting, water blasting, or other mechanical means to provide a surface profile for improved adhesion. Ensure that the surface is sound, clean, thoroughly dry, and free of oil, grease, curing compound, and other foreign matter before applying the first epoxy protective coating. Apply two coats to the specified areas of the structure. Each application shall follow a dry weather period of at least two consecutive days and be within the time frame recommended by the manufacturer. Mask adjacent areas not to be coated or otherwise protect to prevent staining.

464.03.01 Mixing and Application. Mix and apply according to the manufacturer's recommendations. Apply by brush or roller. Do not apply to piers and abutments until the structural steel masonry plates are in place.

464.03.02 Coating Requirements. Sprinkle an excess of sand on the second epoxy coating on the top surfaces of the piers and abutment bridge seat areas between beams pads while it is still wet. When it has hardened sufficiently to resist marring, remove sand not adhering to the coatings. Coat the following areas:

(a) For abutments under a transverse joint, apply the coatings to the entire horizontal surface of the bridge seat areas (between and around the beam pads) and all exposed surfaces of the beam pads, and the entire contiguous vertical faces of the backwalls and cheek walls.

(b) For piers under a transverse joint, apply the coatings to the entire horizontal surface of bridge seat areas (between and around the beam pads), and all exposed surfaces of the beam pads.

(c) For prestressed beams or slab panels, apply coatings in the shop to the limits as specified in 440.03.15(c) after the strands have been detensioned and cut. Touch up any coatings that were damaged in the field after the beams or slabs have been erected.

464.03.03 Material Precautions. Use the manufacturer's Material Safety Data in handling and use of the material.

464.03.04 Repairs. Repair all damage to the structure resulting from the coating operations, including damage to the epoxy protective coating. Perform epoxy protective coating repairs according to the manufacturer's recommendations.

464.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for both coats and all material, labor, equipment, tools, and incidentals necessary to complete the work.

464.04.01 Epoxy protective coatings for concrete for which no specific item is included will not be measured but the cost will be incidental to other pertinent items.

464.04.02 Epoxy protective coatings for concrete will not be measured but will be paid for at the Contract lump sum price for the pertinent Epoxy Protective Coating item.

464.04.03 Epoxy protective coatings for concrete will be measured and paid for at the Contract unit price per square foot for the pertinent Epoxy Protective Coating item.

464.04.04 Epoxy protective coatings for prestressed elements will not be measured but will be paid for at the Contract lump sum price for the pertinent Prestressed Concrete Beams or Prestressed Concrete Slab Panels item.

CATEGORY 400
STRUCTURES

SECTION 465 — MISCELLANEOUS COATINGS FOR METAL (STEEL)

465.01 DESCRIPTION

Furnish and apply various coatings to metal surfaces as specified. Refer to Sections 435 and 436 for cleaning and painting new and existing bridge structural steel, respectively.

465.02 MATERIALS

Paint System C	912.05
Fusion Bonded Epoxy Powder Coating for Steel	917.02
Fusion Bonded Polyester Powder	917.03
Hot Dip Galvanized Zinc	A123, A153, and 465.03.05(c)
Galvanizing Repair	A780 and 465.03.05(c)

Use paint and powder coating material selected from the Qualified Products List (QPL).

465.03 CONSTRUCTION

Perform cleaning and coating in an approved environmentally controlled plant. Provide the Administration with access to each part of the process. The Administration reserves the right to witness or perform any Quality Assurance testing on a random basis.

Use polyester powder coating when coatings other than paint are specified for steel or aluminum or as directed.

The powder coating applicator shall have demonstrated the ability to properly apply and cure the materials of the system and shall be on the Administration's Approved List of Applicators prior to application of any coatings. Coaters shall be qualified for paint and for powder coating as specified in 435.01.04. Galvanizers shall be on the Administration's Approved List of Galvanizers.

465.03.01 Nongalvanized Carbon Steel. Prepare steel metal surfaces as specified in 436.03.10(h). All cut edges shall be broken. Clean all items to be coated of any oil or grease according to SSPC SP-1 and abrasive blast to Near White according to SSPC SP-10. Remove weld spatter, slivers, hackles, or other defects. Protect cleaned surfaces from high humidity, rainfall, and surface moisture. Do not allow cleaned surfaces to flash-rust. Ensure that the blast profile is 2 mils to 3 mils according to D4417, Method C.

(a) Epoxy Powder Coating System. The system consists of a single coat of epoxy powder coating. Ensure that the thickness of the cured coating is 7 ± 2 mils when measured according to SSPC PA2.

(b) Polyester Powder Coating System. The system consists of a zinc rich prime coat; Coat I of System C or Coat I of Powder Coating System and 5 mils to 9 mils of a polyester powder finish coat. Apply primers and the powder coating according to the manufacturer's recommendations and in manner that immediately applies the powder after the organic zinc rich primer has fully cured if Coat I of System C is used. Use a two-stage approach for the zinc rich powder that partially gels the zinc primer prior to application of the top-coat powder. Measure coating thickness according to SSPC PA2.

465.03.02 Hot Dip Galvanized Carbon Steel. Metals for primary members that have reactive steel chemistry require the galvanizer to document the steps to be taken to ensure proper adhesion in their Quality Control Plan. Remove weld spatter, slivers, hackles, or other metal defects prior to galvanizing. Reactive steel for structural elements shall be abrasive blast cleaned to SP6 with a 2 mil to 3 mil profile prior to galvanizing.

The galvanizer shall ensure that the finished galvanized product to be coated is free of excessive zinc areas, spikes, slivers, ash, and dross or other detriments. Paint or powder coat hot dip galvanized steel as specified. Galvanized items shall not have been galvanized more than one month prior to coating and shall not have been water or chromate quenched.

Store items to be coated in an environment free of moisture and dust for a period of 12 hours maximum, when coating application does not immediately follow the sweep blast surface preparation.

(a) Paint System. Clean and profile surfaces to be coated by sweep blasting according to D6386. Ensure that all paint within the paint system is from the same manufacturer and that intermediate and finish coats conform to Coats II and III of System C. Apply all coatings using methods and under conditions recommended by the paint manufacturer. Measure the thickness of the coating according to SSPC PA2.

(b) Polyester Powder Coating System. Clean, sweep blast, and outgas surfaces to coated according to D7396. Use an anti-out-gassing type powder coating material for galvanized items. Follow the powder coating manufacturer's instructions for the metal surface temperature, applying the coating material and maintaining the cure parameters.

465.03.03 Aluminum. Clean and prepare aluminum surfaces to be coated using a five step or more process consisting of cleaning, rinsing, pretreatment or conversion coating, rinsing, then sealing. Do not use any product that contains hexavalent chromium. Use water break test according to Federal Standard TT-C-490F after all cleaning methods to check for freedom from organic contaminants. Submit the coating process to be used and the quality assurance plan, along with the coating manufacturer's recommendations, for approval prior to coating.

465.03.04 Adhesion. Adhesion of the paint or powder coating system to either bare or galvanized metal or aluminum shall be at least 4 A when tested according to D3359, Method A.

465.03.05 Touch Up System. Provide a compatible touch up system to repair defects, areas damaged during erection, and all visible open areas. Prepare areas to be repaired and apply touch up systems according to the coating manufacturer's recommendations.

465.03.06 Defects. Visually inspect all items for pinholes, blisters, bubbles, sags, handling damage, and other defects. Repair all pinholes, blisters, and bubbles to intact surface by grinding. Repair any sags or damage that have resulted in cracks or delamination as specified in 465.03.05, if required. If defects exceed 1/2 of 1 percent of the surface area of the item and total repairs exceed 1 in. in the narrowest dimension, the whole item shall be touched-up and coated.

465.03.07 Holiday and Pinhole Testing. The paint and powder coat finished surfaces shall be holiday and pinhole free when tested with a low voltage holiday detector (minimum 67 1/2 volts) according to D5162. Repair all holidays and pinholes detected with additional coating.

(a) Select the **e**poxy powder touch up material to be used from the Administration's Approved List.

(b) Polyester powder touch-up system shall be a two-component aliphatic polyurethane meeting 912.04.02 in the same color as the polyester powder. The coating thickness of the touch up material for the powder coating shall be applied in multiple coats and shall be the same thickness as the powder coating. Use Coat I of System C to repair damage to the coating that penetrates to the metal surface; followed by the polyurethane.

(c) Make any necessary repairs to the galvanizing according to A 780. Use Coat I of System C selected for use at the bake temperature. Use the solder or metallizing method for repairing the galvanizing if it is to be powder coated.

465.03.08 Color. The color of all coatings and touch up systems shall match Federal Standard 595 and the following:

COLOR	COLOR NO.
Brown	20040
Black	27038
Green	24108

465.03.09 Certification. Paint shall meet 912.01.03, epoxy powder coating shall meet 917.02.02, and polyester powder coating shall meet 917.03.

The acceptance of hot dip galvanized zinc will be based on inspection and shall meet A123, A153, and the Contract Documents.

465.04 MEASUREMENT AND PAYMENT

Coatings for metal will not be measured but the cost will be incidental to the pertinent items specified.

CATEGORY 400
STRUCTURES

SECTION 469 — POROUS BACKFILL

469.01 DESCRIPTION

Furnish and place porous backfill material, reinforced concrete base, and pipe drains at the rear of abutments, wing walls, retaining walls, and other locations.

469.02 MATERIALS

Porous Backfill, Size No. 57, Aggregate	901.01
Portland Cement Concrete	902.10, Mix No. 1
Pipe Drains	Section 905
Reinforcement Steel	908.01
Geotextile, Class as specified	Section 919

469.03 CONSTRUCTION

Place porous backfill material in layers in conjunction with the adjacent fill. Any fill material removed for placing the porous backfill material shall be at no additional cost to the Administration. When a form is used between the porous backfill material and the earth backfill, completely remove the form from the completed fill.

Slope concrete base to drain to points of discharge.

469.04 MEASUREMENT AND PAYMENT

Porous backfill will not be measured but will be paid for at the Contract lump sum price for the pertinent Porous Backfill item. The payment will be full compensation for all excavation, concrete, reinforcement, geotextiles, drains, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

If no item for porous backfill appears in the Contract Documents, the work will not be measured but the cost will be incidental to other items specified.

CATEGORY 400
STRUCTURES

SECTION 470 — UTILITIES ON STRUCTURES

470.01 DESCRIPTION

Place utility markers to identify utilities when they are newly installed, replaced, or relocated. Place the identification markers as specified herein and as approved.

470.02 MATERIALS

Utility Facility Identification.

(a) Any new or replacement utility facility installed shall include an identification marker with the first 50 ft of the facility, the last 50 ft of the facility, and at intervals of 100 ft in-between.

(1) Adjust the spacing to have one marker in every bay bounded by beams and diaphragms through which the utility passes.

(b) The marker shall consist of decals or stenciling onto the pipe or carrier according to industry standard color coding with high quality black or white print.

(1) Provide lettering height of 1/3 the pipe diameter, but not smaller than 1 in. nor larger than 4 in.

(2) The markers shall include the name of the utility and a description of the contents including pressure, voltage, and any other pertinent information required by industry standards.

LABEL BACKGROUND COLOR / LETTERING COLOR	CONTENT
RED	Electrical Power
YELLOW	Gas, Oil Steam, Petroleum or Gaseous Materials
ORANGE	Communication, CATV, Alarm, or Signal
BLUE	Potable Water
PURPLE	Reclaimed Water, Irrigation, or Slurry
GREEN	Sewer and Storm Drain

Figure 470.02(b) – Industry Standard Color Coding

470.03 CONSTRUCTION

Place identification markers within the first and last 50 ft of the structure, and at intervals not to exceed 100 ft.

Ensure that the surface to receive the marker is properly cleaned and prepared prior to the application. Orient the markings for best visibility.

470.04 MEASUREMENT AND PAYMENT

The application of utility markers on structures will not be measured but the cost will be incidental to the pertinent items.

CATEGORY 400
STRUCTURES

SECTION 475 — REMOVAL AND REPLACEMENT OF HOT MIX ASPHALT (HMA) WEARING SURFACE

475.01 DESCRIPTION

Remove the existing asphalt mix wearing surface from the bridge deck, remove additional areas of deteriorated concrete, perform deck repairs, and place asphalt mix wearing surface as specified in the Contract Documents.

475.02 MATERIALS

Asphalt Mix 904.04

475.03 CONSTRUCTION

Refer to Section 508 and Section 504, and as specified herein.

Remove the existing asphalt mix wearing surface to the limits shown on the Plans. Remove the asphalt mix wearing surface with equipment that can remove the wearing surface without damaging the existing concrete deck. Methods used may be as specified herein or as approved.

475.03.01 Equipment and Procedures.

Removal Equipment. Use equipment as specified in 426.03.02(a), 426.03.02 (c), 426.03.02 (d) and 426.03.02 (e).

Removal Procedures. The Engineer will inspect and determine if any damage occurred to the existing bridge that was caused by the Contractor's removal operations. Repair any of the damaged portions of the existing bridge to the satisfaction of the Engineer, at no additional cost to the Administration. All removed material shall become the Contractor's property and shall be disposed of at approved spoil locations.

Prior to the removal and replacement of the asphalt mix wearing surface, perform a test strip removal on the low-side shoulder of each bridge. The Engineer will determine the dimensions of the test strip in the field. Notify the Engineer at least 48 hours prior to performing the test strip operation. Schedule and perform the test strip removal so that the bridge work can be determined prior to performing any specified resurfacing on the approach roadway to the bridges.

Based on witnessing the test strip removal, the Engineer will determine the condition of the bridge deck and whether complete removal of the existing asphalt wearing surface is appropriate. If deemed appropriate, remove, and replace the asphalt mix wearing surface as specified in the Contract Documents.

If the Engineer determines that the existing concrete bridge deck exposed during the test strip removal is so deteriorated as to be best rehabilitated by partial or full depth repairs as specified in Section 423, remove as much the asphalt wearing surface as practical to maintain traffic for inspection of the concrete deck. Repair any portion of the deteriorated existing concrete bridge deck exposed during the test strip work or any other work. Repair spalled concrete, voids, and other defects that are located within the proposed asphalt mix wearing surface in accordance with Section 423.

Prior to the placement of asphalt mix over the existing concrete bridge deck or over an existing asphalt mix surface, apply a tack coat over the entire surface. Replace in-kind that portion of the asphalt mix wearing surface that was removed. Once the entire deck concrete has been repaired the in-kind asphalt has been replaced, add any additional asphalt overlay as specified in the Contract Documents.

475.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all chipping and removal of hot mix asphalt pavement, cleaning, abrasive blast cleaning, air blasting, flushing with water, curing, all saw cuts, disposal of material removed, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

475.04.01 Removal and Disposal of Existing Wearing Surface from Bridge, including that portion removed during the test strip removal will be measured and paid for at the Contract unit price per square yard for the actual surface area removed from the bridge deck.

475.04.02 The new asphalt mix wearing surface will be measured and paid for at the Contract unit price per ton for the pertinent Asphalt Mix for Bridge Deck item. Payment will also include tons of asphalt used in any Type 1 Deck Repairs as specified in Section 423.

CATEGORY 400
STRUCTURES

SECTION 476 — PROTECTION FOR SCOUR AND UNDERMINED AREAS

476.01 DESCRIPTION

Furnish and install grout-filled bags or mats for scour protection and fill undermined areas of structures with grout as specified in the Contract Documents.

476.02 MATERIALS

Geotextile 919, Class SE

476.02.01 Grout shall consist of 846 lb/yd^3 of Type II portland cement, mortar, sand aggregate, 6 $\pm$ 1 percent air entrainment by volume, and water proportioned to provide a pumpable mixture. The 28 day compressive strength shall be a minimum of 3500 psi.

476.02.02 Grout bags/mats shall be made of a high strength water permeable fabric of nylon 6.6 filament fiber. Each bag/mat shall be provided with a self-closing inlet valve to accommodate the insertion of the grout pumping hose. Grout bags shall have a maximum length of 4 ft, a maximum width of 3 ft, and a thickness of 1 ft. Seams shall be folded and double stitched.

Ready mixed high strength grout may be permitted with permission of the Engineer. Ensure that the ready mixed high strength grout is furnished by a manufacturer approved by the Administration and as specified in Section 915.

Fabric shall exhibit the following properties in both warp and fill directions:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Tensile Strength, min	D 4632, Grab Method	400 lb/in.
Tear Strength, min	D 4533, Trapezoidal Method	90 lb
Permittivity, min	D 4491	0.4 sec^{-1}
Apparent Opening Size, min	D 4751	0.4 mm

476.03 CONSTRUCTION

When specified, perform excavation with air lift dredging equipment prior to placement of the grout bags/mats. Place dredged material in dewatering devices specified in the plans or permits. When specified, reuse the dewatered suitable material to fill low points in the same body of water as directed by the Engineer. Otherwise, remove and dispose of dredge material.

Use mixers and agitators as specified in 915.03.05.

When specified or as directed by the Engineer, place geotextile prior to placing grout bags/mats.

Position the bags and fill them so that they abut tightly to each other and to the substructure units. Stagger joints between bags in successive rows and tiers.

Position mats and fill them so that they abut and seal tightly to the substructure. Prevent and eliminate open gaps.

Use a concrete/grout pump that is capable of delivering up to 25 yd^3/hr.

Grout bags may be used to seal off voids while grout mix is pumped into the voids. If grout bags are used for this purpose, install 4 in. minimum diameter vent pipes at 4 ft maximum spacings to allow all trapped water in the void to escape while the grout is being pumped. Insert the concrete/grout tube delivering the mix to the void so that the mix does not free fall. Fill the void by the tremie method. Remove the vent pipes or cut off flush with the bags when completed.

476.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for bags, mats, geotextile, excavation, dewatering basin, hauling, disposal, vent tubes, and all materials, labor, equipment, tools, and incidentals necessary to complete the work.

476.04.01 Grout bags, grout mats, and grout for filling the bags, mats, and undermined areas will be measured and paid for at the Contract unit price per cubic yard for either Grout/Grout Bags for Scour Protection or Grout/Grout Mats for Scour Protection, whichever is specified.

476.04.02 When grout bags or grout mats are not used to seal voids, the grout will be measured and paid for at the Contract unit price per cubic yard for Grout for Undermined Areas.

476.04.03 When not specified for reuse of suitable dredge material, election to recover, dry, stockpile, and reuse suitable dredge material shall be at no additional cost to the Administration.

CATEGORY 400
STRUCTURES

SECTION 477 — REPOINTING EXISTING MASONRY

477.01 DESCRIPTION

Clean and repoint existing masonry as shown in the Contract Documents.

477.02 MATERIALS

All mortar shall meet the requirements specified in 903.06 and match the color of existing mortar as nearly as possible.

477.03 CONSTRUCTION

Thoroughly clean the existing joints of all loose mortar and foreign material for a minimum depth of twice the width of the joint or 1 in. from the face of the masonry whichever is greater. Then fill joints with mortar that is well packed and finished.

Ensure that the finish of the new masonry pointing matches the existing as nearly as possible. After pointing is completed and the mortar is set, thoroughly clean the exposed surface of the masonry of excess mortar. Prevent any material from entering any waterway.

477.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for cleaning, any clearing of vegetation required to access the work site and expose the areas to be repaired, and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

477.04.01 Repointing of existing masonry will be measured and paid for at the Contract unit price per linear foot of the repaired areas for the pertinent Repointing Masonry Joints item.

477.04.02 Repointing of existing masonry will not be measured but will be paid for at the Contract lump sum price for the pertinent Repointing Masonry Joints item.

CATEGORY 400
STRUCTURES

SECTION 478 — JACKING BEAM OPERATIONS

478.01 DESCRIPTION

Jack existing beams for repairs

478.02 MATERIALS

Refer to the Plans and Section 430, Section 436, and 902.11.

478.03 CONSTRUCTION

Refer to the Plans. Use the shielded metal-arc process for all field welding. Adhere to all requirements of the Contract Documents except that for temporary installation, the requirements for radiographic and ultrasonic inspection will be waived if the Engineer's visual inspection indicates the welds are satisfactory.

At the Contractor's option, submit an alternate jacking beam or method to those specified in the Contract Documents to the Engineer for approval. Alternate jacking beams shall comply with the following restrictions:

(a) The alternate jacking beam material must be in new condition.

(b) The section modulus and web area (depth x thickness) shall not be less than the jacking beams shown in the Contract Documents unless otherwise specified.

(c) If the connection detail, stiffener plate detail, or jacking method is changed; submit detailed calculations to the Office of Structures for approval. These calculations shall be stamped by a professional engineer registered in the State of Maryland.

Set jacking beams level unless otherwise specified in the Contract Documents. The existing anchor bolts may be cut above the nut to achieve a level beam. In no instances, will it be permitted to chip away the concrete end diaphragms to achieve a level jacking beam.

Thoroughly clean areas under the proposed jacks to provide a flat, clean jacking surface. When jacking surfaces are not level or have slightly deteriorated concrete areas, use nonshrink grout to repair them to a flat level surface. The minimum thickness of the grout shall be as recommended by the manufacturer.

If the Engineer determines that any jacking surface contains highly deteriorated concrete, delay all work at that location and initiate provisions for cast in place concrete repairs to restore the surface to full capacity for the jacking operations per Section 423.

Utilize the correct scheme and jack capacity corresponding to the particular bearing being repaired as shown in the Contract Documents. Repair any damage resulting from misuse of the jacking schemes to any portion of the existing bridge that is to remain in place to the complete satisfaction of the Engineer, at no additional cost to the Administration.

Do not remove any steel that has been welded to the existing bridge; it shall remain in place. The Contractor may opt to leave the jacking beam in place unless otherwise specified.

The Engineer will determine if any additional bearings are to be repaired by use of a jacking operation.

478.03.01 Jacking Requirements and Restrictions. Adhere to the following requirements and restrictions during the jacking sequences to provide for a safe repair of deteriorated bearing pedestals, pier caps, and bearing assemblies.

The Engineer or his representative shall be present during all jacking operations to check all pertinent dimensions and to ensure conformance with all pertinent Contract requirements before the commencement of the actual jacking.

Jacks with a higher capacity than those listed in the Contract Documents may be allowed, but the Contractor shall monitor the jack load to ensure the safety of the bridge.

The jack system shall be equipped with a direct reading gauge to directly read the jack force in pounds or kips. However, a gauge accompanied by a chart with which the dial reading can be converted into pounds may be used if approved by the Engineer.

An existing bearing may not be raised more than 1/8 in. higher than its as built elevation unless otherwise specified. Do not exceed the maximum jacking forces shown in the Contract Documents.

If any repairs were made to the concrete bearing pedestals, do not lower the beams in place until the new concrete achieves 3500 psi minimum compressive strength.

The jack hydraulics shall not be used to support the load except during the actual jacking operation. However, a jack with a locking nut may be used if approved by the Office of Structures.

Brace as necessary to maintain structural stability and prevent lateral movement until completion of the jacking operation.

If any of the above requirements or restrictions cannot be met, the Engineer will notify the Office of Structures.

478.04 MEASUREMENT AND PAYMENT

The payment for Jacking Beam Operations will be full compensation for fabricated structural steel; installation, removal, storage, and reinstallation of existing steel end diaphragms or cross frames where required; bolts; paint; welding; jacking bearing plates; hydraulic jacks; any temporary timber blocking; scaffolding; providing non-shrink grout leveling pads if necessary; painting the steel; and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

478.04.01 Jacking Beam Operation will not be measured but the cost will be incidental to other pertinent items specified unless a Jacking Beam Operations item appears in the Contract Documents. Refer to Section 423 and Section 432 for payment of repaired areas.

478.04.02 Jacking Beam Operations will be measured and paid for at the Contract unit price per each location jacked. A jacking location is defined as a beam support at which the beam is to be lifted by one or two jacks by the amount specified on the Plans. One payment shall be made for the jacking procedure at any given location to complete the work required. Subsequent jacking procedures required to repair work from Contractor error will not be paid.

478.04.03 Jacking Beam Operation will not be measured but will be paid for at the Contract lump sum price. The payment will be for full compensation including all jacks, jacking beams, required for the complete Jacking Beam Operation work required.

CATEGORY 400
STRUCTURES

SECTION 479 — PRESSURE INJECTED EPOXY CRACK REPAIR

479.01 DESCRIPTION

Inject epoxy in cracks with a maximum width of 1/4 in.

479.02 MATERIALS

The epoxy resin shall conform to 921.04, C 881, Type I. Submit the grade for approval after the Contractor's analysis of the areas to be injected.

The system shall be moisture insensitive and shall not be used when the ambient or concrete temperature is 50 F or below, nor temperatures lower than recommended by the manufacturer.

The expiration date of acceptance of this material shall be one year after the date of manufacture. Any unauthorized tampering or breaking of the seals on the containers between the time of sampling and delivery to the job site will be cause for rejection of the material.

479.03 CONSTRUCTION

The locations for the pressure injection of cracks will be delineated by the Engineer.

Ensure that the epoxy manufacturer's technical representative will be present for the initial day of the epoxy injection process and submit details of the proposed method of repairs and the injection procedure for approval.

Inject the epoxy with a positive displacement pump system having a suitable mixing chamber where the epoxy components are accurately metered and thoroughly mixed immediately prior to injection. A clear, legible, and accurate pressure gauge shall be located in the supply line adjacent to the mixing chamber.

The equipment shall also be capable of providing a continuous and uninterrupted pressure head to continually force the injection of epoxy into the cracks. Epoxy flow shall be capable of being fully controlled by the operator controls at the mixing chamber.

Ensure that all working personnel are familiar with the equipment, materials, and procedures to be used during the operation.

All materials and equipment, including backup equipment, shall be at the work site before injection operations begin. All equipment shall be in proper calibration and in good working order as determined by the Engineer.

Epoxy shall be injected only using the automatic mechanical pumping, metering, and mixing equipment described above. Pressure pot systems and caulking guns or grease guns will not be permitted.

Mix the two components in accordance with the manufacturer's recommendations. Maintain the ratio of the components within a tolerance of five percent.

As a first order of work, clean the crack using a non-chlorinated, VOC compliant solvent that is approved by the epoxy manufacturer. Make sure the solvents have completely evaporated from the cracks or bonding surfaces prior to application of the surface seal or injection of epoxy.

479.03.01 Port Installation. Prior to injection of the epoxy in the crack, apply a surface seal material to the face of the crack to prevent the liquid resin from leaking out. The surface seal material shall be usable on vertical, horizontal, and overhead applications and completely bridge the crack when applied to the face of the crack.

Establish openings to inject the epoxy through the surface seal material along the entire length of the crack and provide entry ports. The holes shall be 3/4 in. in diameter, spaced 6 in. to 12 in. apart, and be of sufficient depth to ensure maximum dissemination of the pressure of the epoxy throughout this area.

Set inserts in drilled holes that are cleaned to remove any dust or debris left by drilling operations. Exercise special care to ensure that oil or other contaminants are not introduced into the air feed hoses or deposited on any air blown surfaces.

479.03.02 Injection. Force the epoxy into the internal voids and cracks by means of hydraulic pressure to completely fill all internal voids. If the surface seal material has insufficient strength and adhesion to confine the injected epoxy until it has cured, remove the surface seal material, and furnish and place a new surface seal material at no additional cost to the Administration.

Before injecting any epoxy, activate the automatic mixing and metering pump and discharge approximately 1 pint of the mixed epoxy into a disposable container. The Engineer will observe this trial operation to determine that the equipment is working properly. If the equipment is not working properly, immediately repair it to full working condition or replace it with the backup equipment. If the backup equipment is used, additional and fully operable equipment shall be provided as backup equipment.

Ensure that the feed line from the mixing equipment is securely held or properly attached to the port. Then initiate the epoxy injection in conformance with the manufacturer's recommendations.

Start the injection at the lowest row of holes and at the hole nearest the center line of the structure. Continue injection at the first port until the epoxy begins to flow out of the port at the next highest

elevation. Then plug the first port and start injection at the second port until the epoxy flows from the next port. Continue this sequence until the entire crack is repaired.

Monitor the injection procedure to ensure the epoxy flow does not cease before the injection epoxy exudes from the adjacent port. If the epoxy flow stops before epoxy appears at the adjacent port, move the feed line to the adjacent port and seal the port just used.

During the course of all operations, ensure extreme care to observe for breaking out of epoxy. When breaking out occurs, stop the injection, and move the line to another crack. Resume injecting in the original location after a minimum elapse of 24 hours.

Accomplish a continuous injection operation by replenishing the epoxy supply tanks in the mixing equipment before they are exhausted. Thoroughly stir each epoxy component before adding it to its respective storage tank in the mixing equipment. No discontinuity of epoxy flow through the feed lines of either component shall be permitted.

Any work stoppage permitting mixed epoxy to remain in the injection equipment more than 15 minutes requires cleaning the mixing chamber and all equipment in contact with the mixed epoxy. Quantities of epoxy purged from the injection equipment shall not be included for payment. After the injection process has been completed and the epoxy is allowed to fully cure, remove the injection ports, and surface seal from all surfaces. Cut or knock off ports and grind off the surface seal and any spillage flush with the original surface.

Repair any damage to the concrete due to these operations in a manner satisfactory to the Engineer at no additional cost to the Administration.

If the Engineer suspects that the epoxy is not completely filling the crack, they can request that the Contractor obtain 4 ins. diameter cores of the repaired concrete from representative locations selected by the Engineer. If the epoxy penetration depth is less than 90 percent of the visible crack along the sides of the core, the crack from which the core was taken will be deemed unsatisfactory and will not be included for payment. Fill the cored holes with epoxy grout.

479.04 MEASUREMENT AND PAYMENT

The preparation of cracks including chipping, cleaning, sealing, installation, and removal of injection ports, testing of repairs, repairing of cored holes, and for all material, labor, equipment, tools, and incidentals necessary to complete the item will be measured and paid for at the Contract unit price per linear foot for the pertinent Epoxy Pressure Injection item.

The epoxy used shall not be included in this item but will be measured and paid for at the Contract unit price per quart for the pertinent Epoxy Used for Epoxy Pressure Injection item.

CATEGORY 400
STRUCTURES

SECTION 481 — REMOVING EXISTING BRIDGE SCUPPERS AND DOWNSPOUTS

481.01 DESCRIPTION

Remove existing bridge scuppers and fill downspouts where designated on the Plans.

481.02 MATERIALS

Nonshrink Grout	902.11(c)
PVC Pipe	Section 905

481.03 CONSTRUCTION

Removing Existing Scuppers and Filling Downspouts. Completely remove all scuppers in conjunction with the removal of the existing bridge deck. Removal of the scuppers includes the grates, scupper basin, associated anchorages, and channels holding the scupper basin in place to the superstructure.

Remove downspouts and piping connected to the removed scuppers in their entirety including all hangers, where designated in the plans. If the downspouts are designated in the plans to remain in place, fill the downspout piping with nonshrink grout.

481.04 MEASUREMENT AND PAYMENT

The payment will include scaffolding, removal of any debris in the scuppers, furnishing and placing nonshrink grout, and all materials, labor, equipment, tools, and incidentals necessary to complete the work.

481.04.01 Removing existing scuppers and filling the downspout piping with grout will not be measured, but the cost will be incidental to the Removal of Portions of Existing Structure item.

CATEGORY 400
STRUCTURES

SECTION 482 — INVERT OF PAVING STRUCTURES

482.01 DESCRIPTION

Furnish and install a paved reinforced grout invert to various structures and fill undermined or eroded areas of a structure with grout. Seal leaks and joints in pipes, concrete slabs, or box culverts with grout or other materials as specified. When specified, furnish and coat the exposed metal of the pipe with a coal tar epoxy.

482.02 MATERIALS

Reinforcement Steel	908.01, Uncoated
Epoxy Bonding Compound	921.04
Carbon Steel Anchor Fasteners (Hardware)	909.10
Water	921.01
Curing Materials	902.07
Coal Tar Epoxy	483.02

482.02.01 Grout. Grout shall consist of 846 lb/yd^3 of Type II Portland cement, mortar, sand aggregate, 6 $\pm$ 1 percent air entrainment by volume, and water proportioned to provide a pumpable mixture. The 28 day compressive strength shall be a minimum of 3500 psi.

Ready mixed high strength grout may be permitted with permission of the Engineer. Ensure that the ready mixed high strength grout is furnished by a manufacturer approved by the Administration and as specified in Section 915.

482.02.02 Sealing leaks. Provide a non-toxic, VOC compliant, rapid expansive, hydrophobic, closed cell, polyurethane resin that cures through exposure to the air. The project data sheet can also call the material a polyurethane grout or polyurethane foam. The resin should have a fast reaction time, be rapid setting, and not wash away from the spray of water. Ensure that any material used is NSF 61 (National Sanitation Foundation) certified to encounter drinking water.

The material shall conform to the following requirements:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Uncured		
Specific Gravity	D 792	1.01 - 1.30
Shrinkage at -20° F	D 2126	0%
Viscosity	D 4889	50 – 400 cps
Cured		
Density – Free Rise	D 1622	1.5 – 2.5 pcf

If multiple products exist that meet this description, ensure that the correct material is used at the appropriate location at no additional cost to the Administration.

482.03 CONSTRUCTION

Provide adequate temporary lighting and proper ventilation for the confined spaces as specified in TC-3.04.

482.03.01 Maintenance of Stream Flow. Install all sediment and erosion control and maintenance of stream flow devices, like dewatering devices, stream diversion dikes, and stream diversion pumps and hoses in accordance with the Plans and permits prior to doing any of the paved invert repairs. Maintenance of stream flow shall be continuous as specified in 308.03.42.

Secondary inflows such as median inlets, manholes, etc. may be blocked off allowing ponding in areas that do not negatively affect roadways, properties, features, etc. as determined by the Engineer. Alternatively, the secondary inflows may be pumped or directed to nearby, storm drains, or either end of the pipe being paved. All controls for secondary inflows must be approved by the Engineer prior to installation.

Invert paving of these structures may be performed in stages when approved. Install all sediment and erosion control devices to dewater each staged area and maintain stream flow including those from secondary inflows. At the start and end of each stage, adjust the controls as needed for the subsequent stage.

482.03.02 Invert Cleaning. Remove and dispose of all debris at the inlet, outlet, and inside the pipe by hand or by water blast cleaning. Refer to 303.03.07. If the invert of the pipe has been an existing bituminous invert, remove it using chipping hammers. The Contractor is alerted that the quantity of debris varies based on erosion and deposition. Bids shall account for anticipated changes in debris. No additional compensation will be given for changes in the debris quantities from those assumed at the time of bidding.

Provide smooth transitions at the inlet and outlet to gradually slope the grade from the cleaned elevation to the original ground within the limits of disturbance as shown in the Contract Documents. If excavation outside the limits of the structure is needed, complete it as Class 5 Excavation as specified in Section 202.

Prior to sealing leaks and paving the structure invert, water blast clean all surfaces of the existing structure that will be in contact with the new grout invert including any surface areas with protective coatings. When cleaning the surfaces of existing structure, use a minimum pressure of 4,000 psi measured at the nozzle, and a rotary tip. Collect all wash water from the cleaning operation in approved dewatering devices, filters, and basins. No wash water may enter the stream without passing through these devices.

482.03.03 Sealing Leaks. Immediately after cleaning, inspect the structure with the Engineer to locate any water leaks along the length of the invert.

Sealing leaks will be required if the volume of water leaking into the structure meets the following criteria:

(a) A steady flow of water collects in the invert of concrete structures or corrugations of metal structures, and

(b) results in a continuous flow or stream through the dewatered structure.

Seal the areas with holes, missing sections of structure, or joint locations where water is leaking into the structure with an approved polyurethane resin. Follow the manufacturer's recommendation to seal the leaks and fill all voids under the structure around a leak.

These sealed areas shall prevent any water from entering the structure and conform to the shape of the structure. If the structure contains corrugations, do not fill in the bottom corrugations. In this case, remove any sealant above the top surface of the bottom corrugation, "trough area." Ensure that the grout paving can occupy the same area in a sealed location as it does in an area that is not sealed.

Sealing leaks will not be required if the Engineer determines that leaks are insignificant and should have no adverse impact to installation of the grout invert.

When needed, use sump pits dug into the invert of the pipe with dewatering pumps at intervals and locations directed by the Engineer to draw down excess water leaking into the pipe. Fill these holes with grout once they are no longer needed.

482.03.04 Reinforcement Steel. Install all reinforcing steel including any anchors, as specified. Ensure that welding is as specified in 430.03.19 and 430.03.20. The requirements for radiographic and ultrasonic inspection may be waived if a visual inspection by the Engineer indicates the welds are satisfactory for the purpose intended. When field welding, use the shielded metal-arc process. Where reinforcing steel is to be welded to a corrugated pipe that has a galvanized surface, remove the galvanized coating with power tool prior to welding.

482.03.05 Grout placement. Ensure that the surface of the structure to be paved is free of all loose scale, concrete, rust; oil, asphalt coatings, or any other foreign material that could act as a bond breaker. Ensure that the surface is clean and dry prior to placing the grout.

Mixers and agitators as specified in 915.03.05.

The concrete/grout pump shall be capable of delivering up to 25 yd^3/hr.

Invert paving may be completed using either pumping or pouring. Pneumatically applied mortar is prohibited. Maintain the same slope on the paved invert as the existing structure and obtain a smooth broom finished surface regardless of method used.

Provide a bulkhead at all construction joints to create a vertical surface. Coat the entire face of any construction joint with an approved epoxy bonding compound. Ensure all reinforcement is continuous through the construction joints.

Cure the paved invert using methods specified in 420.03.09(b), 420.03.09(c), 420.03.09(d), or 420.03.09 (f). Do not permit the stream water to flow over the grout surface for a minimum of 36 hours after completing the last grout placement.

482.03.06 Coal Tar Epoxy Coat. When specified inside a metal pipe, apply a coal tar epoxy coating to all exposed metal after grout invert is placed as specified in Section 483. In lieu of what is specified in 483.03.01, clean all surfaces as specified in 436.03.10(a), 436.03.10(b), and 436.03.10(g). Perform spot cleaning in areas of heavy corrosion as specified in 436.03.10(f).

If the existing structure already has a coal tar epoxy coating, the Engineer may only require cleaning and coating areas of coating failure and corrosion, in lieu of cleaning and coating the entire structure. In this instance, clean and repair only the areas directed by the Engineer as specified above. To promote good adhesion of the new coating, lightly abrade and feather the edges of the existing coating within two inches of new coatings application.

In areas where the contractor removed the existing protective coating beyond the limits shown on the plans and is not covered by the new grout invert or coal tar epoxy, repair the original coating as specified by the Engineer.

Ensure that the coal tar epoxy coating overlaps the grout invert by at least 4 inches.

482.03.07 Clean up. At the completion of all repairs in the waterway, remove dewatering devices, stream diversion dikes, and stream diversion pumps and hoses without spillage of the collected materials. Return the construction area to preconstruction conditions or better. This may require the use of stabilization matting, seeding, and mulch as directed by the Engineer and specified in Sections 704, 705, and 709.

482.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

482.04.01 Invert Paving will be measured and paid for at the Contract unit price per square yard. The payment will be full compensation for ventilation of confined spaces, temporary lighting, digging and filling sump holes, grinding or cutting repair areas, furnishing, installing, and welding reinforcing steel and anchors, installing and removing forms, and furnishing, placing, and curing of grout for invert paving.

482.04.02 Clearing and grubbing will be measured and paid for as specified in 101.04.

482.04.03 Maintenance of stream flow including the installation, maintenance, and removal of all stream diversion devices, pumps, generators, and dewatering equipment will be paid for as specified in 308.04.62.

482.04.04 Excavation of materials beyond the limits of the structure will be measured and paid as class 5 excavation as specified in 202.04.

482.04.05 Cleaning and removing material and debris inside the structure including removal of existing invert material will be measured and paid for as specified in 303.04.16. Payment will include water blast cleaning and collection and disposal of runoff.

482.04.06 Sealing joints between structure sections and other leaks will be measured and paid for at the Contract unit price per gallon for the pertinent Polyurethane Resin for Sealing Leaks item. Payment will include the initial and all subsequent inspections of the structure for leaks. No payment will be made if the resin applied area continues to leak any water after the material has cured. This is a contingent item just to establish a unit cost for the polyurethane resin and GP-4.04 will not apply to this item.

482.04.07 Furnishing and applying the coal tar epoxy coating will be measured and paid for at the Contract unit price per square foot for the pertinent Cleaning and Coating item. Payment will include cleaning the exposed metal surfaces and preparing all other surfaces.

482.04.08 Repairing an existing coal tar epoxy coating will be measured and paid for at the Contract unit price per square foot for the pertinent Cleaning and Repairing Existing Coating item. Payment will include cleaning the exposed metal surfaces, preparing all other surfaces, and furnishing and applying all necessary coating materials.

482.04.09 Temporary seed and mulch will be measured and paid for as specified in 704.04.

482.04.10 Permanent seed will be measured and paid for as specified in 705.04.

482.04.11 Soil and slope stabilization matting will be measured and paid for as specified in 709.04.

CATEGORY 400
STRUCTURES

SECTION 483 — COAL TAR EPOXY COATING

483.01 DESCRIPTION

Furnish and apply a protective coal tar epoxy coating system to the existing steel in the areas specified in the Contract Documents.

483.02 MATERIALS

The coal tar epoxy coating shall be a VOC compliant, self-curing two component system consisting of resin and the catalyst and shall meet the Corps of Engineers Formula C-200 or SSPC-Paint No. 16.

The material shall be processed and packaged in a manner that ensures within a period of one year from date of manufacture, that it will not gel, liver or thicken deleteriously, or form gas in the closed container. Coatings and vehicles shall be packaged in standard containers not larger than 5 gal with removable friction or lug type covers. Each container of separately packaged component shall be clearly and durably labeled to indicate the purchaser's order number, date of manufacture, manufacturer's batch number, quantity, color, component identification, material safety data sheet (MSDS), and the designated name and formula or specification number of the coating together with special instructions.

483.03 CONSTRUCTION

Refer to Section 436 - Cleaning and Painting Structural Steel.

483.03.01 Surface Preparation. Clean all surfaces to be coated as specified in 436.03.10(a), 436.03.10(b), and 436.03.10(h) except clean surfaces within 6 in. of the mean low waterline to bare metal having a minimum surface profile height of 1 mil.

Ensure that all surfaces to be coated are completely dry, free of moisture, soil, dust, grit, etc., at the time the coating is applied. Remove any traces of oil, grease, or other organic matter prior to coating by using solvent, spot blasting, or as directed by the Engineer. Any additional surface preparation, temperature and humidity ranges, and application methods shall be as recommended by the manufacturer and approved by the Engineer.

483.03.02 Mixing. Perform all mixing in accordance with the manufacturer's specifications and by use of mechanical mixers. Only full containers of components A and B packaged by the manufacturer shall be used for mixing, as measuring portions for smaller or larger batches is

prohibited. Full containers shall include scraping the inside of the container unless otherwise specified by the manufacturer.

483.03.03 Application. Apply the coal tar epoxy by spray using a heavy-duty spray gun or airless spray equipment having at least a 28:1 pump ratio. Apply the coal tar epoxy in two coats in accordance with the manufacturer's recommendations to provide a minimum dry film thickness (DFT) of 20 mils on the finished surface. Whenever conditions warrant special procedures or surface preparations as recommended by the manufacturer, perform them prior to application of the coal tar epoxy.

Ensure that the temperature of the coating and the steel at the time of application of the coating is within the manufacturer's tolerances.

Whenever possible apply the coating without thinning. When thinning is required, use the thinner recommended by and at the rate specified by the manufacturer. When thinner is used, it may be necessary to apply three coats in lieu of two to provide the specified dry film thickness.

Ensure that the finished coating is generally smooth, glossy, and free of sharp protuberances. Sags, dimpling, and curtaining will be permitted up to a maximum of 3 percent of the surface. Cut off sharp protuberances using a sharp wood chisel, grinding, or other means acceptable to the Engineer. Smooth the surface of the areas from which material has been removed by recoating.

483.03.04 Inspection. Notify the Engineer when the coating operations are completed and ready for inspection. Inspection of the completed work will be by magnetic detector or low voltage detector readings and by visual inspection for pinholes and holidays. Touch up areas designated as being inadequately coated in accordance with the coating manufacturer's recommendations. When five or more deficiencies are found in a 100 ft^2 area, the Engineer may require recoating of the entire area in which they occur. Provide the holiday detector for inspection.

483.03.05 Safety. Whenever spraying the coating in enclosed spaces, provide an adequate ventilation system except as specified herein. The system shall be capable of positively exchanging the air in the enclosed space for fresh air at the rate of not less than 5000 ft^3 per minute for each spray gun in operation, and all parts of the space shall be swept by moving air. Operate the ventilating system during the entire application period and continue after spraying has halted until the applied film is no longer giving off appreciable solvent vapors. The air in the enclosure shall always be safe from fire and explosion hazards as determined by a commercially available explosion meter approved by the Engineer.

All respirators used for this type of work shall at a minimum meet OSHA Standards, Regulations, and the manufacturer's MSDS.

483.04 MEASUREMENT AND PAYMENT

Cleaning the designated areas and coating with coal tar epoxy will not be measured but the cost will be incidental to the pertinent Cleaning and Painting item specified in the Contract Documents. Payment will be full compensation for furnishing and applying the coal tar epoxy, surface preparation, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 400
STRUCTURES

SECTION 495 — APPLICATION OF BRIDGE/STRUCTURE NUMBERS

495.01 DESCRIPTION

Apply Bridge/Structure Numbers to all completed structures.

495.02 MATERIALS

Select a paint that is suitable for the particular application, subject to the approval of the Engineer.

495.03 CONSTRUCTION

Apply the Number as a last order of work. Refer to the pertinent details included in the Contract Documents for the size, location, etc. Ensure that completed work has sharp edges differentiating all coatings and the previous substrate. Properly prepare surfaces according to the paint manufacturer's recommendations. Do not apply paint to wet or moist surfaces.

On rehabilitation projects repaint the Number if it is faded, removed, or otherwise deemed necessary by the Engineer.

495.04 MEASUREMENT AND PAYMENT

Application of Bridge/Structure Numbers will not be measured but the cost will be incidental to the pertinent items specified.

CATEGORY 400
STRUCTURES

SECTION 499 — WORKING DRAWINGS

499.01 DESCRIPTION

Schedule and distribute working drawings, which are described in AASHTO LRFD Bridge Construction Specification, TC-1.03, TC-4.01, and as specified or required by the Administration. Working Drawings shall exhibit good drafting practices and represent the original work of the Contractor, fabricator, or supplier. Do not duplicate portions of the Plans except to clarify or to add details. When requested, specified, or required by the Administration or consultant, submit calculations and other information deemed necessary to backup working drawings. Sign and seal calculations and other backup material by a professional engineer registered in the State of Maryland.

499.02 MATERIALS

Not applicable.

499.03 CONSTRUCTION

499.03.01 Schedule. As a first order of work, prepare and submit a schedule for the submission of the working drawings as specified in 499.03.02 or 499.03.03. Coordinate the schedule with and in full accord with the Progress Schedule submitted to the procurement officer as specified in GP- 8.04 and TC-5.02.

The schedule shall include each type of working drawings (e.g. form plans, structural steel, etc.), approximate number of drawings to be reviewed, estimated date of first submission, and estimated rate of submission of drawings (e.g. 5/wk). Where possible, submit the most crucial drawings first with sufficient time for review to minimize delays during construction.

499.03.02 Consultant Engineering Firm. When the Contract Documents specify that a consultant engineering firm is to review the working drawings for the structure, send all working drawings to that firm.

To expedite the checking and distribution of working drawings, the Contractor, fabricator, or supplier may send electronic PDF versions or hard copy prints of their submissions directly to the appropriate consultant engineering firm, with copies of all correspondence to the Contractor, Director-Office of Structures, and the District Engineer. If the Contractor requests that all plans be routed through the Contractor's office, then the establishment of that procedure should be the first order of work in order to avoid possible misunderstandings as to the processing. Be advised

that this plan of action will delay the turnaround time and will not constitute grounds for complaint or a time extension.

When electronic PDF versions of the working drawings are being reviewed, the consultant engineering firm will forward the accepted and stamped drawings directly to the Administration's Office of Structures for a secondary review, final stamping, and electronic distribution.

When hard copy working drawings are being reviewed, once the primary review determines the working drawings are acceptable as-is, the Contractor, fabricator, or supplier shall furnish to the consultant engineering firm additional prints (number to be furnished by the primary reviewer, up to 10 copies) for stamping and forwarding to the Administration's Office of Structures for a secondary review and the Administration's final hard copy distribution.

When working drawing submissions warrant revisions, the primary reviewer will return the submission with comments directly to the entity from whom they received the submission. Copies of the transmittal or email returning the submission will be sent to the Engineer and Contractor. Distribution of the working drawings will not occur. Working drawings for structures will not be considered accepted until they are received by the Engineer from the Administration's Office of Structures and bear the acceptance stamps of both the consultant engineering firm and the Administration's Office of Structures.

All working drawings for the structures will not be considered accepted until they bear the acceptance stamps of both the consultant engineering firm and the Administration's Office of Structures.

499.03.03 Office of Structures. When no consultant engineering firm is specified, send all working drawings for the structures to the Director - Office of Structures.

To expedite the checking and distribution of working drawings, the Contractor, fabricator, or supplier may send electronic PDF versions or hard copy prints of their submissions directly to the appropriate Office of Structures' Division's primary reviewer, as listed above, with copies of all correspondence to the Contractor and the District Engineer. If the Contractor requests that all drawings be routed through the Contractor's office, then the establishment of that procedure should be the first order of work in order to avoid possible misunderstandings as to the processing. Be advised that this plan of action will delay the turnaround time and will not constitute grounds for complaint or a time extension.

When electronic PDF versions of the working drawings are being reviewed, the primary reviewer will forward the accepted and stamped drawings directly to the Administration's Office of Structures' secondary reviewer for a secondary review, final stamping, and electronic distribution.

When hard copy working drawings are being reviewed, once the primary review determines the working drawings are acceptable as-is, the Contractor, fabricator, or supplier shall furnish to the Office of Structures additional prints (number to be furnished by the primary reviewer, up to 10 copies) for primary stamping and forwarding directly to the Administration's Office of Structures' secondary reviewer for a secondary review, final stamping, and distribution.

When working drawing submissions warrant revisions, the primary or secondary reviewer will return the submission with comments directly to the entity from whom they received the submission. Copies of the transmittal or email returning the submission will be sent to the Engineer and Contractor. Distribution of working drawings will not occur. Working drawings for structures will not be considered accepted until they are received by the Engineer and bear the acceptance stamps of (a) the Structures Engineering Division (SED) or the Structures Remedial Engineering Division (SRED) and, (b) the Administration's Office of Structures (OOS).

499.03.04 Distribution of accepted working drawings. All accepted working drawings will be distributed either electronically or by hard copy by the Office of Structures' secondary reviewer.

Accepted electronic submittals will be distributed to the Engineer, the primary reviewer, and the Administration. The Engineer will distribute the electronic accepted working drawings to the Contractor for the Contractor's further distribution to their fabricator and suppliers.

Accepted hard copy submissions will be distributed by the Office of Structures to the Engineer, primary reviewer, Contractor, fabricator, suppliers, and to internal SHA offices. Additionally, scanned electronic PDFs will be sent to the Engineer, internal SHA offices, and primary reviewer.

For working drawings submitted and accepted electronically, furnish to the Engineer, upon request, up to 10 full size hard copy color prints of all accepted working drawings, calculations, sketches, cut sheets, etc.

499.03.05 Revisions and Substitutions. Send all structural Contract Document modification requests only to the Director-Office of Structures for review and acceptance. Do not submit any affected working drawings without receiving a written acceptance from the Director-Office of Structures. Any modifications implemented by a working drawing submission, without written acceptance from the Administration's Director-Office of Structures, will be subject to the requirements of GP-5.02.

499.04 MEASUREMENT AND PAYMENT

This work will not be measured but the cost will be incidental to other pertinent items.

CATEGORY 500
PAVING

SECTION 501 — UNTREATED AGGREGATE BASE COURSES

501.01 DESCRIPTION

Construct base courses using one of the following:

(a) Graded aggregate without a stabilizing agent.

(b) Recycled Concrete Graded Aggregate

501.02 MATERIALS

Graded Aggregate for Base Course	901.01
Recycled Concrete, Graded Aggregate	900.03.02
Production Plant	Section 915
Water	921.01
Moisture and Dust Control Agents	921.02

501.03 CONSTRUCTION

At least 30 days prior to the start of constructing the base course, submit the proposed plants, equipment, and material sources for approval.

Protect the subgrade and base against damage from all causes. Repair or replace damaged areas.

Unless protected by a concrete traffic barrier, limit excavation for widening to an area that can be wedged the same day using graded aggregate base. Refer to Standard No. 104.01-28 for the area to be wedged. Maintain the temporary graded aggregate base wedge with a 4:1 or flatter fill slope when there is no barrier. Compact the material as indicated elsewhere in this specification. Leave the graded aggregate base wedge in place until placement of the next layer.

501.03.01 Equipment. All equipment, including the production plant and on-site equipment, is subject to approval. Have the plant ready for inspection at least 48 hours prior to the start of construction operations.

501.03.02 Weather Restrictions.

(a) Temperature and Surface Conditions. Place graded aggregate base when the ambient air and surface temperatures are at least 32 F and rising. Do not ship the material from plant at freezing temperature (32 F) and below. Do not place material on a frozen subgrade.

(b) Precipitation. Do not place material during precipitation. When precipitation has occurred during the previous 24 hours, the Engineer will determine if the subgrade is sufficiently dry. If precipitation occurs during placement, placement of material enroute from the plant to the job site shall be at the Contractor's risk.

501.03.03 Subgrade Preparation. Before beginning base course construction, complete the approved subgrade to final line and grade at least 500 ft ahead. Construct the foundation as specified in Section 204 and Section 208. If traffic, including construction equipment, is allowed to use the subgrade foundation or preceding layer, distribute the loading over the entire width of the course to obtain uniform and thorough compaction. Remove rutting by reshaping and recompacting the affected area as specified in Section 204.

501.03.04 Transportation. Handle and transport mixed base materials in a manner that minimizes segregation and loss of moisture. Cover all loads in accordance with State laws unless hauling is off road and is approved. Do not haul over areas that have met the grade and compaction requirements until its ready for the next layer.

501.03.05 Stockpiling. Stockpiling of the untreated aggregate base is prohibited, unless approved by the Engineer. In addition, a Quality Control Plan to stockpile the untreated aggregate base material must be submitted by the contractor and be approved by the Soils and Aggregate Technology Division. The Quality control plan should include how the contractor will ensure the correct moisture content, minimize segregation, and how long they will be stockpiling the untreated aggregate base.

501.03.06 Spreading. Spread the base material uniformly and in layers of approximately equal thickness, to provide the specified planned depth. Avoid segregation of coarse and fine particles. Build shoulders or berms at least 2 ft wide on each side of the base and to the top elevation of each uncompacted layer, except when placing the base against concrete curbs or gutters.

501.03.07 Grade or Finished Surface Control. Shape the surface of the base material to the specified line, grade, and cross section. Set grades longitudinally and transversely with fixed controls spaced no greater than 25 ft. Compact and smooth the surface over its full width using a smooth faced steel-wheeled roller, or if rolling is not feasible, by mechanical tampers and vibratory compactors, as approved. Maintain the finished grade within 1/2 in. from the established grade.

501.03.08 Compaction. Immediately after placement, compact the material to the required density. During compaction operations, maintain the moisture content of the material to within 2 percent of optimum moisture. Determine the optimum moisture content and maximum dry density as follows:

(a) Graded Aggregate Base according to T 180 with oversize particle correction applied.

(b) Compact graded aggregate base to at least 97 percent of the maximum dry density. Measure in place density according to MSMT 350 or MSMT 352.

Begin compaction operations, except on superelevated curves, at the sides of the course. Overlap the shoulder or berm at least 1 ft and progress toward the center parallel to the center line of the roadway. On superelevated curves, begin compaction at the low side and progress toward the high side. Continue compaction operations until all compaction marks are removed.

501.03.09 Moisture and Dust Control Agents. When specified, add calcium or magnesium chloride at the plant or apply it to the surface of the material at the project site. Apply calcium chloride at the rate of 1 lb./yd^2. Apply magnesium chloride at the rate of 1 lb./yd^2 or as a solution at the rate of 1/2 gal/yd^2.

501.03.10 Maintenance. During construction and after completion of the base course, maintain the grades and protect the base from damage until the next layer is placed. When unacceptable work cannot be repaired, replace it for the full depth of the base.

501.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all aggregate, furnishing, hauling, placing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

501.04.01 Graded Aggregate Base Course will be measured and paid for at the Contract unit price per square yard for the specified thickness.

Surface area measurements will be based on the specified width of the base and the actual length measured along the center line of the base surface.

The temporary graded aggregate base wedge constructed in conformance with Standard No. MD 104.01-28, maintaining the 4:1 or flatter slope, compaction, and removal of the material, will not be measured but the cost will be incidental to the Graded Aggregate Base Course.

501.04.02 Calcium or Magnesium Chloride will be measured and paid for at the Contract unit price per square yard or per ton as specified.

CATEGORY 500
PAVING

SECTION 502 — CEMENT TREATED BASE COURSE AND CEMENT MODIFIED SUBGRADE

502.01 DESCRIPTION

Construct Cement Treated Base (CTB) course or Cement Modified Subgrade (CMS) using a combination of soil or graded aggregate base and Portland cement, uniformly mixed, moistened, compacted, shaped and sealed to the required depth and widths specified. Mix the CTB or CMS in place.

502.02 MATERIALS

Graded Aggregate Base	901.01
Portland Cement	902.03
Emulsified Asphalts	904.03
Select or Capping Borrow for CTB	916.01
Soil for CMS	916.01
Water	921.01

502.03 CONSTRUCTION

Submit the equipment and material sources for approval at least 30 days prior to the start of construction of the CTB or CMS. For mix design approval time frame, refer to 502.03.04. Protect the subgrade and/or base against damage from all causes.

502.03.01 Equipment.

Reclaimer. A self-propelled rotary machine capable of cutting through material to depths equal to or greater than the planned lift thickness as specified in Contract Documents. The reclaimer shall be capable of pulverizing the material at a minimum width of 8 ft and mix water, dry additives, and the pulverized unbound materials into a homogenous mixture to the specified depth. The reclaimer shall be equipped with a computerized integral liquid proportioning system capable of regulating and monitoring the water application rate relative to depth of cut, width of cut, and speed.

The reclaimer shall have a mounted spray bar to allow the water to be injected directly into the cutting drum/mixing chamber.

The cutting drum must have the ability to operate at various speeds independent of the machine's forward speed to control oversized material and gradation. Perform inspection of the condition of the cutting teeth daily. Replace all worn and broken cutting teeth.

(a) Grading Equipment. A self-propelled motor grader capable of shaping the material to the line, grade, and cross section specified.

(b) Compaction Equipment. A vibratory pad-foot roller, pneumatic tire roller or double drum vibrator roller for breakdown compaction. Refer to 502.03.08.

(c) Spreader or Distributor. A non-pressurized mechanical vane-feed cyclone or screw type machine capable of providing a consistent, accurate and uniform distribution for applying stabilizing agents and additives. The spreader or distributor shall be capable of minimizing dust during construction.

(d) Water Trucks. Supply water to the reclaimer or construction operations.

502.03.02 Weather Restrictions.

(a) Temperature and Surface Conditions. Place CTB or CMS when the ambient air and surface temperatures are at least 40 F and rising. Do not place material on a frozen subgrade. Do not place CTB or CMS when temperatures are anticipated to be below 40 F within 3 days of the placement.

(b) Cold Weather Protection. Protect the completed CTB or CMS from freezing during the seven-day curing period.

(c) Precipitation. Any placement during precipitation shall be at Contractor's risk.

502.03.03 Subgrade Preparation for CTB. Complete the subgrade to line and grade at least 500 ft ahead before beginning construction.

Construct the foundation as specified in Section 204 and Section 208. If traffic or construction equipment are allowed to use the subgrade foundation or preceding layer, distribute the loading over the entire width of the course to aid in obtaining uniform and thorough compaction. Remove rutting by reshaping and recompacting the affected area as specified in Section 204.

502.03.04 Design Mix. The contractor shall submit a mix design report for laboratory testing along with soil and Portland cement samples for CTB or CMS from the proposed material sources at least 45 days prior to the start of construction for review and approval by Office of Materials Technology (OMT). Review and approval of the mix design by OMT will be based on OMT performing a mix design verification. The proposed material shall be sampled at the source of the material. Sample the materials as specified in the Material Quality Assurance Processes. If the proposed material source for soil is onsite, then obtain representative samples of the existing soil at least every 500 ft of the proposed CTB or CMS placement to develop the mix design in addition

to the above requirements. Do not include existing material from beneath the proposed depth in mix design testing.

The samples shall be analyzed and tested by an R-18 AASHTO laboratory accredited in the AASHTO Laboratory Test listed below. The AASHTO accredited laboratory shall be approved by OMT. Sampled material must be properly processed and prepared to closely simulate field conditions. The laboratory shall provide the following information as part of the design mix report to the Engineer:

(a) Location or Producer of the materials used in the mix design

(b) Laboratory Testing required:

(1) Sieve Analysis of Fine and Coarse Aggregates	AASHTO T27
(2) Particle Size Analysis of Soils	AASHTO T88
(3) Liquid Limit of Soil	AASHTO T89
(4) Plastic Limit of Soil	AASHTO T90
(5) Moisture-Density Relations of Soil-Cement Mixtures	AASHTO T134
(6) Laboratory Determination of Moisture Content of Soil	AASHTO T265
(7) Classification of Soils and Soil Aggregate Mixtures	AASHTO M145
(8) Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders	ASTM D1633-00

Design recommendations shall clearly show for each mix design: optimum moisture content, aggregate gradation and content (if additional aggregate is required), maximum dry density and the proper rate of application for Portland cement necessary to achieve the seven-day compressive strength (450 psi-700 psi for CTB) and (100 psi-300 psi for CMS) or other ranges determined by OMT. Make, cure and test unconfined compressive strength specimens in accordance with ASTM 1633, Method A.

The submitted design mix report shall include the design recommendations and all laboratory results/tests used to develop the recommendations. All component materials used in the design mix shall be representative of the materials proposed by the Contractor to be used on the Project.

If there is a change in source material of the CTB or CMS, submit materials from the proposed new material source to OMT for review and approval. Using the new materials, the contractor will determine a new or revised mix design for review and approval by OMT.

A new or revised mix design shall be required when unsatisfactory testing results or other conditions deem necessary. If the contractor for any other deemed reason makes any adjustments to the new or revised mix design, the contractor must submit a revised mix design for review and approval by OMT.

Construction shall stop and will only continue once the revised mix design has been approved by OMT.

Once the new or revised mix design is approved, then the Contractor may proceed with the control strip. The contractor may not proceed to the control strip without the mix design approval by OMT.

Approval of the mix design by the OMT is solely for monitoring quality control and in no way releases the Contractor from their responsibilities.

502.03.05 Control Strip. Construct a 500 ft long control strip to the specified lane width during the first day of production to verify that the construction process can meet the required gradation, spread rate for cement and the roller pattern needed to obtain the specified density requirement for the entire project. Placement shall not continue unless the control strip has been approved by OMT. Control strips that do not meet the requirements from the determined mix design shall be reworked, re-compacted, or removed and replaced at no additional cost. Use the same method and procedures for the entire project unless adjustments are required to the mix design. Any adjustments to the approved mix design will need to be re-submitted to OMT for review and approval and require a new control strip.

If the control strip has not yet been approved by OMT, the Contractor may proceed with the placement at their own risk. However, if the control strip is rejected by OMT, then the Contractor shall rework, re-compact, or remove and replace at no additional cost.

Meeting the requirements on the control strip does not relieve the Contractor from meeting the requirements on the entire project. Acceptance of the control strip will be based on obtaining the required design strength validated using the Falling Weight Deflectometer (FWD) testing.

For CTB, acceptance of the control strip will be based on the elastic modulus from FWD testing being equal to the designed elastic modulus subject to a minimum of 610 000 psi or as specified. Guidelines for FWD Testing will be according to the Material Quality Assurance Processes.

For CMS, acceptance of the control strip will be based on obtaining the required design strength validated using the Falling Weight Deflectometer (FWD) testing. The resilient modulus from FWD testing must be equal to the designed resilient modulus subject to a minimum of 4 500 psi and a maximum of 10 500 psi or as specified in the Contract Documents. Guidelines for FWD Testing will be according to the Administration’s Material Quality Assurance Processes.

502.03.06 Pulverization, Shaping, Stabilization. Pulverize the material to the depth and width as specified. Add water as necessary to control dust.

(a) Pulverize the material to ensure that the following gradation is met at the completion of moist mixing.

Sieve Size	Percent Passing for Soils
1-in.	100
No. 4	80 % minimum, exclusive of any gravel or stone. Gravel or stone shall be no more than 2-in. (50-mm) nominal maximum size.

(1) For CTB, refer to 901.01 for Graded Aggregate Base gradation requirements.

Protect any buried structures such as bridges, culverts, utilities, drainage pipes, etc. during pulverization and stabilization by stopping or raising the mixing drum at these obstructions if necessary. Repair any damage to these structures at no additional cost.

Do not pulverize more than can be completed in a work shift or in the event of precipitation, traffic or cold weather. Maintain a uniform driving surface free of ruts and surface irregularities. Repair any ruts and surface irregularities at no additional cost.

(b) Apply the cement at the established application rate according to the approved mix design using an approved spreader/distributor. Use MSMT 254 to verify the spread rate in the presence of the Engineer. The time from addition of cement placement to the start of mixing shall not exceed 30 minutes.

(c) Use a pressurized distributor to spray water to adjust the moisture content to at least optimum moisture content if necessary. Limit any variation in the moisture content of the material at the time of cement application to within two percent plus of optimum moisture.

(d) Compact and smooth the surface over its full width. Remediate unstable areas encountered below the depth of pulverization as directed by the Engineer. Remediation may consist of greater depths of cement treatment, excavation of unstable material and backfilling with cement stabilized material, and/or incorporation of drainage measures. Perform remediation work as extra work on a unit cost basis.

502.03.07 Grade or Finished Surface Control. Shape the surface of the CTB or CMS to the specified line, grade, and cross section. Maintain the finished grade within 1/2 in. from the established grade.

502.03.08 Compaction. Compact to a density of at least 97 percent of the maximum dry density according to T 134. Measure the in-place density according to MSMT 352. Furnish a compaction block as specified in 204.03.04.

For CTB, the compacted thickness of any one layer shall not be more than 8 in. The Engineer may approve increasing the compacted depth of a single layer of the CTB when vibrating or other approved types of compacting equipment are used. For in-situ CMS, the compacted thickness of any one layer shall be no more than 12 in. Keep the surface of the compacted material moist during multiple layer construction until covered with the next layer. Place and compact successive layers so that the required total thickness of the CTB or CMS is completed in the same shift.

Maintain the moisture in the mixture to within 2 plus percent of the specified optimum moisture at the start of compaction. Begin compaction no more than 20 minutes after mixing to within 2 plus percent of the specified optimum moisture. Complete all compaction operations within 2 hours from the start of the mixing operation.

Begin compaction operations at the sides of the course, except on superelevated curves. Overlap the shoulder or berm at least 1 ft and progress toward the center parallel to the center line of the roadway. Begin compaction on superelevated curves at the low side and progress toward the high side. Continue compaction operations until all compaction marks are removed.

Perform additional compaction if the density of an area is less than the required percentage of the target density. If additional compaction does not achieve the required percentage of the target density, adjust the moisture content and re-compact. Moisture correction on the nuclear gauge is required for validation of field density.

If the density is still below the required percentage of the Target Density but the CTB or CMS is otherwise acceptable as determined, define the area as a new control strip to establish a new Target Density. Take a minimum of five density tests at random locations to determine the average in-place density and to define the new Target Density. The other requirements, such as compressive strength, gradation, and moisture content, need to be verified by OMT on the new control strip. Repeat the control strip and Target Density development process if the uniformity of the mixture changes significantly as determined.

502.03.09 Construction Joints. Create a straight transverse construction joint at the end of each day's construction by cutting back into the completed work to form a vertical face. Build the base for large, wide areas as a series of parallel lanes of convenient length and width, complete with longitudinal joints as approved. Longitudinal joints between successive cuts shall overlap a minimum of 6 in. and transverse joints shall overlap a minimum of 2 ft.

502.03.10 Finishing. Complete placement within four hours of initial mixing. Material that is not fine graded and final rolled within four hours of initial mixing shall be reclaimed again with fresh cement at no additional cost.

502.03.11 Protection and Curing. Maintain the surface of the CTB or CMS in a moist condition after completion of final finishing until the emulsified asphalt is applied or by being kept continuously moist until the subsequent pavement layers can be placed with a water spray that will not erode the surface of cement treated base course. Apply emulsified asphalt if used for curing no later than 24 hours after completion of the finishing operations. Use distributing equipment as

specified in 503.03.01 to apply the emulsified asphalt at the rate of 0.2 gal/yd^2. Avoid ponding of the emulsified asphalt. Remove ponding using a sand blotter or an equivalent method as approved.

Allow the CTB or CMS to cure for a period of seven days. Close the CTB or CMS to all traffic, except for construction equipment as specified in 502.03.13, during this period unless otherwise approved. Repair damaged areas as directed.

502.03.12 Maintenance. Maintain the CTB or CMS until the layer above is placed. Replace unacceptable work that cannot be repaired to the full depth of the CTB or CMS.

502.03.13 Subsequent Pavement Layers. Subsequent pavement layers can be placed any time if CTB or CMS is sufficiently rolled to support the required construction equipment without rutting or shoving.

502.03.14 Quality Control Plan (QCP). Submit a Quality Control Plan (QCP) that contains the field-testing procedures and sampling frequency for cement content, density, moisture content, compaction, depth checks of cement treated base course, and remediation plan for areas that do not meet the requirements. The QCP plan shall also include a calibration report of the cement spreader that confirms the application rate of the cement (lbs/yd^2) and designate a Certified Soils and Aggregate Compaction Technician according to the Administration's Mid-Atlantic Region Technician Certification Program. The QCP shall be submitted to OMT-Soils and Aggregate Division for review and approval at least 30 days prior to construction. Do not begin construction until the QCP is approved by OMT.

The Certified Soils and Aggregate Compaction Technician shall be present at the job site during the placement of the CTB or CMS operations.

The Certified Soils and Aggregate Compaction Technician shall be responsible for the required field quality control sampling and testing. Deviations from the QCP shall be grounds for immediate suspension of the CTB or CMS operation. The technician shall perform sampling for quality control, acceptance, split sampling, and verification. Submit quality control test results to the Engineer. Maintain complete records of sampling, testing, corrective actions and quality control inspection results. Provide copies of the reports to the Engineer daily.

502.03.15 Quality Assurance (QA) and Final Acceptance. The Administration will perform independent QA sampling, testing and inspections according to the Material Quality Assurance Processes manual. Final Acceptance and frequency of QA testing will be according to the following:

(a) Mix Design

(b) Control Strip

(c) Field Compaction

(d) Depth Check and Consistency of pulverization

(e) Quality Control Plan

(f) Application Rate of Portland Cement

502.04 MEASUREMENT AND PAYMENT

Payment will be full compensation for control strips, falling weight deflectometer testing, pulverization, shaping, compaction, spreading stabilization additive, mixing, in-situ material, emulsified asphalt, water, quality control testing, hauling, setting of lines and grades where specified, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

502.04.01 Cement Treated Base Course will be measured and paid for at the Contract unit price per square yard.

502.04.02 Portland Cement for Cement Treated Base Course will be measured and paid for at the Contract unit price per ton.

502.04.03 Graded Aggregate Base for Cement Treated Base Course will be measured and paid for at the Contract unit price per square yard.

502.04.04 Select Borrow for Cement Treated Base Course will be measured and paid for at the Contract unit price per square yard.

502.04.05 Capping Borrow for Cement Treated Base Course will be measured and paid for at the Contract unit price per square yard.

502.04.06 Cement Modified Subgrade will be measured and paid for at the Contract unit price per square yard.

502.04.07 Portland Cement for Cement Modified Subgrade will be measured and paid for at the Contract unit price per ton as determined by the approved mix design.

CATEGORY 500
PAVING

SECTION 503 — CHIP SEAL SURFACE TREATMENT

503.01 DESCRIPTION

Apply one or two seal coats or a prime coat followed by one or two seal coats as specified. The seal coat consists of emulsified asphalt followed by an application of aggregate. The prime coat, when required, consists of preparing and treating an existing surface with emulsified asphalt.

503.02 MATERIALS

MATERIAL	SECTION	APPLICATION	SIZE OR GRADE	SPREAD RATE lb/yd²	SPRAY TEMP F	SPRAY RATE SINGLE COAT OR FIRST COAT gal/yd²	SPRAY RATE FOR SECOND COAT (Double) gal/yd²
Aggregate	901	Single or First Coat	No. 7	25-50	—	—	—
		Second (Double Coat)	No. 8	20-35	—	—	—
Emulsified Asphalts	904.03	Seal Coat	CRS-1	—	70-140	0.3-0.5	0.2-0.4
			CRS-2	—	140-160	0.3-0.5	0.2-0.4
			RS-1	—	70-140	0.3-0.5	0.2-0.4
			RS-2	—	140-160	0.3-0.5	0.2-0.4

503.03 CONSTRUCTION

At least 30 days prior to the start of placement of the chip seal surface treatment, submit a proposed plan, including equipment and material sources, for approval.

Protect the treated pavement against damage from all causes. Repair or replace damaged areas as directed.

503.03.01 Equipment. All equipment is subject to approval.

(a) Asphalt Distributing Equipment. This equipment shall be inspected and calibrated by the Administration prior to use and shall bear a current Administration inspection

and calibration tag. A calibration chart showing the total capacity in gallons of the distributor tank, and the fractional capacity for each 1/4 in. of tank depth, shall be carried in the unit. The unit shall be capable of uniformly applying the specified material on variable widths of surface at the rates specified in 503.02. In addition, the equipment shall include the following:

(1) A fifth wheel tachometer for maintaining uniform speed.

(2) A thermometer graduated in 2 F increments to determine the specified temperature ranges.

(3) Heaters for uniformly heating the materials to the proper temperatures.

(4) Full circulation spray bars that are laterally and vertically adjustable, plus a hand spray.

(5) A calibrated tank to determine the quantity of asphalt in each load and the amount used.

(6) A valve or petcock built into the equipment for sampling the asphalt.

(7) A motor driven pump with pressure gauges to deliver the material to the spray bars. When a variable speed pump and metering system is used, provide charts prepared by the manufacturer for selecting the proper pump speed for each application.

(b) Aggregate Spreader. Use equipment that is either self-propelled or attached to a truck tailgate.

(c) Rollers. Refer to 504.03.01 Rollers.

503.03.02 Weather Restrictions. Place when the ambient air and surface temperatures are at least 50 F and rising and the pavement is clean and dry. When weather conditions differ from these limits, placement of material en route from the plant to the job site shall be at the Contractor's risk. When the Engineer stops placement of the material, dispose of all material en route at no additional cost to the Administration.

503.03.03 Foundation Preparation. Construct the foundation as specified. When paving over existing pavement, repair ruts and potholes to provide a smooth surface for the application of the chip seal surface treatment.

503.03.04 Prime Coat. Prior to the application, clean the surface of all loose and foreign materials. Uniformly apply the prime coat to the surface at the application rate specified in 503.02. Remove pooled material before applying the next coat.

503.03.05 First Seal Coat.

(a) No sooner than 24 hours after the application of the prime coat, spray emulsified asphalt on the surface at the application rate specified in 503.02.

(b) Immediately following this asphalt application, spread a dry, dust free aggregate on the surface at the application rate specified in 503.02. Remove excess aggregate, and correct all areas containing insufficient aggregate.

503.03.06 Rolling. Immediately following the aggregate application, roll the surface until the aggregate is uniformly embedded into the asphalt. Discontinue rolling if the aggregate begins to crush.

503.03.07 Second Seal Coat. When specified, after the first seal coat has cured at least 24 hours, apply a second seal coat to the surface, omitting the prime coat. Apply emulsified asphalt and aggregate at the application rate specified in 503.02. Remove excess aggregate and correct all areas containing insufficient aggregate. Roll the surface as specified in 503.03.06.

503.03.08 Traffic. Close completed sections to traffic until the final seal coat has completely cured. Maintain the treated surface after it has been opened to traffic until final acceptance.

503.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for the foundation preparation, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Chip Seal Surface Treatment will be measured and paid for at the Contract unit price for one or more of the items listed below.

503.04.01 No. 7 Aggregate for Single Coat Chip Seal Surface Treatment per ton.

503.04.02 No. 8 Aggregate for Second Coat Chip Seal Surface Treatment per ton.

503.04.03 Emulsified Asphalt for Seal Coat per gallon.

The actual number of gallons of emulsified asphalt distributed will be corrected to the corresponding volume at 60 F as determined by use of conversion tables furnished by the Administration.

CATEGORY 500
PAVING

SECTION 504 — ASPHALT PAVEMENT

504.01 DESCRIPTION

Construct Asphalt Pavement.

504.02 MATERIALS

Performance Graded Asphalt Binders	904.02
Tack Coat	904.03
Asphalt Mixes	904.04
Crack Sealer	911.01
Production Plants	Section 915

504.03 CONSTRUCTION

Quality Control Plan. Submit a Plant Quality Control Plan and a Field Quality Control Plan (QCP) at least 30 days prior to placement of any asphalt pavement. Submit the Plant QCP to the Office of Materials Technology (OMT) for approval. Submit the Field QCP to the District Engineer for approval. The Plans shall contain a statistically based procedure of random sampling and show methods proposed to control the equipment, materials, production, and paving operations. Discuss the QCP requirements in the pre-construction, pre-pave and progress meetings.

The Plant and Field QCP shall contain:

(a) Name and location of asphalt production plants,

(b) Laboratory and field personnel qualifications,

(c) Inspection and record keeping methods, and

(d) Minimum frequencies of sampling and testing.

Use the Quality Control Plans for Plants Template to address all requirements necessary for plant quality control and plant approval.

Corrective actions will be taken for unsatisfactory construction practices and deviations from the Contract Documents.

Plan Administrator and Certified Technicians. The QCPs shall designate a Plan Administrator who shall have full authority to institute any action necessary for the successful implementation of the Plan. The Plan Administrator may supervise the QCP on more than one project if that person can contact the job site within one hour after being notified.

The QCP shall also designate a Certified Asphalt Plant Technician – Level 2, a Certified Asphalt Field Technician, a Certified Inertial Profiler Operator, a Certified Asphalt Plant Technician – Level 1, or Trainee Technicians according to the Mid-Atlantic Region Technician Certification Program (MARTCP) and the Maryland Technician Certification Program.

A Certified Plant Technician shall be present at the plant during asphalt production and shipment unless otherwise approved in the Plant QCP. The technician shall perform quality control sampling, testing and documentation as specified.

A Certified Field Technician shall be present at the job site unless otherwise approved in the Field QCP. The technician shall be responsible for the required field quality control sampling and testing. Deviations from the QCP shall be cause for immediate suspension of production and paving operations.

The Certified Technicians shall perform sampling for quality control, quality assurance, acceptance, split sampling, and verification. Submit quality control test results to the Engineer.

MARTCP-Certified Technicians found deficient in their duties will have their certification(s) rescinded, as determined. Replace the deficient technician with a certified technician before resuming production and paving operations.

Records. Maintain complete records of sampling, testing, corrective actions and quality control inspection results. Provide copies of the reports upon request.

Maintain linear control charts or use other types of control charts (such as standard deviation or range), as approved. Control charts may be maintained by production, by mix, or by mix per project. Maintain the control charts in the quality control laboratory per the QCP. The control charts shall identify the mix design number, each test result, and the upper and lower limits specified for each test. Retain all original Quality Control worksheets for five years.

Quality Assurance (QA). The Administration will perform independent QA sampling, testing and inspections. QA consists of the following:

(a) Periodically observe the performance of Quality Control (QC) or QA testing,

(b) Monitoring control charts,

(c) Directing the sampling of mixes behind the paver prior to compaction,

(d) Directing the sampling of mixes at the plant site,

(e) Directing the sampling of cores taken from the compacted pavement,

(f) Monitoring conformance with the approved QCP(s), and

(g) Quality control sampling and testing procedures and quality control sampling and testing equipment will be evaluated according to the Independent Assurance (IA) program.

504.03.01 Equipment. All production and paving equipment will be subject to approval. Ensure the plant is ready for inspection as specified in 915.01.02.

Hauling Units. Refer to 915.02(f).

Pavers. Pavers shall be equipped with a means of preventing the segregation of the coarse aggregate particles when moving the mix to the paver augers. The means and methods used may consist of chain curtains, deflector plates, or other such devices, or any combination of these according to the manufacturer's recommendations. Demonstrate that modifications to the paving equipment have been implemented on all pavers prior to use on the project.

Use a self-contained, self-propelled unit for mainline paving. Inspection and approval will be based upon the manufacturer's recommendations. The paver shall:

(a) Produce a finished surface of the required smoothness and texture without tearing, shoving, or gouging the mix.

(b) Be operated in a manner which delivers a homogeneous mix the full width of the pavement.

(c) Have automatic controls capable of maintaining the grade and transverse slope within the required tolerances set forth in the contract documents.

(d) Use auger extensions to maintain a distance no greater than 18 in. from the end of the auger to the end gate when screed extensions are used.

Provide reference lines or other approved markings to control the horizontal alignment.

Manual operation will be permitted to make grade changes for constructing irregularly shaped and minor areas.

The equipment may be operated manually for the remainder of the workday if a malfunction of any automatic control occurs, as directed.

Safety Edge Magnetic Protractor. Safety edge magnetic protractor shall have increments of 0 degrees to 90 degrees in four quadrants, with a minimum 4 in. lens diameter and two level vials.

Rollers. Rollers shall be self-propelled, reversible, and steel wheeled or pneumatic tired. Inspect all rollers and present them for approval before use. Rollers shall be operated:

(a) In conformance with the manufacturer's recommendations.

(b) In a manner that does not damage the pavement.

(c) In a manner that delivers the optimal combination of density and ride requirements.

(d) In a manner that protects bridge decks. Do not use rollers in vibratory mode when paving bridge decks.

504.03.02 Weather Restrictions. Place mixes used as the final surface when the ambient air and surface temperatures are at least 40 F. Ensure that surfaces to be paved are clean and dry before paving, as approved.

(a) Place mixes used as intermediate and base layers when the ambient air and surface temperatures are at least 32 F.

(b) Place polymer-modified surface mixes when the ambient air and surface temperatures are at least 50 F.

(c) When it begins raining while the work is underway, material en route from the plant may be used at risk.

(d) The Administration reserves the right to perform any testing necessary to ensure the quality of the pavement.

(e) All additional testing and associated costs, including maintenance of traffic, will be at no cost.

If material placement is halted due to weather conditions, waste all material en route at no additional cost.

Do not place asphalt on a frozen graded aggregate base.

504.03.03 Foundation Preparation. Construct the foundation as specified prior to paving. Place crack seal and mastic as specified in Section 510. Remove excess crack sealer and patch material before paving over existing pavement. Clean, tack coat, fill with asphalt, and tamp spalls and potholes before paving. Adjust to grade manholes, valve boxes, inlets, and other construction appurtenances within the area to be paved as directed.

504.03.04 Tack Coat. Ensure the surface is dry and thoroughly cleaned by a power broom and/or air blowing prior to application. Apply the tack coat by uniformly covering the entire surface to be paved using an application rate of 0.04 gal/yd^2 to 0.10 gal/yd^2 or as directed by the Contract documents. Allow the tack coat time to thoroughly break and set.

504.03.05 Non-Tracking Tack Coat (NTTC). The Manufacturer shall supply a QCP for the NTTC detailing the handling and application procedures according to PP71-11, and test results from an independent, accredited laboratory for shear and tensile strength.

(a) Sample the NTTC as directed and submit to OMT's Asphalt Technology Division. All samples will be tested against the manufacturer's specifications. Material out of compliance will not be accepted for use.

(b) Use equipment to heat and apply the NTTC at an application temperature range that conforms to the manufacturer's recommendations. Apply the NTTC as specified in 504.03.02 and as directed.

(c) Apply the NTTC uniformly with a pressure distributor. Use hand spraying equipment only in areas inaccessible to the pressure distributor. Apply the NTTC using an application rate of 0.05 gal/yd^2 to 0.10 gal/yd^2 and do not dilute with water. The quantity, rate of application, temperature, and areas to be tacked shall be approved prior to application.

(d) Do not clean or discharge the tack coat distributor into ditches, onto shoulders or along the right of way. Park the distributor so the spray bar will not drip NTTC onto the surface of the traveled pavement.

(e) Exclude all traffic from sections treated with NTTC until the tack has cured and will no longer track onto adjacent non-treated areas. Adjacent pavement surfaces shall show minimal visible evidence and pavement markings shall show no visible evidence of tracking.

504.03.06 Asphalt Placement. Delivery and placement of the asphalt should be continuous. Place the asphalt while the temperature is at least 225 F, or as specified in the Field QCP. Place the asphalt with a paver that conforms to 504.03.01. Do not broadcast loose mix over the new surface.

504.03.07 Compaction. Roll the asphalt immediately after placement and compact to the proper in-place density and ride smoothness. Incentive or disincentive price adjustment for density will be as specified in 504.04.02. Use steel wheel rollers for the first rolling of all joints and edges, the initial breakdown rolling, and the finish rolling. Use a power driven trench roller when base widening is too narrow to permit the use of conventional rollers.

Construct an earth berm or shoulder against the loose asphalt as soon as it is placed. The trench must be excavated wider than the proposed width. Roll and compact the two materials simultaneously.

No traffic is permitted on the pavement after rolling until it has cooled to less than 140 F. Roller marks shall not be visible after rolling operations.

504.03.08 Joints. Construct joints as directed and as follows:

(a) Stagger longitudinal and transverse joints in successive courses so that one is not directly above the other.

(b) Stagger transverse joints by the length of the paver.

(c) Stagger longitudinal joints at least 6 in. and arrange so that the longitudinal joint in the top course is within 6 in. of the line dividing the traffic lanes.

(d) Construct joints in a manner that provides a continuous bond between the old and new surfaces.

(e) Overlap the existing pavement 1 in. to 1.5 in. when constructing longitudinal joints adjacent to existing asphalt pavements.

(f) The initial longitudinal roller pass shall be on the uncompacted hot mat and 6 in. to 1 ft from the joint. The successive roller pass shall compact the overlapped material and the 6 in. to 1 ft material simultaneously.

(g) Apply tack coat to joints as directed. Cut back the edge of the existing pavement for its full depth at transverse joints when placing a surface course and apply tack coat material as directed.

(h) Apply tack coat to all contact surfaces before placing the mix against curbs, gutters, headers, manholes, etc.

504.03.09 Edge Drop-off. When paving highways carrying traffic:

(a) Match all compacted pavement courses exceeding 2-1/2 in. in depth with the abutting lane or shoulder on the same working day.

(b) For compacted pavement courses of 2-1/2 in. or less are placed, use the option of paving the abutting lane or shoulder on alternate days.

(c) Pave all abutting lanes or shoulders prior to weekends and temporary shutdowns.

(d) Place advance warning traffic control devices as specified in Section 104 where uneven pavement joints.

504.03.10 Tie-In. When paving highways carrying traffic:

(a) Construct a temporary tie-in at least 4 ft in length for each 1 in. of pavement depth when the posted speed $\leq$ 40 mph.

(b) Construct a temporary tie-in at least 10 ft in length for each 1 in. of pavement depth when the posted speed > 40 mph.

(c) Construct temporary tie-ins before traffic is allowed to cross the transverse joint.

(d) Construct temporary tie-ins 10 ft or greater using a paver meeting 504.03.01.

(e) Remove a transverse portion of the existing pavement at the final tie-in point to maintain the design thickness of the final surface course.

(f) Construct the final tie-in to a length equal to the posted speed per 1 in. depth of the design thickness of the final course, with a length of at least 25 ft per 1 in. depth and a maximum length of 50 ft per 1 in. depth.

504.03.11 Mix Sampling & Testing. Mix sampling and testing for Quality Control (QC) is the responsibility of the Producer or Contractor. Identify the QC sampling locations in the Field QC Plan (plant or project site). Perform Quality Assurance (QA) sampling as directed and witnessed by the Administration. Obtain QA samples from behind the paver prior to compaction. The Administration will perform all QA testing.

(a) QC Sampling at the Plant. Refer to MSMT 457. The Engineer will retain all random sampling documentation. The producer shall sample the mix at the plant. The sample shall be obtained or witnessed by the certified technician. QC plant mix sample results shall not be used in the pay factor calculation. Submit the results to the Administration and identify as Plant samples.

(b) QC Sampling at the Project Site. Refer to MSMT 457. QC and QA samples shall not be split samples. The certified technician shall sample the mix at the project site. Sampling will be witnessed by the Administration.

(1) A mix lot constitutes all sublots of a mix created during the production of required tonnage for a lot.

(2) A mix sublot size should not exceed 1000 tons.

(3) A sublot size up to 200 tons can be combined with the previous 1000 ton sublot placed on the same day.

(4) A new lot number for a mix will be given when there is a change in the approved job mix formula.

(5) QC project site mix sample results may be used in the pay factor calculation.

(c) QA Sampling at the Project Site. Refer to MSMT 457. Sample mixes at the project site as specified.

(1) Obtain the samples from behind the paver prior to compaction. Documentation of random sampling shall be retained by the Engineer.

(2) The Contractor's Certified Technician shall sample the mix at the project site as witnessed by the Administration.

(3) The Administration will take possession of the QA samples and deliver to the Laboratory for testing.

(4) A mix sublot size should not exceed 1000 tons. A sublot size up to 200 tons can be combined with the previous 1000 ton sublot placed on the same day. A mix lot constitutes all sublots of a mix created during the production of required tonnage for a lot. A new lot number for a mix will be given when there is a change in the approved job mix formula.

(d) Mix Acceptance Determination. Obtain at least three behind the paver mix samples per acceptance lot for mix acceptance determination. An acceptance lot size is approximately equal to 6000 tons of mix per project. A mix acceptance lot ends on the day when 6000 tons is reached.

(1) QC and QA results from behind the paver will be compared based on the F-test and t-test methods according to MSMT 733 for each pay factor property.

(2) When F-test and t-test method results indicate a QC and QA pay factor property is not from different populations, QC and QA results will be combined to calculate the mix pay factor property according to MSMT 735 and 504.04.02.

(3) When F-test and t-test method indicate a QC and QA pay factor property is from different populations, the pay factor property will be determined using QA results only.

(4) The Administration will determine the acceptance evaluation procedure when less than three QA samples are obtained for an acceptance lot. The results will be made available within five working days.

504.03.12 Sampling & Testing for Density Determination. Refer to MSMT 457. Random core sampling locations will be selected for each sublot as specified. Sample the QC and QA cores in the presence of the Engineer. Cut 4 in. or 6 in. cores for mixes smaller than 25 mm and 6 in. cores for mixes 25 mm and larger.

A density lot is defined as a day's paving per mix. A sublot shall not exceed 500 tons. A paving day shall begin with a new lot and sublots. The Engineer shall witness the random location coring. At the end of the day's paving, the Engineer will designate one randomly selected core sublot set for QC and one for QA. The Engineer will note specific reasons for any density waivers and submit the proper forms to the Administration.

(a) Quality Control for Density. The density of the core samples will be expressed as a percentage of the maximum specific gravity of the mixture for each lot's placement.

The maximum specific gravity will be determined in accordance with T 209 and the core's percent density will be expressed to the nearest 0.1 percent.

If more than one mix sample is obtained per day's placement, an average of all maximum specific gravity tests for the day will be used for the determination of percent density of each core sample. The QC Laboratory will make results of individual days paving available to the Engineer and the Contractor no later than the next working day. Retain core samples until notified of the results of the F & t test.

(b) Quality Assurance for Density. The Engineer will take possession of the core samples and deliver the cores to the Administration's Laboratory for testing. The density of the core samples will be expressed as a percentage of the maximum specific gravity of the mixture for each lot's placement. The maximum specific gravity will be determined in accordance with T 209 and the core's percent density will be expressed to the nearest 0.1 percent.

(1) If more than one mix sample is obtained per day's placement, an average of all maximum specific gravity tests for the day will be used for the determination of percent density of each core sample. The Laboratory will make results of individual days paving available to the Engineer and the asphalt Producer within five working days.

(c) Acceptance. Each asphalt density lot will be evaluated for compliance using the Engineer's quality assurance test data and the Contractor's QC data. The QC and QA core specific gravity data will be analyzed in conformance with MSMT 733 (F-test and t-test method).

(1) If test results are determined to be from the same population, QC and QA sublot results will be averaged to calculate the density pay factor as specified in 504.04.02.

(2) If results are determined not to be from the same population, the pay factor will be calculated using QA sublot results only. The average QC maximum specific gravity test results and the average project site behind the paver QA maximum specific gravity test results shall be compared.

(3) If QC results and QA results compare within 0.026, the average of the combined QC and QA results shall be used to calculate each core density. If they do not compare within 0.026, QA maximum specific gravity results shall be used to determine each core density.

(4) Pay reduction or incentive for the pavement compaction lot will be calculated as specified in 504.04.02. Statistical outliers will be determined according to MSMT 734.

(5) An asphalt density lot size shall equal one paving day's production per mix. A lot shall be divided into a minimum of five equal sublots. A sublot shall not be greater than 500 tons. When a paving day's production per mix is greater than 2500 tons, then each sublot size shall be 500 tons or fraction thereof.

Acceptance on projects requiring less than 500 tons of asphalt or when asphalt is used in non-traffic areas or on bridge decks will be determined with a thin layer density gauge used according to the manufacturer's recommendations.

504.03.13 Thin Lifts and Wedge/Level Courses. If an asphalt course is determined to be a thin lift in accordance with the "Thin Lift Mix Design Identification Table" in 904.04.07, construct a 400 ft to 500 ft control strip on the first day of paving to determine optimum pavement density.

(a) Use a thin-lift nuclear or non-nuclear asphalt density gauge in accordance with the manufacturer's recommendations to take readings from the control strip in five random locations to determine roller patterns and the number of passes needed to obtain optimum density. Optimum density is defined as when the average density does not change by more than 1.0 percent between successive roller passes and the percent density is between 90.0 and 97.0.

(b) Core the 5 random gauge reading locations to verify the gauge calibration and to determine the percent pavement density. The cores will be tested by the contractor's QC laboratory and results will be verified by the Office of Materials Technology. The QC/QA cores will be saved by the contractor and made available to the Administration for retesting 10 days past after the paving date or as directed.

(c) On the first day of paving, the target optimum density will be determined using the density gauge readings from the control strip; verified by the core results. The lot average density from the five control strip cores will be used as the target optimum density.

(d) Take a minimum of 10 QC/QA gauge readings daily from random locations per day's paving per mix or 2 per 500 tons of paving per mix; whichever yields the higher frequency of locations. A density lot is defined as a day's paving per mix. A sublot shall not exceed 500 tons. A paving day shall begin with a new lot and sublots.

(e) Any lot average 2.0 percent or more below optimum and below 92 percent shall require a new control strip to be constructed, tested and approved before paving continues.

(f) Take 2 QA cores daily when production is in excess of 500 tons per location, or when successive days of less than 500 tons production totals 1000 tons or greater. If the average of the 2 density gauge readings and the average of the two respective QA core densities are within 3.0 lb/ft^3, the Administration will accept all the daily density gauge readings. If they do not compare within 3.0 lb/ft3, construct a new control strip and recalibrate the density gauge.

(g) Wedge/Level courses placed at variable thicknesses and any area greater than 3/4 in. shall be tested and accepted in accordance with this Thin Lift specification. Density incentives are not applicable for Thin Lift or Wedge/Level Courses. Apply mix pay factors as determined by the Engineer and the Contractor at the Pre-pave meeting.

504.03.14 Control Strip. When mixes are not determined to be Thin Lifts as specified in 504.03.13, use the option of constructing a control strip for guidance in determining roller patterns. Construct the control strip on the first workday in which asphalt is placed between 400 ft and 500 ft in length. Remove any control strip, if necessary and as determined at no additional cost.

The construction of a control strip may be required at any time during placement of asphalt based on the evaluation of compaction results, as determined.

504.03.15 Pavement Surface Checks. Ensure an approved 10 ft straightedge is available at all times. The surface of each pavement course shall be true to the established line and grade after final compaction of each course. The surface shall also be sufficiently smooth so that the surface does not deviate more than 1/8 in. when the straightedge is placed parallel to the centerline. The transverse slope of the finished surface of each course shall not deviate more than 3/16 in. when the straightedge is placed perpendicular to the centerline.

Check transverse joints using the straightedge immediately after the initial rolling. When the surface of each course varies more than 1/8 in. from true, make immediate corrections so the finished joint surface is within tolerance.

Areas that are tested and reported as specified in Section 535 – Pavement Surface Profile in the Contract Documents are not applicable to 504.03.15.

504.03.16 Curbs, Gutters, Etc. Construct permanent curbs, gutters, edges, and other supports as shown and as specified, then backfill prior to placing the asphalt.

504.03.17 Shoulders. Construct shoulders as specified. Shoulders abutting the asphalt surface course of any two-lane pavement being used by traffic shall be completed as soon as possible after placement of the surface course on that lane.

504.03.18 Pavement Profile. Refer to Section 535 in the Contract Documents.

504.03.19 Safety Edge. Construct a sloped edge on the pavement shoulder of open section roadways using a device attached to the paver that constrains the asphalt head to produce a compacted profile. The device shall adjust to accommodate varying paving thicknesses. The device shall be capable of being detached or raised when not in use.

Construct a safety edge when the individual thickness is at least 1.5 in. or greater. The target range of the slope shall not be greater than 45 degrees when measured from the horizontal axis. Construct the sloped edge of multiple lifts on the top two pavement lifts when specified. Construct the entire sloped edge on underlying pavement.

(a) Use the safety edge as a standard treatment for the outside edge of all open section roadways with shoulders up to 6 ft wide.

(b) Do not use the safety edge when the resulting travel lane is less than 11 ft wide.

(c) Using the safety edge magnetic protractor, record 10 angle readings per mile in the presence of the Engineer. Readings will be witnessed by the Engineer and the results will be documented on Form OOC-91 by the Contractor for the project files. The performance criteria target is for 90 percent of the readings to fall below 45 degrees.

(d) The safety edge does not replace the requirements in Section 609.

504.04 MEASUREMENT AND PAYMENT

Asphalt pavement will be measured and paid for at the Contract unit price per ton. The payment will be full compensation for furnishing, hauling, placing all materials including anti-stripping additive, tack coat, control strip, pot hole and spall repairs, setting of lines and grades where specified, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Temporary Tie-Ins. Placement and removal of the temporary tie-in where asphalt is being applied to the traveled way carrying traffic will not be measured but the cost will be incidental to the pertinent asphalt item.

Removal of the existing pavement or structure for the final tie-in will be measured and paid for at the Contract unit price for the pertinent items used. The asphalt for the final tie-in will be measured and paid for at the Contract unit price for the pertinent Asphalt item.

Adjustments. Adjustment of existing visible manholes, valve boxes, inlets, or other structures will not be measured but the cost will be incidental to the asphalt item. Adjustment of existing manholes, valve boxes, inlets, or other structures that are encountered below the existing grade will be considered for payment in conformance with GP-4.07.

Removal of Existing Raised/Recessed Pavement Markers. Removal of existing raised/recessed pavement markers will not be measured but the cost will be incidental to the asphalt item. Removal of existing raised/recessed pavement markers that are encountered below the existing pavement will be considered for payment in conformance with GP-4.07.

504.04.01 Price Adjustment for Asphalt Binder. A Price Adjustment (PA) will be made to provide additional compensation to the Contractor or a credit to the Administration for the fluctuation in the cost of asphalt binder.

For adjustment purposes, the prevailing base index price will be the price specified for PG 64-22 (PG64S-22) at time of bid opening. Cost differentials between PG 64-22 (PG64S-22) and a binder specified shall be included in the price bid per ton for Asphalt. A historical database will be maintained by the Administration.

The PA will be made when the index price for the month of placement increases or decreases more than 5 percent of the prevailing base index price. Computations will be as follows:

Percent Change = ((Pp – Pb)/ Pb) X 100

PA = T x Q x ((Pp – (D x Pb))

Where:

PA= Price Adjustment for the current month

T = Design target asphalt content expressed as a decimal

Q = Quantity of asphalt placed for the current month

Pp = Index price for PG 64-22(PG64S-22) asphalt binder per ton for the month of placement

D = 1.05 for increases over 5 percent; 0.95 for decreases over 5 percent

Pb = Prevailing base index price for PG 64-22 (PG64S-22) asphalt binder per ton

PA resulting in increased payment to the contractor will be paid under the item Price Adjustment for Asphalt Binder. The item amount will be established by the Administration and shall not be revised by the Contractor. PA resulting in a decreased payment will be deducted from monies owed the Contractor.

504.04.02 Payment Adjustments for Asphalt Mix and Pavement Density. Payment adjustments for pavement density will be based on individual sublot core test data for a given lot and the lot average density as specified in this section and Table 504A. Payment reductions for density and for mix will be made by adjusting the payment for Asphalt. Incentive payments will be made using the Contract items for Asphalt Mix and Pavement Density. The item amounts established by the Administration shall not be revised. Payment reductions for density will be waived for portions of the pavement where a poor foundation is determined as the cause for inadequate density.

TABLE 504A		
Dense Graded Asphalt Mixes — Percent of Maximum Density		
Lot Average % Minimum	*No Individual Sublot Below %**	*Pay Factor (DF)*
94.0	94.0	1.050
93.8	93.7	1.045
93.6	93.4	1.040
93.4	93.1	1.035
93.2	92.8	1.030
93.0	92.5	1.025
92.8	92.2	1.020
92.6	91.9	1.015
92.4	91.6	1.010
92.2	91.3	1.005
92.0	91.0	1.000
91.8	90.8	0.990
91.6	90.6	0.980
91.4	90.4	0.970
91.2	90.2	0.960
91.0	90.0	0.950
90.8	89.8	0.940
90.6	89.6	0.930
90.4	89.4	0.920
90.2	89.2	0.910
90.0	89.0	0.900
89.8	88.8	0.890
89.6	88.6	0.880
89.4	88.4	0.870
89.2	88.2	0.860
89.0	88.0	0.850
88.8	87.8	0.840
88.6	87.6	0.830
88.4	87.4	0.820
88.2	87.2	0.810
88.0	87.0	0.800
Less than 88.0	87.0	0.750 or rejected by Engineer

Note 1: Lots with test data above 97.0 may be rejected. Lots that are accepted will receive a pay adjustment in accordance with the following:

(a) When the density lot average is above 97.5, the pay factor = 75 percent

(b) When 3 sublot densities are above 97.0, the pay factor = 95 percent

(c) When 4 or more sublot densities are above 97.5, the pay factor = 75 percent

Note 2: Pay incentive or pay disincentive will not be paid for placements identified as wedge/level courses or thin lift courses.

Note 3: When the Contractor's core specific gravity data does not compare with the Administration's core specific gravity data, only the Administration's single sublot values and lot average value will be used in acceptance decision.

Note 4: The average sublot values and the lot average will be used in acceptance decision.

Lots in conformance will be accepted as specified in Section 904 and Section 915, and MSMT 735. A composite pay factor (CPF) for Asphalt content and gradation will be based on the total estimated percent of the lot that is within specification limits using the quality level analysis.

Payment adjustments will be computed as follows:

Density Lot Payment Adjustment = (DF - 1)x(AP)x(TL)

Mix Design Lot Payment Adjustment = (MF - 1)x(AP)x(TL)

Where:

MF = Mixture pay factor [0.55 + (0.5 x CMPWSL)]

Refer to MSMT 735 for CMPWSL.

DF = Density pay factor from Table 504A.

AP = Adjusted/applicable unit price as specified in 504.04.01.

TL = Applicable tonnage per lot.

(a) A lot containing material with a pay factor of less than 1000 may be accepted at the reduced pay factor if the pay factor is at least 0.800 and there are no isolated defects.

(b) A lot containing material with a pay factor of less than 1000 may be accepted at the reduced pay factor provided the composite pay factor for asphalt content and grading is at least 0.750, and there are no isolated defects.

(c) An in-place density lot containing nonconforming material that fails to obtain at least a 0.800 pay factor and a mixture lot containing nonconforming material that fails to obtain at least a 0.750 pay factor for asphalt content and gradation will be evaluated to determine acceptance. Lots that are rejected shall be replaced.

(d) Lots with less than five Quality Control or Quality Assurance samples per in-place density lot will not be evaluated for incentive payment.

(e) When less than three mix samples have been obtained at the time of the acceptance sampling or at the time a lot is terminated, the Engineer will determine if the material in a shortened lot will be considered a part of the previous lot or whether it will be accepted based on the individual test data.

504.04.03 Dispute Resolution. Refer to 915.02.03.

All work associated with the construction and angle measurements of the safety edge will not be measured but the cost will be incidental to the pertinent asphalt pavement item. The labor, equipment, and recordation of the angel measurements of the Safety Edge will not be measured for payment and will be incidental to the pertinent asphalt pavement items. All asphalt materials used in the creation of the pavement edge will be included in the measured tonnage related to the pertinent asphalt pavement item and will be eligible for all related adjustments, disincentives, and incentives. Shoulder backup material will be measured and paid for as specified in Section 609.

CATEGORY 500
PAVING

SECTION 505 — ASPHALT PATCHES

505.01 DESCRIPTION

Repair rigid, flexible, or composite pavements by removing part or all of the section of the existing pavement and replace with asphalt paving material. The locations and extent of the repairs will be as specified or as directed.

Partial Depth Patching (PDP). PDP consists of removing areas of unsound pavement up to 50 percent of the pavement thickness and replacing with an asphalt mix. The pavement thickness is defined as the thickness of all bound materials in the pavement structure including asphalt mix, Portland cement concrete (PCC), and any other asphalt or cement modified material.

Full Depth Patching (FDP). FDP consists of removing the full thickness of the pavement sections to the top of the aggregate base and replacing with an asphalt mix. Perform FDP whenever more than 50 percent of the pavement thickness requires repair.

505.02 MATERIALS

Graded Aggregate Base	901.01
Aggregates for Asphalt Mixes	901.01
Performance Graded Asphalt Binders and Asphalt Mixes	Section 904
Crack Sealer	911.01
Production Plants	Section 915
Cold Patch Material	Section 924

505.03 CONSTRUCTION

Keep disturbance of the base material to a minimum. The faces of the remaining pavement shall be square and vertical without ragged edges. Do not use equipment that could damage the existing pavement.

505.03.01 Weather Restrictions. Refer to 504.03.02.

505.03.02 Existing Pavement. Complete all repairs on the same day in which excavation is completed. Do not leave open excavated areas at the end of the workday.

505.03.03 Removal of Pavement for PDP. Remove existing pavement by milling, grinding, or saw cutting to the specified depth. Maintain square vertical faces after removal.

(a) If concrete is encountered during removal, limit the depth of the patch to the top elevation of the PCC.

(b) For PDP of composite pavements, protect the PCC from damage during removal of the asphalt mix.

(c) When the material at the bottom of the PDP is determined to be unsuitable, remove the unsuitable material until sound material is encountered.

(d) When any PCC present in a composite pavement is determined to be unsuitable, follow the removal and replacement procedures for a FDP.

(e) Remove all loose and foreign materials before placing the patch, then treat all spalled cracks and joints by tack coating, filling and tamping with asphalt.

505.03.04 Removal of Pavement for FDP. Make a perpendicular saw cut full depth around the perimeter and remove the existing pavement to the top of the aggregate base. Refer to 522.03.03 for the concrete portion of a composite pavement. Maintain square vertical faces after saw cutting.

505.03.05 Base and Subgrade Preparation. The aggregate base of the FDP area will be evaluated to determine its suitability.

(a) When the aggregate base is determined to be unstable, compact it as specified in 501.03.08.

(b) When no aggregate base is present, construct the subgrade foundation as specified in Section 208 or as directed.

(c) Removal of Unsuitable Material:

(1) When the aggregate base or subgrade material is unsuitable, remove and dispose of the unsuitable material.

(2) Replace the unsuitable material with graded aggregate base conforming to Section 501.

(3) Compact the replacement material in layers no greater than 4 in. depth.

(4) Protect the aggregate base or subgrade after placement.

(5) Remove and replace any aggregate base or subgrade damaged due to lack of protection at no additional cost.

505.03.06 Subgrade Drains. Refer to Section 306. The construction of subgrade drains may be required in areas of wet underlying subgrade or in areas where future drainage problems may be a concern, as determined.

505.03.07 Emergency Filler. Have sufficient approved cold patch material readily available to fill the void of the repair area. Place and compact the material as directed. Completely remove the material at the beginning of the next workday.

505.03.08 Steel Plates. Ensure that an ample supply of 12 ft x 14 ft by 1 in. thick steel plates are available on site to cover the emergency filler.

505.03.09 Patch Construction. Refer to Section 504. Furnish equipment and perform placement, compaction, and quality control procedures as specified. Manual placement of the asphalt patches is permissible. Thoroughly clean and tack the exposed vertical surface of adjacent pavement prior to placing the asphalt patch as specified in 504.03.04. Patches in excess of 50 ft in length and 10 ft or greater in width shall have the final riding surface placed by a paver. Lower lifts may be placed by a paver or other methods as necessary. Do not place asphalt patches on a frozen base.

505.03.09.01 Crack Sealing. When newly constructed patches will be left open to traffic for at least three months, crack seal the edges as specified in 510.03.08.01.

505.03.10 Patch Placement. Maintain lift thickness in conformance with the following:

ASPHALT LIFT THICKNESS		
MIX DESIGNATION (mm)	**MINIMUM (in.)**	**MAXIMUM (in.)**
9.5	1.0	2.0
12.5	1.5	3.0
19.0	2.0	4.0
25.0	3.0	5.0
37.5	4.0	6.0

505.03.11 Patch Surface Checks. Have an approved 10 ft straightedge available as directed. The patch surface, after final compaction, shall be sufficiently smooth and true to the established line and grade. Test the surface with the straightedge in the longitudinal and transverse direction immediately behind the final roller. The tested surface shall not deviate by more than 3/16 in.

Correct any portions that deviate by more than 3/16 in. by removal and replacement or by diamond grinding at no additional cost.

Recheck all corrected pavement sections, including any additional transverse paving joints created, to determine if the sections meet specifications.

505.03.12 Mix Sampling Requirements. One random sample per mix will be required daily for projects using more than 200 tons per day. Quantities of 200 tons or less of asphalt per day may not require daily field sampling. However, one random sample per mix for every 1000 tons of asphalt or one sample per mix will be required weekly; whichever yields the greater frequency.

Random mix samples will be required for patches placed with a paver. Patches not placed with a paver or patches less than 1000 ft^2 (10 ft wide x 100 ft long) will not require a mix sample.

505.03.13 Testing and Acceptance. Acceptance of Base and/or Surface of each patch per lift will be determined by using an asphalt density gauge with test data witnessed. Calibrate the density gauge to the mix in order to obtain representative readings.

505.03.14 Density Determination Requirements. On the first day of patching, perform density gauge testing and core sampling on three randomly selected test locations. Label the cores with the date sampled. Test the cores then submit the results to OMT. The average pcf of the three cores and the average pcf of two corresponding gauge readings shall be within 3.0 lb/ft^3 of each other. If they do not compare, recalibrate the density gauge according to the manufacturer's recommendation. When the difference between the gauge readings and the core tests are greater than 3.0 lb/ft^3, verify the gauge's accuracy by reading three new random locations. Report the density gauge test data as a percentage of the daily production maximum specific gravity.

An in-place density of 92.0 percent to 97.0 percent is required for each randomly selected patch test location per lift. Compliance will be determined for each patch separately by averaging all density tests performed within each specific patch. Submit compaction sheets to OMT daily for all production. Retain the tested cores in the QC Laboratory until OMT verifies the results.

A patch 2500 linear ft or greater shall require additional readings.

Take three cores and corresponding gauge readings per mix weekly to verify the gauge readings. If the average of the density gauge readings and the average of the core densities are within 3.0 lb/ft^3, all the daily density gauge readings will be accepted. If they do not compare, recalibrate the density gauge. Incentives are not applicable for patch density.

505.04 MEASUREMENT AND PAYMENT

Refer to 504.04 and MSMT 735. Payment will be full compensation for saw cutting, milling, grinding, removal, disposal, trimming of the existing pavement, subgrade preparation, placing all materials including tack coat, steel plates, emergency filler, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. After removal, steel plates and emergency filler will remain the property of the Contractor.

505.04.01 Partial Depth Patching and Full Depth Patching. Payment will be measured and paid for at the Contract unit price per square yard or per ton. The payment will be full compensation for furnishing, hauling, placing all material, additional removal of pavement above the aggregate base, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

505.04.02 Removal of Unsuitable Material. Payment will be measured and paid for at the Contract unit price per cubic yard. The payment will also include excavation and disposal of unsuitable material, backfilling with aggregate, and compaction.

505.04.03 Price Adjustment for Asphalt Binder. Refer to 504.04.01. An adjustment will be made to the final Contract unit price for asphalt mixture if the price of asphalt binder fluctuates significantly from the prevailing price on the date of placement. This includes asphalt patching material converted to tons.

505.04.04 Price Adjustment for Asphalt Mix. Payment reduction or incentive will be made using the Contract items for Asphalt Mixes. Revisions to the established item amounts will not be allowed.

505.04.05 Crack Sealing. As specified in to 510.04.

CATEGORY 500
PAVING

SECTION 506 — GAP-GRADED STONE MATRIX ASPHALT

506.01 DESCRIPTION

Place gap-graded stone matrix asphalt (GGSMA) surface as specified. GGSMA shall conform to Section 504, except as specified.

506.02 MATERIALS

Gap-Graded Stone Matrix Asphalt Mix	904.05
Production Plants	Section 915

506.03 CONSTRUCTION

506.03.01 Demonstration. Demonstrate that a satisfactory mix can be produced, placed, and the compactive effort determined before proceeding with the actual work. Place a minimum of 100 tons of GGSMA outside the project limits for the demonstration. A new strip will be required if a project carries over to a new season. Paver and rollers as specified in 504.03.01. A material transfer vehicle may be used as part of the demonstration strip.

506.03.02 Hauling Units. Use vehicles with tight, clean and smooth metal beds. Lightly coat the beds with an approved asphalt release agent, a combination of release agent/soap solution, or No. 10 dust coated with 1 percent asphalt or uncoated. Do not use petroleum derivatives or other coating materials that may contaminate the characteristics of the mix. Drain the bed before loading. Immediately after loading, cover each load with a full asphalt tarp, securely fastened along the sides and rear of the truck bed. The tarp shall contain no holes or rips.

The time between plant mixing and shipment shall not exceed one hour. Storage time may vary depending upon gradation, type of binder and/or stabilizer. Stored material shall have results of no less quality than mixes discharged directly into hauling vehicles.

506.03.03 Weather Restrictions. Refer to 504.03.02. GGSMA placement will only be permitted when the ambient and surface temperatures are at least 50 F.

506.03.04 Material Transfer Vehicle (MTV). Use a material transfer vehicle to apply the final surface course. The MTV shall perform additional mixing of the GGSMA and then deposit the mix into the paver at a uniform temperature and consistency.

506.03.05 Asphalt Placement. Refer 504.03.06.

506.03.06 Pavement Thickness. The thickness of the pavement shall be as specified. 504.03.13 (Thin Lift) is not applicable to GGSMA.

506.03.07 Tack Coat. Refer to 504.03.04 or 504.03.05 except the resulting coating shall be asphalt applied at a rate of 0.04 gal/yd^2 to 0.08 gal/yd^2 for Tack Coat. Apply Non-Tracking Tack Coat (NTTC) when specified at a rate of 0.05 gal/yd^2 to 0.10 gal/yd^2.

506.03.08 Compaction. Compact the GGSMA using a minimum of 3 steel-wheeled rollers, each weighing 10 tons to 12 tons. The rollers shall be equipped with a plain or soapy watering system to prevent the material from sticking. The rollers shall follow the paver within 500 ft or roll according to the approved Quality Control Plan. Rolling shall start immediately after placement. In-place density as specified in 504.03.12, except density shall be as specified in 506.04.01.

506.03.09 Control Strip. The construction of a control strip may be required at any time during of GGSMA placement, based on the evaluation of compaction results.

The Contractor may opt to construct a control strip between 400 ft and 500 ft in length for guidance in determining roller patterns to achieve optimum density. Construct control strips on the first workday in which GGSMA is placed. Based on Contractor evaluation of the initial control strip, paving may continue at risk.

A density pay adjustment will not be assessed for the amount of material required for the control strips. Removal of any control strip shall be at no additional cost.

506.03.10 Verification of Mix Design. Refer to 904.04.05

506.03.11 Verification Evaluation. MSMT 735 and 904.04.06.

506.03.12 Pavement Profile. Refer to Section 535 in the Contract Documents.

506.03.13 Sampling and Testing for Mixture and Density. Refer to 504.03.11 and 504.03.12.

506.04 MEASUREMENT AND PAYMENT

Gap-Graded Stone Matrix Asphalt will be measured and paid for at the Contract unit price per ton, complete and in place. The payment will be full compensation for furnishing, hauling, placing all materials, material transfer vehicle, anti-stripping additive, tack coat, control strips, setting of lines and guides where specified, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Material produced for the demonstration will not be measured but the cost will be incidental to the Gap-Graded Stone Matrix Asphalt item.

506.04.01 Payment Adjustment for Gap-Graded Stone Matrix Asphalt and Pavement Density. Refer to 504.04 except as follows. Payment adjustments for pavement density will be based on individual sublot core test data for a given lot and the lot average density as specified in this section and the following.

TABLE 506 A

GAP Graded Stone Matrix Asphalt Mixes - Percent of Maximum Density		
Lot Average % Minimum	*No Individual Sublot Below %*	*Pay Factor (DF)*
95.0	95.0	1.050
94.9	94.8	1.045
94.8	94.6	1.040
94.7	94.4	1.035
94.6	94.2	1.030
94.5	94.0	1.025
94.4	93.8	1.020
94.3	93.6	1.015
94.2	93.4	1.010
94.1	93.2	1.005
94.0	93.0	1.000
93.8	92.7	0.990
93.6	92.4	0.980
93.4	92.1	0.970
93.2	91.8	0.960
93.0	91.5	0.950
92.8	91.2	0.940
92.6	90.9	0.930
92.4	90.6	0.920
92.2	90.3	0.910
92.0	90.0	0.900
91.8	89.7	0.890
91.6	89.4	0.880
91.4	89.1	0.870
91.2	88.8	0.860
91.0	88.5	0.850
Less than 91.0	—	0.750 rejected per Engineer

Note 1: When any test data is above 97.0, the lot may be rejected per the Engineer. When not rejected, the lot will receive a pay adjustment in accordance with the following:

(a) When the density lot average is above 97.5, the pay factor = 75 percent.
(b) When 3 sublot densities are above 97.0, the pay factor = 95 percent.
(c) When 4 or more sublot densities are above 97.5, the pay factor = 75 percent.

Note 2: When the Contractor's core specific gravity data does not compare with the Administration's core specific gravity data, only the Administration's single sublot values and lot average value will be used in acceptance decision.

Note 3: The average sublot values and the lot average will be used in acceptance decision.

506.04.02 Dispute Resolution. Refer to 915.02.03.

CATEGORY 500
PAVING

SECTION 507 — SLURRY SEAL AND MICRO-SURFACING

507.01 DESCRIPTION

Construct an asphalt emulsion seal course using Slurry Seal (SS) or Micro-Surfacing (MS).

507.02 MATERIALS

Slurry Seal and Micro-Surfacing	Section 923

507.03 CONSTRUCTION

507.03.01 Certification. Furnish certified weigh tickets daily for the emulsion, residual asphalt content, latex emulsion, aggregate, and mineral filler. The weigh tickets will be used to determine in-place application rates.

507.03.02 Sampling and Testing. Sample the asphalt emulsion seal mixture and the asphalt emulsion at least once daily during paving. Provide samples for asphalt content from the completed mix produced by each mixing unit to be tested by the Administration. Asphalt content will be determined by Ignition Method. Engineer to witness and submit the samples and proper documentation/certification to the Asphalt Technology Division of the Office of Materials Technology (OMT). Residual asphalt content and gradation will be determined in accordance to T 30 and T 164, or T 308. The residual asphalt content shall be within +/- 1.5 percent of the Job Mix Formula (JMF). When successive tests for a mixing unit fail, or one test fails by more than 2 percent, that unit shall be removed from service until approved.

507.03.03 Weather Restrictions. Place asphalt emulsion seal when the air and surface temperatures are at least 50 F. The morning minimum surface temperature may be 40 F provided the ambient temperature is expected to rise to or above 60 F and is not expected to fall below 32 F within 24 hours after placement. Cease placement when the surface or air temperature falls below the specified limits. Ensure surface is dry, with no standing water. Place asphalt emulsion seal when it is not raining or foggy.

507.03.04 Mixing Equipment. Use a self-propelled, front feed, continuous loading mixing machine. The machine shall proportion and deliver the materials to a revolving, multi-blade, shafted mixer; and discharge it continuously and uniformly.

The mixer shall have devices that control the proportioning of each material. Calibrate the mixer for the mix design in the presence of an Administration representative or submit certified calibration documents for approval to ensure the SS or MS treatment meets the job mix formula.

Calibrate the equipment using actual project materials and every time there is a change in material source or composition. Submit a source of materials and a mix design for approval in accordance with 923.05, with corresponding test data from an approved lab at least three weeks in advance of the paving operation.

The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, additives, and water to maintain an adequate supply of the materials for the proportioning controls. Add the proper amount of mineral filler to the aggregate before introduction into the mixer. Use mixing machines equipped with water pressure systems and nozzle spray bars to provide a water spray ahead of and outside the spreader box when required.

Truck mounted machines with positive, non-slipping aggregate delivery systems, but without a front feed continuous loading feature, may be used on project segments of less than 15 000 yd^2 or for spot repairs. Have at least two truck mounted machines on the project prior to construction.

Provide the data for each unit in graphic form indicating the stone gate setting required to obtain the residual asphalt content as determined in the mix design.

Individual volume or weight controls for proportioning each material shall be provided and meters or counters shall be such that the Engineer may determine the amount of each material used at any time. Provide aggregate weigh tickets, a daily delivery summary, and an estimate of aggregate lost or otherwise not used.

507.03.05 Spreading Equipment.

(a) Spread the asphalt emulsion seal uniformly by means of a mechanical squeegee box attached to the mixer and equipped with paddles mounted on an adjustable shaft to continuously agitate and distribute the materials.

(b) Use equipment that provides sufficient turbulence to prevent the mix from setting in the box or causing excessive side buildup or lumps.

(c) Attach flexible seals where the box contacts the road, front and rear, to prevent loss of the mixture.

(d) Do not spray additional water into the spreader box.

(e) Equip the spreader box with a burlap drag (approximately 18 in. wide), or other approved screed to create a smooth surface.

MS material may be used to fill ruts, utility cuts, depressions in the existing surface, etc., as directed and as follows.

(a) Fill ruts of 0.5 in. or greater in depth with a rut-filling box; 5 ft or 6 ft in width.

(b) Ruts in excess of 1-1/2 in. deep may require multiple applications with the rut-filling box to restore the cross-section.

(c) Apply a full width scratch course with the spreader box when rutting or deformation is less than 1/2 in. using a metal or stiff rubber strike-off.

(d) Apply the material at a sufficient rate to level the pavement surface.

(e) The leveling course may or may not meet the application rate specified in 507.03.09.

(f) Cure all rut-filling and leveling material under traffic for at least 24 hours before additional material is placed.

507.03.06 Quality Control Plan (QCP). Submit a QCP for approval at least 30 days prior to the placement of any asphalt emulsion seal. The Plan shall contain a list of technicians working on the project and their qualifications, current equipment calibration data and a statistically based procedure of random sampling.

The Plan shall document the proposed methods for controlling the equipment, materials, production, and asphalt emulsion seal operation to ensure conformance. Discuss the Plan requirements at the pre-pave meeting.

507.03.07 Test Strip. Construct a test strip for approval at the beginning of the roadway project and when there is a change in materials. Provide calibration data for the equipment before placing the test strip. The test strip will be incorporated into the project and the pay quantities if approved.

(a) Construct the test strip over one-full lane width; a minimum of 500 ft long. The mixture consistency and application rate for the test strip shall be representative of the mixture consistency and application rate for the project.

(b) Contact OMT's Asphalt Technology Division one week prior to constructing the test strip to have a representative present.

(c) The test strip must be approved prior to continuing the work. If the test strip is not approved, correct all deficiencies and provide another test strip. Work on the roadway will be permitted to continue once the test strip is successfully installed and approved.

(d) Submit a Production Report Form for each day's paving to OMT at superpave@mdot.maryland.gov before 1pm on weekdays before each day's production.

(e) Open SS test strips to traffic within two hours after placement unless otherwise directed.

(f) Open MS test strips to traffic within one hour after placement unless otherwise directed.

507.03.08 Surface Preparation. Perform surface preparation prior to applying the tack coat and placing the asphalt emulsion seal as directed and as follows:

(a) Perform roadway patching in accordance with Section 505.

(b) Seal cracks with a width greater than 3/8 in. as specified in Section 510.

(c) Ensure the crack sealer is a compatible material (with no rejuvenating agents or solvents).

(d) Ensure that cracks are not overfilled, and that the manufacturer's recommended cure time is adhered to prior to placing the asphalt emulsion seal.

(e) Remove pavement markings as specified in Section 558.

Protect manholes, valve boxes, drop inlets and other service/utility entrances from the asphalt emulsion seal by a suitable method, as approved.

Clean the existing surface and remove all objectionable materials. Ensure the pavement surface is dry prior to applying tack coat and asphalt emulsion seal.

Apply tack coat consisting of one part asphalt emulsion to two or three parts water to surfaces prepared for MS. Use an emulsion type and grade that is compatible with the asphalt emulsion seal. Apply at a rate of 0.05 gal/yd^2 to 0.10 gal/yd^2. Do not apply tack coat to surfaces prepared for SS.

507.03.09 Application. Spread the asphalt emulsion seal to repair slight irregularities and to achieve a uniform, skid resistant surface free of skips, lumps, or tears.

Use squeegees and lutes to spread the mixture in areas that are inaccessible to the spreader box and in areas that require hand spreading.

Additives may be used to provide a slower setting time when hand spreading is necessary. Pour the slurry seal in a small windrow along one edge of the surface to be covered and spread the material uniformly. Construct a smooth, neat seam where two passes meet. Remove excess material immediately from the ends of each run.

(a) Slurry Seal. Apply at the following target application rates and tolerances, based on the dry aggregate weight, unless otherwise specified:

AGGREGATE TYPE	TARGET APPLICATION RATE AND TOLERANCE
Type II Mix	16 ±2 lb/yd^2
Type III Mix	20 ± 2 lb/yd^2

(b) Micro-Surfacing. Apply in one or two coats as directed at the following target application rates and tolerances, based on the dry aggregate weight, unless otherwise specified:

AGGREGATE TYPE	TARGET APPLICATION RATE AND TOLERANCE	
Type II Mix	16 ±2 lb/yd^2	when one coat is specified
Type III Mix	22 ± 2 lb/yd^2	
Type II Mix	32 ±2 lb/yd^2	when two coats are specified
Type III Mix	36 ±2 lb/yd^2	

Apply MS when specified or directed to fill ruts, utility cuts, depressions in the existing surface, etc., at the following target application rates and tolerances, based on the dry aggregate weight:

AGGREGATE TYPE	RUT DEPTH	TARGET APPLICATION RATE AND TOLERANCE
Type III Mix	0.5 – 0.75 inches	25 ±5 lb/yd^2
	0.75 – 1.00 inches	30 ±5 lb/yd^2
	1.00 – 1.25 inches	33 ±5 lb/yd^2
	1.25 – 1.50 inches	36 ±4 lb/yd^2

Fill ruts using a specially designed rut filling box that will leave the surface crowned 1/8 in. to 1/4 in. per inch depth to allow for traffic compaction to an approximately level surface. Provide and use a 10 ft straightedge to control the depth and crown.

Furnish certified weigh tickets for all materials as specified in 507.03.01.

507.03.10 Rolling. Rolling is required for parking facilities, and on roadways as directed. Roll courses using a self-propelled, 10 ton (maximum) pneumatic-tire roller equipped with a water spray system, as directed. Do not commence rolling until the asphalt emulsion seal has cured sufficiently, as determined.

507.03.11 Defective Work. Correct defective work not meeting the following criteria, unless otherwise directed in writing and as determined; to the satisfaction of the Administration and at no additional cost.

(a) Application Rate. Areas where application rates deviate from the acceptable ranges in 507.03.09 will be considered defective work.

(b) Finished Surface. Provide a finished, uniform surface texture meeting the following requirements:

(1) Limit areas of excessive asphalt (flushing) to less than 10 percent of the finished surface area. Areas of excessive asphalt are characterized by a smooth, shiny surface that may be tacky to the touch. Bleeding at joints is not allowed.

(2) No tear and/or drag marks greater than 1 in. wide and 3 in. long.

(3) No more than 12 tear and/or drag marks greater than 1/2 in. wide and 4 in. long per 10 ft of a lane.

(4) No clumps and/or other foreign objects greater than 1-1/2 in. in diameter.

(5) No transverse ripples or joints with greater than a 1/4 in. ridge, bump or depression as measured with a 10 ft straightedge.

(6) No longitudinal streaks with greater than a 1/4 in. ridge, bump or depression, as measured with a 10 ft straightedge.

(c) Longitudinal Joints. Make a neat seam where two longitudinal passes join with no greater than a 1/4 in. bump, ridge or depression as measured with a 10 ft straightedge. Do not overlap longitudinal joints more than 4 in. except on irregular roadway widths as directed.

(d) Longitudinal Edges. Place material to the final widths specified. Make a neat longitudinal edge along the roadway lane, shoulder, and curb lines. Place edges flush with curbs. Place edges with no more than ±3 in. horizontal variance in any 100 ft of roadway.

(e) Transverse Profile. Fill ruts to have no depressions as measured with a 10 ft straightedge.

507.03.12 Tie-Ins for Entrances and Connecting Roads. Make tie-ins at entrances and connecting roads as directed.

507.03.13 Traffic. Maintain active access control at intersections and entrances. When it is necessary to open to traffic early, lightly sand the surface using the same aggregate as in the mix. Remove excess aggregate from the roadway in curb and gutter sections as required. Broadcast clean aggregate used in the seal treatment over the mix at intersections and/or entrances for temporary access as directed. Repair traffic-damaged asphalt emulsion seal at no additional cost.

Place temporary pavement markings as specified in 104.11 after the mix has cured and as directed. Place permanent pavement markings, including thermoplastic pavement markings, at least seven days after curing.

(a) Slurry Seal. Open the roadway to traffic within two hours after placement unless otherwise directed.

(b) Micro-Surfacing. Open the roadway to traffic within one hour after placement unless otherwise directed.

507.04 MEASUREMENT AND PAYMENT

Slurry Seal and Micro-Surfacing will be measured and paid for at the Contract unit price per square yard for one or more of the pertinent items listed below. The accepted quantity of Micro-Surfacing Rutfilling will be paid for at the Contract unit price per ton. Payment will be full compensation for furnishing and placing the aggregate, tack coat, mineral filler, tie-ins to entrances and connecting roads, emulsion, latex emulsion, test strip, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

507.04.01 Slurry Seal Using Type II Mix (One Coat).

507.04.02 Slurry Seal Using Type III Mix (One Coat).

507.04.03 Micro-Surfacing Using Type II Mix (One Coat).

507.04.04 Micro-Surfacing Using Type III Mix (One Coat).

507.04.05 Micro-Surfacing Using Type II Mix (Second Coat).

507.04.06 Micro-Surfacing Using Type III Mix (Second Coat).

507.04.07 Micro-Surfacing Type Rutfilling.

507.04.08 Asphalt patches will be measured and paid for as specified in 505.04.

507.04.09 Removal of Pavement Markings will be measured and paid as specified in Section 558.

507.04.10 Sealing Cracks in Asphalt Pavement will be measured and paid as specified in Section 510.

507.04.11 Price Adjustment. Material not in conformance may be accepted at a reduced price if the nonconformance is determined not detrimental to the work. The following price adjustment will apply:

(a) The residual asphalt content of samples will be averaged for each day's production per lift and will be compared to the submitted mix design. The Contract unit price per square yard will be reduced 1 percent for each 0.10 percent the asphalt content is out of tolerance below the approved job mix formula, as specified in 507.03.02.

(b) The Contract unit price per square yard will be reduced 3 percent for each pound per square yard below the specified rate. This adjustment will be determined by comparing the certified delivery tickets with the project Specifications. No increase in the Contract Unit price will be considered for applications at more than the specified rate.

507.04.12 Price Adjustment for Asphalt Binder. A Price Adjustment (PA) will be made to provide additional compensation, or a credit to the Administration for fluctuations in the cost of asphalt binder.

The prevailing base index price will be the price specified for PG 64S-22 Asphalt Binder posted at www.roads.maryland.gov (Business Center / Contracts Bids and Proposals) for adjustment purposes at time of bid opening.

The PA will be made when the index price for the month of placement increases or decreases more than 5 percent of the prevailing base index price. Computations will be as follows:

Percent Change = ((Pp – Pb)/Pb) x 100

PA = (Q/2000) x AR x (Pp – (D x Pb))

Where:

PA = Price Adjustment for Slurry Seal or Micro-Surfacing

Q = Quantity of Slurry Seal or Micro-Surfacing placed in pounds

D = 1.05 for increases over 5 percent; 0.95 for decreases over 5 percent

Pp = Index price for PG 64S-22 Asphalt Binder per ton for the month of placement

Pb = Prevailing base index price for PG 64S-22 Asphalt Binder per ton

AR= Asphalt Residue expressed as a decimal

PA resulting in increased payment will be paid under the item Price Adjustment for Asphalt Binder. The item amount will be established by the Administration and shall not be revised. PA resulting in a decreased payment will be deducted from monies owed.

CATEGORY 500
PAVING

SECTION 508 — MILLING ASPHALT PAVEMENT

508.01 DESCRIPTION

Mill asphalt pavement.

508.02 MATERIALS

Not Applicable.

508.03 CONSTRUCTION

Perform roadway patching as specified in Section 505 prior to milling. Additional roadway patching may be required after milling.

Quality Control Plan (QCP). Submit a Quality Control Plan for Milling to the District Engineer for approval at least 30 days prior to milling according to the Field Quality Control Plan (QCP) in 504.03. The QCP shall show methods proposed to control and maintain the milling equipment, materials, and daily milling operations. Discuss the Milling QCP requirements in the pre-construction, pre-pave, and progress meetings.

508.03.01 Equipment.

(a) Milling Machine. Provide all equipment necessary for approval prior to beginning work. Use a power operated milling machine capable of removing asphalt pavement to the specified depth in one pass and at least half the lane width. The machine shall be equipped with automatic control devices capable of controlling grade, elevation, and cross slope at a given rate. The machine shall be capable of establishing profile grades along each edge of the machine, within plus or minus 1/4 in., by referencing from the existing pavement or independent grade control. The milling machine shall have a system capable of side, rear or front offloading of the milled material into a transfer vehicle for off-site disposal. The machine shall meet NIOSH standards for emission control. Continuously monitor the cutting head to ensure and maintain a uniform textured surface after milling. Provide supplemental equipment as necessary to remove material in areas that the milling machine cannot reached.

(b) Measurement Devices. An approved 10 ft straightedge for testing the transverse and longitudinal surface during and after milling. Use MSMT 413 for Volumetric Pavement Macrotexture Depth (Sand Patch) Testing.

(c) Street Sweeper. Provide a vacuum equipped or mechanical street sweeper to follow behind the milling machine. The sweeper shall be capable of removing all loose material from the roadway to minimize dust escaping into the atmosphere.

508.03.02 Control Strip. Mill a control strip at least 500 ft in length with a uniformly textured surface and cross section as approved. The resulting surface shall be true to the established grade and verified every 50 ft with a 10 ft straightedge to test the transverse and longitudinal surface tolerance at ±1/4 in. The Contractor has the option to choose either Sand Patch Test (MSMT 413) or the Straightedge Test as shown in Table 1 - Texture Requirements.

Table 1 – Texture Requirements

Milling Type	Minimum Average Diameter Per Sand Patch Option (in.)	Maximum Ridge to Ridge Distance and Ridge to Bottom Height Per Straightedge Option (in.)
Standard	9	5/8
Fine	11	3/8
Micro	14	1/4

Do not perform pavement macrotexture measurements in areas where there is rutting, exposed delamination, within several feet of any structure, in areas that will not hold the pattern, or where the previously milled surface texture is exposed.

508.03.03 Pavement Milling. Mill one lane at a time using all automatic control devices. If the milling depth exceeds 2.5 in., mill the abutting lane or shoulder on roadways carrying traffic on the same day. Mill the abutting lanes and shoulder prior to weekends or temporary shutdowns, regardless of depth. The abutting lane or shoulder may be milled on alternate days if the milling depth is 2.5 in. or less. Provide adequate advance warning devices where uneven pavement joints exist as specified. Provide positive drainage to prevent accumulation of water on the milled pavement as directed.

Straightedge Testing. Verify surface tolerances with a 10 ft straightedge at a minimum of five random locations daily. The variation of the top of two ridges from the testing edge of the straightedge, between two ridge contact points, shall not exceed values in Table 1. The variation from the top of the ridge to the bottom of the groove adjacent to that ridge shall not exceed values in Table 1. Correct unsatisfactory surfaces at no additional cost. Report test information per the QCP.

Sand Patch Testing. Verify surface texture requirements in Table 1 by performing random daily visual checks. Ensure the milling continues to exhibit a uniformly textured surface and cross section as produced in the Control Strip, as determined.

Fill all depressions, potholes, and other irregularities using an asphalt mix after the milling is complete. Construct an asphalt wedge at existing water valves, meters, manhole covers, etc. as specified in Section 106. Where sound pavement has been gouged, torn, or otherwise damaged

during the milling operations or damage is done to other property including utility frames, grates and covers, make repairs at no additional cost.

Areas varying from a true surface more than the tolerance stated in 508.03.02 may be accepted without correction if the Engineer determines that they were caused by a pre-existing condition that the milling operation cannot repair.

The Engineer may require milling of any area where a surface delamination causes a non-uniform texture to occur, at the Contract unit price. Where a surface delamination between asphalt layers or a surface delamination between asphalt on Portland cement concrete causes a non-uniform texture to occur, the depth of milling shall be adjusted in small increments to a maximum of + 1/2 in. Tie into curb and gutter as directed.

The finished milled surface shall provide a smooth surface with straight longitudinal striations, free from scallops, scabs, gouges, ridges and have a uniform texture suitable as a temporary riding surface.

Monitor milled surface after opening to traffic. Immediately notify the Administration of any defective areas. Correct all unsatisfactory surface conditions as directed at no cost to the Contractor.

508.03.04 Temporary Tie-ins. Construct temporary tie-ins before allowing traffic to cross the transverse joint. Temporary tie-ins shall be at least 4 ft in length for each 1 in. of pavement milling depth when milling roadways carrying traffic with a posted speed ≤ 40 mph, and at least 10 ft in length for each 1 in. of pavement milling depth when milling roadways carrying traffic with a posted speed > 40 mph. If the tie-in length is 10 ft or greater, a paver meeting 504.03.01 shall be used for compaction.

508.03.05 Cleanup. Use a vacuum equipped or mechanical street sweeper, in addition to any other equipment required, to remove dust and debris after milling and prior to allowing traffic on the milled surface.

508.03.06 Delay Penalty. Do not open traffic on the milled surface for more than 10 calendar days, beginning at the first day of milling until the start of paving. A deduction of $1500 per day for interstates and $750 per day for all other roadways will be assessed for each additional day the milled surface remains open to traffic. The delay penalty will be deducted from the next progress payment and is a permanent deduction.

508.04 MEASUREMENT AND PAYMENT

Milling Asphalt Pavement will be measured and paid for at the Contract unit price per square yard for the pertinent depth of milling asphalt pavement. The amount will be computed from the width and length measurements of the actual milled areas. The payment will be full compensation for milling, measurement, testing, disposal of milled material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

(a) Standard Milling Asphalt Pavement (0-1 in. depth)

(b) Standard Milling Asphalt Pavement (Over 1-2.5 in. depth)

(c) Standard Milling Asphalt Pavement (Over 2.5-4 in. depth)

(d) Standard Milling Asphalt Pavement (Over 4 in. depth)

(e) Fine Milling Asphalt Pavement (0-1 in. depth)

(f) Fine Milling Asphalt Pavement (1-2.5 in. depth)

(g) Micro Milling Asphalt Pavement (0-0.5 in. depth)

(h) Micro Milling Asphalt Pavement (0.5-1 in. depth)

(i) Micro Milling Asphalt Pavement (1-2 in. depth)

Asphalt mixes for filling depressions and potholes, and for wedging manholes, valve boxes, inlets, temporary tie-ins and other structures will be measured and paid as specified in 106.04.

Asphalt patches will be measured and paid for as specified in 505.04.

CATEGORY 500
PAVING

SECTION 509 — DIAMOND GRINDING

509.01 DESCRIPTION

Grind Portland cement concrete or asphalt pavement with diamond tipped saw blades to restore proper drainage and ride quality.

509.02 MATERIALS

Not applicable.

509.03 CONSTRUCTION

Prepare and submit a traffic control plan for approval as specified in 104.01. Patch the pavement as specified and remove all pavement markings prior to grinding. Seal joints after grinding as specified.

509.03.01 Equipment. Use a power-driven, self-propelled machine capable of grinding the pavement surface to the specified smoothness and texture using diamond tipped saw blades. Do not use equipment that damages the underlying pavement, causes raveling, aggregate fractures, or spalls at joints or cracks. The grinding unit shall:

(a) Weigh at least 35 000 lb, including the grinding head.

(b) Have a grinding head that will grind a strip at least three feet wide.

(c) Have a wheelbase of at least 12 ft.

(d) Have a vacuum system that removes all grinding slurry from the pavement surface and leaves the surface in a clean, near-dry condition.

(e) Be maintained to ensure it is in proper working order with attention paid to the roundness of the match and depth control wheels. Replace any wheels found to be out of round.

509.03.02 Grinding. Grind the pavement in the longitudinal direction, beginning and ending at lines normal to the pavement centerline.

(a) Do allow any unground surface area between passes, and do not overlap passes of the grinding head more than 2 inches.

(b) Eliminate faults to result in a maximum of 1/16 in. differential between adjacent sides of joints or cracks, except that under no circumstances shall the maximum overall grinding depth exceed 1/2 in.

Grind into adjacent lanes or shoulders as directed to transition from the edge of the travel lane to provide lateral surface drainage leaving no more than a 1/8 in. ridge and an acceptable riding surface.

509.03.03 Final Cross Slope. Achieve lateral drainage by maintaining a constant cross slope between grinding extremities in each lane. Have an approved 10 ft straightedge available at all times. The finished surface shall be sufficiently smooth so that when tested with a straightedge placed upon the surface parallel with the center line, the surface does not deviate more than 1/8 in. The transverse slope of the finished surface shall not deviate more than 1/8 in. Straightedge requirements do not apply across longitudinal joints or outside the ground area. Regrind areas of deviation as directed.

509.03.04 Final Finished Surface. Produce a neat, uniform finished surface with a longitudinal line-type texture with corrugations parallel to the outside pavement edge. The peaks of the ridges shall be 1/16 in. ± 1/16 in. higher than the bottom of the grooves with evenly spaced ridges having a land area width ranging from 0.080 in. to 0.110 in. It may be necessary to adjust the blade spacing to achieve the specified texture. Ensure a minimum of 95 percent of any 100 ft section of pavement surface is textured.

509.03.05 Slurry Handling and Removal. Continuously remove the grinding slurry residue from the pavement. Do not allow the slurry to flow across lanes occupied by traffic or to flow into gutters or other drainage facilities. Collect the slurry into water-tight haul units and transport and properly dispose of all slurry and residues from the pavement surface off-site.

509.03.06 Pavement Surface Profile. Refer to Section 535.

509.04 MEASUREMENT AND PAYMENT

Diamond Grinding will be measured and paid for at the Contract unit price per square yard. The payment will be full compensation for grinding, cleaning the pavement and shoulders, slurry removal and disposal, surface profile testing, corrective action, technicians, and for all material, labor, equipment, and incidentals necessary to complete the work.

Traffic control will be measured and paid for under separate pay items for this project. Traffic control will include all devices and requirements as stated in the traffic control plan.

CATEGORY 500
PAVING

SECTION 510 — SEALING CRACKS AND JOINTS IN ASPHALT PAVEMENTS

510.01 DESCRIPTION

Clean and seal cracks with a width between a minimum of 1/8 in. and a maximum of 1 in. Use asphalt repair mastic for cracks equal to or greater than 1 in. Cracks less than 1/8 in. wide do not need to be sealed. Repair distressed areas as specified, unless otherwise directed.

510.02 MATERIALS

Crack Sealer	911.01
Asphalt Repair Mastic	911.01.02

510.03 CONSTRUCTION

510.03.01 Equipment. All equipment shall be subject to approval. Ensure all equipment is maintained in satisfactory working condition at all times.

(a) Air Compressor. Air compressors shall be portable and capable of furnishing a minimum of 100 cubic feet of air per minute (cfm) and a minimum blast flow of 150 cfm. The compressor shall have a maximum of a 3/4 in. (20mm) diameter nozzle and shall be equipped with oil-free compressed air.

(b) Hot Air Lance. The compressed air Hot Air Lance shall produce a minimum temperature of 750 F (400 C) at a minimum velocity of 650 ft/s. The compressed air must be produced from an air-compressor capable of producing a minimum of 125 cfm (0.06 m3/s) of clean, oil-free compressed air. The Hot Air Lance shall be designed such that the flame does not come in contact with the pavement.

(c) Melting Kettle. The Melting Kettle shall be a self-contained double boiler that is capable of heating the sealant using oil as a heat transfer medium. The kettle shall be equipped with an automatic heat-control unit set capable of achieving a predetermined sealant temperature and maintain that temperature as long as required. The kettle shall be capable of safely heating the material to 400 F. The temperature control unit should not allow the heat transfer oil to exceed 525 F. The unit shall be capable of reading the temperature of the sealant within the melting vessel and within the discharge plumbing to provide monitoring and reporting of the sealant throughout the operation. The kettle

shall also have an agitation system capable of continuously mixing the sealant to uniformly maintain the temperature within the manufacturer's recommendations. The kettle must also be capable of applying the sealant to the pavement under pressure supplied by a gear pump with a direct connecting applicator tip. Do not use direct-fired kettles.

(d) Hand Tools. Hand tools such as brooms, shovels, metal bars with chisel shaped ends, tamping equipment, and other miscellaneous tools required to accomplish the work.

(e) Squeegee. Metal industrial type no more than 2-1/2 in. wide used to shape the surficial sealant material into a feather-edge band.

(f) Crack Router. The crack router shall be capable of following random cracks and be designed to adjust cutting widths. The router width shall touch both sides of the crack for proper cutting. The router shall remove 1/8 in. from each side of the crack and cut back to sound pavement.

(g) Mastic Mixer. The Mastic Mixer shall be thermostatically controlled and capable of heating the mastic mixture using oil as a heat transfer medium. The Mastic mixer must be equipped with a full sweep horizontal agitator capable of gently lifting the material from the bottom of the reservoir and mixing the material thoroughly. The agitator shall be capable of mixing and suspending materials filled with aggregates with a specific gravity as high as 3.0.

510.03.02 Quality Control Plan. Submit a Quality Control Plan (QCP) for approval at least 30 days prior to the placement of any crack sealer or asphalt repair mastic. The Plan shall document the proposed methods for controlling the equipment, materials, production, and operations to ensure conformance. The Plan shall also contain a list of technicians working on the project, their qualifications, and a list of all equipment to be used on the project. Discuss the Plan requirements with the Administration prior to construction.

510.03.03 Training. Technicians working on the project must take a mandatory online course from National Highway Institute (NHI), Course No. FHWA-NHI-131110C - Pavement Preservation Treatment Series: Crack Sealing & Filling, and Joint Sealing. The course is provided free of cost. An unofficial transcript of successful completion of the course can be downloaded from NHI's website. Submit transcripts with the QCP.

510.03.04 Crack Identification.

(a) Wheel Path. Wheel path is defined as a distance of 16 in. to 56 in. (width of 40 in.) from the left or right of the center line of the roadway travel lane.

(b) Cracks that can be effectively treated with crack sealants or mastic.

(1) Transverse Thermal Cracks. These cracks extend across the pavement at approximately right angles to the pavement centerline or direction of lay-down.

They are caused by shrinkage of the AC surface due to low temperatures or hardening of the asphalt and/or daily temperature cycling. These cracks are not load associated.

(2) Transverse Reflective Cracks. These cracks extend across the pavement at approximately right angles to the pavement centerline or direction of lay-down. They are caused by cracking beneath the surface course, including cracks in PCC slabs.

(3) Longitudinal Reflective Cracks. These cracks are parallel to the pavement's centerline or laydown direction. They may be caused by shrinkage of the AC surface to low temperatures or hardening of the asphalt and/or daily temperature cycling, or a reflective crack caused by cracking beneath the surface course, including cracks in PCC slabs.

(4) Longitudinal Cold Joint Cracks. They are caused by a poorly constructed paving lane joint or joint location. These joints are generally the least dense areas of a pavement and when constructed on the wheel path, a frequently loaded area, the joint fails prematurely.

(c) Cracks that do not require crack sealing or asphalt repair mastic.

(1) Alligator Cracking. These cracks are a series of interconnected cracks caused by fatigue failure of the asphalt concrete surface under repeated traffic loading. Cracking begins at the bottom of the asphalt surface where tensile stress and strain are highest under a wheel load. The cracks propagate to the surface initially as a series of parallel longitudinal cracks. After repeated traffic loading, the cracks connect, forming many-sided, sharp-angled pieces that develop a pattern resembling chicken wire or the skin of an alligator. The pieces are generally less than 2 ft on the longest side.

(2) Edge Cracking. These cracks are parallel to and usually within 1 ft to 2 ft of the outer edge of the pavement. This distress is accelerated by traffic loading and can be caused by frost weakened base or subgrade near the edge of the pavement.

(3) Slippage Cracks. These are crescent or half-moon shaped cracks having two ends pointing away from the direction of traffic. They are produced when breaking or turning wheels cause the pavement surface to slide or deform.

(4) Longitudinal Cracks within the Wheel Path (defined under 510.03.04(a)).

510.03.05 Crack Sealing. Using the description in 510.03.04, identify cracks 1/8 in. to 1 in. wide at the pavement surface, including reflective cracks, as directed. Exclude all longitudinal cracks within the wheel path areas.

510.03.06 Asphalt Repair Mastic. Identify cracks of at least 1 in. width, small potholes, dislodged RPMS, and other vertically uneven roadway elements as directed. The minimum application depth for mastic should be 3/8 in.

510.03.07 Cleaning and Preparation.

510.03.07.01 Crack Sealing (No Routing).

(a) Cleaning. All surfaces shall be dry and free of all dirt, dust, grease, and loose material prior to application of the filler. The cracks shall be cleaned by the use of compressed air produced from an air-compressor. The use of portable handheld or backpack blowers is not allowed. Direct the compressed air cleaning away from the passing traffic and do not blow debris into an already cleaned crack. Alternative methods of cleaning are subject to review and approval.

(b) Drying. Dry the crack using a hot air lance prior to filler placement. The use of direct flame dryers is not permitted. Do not overheat pavement surfaces.

510.03.07.02 Crack Sealing with Routing.

(a) Crack Routing. Perform routing of cracks to form a reservoir with a cut centered in the crack, touching each side of the crack, with a resulting width ranging from 0.5 in. to 1 in., depending on the width of the crack. The depth shall be 3/4 in. Perform routing in such a way that the pavement does not spall, thus allowing for optimal adhesion of the sealant to the crack edges. The reservoir should be square or U-shaped, not worn to a V-shape.

(b) Cleaning. Refer to 510.03.07.01(a).

(c) Drying. Refer to 510.03.07.01(b).

510.03.07.03 Asphalt Repair Mastic.

(a) Cleaning. Refer to 510.03.07.01(a).

(b) Drying. Refer to 510.03.07.01(b).

(c) Primer. Apply a surface conditioner or primer when recommended by the mastic manufacturer to the surfaces prior to placement of the asphalt repair mastic. Apply in accordance with manufacturer's recommendations to promote increased surface adhesion to the existing pavement. The surface conditioner or primer must thoroughly cover all surface areas where the asphalt repair mastic will be placed. Do not install the asphalt repair mastic until the surface conditioner or primer has sufficiently cured per recommendations.

510.03.08 Installation.

510.03.08.01 Crack Sealing.

(a) Weather Restrictions. Perform crack filling when the ambient and pavement surface temperatures are between 30 F and 80 F, unless otherwise recommended by the manufacturer and as approved. Do not place sealant material if the pavement is wet. Should the sealant be placed and any precipitation occurs before the sealant has properly cured, remove and replace the moisture-affected sealant at no additional cost.

(b) Application Temperature. Prior to installation of the crack sealant, the sealant shall be brought to application temperature recommended by the manufacturer.

(c) Installation. Two methods can be used for crack sealing. The crack shall be sealed using the flush fill method with a squeegee finish or by placing an overband. The width of the overband should not extend more than 2 in. and should be no more than 1/20 in. thick, or the thickness of a dime. Keep sealant narrow and tight to the pavement to minimize snowplow damage. Perform material handling and installation in accordance with the manufacturer's instructions.

(d) Traffic Restrictions. Apply the manufacturer's recommended blotter material to minimize tracking and remove excess material before opening to traffic. The material should have cooled and solidified sufficiently to open to traffic.

(e) Acceptance. Sealant that pulls loose within 96 hours after opening the pavement to traffic shall be repaired at no additional cost.

510.03.08.02 Asphalt Repair Mastic.

(a) Weather Restrictions. Refer to 510.03.08.01(a).

(b) Application Temperature. The minimum application temperature shall be according to the manufacturer's recommendations. The maximum application temperature shall be 410 F, or according to the manufacturer's recommendations.

(c) Installation. The installer must be trained and approved by the mastic manufacturer.

(1) Heat the Asphalt Repair Mastic using the Mastic Mixer. Place the heated mastic onto the properly prepared pavement, in layers if necessary.

(2) Use a heated hand squeegee to level and smooth the mastic until the material has formed a durable, well-bonded, level repair. Keep the heated hand squeegee free of material buildup to ensure a smooth, quality finished product.

(3) Apply the mastic according to the manufacturer's instructions to the surface area from the bottom up in lifts appropriate to the specific application. Due to the depths of some of the repair locations, multiple lifts may be required to obtain a level surface. In the event that multiple lifts are required, allow each lift to be properly cooled before any subsequent lifts are applied on top. The final lift shall fill the uppermost 0.5 in. to 1 in. of the work area. Remove and dispose of all excess material from the roadway.

510.04 MEASUREMENT AND PAYMENT

Payment will be full compensation for furnishing, hauling, and placing of all materials, crack routing, crack sealing, asphalt repair mastic treatment, the removal and disposal of old filler and debris, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Payment will not be made for wasted material.

510.04.01 Crack Sealer without Routing will be measured and paid for at the Contract unit price per linear foot, per lane mile, or per pound as specified.

510.04.02 Crack Sealer with Routing will be measured and paid for at the Contract unit price per linear foot, per lane mile, or per pound as specified.

510.04.03 Asphalt Repair Mastic will be measured and paid for at the Contract unit price per gallon.

CATEGORY 500
PAVING

SECTION 511 — OPEN GRADED FRICTION COURSE

511.01 DESCRIPTION

Construct Open Graded Friction Course (OGFC) according to Section 504 except as specified.

511.02 MATERIALS

Open Graded Friction Course	Section 927
Performance Graded Asphalt Binders	Section 904
Production Plants	Section 915

511.03 CONSTRUCTION

511.03.01 Demonstration. Construct a demonstration strip of at least 100 tons outside the project limits to demonstrate that a satisfactory OGFC mix can be produced and placed before proceeding with the actual work. Construct a new strip if a project carries over to a new season or whenever there is a change in the mix design. Use pavers and rollers that conform to 504.03.01. A material transfer vehicle may be used to construct the demonstration strip.

The demonstration strip may be waived for projects less than 200 tons or as directed. Material not meeting specification requirements may be subject to penalty or removal and replacement.

511.03.02 Hauling Units. Dry soap powder may be used with the release agent specified in 915.02(f). Raise truck beds to drain excess water and/or release agent before loading with OGFC.

The time between plant mixing and shipment shall not exceed one hour. Stored material shall be of no less quality than mixtures discharged directly into hauling vehicles. Each load shall be completely covered with a securely fastened full tarp containing no holes or rips.

511.03.03 Weather Restrictions. Place OGFC only when the ambient and surface temperatures are at least 50 F and in accordance with polymer-modified materials as specified in 504.03.02. Do not place OGFC if the existing surface is wet or frozen.

511.03.04 Material Transfer Vehicle (MTV). Use a material transfer vehicle (MTV) when placing OGFC. The MTV shall perform additional mixing of the OGFC material and then deposit the mixture into the paver at a uniform temperature and consistency. An MTV may be used when placing OGFC for a permeable pavement system but is not required.

511.03.05 Pavement Thickness. The thickness of the pavement shall be as specified. 504.03.13 (Thin Lift) is not applicable.

511.03.06 Tack Coat. Apply tack coat at a rate between 0.04 gal/yd^2 to 0.06 gal/yd^2. Reduce the application rate to 0.02 gal/yd^2 to 0.04 gal/yd^2 on freshly placed bituminous surfaces. Do not apply tack coat to permeable pavement systems using OGFC.

511.03.07 Compaction. Compact the surface using the number of passes determined from the satisfactory construction of the demonstration strip. The rollers shall follow the paver according to the QC Plan. The rollers shall be equipped with a watering or soapy watering system that prevents material from sticking. No vehicular traffic of any kind is permitted on the surface after rolling until the OGFC has completely cooled to 125 F. Continued rolling will not be allowed to prevent crushing the aggregate.

The finished OGFC surface shall be even with no pockets and meet the grades shown. Do not use OGFC in areas designated for storage.

511.03.08 Joint Construction. Clean and tack the vertical face of the longitudinal joint before placing adjoining material. Construct butted (not lapped) longitudinal joints so that the joint is smooth, well-sealed, and bonded**.**

511.03.09 Pavement Profile. As determined.

511.03.10 Mix Sampling and Testing. Refer to 504.03.11

511.03.11 Testing for Pavement Density (Air Voids). Normal density requirements are waived.

511.04 MEASUREMENT AND PAYMENT

Open Graded Friction Course will be measured and paid for at the Contract unit price per ton. Payment will be full compensation for furnishing, hauling, placing all materials, material transfer vehicle, anti-stripping additive, tack coat, setting of lines and guides where specified, and for all material, labor, equipment, tools, required testing, and incidentals necessary to complete the work.

Material produced for the demonstration strip will not be measured but the cost will be incidental to the item OGFC.

511.04.01 Price Adjustment for OGFC. Mix adjustments for gradation and asphalt content will be as follows:

Use Steps 1 through 5 of MSMT 735 in conjunction with the physical properties in Table 901 D and the following:

(6) Determine the Composite Mixture PWSL (CMPWSL) for each lot:

$$CMPWSL = \frac{f1*PWSL1+f2*PWSL2+ f3*PWSL3+f4*PWSL4+ f5*PWSL5}{\sum f}$$

PWSL1 = Asphalt content
PWSL2 = Aggregate passing the 3/8" (9.5mm) Sieve
PWSL3 = Aggregate passing the #4 (4.75mm) Sieve
PWSL4 = Aggregate passing the #8 (2.36mm) Sieve
PWSL5 = Aggregate passing the 200 (75µm) Sieve
∑f = Sum of price adjustment factors

Determine the PWSL for each property from MSMT 735, Table 1.

(7) Use the following table with the price adjustment factors (f) to compute CMPWSL:

Properties	Factor (f)
Asphalt content	64
Aggregate passing the 3/8" Sieve	9
Aggregate passing the #4 Sieve	9
Aggregate passing the #8 Sieve	9
Aggregate passing the 200 Sieve	9

Report the CMPWSL and PWSLs to the nearest whole number.

(8) Use the CMPWSL determined in Steps 6 and 7 for the Mixture Pay Factor.

511.04.02 Dispute Resolution. Refer to 915.02.03

CATEGORY 500
PAVING

SECTION 512 — SURFACE ABRASION

512.01 DESCRIPTION

Perform Surface Abrasion (SA) using high velocity steel shot to modify the pavement surface texture.

512.02 MATERIALS

Not Applicable.

Equipment.

(a) Surface Abrasion Machine. Perform texturing with a machine designed and built for high production pavement texturing. The machine shall be capable of maintaining a minimum average production rate of 1800 yd^2/hour for pavement surfaces with a minimum width of 48 in. per pass. The machine shall be capable of separating and recycling the steel shot employing the High Velocity Impact Method (HVIM), and shall vacuum and contain the abrasion debris into a self-contained unit with a minimum capacity of 3 yd^3. The SA equipment shall be equipped with controls capable of monitoring and controlling the vehicle speed and shot velocity. Self-contained lighting is required for night operations.

(b) Steel Shot. Use steel shot material which does not exceed the EPA Toxicity Characteristic Leaching Procedure (TCLP) test thresholds for the eight metals which define the RCRA toxicity characteristics according to 40 CFR 261.24 (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Submit certification as specified in TC 1.03 and an MSDS for the steel shot to be used.

512.03 CONSTRUCTION

512.03.01 Quality Control Plan. Submit a Quality Control Plan (QCP) for approval at least 30 days prior to construction operations. The QCP shall show the methods proposed to control the equipment and abrasion operations. Discuss the QCP requirements at the pre-construction and progress meetings. The QCP shall contain, at a minimum:

(a) Key Personnel and contact information.

(b) Cleaning and maintenance schedule for the SA equipment.

(c) Field safety;

(d) Control of steel shot and abrasion debris;

(e) Corrective actions that will be taken for unsatisfactory construction practices and deviations from the material Specifications; and

(f) A manufacturer's representative must be present at the construction site to train construction personnel prior to applying SA Treatments and must remain available during application as necessary.

The QCP shall designate a Plan Administrator with full authority to institute any action necessary for the successful operation of the Plan. The Plan Administrator may supervise the QCP on more than one project, if that person can be in contact with the job site within one hour after being notified. Maintain and make available upon request complete records of quality control inspection results and actions taken to correct problems. Any deviation from the approved QCP shall be cause for immediate suspension of construction operations.

512.03.02 Control Strip and Acceptance Testing. Identify each distinct pavement surface by apparent age or material composition visually and based on construction history records. Distinct pavement surfaces longer than 1000 lane-ft require a control strip at least 50 ft. Test the control strip before and after abrasion as specified and according to the table below. All control strip post-abrasion tests must pass prior to proceeding with construction. Provide a new control strip adjacent to the failed strip for re-treatment using modified application parameters.

512.03.03 Surface Abrasion. The distance from the edge of traffic markings to the texture shall be a maximum of 3 in. Do not perform surface abrasion over drainage inlets. The longitudinal area between dashed lane markings need not be textured. Complete all SA treatment, dust/abrasion removal, and successful testing prior to opening to traffic. Collect and store all abrasion debris removed during the texturing process in the SA unit until it can be removed from the project and properly disposed of off-site as directed. Recover any loose steel shot using magnetic means. Abrasion debris is not permitted to be left on the roadway or swept off to the side. Maintain all roadway markings either by exclusion or replacement at no additional cost.

Test the abraded surface according to the table below during construction of the initial and final passes in each lane of each distinct pavement surface. Test locations shall be random and identified as directed. If any test fails during construction, re-treat the failed area halfway between two passing test locations. Conduct a new control strip if two consecutive test locations fail to establish appropriate application parameters. The Administration will perform Quality Assurance (QA) testing as determined.

	Control Strip				Acceptance	
	Pre-Abrasion		Post-Abrasion		During Construction	
	Frequency	Requirement	Frequency	Requirement	Frequency	Requirement
Sand Patch (MSMT 413)	Minimum of 2 per Control Strip	For Documentation Only	Minimum of 2 per Control Strip	Average Diameter ≤ 6.5 in.		
Outflow Meter (E2380)	Minimum of 2 per Control Strip	For Documentation Only	Minimum of 2 per Control Strip	9 Seconds Maximum	2 per distinct surface, or 5 Per Lane Mile, whichever is greater.	9 Seconds Maximum

512.04 MEASUREMENT AND PAYMENT

Surface Abrasion will be measured and paid for at the Contract unit price per square yard of completed and accepted work. Payment will be full compensation for surface abrasion work, hauling, storing, pavement marking replacement, control strip construction, abrasion debris removal and disposal, magnetic steel shot recovery, sampling, Toxicity Characteristic Leaching Procedure testing, control strip and acceptance field testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

(a) Surface Abrasion on Asphalt Surface will be measured and paid for as specified.

(b) Surface Abrasion on Portland Cement Concrete Surface will be measured and paid for as specified.

(c) Surface Abrasion on Bridge Deck Per Square Yard will be measured and paid as specified.

CATEGORY 500
PAVING

SECTION 513 — FOAMED ASPHALT STABILIZED BASE COURSE

513.01 DESCRIPTION

Construct a Foamed Asphalt Stabilized Base Course (FASBC) using a mix consisting of a water-foamed performance-graded asphalt binder and an aggregate blend, as specified.

513.02 MATERIALS

Foamed Asphalt Stabilized Base Course	Section 926
Recycled Asphalt Pavement (RAP)	900.03
Reclaimed/Recycled Concrete (RC)	900.03
Aggregate	Section 901
Portland Cement	902.03
Fly Ash	902.06.04
Performance Graded Asphalt Binders	Section 904
Production Plants	Section 915
Water	921.01
Lime	921.03

513.03 CONSTRUCTION

513.03.01 Mix Design. Refer to 904.04.03. Submit a mix design approval from SHA's Office of Materials Technology's (OMT) Soils and Aggregate Technology Division to the Engineer at least 30 days prior to placement of the FASBC material. Work will not be allowed to commence without OMT approval.

513.03.02 Quality Control Plan. Refer to 504.03, Section 915, and the following. **S**ubmit a Plant Quality Control Plan to the Office of Material Technology and a Field Quality Control Plan to the District Engineer's representative for approval at least 30 days prior to the placement of any FASBC.

(a) The Plant Quality Control Plan shall also contain the following:

(1) Contact information and certifications for key personnel.

(2) Laboratory location, equipment calibration information, and accreditations.

(3) Plant calibration information.

(4) Binder source.

(5) Plant half-life and expansion ratio testing frequency.

(6) Cleaning and maintenance schedule for plant foaming nozzles.

(7) Construction method and historical composition of RAP, RC, and FASBC stockpiles.

(8) Gradation, moisture, and temperature testing frequency of stockpiled materials.

(9) Moisture control methods for stockpiles.

(10) Mixture sampling and testing frequency for gradation, binder quantity, and moisture.

(b) The Field Quality Control Plan shall contain the following, as a minimum:

(1) Identification of production plants and their locations with respect to the project site.

(2) Contact information and qualifications for key personnel.

(3) Inspection and record keeping methods and minimum frequencies of sampling and testing.

(4) Field density and thickness testing method and frequency.

(5) Corrective actions that will be taken for unsatisfactory construction practices and deviations from the material Specifications.

Maintain and make available upon request complete records of sampling, testing, corrective actions, and quality control inspections.

513.03.03 Mixing Plant. Refer to 915.04 and the following:

(a) Capable of producing a homogeneous mix free from foamed asphalt globules and stringers.

(b) Capable of mixing the RAP, RC, reclaimed aggregate material, aggregates, mineral filler, or any combination of the above, water, asphalt binder and additives meeting the approved job mix formula to form a homogenous mass that will bond together when compacted.

(c) Equipped with an exterior test nozzle to verify proper foaming action and to provide a representative sample of the foamed asphalt.

(d) Equipped with an internal electric heat cleaning system for self-cleaning foaming nozzles, or nozzles should be cleaned following accepted industry best practices. Diesel fuel shall not be used to clean foaming nozzles.

513.03.04 Equipment. Refer to 504.03.01.

513.03.05 Weather Restrictions.

(a) Temperature. A minimum surface temperature of 50 F and air temperature of 55 F are required during FASBC placement. Surface and air temperatures must be measured in the shade and away from artificial heat. Do not place FASBC when temperatures below 40 F are anticipated within the next 24 hours.

(b) Precipitation. The existing aggregate base or subgrade must be dry at the time of placement. Do not begin placement when fog, showers, or rain are anticipated within 24 hours. When placement is ceased due to precipitation, all materials en route shall be wasted at no additional cost.

513.03.06 Storage and Transportation. FASBC must be stockpiled at the plant in a manner that prevents moisture changes. FASBC can be stockpiled for a maximum of seven days prior to placement, unless otherwise approved. Stockpiling is not permitted for mixes containing cement or Class C fly ash. Handle and transport FASBC in a manner that minimizes segregation and loss of moisture. Do not dump FASBC into piles, haul over the completed aggregate base course, or stockpile on the job site without approval.

513.03.07 Placement. All FASBC material is to be placed using pavers. If multiple lifts are to be placed, moisten the underlying surface prior to paving.

513.03.08 Compaction. Refer to 504.03.07 and as follows:

(a) Measure in-place density by either MSMT 350 or MSMT 352 Method B. When MSMT 352 Method B is used, all nuclear density gauges used on the project shall be calibrated during placement of the control strip to the specific FASBC job mix formula, and the density gauge moisture content corrected for the presence of asphalt in the FASBC. Compacted dry density must be at least 97 percent of the maximum dry density and the compacted moisture content must be within two percentage points of optimum.

(b) The initial moisture content correction for the nuclear gauge shall be based on the direct moisture content measurements made on the control strip. At the beginning of each day's production, a moisture content specimen will be taken from the first load of delivered FASBC and sent to the laboratory for an overnight moisture content determination via a slow oven burn (temperatures less than 230 F). This moisture content will then be used to determine the density gauge moisture correction for the next day's production.

(c) Begin compaction operations, except on super elevated curves, at the sides of the course. Overlap the shoulder or berm at least 1 ft and progress toward the center parallel to the center line of the roadway. On super elevated curves, begin compaction at the low side and progress toward the high side. Continue compaction operations until all compaction marks are removed.

513.03.09 Curing and Maintenance. The FASBC shall be allowed to cure under ambient environmental conditions and must be successfully proof rolled as specified in Section 204 or a 20 ton loaded truck before overlaying, unless otherwise approved. Repair any damaged areas of the FASBC prior to overlaying as directed. Areas that cannot be repaired must be replaced for the full depth of the base. Only allow necessary construction traffic on the FASBC unless otherwise directed.

Measure the FASBC mat moisture according to T 110, T 265 or D4643 content every 2500 lane-ft through the full lift depth with a minimum sample weight of 3 lb daily until final cure is complete. Moisture may also be measured with a density gauge using the same method and locations used during compaction and applying asphalt and cement moisture corrections. Final cure will be considered complete when the moisture content drops at least 50 percent from the final compaction moisture and the FASBC is satisfactorily proof rolled as directed. Repair any damage to the completed FASBC material prior to overlaying as directed.

513.03.10 Sampling and Testing for Foamed Asphalt Cement Content. Sample for Asphalt Cement Content behind the paver using MSMT 457 sampling method A or B before compaction of the FASBC. Obtain a total of three random samples per placement day using the Random Sample Location program used in asphalt pavement core testing. A Contractor's Certified Technician must sample the mixture at the project site as witnessed by the Administration.

The Administration will test at least one of the random behind-the-paver mix samples according to T 308. The Administration will determine the added foamed asphalt content of the random sample(s) using the ignition oven correction factor and results previously developed from the approved bag samples. The average of the foamed asphalt content of the behind-the-paver samples must be within ± 0.4 of the Job Mix Formula's foamed asphalt cement target but no less than two percent. If the average is not within ± 0.4 of the Job Mix Formula target, the FASBC must be removed and replaced at no additional cost.

513.03.11 Control Strip. Construct a control strip at an approved location to determine the roller patterns needed to achieve optimum density after compaction and after curing. Use the control strip to calibrate the nuclear density gauges used for QC and QA testing during placement. Place

a minimum of 100 tons of FASBC in the control strip. The control strip shall be one-lane wide at the specified thickness and optimum foamed asphalt content.

Measure in-place density and moisture content in the control strip at six random locations according to MSMT 350. The average compacted dry density must be at least 97 percent of the Proctor (AASHTO T 180D) maximum dry density and the average compacted water content must be within two percentage points of optimum. Moisture content must be measured at each location using either a slow oven burn, microwave drying, or other approved suitable means with the temperature not to exceed 110 F. The measured moisture content shall be used to determine the moisture offset for the density gauge to correct for the presence of asphalt in the FASBC. A successful proof roll of the control strip as specified in Section 204 or a 20 ton loaded truck and meeting the compaction requirements are needed before proceeding with remaining FASBC construction.

Accepted control strips may remain in-place and will be accepted and measured as a part of the completed foamed stabilized base. Tests used for the test strip will not be included in the evaluation for payment. Should the removal of any control strip be necessary, the Contractor must remove it at no additional cost.

The Administration reserves the right to collect additional samples and perform additional tests on the material from all FASBC areas for information purposes as directed. The results of these additional tests will not be used for acceptance or payment.

513.04 MEASUREMENT AND PAYMENT

Foamed Asphalt Stabilized Base Course will be measured and paid for at the Contract unit price per square yard of the specified thickness. Surface area measurements will be based on the specified width of the base and the actual length measured along the centerline of the foamed asphalt stabilized base course. Payment will be full compensation for all aggregate, asphalt binder, other additives, furnishing, hauling, placing, curing, control strip, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Temporary graded aggregate base wedge constructed in conformance with Standard No. MD 104.01-28 will not be measured but the cost will be incidental to the foamed asphalt stabilized base course item. The cost of the Control Strip will not be measured but the cost will be incidental to the foamed asphalt stabilized base course item.

CATEGORY 500
PAVING

SECTION 514 — HIGH FRICTION SURFACE TREATMENT

514.01 DESCRIPTION

Construct a High Friction Surface Treatment (HFST) using calcined bauxite aggregate and polymeric resin binder at locations as specified or directed.

514.02 MATERIALS

High Friction Surface Treatment Section 928

514.03 CONSTRUCTION

Provide certification per TC 1.03 at least 30 days prior to construction that the aggregate and binder conform to the specified requirements.

514.03.01 Qualifications. Provide documentation showing a minimum of three HFST projects on which a cumulative minimum of 5000 yd^2 of HFST has been placed within the past three years using calcined bauxite, excluding bridge decks. The projects shall have demonstrated a friction reading of 65 FN40R when tested per E 274, or Dynamic Friction Value of 0.7 per E 1911 at 20 km/hr. Contractors who do not meet the minimum must be certified by the polymeric resin binder manufacturer to install HFST.

514.03.02 Application Quality Control (QC) Plan. Submit a QC Plan for Application and provide a copy to the OMT for approval at least 45 days prior to placement. The QC Plan shall show proposed methods to control the equipment, materials, mixing, and paving operations to ensure conformance with the specifications. Discuss the QC Plan requirements at the pre-construction, pre-pave, and progress meetings. The QC Plan shall contain at a minimum:

(a) Key personnel, Plan Administrator, and their contact information.

(b) Polymeric resin binder production plants, plant locations, personnel qualifications, inspection and record keeping methods, equipment calibration records, accreditation certificates, and minimum frequencies of sampling and testing.

(c) Aggregate source production locations, material testing locations, personnel qualifications, inspection and record keeping methods, equipment calibration records, accreditation certificates and minimum frequencies of sampling and testing per the Soils

and Aggregates Testing Division (SATD) QA Manual (Frequency Guide, https://roads.maryland.gov/OMT/QAM-SATD.pdf) and Table 928B.

(d) Methods to control aggregate moisture.

(e) All certifications as specified.

(f) Procedures for stockpiled and onsite materials storage.

(g) Procedures for binder materials blending and HFST placement.

(h) Cleaning and maintenance schedule for Truck Mounted Application Machine.

(i) Corrective actions to be taken for unsatisfactory construction practices and deviations from specifications. Record of issues encountered in the last three years and remedial actions that were implemented.

(j) A polymeric resin binder manufacturer's representative must be available during application as necessary.

(k) Plan to determine timing for sufficient curing and for initial clean up sweeping.

(l) Plan for staging work to ensure no damage is done to placed material during gelling plastic stage.

(m) Procedure to measure pavement temperature prior to HFST placement.

(n) Procedure to ensure correct Polymeric Resin Binder quantity is applied.

The QC Plan shall designate a Plan Administrator who shall have full authority to institute any action necessary for the successful operation of the Plan. The Plan Administrator may supervise the QC plan on more than one project, if that person can be in contact with the job site within one hour after being notified of a concern.

A field technician provided by the contractor shall be present at the job site unless otherwise approved in the QC Plan. The technician shall be responsible for the required field quality control sampling and testing in conformance with the approved quality control plan and contract documents. Maintain and make available upon request complete records of sampling, testing, actions taken to correct problems, and quality control inspection results. Any deviation from the approved QC Plan shall be cause for immediate suspension of operations.

514.03.03 Weather Restrictions. The pavement must be dry. Do not apply the binder on wet surfaces or when the anticipated weather conditions or pavement surface temperature would prevent proper application. Condensation moisture from construction vehicles in front of binder applications must be removed prior to placement. Do not apply the binder when the ambient and pavement temperatures are less than 40 F.

514.03.04 Equipment.

(a) Truck Mounted Application Machine for Automated Application. Use an approved self-propelled truck mounted application machine capable of continuously and thoroughly mixing the binder components to the ratio recommended by the manufacturer and applying at a minimum coverage rate of 15 gal/min at varying widths up to 12 ft. The applicator vehicle shall mechanically mix, meter, monitor, and apply the binder resin system and spread the aggregate a minimum of 12 ft wide in one uniform and continuous pass. The aggregate should be spread at a rate of 12 lb/sy to 16 lb/sy in varying widths of up to 12 ft with a maximum height from spreader to pavement surface of 12 in. If recommended by the manufacturer, metering pumps shall be heated.

(b) Regenerative Air Sweeper. Use a self-propelled Regenerative Air Sweeper with power brooms capable of cleaning the existing pavement and removing loose aggregate without dislodging the aggregate. If it is desired to re-use loose aggregate, the sweeper must be capable of recycling loose aggregate into clean, uncontaminated, and dry aggregate. The sweeper must be capable of being used without water for dust suppression to ensure a dry surface will be maintained.

514.03.05 Preparation. Perform roadway patching as specified in Section 505. Clean and fill all inadequately sealed joints and cracks 1/4 in. to 1-3/4 in. wide as specified in Section 510 or Section 523 with a sealant approved by resin manufacturer. Where HFST will be applied on new asphalt surface in the same location, construct HFST a minimum of 30 days after placement of underlying and adjacent pavement. Completely remove all curing compounds on new Portland cement concrete surfaces prior to installation. Adequately cover and protect all utilities and existing pavement markings in areas where markings will be left in place prior to HFST placement or remove all existing pavement markings as specified in Section 558. On Portland cement concrete pavement, perform surface abrasion as specified in Section 512 prior to installation.

On all pavement surfaces, clean existing surfaces with a sweeper without dust suppression water, or by methods approved by the manufacturer's representative and the Engineer prior to construction. Clean asphalt pavement surfaces using mechanical sweepers and high-pressure air wash with sufficient oil traps. Mechanically sweep all surfaces to remove dirt, loose aggregate, debris, and deleterious material. Vacuum sweep or air wash, using a minimum of 180 ft^3/minute and 80 lb/in^2 of clean and dry compressed air, all surfaces to remove all dust, debris, and deleterious material. Wash pavement surfaces with a mild detergent solution to remove all dust, oil, grease, debris and any other material that might interfere with the bond between the polymeric resin binder and existing surfaces, and dry using a hot compressed air lance.

514.03.06 Test Section. Select a location and construct a test section a minimum of 200 yd^2 at a minimum of 24 hours prior to beginning the project to demonstrate equipment has been properly calibrated, and appropriate application procedures have been established. If the project site is used for the test section, open the test section to traffic after curing has completed and no uncovered binder remains exposed. Correct deficient areas before opening to traffic as directed at no

additional cost. Approval of the Test Section must be granted by the engineer prior to subsequent placement.

514.03.07 Binder Application. Measure and record the surface temperature of the pavement. Mix the binder components proportionally in accordance with the manufacturer's recommended ratio. Apply mixed binder at a uniform application thickness of 60 ± 5 mils onto the pavement section to be treated, within the pavement surface temperature range specified by the binder manufacturer. Measure the binder thickness using a global wet film thickness gauge every 200 ft. Do not allow the mixed binder to separate in the mixing lines, cure, dry, chill, set up, or otherwise impair retention bonding of the high friction surfacing aggregate. Ensure that no seams are visible in the middle of the traffic lanes after application of the surface aggregate.

514.03.08 Aggregate Application. Immediately after placing the binder, apply the aggregate at a uniform rate of 12 lb -16 lb. per square yard. Completely cover the wet binder with aggregate to achieve a uniform surface with no exposed binder remaining visible on the surface prior to gelling. The binder shall not be exposed for more than 5 minutes, or half of the polymeric resin binder working time relative to the pavement temperature at the time of placement, whichever is shorter. Sprinkle or vertically drop the aggregate without splashing the wet film during placement. Spread the aggregate without displacing the wet binder film during placement.

514.03.09 Manual Application. Manual application may be used when less than 300 yd^2 will be used. Mix the binder components to the correct proportion within 4 percent by weight using a low-speed high torque drill fitted with a helical stirrer. Hand-apply the mixed components onto a prepared pavement surface using a serrated edged squeegee. Use spiked shoes to minimize the contamination or disturbance of applied binder. Avoid contact or contamination of the wet uncured binder prior to application of the aggregate. Remove and replace damaged, contacted or contaminated sections at no cost. The aggregate may be applied manually.

514.03.10 Semi-Automated Application. Semi-Automated application may be used when less than 2000 yd^2will be used, and consists of machine mixing of binder, hand squeegee work to apply mixed binder, and machine application of aggregate. Use equipment to continuously mix, meter, and monitor the binder. If recommended by the binder manufacturer, use a heated metering pump. Mix the binder according to the manufacturer's specifications (± 2 percent by volume). Immediately after the binder application, use a serrated squeegee to distribute a uniform binder thickness. Mechanically apply the aggregate immediately after placing the binder. Manually spreading the aggregate is allowed as a secondary method if the mechanized equipment cannot physically be used.

514.03.11 Automated Application. Automated application consists of machine mixing and application of binder, and machine application of aggregate. No hand squeegee work is allowed. The aggregate drop spreader must be used.

514.03.12 Sampling and Testing. During construction, **s**ample and test binder and aggregate per Table 928A and Table 928B at the start of the project and at a minimum frequency of 1 split set per new lot/batch thereafter, providing one set to the Engineer or as directed. Laboratory Dynamic

Friction Value testing is waived for Quality Control testing. Sample and label the material under direct observation.

514.03.13 Curing and Clean Up. Allow the treatment to cure in accordance the manufacturer recommendations. Clean up by removing the excess aggregate on the treated area and adjacent areas with raveled aggregate with the regenerative air sweeper. Perform initial clean up before opening to traffic. Excess aggregate can be reused on the following day's installation provided the reclaimed aggregate is clean, dry, and uncontaminated. Recovered aggregate may only be reused once and must be blended with new aggregate at a rate of 2:1 (two parts new aggregate to one part recovered aggregate).

Perform secondary cleanup 3 days to 5 days after construction. Perform final cleanup 3 weeks to 5 weeks after construction. Where pavement markings are required to be placed on HFST, use temporary pavement markings until final cleanup is performed. Apply final pavement markings after final clean up.

514.03.09 Manual Application. After the second aggregate sweeping as specified in 514.03.13, remove and re-apply HFST to areas with bare asphalt or concrete pavement, areas with binder material only, and areas with poor aggregate retention at no additional cost. Contact the Office of Materials Technology to schedule field acceptance testing per Table 514Aafter final clean up and within 60 days after construction. Optionally perform FN40R Quality Control testing per Table 514A under the engineer's supervision and submit for approval. OMT will conduct the testing per Table 514A, whether or not the contractor performs optional testing. Remove and replace polymeric resin binder and aggregate at deficient locations as directed and per Table 514C.

TABLE 514A

FIELD ACCEPTANCE TESTING REQUIREMENTS			
PROPERTY	**REQUIREMENTS**	**FREQUENCY**	**TEST METHOD**
FN40R (Corrected field FN by adding the correction in Table 514B)	Refer to Table 514C	Every 0.1 mile in each lane. By SHA	E 274 using a ribbed tire
Mean Profile Depth (inches)	0.04 Minimum	Every 0.1 mile in each lane. By SHA	E 1845

TABLE 514B

HFST SPEED CORRECTION FACTORS FOR E 274 TESTING					
Test Speed (mph)	FN Correction	Test Speed (mph)	FN Correction	Test Speed (mph)	FN Correction
20	-6.7	30	-3.3	40	0.0
21	-6.3	31	-3.0	41	0.3
22	-6.0	32	-2.7	42	0.7
23	-5.7	33	-2.3	43	1.0
24	-5.3	34	-2.0	44	1.3
25	-5.0	35	-1.7	45	1.7
26	-4.7	36	-1.3	46	2.0
27	-4.3	37	-1.0	47	2.3
28	-4.0	38	-0.7	48	2.7
29	-3.7	39	-0.3	49	3.0

TABLE 514C

ACCEPTANCE AND PAYMENT FACTOR PER HFST SITE		
Average FN40R (per HFST Site)	HFST Acceptance	Item Pay Factor (%) (added to initial 50% payment)
≥ 72	Yes	50
65 to < 72	Yes	40
< 65	No	Remove and replace, or reapply, at no additional cost to the Administration to obtain acceptable FN40R. Manufacturer's technical representative must approve any proposed reapplication treatments and be present during all corrective work. Engineer must approve all corrective work plans before implementation. If Average FN40R values are at 65 or higher after reapplication, payment per the first two rows of this table shall apply.

514.04 MEASUREMENT AND PAYMENT

High Friction Surface will be measured and paid for at the Contract unit price per square yard. 50 percent of the payment will occur after placement. If performing optional QC testing, the next 25 percent shall be paid if the Average FN40R is at least 65. The remaining shall be paid after Field Acceptance Testing is complete per 514.03.14 and Table 514C, or if OMT does not perform the Field Acceptance Testing per the timelines in 514.03 14. The payment will be full compensation for furnishing and placing the polymeric resin binder and aggregate, tie-ins to entrances and connecting roads, test section, sweeping, sampling and Quality Control testing, Quality Control plan, clean up, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

No deduction will be made for the areas occupied by manholes, inlets, drainage structures, pavement markings, or by any public utility appurtenances within the area. Material placed outside of the designated treatment area will not be included in computing the quantity.

514.04.01 Asphalt Patches will be measured and paid for as specified in 505.04.

514.04.02 Removal of Pavement Markings will be measured and paid for as specified in Section 558.

514.04.03 Filling Cracks in Asphalt Pavement will be measured and paid for as specified in Section 510.

514.04.04 Surface Abrasion on Portland Cement Concrete Surface will be measured and paid for as specified in Section 512.

CATEGORY 500
PAVING

SECTION 520 — PLAIN AND REINFORCED PORTLAND CEMENT CONCRETE PAVEMENTS

520.01 DESCRIPTION

Construct plain and reinforced Portland cement concrete pavements.

520.02 MATERIALS

Portland Cement Concrete and Related Products	Section 902
Reinforcing Steel	Section 908
Joints	Section 911
Portland Cement Concrete Plant	915.03
Fusion Bonded Epoxy Powder Coatings for Steel	917.02

Reinforcement, including load transfer assemblies, tie bars, deformed steel bars, and longitudinal tie devices shall meet Section 908 and be epoxy coated.

520.03 CONSTRUCTION

Within 30 days prior to the start of paving operations, submit a proposed paving plan for approval. Include the production plants, location of the plants with respect to project site, equipment, proposed material sources, and indicate whether the fixed form method or slip form method is proposed.

Protect the pavement against damage from all causes. Repair or replace damaged pavement.

Mix, place, and finish concrete when natural light is sufficient, or with an approved artificial lighting system.

520.03.01 Equipment. All equipment, including the production plant and paving equipment, is subject to approval. The plant, including central mixers, batching plant, truck mixers, and hauling equipment shall meet Section 915. Have the plant ready for inspection at least 48 hours prior to the start of construction operations. Have the paving equipment on the job site and ready for inspection at least 24 hours prior to the start of construction operations.

Slip form pavers shall be self-propelled on crawler tracks. No other tractive force shall be applied. The paver shall be capable of being automatically controlled for both alignment and grade.

The equipment and methods used shall provide a means to obtain the prescribed weights within the allowable tolerances, to obtain the consistency specified with a minimum amount of water, to achieve proper placement of the mixture in a condition of maximum density with no segregation, and to finish and cure the pavement as specified herein.

520.03.02 Weather Restrictions.

(a) Temperature and Surface Conditions. Begin concrete placement when the ambient air and surface temperatures are at least 40 F and rising. Discontinue placement whenever the temperature falls below 40 F. These requirements may be waived for incidental concrete construction. Do not place concrete on a frozen base.

(b) Precipitation. Have sufficient approved material on hand to cover freshly placed concrete as protection against precipitation.

(c) Wind. Cease placement when the Engineer determines that wind conditions may have a detrimental effect on the work.

When weather conditions differ from these limits, placement of material en route is at the Contractor's risk.

If the Engineer for any other reason stops placement, dispose of en route material at no additional cost to the Administration.

520.03.03 Foundation. Construct the foundation as specified. Construct the total width of the foundation to the width of the pavement plus at least 4 in. outside the base of the fixed form or the outermost edge of the slip form paver track or wheel. No additional payment will be made for the extended width. Ensure that the foundation is approved prior to the installing fixed forms or the use of slip forms.

520.03.04 Forms. Use steel side forms having a thickness of at least 7/32 in. and a depth equal to the edge thickness of the pavement. Forms shall have a base equal to the height, a flat-flanged tread or top surface not less than 2 in. wide, and be of sufficient strength to resist all loads applied during the paving process. Do not use built up forms or warped forms. Use form sections that are at least 10 ft long except for installation along curves with a radius of less than 200 ft. For a curve radius less than 200 ft, use form sections that are no more than 6 ft long or use curved forms. All form sections shall have stake sockets that will accommodate a 1 in. diameter steel stake. Sections 10 ft or greater in length shall have at least three sockets. Sections less than 10 ft long shall have at least two sockets.

Fasten keyways rigidly to the form. Provide holes through both the form and the keyway to accommodate tie bars or dowels.

Place the forms to a tolerance of 1/8 in. in 10 ft for the top, and 1/4 in. in 10 ft for the face. Provide a means for locking the ends of abutting sections. Forms shall be clean and coated with an approved form release compound. Remove or repair forms that are bent, deformed, or broken.

Set grade controls at intervals of no more than 25 ft. Set the forms at least 400 ft ahead of concrete placement. When the foundation has been disturbed subsequent to the forms being set to the correct grade, make corrections as approved. Check the alignment and grade for conformance with the Contract Documents. Use an approved device such as a scratchboard and make any necessary corrections prior to concrete placement.

Wooden forms may be approved for use in exceptional cases, such as for curves of very short radius or when a nonstandard length of straight form is required.

520.03.05 Slip Form Paving. Unless otherwise approved, the minimum width of slip form paving shall be 24 ft. The total foundation width shall be graded using machine methods.

Set grade controls using string lines at intervals of no more than 25 ft. Construct the foundation as specified in 520.03.03; completed and approved at least 1000 ft ahead of the paver before paving begins. Stop paving whenever the paving machine comes to within 200 ft from the end of the approved foundation, and install a bulkhead construction joint. When paving adjacent to an existing pavement, the portion of the equipment supported by the existing pavement shall have wheels with rubber tires or crawler treads on protective pads. Maintain a clearance of at least 1 ft from the inner edge of the paver track or wheel to the edge of the existing pavement.

Slip forms shall be spaced and braced in a vertical position at a uniform and constant width, and of a length sufficient to prevent slumping or sagging of the sides and top edges of the pavement slab. Slip form equipment shall be capable of placing and securing embedded tie bars and keyways in proper position in the plastic concrete before the edge of the pavement slab is free of the slip form.

520.03.06 Reinforcement. Reinforcement shall be as specified. Dowel bars are smooth round bars which serve as load transfer devices across transverse concrete joints to allow concrete slab contraction and expansion, regardless of whether they are designated by bar number or diameter. Refer to Standard MD 572.21 for dowel bar sizes and requirements. Refer to Standard MD 572.23 for dowel bar assembly. Tie bars are deformed rebars or connectors used for holding together longitudinal concrete joints, regardless of whether they are designated by bar number or diameter.

Maintain the reinforcement in a clean condition, free from foreign material that may prevent proper bonding of the concrete. Secure all reinforcement to prevent displacement or movement.

(a) Install dowel bars at joints on the approved foundation parallel to the foundation grade, sufficiently ahead of the placement of slab reinforcement and concrete. Coat each dowel bar with an approved water insoluble lubricant. Dowel bars may be machine placed or set on approved chairs or prefabricated assemblies. Maintain proper alignment, depth, and spacing.

(b) Tie bars for longitudinal construction joints may be placed on chairs or machine placed so that upon the initial set of the concrete they are at the proper alignment, depth, and spacing, and at right angles to the center line of the pavement. Prior to use, submit chairs and machine placement devices for approval.

(c) Furnish fabric and mat reinforcement in flat sheets. Keep the material flat during placement. Maintain the specified reinforcement clearance.

(d) When using slip forms, the tied reinforcement bars, or prefabricated mats may be installed ahead of the placement of concrete by being supported on chairs. Reinforcement installed in this manner shall be in place at least 500 ft ahead of the paver or a two-hour run of the paver before any paving may begin. Stop paving whenever it comes to within 100 ft of the end of the steel placement and install a bulkhead construction joint.

520.03.07 Concrete Placement. Prior to placement of the concrete, ensure that the foundation is in a moist condition. In addition, if the concrete is exposed to the direct rays of the sun and the ambient temperature is 70 F and rising, sprinkle the forms and reinforcement with cool water just before placement of the concrete. Once deposited within the forms, keep any rehandling to a minimum.

Where concrete is to be placed adjoining a previously constructed lane of pavement, mechanical spreading and finishing equipment may be operated upon the existing lane of pavement only after the existing concrete has reached a compressive strength of 3000 psi in conformance with 902.10.03. Wheels that rest on the previously completed concrete shall be flat without flanges, at least 3 in. wide, and located far enough from the edge of the slab to preclude spalling or damage. Perform sampling for control testing at the time of concrete placement and as specified in 902.10.08.

Deposit the total depth of the slab in a single layer except as otherwise specified herein or approved. For pavement constructed using bar mat or wire fabric reinforcement, place the concrete in two layers, unless it is demonstrated that the bar mat or wire fabric can be properly supported on approved devices.

Single Layer Placement. Set the reinforcement on chairs capable of maintaining the stability and proper elevation of the reinforcement. Welding of reinforcement to the chairs in lieu of wire ties will be permitted, except welding for epoxy-coated reinforcement will be permitted only if the epoxy coating is applied after the welding. Refer to Standard MD 572.23 for welding restrictions of dowels. Repair damage to epoxy coating using materials specified in 917.02.

Two Layer Placement. Place the concrete and bar mats or wire fabric reinforcement in a continuous operation. First, place the concrete to the specified depth of reinforcement. Then place the reinforcement on the freshly deposited concrete; follow immediately with the second layer of concrete.

520.03.08 Consolidation of Concrete.

Fixed Form Paving. Consolidate the concrete by using immersion type vibrators. Vibrators shall advance with the paving equipment and be set at the spacing and depth necessary to clear reinforcement by 1/2 in. Maintain the amplitude required to obtain thorough consolidation within the slab, along the faces of the forms, and at the joint assemblies. Avoid excessive vibration that results in segregation, and any vibrator contact with the side forms, joint assemblies, or underlying material. The consolidation system and settings are subject to approval.

Slip Form Paving. Concrete consolidation systems shall be incorporated in the paving equipment. Submit the systems for approval.

520.03.09 Finishing.

Machine Finishing. The machine shall be equipped with two transverse screeds with provision for adjustment to ensure that the concrete is at the specified crown and grade. Following the transverse screeds, the concrete shall be screeded longitudinally. The width of the working face of the screeds shall be at least 6 in. Use a chevron ("V" type) nonreciprocating finishing float or other approved type. The float shall be suspended from a frame that does not ride directly on the forms. Following the finishing float, use a long handled scraping straightedge 10 ft long to bring the pavement to the correct grade. When the finishing machine is operated over concrete that has partially set, make provisions to prevent damage to the concrete by the machine wheels.

Hand Finishing. With approval, hand finishing may be substituted for machine finishing. Do not use rakes for handling concrete.

520.03.10 Slab Surface and Thickness Checks.

Surface Check. After finishing, and before texturing of the concrete, check the entire surface by using an approved 10 ft long metal straightedge. Limit the surface deviation from a straight line or vertical curve transversely or longitudinally to 1/8 in. in 10 ft.

Thickness Check. After the pavement is placed and before final acceptance, cut cores by which the Engineer will check the thickness. Perform coring according to MSMT 552. Locate cores every 1000 ft for each lane unless otherwise specified or directed. Fill core holes at no additional cost to the Administration. Pavement deficient in thickness by more than 1 in. will be unacceptable. Remove and replace the full pavement section. Deficiencies up to 1 in. will be subject to reduced payment as specified in 520.04.

520.03.11 Texturing and Edging.

Texturing. Texture the surface of the pavement with longitudinally tined grooves using a mechanical device (such as a wire comb), following concrete finishing and surface check. The device shall have a single row of tines with nominal widths of 5/64 in. to 1/8 in. each. The nominal spacing of the tines shall be 3/4 in. ± 1/8 in. center-to-center. The nominal depth of the tined

grooves shall be 1/8 in. ± 1/32 in. The device shall have horizontal and vertical controls to ensure straight, tined grooves of uniform depth.

Begin texturing when the concrete is plastic enough to allow texturing to the depth specified, but dry enough to prevent the concrete from flowing back into the grooves. Avoid overlaps and tearing of the concrete. Protect a 2 in. to 3 in. wide strip of pavement surface from tining for the length of the pavement; centered along longitudinal joints. Extend the tining as close as possible to the edge of any adjacent pavement to be placed without damaging the edge. Do not tine areas 6 in. from the edge of pavements where adjacent pavement is not placed. Do not tine areas 1 ft from the curb in closed sections. Hand operated tining equipment that produces an equivalent texture with the specified spacing may be used on small or irregularly shaped areas. The completed textured finish shall exhibit a uniform appearance.

Edging. Edge textured transverse and longitudinal slabs using a 1/4 in. radius edging tool when the concrete has reached its initial set.

520.03.12 Curing. Following texturing and edging, cure the concrete for at least 72 hours. Whenever the ambient air temperature falls below 40 F during the curing period, use insulated or electric blankets, or a method approved by OMT, to maintain the concrete temperature above 40 F and extend cure time to at least 96 hours for cold weather applications. Use the methods described above in addition to any curing material that is used. Provide a sufficient number of high/low thermometers to monitor the temperature of the concrete. Cure the concrete using one of the following methods:

(a) Liquid Membrane Forming Compound. Use a liquid membrane forming compound that is in conformance with 902.07.03. Apply the material to the surface as soon as the free water has disappeared. Use an approved spraying machine having driven wheels that straddle the freshly placed concrete. Have standby equipment on site in the event of failure of the spraying machine. The spraying machine shall be equipped with an adequate wind guard and be capable of producing a fine spray of material that covers the surface with a uniform continuous film. Apply the compound in two applications, each at a rate of 1/2 gal/200 ft^2. Maintain the film free of pin holes, checks, cracks, peelings, and other imperfections. Correct discontinuities in the film by the application of an additional coat to the affected area within 30 minutes of the original coat. If sprayed surfaces are subjected to damaging rainfall within three hours after the second application, respray the surface at no additional cost to the Administration.

Use rope or other approved masking methods to keep the vertical surfaces of longitudinal and transverse joints free of curing compound. Protect the sprayed surfaces to maintain the continuity of the membrane. Application of compound by hand operated spraying equipment in irregular areas shall be as directed.

(b) Burlap Curing. Place burlap conforming to 902.07.01 on the freshly placed concrete as soon as practical, without damaging the concrete. Overlap the burlap to provide a double thickness on the entire surface. Saturate the burlap with water before placement and keep it continuously wet during the curing period.

(c) Cotton Mat Curing. Place cotton mats conforming to 902.07.04 on the freshly placed concrete as soon as practical, without damaging the concrete. Saturate the mats with water before placement and keep them continuously wet during the curing period.

(d) Sheet Materials. Place sheet materials conforming to 902.07.02 on the freshly placed concrete as soon as practical without damaging the concrete. Overlap the material at least 1 ft and extend it outside the slab. Secure all laps and edges in place to provide continuous contact of the sheet with the pavement surface.

520.03.13 Form Removal of Fixed Form Paving. Unless otherwise directed, leave forms in place until the concrete has set at least 12 hours. If the sides of the slab show no damage, continue curing for the remaining 60 hours of the 72 hour curing period. Repair damaged or honeycombed areas and then cure for an additional 72 hours.

520.03.14 Joints. Construct joints in conformance with the details specified, perpendicular to the finished grade of the pavement, and sealed as specified in Section 523. Transverse expansion and contraction joints shall be straight and continuous from edge to edge of the pavement.

(a) Transverse Construction Joints. Place a transverse construction joint at the end of each day's placing operations and at any other points within a paving lane where concrete placement is interrupted for 30 minutes or longer. Locate these joints at a planned joint except in the case of an equipment breakdown. When concrete placement cannot be continued, the transverse construction joint may be located within the slab unit but not less than 10 ft from a planned transverse joint. Dowel transverse construction joints as specified and saw the joints in conformance with (c)(1).

(b) Expansion Joints. Form expansion joints by placing a preformed filler material conforming to 911.02. Use approved metal supports to hold the filler securely in position. Leave the metal supports in the pavement. Install a removable metal channel cap bar to hold the parts of the joint in proper position and to protect the filler from damage during concreting operations. Remove the cap bar without damaging the pavement to provide a space for sealing the joint. Fit adjacent sections of filler tightly together and extend them across the full width of the paving lane to prevent concrete from entering the expansion space. Use a joint filler of the specified type, thickness, and width to form expansion joints around structures and features that project through, into, or against the pavement.

(c) Contraction Joints. Construct longitudinal and transverse contraction joints by sawing. If gravel aggregate is used, tool the joint, or form it by using an approved insert.

(1) Sawed Joints. Sawcut to the specified depth using a 1/8 in. blade. Base the time of sawing on current and anticipated weather conditions and to prevent uncontrolled cracking of the pavement. Start the sawing operation as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. Respray damaged membrane cured surfaces as

soon as the surface is dry. After completion of the curing period, widen the upper portion of the groove by sawing to the specified width and depth. The saw blades may be single or gang type, with one or more blades mounted in tandem. Do not sawcut into load transfer devices. Immediately after sawing the joint, thoroughly flush the saw cut and adjacent concrete surface with water to remove all waste.

(2) Insert Type Contraction Joints. Construct insert type contraction joints by installing a preformed insert in the plastic concrete to form a weakened plane to induce cracking. Use a machine equipped with a vibratory bar for cutting a groove in the plastic concrete for placement of the insert and for vibrating the insert into place. Arrange vibration units to distribute vibration uniformly throughout the bar. The intensity of vibration shall be adjustable as necessary to form a groove of proper size for the filler, to force the insert into the plastic concrete, and to consolidate the concrete around the insert. Immediately following final machine finishing, install the insert at the specified location and required depth for the full width of the paving lane. Ensure that there are no more than two joint spacings between the finishing machine and the inserter. For concrete placed by slip form pavers, support the edges of the plastic concrete to prevent slumping during the vibration and placement of the inserts. Join adjacent sections of the joint inserts within each slab securely together, and thoroughly consolidate the concrete against the full depth of the insert. Maintain the insert perpendicular to the finished grade of the pavement and straight in alignment. Keep the top of the insert flush or not more than 1/8 in. below the pavement surface. Following placement of the insert, use the vibratory float in lieu of hand floating and troweling. Perform any additional straightedge and texturing operations without disturbing the insert.

After the completion of the curing period, remove the top portion of fiberboard fillers or sawable preformed inserts by sawing with a power saw as approved.

520.03.15 Pavement Profile. Refer to pavement surface profile requirements specified.

520.03.16 Opening to Traffic. The pavement may be opened to vehicular traffic after having attained a compressive strength of 3000 psi. Field samples will be tested according to T 23.

520.03.17 Dowel Bar Placement Checks. After each day's placement of the PCC pavement is complete and cured, the alignment and placement of the dowel bars will be checked by the Administration using a non-destructive test method. All joints will be tested to determine conformance with the following.

(a) Vertical Skew. The vertical skew shall be no greater than 1/2 in. tolerance over a 12 in. length of dowel bar.

(b) Horizontal Skew. The horizontal skew shall be no greater than 1/2 in. tolerance over a 12 in. length of dowel bar.

(c) Depth of Dowel Bar. The dowel bar shall be located within the middle third of the slab thickness. A minimum cover depth of 3 in. is required for the top, and a minimum cover depth of 2.5 in. is required for the bottom.

(d) Joint. The joint saw cut shall be in the middle third of the dowel bar length. The minimum embedment length on either side of the joint shall be 4 in.

(e) Missing Dowel Bar. A missing dowel bar shall be considered misaligned.

A joint is in nonconformance or misaligned if any dowel bar in the wheelpaths are not in conformance.

(a) For 12 ft wide or narrower lanes, the 3 outermost bars and 3 bars under the inside wheelpath must be in conformance.

(b) For widened slabs, the 3 bars under the outside wheelpath and the 3 bars under the inside wheelpath must be in conformance.

(c) In addition, a joint is in nonconformance or misaligned if at least 3 dowel bars in non-wheelpath areas do not conform to the above.

After testing is complete, the percentage of those joints not meeting the above will be determined. Deficiency will be subject to a reduced payment as specified in 520.04. This is in addition to the reduced pay for slab thickness.

520.04 MEASUREMENT AND PAYMENT

Plain and reinforced Portland cement concrete pavements will be measured and paid for at the Contract unit price per square yard for the pertinent Portland Cement Concrete Pavement item. The square yard measurement will be computed on the basis of plan width and as-built length measured along the pavement center line. The payment will be full compensation for all concrete, forms, reinforcement steel, chairs, epoxy coating, finishing, curing, joints, joint construction, saw cutting and joint sealing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

520.04.01 Pavement Thickness Price Adjustment. Payment for areas that are accepted at a reduced price for deficient thickness will be adjusted by the factors shown in the following table. Deficiencies will be determined by procedures specified in 520.03.10. There will be no additional payment for excess thickness.

PAVEMENT THICKNESS PRICE ADJUSTMENT	
DEFICIENCY IN INCHES	**PERCENT OF PAYMENT CONTRACT UNIT PRICE**
0.00 to 0.20	100
0.21 to 0.30	80
0.31 to 0.40	72
0.41 to 0.50	68
0.51 to 0.75	57
0.76 to 1.00	50
Greater than 1.00 *See 520.03.10	0*

520.04.02 Dowel Bar Misalignment Price Adjustment. Payment for the percentage of joints accepted at a reduced price for not conforming to the proper alignment will be adjusted by the factors shown in the following table. Alignment is determined by procedures specified in 520.03.17. This shall be a reduced price for the Portland cement concrete pavement item in addition to any reduction due to pavement thickness.

DOWEL BAR PRICE ADJUSTMENT	
Percent of Misaligned Joints *	**Percent of Payment, Contract Unit Price ****
0 to 10	100
>10 to 15	95
>15 to 20	90
>20 to 25	85
>25 to 30	75
>30 to 50	70
Greater than 50	Corrective action***

*This is the percentage of all joints tested.

**This price adjustment is to the PCC price and not for the dowel bars or joints. This is in addition to any price adjustment for pavement thickness.

***Corrective action may include removal and replacement, dowel bar retrofit, or other method approved by the Administration.

CATEGORY 500
PAVING

SECTION 521 — CONTINUOUSLY REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT

521.01 DESCRIPTION

Construct continuously reinforced Portland cement concrete pavement on a prepared subgrade.

521.02 MATERIALS

Refer to 520.02 and the following:

Reinforcement. Section 908 for reinforcement, load transfer assemblies, tie bars, deformed steel bars, and longitudinal tie devices, except that all materials shall be epoxy coated. Select the type of reinforcement from one of the following:

(a) Deformed steel bar mats as specified in 908.07. Use No. 5, Grade 60 longitudinal bars, and No. 4, Grade 60 transverse bars.

(b) Loose deformed steel bars as specified in 908.01. Use No. 5, Grade 60 longitudinal bars with a length of at least 40 ft, and No. 4, Grade 60 transverse bars.

(c) Welded deformed steel wire fabric as specified in 908.06.

521.03 CONSTRUCTION

Refer to 520.03 except as follows.

521.03.01 Placing Reinforcement. Preset the reinforcement on chairs or chair bars with the transverse members placed below the longitudinal members. Place the longitudinal bars within the tolerances specified.

Before placing the concrete, remove rust, mud, oil, or other detrimental coatings. Place the mat and fabric reinforcement flat and free from distortions. Furnish loose steel bars that are free from kinks or bends that prevent them from being properly assembled or installed.

Furnish approved chairs or chair bars designed to support the reinforcement in position without deflection or displacement during the placing and consolidation of the concrete. Use chair bases designed with sufficient bearing to prevent overturning or penetration into the subgrade, and that will not impede placement of the concrete. Chairs may be welded to the transverse bars prior to epoxy coating.

If the support system does not hold the reinforcement within the specified tolerances, increase the number of chairs or take other steps to maintain proper positioning of the steel.

521.03.02 Placing Concrete. Place the concrete in one lift, vibrated internally over its full width and depth by immersion vibrators mounted at intervals of not more than 30 in. center to center across the full width of the slab. The vibrators shall have variably controlled frequencies. Operate the vibrators at the frequency and amplitude necessary to be perceptible on the surface of the concrete more than 1 ft in any direction. Mount the vibrators as a group advancing longitudinally with the paving machinery, hinge mounted to facilitate riding over obstructions, and set to clear the reinforcement by approximately 1/2 in.

Stop all screeding and vibrating operations immediately whenever forward motion of the paving machinery is stopped.

521.03.03 Joints. Do not place transverse expansion or contraction joints in continuously reinforced Portland cement concrete pavement. Construct a transverse bulkhead joint whenever concreting operations are stopped for more than 30 minutes and at the end of any working period. Form the joints using an approved header board in conformance with the cross section of the pavement, placed at right angles to the center line, and perpendicular to the surface. Furnish and install additional bars as specified. Finish the pavement flush with the header board without edging. Complete the joints accurately and keep the bulkhead clean. Extend the roadway reinforcement continuously through the joint. Support the reinforcement extending through the joint securely on chairs or wooden sills to prevent deflection.

Resume paving operations when the Engineer determines that the concrete has sufficiently set. Before resuming concrete placement, remove the bulkhead and debris and clean the joint.

Seal all joints as specified in Section 523.

521.03.04 Terminal Joints. Construct terminal joints as specified.

521.03.05 Thickness Check. Refer to 520.03.10.

521.03.06 Pavement Profile. Refer to the pavement surface profile requirements in the Contract Documents.

521.04 MEASUREMENT AND PAYMENT

Continuously Reinforced Portland Cement Concrete Pavement will be measured and paid for at the Contract unit price per square yard. The square yard measurement will conform to 520.04. The payment will be full compensation for all concrete, forms, reinforcement steel, chairs, epoxy coating, finishing, curing, joints, joint construction, saw cutting and joint sealing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

521.04.01 Pavement Thickness Price Adjustment. Refer to 520.04.01.

521.04.02 Terminal Joints. Terminal Joints will be measured and paid for at the Contract unit price per linear foot. The payment will be full compensation for all steel beams, stiffener plates, end plates, drilled holes, welding, cutting, styrofoam, joint filler, concrete, reinforcement, bond breaker, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 500
PAVING

SECTION 522 — PORTLAND CEMENT CONCRETE PAVEMENT REPAIRS

522.01 DESCRIPTION

Repair plain, conventionally reinforced, or continuously reinforced Portland Cement Concrete (PCC) pavement. Repairs are either Type I, 6 ft to less than 15 ft in length; or Type II, 15 ft and greater in length.

522.02 MATERIALS

Refer to 520.02 except as follows.

Graded Aggregate for Base Course	901.01
Crusher Run Aggregate CR-6	901.01
Concrete Mix No. 9	902.10
Nonshrink Grout	902.11(c)
Epoxy Grout	902.11(d)
Epoxy Adhesive	921.04
Concrete Mix HE	902.10
Macro Polyolefin Fibers	902.15.01

522.02.01 Polyester Grout. A polyester grout may be used in lieu of epoxy grout, provided the grout conforms to 902.11(d). Identify cartridge type systems by batch or lot number.

522.02.02 Epoxy Adhesives. Refer to 921.04. Use water insensitive materials classified as Type V, Grade 3, Class B and C.

522.02.03 Reinforcement. Refer to Section 908 for reinforcement, including load transfer assemblies, tie bars, deformed steel bars, and longitudinal tie devices, except all material shall be epoxy coated.

522.03 CONSTRUCTION

The Engineer will determine the areas to be repaired and the type of repair. Submit a proposed repair plan, including equipment, methods, and procedures prior to the start of repairs. If repairs cover multiple lanes, ensure that the longitudinal joints are established according to

Standard No. MD 572.92 in the same location. Protect the area against damage from all causes. Repair or replace any part of the repaired pavement that is damaged.

522.03.01 Equipment. Refer to 520.03.01 and the following:

522.03.01.01 Drills. For dowel bar holes along transverse joints, use hydraulic gang drills with a minimum of two independently powered and driven drills. Use tungsten carbide drill bits. Control the forward and reverse travel of the drills by mechanically applied pressure. Mount the drill on a suitable piece of equipment such that it is quickly transported and positioned. Rest and reference the drill rig frame on and to the pavement surface such that the drilled holes are cylindrical, perpendicular to the surface being drilled, and repeatable in terms of position and alignment on the surface being drilled. Hand-held drills are not permitted for transverse joints.

For tie-bar holes along longitudinal joints, hand-held drills are permitted.

522.03.01.02 Match Curing Apparatus. According to R 72.

522.03.01.03 Portable Compressive Strength Testing Machine. Refer to T 22. Provide testing machines on site for testing match cure specimens at the specified times.

522.03.02 Weather Restrictions. Refer to 520.03.02, except perform the work only during April through October.

Provide cold weather protection as specified in 520.03.12 when the ambient air temperature is less than 70 F. The 96 hour cure time for cold-weather applications does not apply. Refer to 522.03.11.

522.03.03 Saw Cuts and Removal of Existing Pavement. Make all saw cuts perpendicular using a diamond saw blade. Remove concrete slabs by the lift out method in large sections. No other method of slab removal shall be used unless approved. Repair adjacent slab damage caused by the removal operations. Repair spalls greater than 1/4 in. wide, 2 in. long, and more than 1/2 in. deep below the pavement surface using an approved epoxy mortar. Extend the patch boundary by re-sawing the limits of the patch beyond the spalled area when spalls greater than 1 in. wide, 12 in. long, and more than 1/2 in. deep below the pavement surface are created by the pavement removal operation. Complete all repairs within the same day that the pavement is removed.

Perform saw cutting and pavement removal as follows:

(a) Plain and Conventionally Reinforced Portland Cement Concrete Pavement. Make full depth saw cuts for the full slab width. When the repair is on only one side of an existing transverse joint, extend removal into the adjacent slab a sufficient distance to remove existing dowels. Remove the concrete slab within one week after making the saw cuts.

(b) Continuously Reinforced Portland Cement Concrete Pavement. Locate the boundaries of the repair at least 12 in. from the nearest transverse tight crack. Make a full depth saw cut across the full width of the slab. Remove the concrete to its full depth within the boundaries of the repair area within 72 hours after making saw cuts.

When saw cuts close due to temperature, make narrowly spaced, full depth, and full width saw cuts to relieve the pressure, or as directed. Remove the material between the narrowly spaced saw cuts and between the longitudinal joints as specified. Remove all waste material from the repair site. Seal any saw cuts that extend into adjacent slabs, curbs, or gutters as specified in Section 523.

522.03.04 Base, Subbase and Subgrade Preparation. Refer to 505.03.05, except moisten the subbase or subgrade for all types of repairs.

Backfilling may be done with aggregate or concrete

522.03.05 Subgrade Drains. Construct subgrade drains as specified in Section 306, if directed.

522.03.06 Forms. Use the existing adjacent pavement as a form. Ensure the adjacent pavement surfaces match the existing concrete pavement surface prior to performing repairs.

If the adjacent shoulder becomes damaged during removal of existing pavement, use forms as specified in 520.03.04. Excavate the adjacent shoulder the width of the form plus 6 in. Overlap existing pavement at least 1 ft on each side of the patch and securely fasten to prevent movement. After removing the form, repair the excavated shoulder using the same type of material as used in the original shoulder.

522.03.07 Reinforcement. Refer to 520.03.06 and as specified herein. Place the doweled joint at the slab face closest to the original doweled joint location.

(a) Refer to Standard No. MD 577.08. Drill holes into the face of the existing slab as close as possible to mid depth, avoiding existing reinforcing steel. After cleaning out the holes, make sure the surface is dry before applying epoxy.

(b) Grout or epoxy the dowels and tie bars into place. Align reinforcement in the direction of the pavement and parallel to the surface.

(c) Drill four holes per wheel path (eight per lane) into the face of the existing slab at mid depth. Space holes 12 ± 1 in. apart on center.

(d) Use a pachometer or other device to determine the location and length of longitudinal joint tie bars in the concrete to remain in place outside the repair area.

(e) If a longitudinal joint tie bar is within 12 in. of the surface being drilled, drill the outer holes 3 in. to 4 in. from the end of the tie.

(f) If no tie bars are within 12 in. of the surface being drilled, drill the outer holes 12 in. from a longitudinal joint between two travel lanes and 12 in. from a longitudinal joint between a travel lane and a shoulder.

Place a plastic grout retention disk on each dowel to prevent loss of the bonding material. Coat the protruding ends of the dowel bars with an approved water insoluble lubricant.

522.03.08 Joints. Refer to 520.03.14, except that joint shall not be sealed.

522.03.09 Concrete Placement. Refer to 520.03.07. Clean any adjacent vertical surfaces prior to concrete placement. Construct both plain and continuously reinforced concrete pavement repairs in one full depth operation. Construct conventionally reinforced concrete pavement repairs by placing two equal lifts with the wire mesh laid on the surface of the first lift. Vibrate all concrete.

522.03.10 Finishing. Strike off the surface of the placed concrete to the finished grade using an adjustable steel or wooden template then float the surface. Screed the repair to provide ride uniformity with the adjacent pavement, as necessary. Match the contour of the existing roadway. Perform surface checks as specified in 520.03.10. Patches not meeting uniformity requirements shall be diamond grinded at no additional cost.

522.03.11 Curing. Cure the concrete as specified in 520.03.12, except continue curing for 12 hours after concrete placement or until the repair is put into service. The requirement for an approved spraying machine having drive-wheels is waived when using the liquid membrane forming compound method.

522.03.12 Emergency Filler. Provide a sufficient amount of CR-6 to fill the void of the repair area. Place and compact the material then cover it with a steel plate. Completely remove the material when proceeding with the work using procedures that will not disturb the subgrade, subbase, dowels, load transfer tie bars, load transfer assemblies, or previously placed reinforcement.

522.03.13 Steel Plates. Have an ample supply of 1 in. thick steel plates of sufficient length and width available on the project to cover emergency filler and to protect the patch area until the concrete has developed sufficient strength to carry traffic.

522.03.14 Unacceptable Repairs. Remove and replace repairs that are not in conformance and repairs damaged by traffic or other causes. Repair limits for damages shall be as specified in 522.03.03.

522.03.15 Opening to Traffic. When used, prepare match cure specimens according to R 72. Provide temperature readings of the test specimens and the corresponding patch after finishing at intervals of one hour or less. Test match cure specimens on site at specified ages with a portable compression testing machine certified within 12 months. The pavement may be opened to traffic after having attained a compressive strength of 2000 psi, and as approved.

522.04 MEASUREMENT AND PAYMENT

Portland cement concrete pavement repairs will be measured in place and paid for at the Contract unit price per square yard for the pertinent type Plain Portland Cement Concrete Pavement Repair, Conventionally Reinforced Portland Cement Concrete Pavement Repair, and Continuously Reinforced Portland Cement Concrete Pavement Repair item. The payment will be full compensation for saw cuts, furnishing, hauling, placing of all materials, curing using match cure apparatus, field testing of match curing specimens, removal and disposal of old concrete, grout, drilled holes, chairs, all tie devices, reinforcement, epoxy coating, steel plates, emergency filler, joint sealing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Emergency filler, match curing apparatus, portable compression testing device, and steel plates will remain the property of the Contractor at the completion of the project. Damages caused by the Contractor shall be repaired at no cost to the Administration.

522.04.01 Removal of unsuitable material will be measured and paid for as Class 1-A Excavation. Refill will be measured and paid per cubic yard for aggregate or concrete.

522.04.02 Subgrade drains will be measured and paid for as specified in the applicable portions of Section 306.

CATEGORY 500
PAVING

SECTION 523 — JOINT SEALING OF PORTLAND CEMENT CONCRETE PAVEMENTS

523.01 DESCRIPTION

Clean and seal Portland cement concrete pavement joints.

523.02 MATERIALS

Joint Sealers	911.01
Preformed Joint Fillers	911.02

Backer Rod. Use backer rod that is flexible, compressible, nonshrinkable, has a surface that will not bond with the joint sealer, and is capable of uniformly containing the sealer within the desired shape factor. Do not use hard rubber or materials that swell when wet or deform at sealer application temperatures.

523.03 CONSTRUCTION

Seal joints the same day they are shaped and prepared and complete the joints prior to opening the roadway to traffic, unless otherwise directed. If joints are not sealed the same working day, reclean and dry the joints as specified in 523.03.02 prior to sealing.

523.03.01 Joint Construction. As specified in 520.03.14. If the joint is tooled, do not use preformed joint fillers.

523.03.02 Joint Preparation. Clean joints by one of the following methods as approved:

(a) High pressure water blasting.

(b) Abrasive blasting.

(c) Oil free air blowing at a minimum of 90 psi.

Ensure that all joint walls and surfaces to which the joint material is to adhere are dry prior to installing the joint filler.

Ensure that all prepared joints are inspected and approved prior to sealing.

523.03.03 Sealing. Install preformed joint filler in conformance with the manufacturer's recommendations and the Contract Documents. Insert the backer rod as specified.

Install silicone sealer in conformance with the manufacturer's recommendations.

Backer rods are not required in longitudinal joints.

Apply sealer when the ambient air and pavement temperatures are at least 45 F and rising.

Heat hot applied sealer in accordance with the manufacturer's recommendations in a kettle or other equipment acceptable to the Engineer. Use kettles that have mechanically operated agitators, recirculation pumps, and positive thermostatic temperature controls. The applicator wand and all connecting hoses shall be insulated. Do not overheat or apply direct heat to the sealer.

Withdraw and waste all filler that has been overheated, heated more than four hours, or that remains in the applicator at the end of the day's operation. Prior to the start of each day's operation, withdraw and waste at least 1 gallon of filler through the applicator wand.

Fill joints with sufficient material that the final surface of the sealer is recessed 1/4 in. below the pavement surface. Reseal the joint if within two hours after sealing, the sealer is recessed more than 5/16 in. below the pavement surface.

Use an approved tool to apply a parabolic shape to the surface of the sealer. Ensure that the deepest point at the center of the joint is 5/16 in. below the pavement surface. Remove any excess sealer from the surface of the pavement.

Curing time for silicone material varies with temperature and humidity and may delay opening the pavement to traffic. Traffic is not allowed on the pavement surface until the sealer has cured. Refer to the manufacturer's recommendations for curing time.

Any sealer that pulls loose from the joint or shows excessive bubbling within one week after opening the pavement to traffic shall be replaced.

523.04 MEASUREMENT AND PAYMENT

Joint Sealing of Portland Cement Concrete Pavement will be measured and paid for at the Contract unit price per linear foot of joint unless otherwise specified. The payment will be full compensation for cleaning existing joints, furnishing, hauling, placing all materials including preformed joint filler, joint sealer, backer rod, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Joint construction and sealing will not be measured but the cost will be incidental to the Contract unit price for the pertinent Portland Cement Concrete Pavement item.

CATEGORY 500
PAVING

SECTION 524 — DOWEL BAR RETROFIT

524.01 DESCRIPTION

Place load transfer devices or dowel bars between two slabs in an existing Portland Cement Concrete (PCC) Pavement. Place dowel bars into slots cut across cracks or joints and backfilling with grout.

524.02 MATERIALS

524.02.01 Plain Reinforcement. Dowel bars used as ties in PCC pavement expansion and contraction joints shall be plain round steel bars conforming to A615, Grade 60 or A36 unless otherwise specified. Bars shall be epoxy coated using epoxy powder conforming to 917.02. Each dowel bar shall be coated with a water insoluble lubricant as approved.

524.02.02 Expansion Caps. Use tight-fitting, commercial quality end caps made of a non-metallic, non-organic material that allows for 1/4 in. of movement at each end of the dowel bar.

524.02.03 Dowel Bar Support Chairs. Chairs for supporting the dowel bars shall be either completely epoxy-coated steel conforming to A 884 or fabricated of commercial quality nonmetallic, non-organic material. The dowel bar chairs shall firmly hold the dowels centered in the slots during the fast setting grout backfill operations. Dowel chairs shall be designed to hold the bar a minimum of 1/2 in. above the bottom of the slot while the fast setting grout backfill is placed and consolidated.

524.02.04 Foam Core Insert. Use 3/8 in. thick foam core inserts to re-establish the joint or crack and allow each side of the slot to expand and contract. The inserts shall consist of rigid Styrofoam material or closed cell foam, faced with poster board or plastic material. The width of the foam board in its final position shall be 1/16 in. wider than the slot to minimize movement of the foam board and prevent incompressible material from entering the contraction joint during concrete placement. The width of the foam core board may need to be increased for pavements with skewed cracks or joints.

524.02.05 Grout Material. Refer to 902.14. Use Class II or Class III Rapid Hardening Cementitious Material to backfill the dowel bars.

524.03 CONSTRUCTION

524.03.01 Equipment.

(a) Saw. Create the slots using a power-driven gang type assembly saw equipped with diamond saw blades. The saw shall be capable of sawing to the dimensions described without damage to the surrounding pavement.

(b) Jack Hammers. Use a 30 lb jack hammer. Use a 15 lb hammer if the pavement is damaged by the 30 lb hammer.

524.03.02 Cleaning. Clear the area of all cuttings and other material after the saw cutting and jack hammering are complete. Clean the slot of all foreign material and remove from the job site. Sand blasting equipment may be used to remove all foreign material from the exposed surfaces. Provide a cleaned concrete surface free of spalls, latence, and all contaminants detrimental to achieving an adequate bond.

524.03.03 Dowel Bar Installation. Install the dowel bars in the existing PCC pavement as specified in the Contract Documents and as follows:

(a) Place the dowel bar slots according to Standard No. MD 580.01. Place all dowels parallel to the surface, to each other, and to the edge of the lane along the joint or crack. Multiple saw cuts parallel to the centerline may be required to properly remove the material from the slot.

(b) Saw the pavement to a depth to place the dowel bar at mid-depth in the pavement section. The saw cuts for the slots at each transverse crack or transverse joint shall be made such that the dowel bars are placed within the tolerances as specified in 524.03.01(a).

(c) Remove the concrete from the slot without damaging the surrounding pavement.

(d) Sand blast and clean all exposed surfaces and cracks in the slot prior to bar installation.

(e) Use bar chairs to provide a 1/2 in. clearance between the bottom of the dowel bar and the bottom of the slot and chair such that the dowel bar is secured in place during placement of the grout. Place the dowel bars at the depth shown on the details, parallel to centerline and the top of the roadway surface, and at the middle of the slot, all within the specified tolerances.

(1) Dowel bar placement for skewed cracks shall be within ± 2 in. of the required transverse spacing requirements.

(2) Dowel bar placement for perpendicular cracks or joints shall be within ± 1 in. of the required transverse spacing requirements.

(f) Place the foam core inserts at the middle of each dowel bar to maintain the transverse contraction joint so that the foam core board fits tightly around the dowel bar and to the bottom and edges of the slot. Minimize movement of the foam board and prevent incompressible material from entering the contraction joint during concrete placement. Ensure that the insert extends up to the bottom of the existing joint sealant reservoir. If no sealant reservoir exists, the top of the foam core board shall be flush with the top surface of the concrete pavement.

(g) Thoroughly moisten all surfaces on the sawed slot prior to filling with patching compound. Remove excess water with compressed air.

(h) Fill the slot with the installed dowel bar, chairs, and foam core board in place with grout material. Vibrate the grout material with a small hand-held vibrator capable of thoroughly consolidating the patching compound into the slot and around the dowel bar. Trowel finish and cure the top surface of the filled slot. Curing compound shall meet 902.07.03.

(i) Saw and seal the transverse cracks and transverse contraction joints as shown according to Standard No. MD 580.01.

524.04 MEASUREMENT AND PAYMENT

Dowel Bar Retrofit will be measured and paid for at the Contract unit price per each dowel bar placed and accepted. The payment shall be full compensation for saw cutting, jack hammering, dowel bars, form core, chairs, grout, expansion caps, clearing and hauling waste material, and for all equipment, material, labor, and all incidentals necessary to complete the work.

Repair or replace dowel bar retrofits that are non-functioning or damaged at no additional cost to the Administration.

CATEGORY 500
PAVING

SECTION 525 — PORTLAND CEMENT CONCRETE SPALL REPAIR

525.01 DESCRIPTION

Repair spalled areas at various locations as specified in the Contract Documents or as directed. Spalling consists of small areas of cracking, breaking, chipping, or fraying of Portland Cement Concrete (PCC) slabs that typically occur within 2 ft of the edge of joints. Some spalling may occur in the middle of the slab away from the joints.

525.02 MATERIALS

Rapid Hardening Cementitious Materials for Concrete Pavement Repair	902.14
Portland Cement Concrete Mix #9 using No 7 aggregate	902.10
Epoxy Adhesive	921.04

525.03 CONSTRUCTION

Repair spalled areas according to the following.

525.03.01 Repair Guidelines.

(a) Rapid Hardening Cementitious material or Portland Cement Concrete Mix #9 using No. 7 aggregate may be used in spalled areas that are less than 4 ft^2 and less than 3 in. deep.

(b) Use Portland Cement Concrete Mix #9 using No. 7 aggregate only in spalled areas are 4 ft^2 or greater or when the known depth is 3 in. deep or more. Rapid-hardening cementitious materials with extender aggregate may be used instead of Mix #9.

(c) The maximum repair width shall not be greater than one-third of the travel lane.

(d) Repair areas greater in width than one-third of the travel lane, deeper than one-third of the slab thickness, or where reinforcing steel is exposed as a Type I or Type II full-depth patch as specified in Section 522.

525.03.02 Repair Procedure. Refer to Section 522 and the following.

(a) Sound the area around the spalling with a light hammer to locate the extent of the repair. Mark the perimeter 3 in. beyond the delamination marks.

(b) Do not make repairs on spalls less than 6 in. long and less than 1.5 in. wide.

(c) Combine any two spalled areas less than 2 ft apart into one area of repair.

(d) Make a vertical saw cut along the outside perimeter of the repair area using a diamond-bladed saw set to a depth of approximately 2 in.

(e) Use a chipping hammer fitted with a spade bit having a maximum weight of 30 lbs. to remove the unsound concrete until sound and clean concrete is exposed along the entire bottom of the repair area. Expose the area to a depth of no more than 1/3 of the slab thickness. When more chipping is required, or when any reinforcing steel is exposed, repair the area as specified in Section 522.

(f) Removal of spalled or delaminated concrete may be performed by carbide milling rather than sawing and chipping to a depth of no more than 1/3 of the slab thickness. When any reinforcing steel is exposed, repair the area as specified in Section 522.

(g) Sound the bottom of the repair area with a light hammer to locate any remaining weak spots.

(h) Clean the repair area thoroughly of all loose and foreign material.

(i) Coat the repair area with an epoxy bonding compound according to C881 Type V.

(j) Place the repair material in one continuous operation. Consolidate the concrete using spud vibrators or as recommended by the manufacturer. Finish the repair as specified in 522.03. Trowel the repair outward to push the repair material against the walls of the repair.

(k) Cure the repair as specified in 522.03.11.

525.04 MEASUREMENT AND PAYMENT

Portland Cement Concrete Spall Repair will be measured and paid for at the Contract unit price per cubic yard for the pertinent Portland cement concrete pavement item. The payment will be full compensation for all saw cutting, carbide milling, chipping, concrete, rapid hardening cementitious materials, epoxy bonding compound, cleanup of the patched areas, forms, reinforcement steel, chairs, epoxy coating, finishing, curing, joints, joint construction, joint saw cutting, joint sealing, tack coat, all hauling of materials, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 500
PAVING

SECTION 528 — RESURFACING ASPHALT PAVEMENT USING PORTLAND CEMENT CONCRETE

528.01 DESCRIPTION

Resurface existing asphalt pavements with a Portland Cement Concrete (PCC) surface. The location and extent of the resurfacing will be as specified and as directed.

528.01.01 Whitetop Patching (WT Patching).

Removal of deteriorated remaining pavement, stone base, or soil after milling and replacing with concrete.

528.02 MATERIALS

Aggregates	901.01
Concrete Admixtures	902.06
Portland Cement Concrete Whitetopping Mix	902.10 Mix No. WT
Rapid Hardening Cementitious Materials for Concrete Pavement Repairs	902.14
Synthetic Fibers	902.15
Joints	Section 911
Portland Cement Concrete Plants	915.03

528.03 CONSTRUCTION

Submit the proposed paving plan at least 30 days prior to beginning the work. The plan shall include equipment, milling plan, proposed material sources, and placement methods.

Ensure pavement surfaces are protected from all damage. Mix, place, and finish the concrete when natural light is sufficient, or provide adequate artificial lighting as approved.

528.03.01 Pre-pave meeting. Conduct a pre-paving meeting at least three weeks prior to beginning the work. The meeting shall consist of the following personnel: Contractor, concrete supplier, paving sub-contractor (project manager and onsite foreman/supervisor), traffic control personnel, Project Engineer, lab personnel, and OMT Design Engineer. Provide the meeting minutes to all attendees.

Discuss the following issues during the meeting: work schedule, who is responsible for changes and the approval process for those changes, traffic control, traffic control limits, weather conditions/temperatures, type of equipment for the work, material supply, saw-cutting, curing, protection/transportation of cylinders if being used for opening strength determination, allowable admixtures, material removal, break down procedures, and opening to traffic.

Discussions should also cover the following: a plan if the pavement is left too thin after milling, a plan if stone base/soil is encountered during or after milling, mix approval, and how to maintain the designed pavement thickness while paving.

528.03.02 Surface Preparation. Mill the existing pavement before Whitetopping Mix placement as shown or as directed. After milling clear all debris or other loose material so that the existing pavement can be inspected by the Engineer to determine if WT Patching or RUMR is required. Prior to WT Patching, surface should be free of any dust, contaminants, or loose material that might prevent an adequate bond.

528.03.03 WT Patching. After milling, remove areas showing signs of deterioration as determined. The condition of the underlying stone base or soil and depth of the removed material will be determined by the Engineer after removal of the deteriorated material.

(a) If the stone base is in good condition and shows no sign of distress, patch the area with WT patching.

(b) If the stone base or soil shows sign of distress or is unstable, follow 528.03.04.

528.03.04 Removal of Unsuitable Material and Refill (RUMR). Refer to 528.03.03. Remove the material in these areas to a depth as determined by the Engineer. Compact the underlying stone base or soil then place WT Patching as directed.

528.03.05 Equipment. Refer to 520.03.01. Slip form equipment is not needed. Match curing may be used. If match curing is to be utilized, the following equipment will be required:

(a) Match Curing Apparatus, according to R 72.

(b) Mobile Match Curing Specimen Testing Apparatus, according to T 22.

Match curing apparatus and mobile match curing specimen testing apparatus remain the property of the Contractor at the completion of the project.

528.03.06 Weather Restrictions. Refer to 520.03.02 for weather restrictions except the requirement for the temperature as modified herein.

Place concrete when the ambient air and surface temperatures are at least 50 F and rising and discontinue when the temperature falls below 45 F.

528.03.07 Forms. Refer to 520.03.04.

528.03.08 Concrete Placement. Refer to 520.03.07, except as follows:

(a) Prior to placement of WT patching, check the depth of the milled areas with a string line or long straight edge to determine if the depth of the milled area is uniform over the milled pavement area as shown. Paving operations may proceed upon approval.

(b) Mechanical spreading and finishing equipment may be operated on the existing lane only after the placed concrete has reached a compressive strength of 2000 psi.

(c) An evaporation reducer may be applied to the placed surface during the final finishing process, as needed.

528.03.09 Consolidation of Concrete. Refer to 520.03.08, Fixed Form Paving.

528.03.10 Thickness Check. Refer to 520.03.10, except as follows:

(a) After the pavement is placed and before diamond grinding, cut cores to be measured for thickness for pay and final acceptance.

(b) Locate two cores in each lane unless otherwise specified or as directed.

(c) Fill core holes with Rapid Hardening Cementitious Materials at no additional cost.

528.03.11 Curing. Refer to 520.03.12. If match curing is used, refer to 528.03.05(a), or as directed. Cure the concrete for a minimum of 24 hours or until opening to traffic strength (2000 psi) is achieved. The requirement for an approved spraying machine having drive wheels is waived when using the liquid membrane forming compound method.

528.03.12 Joints. Joints shall conform to the details shown and as specified, and perpendicular to the finished grade of the pavement. Transverse construction and contraction joints shall be straight and continuous from edge to edge of the pavement.

(a) Transverse Construction Joints. Install transverse construction joints at the end of each day's concrete placement operations and at any other points within a paving lane where placement is interrupted for 30 minutes or longer. Locate transverse joints at a planned joint except in cases of equipment breakdown.

(b) Contraction Joints. Construct longitudinal and transverse contraction joints by sawing.

(1) Sawed Joints. Saw grooves in the concrete with a 1/8 in. blade to 1/3 the depth of the slab. The typical joint spacing shall be 6 ft x 6 ft, unless otherwise specified or as directed. Schedule the time of sawing based on current and anticipated weather conditions to prevent uncontrolled cracking of the pavement. Begin sawing as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. Re-spray any membrane cured surface damaged during sawing operations as soon as the surface becomes dry.

528.03.13 Pavement Surface Diamond Grinding. Refer to Section 509.

528.03.14 Pavement Profile. Refer to Section 535.

528.03.15 Opening to Traffic. The pavement may be opened to vehicular traffic after having attained a compressive strength of 2000 psi. Prepare the field samples according to PP 54. Test the cylinders on site under observation with a portable testing machine according to T 22. These tests are for determining concrete strength for opening to traffic, not for acceptance.

528.04 MEASUREMENT AND PAYMENT

Resurfacing Asphalt Pavements Using Portland Cement Concrete will be measured and paid for at the Contract unit price per square yard for the pertinent Portland Cement Concrete Pavement items. The square yard measurement will be computed on the basis of the as-built width and as-built length measured along the pavement center line. The payment will be full compensation for placement of all Portland Cement Concrete, forms, surface preparation, evaporation reducer, curing, joints, joint construction, saw cutting, corrective action due to the Contractor's negligence, match-cure cylinder testing, measuring pavement thickness, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

528.04.01 Milling of the existing pavement and removal and disposal of all asphalt millings will be measured and paid for under separate pay items as specified in Section 508.04.

528.04.02 Portland cement concrete for Whitetop (WT) patching will be measured and paid for at the Contract unit price per cubic yard.

528.04.03 Removal of deteriorated material, stone base or soil will be measured and paid as Class 1-A Excavation as specified in Section 201.

528.04.04 Diamond Grinding Portland Cement Concrete Pavement will be measured and paid for at the unit cost per square yard. The payment will be full compensation for grinding, cleaning the pavement surface, technicians, removal and disposal of all grindings, surface profile testing, corrective action, and for all material, labor, equipment, and incidentals necessary to complete the work.

528.04.05 Pavement Thickness Price Adjustment. Refer to 520.04.01.

CATEGORY 500
PAVING

SECTION 535 — PAVEMENT SURFACE PROFILE

535.01 DESCRIPTION

Measure the roughness of the final surface of Asphalt Mix (SAM) or Portland Cement Concrete (PCC) pavements using an International Roughness Index (IRI) Inertial Profiler to collect Quality Control (QC) data. The IRI Inertial Profiler shall conform to E950 and MSMT 563. The Administration will use an IRI Inertial Profiler to perform all Quality Assurance (QA) testing and acceptance. Measure all traveled roadway surfaces unless otherwise indicated.

535.02 MATERIALS

Not applicable.

535.03 CONSTRUCTION

535.03.01 Equipment Standardization. MSMT 563. Perform standardization on Administration specified sites at regular intervals.

(a) Re-standardization may be required for equipment that may be out of conformance between regular intervals.

(b) Submit a copy of the completed standardization results to the Administration's Office of Materials Technology (OMT) immediately upon completion of the standardization.

(c) QC test data obtained with a profiler that has not been standardized will not be accepted.

535.03.02 Quality Control Testing for Pavement Profile. E950 and MSMT 563.

(a) Measure the pavement profiles in the direction of travel in both wheel paths simultaneously and parallel to the right edge of the lane.

(b) Document a regular schedule of pavement profiling in the Asphalt Pavement Field Quality Control Plan as specified in 504.03 or the Portland Cement Concrete Proposed Paving Plan as specified in 520.03.

(c) Notify the Engineer prior to performing any QC measurements. Submit the results according to the approved QC plan within 72 hours of completion of the paving operations.

535.03.02.01 Data Submittal. Submit all data to the Engineer and OMT (in electronic format) via one of the following:

(a) E-mail: ridespec@mdot.maryland.gov

(b) Delivered: Office of Materials Technology

7450 Traffic Drive
Hanover, MD 21076
Attention: Paving Quality Assurance Team Leader

535.03.02.02 Profile Measurements. QC profile measurements and data submission that have not been completed for all project sections as specified will not be eligible for incentive payment or for defect exemptions. QC data is required for materials clearance.

535.03.02.03 Quality Control.

(a) Measure and report the QC IRI in sections equal to 25 ft in length and one lane in width. Sections measured that are shorter than 25 ft due to exempt areas or the project end are required to be reported but not used in the pay calculation.

(b) Measure a full 25 ft section after each exempt area.

(c) Perform three measurement runs according to MSMT 563. The coefficient of variation of the overall average IRIs shall be less than or equal to 2 percent for three runs.

(d) When the first three runs do not meet the above criteria, perform additional runs until three measured runs meet the criteria. Submit the acceptable three runs to the Administration. Only the median run (based on average IRI) will be considered for the QC IRI data and will be used to compute any pay adjustments.

535.03.02.04 Exempt Areas. The following pavement areas are exempt from profiling and reporting for pay adjustment:

(a) Shoulder areas.

(b) Parking areas of ride sharing facilities or park and ride lots.

(c) Pavements of ramps, side street tie-ins, acceleration lanes, or deceleration lanes less than 1000 ft in length.

(d) Bridge decks, railroad crossings, stop signs, and pavement within 50 ft thereof.

(e) Pavement within 50 ft of transverse joints that separate it from existing pavement. This does not apply when a transverse joint is paved on both sides as part of one contract.

(f) Pavements on projects with less than 1000 center lane ft, after elimination of areas not to be profiled under items (a) through (e).

(g) Ramps greater than 1000 centerline ft with radius less than 2000 ft.

Perform Pavement Surface Checks on areas listed above as specified in 504.03.14.

535.03.02.05 Defects. When any section IRI is greater than or equal to IRI_e according to Table 535B, take one of the following corrective actions as directed and at no additional cost.

(a) Remove and replace the pavement that is greater than or equal to IRI_e,

(b) Grind the section to bring the section IRI into conformance, or

(c) Accept the Defect Cost for any defective section where corrective action is not performed. The Defect Cost is determined as specified in 535.04.01.

Perform the above corrective actions to each defective section as determined. Approval to waive (a) or (b) does not constitute a waiver of (c) unless explicitly stated.

535.03.02.05.01 Re-Profiling.

(a) Re-profile all affected pavement sections after any corrective work, including any additional transverse paving joints created, to determine if the sections are within specification.

(b) The re-profiled data shall include the section prior to the corrected sections and the four sections after the corrected sections.

(c) The re-profiled data shall be used for final pay calculations; however, the minimum IRI value for any corrected section shall be limited to IRI_c.

535.03.02.06 Defects Not Due to Workmanship. When it is determined that a defect is not the result of substandard workmanship, a written justification for removing the defect from final pay calculations will be provided to the District. The matter will be discussed with OMT before the final pay adjustment is determined.

535.03.03 Paving Quality Assurance Testing for Pavement Profile (IRI). The Administration may measure sections of the pavement to verify the QC data.

(a) The QC data will be used for any pay adjustments on the project if the QA measurements have not been performed within 14 calendar days from the date that the completed QC data was submitted.

(b) Perform QA testing as specified in 535.03. The initial QA test will consist of one run on all 25 ft sections. The initial QA run and the median QC run will be compared to determine QC data acceptance.

(c) The average IRI, the number of defects, and the number of tested sections will be compared as follows:

TABLE 535 A

STATISTIC	UNIT	QC DATA TOLERANCE WITH RESPECT TO QA DATA
Average IRI	in./mile	± (2 % + 2)
Number of Defects	Sections	± (10 % + 2)
Number of Tested Sections	Sections	± (1 % + 1)

The QC data will be used for all pay adjustments when it falls within the above tolerances.

535.03.03.01 QA Runs.

(a) Perform a minimum of two additional QA runs when the QC data does not agree with the initial QA data and a cause cannot be determined.

(b) The initial and two additional QA runs will then be evaluated to determine if the coefficient of variation of the overall average IRIs is less than or equal to 2 percent for the three runs.

(c) When the three QA runs do not meet the above criteria, additional runs will be performed until three measured QA runs meet the criteria.

(d) The median run (based on average IRI) of the three QA runs will then be re-compared with the QC data in conformance with Table 535 A.

535.03.03.02 Profiler Quality Corrective Actions. If the QC and QA data are still not within the tolerances described in Table 535 A for Average IRI or Number of Defects, retest both profilers according to MSMT 563 to determine their conformance and recalibrate or repair as necessary.

(a) If the QC profiler is not brought into compliance within three paving days, cease paving operation or use another standardized profiler to collect QC data.

(b) Once the QC profiler is brought into compliance, previously tested sections may be retested for comparison with the QA data or the QA data can be accepted as the basis for any pay adjustment on all sections.

(c) If the QA profiler is out of compliance, then the QC data for all sections tested will be accepted.

(d) If both profilers are found to be in noncompliance, repair or recalibrate as necessary and repeat all QC and QA testing since the previous comparison.

When the QC and QA data for Number of Tested Sections are not within tolerance, recalibrate the respective Distance Measuring Instruments (DMIs) and perform additional QC testing until the QC data meets the tolerance criteria.

535.04 MEASUREMENT AND PAYMENT

Pavement surface profile testing costs will be incidental to the SAM surface material or PCC material as specified. Payment will be full compensation for all set up, technicians, traffic control, any type of corrective work to bring the pavement into conformance, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

535.04.01 Pay Limit and Pay Adjustment Determination. The pay limits and pay adjustment will be determined according to MSMT 736 as provided on the SHA Ride Specification webpage (https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=32) and based on the factors shown in Table 535 B.

TABLE 535 B

	DESCRIPTION	VALUE	UNITS
P_{max}	Maximum Incentive for Overall IRI	+	Dollars per lane-mile
P_{min}	Maximum Disincentive for Overall IRI	+	Dollars per lane-mile
IRI_a	IRI for Maximum Incentive	+	Inches per mile
IRI_b	Minimum IRI for Full Pay	+	Inches per mile
IRI_c	Maximum IRI for Full Pay	+	Inches per mile
IRI_d	IRI for Maximum Disincentive	+	Inches per mile
IRI_e	IRI threshold for Defects	+	Inches per mile

+ The ride specification limits for P_{max}, P_{min}, IRI_a, IRI_b, IRI_c, IRI_d, and IRI_e will be determined by the Administration according to MSMT 736.

CATEGORY 500
PAVING

SECTION 549 — PAVEMENT MARKINGS

549.01 DESCRIPTION

Apply durable and nondurable pavement markings (lines, letters, numbers, arrows, and symbols) to various surfaces at locations and in patterns as specified or as directed.

549.02 MATERIALS

As specified.

549.03 CONSTRUCTION

549.03.01 Quality Control (QC). Submit a proposed Quality Control Plan (QCP) to the Engineer at least 30 days before the pre-striping meeting.

Address procedures for random sampling as specified in MSMT 729. Provide details as to how the equipment and material will be controlled to ensure conformance with the specifications. Include the following.

(a) Manufacturer's application recommendations,

(b) Personnel certifications,

(c) Inspection and record-keeping procedures,

(d) Minimum frequencies of sampling and testing as specified.

Detail when and how corrective actions will be taken for unsatisfactory construction practices and deviations from the Contract Documents. Deviations from the QCP will be cause for immediate suspension of the marking operation. Operations will not resume without approval.

(a) Certified Technicians. MSMT 729. Provide certified technicians to perform quality control testing and sampling. The technicians shall demonstrate that they have a thorough knowledge of sampling and testing procedures. Duties include the following.

(1) Performing quality control during the marking operations in conformance with approved QCP and the MSMT 729.

(2) Identifying the location of quality control tests. Should a certified technician be delinquent in any of their duties as determined, then the technician's certification shall become invalid, and a recertification is required.

(3) All pavement marking operations will be suspended until a certified replacement technician is provided.

(b) Records. Maintain complete records of quality control inspection results, including actions taken to correct problems. Submit a copy of the QC results daily, signed by the certified technician, to the Engineer. Identify the location of the following quality control tests.

(1) Ambient temperature.

(2) Pavement surface temperature.

(3) Material temperature.

(4) Material thickness.

(5) Retro-reflectivity.

(6) Alignment.

(7) Color.

549.03.02 Placement. Do not begin placement operations until the QCP is approved and a walkthrough with the Engineer and pavement marking foreman has been performed to approve the layout.

549.03.03 Quality Control Test Strips. Conduct a quality control test strip and a metal-plate test at the beginning of each day's operations to demonstrate that the application equipment is working properly and applying markings as required. Repeat the demonstration whenever there is a change in the equipment settings, or as directed, when the quality of the line being applied is in question. Authorization to proceed will be given when the quality control test indicates conformance. If the application of the control test strip is on the actual roadway, correct any application that is not in compliance.

549.03.04 Widths. The traveled way lane widths and the longitudinal lines widths shall be as specified. Lane widths shall be measured from center to center of the lane lines once a control line is established for the lane configuration of the roadway. When measurements are taken from existing longitudinal lines, the point of reference shall be the center of the single line or the center of the space between dual lines. The traveled way lane widths are in compliance when they have an acceptable appearance and are within 2 in. of the proposed lane widths.

549.03.05 Alignment. Place markings in a straight and uniform manner. Lane lines are in compliance when they have an acceptable appearance and are visually in alignment, with no more than a 3/8 in. variation in any 40 ft section of traveled way. Maintain longitudinal alignment through all intersections and breaks, even though the lines may discontinue. Do not apply markings over longitudinal joints. Offset the markings 2 in. Place surface surface-applied tape back 1 in. from transverse joints or cracks.

549.03.06 Layout Markings. Remove layout markings that detract from the overall appearance or function of the final markings, as determined.

549.03.07 Cleaning Pavement Surfaces. Prior to application, clean pavement surfaces of oil, dirt, grease, concrete laitance, and other contaminants to a width 4 in. to 6 in. wider than the markings to be applied.

549.03.08 Marking Removal. Refer to Section 558. Remove existing pavement markings that conflict with new or altered traffic patterns. Use an approved method and ensure that the pavement surface is not damaged by the process. Repair or replace damaged pavement.

549.03.09 Curing. Protect the markings until dry or cured by placing warning devices according to the MdMUTCD or as approved. If a vehicle damages uncured markings, reapply the markings and remove marks left on the pavement by the vehicle. For pavements in service, only one lane of traffic at a time will be permitted to close.

549.03.10 Observation Period. Repair any defects in materials and workmanship of the pavement markings for a period of 180 days for durable and 60 days for nondurable materials from the date the pavement is opened to traffic. The observation period for inlaid tape is 365 days. Time charges will not be assessed during the observation period, provided all other work is complete. At the end of the observation period, the pavement markings will be inspected for durability, color, and retro-reflectivity. The Contractor will be informed of pavement markings that have failed and that require corrective action. Pavement markings will be failed for any of the following conditions.

(a) More than 5 percent of the substrate is exposed in any 2000 ft section of longitudinal marking.

(b) Retro-reflectance values have dropped below the minimum retroreflectivity specified.

(c) Marking is discolored when compared visually with the color chips.

Restripe or remove and replace all failed markings within 30 days of receiving written notification.

549.03.11 Removal, Replacement, or Corrective Actions. Provide corrective actions for markings unsatisfactorily installed or that fail during the observation period, as determined, including Maintenance of Traffic. The current road user fee will also be applied when traffic disruption occurs during corrective actions.

549.03.12 Quality Assurance (QA). The Administration will provide certified quality assurance technicians for the following.

(a) Perform independent sampling and testing.

(b) Periodically observe QC testing.

(c) Direct additional sampling and performing additional tests at any time and at any location.

(d) Monitor conformance with the QCP.

(e) Evaluate quality control results.

Results of QA testing will provide the basis for final acceptance. Independent assurance audits will be performed to confirm and assure that both the quality control personnel's test methods and quality control test equipment conform to specifications.

549.04 MEASUREMENT AND PAYMENT

Payment for furnishing and applying pavement markings (lines, letters, numbers, arrows, and symbols) will be made under the pertinent pavement markings items. Quality control will not be measured but the cost will be incidental to the other pertinent items specified.

Removal of layout markings that detract from the overall appearance or function of the final markings as determined will be at no additional cost to the Administration.

Repair or replacement of pavement damaged by marking removal will be at no additional cost to the Administration.

Reapplication of damaged uncured markings will be removed and new markings applied at no additional cost to the Administration.

Removal, replacement, and other corrective actions for markings that are unsatisfactorily installed will be at no additional cost to the Administration, including associated Maintenance of Traffic to perform the corrective work.

CATEGORY 500
PAVING

SECTION 550 — PAVEMENT MARKING PAINT

550.01 DESCRIPTION

Furnish and apply waterborne pavement marking paint as specified or as directed. Markings include longitudinal lines, legends (letters and numbers) and symbols.

550.02 MATERIALS

Paint is a nontoxic lead free waterborne pavement marking and a non-durable material used for temporary or permanent markings. Select Pavement Marking Paint from the Qualified Products List (QPL).

Pavement Marking Paint	951.01
Glass Beads	951.09

550.03 CONSTRUCTION

Refer to 549.03.

550.03.01 Quality Control. Refer to 549.03.01.

550.03.02 Quality Assurance. Refer to 549.03.02.

550.03.03 Cleaning Pavement Surfaces. Refer to 549.03.07.

550.03.04 Quality Control Test Strip. Refer to 549.03.09.

550.03.05 Application Equipment. Use vehicle mounted application equipment capable of applying pavement marking paint as approved. Provide access to the paint application equipment for inspection.

(a) Temperature Gauges. Use temperature gauges that have been calibrated every six months and submit a copy of the calibration certification according to the Quality Control Plan (QCP).

(b) Footage Counters. Use calibrated footage counters to measure pavement markings. Submit notarized certification according to the QCP.

(c) Usage Counters. Use material usage counters and printers or measure tanks manually using equipment manufacturer certified tables. Use beginning and ending quantities to calculate thickness of applied lines. Record the quantities according to the QCP.

(d) Bead Dispenser. Use a pressurized bead dispenser or other mechanical conveying method not dependent upon gravity for uniform application of glass beads for each material dispenser.

(e) Material Dispenser. Use a material dispenser capable of applying all longitudinal markings at multiple width settings ranging from 5 in. to 12 in. and is capable of cleanly cutting off stripe ends. Reapply the quality control strip whenever the guns are repositioned or adjusted.

(f) Maneuverability. Use a vehicle that is mobile and maneuverable enough to produce straight lines and standard curves in true arcs.

(g) Cleanliness. Clean all parts of the equipment of foreign or different colored material prior to introducing a new batch of material.

550.03.06 Application. Apply pavement marking paint at the locations and widths specified and as directed.

(a) Ambient Conditions. Apply material when the ambient and surface temperatures are at least 50 F and rising at the time of application and the relative humidity conforms to the manufacturer's recommendations.

(b) Moisture in Pavement. MSMT 729. Do not apply material if test is positive for moisture.

(c) Application Temperature. Temperature of applied material shall conform to the manufacturer's recommendations.

(d) Glass Beads. MSMT 729. Apply glass beads uniformly across the surface of the stripe at the rate of 7 lb/gal to 9 lb/gal of paint.

(e) Thickness. MSMT 729. Apply paint at a wet film thickness of 15 ± 1 mils.

(f) Color. MSMT 729.

(g) Retroreflectance. MSMT 729. The minimum retroreflectance shall be 150 millicandelas/lux/square meter for yellow and 250 millicandelas/lux/square meter for white.

(h) New Asphalt or Portland Cement Concrete (PCC) surfaces. Apply two full coats of paint including glass beads on new asphalt or PCC pavement that has been tined or otherwise textured. Apply the second coat as soon as the first coat has cured. Apply both coats before opening to traffic.

550.03.07 Curing. Refer to 549.03.10.

550.03.08 Observation Period. Refer to 549.03.11.

550.03.09 Submittals. Supply MSDS, Product Data Sheets, and QCPs.

550.04 MEASUREMENT AND PAYMENT

Refer to 549.04. Payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Pavement Marking Paint will be measured and paid for at the Contract unit price for one or more of the following items.

(a) Pavement Marking Paint lines will be measured and paid for at the Contract unit price per linear foot for the color and width specified.

(b) Pavement Marking Paint Legends (letters and numbers) and Symbols will be measured and paid for at the Contract unit price per square foot.

CATEGORY 500
PAVING

SECTION 551 — PAVEMENT MARKING TAPE

551.01 DESCRIPTION

Furnish and apply permanent, preformed pavement marking tape to existing asphalt or Portland cement concrete pavement surfaces as specified and as directed.

551.02 MATERIALS

Pavement Marking Tape	951.02

Select pavement marking tape from the Qualified Products List (QPL).

Refer to Section 552 for inlaid pavement marking tape.

551.03 CONSTRUCTION

Refer to 549.03.

551.03.01 General. Apply markings to bare pavement according to the manufacturer's recommendations or as directed.

(a) Use primer/adhesive according to the manufacturer's recommendations.

(b) Preformed legends and symbols shall conform to the applicable shape and sizes specified.

(c) Markings shall conform to pavement surface contours and be resistant to deformation by traffic and damage from snow removal equipment. Markings applied to pavement surfaces shall be immediately ready for traffic.

551.03.02 Quality Control. Refer to 549.03.01.

551.03.03 Quality Assurance. Refer to 549.03.02.

551.03.04 Cleaning Pavement Surfaces. Refer to 549.03.07.

551.03.05 Application. Refer to 549.03 and the following.

(a) Adherence. MSMT 729.

(b) Thickness. Apply the markings so that the applied thickness is nominally the same as the unapplied material.

(c) Color. MSMT 729.

(d) Retroreflectance. MSMT 729 and the following.

MINIMUM RETROREFLECTANCE		
COLOR	**RETROREFLECTIVITY**	**CORRECTIVE ACTION**
White	350 or higher	None
Yellow	250 or higher	
White	less than 350	Necessary corrective actions, removal, replacement
Yellow	less than 250	

(e) Widths. Refer to 549.03.04.

(f) Alignment. Refer to 549.03.05.

(g) Layout Markings. Refer to 549.03.06.

551.03.06 Quality Control Test Strip. Refer to 549.03.09.

551.03.07 Observation Period. Refer to 549.03.11. The work will be accepted at the end of the observation period upon satisfactory inspection and approval.

551.03.08 Submittals. Supply MSDS, Product Data Sheets, and QCPs.

551.04 MEASUREMENT AND PAYMENT

Refer to 549.04. Payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Contrast Pavement Marking tape will be measured and paid for at the Contract unit price per linear foot for the colors and widths specified.

CATEGORY 500
PAVING

SECTION 552 — INLAID PAVEMENT MARKING TAPE

552.01 DESCRIPTION

Furnish and apply inlaid pavement marking tape as specified and as directed. Inlaid pavement marking tape shall conform to pavement contours and be resistant to deformation by traffic and damage from snow removal equipment. The tape shall perform in accordance with this specification. The Manufacturer shall warranty the material for a period of five years.

552.02 MATERIALS

Inlaid Pavement Marking Tape	951.02

Inlaid pavement marking tape is a durable material. Select pavement marking tape from the Qualified Products List (QPL).

552.03 CONSTRUCTION

Refer to 549.03, except 549.03.11.

552.03.01 Contractor's Responsibility. Provide a copy of the Manufacturer's application recommendations to the Engineer. Provide storage; prepare surfaces, and use solvents, primers, and equipment to inlay the tape in accordance with the Manufacturer's recommendations, or as approved.

552.03.02 Placement. Place the tape onto the final surface of the new asphalt pavement prior to the final compaction.

(a) Inlay the tape while the surface temperature is within the Manufacturer's recommended guidelines.

(b) Inlay the tape into the pavement surface with a finish roller without vibration.

(c) Placement of the final surface will not be permitted unless the striping crew and marking materials are present.

(d) The pavement shall be immediately ready for traffic after the tape has been inlaid.

552.03.03 Observation Period. The Contractor shall be responsible for the workmanship and repairing of any defects in the inlaid tape for a period of 365 days from the date the pavement is opened to traffic.

Time charges will not be assessed for the observation period provided all other work is completed. At the end of the observation period, the inlaid tape will be inspected for durability. The work will be accepted when it is determined that the quality of the initial and any repaired tape meets the requirements.

The inlaid tape fails durability if any of the following conditions exist.

(a) Film Loss. Any substrate beneath the marking is exposed.

(b) Retroreflectance. Any retroreflectivity values fall below 500 for white tape and 350 for yellow tape.

(c) Color. As specified.

Remove and replace all failed inlaid tape within 30 days of receiving written notification at no additional cost. Select durable replacement materials from the QPL. If the work is not completed within 30 days, time charges will resume until the work is completed and accepted.

552.03.04 Manufacturer's Responsibilities.

(a) Manufacturer's Certification of Functional Requirements. The Functional Requirements are the performance of the inlaid tape over the period of five years after the observation period. The Manufacturer's Certification of Functional Requirements shall begin after the inlaid tape has been accepted.

Functional Requirements are as follows.

(1) Retroreflectivity.

SUBSEQUENT RETROREFLECTANCE (Five Years)			
YEARS	RETROREFLECTIVITY mcd/lux/m^2		CORRECTIVE ACTION
	WHITE	YELLOW	
1	349	249	Remove and replace with an approved durable marking.
2	249	200	
3	200	149	
4	150	125	
5	125	125	Remove and replace with an approved marking

(2) Film Loss.

(a) Solid Longitudinal Line. No more than 5 percent of the substrate is exposed in any 2000 ft section.

(b) Broken Line or Dotted Line. No more than 5 percent of the substrate is exposed in any 2000 ft section, or no loss of two consecutive skips.

(3) Color. As specified.

(b) Warranty. The warranty shall cover the inlaid tape, the work to replace the inlaid tape, if necessary, and maintenance of traffic during the replacement. The Administration may waive the provisions of the warranty in the event that it determines that the failure of the marking is the result of factors other than defective materials.

(c) Corrective Actions. The Manufacturer shall provide the necessary materials, labor, and equipment to replace the inlaid tape if it fails to meet the warranty requirements. The work shall be performed according to recommendations and as specified. Replacement tape shall continue to meet the warranty requirements.

Provide maintenance of traffic while performing corrective actions in accordance with 104.11, and as directed. The Administration will perform Quality Assurance testing for all corrected markings.

(d) Response Time. Provide an acceptable replacement plan and schedule within 30 calendar days upon written notice of any problems with the inlaid tape. Failure to execute an approved plan within 72 hours will result in a $1000 per day charge to be imposed until compliance. The Manufacturer shall provide temporary markings at no cost until the tape is permanently replaced.

(e) Emergency Repairs. The Manufacturer shall perform emergency repairs as directed within 24 hours of being notified that repair are necessary. The Administration reserves the right to perform the repairs using Administration or contractual forces if the Manufacturer fails to respond within the 24 hour period. The Manufacturer shall be responsible for all costs incurred for the emergency repairs; except if the damage was caused deliberately or by natural disaster.

(f) Functional Requirements Monitoring. The Administration will regularly perform day and nighttime visual inspections to monitor the quality of the tape during the warranty period. Inspections will be performed in accordance with MSMT 729. The Manufacturer shall replace any tape that falls below the values specified above.

552.04 MEASUREMENT AND PAYMENT

Payment for furnishing and applying the Inlaid Pavement Marking Tape will be made under the pertinent pavement marking items. Quality Control will not be measured but the cost will be incidental to the other pertinent items specified.

(a) Payment will be full compensation for the Contractor's 365 day observation period, including pavement preparation, furnishing and placing the inlaid tape, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

(b) Payment will also be full compensation for the Manufacturer's 5 year material warranty period; including the furnishing, removal, and replacement of defective tape; maintenance of traffic; Quality Assurance testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 500
PAVING

SECTION 553 — EPOXY PAVEMENT MARKINGS

553.01 DESCRIPTION

Furnish and apply two component epoxy pavement markings to roadway surfaces as specified and as directed.

553.02 MATERIALS

Epoxy Pavement Markings	951.03
Glass Beads	951.09

Epoxy pavement markings are a durable material. Select epoxy pavement markings from the Qualified Products List (QPL).

553.03 CONSTRUCTION

Refer to 549.03.

553.03.01 Quality Control. Refer to 549.03.01.

553.03.02 Quality Assurance. Refer to 549.03.02.

553.03.03 Cleaning Pavement Surfaces. Refer to 549.03.07.

553.03.04 Quality Control Test Strip. Refer to 549.03.09.

553.03.05 Application Equipment. Use application equipment capable of applying two component epoxy pavement marking material, as approved. Provide access to the application equipment for inspection.

(a) Temperature Gauges. Use temperature gauges that have been calibrated every six months and submit a copy of the calibration certification according to the Quality Control Plan (QCP).

(b) Footage Counters. Use calibrated footage counters to measure pavement markings and submit notarized certification according to the QCP.

(c) Usage Counters. Use equipment that is equipped with material usage counters and printers or measure tanks manually using equipment manufacturer certified tables. Use beginning and ending quantities to calculate thickness of applied lines and record according to the QCP.

(d) Bead Dispenser. Use a pressurized bead dispenser or other mechanical conveying method not dependent upon gravity for uniform application of glass beads for each material dispenser.

(e) Material Dispenser. Use equipment capable of applying longitudinal markings at multiple width settings ranging from 5 in. to 12 in. as demonstrated by the quality control strip and as specified. Reconduct the quality control strip whenever the guns are repositioned or adjusted after the initial quality control strip.

(f) Maneuverability. Use a vehicle that is mobile and maneuverable to produce straight lines, standard curves in true arcs, and capable of cleanly cutting off stripe ends.

(g) Cleanliness. Clean all parts of the equipment thoroughly of foreign material or different colored material prior to the introduction of a new batch of material.

553.03.06 Application. Apply to bare pavement or over existing epoxy markings according to the manufacturer's recommendations. Install markings at the location, width, and type of marking as specified and as directed. Do not install markings over longitudinal joints; offset 2 in. or as directed.

(a) Ambient Conditions. Apply material when the ambient and surface temperatures are at least 50 F and rising at the time of application and the relative humidity conforms to the manufacturer's recommendations.

(b) Moisture in Pavement. MSMT 729. Do not apply material if test is positive for moisture.

(c) Application Temperature. Temperature of applied material shall conform to the manufacturer's recommendations.

(d) Glass Beads. MSMT 729. Apply glass beads uniformly across the surface of the stripe, at the rate of 25 lb/gal of paint.

(e) Thickness. MSMT 729. Apply epoxy material at a wet film thickness of 15 ± 1 mils.

(f) Color. MSMT 729.

(g) Retroreflectance. MSMT 729. Measure the retroreflectance of the applied markings. The minimum retroreflectance shall be 200 millicandelas/lux/square meter for yellow and 275 millicandelas/lux/square meter for white.

553.03.07 Curing. Refer to 549.03.10.

553.03.08 Observation Period. Refer to 549.03.11.

553.03.09 Submittals. Supply MSDS, Product Data Sheets, and Quality Control Plans.

553.04 MEASUREMENT AND PAYMENT

Payment will be measured and paid for at the Contract unit price per linear foot for the color and width specified. Payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 500
PAVING

SECTION 554 — THERMOPLASTIC PAVEMENT MARKINGS

554.01 DESCRIPTION

Furnish and apply thermoplastic pavement marking material to roadway surfaces as specified and as directed.

554.02 MATERIALS

Thermoplastic is a durable material. Select thermoplastic pavement markings from the Qualified Products List (QPL).

Thermoplastic Pavement Markings	951.04
Glass Beads	951.09

554.03 CONSTRUCTION

Refer to 549.03.

554.03.01 Quality Control. Refer to 549.03.01.

554.03.02 Quality Assurance. Refer to 549.03.02.

554.03.03 Cleaning Pavement Surfaces. Refer to 549.03.07.

554.03.04 Quality Control Test Strip. Refer to 549.03.09.

554.03.05 Application Equipment.

(a) Kettles. Use equipment that has oil or air jacketed kettles for uniform melting and heating of the thermoplastic material, is equipped with an automatic thermostatic device to provide positive temperature control and conforms to the requirements of the National Board of Fire Underwriters (NBFU), the National Fire Protection Association (NFPA), and State and local authorities.

(b) Agitation. Use equipment that provides continuous mixing and agitation of the material in the kettle, constructed so that all mixing and conveying parts, (including the application apparatus) maintains the material at the specified temperature and

constructed to prevent clogging of the applicator conveying parts between the reservoir and the application apparatus.

(c) Capacity. Use vehicle mounted equipment capable of holding a minimum of 600 lb of molten thermoplastic material for longitudinal line application.

(d) Temperature Gauges. Use temperature gauges that have been calibrated every six months and submit a copy of the calibration certification according to the QCP.

(e) Footage Counters. Use calibrated footage counters to measure pavement markings and submit notarized calibration certification according to the QCP.

(f) Usage Counters. Use equipment that is equipped with material usage counters and printers or measure tanks manually using equipment manufacturer certified tables. Use beginning and ending quantities to calculate thickness of applied lines and record daily.

(g) Bead Dispenser. Use a pressurized bead dispenser or other mechanical conveying method not dependent upon gravity for uniform application of glass beads for each material dispenser.

(h) Material Dispenser. Use a material dispenser that is capable of applying all longitudinal markings at multiple width settings ranging from 5 in. to 12 in. as demonstrated by the quality control strip and as specified. Reconduct the quality control strip whenever the guns are repositioned or adjusted after the initial quality control strip.

(i) Maneuverability. Use a vehicle that is mobile and maneuverable to produce straight lines, standard curves in true arcs, and capable of cleanly cutting off the ends of markings.

(j) Cleanliness. Thoroughly clean all parts of the equipment of foreign or different colored material prior to the introduction of a new batch of material.

554.03.06 Application. Use vehicle mounted equipment to apply markings at the location, width, and type of marking specified and as directed. Apply to bare pavement or over existing thermoplastic according to the manufacturer's recommendations. Do not place thermoplastic material over longitudinal joints; offset 2 in. or as directed.

Use small equipment capable of heating, agitation and applying glass beads to apply thermoplastic markings to gore areas, crosswalks, small intersections, roundabouts, wide markings, transverse markings and other areas that preclude the use of vehicle mounted equipment.

(a) Ambient Conditions. Apply material when ambient and surface temperatures are at least 50 F and rising at the time of application.

(b) Moisture in Pavement. MSMT 729. Do not apply material if test is positive for moisture.

(c) Temperature. Apply thermoplastic material when the molten material temperature is between 400 F and 440 F unless otherwise recommended by the manufacturer and approved.

(d) Primer. Use a primer that is compatible with the thermoplastic material and recommended by the thermoplastic manufacturer when thermoplastic material is applied to Portland cement concrete surfaces.

(e) Thickness. MSMT 729. The pavement markings shall yield a solid of 90 mils above the roadway surface. Variation from this range will be used for the price adjustment specified herein.

(f) Glass Beads. MSMT 729. Apply standard glass beads to the surface of the molten thermoplastic at the minimum rate of 7 lb/100 ft^2 to 9 lb/100 ft^2.

(g) Color. MSMT 729.

(h) Retroreflectance. MSMT 729. The minimum retroreflectance shall be 150 millicandelas/lux/square meter for yellow and 250 millicandelas/lux/square meter for white.

(i) Widths. Refer to 549.03.04.

(j) Alignment. Refer to 549.03.05.

(k) Layout Markings. Refer to 549.03.06.

554.03.07 Curing. Refer to 549.03.10.

554.03.08 Observation Period. Refer to 549.03.11.

554.03.09 Submittals. Supply MSDS, Product Data Sheets, and QCPs.

554.04 MEASUREMENT AND PAYMENT

Refer to 549.04. Payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Thermoplastic Pavement Marking lines will be measured and paid for at the Contract unit price per linear foot for the color and width specified.

Thermoplastic Pavement Marking Legends (letters and numbers) and Symbols will be paid for at the Contract unit price per square feet.

554.04.01 Price Adjustment for Film Thickness. The unit price for Thermoplastic Pavement Markings will be per striped linear foot based on MSMT 729 calculations for thickness, and will be adjusted in conformance with the following:

MIL THICKNESS	PERCENT OF PAYMENT - UNIT PRICE
90- (a)(b)	100
80-89	90
70-89	80
Less than 70	Retrace to achieve a thickness of 90 mils.

(a) The Engineer may require the removal of excess material thickness.

(b) Perform removal of excess material and retracing of pavement markings at no additional cost to the Administration.

CATEGORY 500
PAVING

SECTION 555 — THERMOPLASTIC PAVEMENT MARKINGS - 40 MIL HIGH BINDER

555.01 DESCRIPTION

Furnish and install high binder, thermoplastic pavement markings as specified and as directed. The markings shall conform to pavement contours and be resistant to deformation by traffic and damage from snow removal equipment. The material shall cure at a rate that allows the markings to be ready for traffic immediately after application.

555.02 MATERIALS

Thermoplastic Pavement Markings — High-binder	951.05
Glass Beads	951.09

High Binder Thermoplastic is a durable material. Select High Binder Thermoplastic from the Qualified Products List (QPL).

555.03 CONSTRUCTION

Refer to 549.03.

555.03.01 Quality Control. Refer to 549.03.01.

555.03.02 Quality Assurance. Refer to 549.03.02.

555.03.03 Cleaning Pavement Surfaces. Refer to 549.03.07.

555.03.04 Quality Control Test Strip. Refer to 549.03.09.

555.03.05 Application Equipment.

(a) Kettles. Use equipment that has oil or air jacketed kettles for uniform melting and heating of the thermoplastic material; is equipped with an automatic thermostatic device to provide positive temperature control; and conforms to the requirements of the National Board of Fire Underwriters (NBFU), the National Fire Protection Association (NFPA), and State and local authorities.

(b) Agitation. Use equipment that provides continuous mixing and agitation of the material in the kettle, that is constructed so that all mixing and conveying parts, up to and including the application apparatus, maintains the material at the specified temperature; and is constructed to prevent clogging and accumulation of conveying parts of the applicator between the reservoir and the application apparatus.

(c) Capacity. Use vehicle mounted equipment capable of holding a minimum of 600 lb of molten thermoplastic material for longitudinal line application.

(d) Temperature Gauges. Use temperature gauges that have been calibrated every six months and submit a copy of the calibration certification as part of the QCP.

(e) Footage Counters. Use calibrated footage counters to measure pavement markings and submit notarized certification as part of the QCP.

(f) Usage Counters. Use equipment that is equipped with material usage counters and printers or measure tanks manually using equipment manufacturer certified tables. Use beginning and ending quantities to calculate thickness of applied lines and record daily.

(g) Bead Dispenser. Use a pressurized bead dispenser or other mechanical method not dependent upon gravity for uniform application of glass beads for each individual material dispenser.

(h) Material Dispenser. Use equipment capable of applying longitudinal markings at multiple width settings ranging from 5 in. to 12 in. as demonstrated by the quality control strip and as specified. Reapply the quality control strip whenever the guns are repositioned or adjusted after the initial quality control strip.

(i) Maneuverability. Use a vehicle that is mobile and maneuverable enough to produce straight lines, standard curves true arcs, and capable of cleanly cutting off stripe ends.

(j) Cleanliness. Thoroughly clean all parts of the equipment foreign material or different colored material prior to the introduction of a new batch of material.

555.03.06 Application. Use vehicle mounted equipment to apply markings in conformance with the manufacturer's recommendations at the location, size and dimension as specified and as directed. Avoid application of line markings over longitudinal joints. Apply to bare asphalt pavement, existing thermoplastic or pavement marking paint as determined.

Use small spray equipment to apply markings to gore areas, crosswalks, small intersections, roundabouts, wide markings, transverse markings and other areas that preclude the use of vehicle mounted requirement. The use of extrusion equipment is prohibited.

(a) Ambient Conditions. Apply material when the ambient and surface temperatures are at least 50 F and rising at the time of application.

(b) Moisture in Pavement. MSMT 729. Do not apply material if test is positive for moisture.

(c) Temperature. Apply material when the molten material temperature is between 350 F and 390 F unless otherwise recommended by the manufacturer and as approved.

(d) Primer. Use a primer if thermoplastic is applied to Portland cement concrete. Use a primer that is compatible with the thermoplastic material and recommended by the thermoplastic manufacturer.

(e) Thickness. MSMT 729. The pavement markings shall yield a solid thickness of 40 ± 5 mils above the roadway surface. A five-inch line should yield approximately 585 ft/100 lb of material when compared to the distance striped. Material usage will be tracked by the Administration. Low yields will be considered sufficient cause for restriping.

(f) Glass Beads. MSMT 729. Apply standard glass beads uniformly to the surface of the molten thermoplastic at the minimum rate of 10 lb/100 ft^2.

(g) Color. MSMT 729.

(h) Retroreflectance. MSMT 729. The minimum retroreflectance shall be 150 millicandelas/lux/square meter for yellow and 250 millicandelas/lux/square meter for white.

555.03.07 Curing. Refer to 549.03.10.

555.03.08 Observation Period. Refer to 549.03.11.

555.03.09 Submittals. Supply MSDS, Product Data Sheets, and QCPs.

555.04 MEASUREMENT AND PAYMENT

Payment will be full compensation for furnishing and placing of all materials, and for all labor, equipment, tools, testing, pavement preparation, and incidentals necessary to complete the work.

High Binder Thermoplastic Pavement Markings will be measured and paid for per striped linear foot for the color and width specified.

555.04.01 Removal, Replacement, or Corrective Actions. Any additional cost for removal, including Maintenance of Traffic (MOT) shall be the responsibility of the Contractor. In addition, the current road-users fee will be applied if traffic disruption occurs during corrective actions.

CATEGORY 500
PAVING

SECTION 556 — PREFORMED THERMOPLASTIC PAVEMENT MARKINGS

556.01 DESCRIPTION

Furnish and install preformed thermoplastic pavement marking symbols, legends, and lines as specified in the Contract Documents and as directed.

556.02 MATERIALS

Preformed Thermoplastic is a durable pavement marking material. Select preformed Thermoplastic Pavement Marking material from the Qualified Products List (QPL).

Preformed Thermoplastic Pavement Marking Material	951.06

556.03 CONSTRUCTION

Refer to 549.03.

556.03.01 Quality Assurance/Quality Control. Refer to 549.03.01, 549.03.02.

556.03.02 Clean Pavement Surfaces. Refer to 549.03.07.

556.03.03 Application. Apply markings at the location, size and width as specified and as directed. Use equipment recommended by the thermoplastic manufacturer. Preheat pavement surfaces when recommended by the manufacturer. Apply heat to the surface of the placed thermoplastic according to the manufacturer's recommendations.

Do not apply longitudinal or transverse pavement markings over longitudinal joints; offset 2 in. and as directed. Preheat pavement surfaces and heat the thermoplastic so as to not damage any joint filler. Protect adjacent marking materials from damage when preheating the pavement or heating the thermoplastic by shielding or setback methods.

Preformed Thermoplastic Pavement Markings shall conform to the following:

(a) Temperature. Apply preformed thermoplastic when the thermoplastic, ambient, and surface temperature, and relative humidity conform to the manufacturer's recommendations.

(b) Color. MSMT 729.

(c) Primer. Use a primer if thermoplastic is applied to Portland cement concrete or as recommended by the manufacturer.

(d) Retroreflectance. MSMT 729. The minimum retroreflectance shall be 150 millicandelas/lux/square meter for yellow and 250 millicandelas/lux/square meter for white.

(e) Thickness. Refer to MSMT 729. Apply 90 mil preformed thermoplastic.

556.03.04 Submittals. Supply MSDS, Product Data Sheets, and Quality Control Plans.

556.03.05 Packaging. The material shall be handled for shipping, unloading and storage according to the manufacturer's recommendations. Each shipping package shall be marked with the following information:

(a) Manufacturer's name.

(b) Description of item.

(c) Date of manufacture.

(d) Product code number.

(e) Lot number.

(f) Color.

556.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

(a) Preformed Thermoplastic Pavement Marking Legends (letters and numbers) and Symbols will be paid for at the Contract unit price per square foot.

(b) Preformed Thermoplastic Pavement Marking lines will be measured and paid for at the Contract unit price per linear foot for the color and width specified.

CATEGORY 500
PAVING

SECTION 557 — SNOWPLOWABLE RAISED PAVEMENT MARKERS

557.01 DESCRIPTION

Furnish and install new snowplowable raised pavement markers (SRPM) and replacement components for existing markers as specified and as directed, and in conformance with the Maryland Manual on Uniform Traffic Control Devices. Snowplowable Raised Pavement Markers are durable materials. Select SRPMs from the Qualified Products List (QPL).

557.02 MATERIALS

Holders	951.07
Pavement Marker Reflector Lenses	951.07
Epoxy Holder Adhesive	951.07
Lens Adhesive	951.07

557.03 CONSTRUCTION

As specified in 549.03.

557.03.01 Quality Control. As specified in 549.03.01.

557.03.02 Quality Assurance. As specified in 549.03.02.

557.03.03 Quality Control Test Strip. As specified in 549.03.09. Install a minimum of 10 groove cuts spaced as specified to verify the accuracy and ability of the equipment and personnel. Repair or replace any incorrect groove cuts and any incorrect holder placements within the test strip at no additional cost to the Administration.

557.03.04 Pavement Marker Reflector Lenses. Reflector lenses for pavement markers shall be the same color as the adjacent pavement marking except the back side shall be as follows.

(a) One-Way Applications. The backside for One-Way Markers shall be red or blank as specified or as directed.

(b) Two-Way Applications. The backside for Two-Way Markers shall be the same color as the adjacent pavement marking.

557.03.05 General Installation Requirements.

(a) Ensure all materials and equipment needed to perform the installation are on site.

(b) Ensure the road surface and ambient temperatures meet the manufacturer's recommendations for installation. Do not install markers on wet pavement surfaces.

(c) Replace any incorrect groove cut, incorrect holder placement, or incorrect lens replacement at no additional cost. An additional test strip may be required in the event of incorrect installations.

557.03.06 New Installation. Install SRPMs no later than two weeks after the completion of the final surface or as directed.

557.03.06.01 Recessed SRPMs with Plastic Polycarbonate Holders.

(a) Install SRPM according to D4383 and manufacturer's recommendations.

(b) Install plastic holders that are free of dirt, dust, oil, grease, moisture, gloss or any substances that may impair adhesion to the pavement. Remove any material that inhibits retroreflectivity of the reflector lens without damage to the lens surface. Clean holders to remove all substances prior to installation. Do not damage the holder.

(c) Cut the groove for the holder to the appropriate dimensions to allow 1/4 in. side to side movement. All leveling lugs on the holder shall overlap and contact the pavement and the holders shall seat properly.

(d) Use lenses that are specifically manufactured and approved for use as plastic holder reflector lenses. Do not use markers that are manufactured exclusively for direct application to pavements as substitutes.

557.03.06.02 Recessed Direct SRPMs without Holders.

(a) Install direct SRPM lenses according to D4383 and manufacturer's recommendations. Use lenses manufactured and approved for use as recessed pavement markers. Installed height of marker shall be 1/4 in. below the pavement surface.

(b) Install direct lenses that are free of dirt, dust, oil, grease, moisture, or any substances that may impair adhesion to the pavement. Remove any material that inhibits retroreflectivity of the reflector lens without damage to the lens surface.

(c) Cut the groove for the direct one-way recessed marker reflectors lenses to the appropriate dimensions for properly seating the reflector lens according to D4383 and the manufacturer's recommendations.

(d) Cut the groove for direct two-way recessed marker reflectors lenses to the appropriate dimensions for properly seating both reflectors according to D4383 and the manufacturer's recommendations.

(e) Do not use lenses manufactured for use with holders as substitutes for direct lenses unless recommended by manufacturer.

557.03.07 Holder Replacement.

(a) Polycarbonate Replacement. Do not replace with damaged or used polycarbonate holders. Existing grooves may be recut for replacement. Repair damaged groove cuts as specified in Section 504, Section 505, and Section 522. Locate the replacement groove cut within one longitudinal ft ahead of the damaged cut in the direction of traffic with no lateral deviation exceeding 1.5 in.

(b) Steel SRPM Replacement. Do not replace in kind. Follow 557.03.06 New Installation and 557.03.07(a) Polycarbonate Replacement.

557.03.08 Direct Replacement.

(a) Remove and dispose of any damaged reflector lenses and replace with lenses that conform to the original lens requirements unless otherwise specified or as directed. Install replacement lenses according to the manufacturer's recommendations.

(b) Existing grooves may be recut to comply with D4383.

(c) Repair damaged groove cuts as specified in Section 504, Section 505, and Section 522. Locate the replacement groove cut within one longitudinal foot ahead of the damaged cut (with the direction of traffic) with no lateral deviation exceeding 1.5 in.

557.03.09 Reflector Lens Replacement. Remove from holder and dispose of any damaged reflector lens and replace with a new lens on undamaged steel castings or plastic holders that have missing or damaged lenses. Install replacement lenses according to the manufacturer's recommendations.

557.03.10 Observation Period. Replace damaged, non-retroreflective or missing Pavement Marker Reflector Lenses within 180 days after opening to traffic at no additional cost.

557.03.11 Submittals. Submit product data sheets including instructions for installation, MSDS and a Quality Control Plan for review and approval.

557.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all pavement preparation, furnishing and placement of SRPM's, testing, removal, groove cutting, repair and all materials, labor, equipment, tools and all incidentals necessary to complete the work.

557.04.01 Snowplowable Raised Pavement Markers will be measured and paid for at the Contract unit price per each. The payment includes furnishing and installing Snowplowable Raised Pavement Markers including the holder, reflector, adhesive and grooving.

(a) Recessed Snowplowable Raised Pavement Markers with Plastic Polycarbonate Holders will be measured and paid for as specified.

(b) Recessed Direct Snowplowable Raised Pavement Markers without Holders will be measured and paid for as specified.

557.04.02 Removal of Existing Holders or lenses in groove cuts will be measured and paid for at the Contract unit price per each, excluding any incorrect installations or repairs of groove cuts.

557.04.03 Replacement of Pavement Marker Reflector Lenses will be measured and paid for at the Contract unit price per each.

CATEGORY 500
PAVING

SECTION 558 — REMOVAL OF EXISTING PAVEMENT MARKINGS

558.01 DESCRIPTION

Remove existing pavement markings (lines, letters, numbers, arrows, and symbols) during temporary or permanent traffic shifts or restriping operations and repair any roadway areas damaged during the removal process.

558.02 MATERIALS

Not applicable.

558.03 CONSTRUCTION

Section 549. Layout and apply all new pavement markings (temporary or permanent) for traffic shifts as specified before removing any existing pavement markings.

558.03.01 Quality Control (QC). Refer to 549.03. Submit a Quality Control Plan (QCP) for approval at least two weeks prior to the start of pavement marking removal. The QCP shall contain the following:

(a) Location and quantity to be removed.

(b) Proposed method(s) of performing the work. Consider pavement conditions, types and quantities of equipment to be used, manpower estimates, and time frame to complete the work based on Maintenance of Traffic (MOT) restrictions.

(c) Protective shielding plan and containment system for dust and in case the markings contain toxic materials.

The QCP shall also detail when, how, and what corrective actions will be taken to address unsatisfactory construction practices and deviations from the QCP. Any deviation from the Plan shall be cause for immediate suspension of work. Operations shall not resume without approval.

558.03.02 Quality Control Test Strip. Remove a minimum of 100 ft of existing pavement marking as a test strip at a determined location to demonstrate the proposed removal method for approval prior to beginning the work. If the method does not work or shows signs of damaging the pavement, then employ another method. Additional control strips may be required. The preferred method is that which completely removes the markings with the least damage to the pavement.

558.03.03 Methods of Removal. Use removal methods determined by pavement condition and type of marking material being removed, unless otherwise directed.

(a) Removal methods may include hydro-blasting with or without abrasives, abrasive mineral blasting, and shot blasting or grinding.

(b) Use methods with vacuum systems that will collect removed markings as well as debris and water.

(c) Prevent any debris from draining into inlets and waterways.

(d) Dispose of collected material in accordance with EPA regulations.

558.03.04 Lane Shifts and Temporary Traffic Markings. Remove markings to bare pavement as determined.

(a) Grooves created shall be uniform throughout and may be no more than 1/8 in. depth, with no gouge areas.

(b) If a second pass is necessary to completely remove the markings, feather the edges of the groove to a width of 1.25 in. on each side for every additional 1/8 in. of depth.

Blackout tape may be used in accordance with MdMUTCD. Refer to Section 104.

(c) Use hydro blasting to remove existing markings when lane shifts are temporary, and markings will be returned to original alignment.

558.03.05 Existing Markings for Restriping. Remove markings so that new markings may be placed in the same location and alignment. Refer to D913 for a visual guide to determine percent bare pavement.

(a) Use methods that remove the markings to 80 percent - 90 percent bare pavement across the surface of the eradicated area and only slightly abrade the pavement surface without grooving of the pavement or fracturing of the aggregate.

(b) The applied markings shall be capable of filling slight irregularities while maintaining the full thickness requirements above the pavement surface.

558.03.06 Existing Inlaid and Surface Tapes for Restriping. Remove markings to bare pavement as determined so that new markings may be placed in the same location and alignment.

(a) Use hydro blasting methods or other non grooving method to eradicate to bare pavement.

(b) The applied markings shall be capable of filling slight irregularities while maintaining the full thickness requirements above the pavement surface.

(c) Apply temporary markings in accordance with MdMUTCD if eradicated markings cannot be replaced on the same day. Do not install any temporary markings in the eradicated area.

558.03.07 Cleaning Pavement Surfaces. Refer to 549.03.07.

558.03.08 Alignment. Perform removal in a straight and uniform manner and follow the longitudinal alignment of the markings with a lateral deviation of no more than 1 in. in any 10 ft section. Affected area shall not exceed 1/2 in. on either side of the existing marking.

558.03.09 Corrective Actions. Refer to 549.03.01.

558.04 MEASUREMENT AND PAYMENT

Payment will be full compensation for the removal of the markings, pavement clean up, test strips, protective shielding, containment, disposal of marking material and pavement debris, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Removal of the existing pavement markings will be measured and paid for at the Contract unit price for one or more of the following items:

(a) Removal of Existing Pavement Marking Lines per linear foot, any width.

(b) Removal of Existing Pavement Marking Letters, Symbols, Arrows, and Numbers per each.

CATEGORY 500
PAVING

SECTION 559 — POLYUREA PAVEMENT MARKINGS

559.01 DESCRIPTION

Furnish and apply two component polyurea pavement markings to roadway surfaces as specified and as directed.

559.02 MATERIALS

Polyurea Pavement Markings	951.10
Glass Beads	951.09

Polyurea is a durable material. Select Polyurea Pavement Markings from the Qualified Products List (QPL).

559.03 CONSTRUCTION

559.03.01 Quality Control. 549.03.01

559.03.02 Quality Assurance. 549.03.02

559.03.03 Cleaning Pavement Surfaces. 549.03.07

559.03.04 Quality Control Test Strip. 549.03.09

559.03.05 Application Equipment. Use application equipment capable of applying two component polyurea pavement marking material, as approved. Provide access to the application equipment for inspection.

(a) Temperature Gauges. Use temperature gauges that have been calibrated every six months and submit a copy of the calibration certification according to the QPL.

(b) Footage Counters. Use calibrated footage counters to measure pavement markings and submit notarized certification according to the QPL.

(c) Usage Counters. Use equipment that is equipped with material usage counters and printers or measure tanks manually using equipment manufacturer certified tables. Use beginning and ending quantities to calculate thickness of applied lines and record according to the QPL.

(d) Bead Dispenser. Equipment shall be capable of application of glass beads to the surface of the pavement marking dispensed closely behind the binder application device.

(e) Material Dispenser. Use equipment capable of applying longitudinal markings at multiple width settings ranging from 5 in. to 12 in. as demonstrated by the quality control strip and as specified. Reconduct the quality control strip whenever the guns are repositioned or adjusted after the initial quality control strip. The equipment shall air-blast the pavement, apply the stripe, and immediately drop glass beads in a single pass at speeds up to 8 mph.

559.03.06 Maneuverability. Use truck mounted equipment that is mobile and maneuverable to the extent that straight lines can be followed, and all standard curves can be made in true arcs and capable of cleanly cutting off stripe ends. The glass beads applicator shall be equipped with an automatic cut-off control that is synchronized with the binder material cut-off.

(a) The glass beads applicator shall deliver a uniform drop rate at required application speeds.

(b) The glass beads are applied so they are properly embedded and appear uniform on the entire traffic marking.

(c) The equipment shall proportion two volumes of Parts A to every one volume of Part B and mix the liquid components continuously to ensure proper cure.

(d) The equipment shall heat and maintain the heated temperature of the liquid components to ensure optimal mixing and spraying of material.

559.03.07 Cleanliness. Clean all parts of the equipment thoroughly of foreign or different colored material prior to introducing a new batch of material.

559.03.08 Application. Install markings at the location, width, and type as specified and as directed. Do not install pavement marking material over longitudinal joints; offset 2 in. or as directed.

(a) Ambient Conditions. Apply material when the ambient and surface temperatures is above 32 F and rising at the time of application and the relative humidity conforms to the manufacturer's recommendations.

(b) Moisture in Pavement. MSMT 729. Do not apply material if test is positive for moisture. Do not apply if ice is present on the pavement surface.

(c) Application Temperature. Temperature of applied material shall conform to the manufacturer's recommendations.

(d) Surface applied Glass Beads/Elements. MSMT 729. Apply 20 lb glass beads per gallon.

(e) Thickness. MSMT 729. Apply the material at a wet film thickness of 20 ± 1 mils.

(f) Color. MSMT 729.

(g) Retroreflectance. MSMT 729. Measure the retroreflectance as specified.

(h) Curing. 549.03.10.

(i) Observation Period. 549.03.11.

(j) Submittals. Supply MSDS, Product Data Sheets, and Quality Control Plans.

559.04 MEASUREMENT AND PAYMENT

Polyurea Pavement Markings will be measured and paid for at the Contract unit price per linear foot for the color and width specified. Payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 600
SHOULDERS

SECTION 601 — EARTH SHOULDERS

601.01 DESCRIPTION

Construct shoulders using earth.

601.02 MATERIALS

Refer to Section 204.

601.03 CONSTRUCTION

Refer to 204.03 and 208.03.

601.04 MEASUREMENT AND PAYMENT

Earth shoulders will not be measured but the cost will be incidental to the Contract unit price for the pertinent Excavation item.

CATEGORY 600
SHOULDERS

SECTION 602 — CURB, COMBINATION CURB AND GUTTER, AND MONOLITHIC MEDIAN

602.01 DESCRIPTION

Construct concrete curb, concrete combination curb and gutter, concrete curb openings, concrete monolithic median, and asphalt curb.

602.02 MATERIALS

Refer to 701.02, 705.02, 708.02, and the following:

Crusher Run Aggregate CR-6	901.01
Aggregate	901.01, Size No. 57
Curing Materials	902.07
Form Release Compound	902.08
Portland Cement Concrete	902.10, Mix No. 13
Asphalt Mix	Section 904
Tack Coat	904.03
Reinforcement Steel	908.01
Joint Sealer	911.01
Preformed Joint Filler	911.02
Borrow Excavation	916.01
Common Borrow	916.01
Topsoil	920.01.01, 920.01.02
Subsoil	920.01.03, 920.01.04

602.03 CONSTRUCTION

602.03.01 Concrete Curb, Combination Curb and Gutter, and Monolithic Median.

(a) Excavation. Excavate to the specified depth and to the width required to install and brace the forms. Compact the subgrade to 92 percent density according to T 180, Method C, and trim to the proper shape and required grade. Remove all soft and unsuitable material and replace with approved material.

(b) Forms.

(1) Fixed Form Method. Ensure that all forms are properly designed and acceptable. Use full depth steel forms that are at least 10 ft in length. When installing forms where the radius of the curb face is less than 200 ft, use flexible or curved steel or wooden forms that are no more than 6 ft in length. Securely fasten and brace forms to prevent buckling, warping, or any other movement during the placing of concrete. Place the forms to a tolerance in grade and alignment of 1/4 in. in 10 ft. Thoroughly clean and coat the forms with a form release compound each time they are used.

(2) Slip-Form Method. Refer to 603.03.01(b)(2).

(c) Concreting. Mix according to 915.03.04. Volumetric batching and continuous mixing will be permitted. Before placing concrete, moisten the subgrade with as much water as it can absorb. Consolidate the concrete in the forms by spading or other approved method. Remove curb face forms as soon as the concrete will retain its shape. Keep other forms in place for at least 12 hours.

(d) Depressed Curbs. Construct depressed curbs at entrances and sidewalk ramps.

(e) Openings. Provide an outlet for rainspouts and other drainage by constructing insert openings within the curb.

Construct curb openings as specified.

(f) Finishing. Strike off the concrete to the specified cross section. Finish, float, and apply a broom finish. For matching adjacent concrete surfaces, other methods of finishing may be permitted. Do not use plastering. Use a 1 in. radius edging tool on the face edge of the curb. Finish all other exposed edges with a 1/4 in. edging tool. Limit any deviation from grade and alignment of the face and top surface of curbs and medians to no more than 1/4 in. in 10 ft. Do not add water to the concrete at any time during any phase of the finishing operations. Immediately after removal of the forms, repair all honeycombed and damaged areas. Ensure an ACI Concrete Flatwork Finisher or NRMCA Concrete Exterior Flatwork Finisher is present at all times during finishing operations.

(g) Joints.

(1) Fixed Form Method. Use 10 ft spacing between joints, except where a lesser spacing is necessary for closures and for matching expansion and contraction joints in contiguous concrete pavements. Do not use joint spacings less than 4 ft. Form the joints by using plate steel templates 1/8 in. to 3/16 in. thick that have a width and depth equal to the unit cross section. Do not use intermediate templates or sections of templates. Set the templates perpendicular to the line and grade of the unit. At stationary structures such as bridges and inlets,

construct an expansion joint using 1/2 in. preformed expansion joint filler. Construct expansion joints at points of curves, tangents, at locations coinciding with adjoining pavement joints, and as specified or as directed. Extend the expansion joint material to the full depth of the unit cross section. Apply sealer to the entire gutter portion and 1 in. up the face of all joints. In addition, seal the entire expansion joint of monolithic medians.

(2) Slip-Form Method. Refer to 604.03.01(b), except use 602.03.01(g)(1) for joint spacing.

(h) Cold Weather Construction and Curing. Refer to 520.03.02 and 520.03.12(a) White Pigmented, except the requirement for an approved spraying machine with drive wheels is waived. Apply by sprayers in two directions at 90 degrees to each other, at a rate recommended by the manufacturer, completely covering the surface of the concrete. Have standby equipment on site in the event of spraying equipment failure. Do not allow pedestrian and vehicular traffic during the curing period.

(i) Backfill. Backfill as directed.

(1) Non-Landscaped Areas. Backfill with approved materials as specified in Section 204 or Section 701 to the grade that is 4 in. below the final grade. Complete the backfill to the final grade with aggregate as specified or as directed.

(2) Landscaped Areas. Backfill with topsoil up to 8 in. depth as specified in Section 701 and perform sodding or seeding as described in (3) below. For backfill more than 8 in. depth, the use of aggregate fill is prohibited. Install subsoil or approved common borrow as specified in Section 204 or Section 701 to the grade that is 4 in. below the final grade. Complete the adjustment with topsoil as specified in Section 701 and perform sodding or seeding as described in (3) below.

(3) Sodding or Seeding. Immediately after placing topsoil, perform Turfgrass Sod Establishment as specified in Section 708. Alternatively, perform Turfgrass Establishment as specified in Section 705 and install Type A or Type E Soil Stabilization Matting as specified in Section 709.

602.03.02 Asphalt Curb. Unless otherwise approved, use a self-propelled machine to place Asphalt curb. The machine shall form curbing that is uniform in texture, shape, and density, and to the specified template.

Place the curb on a clean, dry, and stable base. Apply tack coat using asphalt of the type and amount as directed.

When required, backfill the curb as specified in 602.03.01(i) after the asphalt curb has sufficiently hardened to prevent damage.

602.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all concrete, asphalt mixes, forms, excavation, backfill, disposal of excess material, drainage openings, joint sealer, tack coat, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The removal and disposal of unsuitable material will be measured and paid for at the Contract unit price for Class-1A Excavation, which price includes the cost of using acceptable excavation as replacement material. When Borrow, Topsoil, or other selected backfill is specified as replacement material, payment will be made at the Contract unit price for the respective items.

When existing curb, combination curb and gutter, or monolithic median are removed and replaced with new curb, combination curb and gutter, or monolithic median, the cost of the removal will be paid for as specified in 206.04.

602.04.01 Curb, Combination Curb and Gutter, and Monolithic Median will be measured and paid for at the Contract unit price per linear foot. Asphalt Curbs, Concrete Curbs, and Concrete Combination Curb and Gutter will be measured along the front face of the curb. Monolithic Concrete Median will be measured along the center line of the finished top of median.

602.04.02 Concrete Curb Opening and Curb Opening for Concrete Combination Curb and Gutter will be measured and paid for at the Contract unit price per each.

602.04.03 Turfgrass Establishment and Turfgrass Sod Establishment will be measured and paid for separately.

CATEGORY 600
SHOULDERS

SECTION 603 — SIDEWALKS

603.01 DESCRIPTION

Construct asphalt or concrete sidewalks and sidewalk ramps. Ensure that the sidewalks and sidewalk ramps are constructed in accordance with the most recent accessibility guidelines of the Americans with Disabilities Act (ADA).

603.02 MATERIALS

Refer to 701.02, 705.02, 708.02, and the following:

Curing Materials	902.07
Form Release Compound	902.08
Portland Cement Concrete	902.10, Mix No. 13
Asphalt Mix	Section 904
Welded Wire Fabric	908.05
Joint Sealer	911.01
Preformed Joint Fillers	911.02
Borrow Excavation	916.01
Common Borrow	916.01
Topsoil	920.01.01, 920.01.02
Subsoil	920.01.03, 920.01.04

603.03 CONSTRUCTION

603.03.01 Concrete Sidewalks.

(a) Excavation. Refer to 602.03.01(a).

(b) Forms.

(1) Fixed Form Method. Use full depth steel or wood forms. Use forms that are straight, free from warp, and of sufficient strength to resist the pressure of the concrete. Brace and stake the forms so that they remain in both horizontal and vertical alignment. Thoroughly clean and coat forms with form release

compound each time they are used. Allow the concrete to set for at least 12 hours before removing the forms.

(2) Slip-Form Method. Refer to 604.03.01(b), except use 603.03.01(e) for joint construction.

(c) Concreting. Before placing concrete, moisten the subgrade with as much water as it can absorb. Mix the concrete according to 915.03.05. Volumetric batching and continuous mixing will be permitted. Deposit the concrete on the prepared subgrade in successive batches to the full width of the sidewalk. Thoroughly spade along the edges and tamp the entire surface area to eliminate voids. Strike off and screed the concrete to the top of the forms.

(d) Finishing. Immediately after screeding and before bleed water appears, bull float the concrete to seat the coarse aggregate particles. After bull floating and waiting until bleed water has dissipated and the concrete has begun to set, float the concrete to provide a level surface and apply a broom finish. Do not plaster the surface. Use a 1/4 in. edging tool on all outside edges and all joints. On dry and/or windy days and as directed, while waiting for the concrete to set, apply a thin film of evaporation retarder according to the manufacturer's recommendations. Do not use evaporation retarder as a finishing aid. Do not add water to the concrete at any time during any phase of the finishing operations. Immediately following texturing and edging, begin the concrete curing. Ensure an ACI Concrete Flatwork Finisher or NRMCA Concrete Exterior Flatwork Finisher is present at all times during finishing operations.

(e) Joints. Place joints as specified. Tool or saw dummy joints a minimum of 3/4 in. deep.

Match adjacent joints in curb or pavement. Place expansion joint material to the full depth of the concrete.

(f) Cold Weather Construction and Curing. Refer to 602.03.01(h).

(g) Expansion Joint Sealing. Prior to sealing, clear dirt and other foreign material from the expansion joints. Ensure that joint walls and all surfaces to which the sealing material is to adhere are surface dry for at least three hours prior to sealing. Do not seal the joints until they are acceptable to the Engineer. Ensure that the surface of the sealing compound is not more than 1/8 in. below the sidewalk surface.

603.03.02 Asphalt Sidewalks.

(a) Excavation. Complete excavation, subgrade preparation, and form placement when required, as specified in 603.03.01(a) and (b).

(b) Placement. Place asphalt mix as specified in 504.03.06.

(c) Compaction. Use an approved roller. In areas inaccessible to a roller, a vibrating plate compactor or hand tamping may be used. Compact the asphalt mix uniformly, starting compaction as soon as the asphalt mix can be compacted without displacement. Continue until the material is thoroughly compacted and all marks have been removed.

603.03.03 Backfill. Backfill as specified in 602.03.01(i).

603.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, backfill, disposal of excess or unsuitable material, forms, reinforcement when specified, joints, sealer, compaction, curing, finishing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The removal and disposal of unsuitable material will be measured and paid for at the Contract unit price for Class-1A Excavation, which price includes the cost of using acceptable excavation as replacement material. When Borrow, Topsoil, or other selected backfill is specified as replacement material, payment will be made at the Contract unit price for the respective items.

When existing sidewalks are removed and replaced in the same location with new sidewalks, the removal will be measured and paid for as specified in 206.04.

603.04.01 Concrete Sidewalks will be measured and paid for at the Contract unit price per square foot of finished surface including sidewalk ramps.

603.04.02 Asphalt Sidewalks will be measured and paid for at the Contract unit price per ton for the mixture placed.

603.04.03 Turfgrass Establishment and Turfgrass Sod Establishment will be measured and paid for separately.

CATEGORY 600
SHOULDERS

SECTION 604 — CONCRETE TRAFFIC BARRIERS

604.01 DESCRIPTION

Construct concrete traffic barriers.

604.02 MATERIALS

Crusher Run Aggregate CR-6	901.01
Aggregate	901.01, Size No. 57
Curing Materials	902.07
Form Release Compound	902.08
Portland Cement Concrete	902.10, Mix No. 3
Portland Cement Concrete	902.10, Mix No. 6 or 420.02.04 and 902.10
PVC Pipe	Section 905
Reinforcing Steel	Section 908, Grade 60, Epoxy Coated
Preformed Joint Fillers	911.02
Borrow Excavation	916.01
Geotextile	Section 919
Reflective Delineators	QPL
Fusion Bonded Epoxy	917.02

Use concrete mix No. 6 to construct all concrete traffic barriers, end transitions, and footers unless otherwise specified.

604.03 CONSTRUCTION

Use cast-in-place construction. Excavate to the required depth and to a width that will permit the installation and bracing of forms where necessary. Remove all soft and unsuitable material, and replace it with suitable material. Properly shape the subgrade and compact it as specified in Section 208.

604.03.01 Concrete Barriers. Forming of the footer or concrete barrier may be by either the fixed form or the slip-form method. Do not construct the footer and the barrier section monolithically.

(a) Fixed Form Method. Use steel forms with a tolerance in grade and alignment of 1/4 in. in 10 ft. For bifurcated and transition sections, other forming materials may be used as directed.

Thoroughly clean and coat the forms with form release compound each time they are used.

Mix and place concrete as specified in 915.03.05 and Section 420, respectively. Vibrate concrete using an approved immersion type mechanical vibrator.

Saw or form construction and contraction joints at 20 ft intervals with a minimum of 10 ft. For saw time requirements, refer to 520.03.14(c)(1). Place expansion joints where specified or as directed. Ensure that all joints in footers and walls align.

Finish concrete as specified in 604.03.03 except apply a broom finish to the surface when forms are stripped in less than 24 hours. Remove the face forms for finishing as soon as the concrete can retain its shape.

After removing the forms, immediately repair all honeycombed and damaged areas.

(b) Slip-form Method. Use approved slip-form equipment. The equipment shall have internal vibrating capability and automatic guidance controls to follow line and grade references. On vertical and horizontal curves, set an additional intermediate support in the field to establish an acceptable reference line. Do not use ski or shoe sensors. This method shall not be used within 5 ft of either side of a utility junction box. Use the fixed form method.

Mix concrete as specified in 915.03.04. Ensure that the consistency of the concrete after extrusion will maintain the shape of the barrier without support. Provide surfaces that are free of pits larger than 3/16 in. diameter and that require no further finishing other than a broomed finish.

Whenever a tear occurs during the operation of the slip-form equipment, repair it immediately or remove and replace as directed.

Saw or form construction and contraction joints at 20 ft intervals in the barrier and footer with a minimum of 10 ft, except in the area of miscellaneous structures 6 ft will be permitted. Saw the joints 1/8 in. wide and at least 2 in. deep. Use a diamond blade to saw cut contraction joints in the finished barrier. Make cuts and space joints as specified. Saw cut the contraction joints as soon as possible after initial concrete set and after the concrete has set sufficiently to preclude raveling during the sawing. Complete the sawing the same day the concrete is extruded and before any shrinkage cracking occurs. Do not leave concrete overnight without saw cutting the joints. Place expansion joints as specified or as directed. Terminate slip form placements at a barrier joint.

604.03.02 Curing. Cure and protect concrete as specified in Section 420.

604.03.03 Finished Surface. Finish concrete as specified in Section 420. The completed barriers shall be within 1/4 in. in 10 ft from the specified horizontal and vertical lines. The barrier shall present a smooth, uniform appearance.

604.03.04 Reflective Delineators. Install reflective delineators on the concrete traffic barrier as specified.

604.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all test panels, excavation, removal of existing asphalt mix, disposal of excess or unsuitable material, reinforcement, drilled holes, drainage appurtenances, geotextile, No. 57 aggregate, conduit, boxes and fittings, backfilling, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The removal and disposal of unsuitable material will be measured and paid for at the Contract unit price for Class 2 Excavation, which price includes the cost of using suitable excavation as replacement material. When Borrow or Selected Backfill is authorized as replacement material, payment will be made at the Contract unit price for the respective items.

The removal of existing concrete traffic barriers will not be measured unless specified elsewhere in the Contract Documents.

604.04.01 Concrete Traffic Barriers will be measured and paid for at the Contract unit price per linear foot. Measurement will be along the center line of the top of the barrier.

604.04.02 Concrete Traffic Barrier End Transitions will be measured and paid for at the Contract unit price per each.

604.04.03 Reflective Delineators will be measured and paid for at the Contract unit price per each.

CATEGORY 600
SHOULDERS

SECTION 605 — METAL TRAFFIC BARRIERS

605.01 DESCRIPTION

Furnish and Install metal traffic barriers.

605.01.01 Training and Certifications. The Traffic Barrier W-Beam Manager (TBWBM) shall have valid certification from successful completion of the Installer option of the "SHA Traffic Barrier Certification." At all times during the contract, maintain current valid certifications for at least one TBWBM.

605.01.02 Traffic Barrier W-Beam Manager (TBWBM). The Traffic Barrier W-Beam Manager (TBWBM) is responsible for the appropriate installation of traffic barrier w-beam systems and end treatments, including methods of operation and implementation of corrective actions. Duties include the following

(a) Attend pre-construction meeting.

(b) Must be present for the entire duration of traffic barrier work to ensure compliance with the Contract Documents and adherence to the manufacturer installation manual for the product being installed.

(c) Authorize mobilization of crews to make immediate repairs and implement corrective actions to damaged traffic barrier w-beam and end treatments. In situations where the Engineer determines that public safety is endangered, report for evaluation and determination of work within 24 hours of notification. Coordinate with the Engineer to ensure that all deficiencies are immediately corrected, and that the Contract remains in compliance.

(d) When requested, accompany the Engineer during inspections.

605.02 MATERIALS

Refer to 606.02, 609.02, 701.02, 705.02, 708.02, 709.02, and the following:

Common Borrow	916.01
W-Beam/Thrie-Beam	918.01
Steel Posts	918.02
Traffic Barrier Hardware	918.03
Timber Posts	918.04
Wood Offset Blocks	918.04, grooved or routed
Wire Rope	918.05
Rub Rail	A36, Galvanized, A123
Galvanizing Repair	465.03.05
Composite Offset Blocks	As approved, grooved or routed
Reflective Delineators	As approved

605.03 CONSTRUCTION

605.03.01 Preliminary Activities. Prior to beginning construction activities, complete the following.

(a) Attend the Pre-Construction Meeting and present a general overview of how the traffic barrier W-beam systems and end treatments will be installed. TBWBM must attend.

(b) Assign a Traffic Barrier W-Beam Manager (TBWBM) and submit to the Engineer the name(s) and credentials of the TBWBM for approval at least 10 days prior to beginning traffic barrier work. Each installation crew shall have an approved TBWBM in the project files. There may be multiple TBWBMs approved for the Contract. There may be multiple or different TBWBM each calendar day designated to be available 24 hours to respond to emergency situations. The TBWBM shall hold a valid certification as specified in 605.01.01 for the duration of the traffic barrier work.

(c) Do not perform excavation, grading, or post installation without the presence of an Administration representative.

605.03.02 TBWBM. Do not commence work without an approved TBWBM meeting the certification requirements as specified in 605.01.01.

Should there be no TBWBM available with valid unrevoked certifications, immediately cease construction activities and submit to the Engineer for approval the name and credentials of a new TBWBM meeting the certification as specified in 605.01.01. Resume construction activities when directed by the Engineer.

605.03.03 Quality Assurance Inspections. All traffic barrier activities within the Contract are subject to routine, periodic, scheduled, unscheduled, and random field inspections by one or more representatives from the Administration. If non-conformance with the Contract Documents or with the manufacturer installation manuals is determined, the Administration representative(s) will immediately notify the Engineer of the needed corrective actions. Corrective actions may require shutdown of construction activities until the non-conformance is satisfactorily addressed. Failure to satisfactorily address the deficiencies within 72 hours of written notification from the Engineer may result in immediate revocation of the "SHA Traffic Barrier Certification" from the TBWBM for at least six months and until successful completion of the Administration's Traffic Barrier Certification course and exam. Upon meeting 605.01.01 they may resume their former roles on the project.

605.03.04 Post Installation.

(a) Install posts plumb to the specified depth. Drive posts, unless otherwise directed, using a method that will not batter or distort the posts.

(b) If posts are not driven, dig holes of sufficient diameter to allow tamping of the backfill and install the posts as follows.

(1) When rock is encountered, drill a 12 in. diameter hole to the specified footing depth or drill into the rock to at least a depth of 24 in., whichever is less.

(2) When the 24 in. depth is reached prior to the specified footing depth, discontinue drilling, and cut the post to the appropriate length and paint the cut edge with galvanizing repair paint.

(3) Backfill with approved common borrow, CR6, or other material as directed. Place backfill in horizontal layers not exceeding a depth of 6 in. and thoroughly compact. Do not use concrete or grout material.

(c) Do not install posts into pavement.

(d) Remove and dispose of unsuitable materials and restore areas to match adjacent turfgrass, asphalt millings or grindings, or crusher run aggregate CR-6.

(e) Align posts to within 1/4 in. of line and grade before installing rail.

605.03.05 Rail Assembly. Install rail elements in accordance with the SHA Book of Standards. Ensure a smooth and continuous installation, with laps in the direction of traffic flow. Ensure all bolts are tight.

605.03.06 Offset Blocks. Install wood or composite offset blocks with grooves or router lines to prevent the blocks from rotating.

Do not mix different types of composite offset blocks. Do not mix composite and wood blocks.

605.03.07 Grading Adjustment. When grading adjustment is required for installation of traffic barrier, adjust the grading using topsoil, crusher run aggregate CR-6, asphalt millings or grindings, subsoil, common borrow, or other approved materials as follows:

(a) Non-Landscaped Areas. For grading adjustment, install common borrow or subsoil as specified in 204.03.04 or 701.03.04 to the grade that is 4 in. below the final grade. Complete the grading adjustment with crusher run aggregate CR-6 or asphalt millings or grindings.

(b) Landscaped Areas. For grading adjustment up to 8 in. depth, complete the adjustment with topsoil as specified in Section 701, and perform sodding or seeding as described in 605.03.07 (c). For surface adjustment more than 8 in. depth, the use of aggregate fill is prohibited. Install subsoil or approved common borrow as specified in Section 204 or Section 701 to the grade that is 4 in. below the final grade. Complete the adjustment with topsoil as specified in Section 701 and perform sodding or seeding as described in605.03.07 (c).

(c) Sodding or Seeding. Immediately after placing topsoil, perform Turfgrass Sod Establishment as specified in Section 708. Alternatively, perform Turfgrass Establishment as specified in Section 705 and install Soil Stabilization Matting as specified in Section 709.

605.03.08 Traffic Barrier Reflective Delineators. Install reflective delineators as specified.

605.03.09 Remove and Reset Existing Traffic Barrier. Replace severely corroded or damaged individual traffic barrier panels as directed.

When removing and resetting an entire run or a portion of a run of traffic barrier, replace any steel offset brackets with either wood or composite offset blocks as specified in 605.03.06.

When removing and resetting an entire run, use 8 in. offset blocks. When removing and resetting only a portion of a run, match the offset blocks of the existing run as directed.

Ensure that the holes in the blocks match the holes in the existing posts.

When resetting the rail, measure the height of the rail to ensure that it conforms to the current height shown in the Book of Standards. Raise existing rail and posts that do not conform to the current height without damaging the traffic barrier, posts, offset blocks, or surrounding area. Unless otherwise directed, maintain the existing offset distance from the edge of the roadway.

After replacing traffic barrier panels, restore the disturbed areas as specified in 605.03.07.

605.03.10 Remove and Reset Existing Median Traffic Barrier. Refer to 605.03.09.

605.03.11 End Treatments. As specified in Section 606.

605.03.12 Removal and Disposal of Traffic Barrier. Make every effort to recycle or stockpile all existing metal components of traffic barrier. Submit written certification of material recycled or stockpiled to the Administration upon construction completion, including date, time, materials, measurement, and other pertinent information. After removal and disposal of traffic barrier, restore the disturbed areas as specified in 605.03.07.

605.04 MEASUREMENT AND PAYMENT

Payment will be full compensation for all driving, excavating, drilling, traffic barrier rail elements, offset blocks, traffic barrier posts, backfill, compaction, and for all material, labor, equipment, tools, disposal fees, and incidentals necessary to complete the work.

605.04.01 Traffic Barrier W-Beam Using 6 Foot Post or 8 Foot Post will be measured and paid for at the Contract unit price per linear foot.

605.04.02 Traffic Barrier W-Beam Panel. When a bottom W-beam panel is specified for the Traffic Barrier W-Beam item, it will be measured and paid for at the Contract unit price per linear foot.

605.04.03 Traffic Barrier W-Beam Median Barrier will be measured and paid for at the Contract unit price per linear foot.

605.04.04 Traffic Barrier W-Beam Median Barrier with Bottom Panel will be measured and paid for at the Contract unit price per linear foot.

605.04.05 Traffic Barrier Thrie-Beam will be measured and paid for at the Contract unit price per linear foot.

605.04.06 Traffic Barrier Thrie-Beam Median Barrier will be measured and paid for at the Contract unit price per linear foot.

605.04.07 Replacing 6 foot or 8 foot posts, installing additional 6 foot or 8 foot posts, splice joints, and replacing W-beam and Thrie-beam panels will be measured and paid for at the pertinent Contract unit price.

605.04.08 Traffic Barrier Reflective Delineators will be measured and paid for at the Contract unit price per each.

605.04.09 Remove and Reset Existing Traffic Barrier W-Beam or Thrie Beam will be measured and paid for at the Contract unit price per linear foot.

605.04.10 Remove and Reset Existing Median Traffic Barrier W-Beam or Thrie Beam will be measured and paid for at the Contract unit price per linear foot.

605.04.11 Remove and Reset Existing Median Traffic Barrier W-Beam with Bottom Panel will be measured and paid for at the Contract unit price per linear foot.

605.04.12 Removal and Disposal of Existing Traffic Barrier W-Beam or Thrie Beam will be measured and paid for at the Contract unit price per linear foot, including all costs required for disposal and certification. Certification of material recycled or stockpiled will be required prior to payment.

605.04.13 Grading Adjustment using topsoil and subsoil will be measured and paid for at the Contract unit price as specified in 701.04.

605.04.14 Grading Adjustment using CR-6 crusher run aggregate, or asphalt millings or grindings, will be measured and paid for as specified in 606.04.06.

605.04.15 Grading Adjustment using common borrow will be measured and paid for at the contract unit price per cubic yard as specified in 203.04.

605.04.16 Grading Adjustment using other approved materials will be measured and paid for as pertinent items.

605.04.17 Type A Soil Stabilization Matting or Type E Soil Stabilization Matting will be measured and paid for at the Contract unit price per square yard.

605.04.18 Turfgrass Sod Establishment or Turfgrass Establishment will be measured and paid for at the Contract unit price per square yard.

605.04.19 The Traffic Barrier W-Beam Manager(s) will not be measured but the cost will be incidental to the Traffic Barrier W-Beam items. Replacement of the Traffic Barrier W-Beam Manager(s) with another will be at no additional cost to the Administration.

CATEGORY 600
SHOULDERS

SECTION 606 — PERMANENT TRAFFIC BARRIER END TREATMENTS

606.01 DESCRIPTION

Furnish and install permanent traffic barrier end treatments.

Refer to 605.01.01 and 605.01.02.

606.02 MATERIALS

Refer to 605.02, 701.02, 705.02, 708.02, 709.02 and the following:

End Treatments	As specified by the manufacturer
Spare Parts Packages	As specified by the manufacturer
Antifreeze Agent	As approved
Reflectorization	950.03
Plastic Barrels (Yellow)	Standard MD 104.01-70
Sand	901.01
Portland Cement Concrete	902.10, Mix 2 and 6
Concrete	902.10, Mix 7

606.03 CONSTRUCTION

606.03.01. Refer to 605.03.01, 605.03.02, and 605.03.03. Document each step of the installation, and complete and submit to the Engineer the manufacturer installation checklist for the installed product.

606.03.02 End Treatments.

(a) Buried-in-Backslope End Treatment (Type A). Excavate the slope to install these components. Bury the ends of the traffic barrier, the end treatment anchorage, and the bottom rail, when required, in a cut slope. Upon installation, backfill and stabilize the area as specified in 606.03.03 to match the adjacent slope.

For single rail systems, use 6 ft posts throughout the entire end treatment. For double rail systems, use 8 ft posts, except for the last three posts buried in the cut slope.

Construct the end treatment anchorage according to the Book of Standards.

Install traffic barrier W-beam as specified in 605.03.

(b) One-Sided End Treatment (Type C). Install in a straight line according to the manufacturer's recommendations and the Book of Standards.

(c) Two-Sided End Treatment and Crash Cushion (Types D, E, and J). Install these systems as specified by the manufacturer. Refer to the manufacturer's recommendations for installation methods and procedures.

(d) One-Sided Downstream End Treatment (Type K). Install according to the Book of Standards.

(e) Traffic Barrier W-Beam Radius Anchorage (Type L). Install according to the Book of Standards.

(f) All Other Traffic Barrier End Treatments. Install these systems as specified by the manufacturer. Refer to the manufacturer's recommendations for installation methods and procedures.

(g) Nose Section. Reflectorize as shown in the Contract Documents and as approved by the Office of Traffic and Safety.

(h) Permanent Crash Cushion Sand Filled Plastic Barrels (SFPB). Provide the components and assemble, place in the required configuration, and fill each barrel according to the manufacturer's recommendations or as specified in the Contract Documents. Ensure that each SFPB is watertight and separated from other SFPB by a distance of 3 in. Place the last row of SFPB 12 in. from the shielded object.

Reflectorize the first barrel of the SFPB configuration as specified. Mix approved antifreeze agent into loose, dry sand according to the manufacturer's recommendations and install sand mixture in barrels.

606.03.03 Grading Adjustment. When grading adjustment is required for installation of traffic barrier end treatments and crash cushions, adjust the grading using topsoil, crusher run aggregate CR-6, asphalt millings or grindings, subsoil, common borrow, or other approved material as specified in 605.03.07(a), 605.03.07(b), and 605.03.07(c).

606.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, removal, and disposal of the existing end treatment to be replaced, fabrication of all component parts, transitions to barriers, reflectorization, backfill, compaction, and for all material, labor, equipment, tools, disposal fees, and incidentals necessary to complete the work, unless pay items are included in the Contract Documents.

606.04.01 Buried-in-Backslope End Treatment (Type A) will be measured and paid for at the Contract unit price per each.

606.04.02 One-Sided End Treatment (Type C), One-Sided Downstream End Treatment (Type K), Traffic Barrier W-Beam Radius Anchorage (Type L), and Two-Sided End Treatment and Crash Cushion (Type D, E, and J) will be measured and paid for at Contract unit price per each.

606.04.03 Grading Adjustment using topsoil and subsoil will be measured and paid for at the Contract unit price as specified in 701.04.

606.04.04 Turfgrass Sod Establishment or Turfgrass Establishment will be measured and paid for at the Contract unit price per square yard.

606.04.05 Type A Soil Stabilization Matting or Type E Soil Stabilization Matting will be measured and paid for at the Contract unit price per square yard.

606.04.06 Grading Adjustment using CR-6 crusher run aggregate, or asphalt millings or grindings, will be measured and paid for at the Contract unit price per square yard, per ton, or as specified for the pertinent items. The payment will also include full compensation for furnishing, adjusting, and compacting embankment or aggregate material.

606.04.07 Permanent Crash Cushion Sand Filled Barrels will be measured and paid for at the Contract unit price per barrel. The payment will also include full compensation for furnishing and placing sand and antifreeze agent.

606.04.08 Repairs.

(a) Traffic Barrier End Treatment Spare Parts Package furnished and installed will be measured and paid for at the Contract unit price per each for the type specified. The payment will also include full compensation for the clearing and removal of debris and damaged unsalvageable parts, and for restoring damaged topsoil, turfgrass, or aggregate.

(b) When spare parts packages are furnished by the Administration, Repairing Traffic Barrier End Treatments will be measured and paid for at the Contract unit price per each for the type specified. The payment will also include full compensation for all transportation, reconnection to fixed objects where necessary, clearing and removal of debris and damaged unsalvageable parts, and for restoring damaged topsoil, turfgrass, or aggregate.

(c) Payment will not be made for replacement end treatments or spare parts packages used for end treatments damaged due to the Contractor’s operations.

606.04.09 Grading Adjustment using common borrow will be measured and paid for at the Contract unit price per cubic yard as specified in 203.04.

606.04.10 Grading Adjustment using other approved materials will be measured and paid for as pertinent items.

606.04.11 Refer to 605.04.19.

606.04.12 The manufacturer installation checklist signed by the Traffic Barrier W-Beam Manager including their "SHA Traffic Barrier Certification" credential will be required for payment of each end treatment.

CATEGORY 600
SHOULDERS

SECTION 607 — CHAIN LINK FENCE

607.01 DESCRIPTION

Construct chain link fence.

607.02 MATERIALS

Portland Cement Concrete	902.10, Mix No. 2
Fence Fabric	914.01
Tie Wires, Line Post Clips, Tension Wires and Tension Wire Clips	914.02
Posts, Braces, Fittings and Hardware	914.03
Gates	914.04
Barbed Wire	914.05

607.02.01 Type. Install the height and type of fence specified. When the type of fence is not specified, one of the following types may be used:

(a) Galvanized steel and malleable iron components.

(b) Galvanized steel fabric utilizing galvanized steel posts or aluminum line posts.

(c) Aluminum coated steel fabric utilizing galvanized steel line posts.

(d) Aluminum coated steel fabric utilizing aluminum line posts.

(e) Bonded vinyl coated fabric utilizing galvanized steel or galvanized bonded vinyl coated steel line posts and fittings.

(f) Bonded vinyl coated fabric utilizing aluminum line posts.

607.03 CONSTRUCTION

607.03.01 General Requirements. Confine all activities and operations to the area immediately adjacent to the right-of-way lines and within the right-of-way. The Engineer may grant permission to perform normal construction activities through lands owned by or under control of the Administration.

In areas where privately owned fence or other property is within the Administration's right-of-way, remove the items and place them on the owner's property as directed by the Engineer. The Contractor shall be responsible for any damage to privately owned items removed.

Fence lines specified in the Contract Documents are only a guide. The exact location of the fence will be determined in the field by the Engineer.

Install all posts plumb. Maintain, as uniform as practicable, the spacing specified, with a tolerance of minus 2 ft.

Use post lengths that accommodate the fabricated width of the fence fabric without stretching or compressing the fabric and that provide the required spacing below the bottom of the fabric.

Install terminal posts at all ends, abrupt changes in grade, and at changes in horizontal alignment greater than 15 degrees. Install terminal posts at a spacing not exceeding 500 ft.

Install horizontal brace rails with diagonal truss rods and turn buckles at all terminal posts. Supply sufficient braces to provide complete bracing of each terminal post to the adjacent line posts.

Install post caps on all round line, terminal, and corner posts.

Place the bottom of the fabric approximately 1 in. above the groundline. A maximum clearance of 6 in. will be permitted for a maximum horizontal distance of 8 ft, except for special conditions specified in the Contract Documents.

Any excavation or backfill required to comply with the above clearance will require approval. Place fence fabric on the side of the post nearest to the roadway. For stormwater management ponds, place the fabric on the side farthest from the pond. The fence shall be true and taut.

Run a tension wire continuously between terminal posts near the top and bottom of the fabric. Attach the wire to the fabric with hog ring fasteners at 18 in. intervals.

Tie the fabric to the brace rails at intervals not exceeding 2 ft and to posts at intervals not exceeding 12 in. Attach stretcher bars to terminal posts by connectors equally spaced at not more than 16 in. centers. Place top and bottom connectors as close as possible to the ends of the fabric.

607.03.02 Anchorage for Line Posts and Terminal Posts. Where rock is encountered at a depth less than that specified for the footing, drill a hole 1 in. larger than the greatest dimension of the post to a depth of 12 in. or the planned footing depth, whichever is less. After the post has been set, fill the remainder of the drilled hole with grout composed of one part Portland cement and two parts mortar sand by dry loose volume. Fill the space above the rock with concrete. Do not use the drive anchor method in rock areas.

Select the type of anchorage system from the following, except use the concrete method in rock areas.

Concrete Method. Place posts in the center of concrete footings. Thoroughly compact the concrete around the post by rodding or vibrating. Trowel the top surface to a smooth finish slightly above the groundline and uniformly sloped to drain away from the post. Do not disturb the post within the 72 hours after the individual post footing is completed.

Do not use hand mixed concrete unless approved. When permitted, limit the size of the hand mixed batch to 1/2 yd^3.

Drive Anchor Blade Method. A drive anchor blade unit consists of two steel blades driven diagonally through galvanized steel fittings attached to opposite sides of the post. The drive anchor unit shall hold the post rigidly upright. Ensure that the spread of the blades at their full depth is approximately 39 in. Install the device so that its top is at least 3 in. below the finished grade. The anchor unit device and procedure shall be as approved.

Anchor each line post using one of these units. Anchor each terminal post using two units spaced approximately 6 in. apart. At terminal posts, drive each anchor blade unit in the direction that offsets the stresses caused by the tension of the fence.

607.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. The removal of privately owned fence or other property from within the Administration's right-of-way will not be measured but the cost will be incidental to the Contract lump sum price for Clearing and Grubbing.

When an item for Clearing and Grubbing is not specified in the Contract Documents, clearing and grubbing will not be measured but the cost will be incidental to the Contract unit price for the pertinent Chain Link Fence item.

607.04.01 Chain Link Fence will be measured and paid for at the Contract unit price per linear foot for the actual number of linear feet measured to centers of end posts.

607.04.02 Terminal Posts (End, Pull, and Corner Post) will be measured and paid for at the Contract unit price per each for the size and type specified.

607.04.03 Gates will be measured and paid for at the Contract unit price per each as complete units of the size and type specified.

CATEGORY 600
SHOULDERS

SECTION 608 — WHEEL STOPS

608.01 DESCRIPTION

Furnish and install preformed wheel stops.

608.02 MATERIALS

Portland Cement Concrete	902.10, Mix No. 2
Reinforcement Steel	908.01
Recycled Composite Material Wheel Stops	As specified by the manufacturer

Recycled Composite Material. Wheel stops manufactured of recycled composite material shall be as specified by the manufacturer and be insect resistant.

The manufacturer shall furnish certification as specified in TC 1.03.

608.03 CONSTRUCTION

Locate and secure wheel stops in place as specified. Only one type of wheel stop is permitted for each project.

608.04 MEASUREMENT AND PAYMENT

Wheel Stops will be measured and paid for at the Contract unit price per each. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 600
SHOULDERS

SECTION 609 — SHOULDER EDGE DROP OFF GRADING ADJUSTMENT

609.01 DESCRIPTION

Construct the area adjacent to the outside edge of the shoulder to eliminate the shoulder edge drop off.

609.02 MATERIALS

Refer to 605.02, 701.02, 705.02, 708.02, 709.02, and the following:

Crusher Run Aggregate CR-6	901.01
Salvaged Topsoil	920.01.01
Furnished Topsoil	920.01.02
Asphalt Millings or Grindings	Size of individual particles shall be less than 2 in. as determined visually.

609.03 CONSTRUCTION

When the outside edge of the shoulder is greater than 2-1/2 in. above the existing groundline, place a wedge of topsoil installed as specified in Section 701, or crusher run aggregate CR-6, or asphalt millings or grindings, in designated areas as specified or as directed.

Grade the topsoil, or crusher run aggregate CR-6, or asphalt millings or grindings, to a slope of 4:1 or as directed. Compact the material as specified or as directed.

Immediately after grading topsoil, perform either of the following as specified or as directed:

(a) Perform Turfgrass Establishment as specified in Section 705 and immediately install Type A or Type E Soil Stabilization Matting as specified in Section 709.

(b) Perform Turfgrass Sod Establishment as specified in Section 708.

Complete the grading adjustment and install all materials by the end of the day that the drop off is created and prior to opening to traffic. The material, lines and grades, and the cross section shall be as specified.

609.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

609.04.01 Placing Salvaged Topsoil for Grading Adjustment or Placing Furnished Topsoil for Grading Adjustment will be measured and paid for at the Contract unit price per square yard, or as specified.

609.04.02 Crusher Run Aggregate CR-6 or Asphalt Millings or Grindings for Shoulder Edge Drop Off will be measured and paid for at the Contract unit price per square yard, or per ton.

609.04.03 Turfgrass Sod Establishment or Turfgrass Establishment will be measured and paid for at the Contract unit price per square yard.

609.04.04 Type A Soil Stabilization Matting or Type E Soil Stabilization Matting will be measured and paid for at the Contract unit price per square yard.

CATEGORY 600
SHOULDERS

SECTION 610 — SHOULDER RUMBLE STRIPS

610.01 DESCRIPTION

Grind or mill depressions into existing asphalt mix or Portland cement concrete to form rumble strips.

610.02 MATERIALS

Not applicable.

610.03 CONSTRUCTION

Place rumble strips as specified.

Grind or mill the rumble strips into asphalt mix at a rate of at least 4000 strips per hour. Grind into Portland cement concrete at a rate of at least 1000 strips per hour.

Equipment. The equipment shall have rotary type cutting heads with a length of 16 in. and an outside diameter not greater than 24 in. The cutting heads shall have the cutting tips arranged in a pattern providing a relatively smooth cut (approximately 1/16 in. between peaks and valleys).

The cutting heads shall be mounted on their own suspension, independent of the power unit, to allow the tool to self-align with the slope of the shoulder and any irregularities in the shoulder surface.

The cutting tool shall be equipped with guides to provide consistent alignment of each cut in relation to the roadway and to provide uniformity throughout the project. The Engineer will randomly check the pattern edge alignment.

Control Strip. Grind a control strip at least 100 ft in length to demonstrate that the speed of operation, dimensions, and texture are acceptable.

Clean up. Sweep or vacuum the work area before reopening the roadway to traffic. Do not sweep the material to the side of the road.

610.04 MEASUREMENT AND PAYMENT

Shoulder Rumble Strips will be measured and paid for at the Contract unit price per linear foot as measured along the shoulder or center line where the rumble strips are actually placed. Payment will be full compensation for all installation of rumble strips, cleaning and disposal of waste material, control strips, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 600
SHOULDERS

SECTION 611 — DETECTABLE WARNING SURFACE

611.01 DESCRIPTION

Furnish and install detectable warning surfaces. Ensure that the detectable warning surface is in accordance with the most recent accessibility guidelines of the Americans with Disabilities Act (ADA).

611.02 MATERIALS

Detectable Warning Surfaces	Section 925

Select the detectable warning surface from the Qualified Product List (QPL) maintained by the Office of Materials Technology. Ensure that detectable warning surface materials meet certification requirements prior to use. Submit the proposed source of supply and the specific product for approval.

611.03 CONSTRUCTION

The detectable warning system may be either surface applied or cast in place. However, use only Type I, III, or IV detectable warning systems for new or replacement concrete installations. Install the system according to the manufacturer's recommendations. Unless specifically addressed in the manufacturer's recommendations, remove the existing surface texturing by grinding or other means. At a minimum, prepare the concrete surface in accordance with SSPC-SP 13. Remove all old adhesives and sealants.

The detectable warning surface shall be 24 in. wide in the direction of pedestrian travel and installed for the full width of the curb ramp, landing, or blended transition. Do not bridge or overhang cracks or expansion joints.

Ensure that the vertical edges of the installed system are not more than 0.50 in. above the adjacent surfaces. Place a 2:1 or flatter bevel on edges that are more than 0.25 in. above the adjacent surface. The same edge requirements apply to cut material.

611.04 MEASUREMENT AND PAYMENT

Detectable Warning Surfaces will be measured and paid for at the Contract unit price per square foot. The payment will be full compensation for removal and disposal of old treatments, including adhesives and sealants, reapplying, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The sidewalk on which the detectable warning surface is placed will be measured and paid for at the Contract price for the pertinent Sidewalk item.

CATEGORY 600
SHOULDERS

SECTION 612 — CABLE BARRIER SYSTEM

612.01 DESCRIPTION

Furnish and install a high-tension cable barrier system using pre-stretched cables, cable barrier transition to W-beam, and end-anchor terminal sections.

612.02 MATERIALS

Refer to 605.02, 701.02, 705.02, 708.02, 709.02, and the following:

Cable Barrier System	As approved
Cable Barrier System	As approved
Barricades for Maintenance of Traffic	104.13
Concrete Mix 2 and 6	902.10
Common Borrow	916.01
Traffic Barriers	Section 918
Reflective Delineator Sheeting, Type IV	950.03
Line Post and End-Anchor Terminal Footings	As specified by the manufacturer

612.03 CONSTRUCTION

612.03.01 Site Information. Supply the cable barrier manufacturer with soil information and investigation needed to design the cable system line post and end-anchor footings, including any soil borings that have been provided for the project.

612.03.02 Cable Barrier System. Provide a cable barrier system that has a maximum dynamic deflection upon vehicular impact not to exceed 9 ft, and which does not encroach on the opposing traffic shoulder or place a roadside obstruction in the deflection zone. At locations where the dynamic deflection distance is not achievable, decrease the post spacing according to the manufacturer's engineered calculations to not exceed the required deflection.

612.03.03 Working drawings and calculations. Provide working drawings and calculations for the design of line post and end-anchor footings, based on the site-specific soil conditions. Calculate the deflection and post spacing according to the manufacturer's recommendations, signed by a licensed engineer in the State of Maryland, and submit for Administration's review as specified in TC-4.01.

612.03.04 Site Preparation. Provide construction stakeout for the line posts and end-anchor terminals. Notify the Engineer of any potential conflicts with underground utilities or drainage before construction. Complete clearing, grubbing, and final grading before installation of each section of cable barrier line post footings, transitions, or end-anchor terminal systems. If indicated on the Plans, perform excavation, grading, and paving for cable barrier maintenance pavement prior to excavation or drilling for post footings.

612.03.05 Grading Adjustment. When grading adjustment is required for installation of cable barriers, adjust the grading using topsoil, crusher run aggregate CR-6, asphalt millings or grindings, subsoil, common borrow, or other approved material as specified in 605.03.07(a), 605.03.07(b), and 605.03.07(c).

612.03.06 Post Installation. Excavate for and install cast-in-place, reinforced concrete footings for line posts at the manufacturer's recommended location, spacing, and elevation. Install footing reinforcing steel as required in the approved shop drawings. Place the concrete and install sockets as required by the manufacturer, keeping the top of the footing flush with the final grade. Install line posts. Space the specified posts according to the manufacturer's recommendations. Set posts plumb and in a straight line.

612.03.07 Cable Installation. Install cable barrier system cables according to the manufacturer's details and specifications. Position rigging screws such that there is no interference with posts or other rigging screws, unless recommended by the manufacturer. The strength at the splice must be equal to or greater than the strength of the cable itself. If required by the manufacturer, install post caps according to the manufacturer's recommendations.

612.03.08 Cable Tension. Tension each cable according to the manufacturer's specifications. Provide a calibrated tension meter with a serial number and a current Certificate of Calibration from a National Institute of Standards and Testing accredited laboratory to remain with the Engineer at project completion.

Provide a recommended tension chart from the manufacturer for their system with the base condition temperature. The chart shall be indexed using cable temperature, in degrees Fahrenheit, as the independent variable and tension, in pounds, as the dependent variable.

Provide a certified tester to perform tension tests on the system. Retest the cable tension according to the manufacturer's specifications 14 to 21 calendar days after the first test. Re-tension the cable when the test reading is less than the manufacturer's recommendations for the given temperature. Re-tension the cables to the manufacturer's specifications by successively reading tension measurements at every rigging screw or turnbuckle. Repeat the testing and re-tension the cables according to the manufacturer's specifications until the manufacturer certifies the full cable system.

Maintain a tension log showing project name, time and date, weather conditions, segment, cable temperature, test location, and tension reading. Deliver the log, along with the manufacturer's recommended tension chart, to the Engineer prior to acceptance of the cable barrier system.

612.03.09 End-Anchor Terminals. Excavate for the end-anchor terminals in natural, undisturbed ground, to the size and shape required by the manufacturer, based on soil types and ground conditions. If over excavation is unavoidable, as verified by the Engineer prior to installation of the concrete, the sides of the excavation must be vertical and use additional concrete to fill the excavated area completely at no additional cost to the Administration.

Install cast-in-place, reinforced concrete end-anchor terminals according to the manufacturer's recommendations and approved shop drawings. Complete the installation by the end of the same working day. Do not leave any incomplete end-anchor terminal overnight or unprotected when the roadway is under traffic.

612.03.10 Transition to W-Beam. Install cable barrier to W-beam transition according to the manufacturer's recommendations. Install W-beam barrier as specified in 605.03.

612.03.11 Reflective Delineators. Install reflective delineator sheeting every 50 ft of installed cable barrier, every 20 ft on horizontal curves with a radius less than 1300 ft, and on posts installed as part of an end anchor terminal or cable barrier transition to W-beam. Ensure that the delineator sheeting is visible from both directions of traffic unless otherwise shown on the Plans. Attach the delineator reflective sheeting to the post cap, if provided, or near the top of the post according to the manufacturer's recommendations.

612.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for stakeout; utility coordination; installation of all line posts, concrete footings, sockets, wire rope, fittings, and reflective delineators; excavation, backfill, compaction, and shoulder build-up; tensioning; tension meter; restoration of grass, shoulder, or paved areas and other repairs; and for all materials, labor, equipment, tools, working drawings and calculations, additional soil investigation, and incidentals necessary to complete the work.

612.04.01 Any additional soil information gathering (including, but not limited to, test pits, borings, or laboratory testing) are incidental to construction of the cable barrier system.

612.04.02 Cable Barrier System will be measured and paid for at the Contract unit price per linear foot along the centerline of the system.

612.04.03 Grading Adjustment using topsoil and subsoil will be measured and paid for at the Contract unit price as specified in 701.04.

612.04.04 Type A Soil Stabilization Matting or Type E Soil Stabilization Matting will be measured and paid for at the Contract unit price per square yard.

612.04.05 Grading Adjustment using CR-6 crusher run aggregate, or asphalt millings or grindings, will be measured and paid for at the Contract unit price per square yard, per ton, or as specified for the pertinent items. The payment will also include full compensation for furnishing, adjusting, and compacting embankment or aggregate material.

612.04.06 Grading Adjustment using common borrow will be measured and paid for at the Contract unit price per cubic yard as specified in 203.04.

612.04.07 Grading Adjustment using other approved materials will be measured and paid for as pertinent items.

612.04.08 Turfgrass Sod Establishment or Turfgrass Establishment will be measured and paid for at the Contract unit price per square yard.

612.04.09 Cable Barrier Transition to W-Beam will be measured and paid for at the Contract unit price per each.

612.04.10 Cable Barrier End-Anchor Terminal Section Assembly will be measured and paid for at the Contract unit price per each.

612.04.11 Any damage to paved areas due to construction activities will be repaired at no cost to the Administration.

CATEGORY 600
SHOULDERS

SECTION 613 — DRIVEWAYS AND ENTRANCES

613.01 DESCRIPTION

Construct asphalt or concrete driveways and entrances. Ensure that the driveways and entrances are constructed according to the most recent accessibility guidelines of the ADA.

613.02 MATERIALS

Refer to 701.02, 705.02, 708.02, 709.02, and the following:

Graded Aggregate for Base Course	901.01
Crusher Run Aggregate CR-6	901.01
Curing Materials	902.07
Form Release Compound	902.08
Concrete Mix 7 and 9	902.10
Asphalt Mix	Section 904
Welded Wire Fabric	908.05
Joint Sealer	911.01
Preformed Joint Fillers	911.02
Borrow Excavation	916.01
Asphalt Millings or Grindings	Size of individual particles shall be less than 2 in. as determined visually

613.03 CONSTRUCTION

613.03.01 Concrete Driveways and Entrances.

(a) Excavation. As specified in 602.03.01(a).

(b) Forms.

(1) Fixed Form Method. Use full depth steel or wood forms. Use forms that are straight, free from warp, and of sufficient strength to resist the pressure of the concrete. Brace and stake the forms so that they remain in both horizontal and vertical alignment. Thoroughly clean and coat forms with form release

compound each time they are used. Allow the concrete to set for at least 12 hours before removing the forms.

(c) Concreting. Before placing concrete, moisten the subgrade with as much water as it can absorb. Mix the concrete as specified in 915.03.05. Volumetric batching and continuous mixing will be permitted. Deposit the concrete on the prepared subgrade in successive batches to the full width of the driveways and entrances. Thoroughly spade along the edges and tamp the entire surface area to eliminate voids. Strike off and screed the concrete to the top of the forms.

(d) Finishing. Float the surface and apply a broom finish. Do not plaster the surface. Use a 1/4 in. edging tool on all outside edges and all joints.

(e) Joints. Place joints as specified in 602.03.01(g), up to a maximum of 15 ft between contraction joints. Tool or saw dummy joints a minimum of 3/4 in. deep. Match adjacent joints in curb or pavement. Place expansion joints, up to a maximum of 45 ft spacing between joints, with the material to the full depth of the concrete.

(f) Cold Weather Construction and Curing. As specified in 520.03.02 and 520.03.12, except the requirement for an approved spraying machine with drive wheels is waived when using the liquid membrane forming compound method. Do not allow pedestrian and vehicular traffic during the curing period.

(g) Expansion Joint Sealing. Prior to sealing, clear dirt and other foreign material from the expansion joints. Ensure that joint walls and all surfaces to which the sealing material is to adhere are surface dry for at least three hours prior to sealing. Do not seal the joints until they are acceptable to the Engineer. Ensure that the surface of the sealing compound is not more than 1/8 in. below the driveways and entrances surface.

613.03.02 Asphalt Driveways and Entrances.

(a) Excavation or Milling. As specified in 602.03.01(a) or 508.03.

(b) Placement. Place asphalt mix as specified in 504.03.06.

(c) Compaction. Use an approved roller. In areas inaccessible to a roller, a vibrating plate compactor or hand tamping may be used. The asphalt mix shall be uniformly compacted and start compaction as soon as the asphalt mix can be compacted without displacement and continue until the material is thoroughly compacted and all marks have been removed.

613.03.03 Grading Adjustment. When grading adjustment is required for installation of driveways and entrances, adjust the grading using topsoil, crusher run aggregate CR-6, asphalt millings or grindings, subsoil, common borrow, or other approved material, as specified in 605.03.07(a), 605.03.07(b), and 605.03.07(c).

613.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, forms, reinforcement when specified, joints, sealer, compaction, curing, finishing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The removal and disposal of unsuitable material will be measured and paid for at the Contract unit price for Class 1-A Excavation, which includes the cost of using suitable excavation as replacement material.

When borrow, topsoil, or other selected backfill is specified, payment will be made at the Contract unit price for the respective items.

613.04.01 Excavation for driveways and entrances will be measured and paid for as specified in 201.04, except when existing driveways and entrances are removed, the cost of removal will be measured and paid for as specified in 206.04.02.

613.04.02 Asphalt Driveways and Entrances Milling will be measured and paid for per square yard as specified in 508.04.

613.04.03 Graded Aggregate Base Course will be measured and paid for as specified in 501.04.

613.04.04 Concrete Driveways and Entrances will be measured and paid for at the Contract unit price per square yard of finished surface including sidewalk ramps.

613.04.05 Asphalt Driveways and Entrances will be measured and paid for at the Contract unit price per ton for the mixture placed.

613.04.06 Turfgrass Establishment and Turfgrass Sod Establishment will be measured and paid for as specified in 709.04.

CATEGORY 700
LANDSCAPING

SECTION 701 — SUBSOIL AND TOPSOIL

701.01 DESCRIPTION

Prepare existing topsoil; or salvage and place subsoil and topsoil; or furnish and place subsoil and topsoil in preparation for vegetation establishment. Refer to Section 704 and provide short-term, long-term or permanent stabilization as necessary for soil erosion protection. Performance of Subsoil and Topsoil as specified herein complies with all requirements of the Maryland Department of the Environment for handling and placing soils.

701.02 MATERIALS

Existing Topsoil	920.01.01
Salvaged Topsoil	920.01.01
Furnished Topsoil	920.01.02
Salvaged Subsoil	920.01.03
Furnished Subsoil	920.01.04
Limestone	920.02.01
Sulfur	920.02.02
Gypsum	920.02.04
Compost, Type A or Type B	920.02.05
Water	920.09.01
Pesticides	920.09.03

701.03 CONSTRUCTION

701.03.01 General.

(a) Schedule. Perform subsoil and topsoil operations when soil moisture and weather conditions are suitable. Cease operations when soil is muddy, frozen, or otherwise unsuitable.

(b) Pesticide Application. For any work involving existing or salvaged soils, the Contractor shall possess a Maryland Department of Agriculture Commercial Pesticide Business License and a Pesticide Applicator Certificate for the pertinent pesticide application Category: (2) Forest; (3-A) Ornamental Plant Exterior; (3-C) Turf; (5) Aquatic; (6) Right-of-Way and Weed.

Apply pesticides in conformance with the Maryland Pesticide Applicator's Law, OSHA and MOSH regulations, and the manufacturer's label and Safety Data Sheets (SDS).

Ensure that pesticides are applied by a Maryland Certified Pesticide Applicator, or by a Registered Pesticide Applicator under the supervision of a Certified Pesticide Applicator.

(c) Prohibited Weeds. Refer to 920.01.01. Areas of existing topsoil, and areas of topsoil and subsoil to be salvaged and their stockpiles, will be inspected and shall be free of prohibited weeds. Control prohibited weeds as needed and as directed.

(d) Herbicide. To control prohibited weeds, and to remove vegetation when preparing existing topsoil, apply glyphosate 3 percent solution in water or submit a written request to use another herbicide or application rate.

(e) Pesticide Application Reporting. Record the location and details of pesticide applications on the Pesticide Application Reporting Form. Submit the Form within 24 hours after applying pesticides.

(f) Nutrient Management Plan (NMP). The Administration will develop a NMP based upon soil tests. The NMP application rates for soil amendments and fertilizer will be within the ranges shown in the pertinent table of application rates.

Conform to the application rates of the NMP. Do not apply soil amendments when no NMP has been developed. Do not apply soil amendments to subsoil or to furnished topsoil.

(g) Nutrient Management Reporting. Record the location and details of soil amendment and fertilizer applications on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying soil amendments and fertilizer.

701.03.02 Existing Topsoil. Refer to 920.01.01.

(a) Vegetation Removal. Refer to 701.03.01(d). Cut brush and groundcover vegetation, remove debris, and apply herbicide as necessary to prepare areas for seeding or other specified vegetation installation. Do not injure trees, shrubs and other plants to remain.

(b) Compost and Tilling. Refer to 701.03.01(f) and Table 1. Spread Type B Compost over the soil surface as specified in the NMP and lightly till soil to prepare soil and incorporate compost. Immediately install seeding or other vegetation as specified in the Contract documents.

SUBSOIL AND TOPSOIL TABLE 1 - SOIL AMENDMENT APPLICATION RATES & MIXING		
SOIL AMENDMENT & MIXING	**APPLICATION RATE[a]**	
Compost - Existing Topsoil Spread Type B Compost over surface of existing topsoil and lightly till into soil.	Up to 0.25 in. depth compost spread over surface of existing topsoil	Up to 34 yd^3 compost per acre of existing topsoil
Compost - Salvaged Topsoil Thoroughly mix Type A or Type B Compost into salvaged topsoil before placing topsoil.	Up to 1.0 yd^3 compost per 6.0 yd^3 of salvaged topsoil	Up to 0.17 yd^3 of compost per 1.0 yd^3 of salvaged topsoil
Gypsum Spread gypsum over surface of existing topsoil, or over surface of placed salvaged topsoil, and till to mix gypsum into upper 2 in. of topsoil.	Up to 0.721 lb of gypsum per yd^2 of existing topsoil or placed salvaged topsoil	Up to 3500 lb of gypsum per acre of existing topsoil or placed salvaged topsoil
Limestone Spread limestone over surface of existing topsoil, or over surface of placed salvaged topsoil, and till to mix limestone into upper 2 in. of topsoil.	Up to 1.446 lb limestone per yd^2 of existing topsoil or placed salvaged topsoil	Up to 7000 lb of limestone per acre of existing topsoil or placed salvaged topsoil
Sulfur Spread sulfur over surface of existing topsoil, or over surface of placed salvaged topsoil, and till to mix sulfur into upper 2 in. of topsoil.	Up to 0.165 lb sulfur per yd^2 of existing topsoil or placed salvaged topsoil	Up to 800 lb Sulfur per acre of existing topsoil or placed salvaged topsoil
[a] Note: **For existing topsoil and salvaged topsoil, the application rates will be specified in the Nutrient Management Plan (NMP) included in the Contract documents. Do not apply soil amendments except as specified in the NMP. Do not apply soil amendments to subsoil or to furnished topsoil.**		

701.03.03 Salvaging Soils.

(a) Vegetation Removal. Remove vegetation, brush, and other debris from areas where topsoil and subsoil will be salvaged.

(b) Soil Removal. Remove topsoil and subsoil to the depths as specified or as directed. Transport salvaged topsoil and subsoil separately, and keep them apart from other materials.

(c) Stockpiles. Construct stockpiles on well drained land, away from streams, drainage areas and floodplains as specified in Section 308. Maintain stockpiles of salvaged topsoil and salvaged subsoil away from other materials, and separate from each other.

Refer to Section 704 and apply Temporary Mulch or other stabilization as necessary for soil erosion protection immediately after constructing stockpiles. Refer to 308.03.20 and install perimeter sediment controls.

Maintain stabilization and sediment controls. Refer to 701.03.01(c) and control prohibited weeds as needed and as directed.

(d) Weed Inspection. Refer to 701.03.01(c) and ensure that inspection is completed and that prohibited weeds are controlled before removing vegetation, preparing soil, or transporting soil from stockpiles.

(e) Soil Preparation and Transportation.

Subsoil. Transport and place salvaged subsoil as specified in 701.03.04 when directed.

Topsoil. Refer to Table 1. Mix compost in conformance with the Nutrient Management Plan and transport and place prepared salvaged topsoil as specified in 701.03.05 when directed.

701.03.04 Placing Subsoil.

(a) Site Preparation. Ensure the site where subsoil will be spread is uniformly graded true to line and cross section.

(b) Spreading. Spread and compact subsoil in layers up to 8 in. thickness to provide a firm and uniform subsoil base. Ensure that subsoil is spread to the specified depth.

(c) Tracking. Track subsoil on slopes 4:1 and steeper with cleated track equipment operated perpendicular to the slope. Check subsoil thickness, lines, grades, and elevations to ensure the completed work is as specified.

(d) Debris. Remove stones and other debris with a length or width greater than 4 in. from the surface of the subsoil.

(e) Topsoil and Stabilization. Refer to 701.03.05 and immediately place topsoil over subsoil, or refer to Section 704 and provide stabilization as necessary for soil erosion protection.

701.03.05 Placing Topsoil.

(a) Site Preparation. Ensure the site where topsoil will be spread is uniformly graded true to line and cross section, and that the surface of the subsoil base is loose and able to provide a suitable bond for the topsoil layer to be spread.

If the subsoil base is crusted or excessively compacted, then roughen and loosen the surface of the subsoil base with approved machinery before spreading topsoil.

(b) Spreading. Spread topsoil over the designated areas and lightly firm the topsoil to ensure uniform thickness of the specified depth, and to meet the required grades.

(c) Tracking. Track topsoil on slopes 4:1 and steeper with cleated track equipment operated perpendicular to the slope.

(d) Grading Adjustment. When placing topsoil for grading adjustment, the minimum thickness shall be 1/2 in. and the maximum thickness shall be 8 in.

(e) Firming. Ensure that topsoil is uniformly firmed near sidewalks, structures and pavement edges, and that the topsoil surface is without gaps, mounds, depressions, soft spots, or areas that may impair surface drainage or future maintenance. Check topsoil thickness, lines, grades, and elevations to ensure the completed work is as specified.

(f) Soil Amendments. Refer to 701.03.01(f) and Table 1. Apply soil amendments to topsoil in conformance with the Nutrient Management Plan.

(g) Tilling. Refer to Table 1 and till topsoil to incorporate soil amendments and prepare areas for seeding or installation of other specified vegetation.

(h) Debris. In areas within 10 ft of the pavement edge and near commercial and residential property, remove stones, wood, metal, and other debris with a length or width greater than 2 in. from the topsoil surface when spreading is completed. In all other areas, remove debris with a length or width greater than 4 in., or as directed.

(i) Stabilization. Immediately perform Turfgrass Establishment, or install other permanent vegetation as specified in the Contract documents, or refer to Section 704 and install Temporary Mulch or Temporary Seed for soil erosion protection.

701.03.06 Inspection and Acceptance. Submit a request for Acceptance when operations are completed. Inspection will be conducted to verify that operations were completed as specified. Acceptance will be granted at that time.

701.04 MEASUREMENT AND PAYMENT

Subsoil and topsoil will be measured and paid for at the Contract unit price for one or more of the specified items. The payment will be full compensation for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

701.04.01 Existing Topsoil will not be measured and paid for. The cost of preparing existing topsoil, and any cost required for applying soil amendments in conformance with the Nutrient Management Plan, shall be incidental to the pertinent Contract unit price of the specified vegetation establishment.

701.04.02 Salvaging Subsoil and Salvaging Topsoil will not be measured but the cost shall be incidental to the Contract unit price for Class 1 Excavation.

701.04.03 Placing Salvaged Subsoil and Topsoil will be measured and paid for at the pertinent Contract unit price for the specified depth per square yard, or per cubic yard. Any cost required for applying soil amendments in conformance with the Nutrient Management Plan shall be incidental to the pertinent Contract unit price of the specified vegetation establishment.

701.04.04 Placing Furnished Subsoil and Topsoil will be measured and paid for at the pertinent Contract unit price for the specified depth per square yard, or per cubic yard.

701.04.05 Placing Topsoil for Grading Adjustment will be measured and paid for at the pertinent Contract unit price per square yard, or per cubic yard. No payment will be made for topsoil placed less than 1/2 inch depth. Any cost required for applying soil amendments to salvaged soil in conformance with the Nutrient Management Plan shall be incidental to the pertinent Contract unit price of the specified vegetation establishment.

701.04.06 Temporary Mulch, Temporary Seed, Turfgrass Establishment and other permanent vegetation establishment will be measured and paid for at the pertinent Contract unit price per square yard.

CATEGORY 700
LANDSCAPING

SECTION 704 — TEMPORARY MULCH AND TEMPORARY SEED

704.01 DESCRIPTION

Perform Temporary Mulch and Temporary Seed to provide temporary soil erosion protection as follows.

Short-Term Temporary Stabilization. Refer to 704.03.02 and apply Temporary Mulch to stabilize topsoil, subsoil, common borrow, or other specified soil substrate for up to two months after installation.

Long-Term Temporary Stabilization. Refer to 704.03.03 and apply Temporary Seed to stabilize topsoil, subsoil, common borrow, or other specified soil substrate for two months to six months after installation.

Permanent Stabilization. Refer to Section 705 and perform Turfgrass Establishment when redisturbance is expected in more than six months, or perform other permanent vegetation establishment as specified or as directed. Do not apply Temporary Mulch or Temporary Seed when redisturbance of soil is expected in more than six months.

Performance of Temporary Mulch and Temporary Seed as specified herein complies with all requirements of the Maryland Department of the Environment for temporary stabilization of soils.

704.02 MATERIALS

Fertilizer 37-0-0 (SCU)	920.03.01
Straw Mulch	920.04.01
Wood Cellulose Fiber Mulch	920.04.02
Soil Stabilization Matting	920.05.01
Fasteners	920.05.02
SHA Temporary Seed Mix	920.06.07(c)
Water	920.09.01

704.03 CONSTRUCTION

704.03.01 General.

(a) Schedule. Apply Temporary Mulch and Temporary Seed any time of the year.

(b) Nutrient Management Plan (NMP). The fertilizer application rate specified in Table 2 of 704.03.03 shall be the NMP rate for Temporary Seed unless the Administration develops a NMP to revise the application rate.

(c) Nutrient Management Reporting. Record the location and details of fertilizer applications on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying fertilizer.

704.03.02 Temporary Mulch. Refer to Description. Temporary Mulch may be either temporary straw mulch or temporary matting mulch.

(a) Selection of Temporary Mulch.

Apply temporary straw mulch or temporary matting mulch to provide temporary erosion protection in flat or mildly sloping areas.

Apply temporary matting mulch to provide temporary erosion protection in slopes or channels where flowing water may dislodge temporary straw mulch.

(b) Temporary Straw Mulch. Lightly smooth excessively rough areas, but do not till the soil. Immediately apply straw and cover with wood cellulose fiber. Apply materials as follows.

TEMPORARY MULCH AND TEMPORARY SEED
TABLE 1 - APPLICATION RATES - TEMPORARY STRAW MULCH

MATERIAL	LB PER yd^2	LB PER ACRE
Straw Mulch	0.826	4000
Wood Cellulose Fiber Mulch	0.155	750

Cover at least 90 percent of the soil surface with straw mulch. When applied with mulch blower, apply straw mulch to a loose depth of 3/4 in. to 2 in. When applied by hand, apply straw mulch to a loose depth of 1-1/2 in. to 3 in.

Secure straw mulch immediately after the completion of mulching operations by applying wood cellulose fiber uniformly over the straw without displacing the mulch.

Do not operate machinery during windy weather that may interfere with uniform application. Do not allow materials to blow onto sensitive areas or structures.

(c) Temporary Matting Mulch. Select Type A, Type B, Type D, or Type E soil stabilization matting for installation in areas that will be redisturbed within two months. Install any of these matting types using methods and fasteners as specified in Section 709 for Type E Soil Stabilization Matting.

Smooth the soil surface to allow uniform installation of matting. Install matting over the soil surface without tenting. Overlap edges of the matting at least 2 in. Install fasteners no more than 24 in. apart along edges, overlaps, and throughout the matting to firmly secure the matting to the soil surface. Do not water the matting.

Remove matting and fasteners before performing permanent vegetation establishment. When approved, matting and fasteners may be removed and reused as Temporary Mulch in the same or different locations when their integrity is not degraded by damage or decomposition.

704.03.03 Temporary Seed. Refer to Description. Prepare the soil and apply seed, fertilizer, straw mulch, and wood cellulose fiber mulch to areas that will remain undisturbed for two months to six months.

Complete grading and shaping operations as directed. Perform operations when soil moisture and weather conditions are suitable. Cease operations when soil is frozen, or conditions are unsuitable. Loosen soil surfaces before applying seed and fertilizer.

Refer to 705.03.06(b) through 705.03.06(d) regarding application equipment, and apply fertilizer materials according to Table 2 at any time of the year.

Immediately apply straw and wood cellulose fiber over seeded and fertilized areas as specified in 704.03.02(b).

Refer to 704.03.02(b) and install Type A, Type D, or Type E soil stabilization matting in lieu of straw and wood cellulose fiber when approved.

TEMPORARY MULCH AND TEMPORARY SEED
TABLE 2 - APPLICATION RATES - TEMPORARY SEED

MATERIAL	LB PER yd^2	LB PER ACRE
SHA Temporary Seed Mix	0.026	125
Fertilizer 37-0-0 (SCU)	0.021	100
Straw Mulch	0.826	4000
Wood Cellulose Fiber Mulch	0.155	750

704.03.04 Repair. Repair Temporary Mulch or Temporary Seed that is defective before Acceptance.

704.03.05 Acceptance. Submit a request for Acceptance when operations are completed. Inspection will be conducted to verify completion.

704.03.06 Disturbance, Removal and Replacement.

(a) Do not disturb or remove Temporary Mulch or Temporary Seed except as necessary to prepare soil, or to install permanent vegetation, or to perform other work as directed.

(b) Replace Temporary Mulch with approved materials when it has degraded, or when more than 2 months have elapsed since Acceptance. Replace Temporary Mulch as additional work when directed.

(c) Replace Temporary Seed with approved materials when it has degraded, or when more than 6 months have elapsed since Acceptance. Replace Temporary Seed as additional work when directed.

704.04 MEASUREMENT AND PAYMENT

Temporary Mulch and Temporary Seed will be measured and paid for at the Contract unit price for one or more of the specified items. The payment will be full compensation for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

704.04.01 Temporary Mulch, applied as either temporary straw mulch or temporary matting mulch, will be measured and paid for at the Contract unit price per square yard. Any soil stabilization matting which may be installed as temporary matting mulch will be incidental to the Contract unit price for Temporary Mulch, and will not be measured and paid for.

704.04.02 Temporary Seed will be measured and paid for at the Contract unit price per square yard. Any soil stabilization matting which may be installed with Temporary Seed will be incidental to the Contract unit price for Temporary Seed, and will not be measured and paid for.

704.04.03 Turfgrass Establishment will be measured and paid for at the Contract unit price per square yard.

CATEGORY 700
LANDSCAPING

SECTION 705 — TURFGRASS ESTABLISHMENT

705.01 DESCRIPTION

Perform Turfgrass Establishment as follows.

At Final Grade. For areas that are at final grade, establish turfgrass in topsoil or other specified soil substrate to provide permanent vegetation groundcover.

Not Final Grade. For areas that are not at final grade, or areas that will not be redisturbed for at least six months after seeding operations are completed, establish turfgrass in topsoil, subsoil, common borrow, or other specified soil substrate to provide temporary vegetation groundcover.

Temporary Stabilization. When it is not possible to perform Turfgrass Establishment, refer to Section 704 and perform Temporary Mulch or Temporary Seed, or as directed.

Performance of Turfgrass Establishment as specified herein complies with all requirements of the Maryland Department of the Environment for permanent seeding.

705.02 MATERIALS

Fertilizer	920.03.01
Straw Mulch	920.04.01
Wood Cellulose Fiber	920.04.02
Seed	920.06
SHA Turfgrass Seed Mix	920.06.07(a)
SHA Special Purpose Seed Mix	920.06.07(b)
SHA Temporary Seed Mix	920.06.07(c)
Water	920.09.01

705.03 CONSTRUCTION

705.03.01 General.

(a) Regions. Maryland is divided into Regions by counties as follows:

Region 1. Garrett, Allegany, and Washington, west of Clear Spring MD.

Region 2. Washington, east of Clear Spring, MD, Frederick, Carroll, Baltimore, Harford, Cecil, Howard, Montgomery, and Baltimore City.

Region 3. Anne Arundel, Prince George's, Calvert, Charles, St. Mary's, Kent, Queen Anne's, Talbot, Caroline, Dorchester, Wicomico, Worcester, and Somerset.

(b) Seeding Seasons and Seed Mixes. Perform operations according to Table 1 when soil moisture and weather conditions are suitable, when the temperature is above 32 F, and the soil is not frozen. Cease operations when conditions are unsuitable.

TURFGRASS ESTABLISHMENT
TABLE 1 - SEEDING SEASONS AND SEED MIXES

REGION	*SEEDING SEASON MONTH/DAY*				
	Spring	**Summer**	**Fall**	**Late Fall**	**Winter[3]**
	SHA Turfgrass Seed Mix[1]				
1	3/1 to 6/14	6/15 to 7/31	8/1 to 9/30	10/1 to 11/15	11/16 to 2/29
2	3/1 to 5/14	5/15 to 7/31	8/1 to 10/14	10/15 to 11/15	11/16 to 2/29
3	3/1 to 4/30	5/1 to 7/31	8/1 to 10/31	11/1 to 11/15	11/16 to 2/29
		Plus Additive[2]		Plus Additive[2]	Plus Additive[2]
Notes:	[1]When seeding within 4 miles of a State airport: Use no additives and use SHA Special Purpose Seed Mix in lieu of SHA Turfgrass Seed Mix on slopes 4:1 and steeper, or in designated areas. [2]Additive = SHA Temporary Seed Mix [3]Approval is required for seeding during Winter. When approved, apply all materials except fertilizer. Refer to 705.03.06(e)				

(c) Nutrient Management Plan (NMP). Soil testing will be performed and a NMP will be developed by the Administration. Conform to the application rates of the NMP and replace application rates of Table 2 in 705.03.03 as required by the NMP. When no NMP has been developed, apply 200 lb per acre of 20-16-12 (83 percent UF with MAP & SOP) fertilizer as the NMP rate for Turfgrass Establishment.

(d) Nutrient Management Reporting. Record the location and details of soil amendment and fertilizer applications on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying fertilizer.

705.03.02 Modification Request. Submit a written Modification Request to perform seeding during Winter Seeding Season; to install an approved tackifier at manufacturer's recommended application rates in lieu of wood cellulose fiber to secure straw mulch; or to use Type A, Type D, or Type E Soil Stabilization Matting as specified in Section 709 in lieu of straw mulch and wood cellulose fiber in areas where those mattings have not been specified.

The Engineer in consultation with the Landscape Programs Division will evaluate the Request. If granted, a notice of approved modification will be returned within 14 days after the request is received.

705.03.03 Application Rates. Apply materials according to Table 2.

TURFGRASS ESTABLISHMENT
TABLE 2 - APPLICATION RATES

MATERIAL	LB PER yd^2	LB PER ACRE
INITIAL FERTILIZER per Nutrient Management Plan [a, b]		
20-16-12 (83% UF with MAP & SOP)	0 to 0.041	0 to 200
or one or more of the following[c]		
38-0-0 (UF)	0 to 0.021	0 to 100
11-52-0 (MAP)	0 to 0.036	0 to 175
0-0-50 (SOP)	0 to 0.041	0 to 200
SEED MIXES; select one		
SHA Turfgrass Seed Mix, applied to roadsides, facilities, and other designated areas	0.041	200
or		
SHA Special Purpose Seed Mix, applied to slopes 4:1 and steeper within four miles of a State airport, and other designated areas.	0.041	200
ADDITIVE SEED; when required per Table 1		
SHA Temporary Seed Mix	0.006	25
STRAW MULCH	0.826	4000
WOOD CELLULOSE FIBER to secure straw mulch	0.155	750
REFERTILIZING[d]		
37-0-0 Sulfur Coated Urea (SCU)	0.021	100
Notes:	[a]For existing topsoil and salvaged topsoil, the application rates will be included in the Contract documents. For furnished topsoil, the application rates will be developed for the approved source of supply. [b]When no NMP has been developed, apply 200 lb per acre of 20-16-12 initial fertilizer. [c]UF = Ureaform; MAP = Monoammonium Phosphate; SOP = Sulfate of Potash. When application rate of 20-16-12 fertilizer is below 200 lb per acre, apply UF, MAP, and SOP per NMP. [d]Refer to 705.03.06(d) and 705.03.09(c). Apply Refertilizing when included in the Contract documents.	

705.03.04 Grade Repair. Ensure that soil meets specified grades. Repair any gullies, washes, or disturbed areas that develop before preparing soil.

705.03.05 Preparing Topsoil. Provide a uniform and porous surface that is free of debris and weeds as follows.

(a) Areas Flatter than 4:1. Remove clods, stones, wood, metal and other debris with a length or width greater than 1-1/2 in. in any dimension from the soil surface.

(b) Slopes 4:1 and Steeper. Track slopes 4:1 and steeper with cleated track equipment operated perpendicular to the slope. After tracking, remove stones, wood, metal, and other debris with a length or width greater than 3 in. in any dimension from the soil surface.

705.03.06 Seeding and Initial Fertilizer.

(a) Application Schedule. Apply seed and initial fertilizer after preparing soil. Do not apply initial fertilizer in the Winter Seeding Season from November 16 through February 29.

(b) Application Equipment. Use hydroseeders, spreaders, drills, or other approved machinery. Calibrate equipment before application. Apply materials accurately and uniformly to avoid misses and overlaps. Do not operate machinery during windy weather that may interfere with uniform application.

(c) Hydroseeders. Hydroseeders shall be equipped with an agitation system able to keep solids in suspension, and have a gauge to show fill levels and tank capacity. Apply fertilizer and seed mixtures within two hours after mixing. Direct hydroseeding mixtures so the droplets produce a uniform spray. Do not allow materials to runoff or cause erosion, or to blow onto sensitive areas or structures.

(d) Mechanical Seeders. Mechanical seeders shall be capable of uniformly placing seed and fertilizer at the specified rate.

(e) Delayed Initial Fertilizer. Apply initial fertilizer at the time of seeding per Table 1, except in Winter. When seeding from November 16 to February 29, apply initial fertilizer during March, and apply Refertilizing in conformance with 705.03.09(c) during April.

705.03.07 Mulching. Apply mulch immediately after seeding.

(a) Soil Stabilization Matting. Refer to Section 709 and install soil stabilization matting in lieu of straw mulch in designated areas.

(b) Straw Mulch. Cover at least 90 percent of the soil surface with straw mulch. When applied with mulch blower, apply straw mulch to a loose depth of 3/4 in. to 2 in. When applied by hand, apply straw mulch to a loose depth of 1-1/2 in. to 3 in.

Secure straw mulch immediately after the completion of mulching operations by applying wood cellulose fiber uniformly over the straw without displacing the mulch.

Do not operate machinery during windy weather that may interfere with uniform application. Do not allow materials to blow onto sensitive areas or structures.

705.03.08 Seeding Phase Acceptance. Submit a request for Seeding Phase Acceptance when operations are completed. Inspection will be conducted to verify completion, and Seeding Phase Acceptance will be granted at that time.

705.03.09 Establishment Phase. The Establishment Phase will begin upon Seeding Phase Acceptance.

(a) Period of Maintenance. Maintain seeded areas until Final Acceptance.

(b) Required Maintenance. Perform the following during the Establishment Phase.

Watering. Apply water as needed to ensure survival of the turfgrass. Apply water to seeded and mulched areas with approved machinery. Do not allow water to cause erosion or to displace the mulch.

Overseeding. Overseeding consists of seeding and mulching in areas where living turfgrass coverage is 40 percent to 95 percent. When living turfgrass groundcover is not acceptable, perform overseeding as directed. In areas to be overseeded, cut the turfgrass to a height of 3 in. to 5 in. and remove debris that may interfere with seeding. Apply seed mixtures, seed additives, fertilizer, mulch, and secure mulch as specified in 705.03.01 through 705.03.07, but do not repair grade or prepare soil.

Reseeding with Slit Seeder. Perform reseeding when directed in areas where turfgrass groundcover is less than 40 percent, but soil conforms to 701.03.05 and 705.03.05. Cut the area to be reseeded to a height of 1 in. to 3 in., and remove debris that may interfere with seeding. Utilize a mechanical slit seeder to cut groves into the soil at least 0.25 in. depth. Refer to 705.03.06 and 705.03.07 and apply seed, fertilizer, and mulch, but do not secure mulch.

Soil Restoration, Tilling and Reseeding. Perform soil restoration and reseeding when directed in areas where turfgrass groundcover is less than 40 percent, or when soil does not conform to 701.03.05 and 705.03.05 because eroded gullies are present or soil grades are not acceptable. Cut the area to be restored and reseeded to a height of 3 in. to 5 in. and remove debris that may interfere with seeding. Refer to 705.03.01 through 705.03.07 and repair grades, prepare soil, apply seed, fertilizer, and mulch, and secure mulch.

Mowing. Mow turfgrass in areas flatter than 4:1 before the grass grows to a height of 8 in. Use approved machinery to cut to a height of 3 in. to 5 in.

(c) Refertilizing. Refer to 705.03.06 and apply 37-0-0 SCU Refertilizing as specified in Table 2 at least one month after initial fertilizer was applied. Do not apply Refertilizing in the Winter Seeding Season from November 15 through March 1.

705.03.10 Final Acceptance. The Engineer and the Quality Assurance Division will complete an Inspection Report of turfgrass height, color, and percent groundcover. When it is not possible to perform the Inspection, Final Acceptance will be delayed until Inspection is possible. The Inspection Report will be included in the Punch List requirements for the project. Complete the Punch List requirements as directed.

Final Acceptance will be granted after all operations have been completed, and when the seedlings of turfgrass species have grown at least 4 in. tall, exhibit dark green color, and are least 95 percent groundcover.

705.04 MEASUREMENT AND PAYMENT

Turfgrass Establishment will be measured and paid for at the Contract unit price for one or more of the specified items. The payment will be full compensation for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

705.04.01 Turfgrass Establishment, including grade repair, preparing soil, applying soil amendments and initial fertilizer in conformance with the Nutrient Management Plan, seed mixes, seed additives, mulching, securing mulch, watering, overseeding, reseeding, and mowing, will be measured and paid for at the Contract unit price per square yard.

The use of other materials in conformance with an approved Modification Request shall be incidental to the Contract unit price, and will not be measured or paid for.

(a) Payment Schedule. Payments will be made according to Table 3 when construction requirements are met:

TURFGRASS ESTABLISHMENT
TABLE 3 - PAYMENT SCHEDULE

CONSTRUCTION REQUIREMENTS	PERCENT OF TOTAL CONTRACT PRICE	PAYMENT FOR COMPLETED WORK
705.03.01 through 705.03.08	80%	At Seeding Phase Acceptance
705.03.09 (a) and (b) and 705.03.10	20%	At Final Acceptance
Total Payment	100%	

(b) Forfeiture. Failure to complete operations as required in conformance with the Payment Schedule will result in forfeiture of that percentage of payment.

705.04.02 Refertilizing will be measured and paid for at the Contract unit price per square yard.

705.04.03 Temporary Mulch and Temporary Seed will be measured and paid for at the Contract unit price per square yard.

CATEGORY 700
LANDSCAPING

SECTION 706 — SHRUB SEEDING ESTABLISHMENT

706.01 DESCRIPTION

Establish shrub seeding in topsoil or other specified soil substrate to provide permanent vegetation groundcover.

When it is not possible to perform Shrub Seeding Establishment to provide permanent soil stabilization, refer to Section 704 and perform Temporary Mulch, or as directed.

Performance of Shrub Seeding Establishment as specified herein complies with all requirements of the Maryland Department of the Environment for permanent seeding.

706.02 MATERIALS

Fertilizer	920.03.01
Straw Mulch	920.04.01
Wood Cellulose Fiber	920.04.02
Tall Fescue, Hard Fescue, Kentucky Bluegrass	920.06.06(a)
Common Oat	920.06.06(b)
Meadow Forb Seed	920.06.06(c)
Meadow Grass, Sedge and Rush Seed	920.06.06(d)
Shrub Seed	920.06.06(f)
Water	920.09.01
Seed Carrier	920.09.02
Pesticides	920.09.03

706.03 CONSTRUCTION

706.03.01 General.

(a) Regions. Refer to 705.03.01(a).

(b) Seeding Seasons. Perform operations according to Table 1 when soil moisture and weather conditions are suitable, when the temperature is above 32 F, and the soil is not frozen. Cease operations when conditions are unsuitable.

SHRUB SEEDING ESTABLISHMENT TABLE 1 - SEEDING SEASONS AND SEED MIXES				
REGION	***SEEDING SEASON - MONTH/DAY***			
	Spring	**Summer**	**Fall**	**Late Fall & Winter**
	SHA Lowland Shrub Seed or SHA Upland Shrub Seed			
1	3/1 to 6/14	6/15 to 7/31	8/1 to 9/30	10/1 to 2/29
2	3/1 to 5/14	5/15 to 7/31	8/1 to 10/14	10/15 to 2/29
3	3/1 to 4/30	5/1 to 7/31	8/1 to 10/31	11/1 to 2/29
		Plus Additive A*		Plus Additive B*
Notes*: Additive A = Tall Fescue Additive B = Common Oat				

(c) Pesticide Application. The Contractor shall possess a Maryland Department of Agriculture Commercial Pesticide Business License and a Pesticide Applicator Certificate for the pertinent pesticide application Category: (2) Forest; (3A) Ornamental Plant Exterior; (3-C) Turf; (5) Aquatic; (6) Right-of-Way and Weed.

Apply pesticides in conformance with the Maryland Pesticide Applicator's Law, OSHA and MOSH regulations, and the manufacturer's label and Safety Data Sheets (SDS).

Ensure that pesticides are applied by a Maryland Certified Pesticide Applicator, or by a Registered Pesticide Applicator under the supervision of a Certified Pesticide Applicator.

(d) Pesticide Application Reporting. Record the location and details of pesticide applications on the Pesticide Application Reporting Form. Submit the Form within 24 hours after applying pesticides.

(e) Nutrient Management Plan (NMP). Soil testing will be performed and a NMP will be developed by the Administration. Conform to the application rates of the NMP and replace application rates of Table 2 in 706.03.05 as required by the NMP. When no NMP has been developed, apply 200 lb per acre of 20-16-12 (83 percent UF with MAP & SOP) fertilizer as the NMP rate for Shrub Seeding Establishment.

(f) Nutrient Management Reporting. Record the location and details of soil amendment and fertilizer applications on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying soil amendments and fertilizer.

(g) Seeding Schedule. Develop a Schedule that provides dates for completing seeding operations. Submit the written Schedule at least 14 days before beginning operations. The Schedule will be reviewed by the Engineer and Landscape Programs Division for completeness and feasibility, and will be approved or returned for correction.

(h) IPM Program and Establishment Schedule. Refer to 701.03.01(c) and 920.01.01. Develop an IPM Program to control prohibited weeds that includes methods of pest monitoring for weed control, pesticide selection, application rates, and scheduling. Submit the IPM Program and Establishment Schedule when seeding operations are completed. The Program and Schedule will be forwarded to the Landscape Programs Division for review and comment before approval is granted.

706.03.02 Modification Request. Submit a written Modification Request to install other species; or to adjust seeding rates; or to install an approved tackifier at manufacturer's recommended application rates in lieu of wood cellulose fiber to secure straw mulch; or to use Type D or Type E Soil Stabilization Matting as specified in Section 709 in lieu of straw mulch and wood cellulose fiber in areas where those mattings have not been specified.

The Engineer in consultation with the Landscape Programs Division will evaluate the Request. If granted, a notice of approved modification will be returned within 14 days after the request is received.

706.03.03 Grade Repair and Preparing Soil. Refer to 705.03.04 and 705.03.05.

706.03.04 Seed Delivery, Weighing, and Mixing. Deliver seed unmixed with label showing common name and scientific name as specified in 920.06. Test seed as specified in 920.06.05 before weighing and mixing. Use a scale with 0.01 oz or gram accuracy to verify application rates and quantities of seed. Mix and apply seed separately or with other specified seed.

706.03.05 Application Rates. Refer to 706.03.01(b) and Table 1, and include seed additives as specified. Apply materials according to Table 2, Table 3 and Table 4.

SHRUB SEEDING ESTABLISHMENT
TABLE 2 – APPLICATION RATES

MATERIAL	**LB PER yd²**	**LB PER ACRE**
FERTILIZER per Nutrient Management Plan [a, b]		
20-16-12 (83% UF with MAP & SOP) or one or more of the following[c]	0 to 0.041	0 to 200
38-0-0 (UF)	0 to 0.021	0 to 100
11-52-0 (MAP)	0 to 0.036	0 to 175
0-0-50 (SOP)	0 to 0.041	0 to 200
SHRUB SEED AND OTHER SEED SPECIES Select one of the following:	**RATE**	
	GRAM PER yd²	**GRAM PER yd²**
SHA Lowland Shrub Seed and Other Seed Species	Refer to Table 3 – Application Rates	
SHA Upland Shrub Seed and Other Seed Species	Refer to Table 4 – Application Rates	

ADDITIVE SEED when required per Table 1	**RATE**	
	LB PER yd²	**LB PER ACRE**
A = Tall Fescue	0.005	25
B = Common Oat	0.010	50
STRAW MULCH	0.413	2000
WOOD CELLULOSE FIBER to secure straw mulch	0.103	500

Notes:
[a] For existing topsoil and salvaged topsoil, the application rates will be included in the Contract documents. For furnished topsoil, the application rates will be developed for the approved source of supply.
[b]When no NMP has been developed, apply 200 lb per acre of 20-16-12 initial fertilizer.
[c]UF = Ureaform; MAP = Monoammonium Phosphate; SOP = Sulfate of Potash. When application rate of 20-16-12 fertilizer is below 200 lb per acre, apply UF, MAP, and SOP per NMP.

SHRUB SEEDING ESTABLISHMENT
TABLE 3 - APPLICATION RATES - LOWLAND SHRUB SEED

SHRUB SPECIES Select 7 Marked 'x'	**SEEDING RATE**		**REGION**		
	GRAM PER yd²	**LB PER ACRE**	**1**	**2**	**3**
American Cranberrybush	0.281	3.0	x	x	
American Black Elderberry	0.235	2.5	x	x	x
Blackhaw	0.281	3.0	x	x	
Common Buttonbush	0.328	3.5	x	x	x
Common Winterberry	0.281	3.0	x	x	
Desert False Indigo	0.281	3.0		x	x
Inkberry	0.328	3.5		x	x
Maryland Senna	0.188	2.0	x	x	x
Ninebark	0.094	1.0	x	x	
Red Chokeberry	0.188	2.0	x	x	x
Redosier Dogwood	0.328	3.5	x	x	
Silky Dogwood	0.188	2.0	x	x	x
Southern Arrowwood	0.328	3.5		x	x
Steeplebush	0.094	1.0		x	x
Swamp Rose	0.141	1.5		x	x
OTHER SEED SPECIES Select All Marked 'x'	**GRAM PER yd²**	**LB PER ACRE**	**1**	**2**	**3**
Blackeyed Susan, PLS[1]	0.094	1.0	x	x	x
Deertongue, PLS[1]	0.188	2.0	x	x	x
Kentucky Bluegrass	0.469	5.0	x	x	x
Purpletop, PLS[1]	0.094	1.0	x	x	x
Switchgrass, PLS[1]	0.094	1.0	x	x	x
Purple Coneflower, PLS[1]	0.188	2.0	x	x	x

Note:
[1] The rate shown is Pure Live Seed. Use germination and purity data from the seed tag to calculate the actual seeding rate needed to obtain the seeding rate in Pure Live Seed.

SHRUB SEEDING ESTABLISHMENT TABLE 4 - APPLICATION RATES - UPLAND SHRUB SEED					
SHRUB SPECIES	**SEEDING RATE**		**REGION**		
Select 7 Marked 'x'	**GRAM PER yd²**	**LB PER ACRE**	**1**	**2**	**3**
Black Chokeberry	0.094	1.0	x	x	x
Blackhaw	0.281	3.0	x	x	x
Bristly Locust	0.235	2.5	x		
Chokecherry	0.281	3.0	x	x	
Fragrant Sumac	0.281	3.0	x		
Gray Dogwood	0.281	3.0	x	x	
Mapleleaf Viburnum	0.141	1.5		x	x
Nannyberry	0.281	3.0	x	x	x
Red Elderberry	0.047	0.5	x		
Smooth Sumac	0.281	3.0	x	x	x
Spicebush	0.281	3.0		x	x
Staghorn Sumac	0.281	3.0	x	x	x
Witch Hazel	0.281	3.0		x	x
OTHER SEED SPECIES **Select All Marked 'x'**	**GRAM** **PER yd²**	**LB** **PER ACRE**	**1**	**2**	**3**
Blackeyed Susan, PLS[1]	0.047	0.5	x	x	x
Hard Fescue	1.876	20.0	x	x	x
Indiangrass, PLS[1]	0.188	2.0	x	x	x
Purpletop, PLS[1]	0.094	1.0	x	x	x
Switchgrass, PLS[1]	0.094	1.0	x	x	x
Wild Bergamot, PLS[1]	0.019	0.2	x	x	x
Note: [1] The rate shown is Pure Live Seed. Use germination and purity data from the seed tag to calculate the actual seeding rate needed to obtain the seeding rate in Pure Live Seed.					

706.03.06 Preparing Soil. Provide a uniform and porous surface that is free of debris and weeds as follows.

(a) Areas Flatter than 4:1. Remove clods, stones, wood, metal and other debris with a length or width greater than 1-1/2 in. in any dimension from the soil surface. If no soil amendments are required according to the NMP, and when a drill seeder will be used for seeding, tilling will not be required.

(b) Slopes 4:1 and Steeper. Track slopes 4:1 and steeper with cleated track equipment operated perpendicular to the slope. Apply soil amendments to tracked soil.

(c) Debris Removal. Remove stones, wood, metal, and other debris with a length or width greater than 3 in. from the soil surface.

706.03.07 Fertilizing and Seeding. Use spreaders, drills, or other approved machinery. Hydroseeders shall not be used to apply seed or fertilizer.

Apply fertilizer and seed after preparing soil. Seeders shall be capable of uniformly placing seed and fertilizer at the specified rate. Calibrate equipment before application.

Apply materials accurately and uniformly to avoid misses and overlaps. Do not operate machinery during windy weather that may interfere with uniform application.

706.03.08 Mulching. Refer to 705.03.07.

706.03.09 Seeding Phase Acceptance. Refer to 705.03.08.

706.03.10 Establishment Phase. The Establishment Phase will begin upon Seeding Phase Acceptance.

(a) Period of Maintenance. Maintain seeded areas for 12 months after Seeding Phase Acceptance.

(b) Required Maintenance. Perform the following during the Establishment Phase.

Watering. Apply water to ensure survival of the seeded species as needed. Apply water to seeded and mulched areas with approved machinery. Do not allow water to cause erosion or to displace the mulch.

Weed Control. Refer to 706.03.01(h). Monitor and promptly implement the IPM Program to control weeds in conformance with the IPM Program as needed or as directed. Remove weeds over 18 in. tall.

Overseeding. Overseeding consists of seeding and mulching areas where living seedling coverage is less than 70 percent. When living seedling groundcover is not acceptable, perform overseeding as directed. Repair grades but do not cut vegetation or prepare soil. Apply seed mixtures, seed additives, fertilizer, mulch, and secure mulch as specified in 706.03.01 through 706.03.08.

(c) Partial Establishment Phase Inspection. Seeded areas will be inspected six months after Seeding Phase Acceptance. The Inspection Report will include actions to perform before Partial Establishment Phase Acceptance is granted.

706.03.11 Final Acceptance. The Engineer and the Quality Assurance Division will complete an Inspection Report of seedling height, color, and percent coverage at the end of the Period of Maintenance. When it is not possible to perform the Inspection, Final Acceptance will be delayed until Inspection is possible.

The Inspection Report will be included in the Punch List requirements for the project. Complete the Punch List requirements as directed.

Final Acceptance will be granted after all operations have been completed, and when shrub seedlings and other permanent seeded species have grown at least 4 in. tall, exhibit dark green color, and are at least 95 percent groundcover.

706.04 MEASUREMENT AND PAYMENT

Shrub Seeding Establishment will be measured and paid for at the Contract unit price for one or more of the Specified items. The payment will be full compensation for applying soil amendments and fertilizer in conformance with the Nutrient Management Plan, and for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

(a) Payment Schedule. Payments will be made according to Table 5 when construction requirements are met.

SHRUB SEEDING ESTABLISHMENT
TABLE 5 - PAYMENT SCHEDULE

CONSTRUCTION REQUIREMENTS	PERCENT OF TOTAL CONTRACT PRICE	PAYMENT FOR COMPLETED WORK
706.03.01 through 706.03.09	70%	At Seeding Phase Acceptance
706.03.10	15%	At Partial Establishment Phase Acceptance
706.03.10 and 706.03.11	15%	At Final Acceptance
Total Payment	100%	

(b) Forfeiture. Failure to complete operations as required or directed in conformance with the Payment Schedule will result in forfeiture of that percentage of payment.

706.04.01 Upland Shrub Seeding will be measured and paid for at the Contract unit price per square yard. The use of other materials in conformance with an approved Modification Request shall be incidental to the Contract unit price and will not be measured or paid for.

706.04.02 Lowland Shrub Seeding will be measured and paid for at the Contract unit price per square yard. The use of other materials in conformance with an approved Modification Request shall be incidental to the Contract unit price and will not be measured or paid for.

706.04.03 Temporary Mulch will be measured and paid for at the pertinent Contract unit price per square yard.

CATEGORY 700
LANDSCAPING

SECTION 707 — MEADOW ESTABLISHMENT

707.01 DESCRIPTION

Establish meadow in topsoil or other specified soil substrate to provide permanent vegetation groundcover. When it is not possible to perform Meadow Establishment, refer to Section 704 and perform Temporary Mulch, or as directed. Performance of Meadow Establishment as specified herein complies with all requirements of the Maryland Department of the Environment for permanent seeding.

707.02 MATERIALS

Fertilizer	920.03.01
Straw Mulch	920.04.01
Wood Cellulose Fiber	920.04.02
Tall Fescue, Hard Fescue, Kentucky Bluegrass	920.06.06(a)
Common Oat, Perennial Ryegrass	920.06.06(b)
Meadow Forb Seed	920.06.06(c)
Meadow Grass, Sedge and Rush Seed	920.06.06(d)
Wildflower Seed	920.06.06(e)
SHA Turfgrass Seed Mix	920.06.07(a)
Water	920.09.01
Seed Carrier	920.09.02
Pesticides	920.09.03

707.03 CONSTRUCTION

707.03.01 General.

(a) Regions. Refer to 705.03.01.

(b) Seeding Seasons. Perform operations in conformance with Table 1 when soil moisture and weather conditions are suitable, when the temperature is above 32 F, and the soil is not frozen. Cease operations when conditions are unsuitable.

MEADOW ESTABLISHMENT TABLE 1 - SEEDING SEASONS AND SEED MIXES					
REGION	**SEEDING SEASON - MONTH/DAY**				
	Spring	**Summer**	**Fall**	**Late Fall**	**Winter**
	SHA Wet Meadow Seed, SHA Lowland Meadow Seed, SHA Upland Meadow Seed				
1	3/1 to 6/14	6/15 to 7/31	8/1 to 9/30	10/1 to 11/30	12/1 to 2/29
2	3/1 to 5/14	5/15 to 7/31	8/1 to 10/14	10/15 to 11/30	12/1 to 2/29
3	3/1 to 4/30	5/1 to 7/31	8/1 to 10/31	11/1 to 11/30	12/1 to 2/29
All Regions	Plus Additive A*	Plus Additive B*	Plus Additive B*	Plus Additive D*	Plus Additive A*
	Plus Additive B*	Plus Additive C*	Plus Additive D*	Plus Additive E*	Plus Additive E*
Notes* Additive A for Lowland Meadow and Upland Meadow = Garden Cosmos Additive B for Lowland Meadow and Upland Meadow = Plains Coreopsis Additive C for Lowland Meadow and Upland Meadow = Tall Fescue Additive C for Wet Meadow = Perennial Ryegrass Additive D for Lowland Meadow and Upland Meadow = Corn Poppy Additive E for all Meadow Establishment = Common Oat					

(c) Pesticide Application. Refer to 701.03.01(b).

(d) Pesticide Application Reporting. Refer to 701.03.01(e).

(e) Nutrient Management Plan (NMP). Soil testing will be performed and a NMP will be developed by the Administration. Conform to the application rates of the NMP and replace application rates of Table 2 in 707.03.03 as required by the NMP. When no NMP has been developed, apply 200 lb. per acre of 20-16-12 (83 percent UF with MAP & SOP) fertilizer as the NMP rate for initial fertilizer for Meadow Establishment.

(f) Nutrient Management Reporting. Record the location and details of soil amendment and fertilizer applications on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying soil amendments and fertilizer.

(g) Seeding Schedule. Refer to 706.03.01(g).

(h) IPM Program and Establishment Schedule. Refer to 706.03.01(h).

707.03.02 Modification Request. Refer to 706.03.02.

707.03.03 Application Rates. Refer to 707.03.01(b) and Table 1, and include seed additives as specified. Apply materials in accordance with Table 2 through Table 5.

MEADOW ESTABLISHMENT TABLE 2 - APPLICATION RATES		
MATERIAL	**RATE**	
FERTILIZER per Nutrient Management Plan[a, b]	**LB PER yd²**	**LB PER ACRE**
20-16-12 (83% UF with MAP & SOP) or one of the following[c]	0 to 0.041	0 to 200
38-0-0 (UF)	0 to 0.021	0 to 100
11-52-0 (MAP)	0 to 0.036	0 to 175
0-0-50 (SOP)	0 to 0.041	0 to 200
SEED MIXES; select one of the following	**RATE**	
	GRAM PER yd²	**LB PER ACRE**
SHA Wet Meadow Seed	Refer to Table 3 - Application Rates	
SHA Lowland Meadow Seed	Refer to Table 4 - Application Rates	
SHA Upland Meadow Seed	Refer to Table 5 - Application Rates	
SHA Short Meadow Seed	Refer to Table 6 - Application Rates	
ADDITIVE SEED per Table 1	**RATE**	
	GRAM PER yd²	**LB PER ACRE**
A = Garden Cosmos	0.028	0.3
B = Plains Coreopsis	0.028	0.3
C = Tall Fescue or Perennial Ryegrass	2.345	25
D = Corn Poppy	0.028	0.3
E = Common Oat	4.690	50
MULCH AND REFERTILIZING	**RATE**	
	LB PER yd²	**LB PER ACRE**
STRAW MULCH	0.413	2000
WOOD CELLULOSE FIBER to secure straw mulch	0.103	500
REFERTILIZING - 37-0-0 SCU for Short Meadow Establishment	0.021	100

Notes:
[a]For existing topsoil and salvaged topsoil, the application rates will be included in the Contract documents. For furnished topsoil, the application rates will be developed for the approved source of supply.
[b]When no NMP has been developed, apply 200 lb per acre of 20-16-12 initial fertilizer.
[c]UF = Ureaform; MAP = Monoammonium Phosphate; SOP = Sulfate of Potash. When application rate of 20-16-12 fertilizer is below 200 lb per acre, apply UF, MAP, and SOP per NMP.

MEADOW ESTABLISHMENT
TABLE 3 - WET MEADOW SEED

FORBS Select 8	PURE LIVE SEED*		GRASSES, SEDGES and RUSHES Include All	PURE LIVE SEED*	
	GRAM PER yd^2	LB PER ACRE		GRAM PER yd^2	LB PER ACRE
Allegheny Monkeyflower	0.038	0.4	Common Rush	0.150	1.6
Crimsoneyed Rosemallow	0.038	0.4	Fox Sedge	0.094	1.0
Flat-top Goldenrod	0.038	0.4	Fowl Bluegrass	0.188	2.0
King of the Meadow	0.038	0.4	Longhair Sedge	0.056	0.6
New York Aster	0.038	0.4	Rattlesnake Mannagrass	0.094	1.0
New York Ironweed	0.038	0.4	Shallow Sedge	0.056	0.6
Seedbox	0.038	0.4	Woolgrass	0.056	0.6
Swamp Milkweed	0.019	0.2	Note: *The rate shown is Pure Live Seed. Use germination and purity data from the seed tag to calculate the actual seeding rate needed to obtain the seeding rate in Pure Live Seed.		
Swamp Sunflower	0.56	0.6			
Swamp Verbena	0.131	1.4			
Trumpetweed or Spotted Joe Pye Weed	0.038	0.4			

MEADOW ESTABLISHMENT
TABLE 4 - LOWLAND MEADOW SEED

FORBS Select 8	PURE LIVE SEED*		GRASSES, SEDGES and RUSHES Include All	PURE LIVE SEED*	
	GRAM PER yd^2	LB PER ACRE		GRAM PER yd^2	LB PER ACRE
Common Boneset	0.019	0.2	Big Bluestem	0.188	2.0
Eastern Purple Coneflower	0.113	1.2	Eastern Gamagrass	0.188	2.0
Common Evening Primrose	0.019	0.2	Hard Fescue	1.876	20.0
Lanceleaf Tickseed	0.141	1.5	Indiangrass	0.188	2.0
Maximilian Sunflower	0.047	0.5	Kentucky Bluegrass	0.469	5.0

New England Aster	0.019	0.2	Switchgrass	0.094	1.0
New York Ironweed	0.019	0.2	Virginia Wildrye	0.047	0.5
Bearded Beggarticks	0.019	0.2	Note: *The rate shown is Pure Live Seed. Use germination and purity data from the seed tag to calculate the actual seeding rate needed to obtain the seeding rate in Pure Live Seed.		
Stiff Goldenrod	0.028	0.3			
Swamp Verbena	0.066	0.7			
Trumpetweed or Spotted Trumpetweed	0.019	0.2			

MEADOW ESTABLISHMENT
TABLE 5 - UPLAND MEADOW SEED

FORBS Select 8	**PURE LIVE SEED***		**GRASSES, SEDGES and RUSHES Include All**	**PURE LIVE SEED***	
	GRAM PER yd²	**LB PER ACRE**		**GRAM PER yd²**	**LB PER ACRE**
Blackeyed Susan	0.094	1.0	Broomsedge Bluestem	0.094	1.0
Browneyed Susan	0.094	1.0	Deertongue	0.188	2.0
Eastern Purple Coneflower	0.225	2.4	Hard Fescue	1.876	20.0
Gray Goldenrod	0.038	0.4	Little Bluestem	0.188	2.0
Lanceleaf Tickseed	0.263	2.8	Purpletop	0.094	1.0
Maryland Senna	0.056	0.6	Virginia Wildrye	0.047	0.5
Partridge Pea	0.225	2.4	Note: *The rate shown is Pure Live Seed. Use germination and purity data from the seed tag to calculate the actual seeding rate needed to obtain the seeding rate in Pure Live Seed.		
Smooth Blue Aster	0.038	0.4			
Sundial Lupine	0.263	2.8			
Foxglove Beardtongue	0.038	0.4			
Wild Bergamot	0.038	0.4			

MEADOW ESTABLISHMENT TABLE 6 - SHORT MEADOW SEED					
FORBS	**PURE LIVE SEED***		**GRASS IN BAGS PER 920.06.07(a)**		
Select All	**GRAM PER yd²**	**LB PER ACRE**	**Include All**	**GRAM PER yd²**	**LB PER ACRE**
Bird's-Foot Trefoil	0.469	5.0	SHA Turfgrass Seed Mix	9.380	100.0
Common Yarrow	0.094	1.0			
White Clover	0.188	2.0			
Note: ∗The rate shown is Pure Live Seed. Use germination and purity data from the seed tag to calculate the actual seeding rate needed to obtain the seeding rate in Pure Live Seed.					

707.03.04 Grade Repair. Refer to 705.03.04.

707.03.05 Preparing Soil. Refer to 706.03.06. Use rakes, soil rollers, and similar tools and equipment as necessary to ensure a firm and uniform soil surface in preparation for seeding.

707.03.06 Seed Delivery, Weighing, and Mixing. Refer to 706.03.04.

707.03.07 Fertilizing and Seeding. Refer to 706.03.07.

707.03.08 Mulching. Refer to 705.03.07.

707.03.09 Seeding Phase Acceptance. Refer to 705.03.08.

707.03.10 Establishment Phase.

(a) Lowland, Upland, Short and Wet Meadow Establishment. Refer to 706.03.10 and perform Overseeding as necessary using seed of the pertinent type of Meadow Establishment in conformance with 707.03.03.

(b) Short Meadow Establishment. Refer to 705.03.09 and perform Overseeding as necessary.

707.03.11 Final Acceptance. Refer to 706.03.11.

707.03.12 Refertilizing. Refer to 705.03.06(c) and apply Refertilizing to Short Meadow when Refertilizing is included in the Contract documents.

707.04 MEASUREMENT AND PAYMENT

Meadow Establishment will be measured and paid for at the Contract unit price for one or more of the Specified items. The payment will be full compensation for applying soil amendments and initial fertilizer in conformance with the Nutrient Management Plan, and for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

(a) Payment Schedule. Payments will be made according to Table 7 when construction requirements are met.

MEADOW ESTABLISHMENT
TABLE 7 - PAYMENT SCHEDULE

CONSTRUCTION REQUIREMENTS	PERCENT OF TOTAL CONTRACT PRICE	PAYMENT FOR COMPLETED WORK
707.03.01 through 707.03.09	70%	At Seeding Phase Acceptance
707.03.10	15%	At Partial Establishment Phase Acceptance
707.03.10 and 707.03.11	15%	At Final Acceptance
Total Payment	100%	

(b) Forfeiture. Failure to complete operations as required or directed in conformance with the Payment Schedule will result in forfeiture of that percentage of payment.

707.04.01 Wet Meadow Establishment will be measured and paid for at the Contract unit price per square yard. The use of other materials in conformance with an approved Modification Request shall be incidental to the Contract unit price, and will not be measured or paid for.

707.04.02 Lowland Meadow Establishment will be measured and paid for at the Contract unit price per square yard. The use of other materials in conformance with an approved Modification Request shall be incidental to the Contract unit price, and will not be measured or paid for.

707.04.03 Upland Meadow Establishment will be measured and paid for at the Contract unit price per square yard. The use of other materials in conformance with an approved Modification Request shall be incidental to the Contract unit price, and will not be measured or paid for.

707.04.04 Short Meadow Establishment will be measured and paid for at the Contract unit price per square yard. The use of other materials in conformance with an approved Modification Request shall be incidental to the Contract unit price, and will not be measured or paid for.

707.04.05 Temporary Mulch will be measured and paid for at the pertinent Contract unit price per square yard.

707.04.06 Refertilizing will be measured and paid for at the Contract unit price per square yard.

CATEGORY 700
LANDSCAPING

SECTION 708 — TURFGRASS SOD ESTABLISHMENT

708.01 DESCRIPTION

Establish turfgrass sod on topsoil or other specified soil substrate to provide permanent vegetation groundcover. When it is not possible to perform Turfgrass Sod Establishment, refer to Section 704 and perform Temporary Mulch, or as directed. Performance of Turfgrass Sod Establishment as specified herein complies with all requirements of the Maryland Department of the Environment for permanent vegetation groundcover.

708.02 MATERIALS

Fertilizer	920.03.01
Turfgrass Sod	920.06.03
Fasteners	920.05.02
Water	920.09.01

708.03 CONSTRUCTION

708.03.01 General.

(a) Regions. Refer to 705.03.01(a).

(b) Installation Season and Species. Perform operations when soil moisture and weather conditions are suitable. Cease operations when sod or soil is frozen, or conditions are unsuitable.

Tall Fescue Sod. Install from August 15 to May 31 in Region 1, Region 2, and Region 3 unless another species of sod is specified. Approval is required for installation from November 16 to February 29 when fertilizer may not be applied.

Zoysiagrass Sod. Install in specified areas of Region 2 and Region 3 from March 1 to June 15, and from August 1 to September 15.

Bermudagrass Sod. Install in specified areas of Region 3 from March 1 to June 15, and from August 1 to September 15.

(c) Nutrient Management Plan (NMP). Soil testing will be performed and a NMP will be developed by the Administration. Conform to the application rates of the NMP and replace application rates of Table 2 in 705.03.03 as required by the NMP. When no NMP has been developed, apply 200 lb per acre of 20-16-12 (83 percent UF with MAP & SOP) fertilizer as the NMP rate for Turfgrass Sod Establishment.

(d) Nutrient Management Reporting. Record the location and details of soil amendment and fertilizer applications on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying soil amendments and fertilizer.

708.03.02 Grade Repair. Refer to 705.03.04.

708.03.03 Preparing Soil. Refer to 705.03.05.

708.03.04 Application Rates. Apply materials according to Table 1.

TURFGRASS SOD ESTABLISHMENT
TABLE 1 - APPLICATION RATES

MATERIAL	LB PER yd^2	LB PER ACRE
INITAL FERTILIZER per Nutrient Management Plan[a, b]		
20-16-12 (83% UF with MAP & SOP)	0 to 0.041	0 to 200
or one or more of the following[c]		
38-0-0 (UF)	0 to 0.021	0 to 100
11-52-0 (MAP)	0 to 0.036	0 to 175
0-0-50 (SOP)	0 to 0.041	0 to 200
SEED MIXES; select one		
SHA Turfgrass Seed Mix, applied to roadsides, facilities, and other designated areas	0.041	200
or		
SHA Special Purpose Seed Mix, applied to slopes 4:1 and steeper within four miles of a State airport, and other designated areas.	0.041	200
ADDITIVE SEED; when required per Table 1		
SHA Temporary Seed Mix	0.006	25
STRAW MULCH	0.826	4000
WOOD CELLULOSE FIBER to secure straw mulch	0.155	750
REFERTILIZING[d]		
37-0-0 Sulfur Coated Urea (SCU)	0.021	100

Notes:
[a]For existing topsoil and salvaged topsoil, the application rates will be included in the Contract documents. For furnished topsoil, the application rates will be developed for the approved source of supply
[b]When no NMP has been developed, apply 200 lb per acre of 20-16-12 initial fertilizer.
[c]UF = Ureaform; MAP = Monoammonium Phosphate; SOP = Sulfate of Potash. When application rate of 20-16-12 fertilizer is below 200 lb per acre, apply UF, MAP, and SOP per NMP.
[d]Refer to 705.03.06(d) and 705.03.09(c). Apply Refertilizing when included in the Contract documents.

708.03.05 Initial Fertilizer. Apply initial fertilizer after preparing soil, or after installing sod, according to Table 1. When sodding from November 16 to February 29, apply initial fertilizer during March, and apply refertilizing in conformance with 708.03.12 during April.

Use spreaders, drills, or other approved machinery. Machinery shall be capable of uniformly placing fertilizer at the specified rate. Calibrate equipment before application. Apply materials accurately and uniformly to avoid misses and overlaps. Do not operate machinery during windy weather that may interfere with uniform application.

708.03.06 Transporting and Handling Sod. Transport and install turfgrass sod within 48 hours after harvest. Handle sod without excessive breaking, tearing, or loss of soil.

708.03.07 Placing Sod. Place sod neatly over the soil surface. Ensure that sod edges are tightly abutted. Do not overlap edges of sod, or leave gaps between strips of sod.

708.03.08 Securing. Install fasteners in locations where sod may be dislodged by water flow. Secure turfgrass sod to the soil of ditches and slopes with at least two fasteners per strip spaced no more than 2 ft apart. Drive the fasteners through the sod and firmly into the soil, so there is no gap at the top of the fastener.

708.03.09 Firming. Tamp or roll turfgrass sod after installation and securing sod to close press the sod firmly into the soil. Hand tampers shall weigh approximately 15 lb with a flat surface of approximately 100 in^2. Rollers shall weigh approximately 40 lb per ft of width.

708.03.10 Initial Watering. Gently apply water with a sprinkler or water-breaker nozzle over the surface of the sod. Do not allow water to cause erosion or to displace the sod. Perform the first watering within 4 hours after placing sod. Wet the soil to a depth at least 2 in. below the sod.

708.03.11 Installation Acceptance. Submit a request for Installation Phase Acceptance when operations are completed. Inspection will be conducted to verify completion. Installation Phase Acceptance will be granted at that time.

708.03.12 Establishment Phase. The Establishment Phase will begin upon Installation Phase Acceptance. Perform the following during the Establishment Phase.

(a) Period of Maintenance. Maintain areas of sod until Final Acceptance.

(b) Required Maintenance. Perform the following during the Establishment Phase.

Watering. Apply water to ensure survival of sod in good condition. Apply water with approved machinery. Do not allow water to cause erosion, or to displace the sod.

Reset Sod. When sod is not firmly fastened to the soil, repair the unsecured areas using fasteners as needed or as directed.

Sod Replacement. When sod does not meet acceptance standards, remove the unacceptable sod and install new sod as needed or as directed.

Mowing. Mow sod before it grows to a height of 8 in. Use approved machinery to cut to a height of 3 in. to 5 in.

(c) Refertilizing. Refer to 708.03.05 and apply 37-0-0 SCU Refertilizing as specified in Table 1 at least 1 month after initial fertilizer was applied. Do not apply Refertilizing from November 15 through March 1.

708.03.13 Final Acceptance. The Engineer and the Quality Assurance Division will complete an Inspection Report of sod height, color, and percent groundcover. When it is not possible to perform the Inspection, Final Acceptance will be delayed until Inspection is possible. The Inspection Report will be included in the Punch List requirements for the project. Complete the Punch List requirements as directed.

Final Acceptance will be granted after all operations have been completed, and when the turfgrass sod has grown at least 4 in. tall, exhibits dark green color, is firmly rooted into the soil, and is at least 99 percent groundcover.

708.04 MEASUREMENT AND PAYMENT

Turfgrass Sod Establishment will be measured and paid for at the Contract unit price for one or more of the specified items. The payment will be full compensation for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

(a) Payment Schedule. Payments will be made according to Table 2 when construction requirements are met.

TURFGRASS SOD ESTABLISHMENT
TABLE 2 - PAYMENT SCHEDULE

CONSTRUCTION REQUIREMENTS	PERCENT OF TOTAL CONTRACT PRICE	PAYMENT FOR COMPLETED WORK
708.03.01 through 708.03.11	80%	At Installation Phase Acceptance
708.03.12 (a), 708.03.12(b) and 705.03.13	20%	At Final Acceptance
Total Payment	100%	

(b) Forfeiture. Failure to complete operations as required in conformance with the Payment Schedule will result in forfeiture of that percentage of payment.

708.04.01 Turfgrass Sod Establishment, including grade repair, preparing soil, applying soil amendments and initial fertilizer in conformance with the Nutrient Management Plan, sod, fasteners, watering, resetting sod, sod replacement, and mowing will be measured and paid for at the Contract unit price per square yard.

708.04.02 Zoysiagrass Sod Establishment, including grade repair, preparing soil, applying soil amendments and initial fertilizer in conformance with the Nutrient Management Plan, sod, fasteners, watering, resetting sod, sod replacement, and mowing will be measured and paid for at the Contract unit price per square yard.

708.04.03 Bermudagrass Sod Establishment, including grade repair, preparing soil, applying soil amendments and initial fertilizer in conformance with the Nutrient Management Plan, sod, fasteners, watering, resetting sod, sod replacement, and mowing will be measured and paid for at the Contract unit price per square yard.

708.04.04 Refertilizing will be measured and paid for at the Contract unit price per square yard.

708.04.05 Temporary Mulch will be measured and paid for at the Contract unit price.

CATEGORY 700
LANDSCAPING

SECTION 709 — SOIL STABILIZATION MATTING

709.01 DESCRIPTION

For areas that are at final grade, install soil stabilization matting in conjunction with permanent vegetation groundcover per Section 705, Section 706, and Section 707, or as specified.

For areas that are not at final grade or that will be redisturbed at least six months after seeding operations are completed, install soil stabilization matting in conjunction with Sections 704 or 705.

Performance of Soil Stabilization Matting as specified herein complies with all requirements of the Maryland Department of the Environment for permanent seeding.

709.02 MATERIALS

Topsoil	920.01
Turfgrass Sod	920.06.03
Soil Stabilization Matting (SSM)	920.05.01
Fasteners	920.05.02
Water	920.09.01

709.03 CONSTRUCTION

709.03.01 Modification Request. Certain types of matting may be substituted for other matting when the substitution will provide improved erosion protection.

Submit a written Modification Request to substitute one type of soil stabilization matting for another type in areas where specific types of matting have been specified.

The Engineer in consultation with the Landscape Programs Division will evaluate the Request. If granted, a notice of approved modification will be returned within 14 days after the request is received.

The following modifications and others may be approved.

(a) Turfgrass Establishment: Type D SSM in lieu of Type A SSM.

(b) Turfgrass Establishment: Type A SSM in lieu of Type E SSM.

(c) Meadow Establishment: Type D SSM in lieu of Type E SSM.

(d) Shrub Seeding Establishment: Type D SSM in lieu of Type E SSM.

709.03.02 Soil Preparation. Perform operations when soil moisture and weather conditions are suitable. Cease operations when soil is frozen, saturated, or when conditions are otherwise unsuitable. Perform operations for the SSM type as follows.

(a) Type A. Prepare soil and seedbed for Turfgrass Establishment as specified in Section 705, or for other specified vegetation, but do not apply mulch.

Install SSM as specified in 709.03.03 through 709.03.06 immediately after seeding and fertilizing.

(b) Type B. Prepare soil and seedbed for Turfgrass Establishment as specified in Section 705, or for other specified vegetation, but do not apply mulch.

Firm soil with an approved roller to ensure uniform soil surface and firmness. The roller shall weigh approximately 40 lb per ft of width.

Install SSM as specified in 709.03.03 through 709.03.06 immediately after seeding, fertilizing and rolling are completed.

(c) Type C. Prepare soil and firm with an approved roller to ensure uniform soil surface and firmness.

Install Type C SSM as specified in 709.03.03 through 709.03.06 and infill with soil as specified in 709.03.07.

(1) Immediately perform Turfgrass Sod Establishment as specified in Section 708, but do not till; or

(2) Immediately perform Turfgrass Establishment as specified in Section 705, but do not till or apply mulch, and then cover with Type B SSM; or

(3) Immediately install other specified material and vegetation.

(d) Type D. Prepare soil and seedbed for Meadow Establishment as specified in Section 707, or for other specified vegetation, but do not apply mulch.

Install SSM as specified in 709.03.02 through 709.03.05 immediately after seeding and fertilizing.

(e) Type E. Prepare soil and seedbed for Turfgrass Establishment as specified in Section 705, or for other specified vegetation, but do not apply mulch.

Install SSM as specified in 709.03.03 through 709.03.06 immediately after seeding and fertilizing.

709.03.03 Unrolling. Unroll SSM in the direction of the flow of water. Lay matting smoothly in firm, uniform contact with the soil surface, without stretching or tenting.

709.03.04 Overlapping. Overlap SSM with the upslope portion on top. Overlap edges at least 2 in., and ends at least 6 in. Do not install longitudinal overlaps in channel bottoms.

709.03.05 Keying-in. Key-in matting by digging a trench, fastening and backfilling one or more edges of the matting into the bottom of the trench.

(a) Type of Matting. Key-in the areas described in Table 1 for each type of matting:

SOIL STABILIZATION MATTING
TABLE 1 - AREAS OF MATTING TO KEY-IN

MATTING TYPE	AREA OF MATTING
A, B	Uppermost or leading-edge.
A, B, D	Edges adjacent to pavement, catch basins, and structures.
B	Lowermost or toe-edge.
B	Check trenches; folds of matting perpendicular to water flow every 40 ft - 45 ft.
C	All edges.
C	Check trenches; folds of matting perpendicular to water flow every 20 ft - 25 ft.
D	Edges exposed to flow in BSM, ponds, swales, channels, slopes. All edges when installed in streams.
E	As directed.

(b) Trenching. Trench into the soil perpendicular to the flow of water to at least 6 in. depth.

(c) Fastening. Install fasteners as specified in 709.03.06 through SSM into the bottom of the trench.

(d) Backfilling. Backfill the trench with firmly tamped soil, and secure the matting over the backfilled area.

709.03.06 Fastening. Secure SSM with fasteners driven perpendicular to the soil grade, and flush with the surface of the matting.

(a) Fastener Selection. Refer to 920.05.02 and use fasteners of the shape and length approved for the matting type according to Table 2.

When more than one fastener is acceptable for a type of matting according to Table 2, install the fastener type and length best suited to the installation conditions to ensure that the matting is securely installed, or as directed.

(b) Placement of Fasteners. Install fasteners at the specified distance apart as required for the matting type and the area of matting according to Table 3.

SOIL STABILIZATION MATTING
TABLE 2 - FASTENER SELECTION

MATTING TYPE	FASTENER SHAPE	FASTENER LENGTH*			
		6 in. Length	8 in. Length	12 in. Length	18 in. Length
A & E	U-Shaped Staple	X	X		
	Circle-Top Pin	X	X		
	Round Head Pin	X	X		
	T-Head Pin	X	X		
B	U-Shaped Staple		X	X	
	Fabric Pin			X	X
C	U-Shaped Staple			X	X
	Fabric Pin			X	X
D	U-Shaped Staple in BSM, Ponds, Swales, Slopes	X	X	X	
	U-Shaped Staple or Fabric Pin in Channels, Streams		X	X	X

Note: *X=Denotes fasteners acceptable for the matting type. Refer to 709.03.06(a)

SOIL STABILIZATION MATTING
TABLE 3 - FASTENER PLACEMENT

AREA OF MATTING	MATTING TYPE	MAXIMUM DISTANCE BETWEEN FASTENERS in.
Uppermost or Leading-Edge of Matting	A, B, C, D, E	6
Overlapping Edges of Matting	A, B, C, D, E	18
Center of Ditch	A, B, C, D, E	18
Lowermost or Toe-Edge of Matting	A, B, C, D, E	18
Throughout Matting	A, B, C, D, E	24
Check Trenches in Folds Every 40 ft - 45 ft	B[1]	12
Check Trenches in Folds Every 20 ft - 25 ft	C	12

Note: [1]Do not install check trenches in Type B SSM installed over Type C SSM.

709.03.07 Infilling Type C SSM. Infill the matting with approved topsoil to fill matting voids and to cover the matting with topsoil to a depth of 1/8 in. to 1/4 in. Immediately install sod, or seed and cover with Type B SSM, or as specified.

709.03.08 Watering. Gently apply water with a sprinkler or water-breaker nozzle immediately after installation is completed as follows.

(a) For Type E SSM, apply water over the surface of the matting as needed to settle the matting and soil.

(b) For Types A, B, and D SSM, apply water over the surface of the matting to wet the soil at least 2 in. depth.

(c) For Type C SSM, apply water over the sod, over the Type B SSM, or over other specified material, to wet the soil at least 2 in. depth.

709.03.09 Installation Phase Acceptance. Inspection will be conducted to verify that matting and vegetation installation operations were completed as specified. Installation Phase Acceptance will be granted at that time.

709.03.10 Establishment Phase. The Establishment Phase will begin upon Installation Phase Acceptance. Perform the following during the Establishment Phase.

(a) Period of Maintenance. Maintain areas of soil stabilization matting until Final Acceptance.

(b) Required Maintenance. Perform the following during the Establishment Phase.

Watering. Apply water to ensure survival of the seeded species or sod as needed. Apply water with approved machinery. Do not allow water to cause erosion or to displace the matting, seed, or sod.

Reset Matting. When matting is not firmly fastened to the soil, or if keyed-in areas or check trenches are not secure, repair the unsecured areas using fasteners as needed or as directed.

Seeding Repair. When Turfgrass Establishment has not met acceptance standards, remove Type A, B, D, or E SSM and refer to 705.03.09 and perform overseeding or reseeding as directed. Remove Type C matting only if directed. Install new matting unless the original matting is approved for reuse.

When Shrub Seeding Establishment or Meadow Establishment has not met acceptance standards, remove Type D or E SSM and refer to 706.03.10(b) and perform overseeding in conformance with specifications for the pertinent vegetation. Install new matting unless the original matting is approved for reuse.

Sod Replacement. When Turfgrass Sod Establishment does not meet acceptance standards, refer to 708.03.12 and remove the unacceptable sod and install new sod.

709.03.11 Final Acceptance. The Engineer and the Quality Assurance Division will complete an Inspection Report of the installed soil stabilization matting and vegetation establishment in conformance with the pertinent specifications. When it is not possible to perform the Inspection, Final Acceptance will be delayed until Inspection is possible.

The Inspection Report will be included in the Punch List requirements for the project. Complete the Punch List requirements as directed. Final Acceptance will be granted when the SSM is secure, and when the specified vegetation has met acceptance standards.

709.04 MEASUREMENT AND PAYMENT

Soil stabilization matting will be measured and paid for at the Contract unit price per square yard for one or more of the specified items. The payment will be full compensation for all material, fasteners, water, labor, equipment, tools, disposal fees, and incidentals necessary to complete the work.

(a) Payment Schedule. Payments will be made according to Table 4 when construction requirements are met.

SOIL STABILIZATION MATTING
TABLE 4- PAYMENT SCHEDULE

CONSTRUCTION REQUIREMENTS	PERCENT OF TOTAL CONTRACT PRICE	PAYMENT FOR COMPLETED WORK
709.03.01 through 709.03.09	80%	At Installation Phase Acceptance
709.03.10 and 709.03.11	20%	At Final Acceptance
Total Payment	100 %	

(b) Forfeiture. Failure to complete operations as required in conformance with the Payment Schedule will result in forfeiture of that percentage of payment.

709.04.01 Type A Soil Stabilization Matting. The measurement will be the area actually covered by matting, per square yard. Payment for Turfgrass Establishment or other specified vegetation will be measured and paid for separately.

709.04.02 Type B Soil Stabilization Matting. The measurement will be the area actually covered by matting, per square yard. Payment for Turfgrass Establishment or other specified vegetation will be measured and paid for separately.

709.04.03 Type C Soil Stabilization Matting. The measurement will be the area actually covered by matting, per square yard. Topsoil used for infilling will be incidental to the Contract price. Payment for Type B Soil Stabilization Matting, Turfgrass Sod Establishment, Turfgrass Establishment, or other specified vegetation will be measured and paid for separately.

709.04.04 Type D Soil Stabilization Matting. The measurement will be the area actually covered by matting, per square yard. Payment for Meadow Establishment or other specified vegetation will be measured and paid for separately.

709.04.05 Type E Soil Stabilization Matting. The measurement will be the area actually covered by matting, per square yard. Payment for Turfgrass Establishment or other specified vegetation will be measured and paid for separately.

709.04.06 Temporary Mulch and Temporary Seed will be measured and paid for at the pertinent Contract unit price per square yard. Any soil stabilization matting which may be installed with Temporary Mulch or Temporary Seed will be incidental to the pertinent Contract unit price of those items in conformance with 704.04.01 or 704.04.02.

CATEGORY 700
LANDSCAPING

SECTION 710 — TREE, SHRUB AND PERENNIAL INSTALLATION AND ESTABLISHMENT

710.01 DESCRIPTION

Install and establish trees, shrubs, perennials, vines, and grasses in topsoil or Bioretention Soil Mix. When it is not possible to perform this work, refer to Section 704 and perform Temporary Mulch, or as directed to provide temporary soil stabilization.

710.02 MATERIALS

Furnished Subsoil	920.01.04
Type B Compost	920.02.05(b)
Fertilizer	920.03
Shredded Hardwood Bark (SHB) Mulch	920.04.03
Plant Materials	920.07
Marking and Staking Materials	920.08
Water	920.09.01
Pesticides	920.09.03
Marking Dye	920.09.04
Spray Adjuvant and Wetting Agent	920.09.05

710.03 CONSTRUCTION

710.03.01 General.

(a) Planting Seasons. Perform operations during Planting Seasons when soil moisture and weather conditions are suitable, when the temperature is above 32 F, and the soil is not frozen. Cease operations when conditions are unsuitable.

Spring Planting Season. February 1 through June 30. Do not install plants in July.

Fall Planting Season. August 1 through December 31. Do not install plants in January.

(b) Modification Request. Submit a written Modification Request to install plants of different species, cultivars, sizes, growth habits, or planting stock type. The Engineer

in consultation with the Landscape Programs Division will evaluate the Request. If granted, notice of the approved modification will be returned within 14 days afterwards.

(c) Pesticide Application. The Contractor shall possess a Maryland Department of Agriculture Commercial Pesticide Business License and a Pesticide Applicator Certificate for the pertinent pesticide application Category: (2) Forest; (3A) Ornamental Plant Exterior; (3-C) Turf; (5) Aquatic; (6) Right-of-Way and Weed.

Apply pesticides in conformance with the Maryland Pesticide Applicator's Law, OSHA and MOSH regulations, and the manufacturer's label and Safety Data Sheets (SDS).

Ensure that pesticides are applied by a Maryland Certified Pesticide Applicator, or by a Registered Pesticide Applicator under the supervision of a Certified Pesticide Applicator.

(d) Pesticide Application Reporting. Record the location and details of pesticide applications on the Pesticide Application Reporting Form. Submit the Form within 24 hours after applying pesticides.

(e) Nutrient Management Plan (NMP). The specified application rates of 14-14-14 fertilizer will be the NMP unless the Administration develops a substitute NMP. Replace application rates of 710.03.04 and 710.03.05 as required by the NMP.

(f) Nutrient Management Reporting. Record the location and details of soil amendment and fertilizer applications on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying soil amendments and fertilizer.

(g) Plant Storage and Handling. Refer to 920.07.05.

(h) Standard Details. Refer to Maryland Standard MD-710.03-01 through MD-710.03-15 when preparing plant materials, constructing planting beds, and installing plant materials.

710.03.02 Submittals and Inspection. Submit the following items:

(a) Breakdown List of Contract Prices. Refer to 710.04.01 and develop a Breakdown List of Contract Prices for each plant in the Contract. Include the cost of all installation and establishment operations in the per plant price.

Submit the written Breakdown List within 14 days after Award of Contract. The Breakdown List will be reviewed by the Engineer and Landscape Programs Division for completeness and balance, and will be approved or returned for correction.

(b) Installation Phase Schedule. Develop a Schedule with dates for completing operations related to 710.03.01 through 710.03.15 according to Table 1.

TREE, SHRUB, AND PERENNIAL TABLE 1 - OPERATIONS IN INSTALLATION PHASE SCHEDULE	
1	Layout, utilities review and marking.
2	Undesirable vegetation removal and herbicide application.
3	Planting pit excavation, soil preparation, and plant installation.
4	Planting beds rototilling and soil preparation, applying shredded hardwood bark (SHB) mulch, and plant installation.
5	Applying fertilizer solution after installation, and cleanup.

Submit the written Schedule at least 30 days before beginning landscape work. The Schedule will be reviewed by the Engineer and Landscape Programs Division for completeness and feasibility, and will be approved or returned for correction.

(c) Plant Material Inspection and Approval. The Inspection will be conducted by the Landscape Programs Division as specified in 920.07.02.

(d) Establishment Phase Schedule & IPM Program. Develop a Schedule with dates for completing 710.03.22. Include an Integrated Pest Management (IPM) Program with methods of pest monitoring (weeds, diseases, insects, mammals, etc.), pesticide selection, application rates, and scheduling.

Submit the written Establishment Phase Schedule & IPM Program at the Installation Phase Inspection.

The Schedule will be reviewed by the Engineer and the Landscape Programs Division, and will be approved or returned for correction.

710.03.03 Utilities Marking, Layout, and Inspection. Refer to Section 875 when included in the Contract Documents.

(a) Utilities Marking. Contact 'Miss Utility' or another approved service to identify and mark utilities in the rights-of-way and on SHA property.

(b) Conflicts. Notify the Administration in writing of conflicts that may involve design changes. Conflicts will be reviewed by the Landscape Programs Division and resolved within 14 days after notice.

(c) Planting Layout. Refer to Maryland Standard MD-710.03-10, MD-710.03-11 and MD-710.03-12. Provide the necessary materials and lay out the locations of planting pits and planting beds specified in the Contract Documents, or as adjusted by the Landscape Programs Division.

(d) Inspection. At least seven days notice will be required to schedule each stage of a layout inspection in consultation with the Landscape Programs Division. Proceed with operations after layout approval.

710.03.04 Preparing Planting Pits. Refer to Maryland Standard MD 710.03-14 and MD 710.03- 15. Perform the following operations when preparing planting pits for individual plants.

(a) Undesirable Vegetation. Manually remove undesirable vegetation or refer to 710.03.01(c) and 710.03.01(d) and apply non-selective herbicide in water with wetting agent and dye according to Table 2 at least 14 days before plant installation. Cut and remove dead vegetation or debris that interferes with soil preparation, plant installation or future maintenance.

TREE, SHRUB, AND PERENNIAL
TABLE 2 - NON-SELECTIVE HERBICIDE APPLICATION

MATERIAL	RATE PER ACRE
Glyphosate Herbicide	5 lb of active ingredient
Marking Dye	6 oz to 15 oz
Water	40 gal to 50 gal

(b) Excavation. Excavate planting pits to the depth required for the placement of root collars as specified in 710.03.09(c). Retain the excavated soil for preparation as backfill soil. Remove excess soil from the site, or spread as directed.

For Expanded Tree Pits (ETP), refer to the detail provided in the Contract Documents. Excavate additional depth and width as shown in the detail, place furnished subsoil to the dimensions shown in the detail, and complete tree installation using Table 3. Remove excess soil from the site, or spread as directed.

(c) Planting Pit Diameter. Use Table 3 to determine the diameter of the planting pit based upon the container or root ball diameter.

TREE, SHRUB, AND PERENNIAL
TABLE 3 - PREPARING PLANTING PITS AND BACKFILL SOIL

Container or Root Ball Diameter In.	ANSI Z60 Container Size	Planting Pit Diameter In.	Compost Ft^3	14-14-14 Fertilizer Oz	Water per Event Gal
< 3	Plugs	2 to 4	0	0	0.10
3	#SP3	6	0.02	0.10	0.15
5	#SP4	10	0.02	0.12	0.2
6	#SP5 OR #1	12	0.03	0.18	0.3
8	#2	17	0.09	0.30	0.5
10	#3	21	0.18	0.55	1.0

12	#5	24	0.28	0.75	1.5
14	#7	28	0.44	1.0	2.3
16	#10	32	0.65	1.3	3.5
18	#15	36	0.94	1.6	5.0
20	#20	40	1.27	2.0	6.8
24	#25	48	2.20	3.0	12
30	—	60	4.30	4.5	23
36	#45	72	7.40	6.5	40
42	#65	84	11.80	8.8	60
Note:	When water is applied over the surface of planting beds where most plants are less than 36 in. apart, apply water per plant in conformance with 'Water per Event', or apply at least 5 gallons of water per yd^2 of planting bed.				

(d) Compost and Fertilizer. Use Table 3 to determine the quantity of compost and 14-14-14 fertilizer to mix into backfill soil, based upon planting pit diameter. Uniformly mix compost and fertilizer into the backfill soil.

Use a scale with 0.01 oz or gram accuracy to calibrate measures and verify application rates of 14-14-14 fertilizer when directed.

(e) Water. Use Table 3 to determine the quantity of water to apply for each installed plant based upon planting pit diameter.

710.03.05 Preparing Planting Beds. Refer to Maryland Standards MD 710.03-10, MD 710.03-11, MD 710.03-12 and perform the following operations.

(a) Undesirable Vegetation. Remove undesirable vegetation as specified in 710.03.04(a). Cut or mow dead vegetation to a height of 1 in. and remove the debris.

(b) Compost and Rototilling.

(1) Areas Flatter than 4:1. Apply 2 in. layer of compost over the soil surface of the planting bed. Rototill to a depth of 6 in. to thoroughly mix compost and any materials specified in the NMP. Do not apply compost or rototill Bioretention Soil Mix (BSM) unless specified otherwise.

(2) Slopes 4:1 and Steeper. Do not rototill.

(c) Fertilizer. Mix 14-14-14 fertilizer into the backfill soil of each planting pit within the bed according to Table 3.

(d) Debris Removal. Remove debris, stones, and soil clods with a length or width greater than 2 in. that are uncovered during rototilling.

(e) Leveling. Level the soil surface after rototilling, and leave it in a condition ready for shredded hardwood bark (SHB) mulching and plant installation.

710.03.06 Plant Acclimation. Ensure that container grown plants are acclimated to prevailing weather conditions before installing. Install bare root plants while dormant when soil and air temperatures are above freezing.

710.03.07 Plant Care. Begin plant care at the time each plant is installed, and continue until Installation Phase Acceptance is granted.

710.03.08 Pruning. Refer to Maryland Standard MD 710.04-14. Remove dead branches, damaged branches, water sprouts, and other undesirable growth manually with pruners. Preserve the natural appearance of trees and shrubs. Remove branches or portions of branches over sidewalks to ensure 8 ft clearance for pedestrians.

710.03.09 Installing. Install plants vertically in planting pits and beds prepared as specified in 710.03.04 and 710.03.05, and as follows.

(a) Removing Containers, Burlap, Wire Baskets. Remove containers. Remove twine, burlap or other fabric from the tops of root balls to a depth at least 6 in. below the surface of the backfilled planting pit. Cut and remove the tops of wire baskets from the upper half of the rootball. Discard containers and any removed twine, wire, burlap or other fabric.

(b) Preparing Roots. Carefully remove the containers of container grown plants, and loosen the soil mass to eliminate girdling roots.

Spread the roots of bare root plants in a natural position, and firmly press backfill soil around the roots.

(c) Placing Root Collar. Refer to Maryland Standard MD 710.03-15. Place the root collar of plants at or above the average soil surface grade outside the planting pit according to Table 4.

TREE, SHRUB, AND PERENNIAL
TABLE 4- ROOT COLLAR PLACEMENT

SOIL CONDITIONS	HEIGHT OF ROOT COLLAR
Normal, Well Drained	Place collar at same level to 1 in. above average surface grade
Compacted	Place collar at 1 in. to 2 in. above average surface grade.
Poorly Drained or Wet	Place collar as needed to ensure 25% of root mass is above average surface grade.

(d) Backfilling. Remove clods, stones and other foreign material with a length or width greater than 2 in. from soil used for backfilling.

Place backfill soil that has been mixed with compost and fertilizer as specified in 710.03.04 and 710.03.05 under and around roots to stabilize plants in upright position and restore the grade. Lightly firm and compact backfill soil to reduce air pockets.

710.03.10 Soil Berming. Form a 4 in. high berm of backfill soil around planting pits and planting beds as follows.

(a) Planting Pits. On areas flatter than 4:1, form the berm around the entire planting pit. On slopes 4:1 and steeper, take soil from the upslope rim of the pit and place it on the downslope rim to form the berm.

(b) Planting Beds. On slopes 4:1 and steeper, form the berm as a shoulder at the lower edge of the bed. Berm individual trees and shrubs installed within beds on slopes 4:1 and steeper as described in (a) above.

710.03.11 Edging. Cut edging at a steep angle into the mulched area to a 3 in. depth into the soil. On slopes 4:1 and steeper, cut edging outside of the bermed area on the lower edge of berm. Remove and discard excess soil.

(a) Planting Pits. Edge entirely around all planting pits except planting pits within planting beds.

(b) Planting Beds. Smoothly cut edging around all planting beds to the shapes specified.

710.03.12 Staking and Guying. Refer to Maryland Standard MD 710.03-01 through MD 710.03-09. Stake and guy trees the same day they are installed.

(a) Installation. When two or three stakes are specified for trees, install two stakes parallel to the direction of traffic, or as directed. Drive stakes vertically to a depth of 10 in. below the bottom of the pit, and 5 in. to 8 in. away from roots according to Table 5.

TREE, SHRUB, AND PERENNIAL TABLE 5 - STAKING AND GUYING				
TREE TYPE	**CALIPER, in.**	**HEIGHT, ft**	**SUPPORT**	
			No. of Stakes	**Length, ft**
Shade	Under 1	6 and 8	2	6
	1 to 2	_	2	8
	2-1/2 to 3-1/2	_	3	10
	4 and over	_	_	3 guy wires attached to tree anchors
Flowering	3/4 to 2-1/2	_	2	5-8
	3 and over	_	_	3 guy wires attached to tree anchors
Evergreen	_	5 and 6	2	5-6
	_	7,8 and 9	3	7-8
	_	10 and over	_	3 guy wires attached to tree anchors

(b) Maintenance. Promptly straighten trees that become crooked after installation. Repair or replace stakes, guys, and other support materials as needed.

710.03.13 Mulching. Spread SHB mulch uniformly over the soil surface to a 3 in. depth. Promptly repair damage caused by washouts or construction activities.

(a) Planting Pits. Spread SHB mulch the same day that plants are installed. Mulch around the base of each plant to cover the soil of the planting pit to its outside edge, including the soil berm. Do not allow mulch to touch the bark or main stem of the plant.

(b) Planting Beds. SHB mulch may be spread before or after installing plants. Spread mulch over the entire bed and rake it to an even surface, including berms and shoulders. Ensure that mulch does not cover plants.

For rototilled beds, spread mulch the same day after rototilling. For non-rototilled beds, spread mulch within 3 days after plant installation. When installation is completed, ensure that mulch uniformly covers the soil to a uniform 3 in. depth.

(c) Stormwater Infiltration Facilities or other specified areas. SHB mulch applied as Shredded Hardwood Bark Mulching 3 in. depth may be spread before or after installing plants. Spread SHB mulch over the specified area and rake it to an even surface the same day that soil is placed, or refer to 704.03.02 and immediately install Temporary Matting Mulch. As soon as feasible, remove Temporary Matting Mulch and install SHB mulch, and ensure that SHB mulch uniformly covers the specified area to a uniform 3 in. depth.

710.03.14 Watering after Installation.

(a) Application Equipment. Watering equipment shall consist of sprinklers or hoses equipped with water breaker nozzles so the materials are applied with care to prevent damage to plants and minimize disturbance to SHB mulch.

For planting pits, refer to Table 4 and apply the required quantity of water to each plant.

For planting beds, apply water to the entire bed area to wet the soil to a depth of 3 in.

(b) Follow-Up Watering. Monitor and apply water during the Installation Phase to supply plant needs.

710.03.15 Cleanup. Remove growers tape, plant stakes, pot markers, field tags, and similar materials at the time of installation. Ensure that the Administration's Material Inspection Approval Seals and plant tags remain on trees and shrubs until the end of the Establishment Phase.

Keep turfgrass areas, paved surfaces, and sidewalks clean. Promptly remove excess and waste materials. Take precautions to avoid damage to existing structures, plants, and turfgrass. Repair damage caused to surrounding areas during installation, and fill ruts and reestablish turfgrass as necessary.

710.03.16 Relocating Plants. Begin plant relocation operations within seven days after notice to relocate, and continue until work is completed. Remove plants installed in undesirable locations as directed by the Engineer, and reinstall these plants as specified in herein.

710.03.17 Abandoned Planting Pits. Backfill abandoned planting pits when directed with excavated soil or approved backfill. Compact the backfill in 8 in. layers to the finished grade. Establish turfgrass as specified in Section 705.

710.03.18 Unacceptable Plants and Replacement Plants. Promptly remove and replace plants that are unacceptable at any time during the Installation Phase as specified in 920.07, or when requested.

Plants that are determined to be missing, dead, dying, damaged, diseased, deformed, underdeveloped, damaged by pesticides, or not true to species, cultivar, size or quality shall be replaced.

Refer to GP-5.09 regarding removal of defective work and materials, and GP-7.16 regarding Contractor responsibility for work, theft, damage, and loss.

(a) Criteria. The criteria of Table 6 will be used to identify unacceptable plants.

TREE, SHRUB, AND PERENNIAL TABLE 6 - CRITERIA FOR UNACCEPTABLE PLANTS			
Item	**Plant Type**	**Condition**	**Unacceptable**
1	Tree, Shrub, Vine, Perennial Grass	Dead or Missing	Any dead or missing plant, any cause.
2	Tree, Shrub, Vine, Perennial Grass	Defoliation	More than 25% of leaf area dead, lost or dropped.
3	Tree, Shrub, Vine	Bark Wound	More than 15% of bark circumference or 2 in. length.
4	Shrub or Vine	Height Die-back	More than 25% of the shrub or vine height.
5	Tree	Leader Die-back	More than 10% of tree height.
6	Tree	Branch Die-back	More than 6 in. on 75% of branches.

(b) Replacement Plants. Replacement plants shall be true to species, cultivar, size, and quality as specified in the Contract Documents unless a Modification Request is approved.

Install replacement plants as soon as feasible during the current Planting Season, or if between Planting Seasons, during the next Planting Season. Promptly submit a Modification Request as specified in 710.03.01(b) when it is not possible to obtain plants that meet specifications.

Replacement plants shall meet the specifications of 920.07, and be installed and established as specified in Section 710 until Final Acceptance.

710.03.19 Installation Phase Inspection. Submit a request for Installation Phase Inspection when operations are completed, and provide the Establishment Phase Schedule as specified in 710.03.02(d).

The Installation Phase Inspection will be scheduled by the Engineer at the project with the Contractor and the Landscape Programs Division to verify completion. At least 14 days notice will be provided before the scheduled Inspection so that it may be completed in the company of the Contractor.

710.03.20 Installation Phase Punch List. The Engineer in consultation with the Contractor and the Landscape Programs Division will develop the Installation Phase Punch List and list of plants to be replaced. Complete the Punch List requirements and replace plants as required.

710.03.21 Installation Phase Acceptance. Re-inspection will be performed as needed. Installation Phase Acceptance will be granted when the Punch List and all Installation Phase requirements are completed according to Table 7.

TREE, SHRUB, AND PERENNIAL TABLE 7 - REQUIREMENTS FOR INSTALLATION PHASE ACCEPTANCE		
Item	**Requirement**	**Section**
a	Submittals are accepted and Inspections are completed.	710.03.01(b), 710.03.02, 920.07
b	Damaging pests are controlled.	710.03.02(c)
c	Layouts are inspected and approved.	710.03.03
d	Fertilizer and compost is mixed soil, as required.	710.03.04 and 710.03.05
e	Planting pits and planting beds are weed free.	710.03.04(a) and 710.03.05(a)
f	Trees and shrubs are pruned.	710.03.08
g	Trees are installed vertically and straightened.	710.03.09
h	Planting pits and beds are bermed and edged.	710.03.10 and 710.03.11
i	Staking and guying are repaired or replaced.	710.03.12
j	SHB mulch is uniformly spread to the specified depth.	710.03.13
k	Washouts in planting pits and beds are repaired.	710.03.13
l	Plants receive initial watering and follow up watering.	710.03.04 and 710.03.14
m	Clean up is completed, plant tags and ribbons are removed.	710.03.15
n	Plants are relocated to approved locations.	710.03.16
o	Abandoned planting pits are filled and seeded.	710.03.17
p	Unacceptable plants are replaced.	710.03.18
q	Damage repairs and Installation Phase Punch List is completed.	710.03.20
r	Pesticide Application and Nutrient Management Reporting Forms are completed.	710.03.01(d) and 710.03.01 (f)
s	Plants are properly installed, are none are unacceptable or require replacement.	710.03.01 through 710.03.18
t	Establishment Phase Schedule & IPM Program is accepted.	710.03.02(d) and 710.03.21

710.03.22 Establishment Phase. The Establishment Phase begins upon Installation Phase Acceptance. Maintain plants and provide care and replacement as specified in 710.03.01 through 710.03.21, and as follows

(a) Period of Maintenance. Maintain plants for 12 months after installation, until Final Acceptance.

(b) Plant Watering. Monitor the soil moisture and water needs of plants. Promptly apply water as specified in 710.03.14 to planting pits and planting beds as needed, or as directed.

(c) Pest Management. Monitor and promptly control weeds, insects and other pests in conformance with the IPM Program, or when requested. Control weeds in mulched areas in preparation for inspection. Remove dead weeds taller than 6 in. Refer to 710.03.01(d) and complete the Pesticide Application Reporting Form.

(d) Unacceptable Plants and Replacement Plants. Refer to 710.03.18. Promptly remove and replace plants that have become unacceptable during the Establishment Phase as needed or as directed.

(e) End-of-Season Foliage Removal. For perennials, remove the aboveground parts that have declined during the months of November and December, or as directed. For grasses, remove the aboveground parts that have declined and in February or March, or as directed.

(f) Refertilizing. Dissolve 40 lb of 20-20-20 water soluble fertilizer in 1000 gal water. Refer to 710.03.14 regarding application equipment. Apply fertilizer solution in the final 60 days of the Establishment Phase. For planting pits, refer to Table 3 and apply gallons of fertilizer solution to each installed plant based upon the planting pit diameter and water per event gal.

For planting beds, apply 0.21 gal of fertilizer solution per yd^2 of planting bed. Apply fertilizer solution to the entire bed area.

(g) Removing Supports and Seals. Remove tree supports, hoses wires, guys and Material Inspection Approval Seals in the final 30 days of the Establishment Phase. Pull stakes from the soil or cut them to ground level.

(h) Partial Establishment Phase Inspection. The Project Engineer will inspect plant establishment 6 months after Installation Phase Acceptance according to Table 8. The Inspection Report will include actions to perform before Partial Establishment Phase Acceptance is granted. Perform repairs, replacements, and other work as specified in the Contract Documents and Inspection Report.

710.03.23 Establishment Phase Inspection and Final Acceptance. The Engineer and the Landscape Programs Division will complete an Inspection Report 12 months after Installation Phase Acceptance. When it is not possible to perform the Inspection, Final Acceptance will be delayed until Inspection is possible.

Final Acceptance will be granted when the requirements of Table 8 are satisfactorily completed. The Inspection Report will be included in the Punch List requirements for the project. Complete the Punch List requirements as directed.

TREE, SHRUB, AND PERENNIAL TABLE 8 - REQUIREMENTS FOR ESTABLISHMENT PHASE AND FINAL ACCEPTANCE		
Item	**Requirement**	**Section**
1	Water sprouts are manually pruned and removed.	710.03.08
2	Trees are straightened.	710.03.09
3	Staking and guying are repaired or replaced.	710.03.12
4	Washouts in planting pits and beds are repaired.	710.03.13
5	Plants are relocated to approved locations.	710.03.16
6	Abandoned planting pits are filled and seeded.	710.03.17
7	Plants are successfully established.	710.03.22(a) and 710.03.22 (b)
8	Damaging pests are controlled.	710.03.22(c)
9	Planting pits and planting beds are weed free.	710.03.22(c)
10	Unacceptable plants are replaced.	710.03.22(d)
11	Annual foliage dieback of perennials and grasses is cut and removed.	710.03.22(e)
12	Plants are refertilized.	710.03.22(f)
13	Pesticide Application and Nutrient Management Reporting Forms are completed.	710.03.01(d) and 710.03.01(f)
14	Staking, guying, and Material Inspection Seals are removed.	710.03.22(g)
15	Damage repairs and Establishment Punch List are completed.	710.03.22(h)

710.04 MEASUREMENT AND PAYMENT

Tree, Shrub, and Perennial Installation and Establishment will be measured and paid for at the Contract unit price for one or more of the specified items. The payment will be full compensation for all plants, material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

710.04.01 Tree, Shrub, and Perennial Installation and Establishment. Tree, Shrub, and Perennial Installation and Establishment shall include the cost of trees, shrubs, vines, perennials, and grasses of all planting stock sizes and classes, layout, marking, pruning, planting pit excavation and disposal of excavated soil, fertilizer, compost, backfilling, staking, guying, berming, edging, watering, cleanup, relocating plants, abandoned planting pits, pest management, plant maintenance, refertilizing, and all operations related to the Installation and Establishment Phases of each plant, until Final Acceptance.

Tree, Shrub, and Perennial Installation and Establishment will be paid according to Table 9 based upon the approved Breakdown List of Contract Prices. Refer to 710.03.02(a). In the event of change in the quantities required, payment adjustments will be based on the approved Breakdown List of Contract Prices.

(a) Payment Schedule. Payments will be made according to Table 9 when construction requirements are met.

TREE, SHRUB, AND PERENNIAL TABLE 9 - PAYMENT SCHEDULE			
CONSTRUCTION REQUIREMENTS		**PERCENT OF TOTAL CONTRACT PRICE**	**PAYMENT FOR COMPLETED WORK**
710.03.01 through 710.03.21	Installation Phase	70%	At Installation Phase Acceptance
710.03.22(a) through 710.03.22 (e)	Establishment Phase	15%	At Partial Establishment Phase Acceptance
710.03.22(a) through 710.03.22 (h) and 710.03.23	Establishment Phase and Final Acceptance	15%	At Final Acceptance
Total Payment		100%	

(b) Forfeiture. Failure to complete operations as required or directed in conformance with the Payment Schedule will result in forfeiture of that percentage of payment based upon the Breakdown List of Contract Prices.

710.04.02 Constructing Planting Beds. Constructing Planting Beds will be measured and paid for at the Contract unit price per square yard. The price will include the cost of layout, marking, fertilizer, soil amendments, rototilling, berming, edging, applying 3 inches of SHB mulch, refertilizing, and all operations related to construction of the planting bed, and any necessary damage repair as specified in 710.03.21 and 710.03.22 until Final Acceptance. Mulching individual planting pits of trees, shrubs, perennials, vines, and grasses within planting beds will not be measured but the cost will be incidental to 710.04.02.

710.04.03 Shredded Hardwood Bark Mulching 3 Inch Depth. Shredded Hardwood Bark Mulching 3 Inch Depth that is installed within stormwater infiltration facilities or within other specified areas, and which is not installed as part of Constructing Planting Beds, will be measured and paid for separately. The payment will include the cost of SHB Mulch, installation, and any necessary damage repair as specified in 710.03.21 and 710.03.22 until Final Acceptance. Mulching individual planting pits of trees, shrubs, perennials, vines, and grasses within areas of Shredded Hardwood Bark Mulching 3 Inch Depth will not be measured but the cost will be incidental to 710.04.03.

710.04.04 Expanded Tree Pit. Expanded Tree Pit will be measured and paid for at the Contract unit price per each. The price shall include the cost of excavation to the specified dimensions, furnished subsoil, disposal of excavated soil, and all operations related to construction of the expanded tree pit.

710.04.05 Temporary Mulch will be measured and paid for at the Contract unit price.

CATEGORY 700
LANDSCAPING

SECTION 711 — ANNUALS AND BULBS INSTALLATION AND ESTABLISHMENT

711.01 DESCRIPTION

Install and establish annuals and bulbs in topsoil. When it is not possible to perform this work, refer to Section 704 and perform Temporary Mulch, or as directed to provide temporary soil stabilization.

711.02 MATERIALS

Type B Compost	920.02.05(b)
Fertilizer	920.03
Shredded Hardwood Bark (SHB) Mulch	920.04.03
Plant Materials	920.07
Marking and Staking Materials	920.08
Water	920.09.01
Pesticides	920.09.03

711.03 CONSTRUCTION

711.03.01 General

(a) Regional Areas. Refer to 705.03.01(a).

(b) Planting Seasons. Perform operations when soil moisture and weather conditions are suitable. Cease operations when conditions are unsuitable. Install plants according to Table 1.

ANNUALS AND BULBS TABLE 1 - PLANTING SEASONS				
SEASON	**PLANTS**	**INSTALLATION DATE**		
		Region 1	**Region 2**	**Region 3**
Spring	Container Grown Summer Annuals	5/20 – 6/20	5/10 – 6/10	5/01 – 6/01
Fall	Container Grown Winter Annuals	9/01 – 10/20	9/10 – 10/31	9/20 – 11/10
	Spring Flowering Bulbs	9/01 – 11/30	9/10 – 12/31	9/20 – 12/31

(c) Modification Request. Refer to 710.03.01(b).

(d) Pesticide Application. Refer to 701.03.01(b).

(e) Pesticide Application Reporting. Refer to 701.03.01(e).

(f) Nutrient Management Plan (NMP). Refer to 710.03.01(e).

(g) Nutrient Management Reporting. Refer to 710.03.01(f).

(h) Plant Storage and Handling. Refer to 920.07.05.

(i) Standard Details. Refer to Maryland Standard MD 710.03-11 and MD 710.03-12 when constructing planting beds and installing plant materials.

711.03.02 Submittals and Inspection. Submit the following items as indicated:

(a) Breakdown List of Contract Prices. Refer to 710.03.02(a).

(b) Installation Phase Schedule. Refer to 710.03.02(b) and submit the Schedule with dates for completing 711.03.02 through 711.03.12.

(c) Plant Material Inspection and Approval. The Inspection will be conducted by the Landscape Programs Division as specified in 920.07.01.

(d) Establishment Phase Schedule & IPM Program. Refer to 710.03.02(d) and submit the Schedule with dates for completing 711.03.17.

711.03.03 Utilities Marking, Layout, and Inspection. Refer to 710.03.03.

711.03.04 Preparing Planting Beds and Planting Areas.

(a) Planting Beds. Refer to 710.03.05 for preparing beds and planting holes for container grown annuals and bulbs. Dig holes for bulbs to the depth and width recommended for the species or variety by the grower.

(b) Planting Areas for Naturalized Daffodils. Dig planting holes to 3 in. diameter and to a 5 in. depth. Mix 0.20 oz of 14-14-14 fertilizer into the backfill soil of each bulb, or as specified in the NMP. Firmly cover each bulb with backfill soil to the level of the surrounding grade. Omit 711.03.05 through 711.03.10 when installing naturalized daffodils.

711.03.05 Soil Berming. Refer to 710.03.10.

711.03.06 Edging. Refer to 710.03.11.

711.03.07 Mulching. Refer to 710.03.13.

711.03.08 Plant Acclimation. Refer to 710.03.06.

711.03.09 Plant Care. Refer to 710.03.07.

711.03.10 Installing. Handle annuals and bulbs with care to avoid damage or bruising. Refer to 710.03.09 and the following.

(a) Foliage Removal. Remove dead foliage of annuals and other unwanted vegetation from the previous season without damaging or disturbing perennials or other desirable vegetation.

(b) Mulch. Remove and conserve SHB mulch at sites where annuals or bulbs will be installed before digging the planting hole. Replace mulch to a depth of 2 in. over bulbs and around the stems of annuals.

711.03.11 Watering After Installation.

(a) Application Equipment. Refer to 710.03.14(a).

(b) Follow-Up Watering. Refer to 710.03.14(b).

711.03.12 Cleanup. Refer to 710.03.15.

711.03.13 Unacceptable Plants and Replacement Plants. Refer to 710.03.18, 920.07 and replace unacceptable plants as specified in Section 711 for the remainder of the growing season until Final Acceptance.

711.03.14 Installation Phase Inspection. Refer to 710.03.19.

711.03.15 Installation Phase Punch List. Refer to 710.03.20.

711.03.16 Installation Phase Acceptance. Refer to 710.03.21 and provide the Establishment Phase Schedule as specified in 711.03.02(d). Installation Phase Acceptance will be granted when the Punch List and all Installation Phase requirements are completed according to Table 2.

ANNUALS AND BULBS TABLE 2 - REQUIREMENTS FOR INSTALLATION PHASE ACCEPTANCE		
Item	**Requirement**	**Section**
a	Submittals are accepted and Inspections are completed.	710.03.01(b), 711.03.02, 920.07
b	Dead foliage in existing beds is removed.	711.03.10(a)
c	Fertilizer and compost is applied, as required.	711.03.04
d	Planting pits and planting beds are bermed and edged.	710.03.10 and 710.03.11
e	SHB mulch is uniformly spread to the specified depth.	710.03.13 and 711.03.10(b)
f	Plants receive initial watering and follow up watering.	711.03.11
g	Damaging pests are controlled.	711.03.09
h	Cleanup is completed, plant tags and ribbons are removed.	710.03.15
i	Washouts in and around planting beds are repaired.	710.03.13
j	Unacceptable plants are replaced as needed or required.	710.03.18
k	Damage repairs and Installation Phase Punch List is completed.	710.03.20
l	Pesticide Application and Nutrient Management Reporting Forms are completed.	710.03.01(d) and 710.03.01(f)
m	Plants are properly installed, are none are unacceptable or require replacement.	711.03.01 through 711.03.13
n	Establishment Phase Schedule & IPM Program is accepted.	710.03.02(d) and 711.03.16

711.03.17 Establishment Phase. The Establishment Phase for annuals and bulbs planted in beds begins upon Installation Phase Acceptance. Maintain all plants except naturalized daffodils as specified in 711.03.01 through 711.03.16 and as follows.

(a) Period of Maintenance. Plants shall be maintained for one Planting Season, until Final Acceptance.

(b) Plant Watering. Refer to 710.03.22(b).

(c) Pest Management. Refer to 710.03.22(c).

(d) Unacceptable Plants and Replacement Plants. Refer to 710.03.18. Promptly remove and replace plants that have become unacceptable during the Establishment Phase as needed, or at the request of the Engineer.

(e) End-of-Season Foliage Removal. Remove the foliage of annuals that have declined in late summer or fall, as directed by the Engineer. Remove the foliage and flower stems of bulbs planted in beds after they have declined at the end of their growing season in June.

(f) Refertilizing. Refer to 710.03.22(f).

(g) Partial Establishment Phase Inspection. Refer to 711.03.02. The Engineer and the Landscape Programs Division will inspect plant establishment according to Table 2 on the scheduled inspection date, approximately 1 month after Installation Phase Acceptance.

The Inspection Report will include actions to perform before Partial Establishment Phase Acceptance is granted. When it is not possible to perform the Inspection, Partial Establishment Phase Acceptance will be delayed until Inspection is possible.

Perform repairs, replacements, and other work as specified in the Contract Documents and Inspection Report.

711.03.18 Establishment Phase Inspection and Final Acceptance. Refer to 711.03.02. The Engineer and the Landscape Programs Division will inspect plant establishment according to Table 3 on the scheduled inspection date, at least 1 month after the Partial Establishment Phase Acceptance is granted.

The Inspection Report will include actions to perform before Final Acceptance is granted. When it is not possible to perform the Inspection, Final Acceptance will be delayed until Inspection is possible.

Perform repairs, replacements, and other work as specified in the Contract Documents and Inspection Report.

Final Acceptance will be granted when the requirements of Table 3 are satisfactorily completed. The Inspection Report will be included in the Punch List requirements for the project. Complete the Punch List requirements as directed.

ANNUALS AND BULBS
TABLE 3 - REQUIREMENTS FOR ESTABLISHMENT PHASE AND FINAL ACCEPTANCE

Item	Requirement	Section
1	Washouts in and around planting beds are repaired.	710.03.13
2	Plants are watered as needed and refertilized when directed.	710.03.22(b) and 710.03.22(f)
3	Damaging pests are controlled.	710.03.22(c)
4	Planting beds are weed free.	710.03.22(c)
5	Pesticide Reporting and Nutrient Management Reporting Forms are completed.	710.03.01(d) and 710.03.01(f)
6	Unacceptable plants are replaced as requested.	711.03.17(d)
7	End-of-season foliage removal is completed.	711.03.17(e)
8	Damage repairs and Establishment Punch List are completed.	711.03.18

711.04 MEASUREMENT AND PAYMENT

Annuals and Bulbs Installation and Establishment will be measured and paid for at the Contract unit price for one or more of the specified items. The payment will be full compensation for all plants, material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

711.04.01 Annuals and Bulbs Installation and Establishment. Annuals and Bulbs Installation and Establishment shall include the cost of plants, layout, marking, pruning, planting pit excavation, fertilizer, compost, backfilling, berming, edging, watering, pest management, plant maintenance, refertilizing, and all operations related to the Installation and Establishment Phases of each plant, until Final Acceptance.

Annuals and Bulbs Installation and Establishment will be paid according to Table 4 based upon the approved Breakdown List of Contract Prices. Refer to 711.03.02(a). In the event of change in the quantities required, payment adjustments will be based on the approved Breakdown List of Contract Prices.

(a) Payment Schedule. Payments will be made according to Table 4 when construction requirements are met.

ANNUALS AND BULBS
TABLE 4 - PAYMENT SCHEDULE

INSTALLATION AND ESTABLISHMENT PHASE COMPLETION		PERCENT OF TOTAL CONTRACT PRICE			PAYMENT FOR COMPLETED WORK
		Annuals in Beds	Bulbs in Beds	Naturalized Bulbs	
711.03.01 through 711.03.16	Installation Phase	70%	70%	100%	At Installation Phase Acceptance
711.03.17(a) through 711.03.17(d)	Establishment Phase In-Season Maintenance	15%	15%	—	At Partial Establishment Phase Acceptance
711.03.17(e) through 711.03.17(g)	End-of-Season Maintenance, Removal & Replacement, and Final Acceptance	15%	15%	—	At Final Acceptance
Total Payment		100%	100%	100%	—

(b) Forfeiture. Failure to complete operations as required or directed in conformance with the Payment Schedule will result in forfeiture of that percentage of payment based upon the Breakdown List of Contract Prices.

711.04.02 Constructing Planting Beds. Refer to 710.04.02.

711.04.03 Temporary Mulch will be measured and paid for at the Contract unit price.

CATEGORY 700
LANDSCAPING

SECTION 712 — TREE BRANCH PRUNING

712.01 DESCRIPTION

Prune tree branches as indicated in the SP 700 Tree Preservation Program, or in the plans. Perform Tree Branch Pruning in conformance with 101.03.02, and Section 120 when pruning is specified within the limits of a Tree Preservation Area.

712.02 MATERIALS

Not applicable.

712.03 CONSTRUCTION

712.03.01 General.

(a) Permits. Obtain a Roadside Tree Permit from the Maryland Department of Natural Resources - Forest Service.

(b) Tree Preservation Program (TPP). Conform to the requirements of the TPP when developed by the Administration.

(c) Schedule. Perform operations when weather conditions are suitable. Cease operations when conditions are unsuitable.

712.03.02 Breakdown List of Contract Prices. Refer to 712.04 and develop a Breakdown List of Contract Prices for each tree or group of trees in the Contract. Include costs for pruning and completing all operations per tree or group of trees.

Submit the written Breakdown List within 14 days after Notice of Award. The Breakdown List will be reviewed by the Engineer and Landscape Programs Division for completeness and balance, and will be approved or returned for correction.

712.03.03 Maryland Licensed Tree Expert (LTE). A LTE shall perform or directly supervise the Operations in conformance with the Maryland Roadside Tree Law, the Forest Conservation Act, and accepted arboricultural practices.

712.03.04 Meetings. Meet with the Engineer, the LTE, and the LPD to review areas, Operations, and the approved Breakdown List of Contract Prices before beginning Operations.

712.03.05 Marking. Identify trees to be pruned, and obtain approval before beginning Operations.

712.03.06 Equipment. Equipment and tools shall conform to accepted arboricultural practices.

712.03.07 Notice. Notify the Engineer at least 10 days before beginning Operations.

712.03.08 Operations. The Contract Documents will indicate the trees to be pruned or the dimensions or goals to be achieved by pruning. Meet ANSI A300 standards for Tree Care Operations in conformance with one or more of the following Operations, or as specified.

(a) Cleaning. To remove dead, diseased, and broken branches.

(b) Thinning. To reduce the density of live branches; or to remove crossed branches or a codominant leader.

(c) Raising. To provide vertical clearance to a height of 16 ft, or as specified in the Contract Documents.

(d) Reducing. To decrease the height or spread.

(e) Specialty Pruning. To meet the needs of young trees, at planting, once established, pollarding, for restoration, to maintain vistas, or to accommodate utilities.

712.03.09 Wood Chipping. Dispose of wood, or chip wood and disperse chips to a depth of 1 in. as directed.

712.03.10 Cleanup and Restoration. Avoid damage to existing structures, plants, and turfgrass. Keep turfgrass areas, paved surfaces and sidewalks clean. Restore ruts and damaged turfgrass areas by seeding in conformance with Section 705, or perform Turfgrass Sod Establishment in conformance with Section 708 when directed, before beginning any other landscape operations.

712.03.11 Damage Repair. Do not injure vegetation to be preserved. Repair injuries to bark, trunks, or limbs by cutting, smoothing, and tracing the bark in accordance with ANSI A300 Standards for Tree Care Operations.

712.03.12 Damage Compensation. Monetary compensation for damage or loss of trees will be calculated and assessed in conformance with the Guide for Plant Appraisal of the Council of Tree & Landscape Appraisers.

712.04 MEASUREMENT AND PAYMENT

Tree Branch Pruning will not be measured but will be paid for at the Contract lump sum price based upon the Breakdown List of Contract Prices. The payment will be full compensation for all labor, material, equipment, tools, wood disposal and chipping, cleanup and restoration, damage repair, disposal fees and incidentals necessary to complete the work. If the Administration requests a change, the units and payment will be adjusted on the basis of the approved Breakdown List of Contract Prices.

CATEGORY 700
LANDSCAPING

SECTION 713 — BRUSH REMOVAL

713.01 DESCRIPTION

Remove brush as indicated in the SP 700 Tree Preservation Program, or in the plans. Perform Brush removal within a Tree Preservation Area per Section 120 when specified, but do not perform these operations within areas of Clearing and Grubbing.

When areas of bare soil are caused by Brush Removal operations, perform Temporary Mulch in conformance with Section 704 to provide temporary soil stabilization, or perform Turfgrass Establishment in conformance with Section 705, or perform other stabilization as directed.

713.02 MATERIALS

Herbicide	920.09.03(a)
Water	920.09.01
Marking Dye	920.09.04

713.03 CONSTRUCTION

713.03.01 General.

(a) Permits. Obtain a Roadside Tree Permit from the Maryland Department of Natural Resources - Forest Service.

(b) Tree Preservation Program (TPP). Conform to the requirements of the TPP when developed by the Administration.

(c) Schedule. Perform operations when soil moisture and weather conditions are suitable. Cease operations when conditions are unsuitable.

(d) Pesticide Application. Refer to 701.03.01(b).

(e) Pesticide Application Reporting. Refer to 701.03.01(e).

713.03.02 Maryland Licensed Tree Expert (LTE). A LTE shall perform or directly supervise the Operations in conformance with the Maryland Roadside Tree Law, the Forest Conservation Act, and accepted arboricultural practices.

713.03.03 Meetings. Meet with the Engineer, the LTE, and the Landscape Programs Division to review areas and Operations before beginning Operations.

713.03.04 Marking. Mark areas where brush is to be removed. Identify trees and shrubs to be preserved and protected. Ensure that marking and identification is completed and approved before beginning Operations.

713.03.05 Equipment. Equipment and tools shall conform to accepted arboricultural practices.

713.03.06 Notice. Notify the Engineer at least 10 days before beginning Operations.

713.03.07 Operations. Brush removal shall involve cutting, herbicide treatment, and debris removal of areas of living or dead vegetation. Do not injure vegetation identified for preservation. One or more of the following Operations will be specified:

(a) Operation 1 - Brush Removal. Cut vegetation to a height of no more than 1 in. above the soil surface. Remove wood debris.

(b) Operation 2 - Brush Removal with Stump Treatment. Cut vegetation as in Operation 1. Immediately treat the cambium layer and exposed bark of live stumps with an approved herbicide solution and marking dye. Remove wood debris.

713.03.08 Wood Chipping. Dispose of wood in conformance with the pertinent Operation, or chip wood and disperse chips to a depth of 1 in. as directed.

713.03.09 Cleanup and Restoration. Avoid damage to existing structures, plants, and turfgrass. Keep turfgrass areas, paved surfaces and sidewalks clean. Promptly remove, disperse or dispose of wood debris and other waste materials as directed. Restore ruts and damaged turfgrass outside of areas of Brush Removal by seeding in conformance with Section 705, or perform Turfgrass Sod Establishment in conformance with Section 708 when directed, before beginning other landscape operations.

713.03.10 Damage Repair. Do not injure vegetation to be preserved. Repair injuries to bark, trunks, or limbs by cutting, smoothing, and tracing the bark in accordance with ANSI A300 Standards for Tree Care Operations.

713.03.11 Damage Compensation. Monetary compensation for damages or loss of trees will be calculated and assessed in conformance with the Guide for Plant Appraisal of the Council of Tree & Landscape Appraisers.

713.04 MEASUREMENT AND PAYMENT

Brush Removal will be measured and paid for at the Contract unit price per square yard, as specified. The payment will be full compensation for all labor, material, equipment, tools, wood disposal and chipping, cleanup and restoration, damage repair, disposal fees and incidentals necessary to complete the work.

713.04.01 Payment for Temporary Mulch, Turfgrass Establishment, or for other vegetation establishment within areas of Brush Removal will be measured and paid for at the pertinent Contract Unit price.

CATEGORY 700
LANDSCAPING

SECTION 714 — TREE FELLING AND STUMP REMOVAL

714.01 DESCRIPTION

Fell trees and remove stumps as indicated in the SP 700 Tree Preservation Program, or in the plans. Perform Tree Felling and Stump Removal within a Tree Preservation area per Section 120 when specified, but do not perform these operations within areas of Clearing and Grubbing.

714.02 MATERIALS

Furnished Topsoil	920.01.02
Herbicide	920.09.03(a)
Water	920.09.01
Marking Dye	920.09.04

714.03 CONSTRUCTION

714.03.01 General.

(a) Permits. Obtain a Roadside Tree Permit from the Maryland Department of Natural Resources - Forest Service.

(b) Tree Preservation Program (TPP). Conform to the requirements of the TPP when developed by the Administration.

(c) Schedule. Perform operations when soil moisture and weather conditions are suitable. Cease operations when conditions are unsuitable.

(d) Pesticide Application. Refer to 701.03.01(b).

(e) Pesticide Application Reporting. Refer to 701.03.01(e).

714.03.02 Breakdown List of Contract Prices. Refer to 714.04 and develop a Breakdown List of Contract Prices for each tree or stump in the Contract. Include costs for felling, removing stumps, and completing all required operations per tree or stump.

Submit the written Breakdown List within 14 days after Notice of Award. The Breakdown List will be reviewed by the Engineer and Landscape Programs Division for completeness and balance, and will be approved or returned for correction.

714.03.03 Maryland Licensed Tree Expert (LTE). A LTE shall perform or directly supervise the Operations in conformance with the Maryland Roadside Tree Law, the Forest Conservation Act, and accepted arboricultural practices.

714.03.04 Meetings. Meet with the Engineer, the LTE, and the LPD to review areas, Operations, and the Breakdown List of Contract Prices before beginning Operations.

714.03.05 Utilities and Tree Marking. Refer to Section 875 when included in the Contract Documents.

(a) Utilities Marking. Contact 'Miss Utility' or another approved service to identify and mark utilities in the rights-of-way and on SHA Property.

(b) Tree Marking. Mark trees to be felled. Obtain approval before beginning Operations.

714.03.06 Equipment. Equipment and tools shall conform to accepted arboricultural practices.

714.03.07 Notice. Notify the Engineer at least 10 days before beginning Operations.

714.03.08 Operations. Tree felling and stump removal involves cutting, herbicide treatment, stump removal, stump grinding, debris removal, and restoration of turfgrass in conformance with the pertinent Operation. When trees cannot be felled as a unit without danger to traffic or injury to other plants or property, remove the top in sections until the tree can be safely felled. One or more of the following Operations will be specified.

(a) Operation 1 - Felling and Stump Removal. Perform Operation 1 in turfgrass areas, or as specified. Fell trees and remove the stumps or grind them to a depth at least 8 in. below the finished surface. Remove wood debris and stump grindings. Within 24 hours after removal or grinding, backfill the stump hole with topsoil to the surrounding soil level. Perform Turfgrass Sod Establishment in conformance with Section 708, or perform Turfgrass Establishment in conformance with Section 705 when directed.

(b) Operation 2 - Felling and Stump Treatment. Perform Operation 2 for Tree of Heaven and other species that sprout from stumps, as directed. Fell trees and remove wood debris. Cut stumps to a height of no more than 4 in. above the soil surface. Treat stumps with herbicide as specified in 713.03.07(b).

(c) Operation 3 - Felling and Removal. Perform Operation 3 in non-turfgrass areas. Fell trees and remove wood debris. Cut stumps to a height of no more than 4 in. above the soil surface.

(d) Operation 4 - Felling and Delimbing. Perform Operation 4 in naturalized areas that will not be maintained. Fell trees and cut stumps to a height of no more than 12 in. above the soil surface. Branches of felled trees that extend higher than 3 ft above the soil surface shall be cut or delimbed to a height of no more than 3 ft above the soil surface. Do not remove wood debris.

(e) Operation 5 - Stump Removal. Perform Operation 5 to remove stumps of trees in turfgrass areas that were not removed per Operation 1. Remove existing stumps or grind them to a depth at least 8 in. below the finished surface. Remove wood debris and stump grindings. Within 24 hours after removal or grinding, backfill the stump holes with topsoil to the surrounding finished surface. Perform Turfgrass Sod Establishment in conformance with Section 708, or perform Turfgrass Establishment in conformance with Section 705 when directed.

714.03.09 Wood Disposal and Chipping. Dispose of wood in conformance with the pertinent Operation, or chip wood and disperse chips on flat areas and slopes to depths up to 2 in., or to depths as directed. Do not disperse chips onto impervious surfaces, onto turfgrass, or into ditches, stormwater facilities or wetlands.

714.03.10 Cleanup and Restoration. Avoid damage to existing structures, plants, and turfgrass. Keep turfgrass areas, paved surfaces and sidewalks clean. Promptly remove, disperse or dispose of wood debris and other waste materials as directed. Restore ruts and damaged turfgrass areas by seeding in conformance with Section 705, or perform Turfgrass Sod Establishment in conformance with Section 708 when directed, before beginning other landscape operations.

714.03.11 Damage Repair. Do not injure vegetation to be preserved. Repair injuries to bark, trunks, or limbs by cutting, smoothing, and tracing the bark in accordance with ANSI A300 Standards for Tree Care Operations.

714.03.12 Damage Compensation. Monetary compensation for damage or loss of trees will be calculated and assessed in conformance with the Guide for Plant Appraisal of the Council of Tree & Landscape Appraisers.

714.04 MEASUREMENT AND PAYMENT

Tree Felling and Stump Removal will not be measured but will be paid for at the Contract lump sum price based upon the Breakdown List of Contract Prices.

The payment will be full compensation for all labor, material, equipment, tools, wood disposal and chipping, cleanup and restoration, damage repair, disposal fees and incidentals necessary to complete the work. Topsoil and materials required to perform Turfgrass Establishment and Turfgrass Sod Establishment shall be incidental to the Contract price for Tree Felling and Stump Removal.

If the Administration requests a change, the units and payment will be adjusted on the basis of the approved Breakdown List of Contract Prices.

CATEGORY 700
LANDSCAPING

SECTION 715 — TREE ROOT PRUNING

715.01 DESCRIPTION

Prune tree roots as indicated in the SP 700 Tree Preservation Program, or in the plans. Perform Tree Root Pruning within a Tree Preservation Area per Section 120 when specified.

715.02 MATERIALS

Salvaged Topsoil	920.01.01
Furnished Topsoil	920.01.02

715.03 CONSTRUCTION

715.03.01 General.

(a) Permits. Obtain a Roadside Tree Permit from the Maryland Department of Natural Resources - Forest Service.

(b) Tree Preservation Program (TPP). Adhere to the requirements of the TPP when developed by the Administration.

(c) Schedule. Perform operations when soil moisture and weather conditions are suitable. Cease operations when conditions are not suitable.

715.03.02 Maryland Licensed Tree Expert (LTE). A LTE shall perform or directly supervise the Operations in conformance with the Maryland Roadside Tree Law, the Forest Conservation Act, and accepted arboricultural practices.

715.03.03 Meetings. Meet with the Engineer, the LTE, and the Landscape Programs Division before beginning Operations.

715.03.04 Utilities Marking and Conflicts. Refer to Section 875 when included in the Contract Documents.

(a) Utilities Marking. Contact ‘Miss Utility’ or another approved service to identify and mark utilities in the rights-of-way and on SHA property.

(b) Conflicts. Notify the Administration of conflicts that may affect operations. Conflicts will be reviewed by the Landscape Programs Division and resolved within 14 days after notice.

715.03.05 Marking. Mark areas to be root pruned, and obtain approval before beginning Operations.

715.03.06 Equipment. Use a vibratory knife or other equipment and tools that conform to accepted arboricultural practices.

715.03.07 Notice. Notify the Engineer at least 10 days before beginning Operations.

715.03.08 Operations. Meet ANSI A300 standards for Tree Care Operations. Cleanly cut tree roots along the approved line to a depth of 24 in., or to the depth specified in the Tree Preservation Program, and immediately backfill trenches with excavated soil.

715.03.09 Cleanup and Restoration. Avoid damage to existing structures, plants, and turfgrass. Keep turfgrass areas, paved surfaces and sidewalks clean. Promptly remove, disperse, or dispose of wood debris and other waste materials as directed. Restore areas of root pruning, ruts and damaged turfgrass areas by seeding in conformance with Section 705, or perform Turfgrass Sod Establishment in conformance with Section 708 when directed, before beginning other landscape operations.

715.03.10 Damage Repair. Do not injure vegetation to be preserved. Repair injuries to bark, trunks, or limbs by cutting, smoothing, and tracing the bark in accordance with ANSI A300 Standards for Tree Care Operations.

715.03.11 Damage Compensation. Monetary compensation for damage or loss of trees will be calculated and assessed in conformance with the Guide for Plant Appraisal of the Council of Tree & Landscape Appraisers.

715.04 MEASUREMENT AND PAYMENT

Tree Root Pruning will be measured and paid for at the Contract unit price per linear foot. The payment will be full compensation for all labor, material, equipment, tools, cleanup and restoration, damage repair, disposal fees and incidentals necessary to complete the work.

CATEGORY 700
LANDSCAPING

SECTION 716 — TREE FERTILIZING

716.01 DESCRIPTION

Fertilize trees as indicated in the SP 700 Tree Preservation Program, or in the plans. Perform Tree Fertilizing within a Tree Preservation Area per Section 120 when specified.

716.02 MATERIALS

Fertilizer	920.03.01, and as specified in the TPP.
Water	920.09.01

716.03 CONSTRUCTION

716.03.01 General.

(a) Permits. Obtain a Roadside Tree Permit from the Maryland Department of Natural Resources - Forest Service.

(b) Tree Preservation Program (TPP). Conform to the requirements of the TPP when developed by the Administration.

(c) Schedule. Perform operations when soil moisture and weather conditions are suitable. Cease operations when conditions are unsuitable.

(d) Nutrient Management Plan (NMP). The fertilizer application rates of this Section will be the NMP for Tree Fertilizing unless other rates are specified in the TPP.

(e) Nutrient Management Reporting. Record the location and details of fertilizer applications on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying fertilizer.

716.03.02 Maryland Licensed Tree Expert (LTE). A LTE shall perform or directly supervise the Operations in conformance with the Maryland Roadside Tree Law, the Forest Conservation Act, and accepted arboricultural practices.

716.03.03 Meetings. Meet with the Engineer, the LTE, and the Landscape Programs Division before beginning Operations.

716.03.04 Marking. Identify trees to be fertilized and obtain approval before beginning Operations.

716.03.05 Equipment. Equipment and tools shall conform to accepted arboricultural practices.

716.03.06 Notice. Notify the Engineer at least 10 days before beginning Operations.

716.03.07 Operations. Meet ANSI A300 standards for Tree Care Operations. One or more of the following Operations will be specified.

(a) Operation 1 - Injection Fertilizing. Dissolve 200 lb of 20-20-20 water soluble fertilizer in 1000 gal of water, or as specified in the TPP.

Uniformly inject fertilizer solution through a pressurized probe at points 2 ft to 3 ft apart, to a depth of 8 in. to 10 in. below the soil surface, under the dripline of the tree, or at the spacing and depth specified in the TPP.

Inject fertilizer solution at the rate of 1000 gal of solution per acre, or 0.21 gal of solution per yd^2, or at the application rate specified in the TPP.

(b) Operation 2 - Drill Fertilizing. Drill 1 in. to 3 in. diameter holes, at points 2 ft to 3 ft apart, to a depth of 8 in. to 10 in., or as specified in the TPP.

Uniformly apply 200 lb per acre of 20-16-12 (83 percent UF with MAP & SOP) into drilled holes, or at the rate specified in the TPP.

(c) Operation 3 - Broadcast Fertilizing. Uniformly apply 200 lb per acre of 20-16-12 (83 percent UF with MAP & SOP) fertilizer over the soil surface under the dripline of the tree using approved fertilizer spreader machinery, or at the fertilizer application rate and locations specified in the TPP.

716.03.08 Cleanup and Restoration. Avoid damage to existing structures, plants, and turfgrass. Keep turfgrass areas, paved surfaces, and sidewalks clean. Restore ruts and damaged turfgrass areas by seeding in conformance with Section 705, or perform Turfgrass Sod Establishment in conformance with Section 708 when directed, before beginning other landscape operations.

716.03.09 Damage Repair. Do not injure vegetation to be preserved. Repair injuries to bark, trunks, or limbs by cutting, smoothing, and tracing the bark in accordance with ANSI A300 Standards for Tree Care Operations.

716.03.10 Damage Compensation. Monetary compensation for damage or loss of trees will be calculated and assessed in conformance with the Guide for Plant Appraisal of the Council of Tree & Landscape Appraisers.

716.04 MEASUREMENT AND PAYMENT

Tree fertilizing will be measured and paid for at the Contract unit price for one or more of the specified items. The payment will be full compensation for all labor, fertilizer, water, material, equipment, tools, cleanup and restoration, damage repair, disposal fees and incidentals necessary to complete the work.

716.04.01 Tree Injection Fertilizing per square yard.

716.04.02 Tree Drill Fertilizing per square yard.

716.04.03 Tree Broadcast Fertilizing per square yard.

CATEGORY 800
TRAFFIC

SECTION 801 — CONCRETE FOUNDATIONS

801.01 DESCRIPTION

Construct concrete foundations for installing traffic signals, highway lighting, and signs.

801.02 MATERIALS

Curing Materials	902.07
Portland Cement Concrete	902.10, Mix No. 3
Corrugated Metal Pipe	Section 905
Reinforcement Steel	Section 908
Anchor Bolts	909.08
Conduit	950.10
Galvanizing for Hardware	A153

801.03 CONSTRUCTION

801.03.01 Excavation. Excavate to the dimensions specified. Ensure that all excavation work is inspected and approved before proceeding with construction.

801.03.02 Galvanized parts that have been cut or chipped to bare metal shall be repaired according to A780.

801.03.03 Concrete Placement. Place concrete against undisturbed earth wherever possible. However, where the existing ground shows a tendency to cave in or otherwise will not retain its shape during or after excavation provide, install, and leave in place a corrugated steel pipe.

Mix, place, and test concrete as specified in Section 420. Construct footings, including reinforcement and bolt circle data, as specified in the Contract Documents and in conformance with the approved working drawings. Use suitable and accurately placed templates to set the anchor bolts plumb. Leave the templates in place until the concrete attains initial set.

Apply a level trowel finish to the top of the foundation. Apply a liquid membrane forming compound to all exposed surfaces.

801.03.04 Unusual Soil Conditions. When unexpected subsurface conditions are encountered, modify the excavation depth as directed. If rock or boulders cannot be removed by ordinary means, remove them to the levels and dimensions specified, or to a depth necessary to obtain the required stability.

801.03.05 Backfill. Use material that is free of topsoil, organic, frozen, and other undesirable materials. Keep spaces to be backfilled free of trash. Clean the space before placing backfill. Use suitable material from the excavation or other sources as specified in Section 204. Place in layers not more than 8 in. loose thickness. Use mechanical or vibratory compaction equipment to obtain at least 92 percent of maximum density at a moisture content within 2 percent of the optimum according to T 180, Method C.

801.04 MEASUREMENT AND PAYMENT

Concrete foundations for installing traffic signals, highway lighting, and signs will be measured and paid for at the Contract unit price per cubic yard for the pertinent Concrete Foundation item. The payment will be full compensation for all concrete, excavation, corrugated metal pipe or forms, reinforcement steel, anchor bolts, backfill, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Where concrete barrier transitions, grounding, and conduit are required, they will be measured and paid for as specified in Section 604, Section 804, and Section 805 respectively.

CATEGORY 800
TRAFFIC

SECTION 802 — GALVANIZED STEEL BEAM SIGN POSTS

802.01 DESCRIPTION

Furnish and install galvanized steel beam sign posts.

802.02 MATERIALS

Bolts, Nuts and Washers	909.07
Galvanizing for Beams	A123
Galvanizing for Hardware	A153
Steel Beams	A709

802.03 CONSTRUCTION

Stake each location for approval. Upon approval, submit working drawings. Show the highest elevation of the traveled roadway and the shoulder elevation at each post location. Upon approval of the working drawings, materials may be ordered.

Galvanized parts that have been cut or chipped to bare metal shall be repaired according to A780. Install posts plumb and to the lateral orientation specified.

802.04 MEASUREMENT AND PAYMENT

Galvanized Steel Beam Sign Posts will be measured and paid for at the Contract unit price per linear foot for the various sizes of posts specified. The payment will be full compensation for stakeout, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Breakaway Base Support Systems will be measured and paid for as specified in Section 821.

CATEGORY 800
TRAFFIC

SECTION 803 — OVERHEAD SIGN STRUCTURES

803.01 DESCRIPTION

Furnish and install overhead sign structures and appurtenances. Sign panels, electrical work, luminaires, and foundations are excluded.

803.02 MATERIALS

Bolts, Nuts and Washers	909.07
Overhead Sign Structures	950.04

803.03 CONSTRUCTION

Do all fabrication in the shop as specified in Section 430, except do welding in accordance with ANSI/AWS D1.1, Tubular Structures.

Design and manufacture all assemblies and tubular members as specified in A385 to permit hot dip galvanizing. Make all holes required in the supports before galvanizing. Protect the surfaces during transportation and handling.

The structure shall be free from sharp edges, irregularities, misfits, and structural deficiencies. After installation and before final acceptance, repair or replace all damaged surfaces.

Stake each location for approval by the Engineer. Upon approval, submit working drawings. Show the highest elevation of the traveled roadway and the shoulder elevation at each support location. Upon approval of the working drawings, materials may be ordered.

803.04 MEASUREMENT AND PAYMENT

Overhead Sign Structures will be measured and paid for at the Contract unit price per each. The payment will be full compensation for all stakeouts, sign and luminaire supports, nuts and washers, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 804 — GROUNDING

804.01 DESCRIPTION

Furnish and install grounding systems.

804.02 MATERIALS

Ground Wire and Rods 950.06.04

804.03 CONSTRUCTION

The grounding system shall conform to the latest editions of the NEC and NESC. Grounding of overhead communication cable and messenger cable attached to a utility company owned pole shall also conform to the utility company's requirements.

804.03.01 Equipment Grounding System. This system shall consist of the ground wire, electrically continuous metallic conduit system, span wire, steel poles, grounding conductors, communications cable steel spans, ground rods, steel span wire back guying, steel span wire pole to pole guying, and steel span wire slack spans and terminations.

Grounding for overhead communications cable shall be to all of the following when present: at the telephone and CATV cables support span wires, at the ground wire of a multigrounded system, at the neutral wire of a multigrounded system, and at the ground of a secondary circuit with approved span wire grounding clamps. Grounding to the overhead communication cable support span at utility company owned poles shall be with a vise type body clamp equipped with jaws having teeth to pierce the insulation, without stripping the jacket on the overhead communications cable span wire, and operated by a single hexagonal head bolt.

804.03.02 Grounding Conductors. Furnish and install grounding conductors of the size and type specified.

804.03.03 Ground Rods. Install ground rods as specified. Measure the ground resistance of each rod before connecting the rod to the grounding conductor. If the measured resistance exceeds 25 ohms, exothermically weld a 10 ft extension rod to the top of the first rod and drive to its full depth. Measure the earth resistance again. If it still exceeds 25 ohms, contact the Engineer for instructions.

Where rock is encountered and acceptable earth grounds cannot be accomplished by driving as described above, the Engineer may direct the use of a grounding grid. In a grounding grid, direct buried rods are exothermically welded end to end to bond lighting standards and structures in continuous series to some point where an acceptable earth ground can be obtained.

804.03.04 Continuity. Maintain continuity of the equipment grounding system throughout the project.

804.03.05 Terminations. Connection to equipment grounding system shall be made with suitable lugs at all grounding bushings specified in Section 805, and at the ground lugs in lighting structure access holes or in a breakaway base. Make connections to ground rods as specified in the Contract Documents. Connections to neutral grounding systems shall be made with lugs as specified in Section 805.

Overhead communication cable shall be made with connectors installed at the first attachment on a utility company owned pole in the following method: at the last attachment on the pole; at every fifth attachment between the first and last attachment on the pole; at each attachment where power, CATV, and telephone cables continue onto differing poles; at each attachment where power, CATV, and telephone cables converge onto the same pole; at attachments on poles equal to 1/4 mile or more; and at where more than one separate attachment or guy is on the same pole. Grounding connectors shall be installed to the overhead communications cable, to the telephone and CATV cables support span wires when present, to the ground wire of a multigrounded system, to the neutral wire of a multigrounded system, and to the ground of a secondary circuit. The ground wire between clamps shall be stapled every 12 in.

804.03.06 Testing. Section 820.

804.04 MEASUREMENT AND PAYMENT

Ground Rods will be measured and paid for at the Contract unit price per each 10 ft length. The payment will be full compensation for lugs and welding, excavation, backfill, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Ground wire will be measured and paid for as specified in 810.04.01.

CATEGORY 800
TRAFFIC

SECTION 805 — ELECTRICAL CONDUIT AND FITTINGS

805.01 DESCRIPTION

Furnish and install electrical conduit and fittings.

805.02 MATERIALS

Portland Cement Concrete	902.10, Mix No. 6
Metallic Conduit and Fittings	921.07.01
Nonmetallic Conduit and Fittings	921.07.02
Flexible Conduit and Fittings	921.07.02
PVC Coated Metallic Conduit and Fittings	921.07.03

805.03 CONSTRUCTION

805.03.01 Bends. Unless otherwise specified, use manufactured bends or field bends to make changes in direction. Maintain an 18 in. trade radius.

805.03.02 Connections. Make conduit runs with as few couplings as standard length will permit. Rigid steel conduit connections shall be threaded. Paint field cut threads of galvanized conduit with approved galvanizing repair paint prior to assembly. Connect nonmetallic conduit using a solvent welding process. Use watertight cast ferrous compression type fittings for electrical metallic tubing (EMT).

805.03.03 Conduit Terminations. Use pull boxes or conduit bodies at conduit terminations. Conduits terminating in cast iron junction boxes shall be threaded into hubs, with bonding screws furnished and installed on the interior of the box. Conduits terminating in junction boxes without hubs shall be secured with two lock nuts with an insulated grounding bushing installed. Conduits terminating at concrete foundations, manholes, or hand holes shall be secured as specified in the Contract Documents. Cap all ends of unused conduit.

805.03.04 Cleaning and Capping. Prior to installing conductors, remove all obstructions and debris by pulling a mandrel type device through each conduit run and all fittings in the presence of the Engineer. Cap conduit ends by using a manufactured cap or plug. Prior to the installation of wiring, remove manufactured caps or plugs and install an insulated bonding bushing on galvanized rigid conduit; install bell end fittings on PVC conduit.

805.03.05 Pull Wire. Install a pull wire or cord in all conduits left empty. Pull wire and cord shall be corrosion resistant material with a breaking strength of at least 200 lb.

805.03.06 Exposed Conduit. Exposed conduit runs shall be parallel or at right angles to walls, slabs, girders, etc. Locate conduit to minimize accumulation of dirt and to provide accessibility for painting. Attach conduit to steel, concrete, masonry, or timber using straps, clamps, or hangers of an approved type made of stainless steel or galvanized malleable iron. Space the attachments as specified. When specified, paint all exposed rigid steel conduit surfaces to match the color of adjacent material. Prepare all galvanized surfaces as specified in Section 435 before the application of approved paint.

805.03.07 Expansion Joints. Where conduits cross expansion joints in the structure, or where otherwise specified, use expansion fittings of a type that ensures electrical continuity across the joint.

805.03.08 Buried Conduit (Trenched). Conduits shall be sloped to drain and have a cover of at least 24 in.

805.03.09 Encased Conduit (Slotted or Trenched). Place the conduit accurately, and secure it rigidly to maintain position during concrete placement.

805.03.10 Conduit Installation Under Existing Paved Areas (Bored). Do not cause any disturbance to the existing roadway.

805.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, backfill, encasement concrete, asphalt mixes, paint, pull wires, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

805.04.01 Electrical conduit and electrical conduit attached to Bridges will be measured and paid for at the Contract unit price per linear foot measured along the center line of the conduit from end to end.

805.04.02 Electrical hand holes, manholes, pull and junction boxes will be measured and paid for as specified in Section 811.

805.04.03 Electrical conduit, fittings, and junction boxes constructed into concrete structures will not be measured but the cost will be incidental to the pertinent Concrete Traffic Barrier, Concrete Parapet, or other pertinent Concrete items specified in the Contract Documents.

CATEGORY 800
TRAFFIC

SECTION 806 — LUMINAIRES AND LAMPS

806.01 DESCRIPTION

Furnish and install luminaires and lamps.

806.02 MATERIALS

Luminaires and Lamps	950.12
LED Roadway Luminaires	950.12
Photoelectric Controls	950.13.02

Select LED Roadway Luminaires from the Qualified Product List.

806.03 CONSTRUCTION

Attach a safety cable to access doors that face downward and that support the weight of all or part of the ballast. The safety cable shall restrict the amount the door may swing open to 90 degrees. The cable shall be attached to the door by spring clips that can be removed without the use of tools, to allow the door to be easily removed.

806.03.01 Arm Mounted Luminaires. Adjust socket positions to provide the required photometric performance. Provide an individual photocell on each luminaire when specified.

806.03.02 Bridge Underpass Luminaires. Adjust socket positions to provide the required photometric performance.

806.03.03 Cleaning. Prior to the 30 day performance test, clean refractors and reflectors with a product approved by the manufacturer.

806.03.04 Installation. Furnish and install all luminaires and lamps in conformance with the manufacturer's recommendations or as specified in the Contract Documents.

806.03.05 Luminaire Photometric Data and Calculations. Submit the following data with the catalog cut for the luminaire.

(a) Photometric Data. A photometric file for the luminaire selected, in standard IES electronic format. Clearly indicate the name of the file on the catalog cut.

(b) Photometric Calculations. Printouts of the predicted lighting levels for the areas indicated in the Contract Documents. If no areas are indicated, select a typical section of the project for each type of luminaire. Assume a maintenance factor of 0.81 for the calculations.

Calculations for roadway luminaires shall show predicted horizontal footcandle values and veiling luminance ratios for the section selected.

For pedestrian luminaires, show calculations for a typical section of walkway. If any of the walkway is adjacent to a roadway, select a section adjacent to the roadway. The printouts shall show predicted horizontal footcandles for the section of walkway selected, and horizontal footcandles and veiling luminance ratios for the roadways adjacent to the walkway. If roadway lighting also illuminates the adjacent walkway, include the roadway lighting luminaires in the calculations.

For proposed changes to luminaire models during the course of the Contract, or if the manufacturer changes specifications for the luminaire during the Contract, submit photometric calculations and diskette for each change.

All calculated lighting levels for roadway lighting shall be at least the levels specified in the Contract Documents. When no levels are specified, the calculated lighting levels shall be at least those specified in IES RP-8-00 American Standard Practice for Roadway Lighting.

All calculated lighting levels on pedestrian walkways lighting shall be at least the levels specified in the Contract Documents. When no levels are specified, the calculated levels shall conform to IES. In all cases, the maximum calculated veiling luminance ratios on the traveled roadway adjacent to the walkway shall not exceed 0.4.

For Light Emitting Diode (LED) Roadway Luminaires, correction factors shall be applied for the lumen retention at 50 000 hours. The illuminance shall not decrease by more than 10 percent at 50 000 hours, which results in a Lamp Lumen Depreciation (LLD) factor of 0.9. Apply an additional factor of 0.9 for Luminaire Dirt Depreciation (LDD), to obtain a total maintenance factor of 0.81 for calculations. Provide a luminaire mounting height of 40 ft with light centers directly over the edge line of the roadway. Assume four poles in a straight line, parallel to the roadway, spaced at 180 ft each. Perform calculations for illuminance and luminance based on a R3 class pavement. The calculation grid shall be based on a two lane road with 12 ft lanes and shall be placed between the center two poles. Calculate two lines of points for each lane. The first and the second line of calculation points shall be 4 ft from the left and 4 ft from the right lane lines, respectively. Start each line of calculation points directly under the second luminaire and continue every 20 ft until directly under the third luminaire. Each line shall have 10 points, and a total of 40 points shall be calculated. To be acceptable, the average maintained illuminance of all 40 points shall be 0.9 ft candles or greater with an average to minimum uniformity ratio no greater than 4 to 1.

All roadway and pedestrian luminaires shall conform to the following criteria:

(a) Fixed Aim Luminaires. Fixed aim luminaires, such as cobra-head or post top luminaires, shall have an IES Type 3 distribution pattern or as specified in the Contract Documents. The luminous intensity shall not exceed 100 candelas per 1000 lamp lumens for any point 80 degrees, or higher, above nadir.

(b) Adjustable Aim Luminaires. Adjustable aim luminaires, such as floodlights, shall have an IES Type 3 distribution pattern or as specified in the Contract Documents. The luminous intensity shall not exceed 100 candelas per 1000 lamp lumens for any point 80 degrees, or higher, above nadir; or exceed 25 candelas per 1000 lamp lumens for any point 90 degrees, or higher above nadir; when the aiming point is nadir.

(c) High Mast Luminaires. High mast luminaires shall have an IES Type 4 distribution pattern or as specified in the Contract Documents. The luminous intensity shall not exceed 100 candelas per 1000 lamp lumens for any point 80 degrees, or higher, above nadir; or exceed 25 candelas per 1000 lamp lumens for any point 90 degrees, or higher above nadir.

(d) Fixed Aim LED Luminaires. LED Roadway Luminaires shall be a complete lighting device consisting of a cast aluminum housing, LED arrays, LED drivers, terminal blocks, associated hardware, all necessary wiring, and an optical assembly that provides an Illuminating Engineering Society of North America (IESNA) Type II, Type III, Type IV, or Type V distribution as specified in the Contract Documents. If no distribution type is specified, then the Luminaire must have an IESNA Type III distribution. LED Roadway Luminaires shall meet the requirements of a Full Cutoff distribution as defined by IESNA. For 480 volt operation, an integral transformer shall be provided to reduce the voltage.

Testing. Submittal and approval of photometric data and calculations shall not remove the responsibility to perform the photometric testing required by Section 820, or to correct or replace lighting where field measurements do not conform to Administration or IES requirements. The Administration may waive the requirements of 820.03.02(d) for illuminance testing.

806.04 MEASUREMENT AND PAYMENT

Luminaires will be measured and paid for at the Contract unit price per each. The payment will be full compensation for photocell, when required, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Light Emitting Diode Roadway Luminaires will be measured and paid for at the contract unit price per each. The payment will be full compensation for the Light Emitting Diode Roadway Luminaire and drivers, mounting hardware, wiring, integral transformer, shorting cap, and all material, labor, equipment, tools, and incidentals necessary to complete the work.

806.04.01 Photometric calculations, and photometric data, will not be measured but the cost will be incidental to other pertinent items included in the Contract Documents.

CATEGORY 800
TRAFFIC

SECTION 807 — ELECTRICAL SERVICE EQUIPMENT

807.01 DESCRIPTION

Furnish and install electrical service equipment necessary for the utility company to connect the electrical power supply. This work includes coordinating the connection with the local utility company.

807.02 MATERIALS

Control and Distribution Equipment 950.13

807.03 CONSTRUCTION

Electrical service equipment consists of the equipment necessary to connect a utility company service to a traffic signal controller cabinet, lighting control cabinet, traffic monitoring station cabinet, or other traffic control device cabinet. Provide electrical service equipment at the phasing and amperage specified in the Contract Documents.

807.03.01 Embedded Metered Service Pedestal. Install a galvanized steel post including a 200 amp double pole main circuit breaker for service disconnect, branch circuit breakers, and integral meter socket.

The post shall be designed for embedment into the soil at least 18 in. and have a stabilizer shoe. Pour a concrete collar around the post as shown in the Contract Documents. The post and meter socket shall meet NEMA 3R. Provide the means to padlock the post closed and to install a utility company seal on the meter.

Provide branch circuit breakers as specified.

Embedded metered service pedestals shall be UL listed Suitable for Service Equipment and be acceptable to the local utility companies for use as a service connection.

807.03.02 Base Mounted Metered Service Pedestal. Install a base-mounted aluminum pedestal including a 200 amp double pole main circuit breaker for service disconnect, branch circuit breakers, and integral meter socket. The pedestal shall have the option of being ordered with the meter socket facing to the front or back, as shown in the Contract Documents. Extend all conduit stub-outs 6 in. beyond the edge of the foundation and arranged as shown in the contract documents.

The pedestal shall be designed for pad mounting using 18 in. anchor bolts. The pedestal shall measure 16 in. wide, 17 in. deep, and 48 in. tall, and meet NEMA 3R. Provide a means to padlock the customer service side door closed and to install a utility company seal on the meter. The meter shall be protected by a hinged hood.

Main circuit breakers shall consist of an industrial grade, F-frame style circuit breaker. Branch circuit breakers shall consist of industrial grade, QC-style circuit breakers mounted on nonenergized clips. Internal cables between the terminal block and the breakers shall be No. 4 AWG THHN.

Provide branch circuit breakers as specified.

Base mounted metered service pedestals shall be UL 508 listed Suitable for Service Equipment and be acceptable to the local utility companies for use as a service connection.

807.03.03 Electrical Service Distribution Cabinet. Where an electrical service distribution cabinet is specified, furnish and install an equipment enclosure, meter socket, disconnect switch, panel boards, transformers, circuit breakers, thermostats, fans, lightning arresters, conduit, wiring and wiring devices, and all other equipment necessary to provide a complete functioning electrical service distribution cabinet. Protect all electrical outlets with ground fault circuit interrupters (GFCI).

807.03.04 Meter Sockets. Provide either ringed or ringless type meter sockets as required by the utility company. If a meter is not required, provide a ringless socket with suitable shunts and a metallic cover plate. Provide hardware for attaching the meter socket to a cabinet, wood post, or other structure.

807.03.05 Disconnect Switch. Include all hardware for attaching the disconnect switch to a cabinet, wood post, or other structure.

807.03.06 Service Cable. Electric service cable for traffic signals, intersection control beacons, hazard identification beacons, and luminaires mounted on traffic signal structures shall have three individual type THWN wires. Each wire shall be at least 19 strands. Electric service cable color identification by spray paint, tape, heat shrink tubing, or any other post-manufacturing method is prohibited.

807.03.07 Utility Connection. Before any control equipment or material is ordered, arrange a meeting with the utility company representatives, Traffic Operations Division representatives, the Engineer, and the District Utility Engineer to establish a schedule for utility connections.

Do not disconnect, de-energize, reconnect, tamper with, or otherwise handle any of the utility company's facilities. Make the utility service connection to the point of service supplied by the utility company.

Make the necessary arrangements with the utility companies to ensure having needed utilities available at the time of turn on. Delays due to utility energization, connection, or disconnection

will not be a basis for time extension. Report any difficulties in securing utility company services to the Engineer as soon as possible.

807.04 MEASUREMENT AND PAYMENT

807.04.01 Electrical Utility Service Equipment will be measured and paid for at the Contract unit price per each at the phasing and amperage specified. The payment will be full compensation for the disconnect switch, meter socket, meter, shunts, cover plate, lightning arresters, wiring, conduit risers, wiring trough, conduit nipples and adapters, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

807.04.02 Embedded Metered Service Pedestal will be measured and paid for at the Contract unit price per each. The payment will be full compensation for all enclosures, panel boards, circuit breakers, internal wiring, wiring devices, concrete collar, meter sockets, meter, shunts, cover plates, wiring, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

807.04.03 Base Mounted Metered Service Pedestal will be measured and paid for at the Contract unit price per each. The payment will be full compensation for all enclosures, concrete foundation, panel boards, circuit breakers, internal wiring, wiring devices, meter sockets, meter, shunts, cover plates, wiring, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

807.04.04 Electrical Service Distribution Cabinet will be measured and paid for at the Contract unit price per each. The payment will be full compensation for all enclosures, concrete foundation, disconnect switches, lightning arresters, panel boards, circuit breakers, internal wiring, ground fault interrupter outlets, conduits, wiring devices, meter sockets, meter, shunts, cover plates, wiring, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

807.04.05 Meter Socket will be measured and paid for at the Contract unit price per each. The payment will be full compensation for attachment hardware, meter, shunts, cover plate, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. When an item for this work is not included in the Contract Documents, this work will not be measured, but the cost will be incidental to other pertinent items.

807.04.06 Disconnect Switch will be measured and paid for at the Contract unit price per each. The payment will be full compensation for attachment hardware, fuses, switch, and for all material, labor, equipment, tools and incidentals necessary to complete the work. When an item for this work is not included in the Contract Documents, this work will not be measured, but the cost will be incidental to other pertinent items.

807.04.07 Underground conduit will be measured and paid for as specified in 805.04.

807.04.08 Service lateral cable will be measured and paid for as specified in 810.04.

807.04.09 Utility connection coordination with the utility company will not be measured, but the cost will be incidental to other pertinent items.

807.04.10 Utility company energization, connection, and disconnection costs will be the responsibility of the Administration.

CATEGORY 800
TRAFFIC

SECTION 808 — LIGHTING STRUCTURES

808.01 DESCRIPTION

Furnish and install steel and aluminum lighting poles, bracket arms, and fittings.

808.02 MATERIALS

Cast Iron	909.04
Hardware	909.10
Conduit	950.10
Lighting Structures	950.07
Galvanization	A123
Stainless Steel Hardware	A167, Type 302
Aluminum Castings	B26 or B108, alloy 356-T6
Anchor Base Plate for Aluminum Structures	B209, 6000 series alloy

808.03 CONSTRUCTION

Refer to Section 801 for concrete foundations.

Perform all fabrication and welding as specified in Section 430. After forming and welding, the pole shall have a smooth finish with only one longitudinal weld and no transverse welds. When fully assembled, install each lighting structure so that the pole is plumb.

Use a metallic arc consumable electrode inert gas shielded process for all welding for aluminum poles. After welding, the entire assembly shall be precipitation heat treated to the T-6 temper by an approved method and rotary sand finished.

All aluminum poles shall be furnished with internal vibration dampening devices.

Bracket Arms. Secure bracket arms to the poles as specified in the manufacturer's recommendations. Install each bracket arm perpendicular to the travel lane, unless otherwise specified.

808.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

808.04.01 Lighting Structures will be measured and paid for at the Contract unit price per each pole height, bracket arm length, and material type.

808.04.02 Concrete foundations will be measured and paid for as specified in 801.04.

808.04.03 Breakaway base support systems, when specified in the Contract Documents, will be measured and paid for as specified in 821.04.

808.04.04 Bracket arms for signal structures or wood poles will be measured and paid for at the Contract unit price per each for the pertinent Bracket Arm item.

CATEGORY 800
TRAFFIC

SECTION 809 — TRENCHING AND BACKFILLING

809.01 DESCRIPTION

Excavate trenches for the installation of underground conduit, wire, or duct cable for traffic control devices.

809.02 MATERIALS

Backfill	950.05
Conduit Detection Tape	950.11

809.03 CONSTRUCTION

Excavate trenches as specified.

In areas where conduit or cable is trenched, place a detector tape 6 in. below the finished grade. The tape shall be red and imprinted with a continuous warning message that reads **"CAUTION: ELECTRICAL LINE BURIED BELOW",** repeated every 36 in. The tape shall be inductively and conductively traceable using a standard pipe and cable locating device.

Cable Treatment. Bed the duct cable and direct buried wires into the special backfill material as specified.

Backfill. Backfill and compact the trench as specified in 801.03.05 and restore to its original condition. Replace topsoil, reseed, and resod, where directed.

809.04 MEASUREMENT AND PAYMENT

Trenching and backfilling will not be measured but the cost will be incidental to the Contract unit price for the installation of the pertinent Conduit, Wire, or Duct Cable.

CATEGORY 800
TRAFFIC

SECTION 810 — ELECTRICAL CABLE, WIRE, AND CONNECTORS

810.01 DESCRIPTION

Furnish and install loop detector wires and leads, electrical cable, cable ducts, wire, micro-loop probe sets, communication cable, and associated connectors.

810.02 MATERIALS

Sealer for Loop Detector	911.06
Conduit	950.10
Electrical Cable and Wire	950.06
Communication Cable	950.06.08
Cable and Wire Connectors	950.14
Micro-Loop Probe	Refer to Contract Documents.

810.03 CONSTRUCTION

All conductors shall be copper. Unless specified, no cable splicing will be permitted. When specified, lighting cable splices and loop detector lead in cable splices will be permitted only in pull and junction boxes, manholes, and hand holes. Do not install cable until the entire related raceway, including manhole, hand hole, and foundation system is in place. Provide 6 ft of cable slack, neatly tied, coiled, and positioned in the bottom of manholes, hand holes, and cabinets. Provide 8 in. drip loops at all overhead entrance points into structures. Install insulated spade type terminal ends on all wiring placed on terminal blocks.

810.03.01 Direct Burial Cable. Install to the depth of cover specified. Install backfill as specified in 801.03.05.

810.03.02 Cable in Conduits. Install by method in a manner to prevent harmful stretching of the conductor, injury to the insulation, or damage to the other protective covering. Seal the ends of all cables until ready for connection. When installing more than one wire or cable in a single duct or conduit, pull them into the conduit by hand or power winch with the use of cable grips or pulling eyes. Pulling tension shall be governed by recommended standard procedures for straight pulls or bends. Use a lubricant compatible with the cable insulation.

810.03.03 Preassembled Cable Duct. Prior to installation, unwind the cable duct while moving the reel alongside and parallel to the trench. Do not pull cable duct off a reel located in a stationary position. Install the cable using a cable grip in a manner that will not stress or damage conductors, insulation, or sheath wall.

After backfilling, demonstrate that the conductors move freely within the duct by pulling the conductors out at least 2 ft. Pulling tensions as specified in 810.03.02. Then pull the cable back to its original position. Completely seal cable duct ends using a waterproof removable sealing compound, a molded plastic device, or a rubber device.

810.03.04 Cable in Lighting Structures. Support the cable at each luminaire with a suitable clamp as an integral part of the luminaire or a device approved by the Engineer for the application.

810.03.05 Identification Tags. Furnish and install circuit wiring identification tags in all manholes, hand holes, junction boxes, and control cabinet and service pedestals. Use a nylon self-clinching type nonconductive band with an adequate sized tab for labeling. Mark each band using 1/4 in. minimum lettering dies, engraving device, or other approved permanent marking process. Indicate the circuit number, the terminal block position for loop detector cables, and the traffic signal phase for all other signal cables.

810.03.06 Loop Detector Wire and Loop Detector Lead-in. Prior to the installation of loop wires, the saw cut area shall be dry and free of saw cut debris. Twist the loop detector wire five turns per foot from the loop itself to the terminal point. Use a blunt instrument to seat the loop detector wire at the bottom of the saw cut. Splice the loop detector wire to the loop detector lead-in as specified.

810.03.07 Grounding Wire. Refer to Section 804.

810.03.08 Connector Kits. Furnish and install connector kits as required for the types of cables specified in the Contract Documents and in conformance with the manufacturer's recommendations.

810.03.09 Micro-Loop Probes. Furnish and install Micro-loop probe sets as specified. Terminate all leads in the controller cabinet.

810.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all overhead communication cable attachments, trench excavation, backfill, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

810.04.01 Electrical Cable, Cable Ducts, Loop Detector Wire, Loop Detector Lead-in Cable, Grounding Wire, and Communication Cable will be measured and paid for at the Contract unit price per linear foot for the type and sizes specified.

810.04.02 Connector Kits will be measured and paid for at the Contract unit price per each type.

810.04.03 Micro-Loop Probe Sets will be measured and paid for at the Contract unit price per each set. The payment will be full compensation for all sealant, PVC conduit, hole drilling, installation of lead-in cable, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Saw cuts for loop detector wire and micro-loop probe sets will be measured and paid for as specified in 815.04.

CATEGORY 800
TRAFFIC

SECTION 811 — ELECTRICAL HAND HOLES, MANHOLES, PULL AND JUNCTION BOXES

811.01 DESCRIPTION

Furnish and install electrical hand holes, manholes, pull and junction boxes.

811.02 MATERIALS

811.02.01 Hand holes.

No. 57 Coarse Aggregate	901.01
Portland Cement Concrete	902.10, Mix No. 2
Brick	903.02
Bolts	A276, Type 304
Frames and Covers	AISC 1020 Steel
Precast Concrete	M 199

811.02.02 Manholes.

No. 57 Coarse Aggregate	901.01
Reinforced Concrete Pipe	Section 905
Cast Iron Manhole Covers	909.04
Polyethylene (PE)	921.09
Precast Concrete	M 199

811.02.03 Pull and Junction Boxes.

Steel Plate	909.02
Cast Iron	909.04

811.03 CONSTRUCTION

811.03.01 Hand Holes and Manholes. Install hand holes and manholes flush to drain with the finished grade. Mix, place, and test concrete as specified in Section 420. Install aggregate drain as specified. Excavate and backfill as specified in Section 809. When installing hand holes and

manholes in sidewalks, remove and reinstall the sidewalk to the nearest joint. Fill or patch spaces between conduit and the hand hole and manhole wall with concrete or other sealer as directed.

Set hand hole and manhole frames in a mortar or concrete bed as shown in the Contract Documents.

811.03.02 Pull and Junction Boxes. The conduit entrance shall have a hub or boss of sufficient thickness that five full threads of the conduit engage the threaded holes in the box.

811.04 MEASUREMENT AND PAYMENT

Electrical Hand Holes, Manholes, Pull and Junction Boxes will be measured and paid for at the Contract unit price per each unless otherwise specified in the Contract Documents. The payment will be full compensation for all excavation, aggregate drain, concrete, bolts, bricks, pipes, backfill, sealer, frames and covers, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 812 — WOOD SIGN SUPPORTS

812.01 DESCRIPTION

Furnish and install wood sign supports.

812.02 MATERIALS

Wood	921.05
Preservatives	921.06

Wood supports shall be No. 1 dense grade.

812.03 CONSTRUCTION

Auger or dig holes using methods approved by the Engineer. Place supports in a plumb position and to the specified depth and lateral orientation. Backfill using suitable excavation material, and compact in place. Do not drive or hammer supports into undisturbed earth.

When specified, wood sign supports shall have drilled holes conforming to the breakaway requirements specified in AASHTO Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, or as shown in the Contract Documents.

812.04 MEASUREMENT AND PAYMENT

Wood Sign Supports will be measured and paid for at the Contract unit price per linear foot for the length and size specified. The payment will be full compensation for all excavation, backfill, drilled holes, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 813 — SIGNS

813.01 DESCRIPTION

Furnish and install signs as specified. Refer to Section 802, Section 803, and Section 812 for sign supports.

813.02 MATERIALS

Sign Panel Supports and Hardware	909.07, 921.05, 921.06, 950.04, A123, A153, and A709
Reflective and Nonreflective Sheeting	950.03
Sign Materials	950.08

Provide all hardware not provided by the Administration. Hardware shall be stainless steel. The Administration will supply traffic signal related signs and their mounting hardware for span wire, mast arm, and signal pole mounted applications.

Furnish and install, or install, vandalism installation date (VID) stickers to the back lower right hand corner of all installed signs. The Administration will supply VID stickers with all Administration supplied signs. Supply VID stickers with all non-Administration supplied signs.

813.03 CONSTRUCTION

Use demountable copy or direct applied copy on extruded aluminum. Use direct applied or silk screen copy on sheet aluminum.

The signs will be inspected after sign installation is complete. If specular reflection is apparent on any sign, reposition the sign as directed.

Inspect each new sign location to determine if clearing is required to provide for good sight distance. Complete all clearing and disposal as specified in Section 101. Remove any tree limbs protruding within the limits of clearing as specified in Section 712. The limits of clearing for each location will be as specified.

Use the following minimum thickness for fabricated sheet aluminum signs.

Longest Dimension of Sheet Sign in.	Minimum Thickness in.
≤ 12	0.040
12+ to 24	0.063
24+ to 36	0.080
36+ to 48	0.100
> 48	0.125

Install sheeting according to the manufacturer's recommendations. Repair/replace defects in workmanship according to the manufacturer's recommendation.

813.04 MEASUREMENT AND PAYMENT

813.04.01 Signs will be measured and paid for at the Contract unit price per square foot of area of the vertical front face of the completed sign with no deduction for required shaping. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

813.04.02 Administration furnished signs and mounting hardware will be measured and paid for at the Contract unit price per square foot for the completed sign installed. The payment will be full compensation for all transportation, drilling holes as specified, installation, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

813.04.03 Clearing for signing will not be measured but the cost will be incidental to the Contract unit price for furnishing and installing the signs.

813.04.04 Furnish and Install or Install Vandalism Installation Date stickers will not be measured, but the cost will be incidental to the Contract unit price for furnishing and installing the signs.

CATEGORY 800
TRAFFIC

SECTION 814 — SIGNAL HEADS

814.01 DESCRIPTION

Furnish and install vehicle traffic control signal heads and pedestrian traffic control signal heads.

814.02 MATERIALS

Traffic Signal Heads 950.15

814.03 CONSTRUCTION

Aiming. Aim signal heads to be visible in conformance with the minimum requirements of the MdMUTCD.

814.04 MEASUREMENT AND PAYMENT

Aluminum, Polycarbonate, and Optically Programmed Signal Heads and Pedestrian Signal Heads furnished and installed will be measured and paid for at the Contract unit price per each section of signal head type and size as specified in the Contract Documents. The payment will be full compensation for all lenses, mounting hardware, assembly, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 815 — SAW CUTS FOR TRAFFIC CONTROL DEVICES

815.01 DESCRIPTION

Saw cut and seal the saw cuts for traffic control devices.

815.02 MATERIALS

Sealer 911.06

815.03 CONSTRUCTION

815.03.01 Saw Cut. Prior to sawcutting, drill holes at all turns. Saw cut using a water quenched process. Do not saw cut curbs and gutter. Maintain the specified saw cut width.

815.03.02 Saw Cut Sealing. Sealing shall not be performed until the electrical testing is completed as specified in Section 820. Apply sealer according to the manufacturer's recommendations into washed, cleaned, and dried saw cuts. Sealer shall not be poured when the roadway surface temperature is below 35 F or during any precipitation.

815.04 MEASUREMENT AND PAYMENT

Saw Cuts for Traffic Control Devices will be measured and paid for at the Contract unit price per linear foot. The payment will be full compensation for all drilled holes, sealing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 816 — TRAFFIC CONTROL DEVICE CABINETS AND EQUIPMENT

816.01 DESCRIPTION

Install Administration furnished traffic signal controllers and cabinets, furnish and install traffic signal controllers and cabinets, furnish and install Intelligent Transportations Systems control cabinets, and furnish and install lighting control cabinets for highway and sign lighting.

816.02 MATERIALS

Conduit	921.07.01, 921.07.03
Detector Tape	950.11
Control and Distribution Equipment	950.13
Anchor Bolts, Hardware, Cabinets and Controllers	Furnished by, or as approved by the Office of Traffic and Safety

All materials, equipment and installations shall be new, UL listed or labeled, and meet NEC, NESC, NEMA, IES, and local codes and ordinances applicable to the installation.

816.03 CONSTRUCTION

816.03.01 Base Mounted Traffic Signal Cabinets. Mount cabinets on concrete foundations conforming to Section 801. Furnish and install conduit as specified in Section 805.

816.03.02 Pole Mounted Traffic Signal Cabinets. Install cabinets as specified. Furnish and install conduit as specified in Section 805.

816.03.03 Base Mounted Lighting Cabinets. Furnish and install the equipment enclosure, panel boards, transformers, circuit breakers, lighting contactor, relay, photoelectric controls, thermostats, selector switches, fans, lightning arresters, conduit, wiring and wiring devices, and all other equipment necessary to provide a complete functioning lighting cabinet as specified. Protect all electrical outlets with ground fault circuit interrupters (GFCI).

816.03.04 Pole Mounted Lighting Cabinets. Furnish and install a NEMA 4X, stainless enclosure with hardware for attaching the unit to a utility pole, wood post, or traffic control device structure. Include a 60 amp, double pole main circuit breaker; a 60 amp, double pole electrically held lighting contactor; four double pole circuit breakers at the amperage specified in the Contract

Documents; photoelectric control; lightning arrester; and all incidentals necessary to provide a complete lighting control unit.

816.04 MEASUREMENT AND PAYMENT

816.04.01 Installing Administration furnished signal controllers and cabinets will be measured and paid for at the Contract unit price per each for the pertinent Install Traffic Signal Controllers and Cabinets item. Installing Contractor furnished traffic signal controllers and cabinets will be measured and paid for at the Contract unit price per each for the pertinent Traffic Signal Controllers and Cabinets item. The payment will be full compensation for pickup, transportation, and installation of the controller or cabinet when applicable, furnishing and installing the controller or cabinet when applicable, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

816.04.02 Concrete foundations will be measured and paid for as specified in 801.04.

816.04.03 Conduit will be measured and paid for as specified in 805.04.

816.04.04 Ground rods will be measured and paid for as specified in 804.04.

816.04.05 Lighting Control Cabinets will be measured and paid for at the Contract unit price per each of the type and size specified. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 817 — PUSH BUTTONS AND PUSH BUTTON SIGNS

817.01 DESCRIPTION

Furnish and install pedestrian push button assemblies and push button signs.

817.02 MATERIALS

Retroreflective Sheeting	950.03
Push Button Sign	950.08
Push Buttons	A319

The push button assembly shall be weather-tight and tamper proof. The assembly shall be designed to prevent an electrical shock under any weather condition and have provisions for grounding in conformance with the NEC.

(a) The push button assembly shall be fabricated from aluminum ingot and have an anodized finish.

(b) The push button plunger shall be chrome plated, 2 in. diameter, and have a spring with operative force not to exceed 5 lb.

(c) The push button switch shall have single-pole momentary, normally-open, single-throw contacts and spade-type terminals.

(d) The switch assembly shall have an operating force of approximately 0.5 lb, but not more than 1 lb.

(e) The switch assembly shall be UL approved and electrically rated to carry 25 amps at 120 volts AC.

817.03 CONSTRUCTION

Locate push buttons in positions that clearly indicate to the pedestrian which crosswalks are actuated by each push button.

Furnish all mounting hardware and drill holes to provide cable and wire entrances.

817.04 MEASUREMENT AND PAYMENT

Push buttons and push button signs will be measured and paid for at the Contract unit price per each for the pertinent Push Button and Sign item. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 818 — SIGNAL STRUCTURES

818.01 DESCRIPTION

Pickup and install Administration furnished signal structures. The grommets and miscellaneous hardware will be furnished by the Administration.

818.02 MATERIALS

Signal Structures Hardware	Furnished by the Administration

818.03 CONSTRUCTION

Install the signal structure on a concrete foundation as specified in Section 801.

Breakaway base support systems, when specified, shall conform to Section 821.

Repair any finish on the signal structures and mounting hardware damaged during transportation and installation to match the original finish as approved by the Engineer at no additional cost to the Administration.

818.04 MEASUREMENT AND PAYMENT

818.04.01 Installation of Administration furnished signal structures will be measured and paid for at the Contract unit price per each for the type and size specified. The payment will be full compensation for the pickup, transportation and installation of all steel poles, mast arms, twin mast arms, triple mast arms, strain poles, and pedestal poles, breakaway base support systems, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

818.04.02 Concrete foundations will be measured and paid for as specified in 801.04.

CATEGORY 800
TRAFFIC

SECTION 819 — STEEL SPAN WIRE

819.01 DESCRIPTION

Furnish and install steel span wire for signal head or sign mountings, interconnect runs, and for tethering purposes.

819.02 MATERIALS

Steel Span Wire	950.09
Galvanizing	A153

Steel messenger rings shall be the specified size and be mechanically or hot dip galvanized after fabrication.

819.03 CONSTRUCTION

Attach the span wire to poles by wrapping two full turns of the span wire around the pole at the specified height leaving a free end of 2 ft.

Secure the free end to the traversing span wire using a three-bolt clamp and serving sleeve as specified.

Space messenger rings 8 in. apart.

819.04 MEASUREMENT AND PAYMENT

Steel Span Wire will be measured and paid for at the Contract unit price per linear foot for the size of wire installed. The payment will be full compensation for all hardware, material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 820 — GENERAL ELECTRICAL WORK AND TESTING

820.01 DESCRIPTION

Test all electrical items referred to in Category 800.

820.02 MATERIALS

All materials and equipment installed as part of the permanent installation shall be new, UL listed or labeled, and meet NEC, NESC, NEMA, IES, and local codes applicable to the area of installation.

820.03 CONSTRUCTION

820.03.01 General. All installations shall meet NEC, NESC, local utility company requirements, and State and local laws and ordinances governing the work. All electrical work shall be under the direct supervision of a master electrician licensed in the State of Maryland or in the county where the work is performed. All work done under Section 804, Section 805, Section 806, Section 807, Section 810 (except loop wire), Section 811, Section 814, Section 816, Section 817, and Section 820 shall be performed by a journeyman electrician. Obtain and pay for all permits, licenses, and inspection fees.

820.03.02 Testing. Supply all personnel and equipment required to perform the following tests. Furnish four certified copies of the complete test reports to the Engineer.

At least 30 days prior to the commencement of each test, submit the types, styles, or catalog numbers of all required testing equipment. Include a written certification stating when the testing equipment was last calibrated by an Administration approved testing agency. The calibration date shall be within 180 days of the date when the tests are to be performed. Perform all tests in the presence of the Engineer.

Immediately repair or replace any defects found in the completed installation.

(a) Ground Resistance Testing. Use a megger ground tester, using the null balance fall of potential method. Corrected readings greater than 25 ohms will not be accepted.

(b) Circuit Testing. Determine the insulation resistance on all cables of every circuit except those installed in lighting structures. Cable insulation resistance shall be at least

10 megohms at 500 volts D.C., except loop detector wire and loop detector lead in shall be at least 100 megohms at 500 volts D.C.

Demonstrate to the Engineer that all conductors are continuous, free from short circuits and unspecified grounds, and that all circuits are properly connected.

(c) Performance Testing. Conduct a performance test using the design power source. Operate the electrical system, including automatic control equipment, for 30 consecutive days. If any component fails, replace it immediately and continue the test. Record each fault, the method and date of correction of each, and the beginning and end of the 30-day test period. If more than 5 percent of any component fails during the test, replace the component and restart the 30-day test cycle for the entire system.

(d) Illumination Testing. Conduct an illumination test, conforming to procedures approved by the Administration, to determine the illumination characteristics of the roadway lighting installation.

820.03.03 Traffic Signal Testing. Conduct testing without causing a hazard to the traveling public.

Maintain all new materials until satisfactorily tested and their operation is accepted by the Engineer.

Signal heads and signs that are in place, but not in use, shall be entirely covered with opaque burlap.

After completion, testing, and acceptance, place new traffic signals on flashing operation for a 72 hour period prior to placing the signals on full color operation. Existing full color and flashing signals shall not flash but shall be kept in operation until the new signal is completed, satisfactorily tested, and approved.

Remove STOP signs at new full color signals at the end of the 72 hour flashing period. Provide a log of the date and time of removal to the Engineer.

Upon acceptance and placement of the new traffic control device into operation, remove unnecessary signal heads, signs, spans, and mast arms.

New traffic signals, exclusive of signal system interconnect installation, may be placed into operation when testing is completed and upon acceptance by the Engineer. Upon completion of the signal system interconnect installation, the signal system interconnect shall also be satisfactorily tested and approved by the Engineer.

820.04 MEASUREMENT AND PAYMENT

General electrical work and testing and the as-built drawings will not be measured but the cost will be incidental to the other pertinent items specified in the Contract Documents.

CATEGORY 800
TRAFFIC

SECTION 821 — BREAKAWAY BASE SUPPORT SYSTEMS

821.01 DESCRIPTION

Furnish and install breakaway base support systems or install Administration furnished breakaway base support systems if applicable.

821.02 MATERIALS

Breakaway base support systems shall conform to the breakaway requirements specified in AASHTO Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

Breakaway Base Support Systems	Refer to Contract Documents

821.03 CONSTRUCTION

Install breakaway base support systems for signals, lighting, and signing, including post hinge assembly units for sign structures, as specified in the Contract Documents and in conformance with the manufacturer's recommendations. Grade the ground adjacent to the breakaway base as specified in the Contract Documents.

821.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all excavation, backfill, grading, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Breakaway Base Support Systems will be measured and paid for at the Contract unit price per each for breakaway support systems furnished and installed as specified in the Contract Documents.

Pick up, delivery, and installation of Administration supplied breakaway base support systems will be measured and paid for at the Contract unit price per each for the pertinent Install Breakaway Base item.

CATEGORY 800
TRAFFIC

SECTION 822 — REMOVE AND RELOCATE EXISTING SIGNS AND SIGN STRUCTURES

822.01 DESCRIPTION

Remove and relocate existing signs and sign structures.

822.02 MATERIALS

Not applicable.

822.03 CONSTRUCTION

Make all existing cable safe in accordance with the appropriate electrical codes.

822.03.01 Removing Existing Signs. Existing signs may be relocated during construction. Remove existing and relocated signs when the new signing system is complete. All new signs in a particular sequence giving similar directions shall be installed before existing signs are removed.

After removing the sign structure, remove the remaining concrete foundations as specified in 207.03.01. Holes left after sign removal shall be backfilled, compacted, and restored to conditions similar to the surrounding area.

822.03.02 Relocating Existing Signs. Relocate existing signs as specified in the Contract Documents and as part of the new signing system. For removal and backfill of remaining concrete foundations, refer to 822.03.01.

822.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for removing and relocating existing signs and sign structures, removing existing concrete foundations, backfilling and compacting existing holes left after foundation removal, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

822.04.01 Remove Existing Ground Mounted Signs and Supports will be measured and paid for at the Contract unit price per square foot area of the sign. Removal of sign supports and concrete foundations will not be measured but the cost will be incidental to the Contract unit price for removing the signs.

822.04.02 Remove Signs from Existing Overhead Structure will be measured and paid for at the Contract unit price per square foot area of the sign. Removal of sign supports, sign luminaire supports, luminaires, conduit, and cable will not be measured but the cost will be incidental to the Contract unit price for removing the signs.

822.04.03 Relocate Existing Ground Mounted Signs will be measured and paid for at the Contract unit price per square foot area of the sign. Removal and disposal, or removal and relocation of the sign support will not be measured but the cost will be incidental to the Contract unit price for relocating the signs.

822.04.04 Relocate Signs from Existing Overhead Structure will be measured and paid for at the Contract unit price per square foot area of the sign. Removal and relocation of sign supports, luminaires, and luminaire supports will not be measured but the cost will be incidental to the Contract unit price for relocating the signs.

822.04.05 Remove Existing Cantilever or Overhead Sign Structure and Signs and Supports will be measured and paid for at the Contract unit price per each structure. Disconnecting the electrical service and removal of concrete foundations will not be measured but the cost will be incidental to the Contract unit price for removing the structure.

822.04.06 If required for new sign supports; concrete for sign foundations, galvanized steel beam sign posts, wood sign supports, and breakaway base support systems for steel beams will be paid for as specified in the applicable portions of Section 801, Section 802, Section 812 and Section 821 respectively.

CATEGORY 800
TRAFFIC

SECTION 823 — REMOVE AND RELOCATE OR REMOVE AND DISPOSE OF ROADWAY LIGHTING STRUCTURES

823.01 DESCRIPTION

Remove and relocate or remove and dispose of roadway lighting structures.

823.02 MATERIALS

Hardware	909.10
Conduit	950.10

823.03 CONSTRUCTION

Remove concrete foundations and place backfill as specified in 822.03.01. Lighting structures removed and not reused shall become the property of the Contractor. Remove and store lighting structures scheduled to be reused on the same project as specified in GP-6.02.

Make all existing cable safe in conformance with the appropriate electrical codes.

823.04 MEASUREMENT AND PAYMENT

Remove and Dispose of Roadway Lighting will be measured and paid for at the Contract unit price per each. The payment will be full compensation for the removal and disposal of the lighting structure, removal of existing concrete foundation, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Remove and Relocate Roadway Lighting Structure will be measured and paid for at the Contract unit price per each. The payment will be full compensation for the removal, storage, reinstallation, connection to existing lighting circuits, removal of existing concrete foundations, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 800
TRAFFIC

SECTION 824 — MODIFY EXISTING SIGN MESSAGES

824.01 DESCRIPTION

Remove existing and add new sign copy, shields, and arrows for existing signs, or overlay existing sign messages.

824.02 MATERIALS

Reflective and Nonreflective Sheeting and Copy	950.03
Sign Materials	950.08

824.03 CONSTRUCTION

824.03.01 Modifying Signs with Demountable Copy. Remove existing copy or shields carefully. Prior to installing the new material, clean the sign background material thoroughly using mild detergent and water.

When specified, cover existing demountable copy with sheet aluminum at least 0.040 in. thick. The overlay shall have the same background and copy as the sign.

824.03.02 Modifying Signs with Direct Applied Copy. When specified, cover existing copy with sheet aluminum at least 0.040 in. thick. The overlay shall have the same background and copy as the sign.

Direct applied overlays may be used for minor modifications to sign messages according to the manufacturer's recommendations.

824.04 MEASUREMENT AND PAYMENT

The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

824.04.01 Modify Message on Existing Ground Mounted or Overhead Signs will be measured and paid for at the Contract unit price per each removed or each installed character for the type of sign installation specified. Characters include shields, arrows, and sign copy.

824.04.02 Overlay Existing Ground Mounted or Overhead Signs will be measured and paid for at the Contract unit price per square foot, removed or installed for the type of sign specified.

CATEGORY 800
TRAFFIC

SECTION 825 — CUTTING AND CAPPING MAST ARMS AND POLES

825.01 DESCRIPTION

Cut, clean, galvanize, and cap mast arms, mast arm poles, pedestal poles, and strain poles.

825.02 MATERIALS

Cold Galvanizing Compound A780

825.03 CONSTRUCTION

Galvanized parts that have been cut or chipped to bare metal shall be repaired according to A780.

Saw cut the pole or mast arm to the required length. Clean the area inside and outside with a wire brush. Spray cold galvanizing compound on the affected area. Place an end cap of matching size.

825.04 MEASUREMENT AND PAYMENT

Cutting and Capping of Mast Arms and Poles will be measured and paid for at the Contract unit price per each. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

CATEGORY 900
MATERIALS

SECTION 900 — GENERAL

900.01 GENERAL

Sample, test, and inspect all materials included in this Category as specified in the most recently published cited standards. The specification limits for each material are established and deviations from these limits are prohibited except when, in the judgment of the Engineer, the deviation will not be detrimental to the work. In these cases, refer to the appropriate specification governing price adjustments for nonconformance.

Within 30 days after receipt of notification of award of the Contract, submit in writing, to the Office of Materials Technology (OMT), the proposed sources of all materials to be incorporated into the project. Update and submit all nursery stock sources to OMT 45 days prior to the planting season in which the planting is to begin. Do not introduce material into the work until sources are approved. The Administration reserves the right to completely or partially test any material for Specification compliance.

Sample according to the Administration's Sample Testing and Frequency Guide unless otherwise directed. All source approvals are made subject to continuing production of materials conforming to these Specifications. Material sources may be rejected where it is evident that the material tends to be of marginal quality when compared to the Specification limits in any of its specified properties.

900.02 TECHNICIAN QUALIFICATION REQUIREMENTS

Technicians performing Quality Assurance (QA)/Quality Control (QC) sampling and testing shall be qualified through the certification program provided by the Administration. Private laboratories performing testing shall be in the AASHTO Accreditation Program or approved by the Administration.

Technicians include those who work for inspection agencies, Contractors, consultants, producers, private laboratories, and State and local government employees.

900.03 RECYCLED MATERIALS

900.03.01 CERTIFICATION. All recycled or rehandled material furnished or supplied for use may require testing and certification to ensure compliance with all State and local applicable environmental and EPA regulations. The required testing may include, but not be limited to, the EPA Toxicity Characteristic Leaching Procedure (TCLP) or its successor. Provide testing and

certification for all recycled materials at no additional cost to the Administration. Evaluation and interpretation of the test data will be made by an OMT QA Manager. The above requirements do not preclude the normal materials acceptance process, and the recycled material shall meet all applicable specifications. EPA regulations governing the use of the material, certified test results, and material safety data sheets shall accompany the source of supply letter and sample submitted for approval.

Only highway demolition materials are to be used in constructing reclaimed/recycled concrete stockpiles for Administration projects. The use of building materials is prohibited.

Refer to the Contract Documents for recycled materials not covered by this specification.

900.03.02 RECLAIMED/RECYCLED CONCRETE (RC)

Usage. Use RC for the following with written approval.

(a) Graded Aggregate Base (GAB).

(b) Common, Select, or Modified Borrow.

(1) At least 2 ft above saturated soil or groundwater conditions, as determined.

(2) At least 100 ft from surface waters (streams, creeks, or rivers, ponds and lakes).

(3) At least 3 ft from exposed metal surfaces.

(4) At least 3 ft from geotextile.

(5) At least 3 ft from any water discharge locations.

Do not use RC as Capping Borrow nor as aggregate for the following.

(a) Portland cement concrete.

(b) Asphalt mixes.

(c) Drainage systems.

(1) Base course under permeable pavements.

(2) Longitudinal underdrains.

(3) Base course and Subbase within 3 ft of Longitudinal underdrains.

(d) Mechanically stabilized earth (MSE) systems.

(1) MSE walls.

(2) Reinforced soil slopes (RSS).

(3) Reinforced earth slopes (RES).

(e) In embankment construction as follows.

(1) Within 1.5 ft of the top surface of any area to be vegetated.

(2) Within 2 ft of saturated soil or groundwater conditions, as determined.

(3) Within 100 ft of any surface water course (streams, creeks, or rivers, ponds and lakes).

(4) Within 3 ft of any metal pipe or shoring.

(5) Within 3 ft of any water discharge locations.

(6) Under permeable or porous surfaces.

Grading Requirements. The grading requirements for the use of RC.

(a) Table 901 A when used as GAB or for any other application within the pavement structure.

(b) 204.02 when used in embankment construction.

(c) 916.01 when used as Borrow material.

RC shall not contain more than 5 percent brick and asphalt mix material by mass except when used as Common Borrow.

pH Requirements. RC pH shall be less than 12.4 for all applications. RC usage shall not cause any outfall and infiltration water leaving the site to exceed a pH of 8.5. Acid sulfate, sulfur or any other environmentally safe organic material may also be used to control the pH.

pH Testing.

(a) Plant: The producer is required to test pH at the plant per T 289 every 1000 tons shipped or once a day, whichever yields the greater frequency. Plant pH testing shall be recorded as specified and a history shall be kept at the producer's laboratory. The producer may be required to present TCLP and any other tests conducted by an independent laboratory as directed.

The Administration reserves the right to test the producer's RC at the plant for pH. Material delivery may be terminated if the test results repeatedly meet or exceed a pH of 12.4. In case of high pH the producer is require to use shorter stock pile by spreading the material at around the plant or mixing the RC-GAB with the natural GAB to reduce the pH issue.

(b) Construction Site: The OMT representatives will perform QA testing to monitor, test, for the pH levels for any discharge associated with RC placement as directed. This includes monitoring and testing during periods of precipitation or dampness. In cases of high pH, the producer shall provide a reduction control plan for the pH.

Quality Control. The producer shall submit a Quality Control Plan and obtain approval prior to production. The plan shall include, but not be limited to, the operational techniques and procedures proposed to produce the RC product. QC includes the sampling, testing and data recording performed to validate the quality of the product during production operations.

Quality Assurance. OMT QA personnel will perform quality assurance inspection, sampling, and testing at the RC plant and construction site. Additional inspection, testing and compaction control will be performed by the Engineer.

900.03.03 RECYCLED ASPHALT PAVEMENT (RAP)

Usage. Use RAP for Common, Select, Capping, or Modified Borrow.

Do not use RAP as aggregate for the following.

(a) Graded Aggregate Base (GAB).

(b) Portland cement concrete.

(c) Drainage systems.

(d) Embankment construction.

(1) Within 1 ft of the top surface of any area to be vegetated.

Refer to MSMT 412 and M 323 for the use of RAP in asphalt mixes.

Grading Requirements. The grading requirements for the use of RAP.

(a) 204.02 when used in embankment construction,

(b) 916.01 when used as Borrow material,

(c) 901.02.01 when used as riprap.

Quality Control. Create a captive stockpile for storing the RAP prior to use. Create a new captive stockpile and take new acceptance samples for gradation approval whenever the source of the RAP changes.

Quality Assurance. OMT QA personnel will sample and test the RAP stockpiles to ensure that they meet the above gradation requirements. The completed test results will be reviewed by the OMT Soils and Aggregate Division for approval.

Construction of Control Test Strip. The location, equipment, and methods used to construct the control test strip shall be as directed; prior to approval. The equipment and methods used to construct the control test strip shall be the same as those used in subsequent construction. Place and test the control test strip when the RAP is 32 F or higher to establish the maximum density. RAP is temperature sensitive, which may affect the density.

Construct the control test strip that shall be at least 100 ft long, 12 ft wide and a maximum compacted lift thickness of 6 in. Prepare the subgrade for the control test strip in accordance with 204.03.07. Do not construct the control strip, or perform any subsequent construction, on frozen subgrade.

Compact the RAP for the control test strip with one pass of the roller. Measure the density after one pass with a nuclear density gauge (backscatter method) at the frequency for capping material at five random locations distributed across the length and width of the control test strip, as directed. Record the measurements and mark the locations for future reference.

Compact the RAP for the control test strip with a second pass of the roller. Measure and record the density again at the exact locations previously tested and as described above. Prepare a plot of density versus the number of roller passes. Continue this process until the maximum dry density of the control strip is established.

There should be no drop in average density during construction of the control test strip for each lift. A drop in the average density of greater than 2 pcf during construction of the control test strip is an indication that the material is not properly compacting, and a new test strip shall be constructed.

The Engineer may require the Contractor to cut into the control test strip for visual inspection. All material, labor, equipment, tools, and incidentals necessary to provide an approved control test strip shall be at no additional cost to the Administration.

Compaction Control. Use the roller pattern and number of passes determined from the construction of the test strip to compact the RAP for production placement. The density of the RAP compacted for production work shall be at least 97 percent of the maximum density obtained from the control test strip. Recheck the density of the production work if it is less than 97 percent of the maximum density obtained from the control test strip. Construct a new control test strip if the second density does not meet the 97 percent requirement. Construct a new control test strip if the measured density of the compacted RAP for production work exceeds 105 percent.

Establish one rolling pattern to achieve maximum density for each use based on the control test strips. Samples or results produced prior to the construction of any new stockpiles will not be considered.

900.03.04 DREDGED MATERIAL (DM) and DREDGED MATERIAL BLENDS (DMB)

Definitions.

Dredged Material (DM). Material excavated or dredged from the waters of the State as referenced in COMAR 26.04 and COMAR 26.10.13. The term "waters of this State" is also specifically defined in COMAR. It includes a wide range of surface and underground waters within Maryland's jurisdiction, such as surface and underground waters within state boundaries, the Chesapeake Bay and its tributaries, and various bodies of water and drainage systems like ponds, lakes, rivers, and streams. It also encompasses the portion of the Atlantic Ocean within the state's boundaries and the floodplain of free-flowing waters as determined by the Department based on the 100 year flood frequency. The DM includes Sand, Silt, Clay, Gravel, Mud, Muck, Rock or other sediment or material excavated or dredged from tidal, estuarine, or riverine waters of the State, including potentially dry areas at the time of excavation beneath the plane bounded by the normal high water line. DM includes but is not limited to dredged slurry, hydraulic fill, or dewatered dredged material from fresh, brackish, or saltwater environments.

Dredged Material Blend (DMB): A homogeneous mixture of dredged material with other approved borrow materials.

Corrosivity, Gradation and Toxicity Requirements. DM and DMB shall meet the following requirements:

Parameter	Acceptable Range	Test Method
Minimum resistivity (Ω·cm)	> 3,000	T 288
pH	5.5 – 8.5	T 289
Sulfate content (ppm)	< 500	T 290
Chloride content (ppm)	< 400	T 291
PFOA and PFOS	< 4 ng/L (in leachate)	EPA Method 1633 with D 3987 (Leaching)
Organic Content	< 8%	T 267
Gradation % Passing #200 Sieve	≤ 30%	T 11

Notes: Ω·cm = Ohm·Centimeter,
ppm = Parts per Million.
PFAS = Perfluoroalkyl and Polyfluoroalkyl Substances
PFOA = Perfluorooctanoic Acid
PFOS = Perfluorooctane Sulfonate

In addition to the above requirements, DM and DMB shall follow the procedures and meet the requirements of Category 1 – Residential Unrestricted Use Soil and Fill Material or Category 2 – Non-Residential Restricted Use Soil and Fill Material land use categories as specified by Maryland Department of the Environment (MDE) in the current Innovative Reuse and Beneficial Use of Dredged Materials (IRBDM). All MDE requirements shall be satisfactorily met, including but not limited to the screening process, sampling, frequency of sampling, and testing analysis with a listing of the appropriate test procedures. It is the contractor's responsibility to obtain the MDE approval, whether directly or indirectly from the source vendor, satisfactorily demonstrating that all MDE requirements are met.

DMB requires blending DM, as necessary, with soil, quarry fines or other materials to meet the above requirements. The DMB will be subject to a blending study done by the contractor or supplier. The blending study will be outlined in the Sampling and Analysis Plan (SAP) which will be reviewed and approved by MDE within 30 days. Test the blending material(s) in accordance with all MDE IRBDM testing requirements. SHA will only sample and test the final blend for the final approval of the material after receiving approval and test results per the IRBDM. Source submissions will be considered with an approved Sampling and Analysis Plan (SAP) from MDE if a blending study was conducted. Provide a declaration of potential environmental impacts to adjacent properties and a Confirmation of Suitability of use / Interim Receiving Site Form containing the following information:

(a) MDE Tracking Number.

(b) Land Use Category.

(c) Volume of Material.

(d) The End User/Interim Receiving site a "Groundwater Use Area" has been determined.

(e) Both forms must have the appropriate signatures.

Usage. Use DM and DMB as Common, Select or Modified Borrow provided DM and DMB meet the requirements of 916.01, 204.02, MDE IRBDM, and the Corrosivity, Gradation and Toxicity Requirements above. An additional written consent by the Administration is required prior to DM or DMB use. Do not use DM and DMB for the following:

(a) Portland cement concrete.

(b) Hot mix asphalt.

(c) Mechanically stabilized earth (MSE) systems:

(1) MSE walls.

(2) Reinforced Soil Slopes (RSS).

(3) Reinforced Earth Slopes (RES).

(d) Within 500 feet of any potable water supply wells.

(e) Within karst geologic terrain.

CATEGORY 900
MATERIALS

SECTION 901 — AGGREGATES

901.01

This Section includes the material details, quality requirements, and test methods applicable to aggregates. Grading requirements are outlined in Tables 901 A and 901 C; physical properties in 901 B and 901 D. Force drying may be used in the preparation of samples for grading tests conducted in the field.

TABLE 901 A
AGGREGATE GRADING REQUIREMENTS - T 27

MATERIALS		SIEVE SIZE															
		2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 10	No. 16	No. 30	No. 40	No. 50	No. 100	No. 200
		63 mm	50 mm	37.5 mm	25 mm	19 mm	12.5 mm	9.5 mm	4.75 mm	2.36 mm	2.0 mm	1.18 mm	600 µm	425 µm	300 µm	150 µm	75 µm
CRUSHER RUN AGGREGATE CR -6 (f)(g)		—	100	90-100	—	60-90	—	—	30-60	—	—	—	—	—	—	—	0-15
BANK RUN GRAVEL — SUBBASE		100	—	—	90-100	—	60-100	—	—	—	35-90	—	—	20-55	—	—	5-25
GRADED AGGREGATE — BASE DESIGN RANGE (a)		—	100	95-100	—	70-92	—	50-70	35-55	—	—	—	12-25	—	—	—	0-8
TOLERANCE (b)		—	(-)2	±5	—	±8	—	±8	±8	—	—	—	±5	—	—	—	±3(c)
BANK RUN GRAVEL — BASE		100	—	—	85-100	—	60-100	—	—	—	35-75	—	—	20-50	—	—	3-20
COARSE AGGREGATE - PORTLAND CEMENT CONCRETE	57 and UNDERDRAIN (h)	—	—	100	95-100	—	25-60	—	0-10	0-5	—	—	—	—	—	—	—
	67	—	—	—	100	90-100	—	20-55	0-10	0-5	—	—	—	—	—	—	—
	7	—	—	—	—	100	90-100	40-70	0-15	0-5	—	—	—	—	—	—	—

FINE AGGREGATE — PORTLAND CEMENT CONCRETE, UNDERDRAIN, and PNEUMATIC MORTAR (d)	—	—	—	—	—	—	100	95-100	—	—	45-85	—	—	5-30	0-10	—
COARSE AGGREGATE — LIGHTWEIGHT PORTLAND CEMENT CONCRETE	—	—	—	100	90-100	—	10-50	0-15	—	—	—	—	—	—	—	—
FINE AGGREGATE — LIGHTWEIGHT PORTLAND CEMENT CONCRETE (d)	—	—	—	—	—	—	100	85-100	—	—	40-80	—	—	10-35	5-25	—
FINE AGGREGATE/SAND MORTAR and EPOXIES (d)	—	—	—	—	—	—	—	100	95-100	—	—	—	—	—	0-25	0-10
MINERAL FILLER	—	—	—	—	—	—	—	—	—	—	—	100	—	95-100	—	70-100

(a) To establish target values for design.
(b) Production tolerance.
(c) ±2 for field grading (omitting T 11).
(d) Fine aggregate includes natural or manufactured sand.
(e) Crushed glass shall not contain more than one percent contaminants by weight.
(f) Not to be used in the structural part of any Administration project.
(g) Recycled asphalt pavement may be used as a component not to exceed 15 percent and is not subject to aggregate physical property requirements in TABLE 901 B.
(h) Recycled concrete is prohibited in drainage applications.

TABLE 901 B
AGGREGATE PHYSICAL PROPERTY REQUIREMENTS

MATERIAL	TEST METHOD				
	SPECIFICATION	T 90	T 11	T 96	T 104
		PI MAX	MATERIAL FINER THAN No. 200 SIEVE %MAX	LOS ANGELES ABRASION %MAX	SODIUM SULFATE SOUNDNESS %MAX
CRUSHER RUN AGGREGATE CR-6	D1241(a)	6	—	50	12
BANK RUN GRAVEL — SUBBASE	D1241	6	—	50	12
GRADED AGGREGATE — BASE	D1241	6	—	50	12
BANK RUN GRAVEL — BASE	D1241	6	—	50	12
COARSE AGGREGATE — PCC (b)	M 80 CLASS A	—	1.0(c)	50	12
FINE AGGREGATE — PCC (b)(d)	M 6 CLASS B	—	4.0(e)	—	10
COARSE AGGREGATE — LIGHTWEIGHT PCC	M 195	—	—	—	—
FINE AGGREGATE — LIGHTWEIGHT PCC (f)	M 195	—	—	—	—
FINE AGGREGATE/SAND MORTAR and EPOXIES	M 45	—	—	—	10
MINERAL FILLER (g)	M 17	4	—	—	—
GLASS CULLET (h)	M 318	—	—	—	—

(a) Other approved inert materials of similar characteristics may be used provided they meet these provisions. For crushed reclaimed concrete, the soundness loss shall not exceed 18 percent after magnesium sulfate testing as specified in T 104.
(b) Test coarse and fine aggregate for PCC for alkali silica reactivity (ASR) per 902.10.
(c) 1.5 if material passing No. 200 sieve is dust of fracture, free of clay or shale.
(d) In areas exposed to traffic, manufactured sand shall have a minimum ultimate Dynamic Friction Value (DFV) of 40, based on the parent rock.
(e) 5.0 for concrete not subject to surface abrasion.
(f) Fine aggregate meeting M 6 may be used if the lightweight concrete does not exceed the maximum unit weight specified in the Contract Documents.

(g) Fly ash shall not exceed 12 percent loss on ignition.
(h) For use as a granular road base material. Not intended for use in locations where surfacing will not be placed over the base.

TABLE 901 C
ASPHALT MIXES AGGREGATE GRADING REQUIREMENTS, % PASSING FOR MIX DESIGN T 27

MATERIAL		SIEVE SIZE									
		3/4in.	**1/2in.**	**3/8in.**	**No. 4**	**No. 8**	**No. 16**	**No. 30**	**No. 50**	**No. 100**	**No. 200**
		19.0 mm	**12.5 mm**	**9.5 mm**	**4.75 mm**	**2.36 mm**	**1.18 mm**	**600 µm**	**300 µm**	**150 µm**	**75 µm**
GAP GRADED STONE MATRIX ASPHALT MIX - 9.5 mm		100	100	75–90	30–50	20–30	—	—	—	—	8–13
GAP GRADED STONE MATRIX ASPHALT MIX -12.5 mm		100	90–99	70–85	28–40	18–30	—	—	—	—	8–11
GAP GRADED STONE MATRIX ASPHALT MIX -19.0 mm		100	82–88	60 max	22–30	14–20	—	—	—	—	9–11
OPEN GRADED FRICTION COURSE – 9.5 mm (a)		—	100	85–100	20–40	5–10	—	—	—	—	2–4
OPEN GRADED FRICTION COURSE – 12.5 mm (a)		100	85–100	55–75	15–25	5–10	—	—	—	—	2–4
OPEN GRADED FRICTION COURSE – 12.5 mm (b)		100	80–100	35–60	10–25	5–10	—	—	—	—	1–4
SLURRY SEAL (SS) AND MICRO - SURFACING (MS)	TYPE II	—	—	100	90–100	65–90	45–70	30–50	18–30	10–21	5–15
	TYPE III	—	—	100	70–95	45–70	28–50	19–34	12–25	7–18	5–15
CHIP SEAL SURFACE TREATMENT	7	100	90–100	40–70	0–15	0–5	—	—	—	—	—
	8	—	100	85–100	10–30	0–10	0–5	—	—	—	—

(a) Less than Design Level 4 (ESAL)
(b) Porous European Mix (PEM) – Design Level 4 (ESAL)

TABLE 901 D
AGGREGATE PHYSICAL PROPERTY REQUIREMENTS FOR ASPHALT MIXES

MATERIAL	SPECIFICATION	TEST METHOD				
		T 11	T 96	T 104	D4791	MSMT 216
		MATERIAL FINER THAN No. 200 SIEVE	LOS ANGELES ABRASION (LA)	SODIUM SULFATE SOUNDNESS	FLAT and ELONGATED (a)	DYNAMIC FRICTION VALUE (DFV) (b) (c)
		% max	% max	% max	% max	min
SURFACE COURSE 4.75 mm, 9.5 mm, 12.5 mm, and 19.0 mm	M323	—	45	12	10	25
SURFACE COURSE — HIGH DFV 4.75 mm, 9.5 mm, 12.5 mm, and 19.0 mm	M323	—	45	12	10	40 (e)
BASE COURSE 19.0 mm, 25.0 mm and 37.5 mm	M323	—	45	12	10	—
GAP GRADED STONE MATRIX ASPHALT 9.5 mm, 12.5 mm, and 19.0 mm	M323	—	30	12	20/5 (g)	40 (e)

OPEN GRADED FRICTION COURSE 9.5 mm, 12.5 mm, 12.5 mm PEM (h)	MSMT 409	0.5	30	12	20/5 (g)	40 (e)
SLURRY SEAL (SS) and MICRO-SURFACING (MS)	—	—	—	12	—	40 (f)
CHIP SEAL SURFACE TREATMENT	M 80, CLASS A	1.0 (d)	45	—	—	—

(a) Testing for flat and elongated particles shall be conducted on the blended aggregates. Dimensional ratio of calipers shall be 5:1.
(b) The minimum Dynamic Friction Value (DFV) shall be based on a single aggregate source or a blend of aggregates used. Determine proportions of blended aggregates using MSMT 416.
(c) DFV determined on parent rock. Reclaimed Asphalt Pavement (RAP) shall have a DFV of 30.0.
(d) 1.0 for samples taken at the point of production. Samples taken at any point after shipment shall have no more than 1.5 percent finer than 0.075 mm sieve.
(e) Carbonate rock shall have a minimum of 25 percent insoluble residue retained on the 0.075 mm sieve.
(f) No blending allowed.
(g) Testing conducted on particles retained on the 4.75 mm sieve. Dimensional ratio of calipers shall be 3:1/5:1.
(h) Porous European Mix.

901.01.01 Steel Slag. Steel slag may be used for chip seal surface treatment, but not for any other aggregate.

901.02 STONE FOR RIPRAP, CHANNELS, DITCHES, SLOPES, AND GABIONS

Use field or quarry stone of approved quality. Stone may be certified from a source previously approved. Ensure that maximum dimension does not exceed four times the minimum dimension.

901.02.01 Stone for Riprap. Ensure that stone for riprap is uniformly graded from the smallest to the largest pieces as specified in the Contract Documents. The stone will be accepted upon visual inspection at the point of usage, as follows:

CLASS OF RIPRAP	SIZE	PERCENT OF TOTAL by weight
0	Heavier than 33 lb Heavier than 10 lb Less than 1 lb	0 50 10 max
I	Heavier than 150 lb Heavier than 40 lb Less than 2 lb	0 50 10 max
II	Heavier than 700 lb Heavier than 200 lb Less than 20 lb	0 50 10 max
III	Heavier than 2000 lb Heavier than 600 lb Less than 40 lb	0 50 10 max

Note: Optimum gradation is 50 percent of the stone being above and 50 percent below the midsize. Reasonable visual tolerances will apply.

901.03 STONE FOR CHANNELS AND DITCHES

Meet the size requirements of Class I Riprap and the following:

QUALITY REQUIREMENTS	
TEST AND METHOD	**SPECIFICATION LIMITS**
Apparent Specific Gravity T 85, min	2.50
Absorption T 85, % max	3.0
Sodium Sulphate Soundness - 5 cycles, 2-1/2 to 1-1/2 in. Aggregate T 104, % loss max	20

901.04 STONE FOR SLOPES

M 43, size number 1 omitting T 11. The stone shall also meet the quality requirements specified in 901.03.

901.05 STONE FOR GABIONS

Meet the quality requirements specified in 901.03 except the loss by sodium sulfate shall not be greater than 12 percent:

DEPTH OF BASKET in.	SIZE OF INDIVIDUAL PIECES * in.
6	3-6
9	4-7
12	4-7
18	4-7
36	4-12

*Size of pieces will be determined visually.

CATEGORY 900
MATERIALS

SECTION 902 — PORTLAND CEMENT CONCRETE AND RELATED PRODUCTS

902.01 STORAGE

Storage of materials shall conform to the Contract Documents and as directed by the Engineer.

902.02 CERTIFICATION OF PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT

The manufacturer shall furnish certification as specified in TC-1.03. The certification shall also include:

(a) The mill shall report its quality control procedures and submit a new report whenever there is a procedural change.

(b) The mill's control laboratory shall be inspected by the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology on their regularly scheduled visits. The Engineer shall be provided with copies of the reports of these inspections along with an account of the action taken to correct cited deficiencies.

(c) Records of data accumulated by the quality control procedures shall be produced upon request.

(d) A certified document shall accompany each shipment stating that the contents conform to all applicable requirements. Additionally, the document shall show the producer's name, mill location, carrier number, date loaded, weight contained in carrier, silo number, consignee, destination, Contract number, and type of cement. The signature and title of the signer shall be shown on the document.

(e) The mill shall, upon request, supply certified chemical and physical test values that can be associated with any sample representing cement drawn from a particular silo on a given date.

(f) Acceptance of cement by certification will be terminated if test results differ from mill results by more than the precision limits given in the test method. The acceptance procedure will then revert to storage testing and approval prior to shipment.

902.03 HYDRAULIC CEMENT

902.03.01 Portland Cement. M 85, with the fineness and the time of setting determined using T 153 and T 131, respectively.

902.03.02 Slag Cement. M 302, Grade 100 or Grade 120. The Contractor may request to substitute up to a maximum of 50 percent of the weight of Portland cement or Type IL Blended Hydraulic Cement with slag cement. When slag cement is used, the minimum cement factor and water/cement ratio will be determined on the basis of the combined weight of the Portland cement or Type IL Blended Hydraulic Cement and slag cement. Do not use slag cement and Type IP or Type IS Blended Hydraulic Cement in the same mix.

902.04 BLENDED HYDRAULIC CEMENT

M 240 Type IP containing 15 percent to 25 percent Fly Ash by weight of blended cement, Type IS containing 25 percent to 50 percent slag cement by weight of blended cement or Type IL. Maximum loss on ignition for Type IP or Type IS is 3.0 percent. The requirement for a manufacturer's written statement of the chemical composition is waived.

902.05 MASONRY CEMENT

C91, except the water retention and staining tests are waived.

902.06 CONCRETE ADMIXTURES

Do not use concrete admixtures that contribute more than 200 ppm of chlorides based on the cement content when tested according to MSMT 610. Use only prequalified admixtures.

902.06.01 Air Entraining Admixtures. M 154.

902.06.02 Chemical Admixtures. M 194, Type A, D, or non-chloride C.

902.06.03 High Range Water Reducing Admixtures. M 194, except that it shall be a liquid, the water content shall be a maximum of 85 percent of that of the control, and the durability factor shall be a minimum of 90. Use Type F for early strength, which shall produce a minimum compressive strength in 12 hours of 180 percent of that of the control. Use Type G when early strength is not specified. The manufacturer shall furnish certification as specified in TC-1.03. The certification shall include curves indicating the fluid ounces of admixture per 100 lb of cement as related to water reduction and strength gain for 12 hours when used with a minimum cement factor of 700 lb.

902.06.04 Pozzolans. When a pozzolan is used, the minimum cement factor and water/cement ratio will be determined on the basis of the combined weight of the Portland cement or Type IL Blended Hydraulic Cement and pozzolan. Do not use pozzolan and Type IP or Type IS Blended Hydraulic Cement in the same mix.

(a) Fly Ash. M 295, pozzolan Class C or F, except that the maximum permissible moisture content shall be 1.0 percent, and when used in concrete Mix Nos. 3 and 6 the maximum loss on ignition 3.0 percent. Fly Ash may be substituted up to a maximum of 25 percent of the weight of cement.

(b) Microsilica. C1240, except that the oversize requirement is waived. Microsilica may be substituted up to a maximum of 7 percent of the weight of cement.

(c) Natural Pozzolans. M 295, pozzolan Class N, Natural Pozzolan may be substituted up to a maximum of 30 percent of the weight of cement.

902.06.05 Corrosion Inhibitors. Corrosion inhibitors shall be calcium nitrite based and contain a minimum of 30 percent active ingredients by mass. The gallonage of corrosion inhibitor used in the concrete mixture shall be included as water when determining the water/cementitious materials ratio.

902.07 PORTLAND CEMENT CONCRETE CURING MATERIALS

Use burlap cloth, sheet materials, liquid membrane forming compounds, or cotton mats.

902.07.01 Burlap. M 182, Class 1, 2, or 3.

902.07.02 Sheet Materials. C171 with the following exceptions:

(a) White Opaque Burlap Polyethylene Sheeting. Tensile strength and elongation requirements are waived. Use sheeting having a finished product weight of not less than 10 oz/yd^2.

(b) White Opaque Polyethylene Backed Nonwoven Fabric. 902.07.02(a), with the thickness requirement waived. Use material having a finished product weight of not less than 5 oz/yd^2.

(c) White Opaque Polyethylene Film. Tensile strength and elongation requirements are waived.

902.07.03 Liquid Membrane. C309. Field control testing of the white pigmented curing compounds is on the basis of weight per gallon. The samples shall not deviate more than ± 0.3 lb/gal from the original source sample.

902.07.04 Cotton Mats. Cotton mats consist of a filling material of cotton bats or bats covered with unsized cloth and tufted or stitched to maintain the shape and stability of the unit under job conditions of handling.

Use coverings of either cotton cloth, burlap or jute having the following properties:

(a) Cotton cloth covering shall weigh not less than 6.0 oz/yd^2 and have an average of not less than 32 threads/in. of warp and not less than 28 threads/in. of filling. Use raw cotton, cotton comber waste, cotton card strip waste, or combinations thereof as the raw material used in the manufacture of the cotton cloth.

(b) Burlap or jute covering for cotton mats shall weigh not less than 6.4 oz/yd^2 and shall have not less than of 8 threads/in. of warp and not less than 8 threads/in. of filling. Use the grade known commercially as "firsts" and they shall be free from avoidable imperfections in manufacture and from defects or blemishes affecting the serviceability.

Use a cotton bat, or bats made of raw cotton, cotton waste, cotton linters, or combinations thereof, as the filling material for the mats. Mats shall weigh not less than 12 oz/yd^2.

902.08 FORM RELEASE COMPOUNDS

Use form release compounds that effectively prevent the bond of the concrete to the forms. Form release compounds shall not cause discoloration of the concrete or adversely affect the quality or rate of hardening at the interface of the forms.

The flash point of the form release compound shall not be less than 100 F when tested according to D93.

902.09 PARAFFIN WAX

Use clear paraffin wax for use as a bond breaker for concrete. The flash point shall not be less than 380 F when tested under D92.

902.10 PORTLAND CEMENT CONCRETE

Section 915 and as specified.

902.10.01 Proportioning. Prior to the start of construction, submit to the Area Materials Engineer (AME) the source and proportions of materials to be used for each concrete mix. The mixture shall meet 902.10.03.

The concrete, with the exception of water and chemical admixtures, shall be proportioned by weight. Water and chemical admixtures may be proportioned by volume or weight. The mix shall be uniform and workable.

902.10.02 Materials.

Coarse Aggregate	901.01
Fine Aggregate	901.01
Hydraulic and Blended Hydraulic Cement	902.03 and 902.04
Concrete Admixtures	902.06
Synthetic Fibers	902.15
Water	921.01

902.10.03 Portland Cement Concrete Mixtures.

The concrete mixes shall conform to the following:

TABLE 902 A

PORTLAND CEMENT CONCRETE MIXTURES										
MIX NO.	**SPECIFIED ACCEPTANCE COMPRESSIVE STRENGTH psi**	**COMPREHENSIVE STRENGTH ACCEPTANCE TEST AGE days**	**STD. DEV. psi**	**CRITICAL VALUE psi**	**MIN CEMENT FACTOR lb/yd³**	**COARSE AGGREGATE SIZE M43 / M195**	**MAX WATER/ CEMENT RATIO by wt**	**SLUMP RANGE in.**	**TOTAL AIR CONTENT %**	**CONCRETE TEMP. °F.**
1	2500	28	375	2430	455	57, 67	0.55	2 - 5	5 - 8	50 - 95
2	3000	28	450	3010	530	57, 67	0.50	2 - 5	5 - 8	50 - 95
3	3500	28	525	3600	580	57, 67	0.50	2 - 5	5 - 8	50 - 95
4	3500	28	525	3600	615	57, 67	0.55	4 - 8	N/A	50 - 95
5	3500	28	525	3600	580	7	0.50	2 - 5	5 - 8	50 - 95
6	4500	28	675	4770	615	57, 67	0.45	2 - 5	5 - 8	50 - 80
7	4200	28	630	4420	580	57	0.50	1½ - 3	5 - 8	50 - 95
8	4000	28	600	4180	750	7	0.42	2 - 5	5 - 8	50 - 80
9	3000	(a)	N/A	N/A	800	57, 67	0.45	4 - 8	5 - 8	60 - 100
10	4500	28	675	4770	700	¾" - No. 4	0.45	2 - 5	6 - 9	50 - 80
11	4200	28	630	4420	—	57, 67	0.45	2 - 5	5 - 8	50 - 80
12	4200	28	630	4420	—	¾" - No. 4	0.45	2 - 5	6 - 9	50 - 80

13	4000	28	600	4180	615	57, 67	0.45	2 - 5	5 - 8	50 - 95
HE	3000	(b)	N/A	N/A	N/A	N/A	N/A	3 - 9	5 - 8	60 - 100
PC (c)	N/A	N/A	N/A	N/A	450	7, 8	0.45	N/A	15 - 25	N/A
WT	2500	(d)	N/A	N/A	650	57	0.45	5 max	5 - 8	50 - 95

Note 1: When concrete is exposed to water exceeding 15 000 ppm sodium chloride content, Type II cement shall be used. In lieu of Type II cement, a Type I or a Type 1L blended hydraulic cement may be used in combined form with an amount of up to 50 percent replacement with slag cement, or an amount of up to 25 percent replacement with Class F fly ash. The Contractor shall submit to the Engineer the proposed mix proportions and satisfactory test results according to C1012 showing a sulfate resistance expansion not exceeding 0.10 percent at 180 days.

Note 2: The temperature of Mix No. 6 when used for other than superstructure work as defined in TC-1.03 shall be 50 – 95 F.

Note 3: Type A or D admixture shall be added to bridge, box culvert, and retaining wall concrete.

Note 4: Non-chloride Type C admixtures may be used when approved by the Engineer.

Note 5: Other Slump Requirements:
When a high range water reducing admixture Type F or Type G is specified, the slump shall be 4 in. to 8 in.
When synthetic fibers are specified, the slump shall be 5 in. maximum.
When concrete is to be placed by the slip form method, the slump shall be 2-1/2 in. maximum.
When the absorption of the coarse aggregate is greater than 10 percent, the slump shall be 3 in. maximum.

Note 6: Mix No. 9 shall contain a Type F high range water reducing admixture.

Note 7: Mix Nos. 10 and 12 shall be proportioned as specified in 211.2 of the ACI's Recommended Practices for Selection Proportions for Structural Lightweight Concrete. The maximum average Density of Cured Concrete shall be 118 lb/ft^3. Control testing for Density of Cured Concrete shall be two companion cylinders for each 100 yd^3, or fraction thereof, as specified in M 195.

Note 8: Mix Nos. 11 and 12 shall also conform to all requirements as specified in Table 902 C.

Note 9: Add Polyolefin Macro Fibers to Mix No. 8, Mix No. 9 and High Early Strength Patch Mix (HE). The dosage rate shall be according to the manufacturer's recommendations.

(a) Mix No. 9 is for concrete pavement repair only. Match cure of the samples is permissible in accordance with AASHTO PP 54. Strength tests shall be scheduled accordingly on weekdays and acceptance will be based on a minimum compressive strength of 3000 psi in 24 hours or 3600 psi in 3 days. Acceptance testing shall conform to 902.10.08 except that cylinders shall be field cured and remain in the molds until tests are conducted. Mix No. 9 when specified for incidental work and not requiring traffic control in conformance with 522.03.15 will not require the addition of fibers.

(b) Match cure the samples in accordance with AASHTO PP 54. Design approval will be given based on trial batch obtaining a minimum compressive strength of 2500 psi in 6 hours. Strength tests shall be scheduled accordingly on weekdays and acceptance will be based on a minimum compressive strength of 3000 psi in 24 hours or 3600 psi in 3 days. Acceptance testing shall conform to 902.10.08 except that cylinders shall be field cured and remain in the molds until tests are conducted.

(c) Pervious Concrete (PC) shall be proportioned as specified in 522R of the ACI's Recommended Practices for Pervious Concrete Mixture Proportions. Acceptance of freshly mixed Pervious Concrete shall be made based on Density and Total Void Content. Density and Total Air Voids of Freshly Mixed Pervious Concrete shall be performed according to C1688

(d) Whitetopping (WT) mix shall contain a high range water reducing admixture, macro-fibers at 3 lbs/yd^3 Max, and acceptance will be on a minimum compressive strength of 2500 psi in 24 hours.

Preventive Measures for Aggregate Alkali-Silica Reactivity (ASR). All aggregate, both coarse and fine, intended for use in concrete shall be tested for ASR in accordance with C1260. Testing shall be performed by an accredited laboratory. Coarse and fine aggregate from the same source shall be tested separately. Testing shall be performed once every 3 years.

The following limitations apply for C1260 results:

EXPANSION @ 14 DAYS	CLASS AND REACTIVITY STATUS	MITIGATION NOTE
≤0.10%	R0- Innocuous	No mitigation required
>0.10 but ≤0.20%	R1- Potentially Reactive	Mitigation Required*
>0.20 but ≤0.30%	R2- Reactive	Mitigation Required*
>0.30%	Highly Reactive	Shall not be used in PCC

*See Table 902 B for the minimum Supplementary Cementitious Material (SCM) replacement levels for ASR mitigation

Optional C1293 Concrete Prism Testing. Testing in accordance with C1293 is non-mandatory but recommended. The test may be used to verify the ASR class status of aggregate having C1260 result greater than 0.10 percent expansion. If C1293 testing is not performed, then compliance is assessed based entirely on the C1260 result.

The requirements for compliance when using C1293 are as follows;

(a) Test frequency is once every 3 years.

(b) The Administration will not perform this test. Testing must be performed by an accredited laboratory.

(c) Coarse and Fine aggregate from the same source shall be tested separately.

(d) Each sample shall be split and tested in accordance with both C1260 and C1293. This is required to provide comparable data for future reference. Scheduling of the testing is at the producer's discretion, but both results must be submitted together for approval review.

(e) The C1293 result will supersede the C1260 result for compliance status.

The following limitations apply for C1293 results:

EXPANSION AT 1 YEAR	CLASS AND REACTIVITY STATUS	MITIGATION NOTE
≤0.04%	R0- Innocuous	No mitigation required
>0.04 but ≤0.12%	R1- Potentially Reactive	Mitigation Required*
>0.12 but ≤0.24%	R2- Reactive	Mitigation Required*. **No structural uses allowed.**
>0.24%	Highly Reactive	May not be used in PCC

*See Table 902 B for the minimum Supplementary Cementitious Material (SCM) replacement levels for ASR mitigation;

TABLE 902 B

MINIMUM MITIGATION REQUIREMENTS				
SCM Type	**Low** Alkali Cement (≤0.7% Na_20 equiv.) **R1**	**Normal** Alkali Cement (≤1.0% Na_20 equiv.) **R1**	**Low** Alkali Cement (≤0.7% Na_20 equiv.) **R2**	**Normal** Alkali Cement (≤1.0% Na_20 equiv.) **R2**
Class F Fly Ash	20%	25%	25%	25%
Slag (GGBFS)	35%	50%	50%	50%
Ternary Blends	Approval Required	Approval Required	Approval Required	Approval Required
Binary Blends with Type IL	Approval Required	Approval Required	Approval Required	Approval Required

Ternary blends using two SCMs and binary blends with Type IL hydraulic cement and an SCM will require C1567 testing by an accredited laboratory. The expansion test results shall not be greater than 0.10 percent to be considered acceptable. Changes to the SCM blend percentages will require retesting.

TABLE 902 C

MIX PHYSICAL PROPERTIES		
TEST PROPERTY	**TEST METHOD**	**SPECIFICATION LIMITS**
Minimum Cementitious Materials Factor, lb/yd^3	—	580
Maximum Content of Portland Cement, lb/yd^3	—	550
Water/Cementitious Materials Ratio by Wt.	—	0.45
Corrosion Inhibitor, gal/yd^3	902.06.05	2.0
Synthetic Fibers, lb/yd^3	902.15	1.5
Permeability of Field Concrete, moving average of three tests, coulombs max	T 277	2500
Permeability of Field Concrete, individual test, coulombs max	T 277	3000
Shrinkage at 28 days, microstrains	C157	400

Note 1: Only Type I or II Portland cement shall be used.
Note 2: Mixes shall contain slag cement, fly ash or microsilica.
Note 3: The water to cement ratio shall be based upon the total water to cementitious materials ratio. The gallonage of the corrosion inhibitor shall be included in the water/cementitious materials ratio.
Note 4: The permeability test value of field concrete shall be the average of two test specimens representing production concrete. Test specimens shall be molded on the project site in 4 x 8 in. molds conforming to M 205. Test specimens shall be handled in accordance with T 277 - Accelerated Moist Curing. Test for the geometry of test specimens will be waived.
Note 5: Shrinkage tests will be performed on trial mixes only.
Note 6: High range water reducing admixture may be used except the water reducing requirements will be waived.
Note 7: A sealer conforming to 902.12 shall be used on the finished surface.

902.10.04 Trial Batch. A trial batch shall be prepared to certify that each mix meets 902.10.05 and 902.10.06 except for Mix No. 9. Approval will be given when the test results meets the minimum required average strength. Mix No. 9 design approval will be given based on trial batch obtaining a minimum compressive strength of 2500 psi in 12 hours.

Make arrangements with the AME at least two weeks in advance, to have an authorized representative present during the batching and testing. Each trial batch shall consist of at least 3 yd^3 of concrete. Laboratory testing in lieu of plant trial batches may be conducted when approved by the AME. Supply all equipment, and labor required to produce the trial batches and conduct the required tests at no additional cost to the Administration.

The AME may waive the requirement for a trial batch when past performance records show that the required average strength requirement has been met.

902.10.05 Design Required Average Strength.

Specified compressive strength, $f_{c'}$, psi	Required average compressive strength, $f_{cr'}$, psi
$f_{c'} \leq 5000$	Use the larger value computed from Eq. (A-1) and (A-2) $f_{cr'} = f_{c'} + 1.34s$ (A-1) $f_{cr'} = f_{c'} + 2.33s - 500$ (A-2)
Over 5000	Use the larger value computed from Eq. (A-1) and (A-3) $f_{cr'} = f_{c'} + 1.34s$ (A-1) $f_{cr'} = 0.90 f_{c'} + 2.33s$ (A-3)

where:

$f_{c'}$ = the 28 day specified compressive strength.
s = the standard deviation as specified in 902.10.06.

A test is defined as the average strength of two companion cylinders.

902.10.06 Standard Deviation.

(a) When past performance records are available, a standard deviation will be established from documented performance records of the producer consisting of a minimum of 15 consecutive 28 day compressive strength tests obtained within the last 12 months.

The standard deviation will be established as the product of the calculated standard deviation and multiplier.

NUMBER OF TESTS	MULTIPLIER FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

Interpolate for intermediate number of tests.

(b) When past performance records are not available, the required average strength shall meet to the following:

Specified compressive strength, $f_{c'}$, psi	Required average compressive strength, $f_{cr'}$, psi
$f_{c'} < 3000$	$f_{cr'} = f_{c'} + 1000$
$3000 \leq f_{c'} \leq 5000$	$f_{cr'} = f_{c'} + 1200$
$f_{c'} > 5000$	$f_{cr'} = 1.10 f_{c'} + 700$

902.10.07 Standard of Control. The average of all sets of three consecutive strength tests shall equal or exceed the critical value as specified in 902.10.03 which shall be computed using the following formula:

Critical Value = $f_{c'}$ + (1.14 X S) – 500

Failure to conform to this criterion shall be cause for immediate investigation and remedial action up to and including suspension of production. A design standard deviation equal to 15 percent of the specified strength shall be used for calculation until a minimum of 15 test results are obtained.

The actual average strength and standard deviation shall be computed upon the availability of 28 day strength data comprising a minimum of 15 tests. Should this determination indicate an excessive margin of safety, the concrete mix may be modified to produce lower average strength as approved by the Engineer. If these calculations indicate a coefficient of variation greater than 15, the quality of the concrete and testing will be evaluated.

902.10.08 Testing. Sampling according to R 60. Testing as follows:

TEST	METHOD	MINIMUM TEST FREQUENCY	RESPONSIBILITY
Temperature (e)	T 309	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Slump (a)(e)	T 119	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Air Content (a)(e)	T 152 T 196	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Compression (b)(c)(d)	T 23	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Compression (b)(c)(d) Mix No. 7 Only	T 23	3 per Day	Project Engineer

(a) A second test will be made when the first slump or air content test fails. Acceptance or rejection will be based on the results of the second test.

(b) Compressive strength tests are defined as the average of two companion cylinders.

(c) The Contractor shall be responsible for the making of all early break cylinders and furnishing the molds, stripping, curing/delivery of all cylinders, including 28 day cylinders, to the testing laboratory.

(d) The Project Engineer will be responsible for making, numbering and signing the 28 day cylinders.

(e) When constructing plain and reinforced concrete pavements, the testing frequency for slump, air content, and temperature shall be 1 per 100 yd^3 or fraction thereof.

902.10.09 Acceptance. Concrete will be acceptable if both of the following requirements are met:

(a) The average of all sets of three consecutive strength tests equal or exceed the specified design strength.

(b) No individual strength test (average of two companion cylinders) falls below the specified design strength by more than 500 psi.

902.10.10 Price Adjustment. A price adjustment will be based on the Contract unit price per cubic yard of concrete. If the unit is a lump sum item, the price per cubic yard for the concrete will be determined by dividing the cubic yards into the Contract lump sum price.

(a) Test Results More Than 500 psi Below the Specified Design Strength. Failing strength tests will be considered individually with a price adjustment being applied on the percentage basis as shown below.

(Price per yd^3) X (quantity of yd^3 represented by the failing concrete strength) X (percent of failure).

Example:

$400.00 per yd^3 X 50 yd^3 X [1-(3600/ 4500 psi)] = $4000.00

No payment will be allowed when the test results fall below 50 percent of the specified design strength for structural concrete or 40 percent for incidental concrete.

The Engineer will determine when the strength of the concrete represented by the failing tests is sufficient to remain in place or whether it must be removed and replaced with Specification concrete.

(b) Test Results 500 psi or Less than the Specified Design Strength. Strength failures 500 psi or less than the specified design strength will be averaged with the next two consecutive tests. If those two tests include a failure greater than 500 psi, those tests will be evaluated as in 902.10.10(a) and replaced with the next consecutive test. If the resulting average falls below the specified design strength, a price adjustment will be applied as specified in the table below. Any failure will only be included in one grouping.

STRENGTH BELOW THE SPECIFIED (avg of 3 tests) DESIGN LEVEL, psi	**ADJUSTMENT FACTOR**
MIX NO. 1 THRU MIX NO. 12 EXCLUDING MIX NO. 9	
1 – 100	0.005
101 – 200	0.01
201 – 300	0.02
301 – 400	0.04
401 – 500	0.08

Adjustment price equals (price per yd^3) X (quantity of yd^3 represented by the failing cylinders) X (the adjustment factor).

Example

$400.00 per yd^3 X 50 yd^3 X 0.01 = $200.00

902.11 MORTAR FOR GROUT

Mortar used for grouting reinforcement steel, anchor bolts, pipe, handrail posts, and miscellaneous items shall be composed in accordance with one of the following:

(a) One part Portland cement or blended hydraulic cement and one part mortar sand by dry loose volume.

(b) Prepared bag mixes consisting of Portland cement or blended hydraulic cement and mortar sand. The prepared mixes shall produce a mortar meeting the strength requirements specified in the Contract Documents.

(c) Use nonshrink grout when specified. The grout shall have a minimum compressive strength of 5000 psi in seven days when tested according to T 106, except that the cube molds shall remain intact with a top firmly attached throughout the curing period. The nonshrink grout shall have a minimum expansion of 0.0 percent after seven days when tested according to T 160.

(d) Epoxy grout shall consist of sand and epoxy mixed by volume according to the manufacturer's recommendations. The grout shall be capable of developing a minimum compressive strength of 6500 psi in 72 hours when tested according to MSMT 501. Sand for epoxy grout as specified in 901.01.

(e) An epoxy or polyester anchoring system may be used when approved by the Engineer in accordance with the manufacturer's recommendations. Strength values shall be as specified in the Contract Documents.

902.12 LINSEED OIL

Shall consist of a 50-50 mixture (by volume) of boiled linseed oil meeting Federal Specification TT-L-190 and kerosene according to D3699.

902.13 LATEX MODIFIED CONCRETE

Portland cement concrete containing prequalified Laboratory approved styrene butadiene latex emulsion is defined as Latex Modified Concrete (LMC).

Latex emulsion shall have a minimum of 90 percent of the nonvolatiles as styrene butadiene polymers. The latex emulsion as specified in Table 902.13 A. The material shall be stored in suitable containers and be protected from freezing and exposure to temperatures in excess of 85 F.

LMC shall be proportioned using volumetric mixing and designed as follows:

LATEX MODIFIED CONCRETE	
MATERIAL	**SPECIFICATION LIMITS**
Portland Cement, CWT/yd^3, min	6.6
Latex Emulsion/Cement Ratio	0.31–0.34
Water/Cement Ratio, max	0.22
Entrained Air, %	6.0±3
Slump, in.	5±1

The physical properties of LMC shall conform to Table 902.13 B. The Contractor shall furnish the necessary 3 in. x 6 in. molds according to M 205 to be used for the fabrication of compressive strength cylinders.

Control and Acceptance Sampling.

(a) Submit a two quart minimum sample, of the styrene butadiene latex emulsion to the AME daily for each lot of material used in a day's production.

(b) A batch for LMC is defined as the capacity of the equipment being used on the project. Slump and air samples will be taken and tested before the placement of a batch is permitted. The slump shall be measured four to five minutes after discharge from the mixer. The test material shall be deposited off the deck and not be disturbed during this waiting period. One additional sample for slump and air will be taken randomly during the placement of each batch. For seven day compressive strength, two tests each per batch are required. A test is defined as consisting of two companion cylinders. The samples for these tests will be taken at random while the placement is in progress.

TABLE 902.13 A

REQUIREMENTS FOR CHEMICAL PROPERTIES OF LATEX EMULSION MATERIALS				
PROPERTY	SPECIFICATIONS		QUALITY ASSURANCE TESTS	
	LIMITS	TOLERANCE	PREQUALIFICATION TESTS	CONTROL AND ACCEPTANCE
Color	White	—	X	X
pH	9.0-11.0	—	X	X
Weight, lb/gal	8.40 – 8.47	—	X	X
Solids Content, %	46 – 53	—	X	X
*Butadiene Content, % of polymer	30 – 40	—	—	—
Viscosity @ 10 rpm-cps	Match Original	±20	X	X
*Surface Tension, dynes/cm max	50	—	—	—
*Mean Particle Size, polymer – Å	1400 – 2500	—	—	—
Coagulum, % max	0.10	—	X	X
*Freeze-Thaw Stability, coagulum, % max	0.10	—	X	X
Infrared Spectra of Latex Film	Match Original	—	X	X
Infrared of Alcohol, Soluble Portion of Latex	Match Original	—	X	X
Shelf Life, min	1 yr	—	X	—

Note 1: Quality assurance tests shall be conducted as specified in MSMT 612 except those denoted by an * shall be conducted as specified in FHWA RD – 78-35.

Note 2: The original or prequalification sample shall be accompanied by the producer's certification on all of the tests and properties noted above and as specified in TC-1.03. The certification shall contain actual test values of the product and the infrared spectrograph.

Note 3: A separate certification is required for each lot of material. The certification shall note the date of manufacture, lot size, and whether or not the material is identical to the formulation of the original sample.

TABLE 902.13 B

LATEX MODIFIED CONCRETE PHYSICAL PROPERTIES			
TEST PROPERTY	**TEST VALUES**	**QUALITY ASSURANCE TESTS**	
		PREQUALIFIED TESTS	**CONTROL AND ACCEPTANCE**
7 Day Compressive Strength, psi min	3000	X	X
28 Day Compressive Strength, psi min	3500	X	—
42 Day Compressive Strength, psi min	3500	X	—
7 Day Flexural Strength, psi min	550	X	—
28 Day Flexural Strength, psi min	650	X	—
42 Day Shear Bond Strength, psi min	2000	X	—
Durability Factor, 300 cycles, % min	85	X	—
Chloride Permeability, Ppm max	510	X	—
Scaling Resistance, 50 cycles, max	3	X	—

Note 1: Quality assurance tests shall be conducted as specified in MSMT 721.

Note 2: Seven Day Compressive Strength Test will be used for Control & Acceptance of the material. The minimum specified design strength is 3000 psi at seven days. The mix design approval and acceptance will be based on a coefficient of variation of 10 percent with a probability of 1 in 10 tests falling below the specified strength. Only test values 80 percent or greater than the specified strength will be accepted

902.14 RAPID HARDENING CEMENTITIOUS MATERIALS FOR CONCRETE PAVEMENT REPAIRS

Materials shall be a dry, packaged cementitious mortar having less than 5 percent by weight of aggregate retained on the 3/8 in. sieve and meet the following requirements:

Classification.

Class I — For use at ambient temperatures below 50 F.

Class II — For use at ambient temperatures of 50 to 90 F.

Class III — For use at ambient temperatures above 90 F.

Chemical Requirements. C928 except that no organic compounds such as epoxy resins or polyesters as the principal binder.

Physical Requirements. Meet the following when tested according to MSMT 725:

COMPRESSIVE STRENGTH, psi min				
CLASSIFICATION	**< 2 hr**	**2-6 hr**	**6 hr**	**28 days**
Type I — Slow	—	—	2000	4500
Type II — Rapid	—	2000	—	4500
Type III — Very Rapid	2500	—	—	4500

TEST RESULTS	
TEST PROPERTY	**LIMITS**
Bond Strength, 7 days, psi min	2000
Length Change, increase after 28 days in water, based on length at 3 hr, % max	(+)0.15
Length Change, decrease after 28 days, % max	(-)0.15
Freeze Thaw, loss after 25 cycles in 10% $CaCl_2$ solution, % max	8
Initial Setting Time, minutes min	10

Marking. All packages delivered to the project shall be marked with the following information:

(a) Date material was packaged.

(b) Approximate setting time.

(c) Recommended dosage of water or liquid component.

(d) Mixing instructions.

(e) Class or temperature range.

Certification. The manufacturer shall furnish certification as specified in TC-1.03 showing the actual test results for each class and type of material submitted to the Laboratory.

902.15 SYNTHETIC FIBERS

When synthetic fibers are specified in the Contract Documents, the fibers shall be 1/2 to 1-1/2 in. long and conform to C1116, Type III. The manufacturer shall furnish certification as specified in TC-1.03. The quantity of fibers used and their point of introduction into the mix shall conform to the fiber manufacturer's recommendations.

902.15.01 Macro Polyolefin Fibers. D7508 with a minimum length of 1-1/2 in.

902.16 CONTROLLED LOW STRENGTH MATERIAL

902.16.01 Usage. Controlled Low Strength Material (CLSM) shall consist of the types described below:

TYPE A – Used where future excavation of the CLSM may be necessary (e.g. utility trenches, pipe trenches, bridge abutments, and around box culverts).

TYPE B – Used where future excavation of the CLSM is not anticipated (e.g. filling abandoned conduits, pipes, tunnels, mines, etc. and replacing unsuitable soils below roadway and structure foundations where extra strength is required).

902.16.02 Materials.

Coarse Aggregate	901.01*
Fine Aggregate	901.01
Hydraulic and Blended Hydraulic Cement	902.03 and 902.04
Concrete Admixtures	902.06
Fly Ash	902.06.04
Water	921.01

*maximum size of 3/4 in.

Produce CLSM in conformance with the applicable portions of Section 915 and the following:

902.16.03 Proportioning. Submit the sources and proportions of materials, and certified test data as specified in TC-1.03 for each CLSM mixture prior to construction. CLSM shall be proportioned, on the basis of field experience and/or laboratory trial mixtures, to produce a flowable and self-compacting mixture meeting the requirements of 902.16.04.

CLSM shall be proportioned by weight; with the exception of water and chemical admixtures. Water and chemical admixtures may be proportioned by volume or weight.

902.16.04 CLSM Mixtures. Proportion CLSM with sufficient amounts of Portland cement, fly ash, or slag cement; individually or in combination, to produce a cohesive, non-segregating mixture that conforms to the physical properties in the following table:

CLSM Mix	28 Day Compressive Strength, (psi) D4832	Flow Consistency, (in.) D6103
Type A	50 - 200	8 min.
Type B	500 min.	8 min.

902.17 SELF CONSOLIDATING CONCRETE (SCC)

The SCC mixture must meet the following requirements.

SELF-CONSOLIDATING CONCRETE PROPERTIES		
	PRESTRESS BEAMS	**PRECAST**
Compressive Strength C1758/T 23	As per Contract Documents	As per Contract Documents
Min Cement Factor lbs./yd^3	700	615
W/C ratio	.32 - .45	.32 - .50
Total Air Content	5.5 +/- 1.5	6.5 +/- 1.5
Concrete Temperature F	65 +/- 15	70 +/- 20
Slump Flow C1611	22 – 28 in.	22 – 28 in.
Visual Stability Index (VSI)	0 to 1	0 to 1
T 20(T 50)	2 - 10 sec.	2 - 10 sec.
J-Ring C1621	+/- 2 in. design slump flow	+/- 2 in. design slump flow
Column Segregation C1610	12 % maximum	—
Rapid Chloride Permeability	Coulombs maximum 2500	—
Freeze Thaw C666	Minimum durability factor 80	—
Shrinkage at 28 Days C157	400	—

Note 1: Column Segregation (C1610), Rapid Chloride Permeability (T 277), Freeze Thaw (C666), and Shrinkage at 28 Days (C157) are required only at time of trial batch for mix approval or any time there is a change in materials.

Note 2: Report water/cement ratio, aggregate moistures and cement temperature on each batch ticket. For e-ticketing, refer to 121.03.01.05 for all other required delivery ticket data requirements.

Note 3: Mold a minimum of one set of Compressive Strength Test Cylinders for each trial batch and for each day's production or each 50 yd^3 lot. Take the temperature of the mix once for each day's production or each 50 yd^3 lot. Slump Flow, T 20 and VSI testing shall be performed at trial batch and at the beginning of each day's production or each 50 yd^3 lot. Conduct J-Ring testing during each trial batch or on the next batch following a failure of either the spread or VSI test.

Note 4: For ASR Mitigation see 902.10.03 - Preventive Measures for Aggregate Alkali-Silica Reactivity

Note 5: High Range Water Reducing admixtures must be Type F or Type G and meet M 194.

Note 6: Viscosity modifying admixtures may be used only with prior approval by the Administration.

902.18 CONCRETE STAIN

The material shall conform to the following requirements:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Accelerated Weathering	G7	Passing results
Mildew Resistance/fungus growth	Fed. Test Method STD.141, Method 6271	Resistance
Weatherometer, 1000 hours minimum	ASTM G26	No crazing, cracking, chipping, or flaking. Light chalk and color change. No other deterioration
Total Non Volatile Vehicle, %	D2369	Mfr. Stated Value +/- 2%
Viscosity, Krebs Units, 77 deg. F	D562	Mfr. Stated value +/- 10 KU
Drying time (to touch)	D1640	1 hour minimum
Recoat dry time	D1640	Able to recoat within 24 hours
Infrared Spectrogram	D2621	n/a
Color	AMS-STD-595A	As specified in contract documents
Weight/gallon, lb. gal	D1475	Mfr. State value +/- 0.3 lb/gal
Shelf life		6 months minimum

Material more than six months old shall be retested. Material must be VOC compliant for Maryland.

CATEGORY 900
MATERIALS

SECTION 903 — MASONRY PRODUCTS

903.01 SEWER BRICK

M 91, Grade SM, with a standard size of 2-1/4 in. x 3-3/4 in. x 8 in.

903.02 MANHOLE BRICK

M 91, Grade MS.

903.03 BUILDING BRICK

M 114, Grade SW.

903.04 HOLLOW CONCRETE MASONRY BLOCK

C90, Grade N, Type I, normal weight.

903.05 SOLID CONCRETE MASONRY BLOCK

C139.

903.06 MORTAR FOR MASONRY

Composed in accordance with one of the following:

(a) One part portland or blended cement and three parts mortar sand by dry loose volume and hydrated lime not to exceed 20 percent of the cement by weight.

(b) One part masonry cement and three parts mortar sand by dry loose volume.

(c) Prepared bag mixes consisting of masonry cement and mortar sand. The prepared mixes shall produce a minimum compressive strength of 500 psi in seven days when tested using the applicable procedures specified in C91.

Materials for mortar shall meet the following:

Mortar Sand	901.01
Portland Cement	902.03
Blended Hydraulic Cement	902.04
Masonry Cement	902.05
Water	921.01
Lime	921.03

CATEGORY 900
MATERIALS

SECTION 904 — PERFORMANCE GRADED ASPHALT BINDERS AND ASPHALT MIXES

904.01 CERTIFICATION

The manufacturer and hauler shall furnish certifications as specified in TC-1.03 and the following:

The manufacturer shall certify:

(a) Date and time of loading.

(b) Tank or blending system.

(c) Identification of hauling unit.

(d) Binder grade, temperature, and quantity of materials.

(e) Complete certified analysis.

(f) Lot number, if applicable.

The hauler shall certify:

(a) Identification of hauling unit.

(b) Binder grade and source of last delivery.

(c) The date of the last delivery using this hauling tank and volume of material remaining in the tank at the time of current loading.

904.02 PERFORMANCE GRADED ASPHALT BINDERS

M332 Table 1, for mixes containing all virgin materials, recycled asphalt pavement materials, or roofing shingles from manufacturing waste. The Office of Materials Technology's (OMT) Asphalt Technology Division (ATD) will approve all PG binders. Submit certification from an approved supplier per M332 showing the final product meets specifications.

Chemical or organic additive suppliers shall supply the dosage rate and provide certification of the resultant PG binder.

The PG binder for asphalt mixes shall be achieved by the use of Neat Asphalt with elastomer polymer modifications when needed. Modifications to PG binder shall be as approved.

904.02.01 Warm Mix Asphalt (WMA) PG Binders. Include the PG binder performance grade test data over the range of WMA additive percentages proposed for WMA use. An AASHTO accredited laboratory shall be employed to perform all required WMA binder laboratory testing.

904.03 EMULSIFIED ASPHALTS

M140 or M208, and M316 with the following exceptions:

(a) Cement mixing tests are waived.

(b) Maximum of 3.0 percent by volume of oil distillate.

(c) The sieve test requirement for field samples shall be a maximum of 0.4 percent.

904.04 ASPHALT MIXES

Section 915. Asphalt mixes shall be produced as specified.

904.04.01 Aggregates. M323 and Section 901. Test the aggregate retained on the 4.75 mm sieve for flat and elongated particles per D4791. Recycled asphalt pavement used in an asphalt mix shall be considered an aggregate source per 900.03.

904.04.02 Mix Design. Develop asphalt mix designs in conformance with R35, M323 and MSMT 416, except replace "Table 6, Superpave HMA Design Requirements" in M323 with the following:

DESIGN LEVEL	20-Year Design Traffic, ESALs	N_{design}
1	<300,000	50
2	300,000 to <3,000,000	65
3	3,000,000 to <10,000,000	80
4	10,000,000 to <30,000,000	80
5	≥30,000,000	100

Design asphalt mixes for the Equivalent Single Axle Loading (ESAL) range specified.

Asphalt mixes designed with Reclaimed Asphalt Pavement (RAP) and/or Reclaimed Asphalt Shingles (RAS) shall also conform to MSMT 412.

904.04.03 Mix Design Approval. Submit data from the laboratory study to OMT for tentative approval at least 30 days prior to paving operations. Submit mix designs in an approved format. Include the following:

(a) Mix designation.

(b) Source, percentage, and grade of performance graded asphalt binder.

(c) Source, gradation, and proportion of each component aggregate.

(d) Target aggregate gradation.

(e) Plant where the asphalt mix will be produced.

(f) Plant target mixing temperature based on viscosity of 0.22 Pa·s.

(g) Ratio of dust to binder material on effective asphalt.

(h) Maximum specific gravity at the target binder content.

(i) Mix design grading plotted on 0.45 power gradation chart.

(j) Tensile strength ratio and worksheets.

(k) The bulk specific gravity and gyratory weight at N_{design} gyrations.

(l) The air void content (percent Va) at N_{design} gyrations.

(m) The voids in the mineral aggregate (percent VMA) and the voids filled with asphalt (percent VFA) at N_{design} gyrations (T 312).

(n) All consensus and source properties.

(1) Coarse aggregate angularity.

(2) Flat and elongated.

(3) Sand equivalent.

(4) Uncompacted void content of fine aggregate.

(5) Bulk and apparent specific gravity of coarse and fine aggregate.

(6) Absorption of coarse and fine aggregate.

Include the quantity of job mix formula aggregate and appropriate amount of required PG binder for ignition oven calibration with each mix design submitted for approval.

When previous construction or performance experience has shown the proposed mix design to be unsatisfactory, OMT may require submission of a more suitable design.

(a) When a change to the source of aggregate used in the mix is proposed, submit a revised mix design as specified.

(b) Notify OMT two working days in advance if a change in the PG binder source becomes necessary.

(c) Conduct a stripping test per MSMT 410 and submit an initial PG binder sample for testing and approval. OMT may require an anti-stripping additive test per D4867 before approval.

904.04.04 WMA Mix Design Approval. 904.04.03 and the following:

(a) Warm Mix technology and/or additive information.

(b) WMA manufacturer's established target rate for water and additives and the acceptable variation for production.

(c) Producer's compaction temperature of gyratory specimens.

(d) The producer shall follow the manufacturer's recommendation for incorporating additives and WMA technologies into the mix per the manufacturer's recommendations.

When a foaming, chemical or organic additive is used, submit the appropriate job mix formula (JMF) per R35 for approval.

(a) All WMA technology methods shall require a mix design/field placement demonstration on a non-Administration project once the JMF is approved and before verification, or as approved. Notify OMT two working days prior to shipment.

(b) A technical representative from the product supplier must be present during the initial shipment and placement of the WMA when a chemical or organic additive is used.

(c) If all specification requirements are met, this is a one-time demonstration per product, per plant, or with a combination of products.

(d) The demonstration may be waived if the asphalt producer has successfully placed WMA on other projects with the same aggregates and can provide testing data and contact information.

904.04.05 Verification of Mix Design. Conduct a verification of the mix at the beginning of production in each plant after receiving tentative approval for the design.

(a) Notify the Engineer and OMT at least two working days in advance of the scheduled verification. Verification shall be performed by certified personnel per 504.03.

(b) Prepare the verification samples per R35. All verification samples will be split with the OMT laboratory.

(c) Compare and evaluate the verification test results per MSMT 735.

904.04.06 Verification Evaluation. MSMT 735.

(a) Initial verification consists of four split samples tested as specified. Begin random sampling with the first day's production, with at least one split sample witnessed by an OMT representative.

(b) If the first day of production is less than 2000 tons, verification testing may be spread over no more than five working days with production of 200 tons or more. Complete verification testing no later than the fifth working day with production in excess of 200 tons or on the day when production has reached 2000 tons, whichever occurs first.

(c) Production may proceed without any changes when the Contractor's and Administration's test results conform to a Percent within Specification Limit (PWSL) of at least 85. If the mixes submitted have identical aggregate combinations and differing asphalt contents associated with changes in ESAL loads, verification may be limited to volumetric analysis, as determined.

(d) If all test results do not conform to the parameters with a PWSL of at least 85, then an adjustment to the asphalt content or gradation may be made to bring the mix design requirements within acceptable levels. Permissible adjustment limitations between the approved Mix Design and Adjusted Mix Design are as follows:

TEST PROPERTY	PERMISSIBLE ADJUSTMENT % (*)
Larger than 1/2 in. (12.5 mm) sieve	± 5
1/2 in. (12.5 mm) through No. 4 (4.75 mm) sieves	± 4
No. 8 (2.36 mm) through No. 100 (1.50 µm) sieves	± 3
No. 200 (75 µm) sieve	± 1.0
Binder Content	± 0.20

*The permissible adjustment for all mixes shall be within control points

(e) Perform a second verification to ensure that the modified mix conforms to all design requirements when an adjustment outside the permissible adjustment percentage is made to the mix design. Conform to the time and tonnage limitations as specified. Production may proceed when the adjusted mix is within control points and meets the PWSL. Suspend mix production and submit a new mix design for approval if the mix does not meet specifications. Design the new mix as specified.

(f) Suspend mix production if subsequent designs submitted due to nonconformance do not meet specifications during the initial verification until corrective action is taken, as approved.

If an adjustment to a verified mix is necessary due to aggregate changes, the mix design must meet all specification requirements before a new mix design number is issued. Verification will be based on the last 4 QA and QC production samples.

904.04.07 Thin Lifts. As specified in 504.03.13. Lift thicknesses shall be designated as thin lifts when the lift thickness specified does not meet 3-times nominal maximum aggregate size for fine graded mix designs or 4-times nominal maximum aggregate size for coarse graded mix designs.

Determine fine and coarse graded thin lift mix designs per M 323 and in accordance with the table below.

Thin Lift Mix Design Identification Table		
	Gradation Classification Control Sieve Mix Design Target (% Passing)	
Mix Designation	Fine Graded	Coarse Graded
4.75mm	A thin lift is a specified pavement thickness < 1 in.	A thin lift is a specified pavement thickness < 1 in.
9.5mm	When the 2.36mm (#8) is ≥ 47%, a thin lift is a specified pavement thickness < 1 1/8 in.	When the 2.36mm (#8) is < 47%, a thin lift is a specified pavement thickness < 1 1/2 in.
12.5mm	When the 2.36mm (#8) is ≥ 39%, a thin lift is a specified pavement thickness < 1 1/2 in.	When the 2.36mm (#8) is < 39%, a thin lift is a specified pavement thickness < 2 in.
19.0mm	When the 4.75mm (#4) is ≥ 47%, a thin lift is a specified pavement thickness < 2 1/4 in.	When the 4.75mm (#4) is < 47%, a thin lift is a specified pavement thickness < 3 in.
25.0mm	When the 4.75mm (#4) ≥ 40%, a thin lift is a specified pavement thickness < 3 in.	When the 4.75mm (#4) < 40%, a thin lift is a specified pavement thickness < 4 in.
37.5mm	When the 9.50mm (3/8) ≥ 47%, a thin lift is a specified pavement thickness < 4 1/2 in.	When the 9.50mm (3/8) < 47%, a thin lift is a specified pavement thickness < 6 in.

904.04.08 Anti-stripping Additives. D4867. Asphalt mixes shall have a Tensile Strength Ratio (TSR) of at least 0.85.

(a) The freeze-thaw conditioning cycle is required. OMT testing of TSR's will be performed randomly.

(b) Asphalt mixes not meeting the minimum TSR require the use of an approved anti-stripping additive.

(c) The producer shall determine the exact quantity of anti-stripping additive required per D4867 based on a minimum TSR of 0.85.

(d) The dosage rate when a heat stable anti-stripping additive is used shall be at least 0.20 percent of the total weight of asphalt. The additive shall be introduced by the PG binder supplier or at the plant by line blending, metering, or otherwise measuring to ensure accurate proportioning and thorough mixing.

(e) Hydrated lime (when used) shall conform to C1097. Add hydrated lime in slurry form at the rate of 1.0 to 1.5 percent by weight of total aggregate. The lime slurry shall be sprayed uniformly on the aggregate on the feed belt prior to entry into the asphalt plant dryer.

(f) Plant control and acceptance of the mix will be based on MSMT 410 according to its stripping potential.

904.04.09 Plant Control. The following tolerances shall apply:

TABLE 904 A – DENSE-GRADED MIX TOLERANCES

PHYSICAL PROPERTIES	PLANT	PROJECT SITE
	Site or Hauling Unit Samples	**Behind the Paver Samples**
Passing No. 4 (4.75 mm) sieve and larger, %	± 7	± 7
Passing No. 8 (2.36 mm) through No. 100 (150 µm) sieve, %	± 4	± 5
Passing No. 200 (75 µm) sieve, %	± 2	± 2
Asphalt content, %	± 0.4	± 0.5
Ratio of dust to binder material	0.6 to 1.6 (a)	0.6 to 1.6 (a)
Mix temperature leaving plant vs.mix design temperature, F	± 25	NA
Deviation of maximum specific gravity per lot versus design maximum specific gravity	± 0.030	± 0.040
Voids, total mix, (VTM), %	4.0 ± 1.2	4.0 ± 1.2
Voids, total mix, 4.75 mm mix (VTM), %	3 ± 2	3 ± 2
Voids in mineral aggregate, (VMA), %	± 1.2 from design target	± 1.2 from design target
Voids filled asphalt (VFA), %	Within spec	Within spec
Bulk specific gravity, Gmb, %	± 0.022	± 0.022

(a) Not applicable to 4.75 mm.

904.04.10 PWSL Computations. As specified in 504.04.02. Perform PWSL computations for maximum specific gravity, voids in the total mix, voids in the mineral aggregate, and voids filled with asphalt. Use the moving average of the last three consecutive test values for each parameter. This requirement also applies to 904.05 Gap-Graded Stone Matrix Asphalt (GGSMA).

(a) If the PWSL for the three test values falls below 85, take corrective action to bring the PWSL to at least 85.

(b) If the PWSL drops below 68, production shall be suspended until corrective action is taken as approved.

904.05 GAP-GRADED STONE MATRIX ASPHALT (GGSMA)

904.05.01 Aggregates. Refer to 904.04.01.

904.05.02 Mix Design. Refer to 904.04.02 and the following:

MIX TOLERANCES PHYSICAL PROPERTIES	MIX DESIGN
VMA, %	18.0 min.
VTM, %	3.5
Ndesign Gyrations	100
AC% by weight	6.5 min.
Draindown, % max	0.3
Fiber stabilizer, by weight of total mix, % (a)	0.2 – 0.4

(a) If used in mix design.

904.05.03 Mix Shipment and Placement Tolerances for GGSMA.

PHYSICAL PROPERTY	TOLERANCE: PLANT SITE OR HAULING UNIT SAMPLES	TOLERANCE: PROJECT SITE BEHIND THE PAVER SAMPLES
Passing No. 3/8 (9.50 mm) sieve and larger, %	± 5	± 5
Passing No.4 (4.75 mm) sieve, %	± 4	± 5
Passing No.8 (2.36 mm) sieve, %	± 4	± 5
Passing No.16 (1.18 mm) sieve, %	± 4	± 5
Passing No.30 (0.60 mm) sieve, %	± 3	± 4
Passing No.50 (0.30 mm) sieve, %	± 3	± 4
Passing No.100 (0.15 mm) sieve, %	± 3	± 4
Passing No. 200 (75 μm) sieve, %	± 2	± 2
Asphalt content, %	± 0.4	± 0.5
Ratio of dust to binder material	NA	NA
Mix temperature leaving plant versus mix design temperature, F	± 25	NA
Deviation of maximum specific gravity per lot versus design maximum specific gravity	±0.030	± 0.040
Voids, total mix, (VTM), %	3.5 ± 1.2	3.5 ± 1.2
Voids in mineral aggregate, (VMA), %	17.0 min	17.0 min
Voids filled asphalt (VFA), %	NA	NA

Fiber Stabilizer, by weight of total mix, %	±0.1	NA

904.05.04 Mix Design Approval. Refer to 904.04.03.

904.05.05 Stabilizer. Stabilizer systems with cellulose or mineral fibers or a stabilizer system without fibers shall be as approved. Add stabilizers to the mix per the manufacturer's recommendations.

904.05.06 Stabilizer Supply System for Cellulose or Mineral Fibers. A separate system for feeding shall be used to proportion the required amount into the mixture to ensure uniform distribution.

(a) For batch plants, add the stabilizer to the aggregate in the weigh hopper and increase both dry and wet mixing times. Ensure the stabilizer is uniformly distributed prior to the addition of asphalt cement into the mixture. The plant shall be interlocked so that asphalt cannot be added until the stabilizer has been introduced into the mix.

(b) For drum plants, add the stabilizer to the mixture in a manner that prevents the stabilizer from becoming entangled in the exhaust system.

(c) The stabilizer supply system shall include low level and no-flow indicators, a printout of the status of feed rate in lb/minute, and a 60 second plant shut down function for no-flow occurrences.

(d) The stabilizer supply line shall include a section of transparent pipe for observing consistency of flow or feed.

904.05.07 Antistripping Additives. Refer to 904.04.08.

CATEGORY 900
MATERIALS

SECTION 905 — PIPE

905.01 CERTIFICATION

Furnish certification for pipe as specified in TC-1.03.

MATERIAL	SPECIFICATION	REMARKS
Nonreinforced Concrete Pipe	M 86, Class 3	—
Reinforced Concrete Pipe (RCP)	M 170, Class 4 and 5	60 in. and smaller diameter, Load bearing option. Larger than 60 in. diameter, Material option.
Reinforced Concrete Elliptical Pipe (HERCP)	M 207, Class 4, Horizontal installation only	60 in. and smaller equivalent diameter, Load bearing option. Larger than 60 in. equivalent diameter, Material option.
Concrete End Sections	M 170	Class 3 pipe reinforcement required
Reinforced Concrete Arch Culvert	M 206	—
Concrete Drain Tile	M 178	—
Non-Asbestos Fiber-Cement Storm Drain Pipe	C1450	—
Reinforced Concrete Low-Head Pressure Pipe	C361	—
Corrugated Polyethylene Pipe (CPP)	M 294	300 to 15000M (12 in. - 60 in.) Diameter
Corrugated Polyethylene Drainage Pipe	M 252	Perforated underdrain and underdrain outlet pipe.
Corrugated Polypropylene Drainage Pipe	M 330	300 to 15000M (12 in. - 60 in.) Diameter
Polyvinyl Chloride Profile Wall Pipe (PPWP)	M 304	—
Polyvinyl Chloride (PVC) Pipe	M 278	Underdrain outlet pipe
	M 278 (a)	Perforated underdrain
Joints for Concrete Pipe and Manholes Using Rubber Gaskets	C443	—
Joints for Concrete Pipe, Manholes and Precast Box	C990	Not for use with circular pipe

Sections Using Preformed Flexible Joint Sealants		
Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals	D3212	—
Corrugated Steel Pipe (CSP), Pipe Arches and Underdrain	M 36 (b), (c)	End finish shall be annular corrugations
Corrugated Aluminum Alloy Pipe	M 196 (b)	End finish shall be annular corrugations
Structural Plate for Pipe, Pipe Arches and Arches (SPPA)	M 167	—
Copper Pipe	Fed Spec WW – T–799, Type K	—
Polyethylene (PE) Precoated Corrugated Steel Pipe	M 245 and M 246	Minimum thickness 10 mil on each of the surfaces.

(a) Perforations shall conform to the requirements of F758.
(b) Bands with dimples are prohibited.
(c) All Corrugated Steel Pipe shall be aluminum-coated Type 2 conforming to M 274 unless otherwise specified.

905.02 CERTIFIED REINFORCED CONCRETE PIPE PLANTS

Reinforced concrete pipe (RCP) will be accepted on certification based on TC-1.03 and the requirements outlined below. This includes the sampling, testing, documentation, and certification of the product by the manufacturer in combination with an Administration monitoring program.

Annual Inspections. Plants producing material for the Administration, or an Administration inspected contract, for the first time or after a break in production longer than one calendar year will be subject to a comprehensive inspection of its production, testing, storage facilities, materials used and applicable documentation prior to production. Each plant will be subject to another comprehensive inspection at the beginning of each calendar year thereafter. The Administration will determine whether plant equipment and personnel conform to all applicable specifications and that suitable testing facilities are available. Submit a Quality Control Plan (QCP) for review and approval prior to inspection. The producer is responsible for ensuring timely delivery of the QCP. The QCP shall include the following:

(a) The manner in which the materials will be handled including.

(1) Locations of stockpiles.

(2) Methods of weighing and batching material into mixers.

(3) Sources of materials and certifications that those materials meet these Specifications.

(4) Methods to be used to heat or cool materials during periods of extreme temperature.

(b) The following Quality Control (QC) procedures.

(1) The names, qualifications, responsibilities and a unique identification number for each of the QC personnel and the designation of a QC manager.

(2) Sampling and testing methods and frequencies.

(3) Method used for inspecting reinforcement cages prior to and during production.

(4) Method of curing.

(5) Method of maintaining accurate QC records.

(6) Samples of forms approved by the Administration.

(7) Patching procedure.

(8) Method of preparation of units for shipping.

(9) Method of identification of each unit as tested and approved.

Certification by a Professional Engineer registered in the State of Maryland attesting the plant's facilities conform to all applicable specifications will be accepted in lieu of Administration inspection. However, final determination of conformance will be as determined.

905.02.01 Responsibilities of the Concrete Pipe Producer. Perform Quality Control operations at the plant to ensure that the material conforms to specifications. The QC process will be subject to unannounced periodic Quality Assurance (QA) verification and the plant's QC personnel shall fully participate in the verification process. Submit any change in personnel, production, testing facility and policy as a supplement to the QCP in writing within 10 days.

905.02.02 Lot Size. A pipe lot is defined as a maximum 14-day production run of concrete pipe of like size, material, strength designation, and manufacturing process. The 14 days need not be consecutive, as long as they occur within a period of 30 consecutive days and the manufacturing process is not altered in any way between production days. Lot size may include up to 1000 pieces for 12 in. to 36 in. pipe and 18 in. to 36 in. equivalent elliptical diameter pipe, or 500 pieces for 42 in. and larger pipe and 42 in. and larger equivalent elliptical diameter pipe.

905.02.03 Acceptance Testing. Perform a three-edge bearing test to produce a 0.01 in. crack for each lot in conformance with M 170, Section 5.1.1 except as modified for pipe diameter per Table 905. Pipe that have been tested only to the formation of a 0.01 in. crack and that meet the 0.01 in. or lesser load requirement will be considered acceptable for use.

905.02.04 Quality Control Testing. Perform one three-edge bearing test to ultimate load at least once every 12 months in conformance with M 170, Section 5.1.1 for each size and class of pipe shipped to Administration inspected Contracts. Also, perform an absorption test on each size and class of pipe manufactured and shipped to Administration projects at least once every 12 months. Specify in the QCP the method selected to test the lots for ultimate load and absorption.

905.02.05 Test Facilities. The producer's facilities, equipment, and quality control personnel shall be capable of conducting the tests specified in T 280 and will be approved as part of the Annual Inspection. Identify all QC personnel in accordance with 905.02(b)(1) with a unique number used for testing and stamping or stenciling pipe for shipping. Record that number in the QCP and include the individual's printed name and signature. Maintain yearly calibration certificates on all equipment used for testing. The producer may elect to use the services of an independent commercial testing laboratory as approved in lieu of conducting their own tests.

905.02.06 Shipment. Pipe may be shipped to Administration projects only after the required testing for all pipe in the lot have been completed with acceptable results and all pipe to be shipped is at least the age of the test specimens at testing. Visual inspection of the pipe and the accompanying documentation will be made when pipe is received on the project to verify compliance with certification requirements.

Prior to shipping, mark the following information on the inside of each pipe.

(a) Plant name.

(b) Plant location.

(c) Size of pipe.

(d) Class of pipe.

(e) Date of manufacture.

(f) Quality control stamp.

(g) Quality control personnel number.

905.02.07 Certification. Manufacturer's certification shall accompany each shipment of pipe. Deliver a copy of the certification to the Engineer, the Administration's laboratory, the Contractor, and maintain a copy at the plant. Certification shall include the following:

(a) The plant name, address, and location.

(b) Size and class of the pipe.

(c) Date of manufacture and shipment.

(d) Number of pieces.

(e) Administration Contract number.

(f) Statement of Specification compliance.

(g) Signature and number of the quality control personnel that inspected the shipment.

905.02.08 Records. Maintain all testing and inspection documents at the production plant for at least three years from the manufacture date and make available upon request. Collect and maintain conformance certificates and mill test reports for aggregates, cement, fly ash, joint material, reinforcing steel, and other materials intended for use in products used on Administration projects.

905.02.09 QC Forms. Maintain an Administration approved quality control form for all pipe produced for use on Administration projects. Include the following on the forms for each lot:

GENERAL INFORMATION	PIPE DIMENSIONS	REINFORCEMENT	TESTS
Plant Name Lot Identification Production Dates Pipe Class Units Per Lot Technician Signature Material Sources Cement Fine Aggregate Reinforcement	Diameter Length Wall Thickness Joint Style	Size Spacing Area: Specification and Test Results Adequacy and Quality of Welds and Splices	Visual Inspection Absorption: Specification and Test Results: Once per year **THREE EDGE BEARING** **0.01 in. Crack Strength:** Specification and Test Results **Ultimate Strength:** Specification and Test Results: Once per year

905.02.10 Responsibilities of the Administration. The Administration will notify each plant when to present its QCP. 30 days will be provided to make arrangements for delivery after the Administration is notified of the plan's completion. Verification of certification by Quality Assurance Audit will be performed a minimum of once per year, as determined.

The Administration reserves the right to discontinue acceptance of RCP if the verification process indicates that materials, test procedures, or finished pipe do not conform to the specifications, Contract Documents or QCP. Producers will be notified of any type of non-compliance revealed during Quality Assurance Audits and provided with a resolution procedure to resolve any deficiencies.

905.03 CERTIFIED CORRUGATED POLYETHYLENE PIPE PLANTS

Polyethylene pipe conforming to the Specifications will be accepted on the manufacturer's certification based on the requirements outlined below. This includes the sampling, testing documentation, and certification of the product by the manufacturer in combination with an Administration Monitoring Program.

905.03.01 Responsibilities of the Corrugated Polyethylene Pipe Manufacturer. All manufacturers of Corrugated Polyethylene Pipe must be enrolled in the National Transportation Product Evaluation Program (NTPEP) to provide Corrugated Polyethylene Pipe to Administration projects. If a new manufacturer has applied to NTPEP and is awaiting the NTPEP process, the manufacturer may submit to OMT proof of application, a copy of the QCP, and results of an audit and comparison testing by an independent third-party firm which has been signed by a Professional Engineer. Upon review, a pending letter of approval will be issued until such time as the NTPEP audit process is completed.

905.03.02 Test Facilities. The NTPEP Certification Program requires all tests to be conducted at laboratories that are accredited by AASHTO or approved by the Administration. Each source may establish and maintain its own laboratory for the performance of quality control testing or may request to utilize an approved independent laboratory. The manufacturer shall make a written request and have written approval from the Administration prior to having material tested off site. The equipment required for all approved laboratories shall be qualified to perform the required test procedures as required by the applicable specification and standards.

905.03.03 Certification. The manufacturer shall certify as specified in TC-1.03, each shipment of material. The certification shall be submitted to the Structural Materials Lab for review and stamping upon shipment of material. The certification shall include the following:

(a) Plant name, address, and location.

(b) Lot or production identification.

(c) Date of manufacture and shipment.

(d) Number of units of each size pipe or total linear ft of each size pipe.

(e) Contract number.

(f) Statement of specification compliance.

(g) Signature of the quality control manager, or authorized company representative (name shall be designated in the QCP).

(h) Perforation dimensions.

(i) Identification Markings.

(j) Test data as applicable.

(1) Density

(2) Melt Index

(3) NCLS

(4) UCLS

(5) Carbon Black Content

(6) Water Inlet Data

(7) Pipe Stiffness

(8) Pipe Flattening

(9) Brittleness

(10) OIT

(11) Elongation at Break

905.03.04 Records. The manufacturer shall maintain quality control records according to their Quality Control Plan. All testing and inspection documents shall be maintained at the manufacturing facility for at least seven years from the manufactured date and made available upon request.

905.03.05 Responsibilities of the Administration. The Administration may independently verify the manufacturer's certification results by taking random samples of the finished pipe for testing from plant inspections or from project site samples and review all testing results for conformance to specifications.

The Administration will perform a visual inspection on pipe received at the project and will collect the manufacturer's certification at the time of delivery.

CATEGORY 900
MATERIALS

SECTION 906 — GABIONS

906.01 WIRE FOR GABIONS

A974. All wire including tie and connecting wire shall have a tensile strength of at least 60 000 psi. All wire sizes and mesh spacing shall be as recommended by the manufacturer.

Stainless steel interlocking fasteners meeting A313 may be substituted for wire ties. Fasteners shall remain in a closed and locked condition when subjected to directional tension along its axis at a minimum force of 900 lb.

906.01.01 Galvanized Coating for Gabions. A123. Galvanize fabric, ties, and connecting wire to at least 0.8 oz/ft^2.

906.01.02 Polyvinyl Chloride (PVC) Coating for Gabions. PVC coating for fabric, ties, and connecting wires shall exhibit no weight loss. Color number shall meet AMS-STD-595A gray, No. 26440 or green No. 24533 and match throughout the project.

CATEGORY 900
MATERIALS

SECTION 907 — PILES AND PILING

907.01 TIMBER PILING

M 168.

907.01.01 Resin and Fiberglass Caps for Timber Pile Heads. Meet the following:

PROPERTY	SPECIFICATION LIMITS	TEST METHOD
MOISTURE INSENSITIVE RESIN		
Tensile Strength, psi, min	5000	D638
Tensile Elongation, % min	0.05	D638
Compressive Strength, psi min	9000	C109
Abrasive Resistance, *l/mil min	60	D968
WOVEN GLASS CLOTH		
Weight, oz/yd^2 min	9	—
Type	Volan A	—

*liters (l) of fine aggregate per mil thickness of resin

907.02 STEEL PIPE PILES

A252, Grade 2.

907.03 STEEL BEARING PILES

A36, including all splice material.

907.04 STEEL SHEET PILES

A328. Sheet pile accessories A36. High strength bolts 909.07.

907.05 WELDING MATERIALS

AASHTO/AWS D1.5.

CATEGORY 900
MATERIALS

SECTION 908 — REINFORCING STEEL

908.01 DEFORMED REINFORCEMENT

A615, Grade 60 or A706, Grade 60. Use A706 Grade 60 when welding of the reinforcement is required. Deformed bars shall be epoxy powder coated as specified in 917.02.

908.02 PLAIN REINFORCEMENT

A615, Grade 60. Bars used as ties in Portland cement concrete pavement expansion and contraction joints shall be plain round steel bars unless otherwise specified. Bars shall be epoxy powder coated as specified in 917.02. Bars used for traverse joints shall not exceed the maximum pullout strength according to M 254.

908.03 STAINLESS STEEL BARS

A276, Type SM-29. Stainless steel bars may be used in lieu of epoxy powder coated plain bars. Deformed stainless steel bars shall meet A615 for cross sectional area and deformations.

908.04 SLEEVES FOR DOWEL BARS IN PAVEMENT EXPANSION JOINTS

Sleeves for dowel bars shall be sheet metal and capable of fitting over 2 ± 1/4 in. of the bar. Sleeves shall have a closed end with a stop to hold the end of the sleeve a minimum distance of 1 in. from the end of the dowel bar.

908.05 WELDED STEEL WIRE REINFORCEMENT, PLAIN

A1064. Reinforcement shall be furnished in flat sheets.

908.06 WELDED STEEL WIRE REINFORCEMENT, DEFORMED

A497.

908.07 WELDED DEFORMED STEEL BAR MATS

A184.

908.08 STEEL WELDED WIRE REINFORCEMENT FOR PNEUMATICALLY APPLIED MORTAR AND CONCRETE ENCASEMENT

A185, galvanized according to A123. The reinforcement shall be fabricated from size W1.4 wire on 3 in. centers in each direction or from W0.9 wire on 2 in. centers in each direction.

908.09 COLD DRAWN STEEL WIRE

M 32 for concrete reinforcement.

908.10 TIE DEVICES FOR CONCRETE PAVEMENT

Tie device sizes shall be as specified and made from deformed bar meeting 908.01 with a threaded connection. Tie devices shall have a minimum tensile strength of 40 000 psi.

908.11 STEEL STRAND

M 203, Grade 270 Low Relaxation Strand.

908.12 CERTIFICATION

TC-1.03. The steel manufacturer shall furnish certification for each heat of steel supplied.

908.13 LOW CARBON CHROMIUM BARS

A1035, Type CM or CS, Grade 100 or 120. Low carbon chromium bars may be used in lieu of epoxy powder coated plain or deformed bars. Deformed low carbon chromium bars shall meet A615 for cross sectional area and deformations.

CATEGORY 900
MATERIALS

SECTION 909 — METALS

909.00 CERTIFICATION

TC-1.03. The metal producer shall furnish certification as specified. Certification shall include actual mill test results and the chemical and physical properties of the finished metal products.

909.01 STRUCTURAL STEEL

Structural steel shall meet the following:

(a) M 270, Zone 2. All primary load carrying members shall meet the supplementary toughness requirements.

(b) Primary load carrying members are as follows or as specified.

(1) Finger joint steel from which saw tooth configurations have been cut, all stringers, cover plates, bearing stiffeners, splice plates, pins and pin links for straight rolled steel beam bridges; all flanges, webs, bearing stiffeners, splice plates, pins and pin links for straight steel girder bridges.

(2) Curved rolled steel beam and steel girder bridges; all diaphragms, cross frames, lateral bracing, including connection plates to main stringers.

909.02 STEEL FOR MISCELLANEOUS USE

A36, A572 or A709, Grade 36 or 50. Steel for bearings on structures shall conform to A709, Grade 50.

909.03 WELDING MATERIALS

AWS D1.5 or D1.1 according to design criteria.

909.04 GRAY IRON CASTINGS

A48, Class 30B.

909.05 STEEL STUD SHEAR DEVELOPERS

AWS D1.5 or D1.1 according to design criteria.

909.06 BOLTS, NUTS, AND WASHERS FOR GENERAL USE

Galvanize all according to F2329 when required. High temperature galvanizing not allowed.

(a) Bolts, A307.

(b) Anchor bolts F1554, Grade 55, S1.

(c) Washers, F436.

(d) Nuts, A563, Grade A.

909.07 HIGH STRENGTH FASTENERS, BOLTS, NUTS, AND WASHERS

F3125, Grade A325, Type 1 or 3. High temperature galvanizing is not allowed.

(a) Galvanize Type 1 according to F2329 when required.

(b) Use A325, Type 3 on weathering steel.

(c) Washers and nuts shall meet A325 -Table 1.

Perform rotational capacity testing on all high strength fasteners according to MSMT 710.

909.08 ANCHOR BOLTS, NUTS, WASHERS FOR TRAFFIC SIGNALS, HIGHWAY LIGHTING, AND SIGNS

(a) F1554, Grade 55 S1.

(b) Anchor bolts, galvanized for the full length of the threads and at least 3 in. below the threads.

(c) Nuts, heavy hex, A194, Grade 2H or A563, Grade DH.

(d) Flat washers, heavy washers, F436.

(e) Galvanized according to F2329. High-temperature galvanizing is not acceptable.

909.09 CAST WASHERS

Cast washers, ogee washers, and special cast washers according to A48. Hot dipped galvanized according to A153.

909.10 HARDWARE

F1667. Spikes, wood screws, staples, brads, lag screws, carriage bolts, and other parts under general hardware shall be composed of carbon steel.

909.11 STEEL FORMS

A653, Designation SS, Grades 33 through 80S. Steel bridge deck forms and deck form supports that remain in place shall be fabricated as specified. Steel forms shall be coated according to Coating Designation G165. The minimum thickness of uncoated steel shall be 0.0359 in.

909.12 METAL REINFORCED EPOXY FILLER

METAL REINFORCED EPOXY FILLER. The metal reinforced epoxy filler shall be a metal reinforced epoxy/polymeric compound that is designed to rebuild, restore, and repair metal surfaces. The manufacturer shall furnish actual test results for each batch of epoxy filler submitted showing the following:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Compressive Strength (psi)	D 695	8000
Adhesive Tensile Shear Strength (psi)	D 1002	900
Flexural Strength (psi)	D 790	5000
Specific Gravity	D 792	1.5 – 2.5
Cured Hardness, Durometer (Shore D)	D 2240	80 ± 5
Cured Shrinkage (%)	D 2566	< 1
Color	—	Grey or Black

CATEGORY 900
MATERIALS

SECTION 910 — BEARINGS

910.00 CERTIFICATION

The bearing producer shall furnish certification as specified in TC-1.03. The certification shall include actual mill test results. The chemical and physical properties of the finished bearings shall also be furnished by the processing manufacturer.

910.01 BRONZE OR COPPER ALLOY BEARING AND EXPANSION PLATES

Either of cast bronze or rolled copper alloy.

910.01.01 Cast Bronze. B22, Alloy No. 91100 or No. 91300.

Self-lubricating bronze bearing plates shall be an article of standard production by an approved manufacturer of such equipment. They shall be provided with trepanned recesses (not grooves) that shall be filled with a lubricating compound consisting of graphite and metallic substances with a lubricating binder capable of withstanding the atmospheric elements. The lubrication compound shall be compressed into the recesses by pressure to form dense, nonplastic lubricating inserts. The lubricating area shall comprise at least 25 percent of the total area. The static coefficient of friction shall not exceed 0.10.

The certification shall be as specified above and shall include the actual test results showing that bearing plates of the same design as those supplied meet the static coefficient of friction requirements.

Test specimens shall be at least 4 in. long by 4 in. wide. The static coefficient of friction shall be determined by testing a specimen plate subjected to a vertical pressure of 1000 psi and 1000 cycles consisting of 1/2 in. horizontal strokes at a speed not to exceed 9 cycles per minute. Conduct testing at an ambient temperature of 77 ± 9 F. The static coefficient of friction on the specimen bearing plate shall be calculated by dividing the total applied vertical load on the plate into the total horizontal load required to start motion between the bearing plate and it's mating surface while subject to the vertical load. Upon completion of the test, the bronze plate shall show no signs of galling.

910.01.02 Rolled Copper. Per PB 100, Alloy No. 51000.

910.02 STRUCTURAL BEARING PADS

The manufacturer shall furnish certification as specified in TC-1.03.

910.02.01 Elastomeric Pads. Elastomeric bearing pads shall meet material requirements described in the AASHTO LRFD Bridge Design Specifications. The elastomeric bearing pads shall be 60 durometer hardness, Shore Type A. Accompanying the certificate for elastomeric bearing pads shall be two standard ASTM tensile slabs molded from the same compound batch as the furnished elastomeric bearings.

The static load deflection of any layer of elastomeric bearing pads shall not exceed 7 percent at 800 psi average unit pressure when tested under laboratory conditions.

The design load for the elastomeric bearing pads will be as specified. The manufacturer shall proof load each steel reinforced bearing design with a compressive load of 1.5 times the maximum design load and specify that the material conforms to the material certification.

When test specimens are cut from an actual bearing pad, a reduction of 10 percent in the minimum requirements for original tensile strength and ultimate elongation will be required.

910.02.02 Self-Lubricating Bearing Assembly. A fabric reinforced elastomeric pad, Tetrafluoroethylene (TFE) bonded to the pad and a stainless steel sheet. All elements shall meet AASHTO LRFD Bridge Design Specification.

Fabric reinforced elastomeric pad shall be Type A, durometer hardness of 70 to 90. Stainless steel sheet shall be Type 304, minimum thickness of 16 gauge. The surface of the stainless steel sheet in contact with TFE shall have a 2B finish and be welded to the sole plate using an approved welding procedure.

910.02.03 Preformed Fabric Pads for General Application. Multiple layers of 8 oz cotton duck impregnated and bound with high quality natural rubber or of equally suitable materials, approved by the Engineer and compressed into resilient pads of uniform thickness, after compression and vulcanizing. The finished pads shall withstand compression loads perpendicular to the plane of the laminations of at least 10 000 psi without detrimental reduction in thickness or extrusion.

CATEGORY 900
MATERIALS

SECTION 911 — JOINTS

911.01 JOINT SEALER AND CRACK SEALER

Sealant material shall meet the requirements of classification Type II according to D6690 as modified by MSMT 404. The manufacturer shall furnish certification as specified in TC-1.03. Manufacturer's recommendations regarding heating and pouring temperatures will be used when testing these materials. If a range of temperatures is recommended, the midpoint will be used as the pour point.

911.01.01 Silicone Joint Sealer and Crack Sealer. Low modulus, one component compounds. If a primer is required, it shall be as recommended by the sealant manufacturer and be placed on the joint faces following the insertion of the backup material.

Silicone material, when tested at 73 ± 3 F and 45 percent to 55 percent relative humidity, shall meet the following:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Shore A Hardness, at 7 days	D2240	10-25
Tensile Strength at 150 % Elongation, psi max	D412 Die C	45
Elongation, % min	D412 Die C	700
Adhesion in Peel, lb/in. min	Fed Spec TT-S-00230	20
Flow, 0.01 in. max	T 187	0.3
Tack-Free Time, minutes	D2377	20-75

Each container of silicone sealer and crack sealer shall have a shelf life of at least six months. Material more than six months old shall be retested.

911.01.02 Asphalt Repair Mastic. Asphalt repair mastic shall be composed of quality-selected asphalt and/or resins, select aggregates with structural integrity, synthetic rubber polymers, antioxidants, naturally occurring and man-made reinforcing material, and other modifiers. The aggregate and polymer modified binder shall be pre-measured and packaged in a plastic bag but shall not be pre-mixed and the weight of mastic should be within 12 lb/gal to 16 lb/gal range. Asphalt repair mastic shall meet ASTM D8260 Type II and the following.

MATERIAL	PHYSICAL PROPERTIES	TEST	LIMITS
Asphalt Repair Mastic	Shelf Life	—	2 years
	Pot Life	—	12 hours maximum
	VOC, g/l	—	0
Asphalt Binder	Cone Penetration, 77 F (25 C)	D5329	70 Maximum
	Cone Penetration, 122 F (50 C)	D5329	120 Maximum
	Softening Point (R&B)	D36	200 F (93.33 C) Minimum
Aggregate	Aggregate, Factory Blended in Compound	D5444	100% Passing 5/8 in. 8% Passing #200 Maximum
Mix Design	Tensile Adhesion, psi (kPa)	D5329 Modified[1]	15 psi (83 kPa) Minimum, 0.5 in. (12 mm) Minimum Elongation
	Impact Testing, 5/8 in. dart, 2 in. (50 mm) Diameter. 1 in. (25 mm) Thick Specimen	D2794	No Cracking, Chipping or Separation at 6 ft-lb, at 20 F
	Flexibility	D5329 Modified[2]	No Cracking or Loss of Aggregate Adhesion

Note 1: The specimen for the tensile adhesion is 3 in. long x 2 in. wide x 1.5 in. thick.
Note 2: The specimen is 6 in. x 4 in. at 20 mm thickness. The test is run at 77 F and bent over a 1 in. mandrel to 180 F over 10 seconds.

911.01.03 Pourable Silicone Joint Sealant for Structures. Pourable silicone sealant for roadway joints in structures shall be a two component, cold applied, rapid cure (accommodate thermal and vertical traffic movements within 8 hours), self-leveling, 100 percent mixed together. A VOC compliant primer will be used throughout all applicable tests when recommended by the manufacturer.

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Part A		
Specific Gravity	D 792	1.2-1.4
Extrusion Rate (ml/minute)	C 1183, Type S	50 minimum
VOC (g/L)	—	50
Color	—	Dark Grey
Part B		
Specific Gravity	D 792	1.3-1.6
VOC (g/L)	D 3960	0

The material shall conform to the following requirements when mixed and applied at 77 F and 50 percent relative humidity:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
As Cured (Joint size = 1/2 in. x 1/2 in. x 2 in.)		
Skin-Over Time (minutes)	—	20
Tack-Free Time (minutes)	C 679	30-60
Cure (hours)	—	8
Hardness, Durometer (Shore A2)	C 661	25 maximum
Joint Elongation (%)	D 412, Die C	600 minimum
Joint Modulus @ 150% elongation (psi)	D 412, Die C	8-12
Joint Movement (%)	C 719	+100/-50
Operating Temperature Range (F)	—	-50 to 300
Accelerated Weathering (hours)	C 793	5,000

Each container of silicone joint sealant shall have a minimum shelf life of six months, and material more than six months old shall be retested prior to use.

911.01.04 Preformed Silicone Joint Seal. The manufacturer shall furnish certification showing that the preformed silicone joint seal meets the following:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Specific Gravity	D 792	1.3-1.6
Hardness, Durometer (Shore A)	D 2240	55 ± 5
Tensile Strength (psi)	D 412, Die B	750
Elongation (%)	D 412, Die B	350
Tearing Strength (lbs./in.)	D 624, Die B	80
Compression Set (%) @ 350º F, 72 hrs.	D 395	30
Heat Aged Properties (change %) (Hardness, tensile strength, elongation)	D 573	10 maximum
Operating Temperature Range (F)	—	-50 to 300
Color	—	Black

911.01.05 Silicone Adhesive. The manufacturer shall furnish certification showing that the non-sag, high modulus silicone adhesive meets the following at 77 F and 50 percent relative humidity:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Sag/Flow (in.)	C 639	0.20 maximum
Skin Over Time (minutes)	—	5-10
Tack Free Time (minutes)	C 679	30 maximum
Cure, 1/4 in. thickness, (hours)	C 679	24 maximum
Hardness, Durometer (Shore A2)	C 661	25 maximum
Elongation (%)	D 412	450 minimum
Tensile Strength (psi)	D 412	200 minimum
Resistance to UV	C 793	No Cracking, Chalking or Degradation
Peel Adhesion to Substrates (lbs./in.)	C 794	50 minimum
VOC	D 3960	0

911.01.06 Non-Sag Silicone Sealant for Vertical Joints in Structures. Non-sag silicone sealant for vertical joints in structures shall be a one-part, cold applied, non-sag silicone sealant material that cures to a weather and UV resistant low-modulus silicone rubber upon exposure to atmospheric moisture.

The material shall conform to the following requirements when applied and cured for 21 days at 77 F and 50 percent relative humidity:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Specific Gravity	D 792	1.3-1.6
Slump (in.)	D2202	0.30 maximum
Extrusion Rate (ml/minute)	C 1183	20 maximum
Skin-Over Time (minutes)	—	60 maximum
Tack-Free Time (hours)	C 679	5 maximum
Hardness, Durometer (Shore A2)	C 661	25 maximum
Tensile Stress @ 150% elongation (psi)	D 412, Die C	45 maximum
Elongation (%)	D 412, Die C	600 minimum
Joint Movement (%)	C 719	+100/-50
Heat Aged Properties (change %) (hardness, tensile strength, elongation)	C 792	10 maximum
Accelerated Weathering (hours)	C 793	5,000
Color		Grey or Black

No cracks or separation is allowed after the material is cured.

Each container of silicone sealer shall have a minimum shelf life of six months. Material more than six months old shall be retested.

911.02 PREFORMED JOINT FILLERS

M 153. Bituminous fiber type shall meet M 213, with the bitumen content determined according to T 164. The weathering test is not required for either type of material.

911.03 PREFORMED JOINT INSERTS

M 220.

911.04 PREFORMED POLYCHLOROPRENE ELASTOMERIC COMPRESSION JOINT SEALS

The manufacturer shall furnish certification as specified in TC-1.03.

911.04.01 Roadway Seals for Concrete Pavement. M 220.

911.04.02 Bridge Seals. M 297. The minimum depth of all seals measured at the contact surface shall be at least 90 percent of the minimum uncompressed width of the seal.

911.04.03 Lubricant Adhesive. The lubricant adhesive shall be compatible with the preformed joint seals and concrete. The Engineer will determine if consistency is suitable at the time of installation.

The manufacturer shall furnish certification as specified in TC-1.03 showing that lubricant adhesive meets the following:

TEST and METHOD	SPECIFICATION LIMITS
Viscosity, D1084, Method B, CP min	25 000
Film Strength, D412, psi min	2000
Elongation, D412, % min	250

Each container shall be plainly marked with the manufacturer's name or trademark, lot number, and date of manufacture. Do not use lubricant adhesive after nine months from the date of manufacture.

911.05 NEOPRENE STRIP SEALS

The manufacturer shall furnish certification as specified in TC-1.03 showing that the neoprene strip seals meet the following:

PHYSICAL PROPERTIES FOR PREFORMED ELASTOMERIC STRIP SEALS		
PROPERTY	**REQUIREMENT**	**TEST METHOD**
Tensile Strength, psi min	2000	D412
Elongation at Break, %, min	250	D412
Hardness, Type A Durometer, points	60 ± 5	D2240 (modified)(a)(c)
Oven Aging, 70 hr at 212 F Tensile Strength, % loss, max Elongation, % loss, max Hardness, Type A Durometer, points change	 20 20 0 to + 10	D573 D2240 (modified)(a)(c)
Oil Swell, ASTM oil 3 70 hr at 212 F weight change, % max	45	D471
Ozone Resistance 20% strain, 300 pphm in air, 70 hr at 104 F	No Cracks	D1149 (modified)(b)
Low Temperature Stiffening 7 days at 14 F Hardness, Type A Durometer, points change	0 to + 15	D2240 D2240 (modified) (a)(c)
Compression Set, 70 hr at 212 F, % max	40	D395 Method (modified) (b)(a)

(a) The term "modified" in the table relates to the specimen preparation. The use of the strip seal as the specimen source requires that more applications than specified in either of the modified test procedures be used. The specimen modification shall be agreed upon by the purchaser and producer or supplier prior to testing.

(b) Test per procedure A of D518. Ozone concentration is expressed in pphm.
(c) The hardness test shall be performed with the durometer in a durometer stand as recommended in D2240.

911.05.01 Special Molded Intersection Pieces. Where joint elements intersect, a special strip seal element manufactured by molding in one piece from neoprene material similar to that specified above shall be 10 in. from point of intersection to nearest end along center line of joint in any direction. Ends shall be plane and square to facilitate bonding to adjacent extruded areas, and corners of sharp angles shall be rounded sufficiently to relieve damaging stress concentrations. Angles to which moldings are fabricated shall be within 5 degrees of the actual angle as specified in the Contract Documents to avoid excessive deformation when installed in steel joint components.

Lubricant adhesive for use in installing and bonding neoprene seal elements to steel joint components shall be one part moisture curing polyurethane and hydrocarbon solvent mixture having the following physical properties:

TEST and METHOD	SPECIFICATION LIMITS
Average Weight, lb/gal	8 ± 0.8
Solids Content, % min	65
Adhesives shall remain liquid from, F	5 to 120
Film Strength, D412, psi min	2000
Elongation, D412, % min	250

Steel extrusions and neoprene seals shall be matching components by the same manufacturer. The steel extrusions shall have a thickness of at least 3/8 in. All steel portions of the joint assembly shall be painted with an inorganic zinc rich primer meeting 912.03 and applied as specified in Section 435.

911.06 SEALER FOR LOOP DETECTOR

Type A two part epoxy or Type B, one part polyurethane. The manufacturer shall furnish certification as specified in TC-1.03. Do not mix aggregate with the sealer material. Apply the sealer in accordance with the manufacturer's recommendations.

911.06.01 Tests. Meet to the following:

TYPE A – TWO PART EPOXY		
TEST PROPERTY	**TEST METHOD**	**SPECIFICATION LIMITS**
Viscosity, cone and plate Viscometer@ 25 C, cps max	—	12 000
Pot life @ 25 C, minutes min	—	10
Cure time @ 25 C, no tackiness, hr max	—	1
Hardness, Type D durometer	D2240	50 – 60
Tensile elongation, % min	D638	100
Water absorption, %/24 hr max	D570	0.5
Oil absorption, % max	D471	0.02
Volume resistivity @ 25 C, ohm-cm min	D257	2.4×10^{10}
TYPE B - ONE PART POLYURETHANE		
TEST PROPERTY	**TEST METHOD**	**SPECIFICATION LIMITS**
Viscosity, Brookfield RVF #6 spindle @ 20 rpm 25 C, cps max	—	30 000
Cure time @ 25 C, no tackiness, hr max	—	24
Hardness, Rex Type A	—	50 – 60
Tensile strength, psi min	D412	500
Tensile elongation, % min		300
ARC resistance, sec min	D495	70
Dielectric constant, min	D150	6 @ 50 hz 4.25 @ 500 kHz
Nonvolatile content, %	—	85

911.07 ROOFING PAPER

Roofing paper used in expansion joints shall be composed of roofing felt saturated and coated on both sides with an asphaltic material. It shall weigh at least 39.8 lb/100 ft^2 and not crack when bent 90 degrees over a 1/2 in. radius at room temperature.

911.08 WATER STOPS

Rubber or polyvinyl chloride (PVC).

Shall be of the shape and dimensions specified. The cross section shall be uniform along its length and transversely symmetrical so that the thickness at any given distance from either edge of the water stop is uniform.

Shall meet the following:

TEST and METHOD	SPECIFICATION LIMITS
Tensile Strength, D412, psi min	2000
Elongation @ Break, D412, % min	300
Hardness, Rubber, Type A durometer, D2240	55 ± 5
Hardness, PVC, Type A durometer, D2240	75 ± 5

Furnish a test sample for each lot or shipment of water stop. The manufacturer shall furnish certification as specified in TC-1.03.

911.09 ASPHALT SEALER FOR CONCRETE PIPE

A mixture of asphalt, mineral filler, and petroleum solvents, and having adhesive and cohesive properties. Each container shall be clearly marked with a lot number, manufacturer, and location of manufacturer.

The supplier shall furnish a certified copy of the test results showing that the sealer meets the following:

TEST and METHOD	SPECIFICATION LIMITS
Residues by evaporation, nonvolatile matter, D2939, % min	70
Inorganic filler on ignition, ash content, D2939, %	15 – 45

911.10 CLOSED CELL NEOPRENE SPONGE ELASTOMER

D1056, Type 2. Skin coating is optional. The material shall meet the following:

TEST and METHOD	SPECIFICATION LIMITS
Compression Deflection, D1056	Pressure necessary for 25 % deflection, 5 – 10 psi, one layer 1/2 in. thick pad @ 70 ± 5 F
Accelerated Aging Test	Change in compression deflection after aging 7 days @ 158 F, 20 % max
Permanent Set, *D1056	50 % deflection @ 158 F for 22 hr, 40 % max residual permanent set after 10 days recovery,10 % max
Water Absorption by weight	2 in. immersion of 1.129 in. diameter sample for 24 hr @ room temperature, 10 % max
Water Resistance, D1171	Quality retention, 6 weeks exposure, 100 %

*Method to calculate permanent set:

Permanent set = $(t_0 - t_1) \times 100/t_0$

where:

t_0 = original thickness of sample, and

t_1 = thickness of specimen 30 minutes after removal of clamps or after 10 days recovery.

911.11 DRAINAGE TROUGHS

911.11.01 Neoprene Drainage Troughs. M 220, and the following:

NEOPRENE DRAINAGE TROUGHS		
PHYSICAL PROPERTY	**METHOD**	**LIMITS**
Thickness, in. min	—	1/4
Tensile Strength, psi min	D412	2000
Elongation at Break, % min	D412	250
Hardness, Type A Durometer	D2240 (modified)	60 ± 5
Compression Set, 22 hr @ 212 F, % max	D395	35
Oven Aging, 70 hr @ 212 F		
Tensile Strength, % loss max	D573	20
Elongation, % loss max		20
Hardness, Type A Durometer (points change)		0 to + 10

911.11.02 OPTIONAL PREFORMED FABRIC DRAINAGE TROUGHS. A sheet composed of multiple plies of 15 ± 5 oz/yd^2 polyester fabric laminated with butadiene acrylonitrile, vulcanized to form an integral laminate. Physical properties of the laminate shall meet the following:

ALTERNATE PREFORMED FABRIC DRAINAGE TROUGHS		
PHYSICAL PROPERTY	**METHOD**	**LIMITS**
No. of Plies	—	3
Laminate Weight, lb/ft^2 min	—	0.85
Thickness, in. min	—	5/32
Breaking Strength, lb/in. min	D378	1200
Elongation at Break, % max	D378	30
Elongation at 1/10 Breaking Strength, % max	D378	3

911.12 SHIMS FOR NOISE BARRIER INSTALLATION

Either neoprene or composite elastomer with a durometer of 60 ± 5 (Shore A) value.

911.13 PREFORMED FOAM SEALS

911.13.01 Closed Cell Foam Joint Seal. Use a low density, closed cell, cross-linked, ethylene vinyl acetate polyethylene copolymer preformed foam that is physically blown using nitrogen, and is impermeable, weather and wear resistant, waterproof and chemical resistant, hold in temperature extremes of -94 F to 158 F, and meeting the following:

PROPERTY	REQUIREMENT	TEST METHOD
Density	2.5 – 3.5 lb/ft^3	D 545
Tensile, min	70 psi	D 3574
Water Absorption, max by volume	(0.02) 0.07	MIL SPEC. P-40619
Tear Strength, min	13 psi	D 624
Chemical Resistance	—	D 543

Place grooves on the foam seal along the bond surfaces at a distance of 1/4 in. to 1/2 in. apart. Ensure the grooves have an approximate dimension of 1/8 in. wide by 1/8 in. deep and run the entire length of the joint.

911.13.02 Adhesive. Use a two component, 100 percent solid, modified epoxy adhesive designed for bonding the joint seal to steel. Obtain the adhesive from the seal manufacturer that is fully compatible with the foam joint seal material in accordance with the manufacturer's specifications.

CATEGORY 900
MATERIALS

SECTION 912 — COATING SYSTEMS FOR STRUCTURAL STEEL

912.01 GENERAL

The Office of Materials Technology (OMT) will maintain a list of Approved Paint Manufacturers. Only manufacturers on this list will be acceptable. Unless otherwise specified, paint shall be tested in accordance with Federal Test Method Standard 141. Only one formulation per color will be permitted per project. Tests shall be performed at 75 F and 50 percent relative humidity unless otherwise specified. All paint shall be satisfactory for brushing, rolling, or spraying. All paints within a system shall be from the same manufacturer and shall be tinted at the point of manufacture to differentiate between coats, existing coats, and bare metal. Paint shall be shipped in the original containers and all containers shall bear the identification of the paint, consisting of the manufacturer's name, the name or title of material, volume of contents, manufacturer's paint identification number, the date of manufacture, color name and number, handling instructions, precautions, and the batch number.

912.01.01 Approved Paint Manufacturers. Admission onto the list of Approved Paint Manufacturers will be based upon the acceptance of the manufacturer's submitted Quality Control Plan.

912.01.02 Quality Control Plan. The Quality Control Plan shall define the manufacturer's process to ensure the quality of the products during and upon completion of the manufacturing process. As a minimum, the Quality Control Plan shall list the following information:

(a) Name of quality control tests and test procedures used.

(b) Detailed description of the test procedures if not a standard test.

(c) Frequency of quality control tests.

(d) Maintenance of quality control records and length of time that they will be maintained.

912.01.03 Acceptance. The paint manufacturer shall furnish certified test results for each lot and color of paint as specified in TC-1.03. Certified test results for each lot shall list the actual test results for the specified properties. The certification shall be approved by OMT prior to shipment, and a copy shall accompany each shipment.

912.01.04 Original Infrared Spectrogram. The manufacturer shall submit an original analysis of vehicle solids by infrared spectroscopy performed as specified in D2621 as follows:

(a) For zinc primer coatings, infrared spectrum (2.5 to 15 μm) of each vehicle component.

(b) For two component coatings, infrared spectrum (2.5 to 15 μm) of each single component and each mixed component, when applicable, in appropriate mixing ratios.

912.01.05 Certification Verification Tolerances. The manufacturer's facilities will be visited at random intervals, and samples will be taken. A comparison will be made between the manufacturer's certified test results and the Administration's tests results on the same batch. The tolerances between these results shall meet the following:

TEST	TOLERANCE	TEST METHOD
Total Solids by mass, %	±2	D2369
Pigment Content by mass, %	±2	D2698 or D4451
Vehicle Solids by mass, %	±2	D2369
Viscosity, KU	±10	D562
Unit Weight, lb/gal	±0.5	D1475

*Volatile Organic Compound (VOC) maximum limits shall meet the current regulations governing the point of application.

912.02 PRIMER COATS AND SEALERS

912.02.01 Inorganic Zinc Rich. M 300, Type I or IA. Zinc dust shall meet D520, Type II.

912.02.02 Aluminum Epoxy Mastic. Aluminum epoxy mastic primer shall have one component that is the condensation product of the reaction of epichlorohydrin with bisphenol A. Drying times shall be 8 hours maximum to touch, 24 hours minimum to 30 days maximum for recoat, and 48 hours maximum for hard. Minimum pot life shall be three hours. Solids by weight shall be 90 percent minimum and 80 to 90 percent by volume. Viscosity shall be 95 to 140 KU and flexibility shall pass a 180 degree bend around a 3/4 in. mandrel when tested per D522. The material shall resist sagging when tested per D4400 with no sagging at the manufacturer's recommended wet film thickness. The material shall weigh 13.0 ± 0.5 lb/gal.

912.02.03 Organic Zinc Rich. SSPC-Paint 20, Type II.

912.02.04 Zinc Rich Moisture Cured Urethane. One-component having a minimum zinc pigment content in the dry film of 80 percent. Minimum solids shall be of 80 percent by weight and 62 percent by volume. The viscosity shall be 95 to 105 KU and shall be capable of being applied at 50 percent greater film build than required without runs or sags per D4400. The interval for application of the next coat shall be 8 hours minimum and 30 days maximum. The coating shall also meet the Moisture Cured Urethanes Additional Performance Criteria Table except that the maximum loss for Abrasion Resistance shall be 82.0 mg, and Salt Spray after 1000 hours shall be 1/32 in. maximum.

912.02.05 Penetrating Sealer. Shall have a viscosity of 75 to 101 KU and be able to penetrate and seal existing coatings and substrate. It shall be suitable for application over marginally

prepared steel and most generic types of aged coatings. The sealer shall conform to one of the following:

(a) Epoxy penetrating sealer shall be cross-linked amido-amine epoxy primer/sealer having two components mixed in accordance with the manufacturer's recommendations. It shall be a minimum 95 percent solids by weight.

(b) Moisture cured urethane micaceous iron oxide filled penetrating primer/sealer shall be one component having a minimum 75 percent solids by weight. It shall also meet the Moisture Cured Urethanes Additional Performance Criteria Table.

912.03 INTERMEDIATE COATS

912.03.01 Acrylic. A single component 100 percent acrylic and have minimum solids of 48 percent by weight and 36 percent by volume. Maximum dry time to touch and recoat shall be 2 and 8 hours, respectively.

912.03.02 Epoxy Polyamide. Epoxy polyamide intermediate coat shall have one component that is the condensation product of the reaction of epichlorohydrin with bisphenol A. The epoxy polyamide shall have a 3.0 minimum fineness of grind (Hegman Units), and minimum solids of 75 percent by weight and 62 percent by volume. Maximum dry time to touch and recoat shall be 6 and 15 hours, respectively.

912.04 FINISH COATS

The color number will be specified in the Contract Documents and shall conform to AMS-STD-595A. All finish coats shall resist sagging when tested per D4400 with no sagging at the manufacturer's recommended wet film thickness.

912.04.01 Acrylic. Refer to 912.03.01.

912.04.02 Aliphatic Urethane. Finish coat shall have minimum solids of 70 percent by weight and 47 percent by volume. Drying time to touch and hard shall be the minimum recommended by the paint manufacturer.

912.04.03 Polyaspartic Urethane. Finish coat shall have a solids of 75-85 percent by weight and 65-75 percent by volume. Drying time to touch and hard shall be the minimum recommended by the paint manufacturer.

912.05 PAINT SYSTEMS

As specified in the Paint Systems Table.

PAINT SYSTEMS TABLE

PAINT	COAT	SECTION	DRY FILM THICKNESS, mils, min - max	USAGE
SYSTEM A				
Inorganic Zinc	I	912.02.01	3.0 - 5.0	Shop Primer Coat
Acrylic	II	912.03.01	2.0 - 4.0	First Intermediate Coat
Acrylic	III	912.04.01	2.0 - 4.0	Finish Coat
SYSTEM B				
Inorganic Zinc	I	912.02.01	3.0 - 5.0	Shop Primer Coat
Epoxy Polyamide	II	912.03.02	5.0 - 8.0	Intermediate Coat
Aliphatic Urethane	III	912.04.02	2.0 - 3.0	Finish Coat
SYSTEM C				
Organic Zinc	I	912.02.03	3.0 - 5.0	Primer Coat
Epoxy Polyamide	II	912.03.02	5.0 - 8.0	Intermediate Coat
Aliphatic Urethane	III	912.04.02	2.0 - 3.0	Finish Coat
SYSTEM D				
Organic Zinc	I	912.02.03	3.0 - 5.0	Primer Coat
Acrylic	II	912.03.01	2.0 - 4.0	Intermediate Coat
Acrylic	III	912.04.01	2.0 - 4.0	Finish Coat
SYSTEM E				
Aluminum Epoxy Mastic	I	912.02.02	5.0 - 8.0	Primer Coat
Epoxy Polyamide	II	912.03.02	5.0 - 8.0	Intermediate Coat
Aliphatic Urethane	III	912.04.02	2.0 - 3.0	Finish Coat
SYSTEM F				
Zinc Rich Moisture Cured Urethane	I	912.02.04	2.0 - 3.0	Primer Coat
Polyaspartic Urethane	II	912.04.03	6.0 - 9.0	Finish Coat
SYSTEM G				
Zinc Rich Moisture Cured Urethane	I	912.02.04	2.0 - 3.0	Primer
Epoxy Polyamide	II	912.03.02	3.0 - 5.0	Intermediate Coat
Polyaspartic Urethane	III	912.04.03	6.0 - 9.0	Finish Coat
SYSTEM H				
Penetrating Sealer	I	912.02.05	1.0 - 2.0	Spot Primer/ Sealer
Aluminum Filled Epoxy Mastic	II	912.02.02	3.0 - 5.0	Spot Intermediate
Aliphatic Urethane	III	912.04.02	3.0 - 5.0	Spot Finish

SYSTEM I				
Organic Zinc	I	912.02.03	3.0 - 5.0	Primer Coat
Polyaspartic Urethane	II	912.04.03	6.0 - 9.0	Finish Coat
SYSTEM J				
Organic Zinc	I	912.02.03	3.0 - 5.0	Primer Coat
Epoxy Polyamide	II	912.03.02	3.0 - 5.0	Intermediate Coat
Polyaspartic Urethane	III	912.04.03	6.0 - 9.0	Finish Coat

MOISTURE CURED URETHANES ADDITIONAL PERFORMANCE CRITERIA TABLE

TEST PROPERTY	TEST METHOD	TEST CRITERIA	COAT I and II	ENTIRE SYSTEM
Cyclic Salt Fog/UV Exposure of Painted Metal	D5894	Final Ratings: Rusting: 6 min Blistering: 10 min Rust Creep: 6 max Cracking: Degree and Type Flaking: Degree and Type	1000 hr	3000 hr
Salt Spray	B117	1/32 in. Scribe, 1/16 in. max undercut	1000 hr	3000 hr
Abrasion Resistance	D4060	Taber Abraser, CS-17 Wheel, 1000 g load, 1000 cycles, max loss	100 mg	56 mg
Adhesion	D3359	Cross-Cut Tape Test	No peeling or removal	No peeling or removal
Flexibility	D522	Conical Mandrel Bend Test, min elongation	10 %	40 %
Pencil Hardness	D3363	min	F	F
Accelerated Weathering	G53	QUV using UV - B Lamp, time after no more than 10 % loss of gloss	—	400 hr
Impact Resistance	D2794	min	—	40 in. lb
Chemical Resistance, Solutions	Fed. Spec. T-C 550 4.4.6	5 % Sodium Hydroxide 5 % Hydrochloric Acid 5% Sulfuric Acid 5 % Acetic Acid	—	Unaffected - Slight discoloration permitted
Reversed Impact	D2794	Rapid Deformation	—	No cracking or delamination

CATEGORY 900
MATERIALS

SECTION 913 — WATERPROOFING

913.00 CERTIFICATION

The producer shall furnish certification as specified in TC-1.03.

913.01 ASPHALTIC MATERIALS FOR DAMPPROOFING AND WATERPROOFING

913.01.01 Hot Applied Asphalt. D449.

913.01.02 Cold Applied Asphalt. Meet the following when tested per MSMT 423, Procedure A. The material shall not contain isocyanide or any derivative of cyanide.

TEST and METHOD		SPECIFICATION LIMITS		
		GRADE I	GRADE II	GRADE III
R and B Softening Point T 53		104 – 143 F	145 – 170 F	172 – 200 F
Penetration, 0.10 mm, T 49	32 F, 200 g, 60 sec	10 min	5 min	5 min
	77 F, 100 g, 5 sec	30 – 100	25 – 50	20 – 40
	115 F, 50 g, 5 sec	100 min	130 max	100 max
Permeability, g/cm^3, max, MSMT 423		0.09	0.09	0.09
Flow test, mm, max, MSMT 423		CC	20	15
Flexibility, 60 F, MSMT 423		No peeling or loss of adhesion		
Imperviousness Test, MSMT 423		No pitting or discoloration		
Sag test, MSMT 423		No movement		

Grade I - Suitable for below ground and horizontal applications.
Grade II - Suitable for below ground and above ground where surface temperatures do not exceed 120 F.

Grade III - Suitable for below ground and above ground where surface temperatures exceed 120 F.

913.01.03 Cold Applied Asphalt Emulsion. D1227, Type II, using D2939, modified by MSMT 423, Procedure B.

913.02 PRIMER FOR USE WITH ASPHALT FOR DAMPPROOFING AND WATERPROOFING

D41.

913.03 FABRIC SATURATED WITH ASPHALT FOR USE IN WATERPROOFING

D173.

913.04 DAMPPROOFING AND WATERPROOFING MEMBRANE

The adhesive side of the membrane shall be protected with a special release paper that can be easily removed for installation. The membrane shall meet the following requirements:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Grab Tensile Strength, lb/in. @ 12 in./minute rate of loading, min	D5034	70
Pliability, 180° bend, 1 in. mandrel @ 20 F	D146	unaffected
Resistance to Puncture, lb min	E154 (square mounting frame method)	40
Permeance, perm (kg/Pa · s · m^2), max	E96, Method B	0.1
Weight, oz/yd^2 min	D3776	40
Primer	—	as specified by the manufacturer

Roll and sheet waterproofing membrane may be accepted on certification. The manufacturer shall furnish certification as specified in TC-1.03 with actual test results showing that the material meets these Specifications.

913.05 SHEET METAL FOR FLASHING

Shall be of the material and gauge specified.

913.05.01 Copper. B152 for weight per square foot and gauge.

913.05.02 Galvanized Sheets. A653, Coating Designation G90.

CATEGORY 900
MATERIALS

SECTION 914 — CHAIN LINK FENCE

914.00 CERTIFICATION

The manufacturer shall furnish certification as specified in TC-1.03. A sample of the fence fabric shall be submitted with the fabric certification.

914.01 CHAIN LINK FENCING FABRIC

Fabric shall be 2 in. mesh woven from coated No. 6 gauge wire for 6 ft and 8 ft fence and No. 9 gauge wire for 5 ft fence unless otherwise specified. The ends shall have a knuckled selvage at the bottom and a barbed selvage at the top. The fabric shall conform to M 181. Type I fabric shall meet Class D coating. Vinyl coated steel shall meet F668, Class 2B thermally fused. Vinyl color shall be warm gray or black as specified.

914.01.01 Fence Fabric for Super Silt Fence. Galvanized fabric for super silt fence shall meet 914.01, except that it shall be woven from No. 9 gauge wire having a Class C coating. The fabric shall be 42 in. high.

914.02 TIE WIRES, LINE POST CLIPS, TENSION WIRES, AND TENSION WIRE CLIPS

M 181. The galvanized coating shall have a minimum weight of 1.2 oz/ft^2. When used with aluminum coated steel fabric; these items shall be coated with aluminum at a minimum weight of 0.40 oz/ft^2. The tension wire used with polyvinyl chloride (PVC) coated steel fabric shall have the same coating thickness and color requirements as the fence fabric.

914.03 POSTS, BRACES, FITTINGS, AND HARDWARE

M 181. When PVC coating is specified, PVC shall be thermally fused and bonded. The PVC thickness shall be 10 to 15 mil except that bolts, nuts, and washers shall be metallic coated steel. Polyester powder coating material for galvanized metal meeting 465.03.02(b) may be used in lieu of PVC.

Round posts shall meet industry standards for Class 1 or 2.

914.04 GATES

The fabric used for gates shall be identical to the fencing fabric. The gate frame and other hardware shall meet 914.02 and 914.03. When the gate frame is PVC coated, movable fittings shall be field coated with a PVC coating specifically prepared for this purpose.

914.05 BARBED WIRE

A121. The barbed wire shall be 12-1/2 gauge with four point round barbs at 5 in. spacing and Class 3 coating.

CATEGORY 900
MATERIALS

SECTION 915 — PRODUCTION PLANTS

915.01 GENERAL

These specifications are applicable to all batching and proportioning plants.

915.01.01 Approval. The plant from which the Contractor proposes to obtain material shall be approved by the Office of Materials Technology (OMT) before starting deliveries.

915.01.02 Lead Time. Notify OMT at least two working days prior to the start of operations. OMT shall be kept informed of plant operational procedures and be notified when a change is planned. Inspectors shall have safe access to all areas of the plant for the performance of their duties. All equipment, tools, machinery, and parts of the plant shall be maintained in a satisfactory working condition at all times.

915.01.03 Storage. The storage and handling of aggregates in stockpiles and bins shall be done in a manner that will prevent segregation, intermingling, and contamination by foreign material or equipment. Bins discharging to feeder systems shall be equipped with accessible calibrated devices to vary the quantity of material being fed.

915.01.04 Measuring Devices. Measuring devices shall meet the current edition of the National Institute of Standards and Technology Handbook 44, except as modified by Table 915. The producer shall provide all personnel and equipment for calibrating measuring devices.

Before the plant starts any proportioning operation, and at least once each year thereafter, all measuring devices, meters, dispensers, test weights, and other measuring devices shall be inspected, tested, and certified to be in proper operating condition by an approved testing agency. During the period of operation, all measuring devices, meters, dispensers, and other measuring devices shall be tested monthly and certified for accuracy and operating condition by the producer or an approved testing agency. Any weighing device by which materials are sold by weight as a basis of payment shall be tested monthly and certified by an approved testing agency. The Engineer shall be notified at least two working days in advance of monthly scale inspections. The certifications shall state capacities, minimum graduations, loads applied, degree of accuracy, and magnitude.

Balance and zero conditions of scales shall be checked daily, and at any other time requested by OMT. The Engineer may, at any time, direct that any measuring device be tested by the producer or an outside agency if there is any doubt about the accuracy of the measuring device. Certificates of inspection shall be posted in a prominent place in the plant, and a copy shall be promptly submitted to the Engineer.

Production plant tolerances shall meet the following table:

TABLE 915

MATERIAL	*MAINTENANCE TOLERANCE	UNIT OF MEASURE
Aggregate	0.2%	Weight
Portland Cement or Blended Hydraulic Cement of Ground Iron Blast Furnace Slag or Fly Ash	0.2%	Weight
Asphalt	0.2%	Weight or Volume
Water	1.5%	Weight or Volume
Additives	0.5%	Weight or Volume

∗Maintenance tolerance shall be the specified percent of the total capacity of the scale or the smallest scale graduation, whichever is greater.

If during the monthly check, the measuring devices are found to deviate from the allowable tolerance, they will be suspended from use until recalibrated to the Specification requirements. A price adjustment will apply to materials sold and accepted by weight that are supplied during the measuring device malfunction period when the malfunction resulted in an overpayment. The measuring device malfunction period is defined as the elapsed time between the two successive monthly checks.

915.01.05 Sampling Equipment. The producer shall provide all personnel and equipment for obtaining samples.

(a) Refer to M 156 and D140. Sample liquid binder from a tap located at the last practical and safe point between the binder control unit and the plant.

(b) Sample and split asphalt mixes per R 47.

(c) Sample and process aggregate per T 2.

915.01.06 Quality Control Laboratory. The producer shall provide an Administration-approved laboratory at proportioning or batching plants suitable for conducting the various tests required. An off-site laboratory may be used with Administration approval. Approval of the QC laboratory and testing personnel will be subject to periodic inspection. Correct any deficiencies to the satisfaction of the Administration or approval will be withdrawn.

915.02 ASPHALT PLANTS

M156. Asphalt plants shall be equipped with Automatic Batching and Recording of Batching except as modified in 915.01 and the following:

(a) Dryer. Dry the aggregates per the plant manufacturer's recommendations.

(b) Hot Aggregate Bins. M156.

(c) Mixer Unit for Batch Method. Minimum dry and wet mixing times shall be 5 and 15 seconds, respectively.

(d) Truck Scales. Per the National Institute for Standards and Technology (NIST).

(e) Delivery Records and Tickets.

(1) Maintain a delivery record showing the Contract number, truck identification (ID) number, identification of the type of mix being produced, number of truck loads, and total tons of mix.

(2) Use an approved plant automatic weighing and printing system. Provide a printed delivery ticket for each load with the cumulative total weight of mix in each truck.

Delivery tickets for each load shall also contain the truck ID number, Contract number, identification of the type of mix, date, time loaded, gross and tare weights, and net weight of the mix.

(3) Record the temperature of the mix on the delivery ticket when requested. The temperature may be handwritten.

(f) Hauling Units.

(1) Transport the mix to the work site in units cleaned of all foreign material. Treat the inside surface of all hauling units with an approved asphalt release agent that will not contaminate the mix nor alter its characteristics. The use of petroleum derivatives is prohibited.

(2) Cover the contents of each load with suitable material of sufficient size to completely protect it from the weather.

(g) Drum Mixer Plants.

(1) Refer to MSMT 453 for calibration approval.

(2) Provide a monitoring station for the purpose of controlling the entire operation. If any part of the control system fails, an alternative control system may be used for a maximum of two working days.

(3) Determine the moisture content of all aggregates per MSMT 251.

915.02.01 Certified Asphalt Plant. The producer is responsible for quality control of plant operations to ensure that the material meets specifications. The quality control process will be subject to unannounced periodic inspection when project production is in progress. The plant's certified technician shall fully participate in the inspections.

Initial Inspection. Plants initially setting up and starting production will be subject to a comprehensive inspection to determine whether the plant equipment and personnel meet all applicable specifications. Certification by a professional engineer registered in the State of Maryland that the plant facilities meet as specified will be accepted. Final acceptance will be as determined.

915.02.02 Responsibilities of the Asphalt Producer.

Notification. Notify the Engineer one working day prior to producing materials for Administration projects. Report total tons shipped one business day after completed daily shipments. Send report to Superpave@mdot.maryland.gov.

Quality Control (QC). Refer to 504.03. Perform additional sampling and testing when directed. Provide the Engineer with the opportunity to witness all sampling and testing. Report QC test results within 24 hours of production.

Reports. Furnish test results on Administration-approved documents. Retain all original QC source documents for five years.

915.02.03 Responsibilities of the Administration.

Technician Certification. Conducted per the Mid-Atlantic Region Technician Certification Program (MARTCP) and the Maryland Technician Certification Program.

Independent Assurance Audits (IAA). The Administration will evaluate the equipment and the proficiency of QC technicians through audits performed on a random basis. The QC technician shall cooperate with the IAA technician in the evaluations.

Split Samples to Evaluate the Effectiveness of the Plant Quality Control Operation. Take a mix sample at the plant or project and split per R47. Sample a minimum of once per ten days of production and when daily production exceeds 200 tons. Provide one of the split samples to the Administration for testing. Test the other split sample per MSMT 735 and submit the results within 72 hours. Approval may be withdrawn if split sample data is not submitted as specified.

(a) Effective Plant Quality Control Operations. Plant QC operations will be evaluated as effective when both split sample results compare within AASHTO Acceptable Range of Two Test Results, Multi-Laboratory Precision parameters for binder content, percent passing the 4.75 mm, 2.36 mm, 0.075 mm gradation sieves, and maximum specific gravity (G_{mm}).

After three consecutive split samples compare within the AASHTO parameters and have been evaluated, the split sample frequency may be decreased to a minimum of once every 15 days of production.

(b) Ineffective Plant Quality Control Operations. When two consecutive QC and Administration split samples do not compare, a three-way split will be taken and evaluated. If the results of the three-way split compare, the QC Lab will be considered effective and monitored. If the three-way split evaluation does not compare for all the indicated tests, the QC operation will be evaluated by the Administration and approval may be withdrawn if equipment or procedural deficiencies are determined to exist.

Recertification of Plant QC Laboratory. Documentation of corrective action shall be submitted by the QC Plan Administrator. A comprehensive inspection will be conducted to recertify the plant once the documentation is approved.

Dispute Resolution. Following is the procedure to resolve conflicts resulting from discrepancies between test results from the Office of Materials Technology's (OMT) Asphalt Technology Division or their designated AASHTO accredited third-party testing laboratory and the producer.

Verification. The producer and/or Project Engineer will provide a written dispute to OMT'S ATD Chief describing the nature of the dispute along with any pertinent information. Also provide OMT's Deputy Director for Material Quality with a copy of the written dispute.

The written dispute must be filed within five business days after receiving QA data from OMT. If the dispute was filed by the producer only, then OMT will inform the Project Engineer. The dispute will only be considered for review if test results are outside the multi-lab or operating tolerance limits for any particular test of concern.

ATD's Assistant Division Chiefs will review the pertinent information and report to the Chief. The Chief will report the findings of their review to the producer. This process will take three business days from the day written notification was received. This level will identify if further investigation or retesting is required.

Check Testing. Check testing will be performed on a split sample from the next day's production by the producer and OMT's Central Laboratory to determine any sampling/testing errors. The Producer and/or OMT can witness the testing performed by each laboratory if requested.

Verification and Check Testing will be completed within three to five business days from the day of the agreement and will focus on the questionable test results. If the issue is still not resolved, refer to Third-party Testing.

Third-party Testing. The producer and OMT will employ an AASHTO accredited laboratory to perform testing using split of the original sample. The lab whose test results vary the most from the test performed by the third-party lab will pay for the testing. The new test results will replace the original test results in the pay factor calculations. Third-party results will be considered binding unless the dispute is resolved without third-party testing, then mutually agreed upon test results will be considered binding. Testing shall be completed by the third-party testing laboratory within 10 business days of sample receipt.

Dispute Resolution Process for Discrepancies Related to Non-Test Results. The resolution process for non-test related disputes (pay factor calculations, turnaround times or mix design approvals) of sufficient magnitude to impact payment is as follows:

(a) When a non-test related dispute arises, the producer or Project Engineer will file a written dispute with the ATD Chief describing the nature of the dispute along with the pertinent information. The OMT Deputy Director of Material Quality will be copied on all written disputes. The written dispute must be filed within five business days from when the issue arises.

(b) The ATD Chief or Deputy Director of Material Quality will appoint a panel of three members to provide recommendations to resolve the dispute. The panel will include a member selected by the asphalt industry.

(c) The panel will make recommendations to the ATD Chief within five business days from the appointment.

(d) The ATD Chief or Deputy Director of Material Quality will decide the disposition of the dispute based on the panel's recommendations.

(e) A written report from the panel describing all subsequent actions and final disposition of the dispute shall be included in the project records.

(f) The process will be completed within ten business days from the date of notification. If subsequent disputes arise on the same issue, the written report will be included as a resource during the resolution process.

915.03 PORTLAND CEMENT CONCRETE PLANTS

M 157, except as modified herein, including the applicable requirements of 915.01.

915.03.01 Aggregate Storage. All aggregate used in Portland cement concrete shall be maintained at a uniform moisture content in excess of its saturated surface dry condition. Water used shall meet 921.01.

915.03.02 Moisture Probes. Moisture probes may be used in place of actual daily moisture testing of fine aggregate. Calibrate and maintain moisture probes per the manufacturer's recommendations.

(a) Perform actual moisture tests for fine aggregate weekly and as directed. When the actual tests of the fine aggregate indicate a difference of greater than 0.5 percent free moisture than the moisture probe readings, immediately perform a second actual test.

(b) If the second test indicates a moisture difference of greater than 0.5 percent, recalibrate the moisture probe and verify. Records of all calibrations and weekly tests shall be maintained and made available.

915.03.03 Mixing Temperatures. The plant shall be equipped with approved methods of heating and cooling the mix. The temperature of the plastic concrete shall meet 902.10.03. The temperature of the cementitious materials and water during mixing shall not exceed 170 F.

915.03.04 Load Tickets. AASHTO M 157. The plant shall upload all required delivery and batch ticket data as specified in 121.03.01.05, to the Administration's e-ticketing software, prior to any loaded delivery vehicle, destined for the Project utilizing e-ticketing, leaving the plant with that plant's certified technician's oversite for all control tests performed on each electronic ticket as specified in 915.03.06(c)(2). Issue a Form 116 for each load in the event an electronic batch ticket cannot be provided.

915.03.05 Mixers and Agitators. M 157 except as follows.

(a) Operate drums during transit at agitating speed only. Mixing during transit is prohibited.

(b) Add at least 85 percent of design water requirement at the plant through the certified plant water meter.

(c) Water for slump adjustment may be added at the plant through truck water system under the supervision of the certified concrete technician, provided the maximum specified water/cement ratio is not exceeded.

(d) A maximum of 3 gal of water per cubic yard of concrete may be added at the point of discharge provided it does not exceed the maximum specified water/cement ratio.

(e) No water may be added after partial discharge of the load.

(f) Loading of mixers or agitators that contain wash water in the drum is prohibited.

(g) When the concrete is to be produced by volumetric batching and continuous mixing, the batching and mixing unit shall meet C685. Calibration shall meet MSMT 558.

Concrete produced by the volumetric batching and continuous mixing method is only permissible for use in sidewalks, curbs, gutters, monolithic median, fence post footings, and utility encasement. Contractor may request additional uses.

(h) The minimum mixing time is 75 seconds for stationary mixers not subject to mixer performance tests.

915.03.06 Certified Concrete Plant. The producer shall be responsible for quality control of plant operations to ensure that the material meets as specified. The quality control process will be subject to unannounced periodic inspection by representatives of the Concrete Technology Division (CTD). Full participation in the inspection by the plant's certified technician is required.

Initial and Annual Inspection. Any plant initially setting up and annually thereafter will be subject to a comprehensive inspection to determine whether the plant equipment and personnel meet all applicable requirements. The Administration will accept certification that the plant facilities meet all applicable requirements from either of the following:

(a) National Ready Mixed Concrete Association (NRMCA) Plant Certification Program. The Administration will review NRMCA Plant Certification Data and annually issue a written Plant Certification Approval. The Administration will perform QA visits as needed to validate the plant certification.

(b) A Professional Engineer registered in the State of Maryland with at least 5 years operational or technical experience in concrete production. The Administration will review the Engineer's inspection report and issue a written Plant Certification Approval.

(c) The Administration will conduct the inspections only if (a) and (b) are not feasible or applicable. The cost for inspection will be charged to a current Contract if applicable or to the ready mix producer if a current Contract is unavailable.

Responsibilities of the Concrete Producer.

(a) Notification. Notify CTD one working day prior to producing materials for Administration projects. Notify CTD at least five working days in advance of scheduling the comprehensive inspection.

(b) Quality Control. Have the certified concrete plant technician present while concrete is being batched and delivered to Administration projects. This technician shall supervise concrete production.

(1) Develop and use an acceptable Quality Control Plan (QCP) that addresses all elements necessary for plant quality control. Submit the QCP for review and approval at the time of the annual comprehensive inspection. The QCP shall include the names, qualifications and responsibilities of a Quality Control Manager and Quality Control Technicians.

(2) Control tests shall be performed by or under the direct supervision of the certified concrete plant technician. The technician shall perform moisture tests,

adjust proportions of aggregate for free moisture, complete and sign batch or approved delivery tickets, and ensure quality control of the batching operations.

(3) Concrete Plant Technician certification will be awarded upon satisfactory completion of examinations administered by the Administration.

(4) Supply all necessary test equipment.

(5) Sampling and testing shall meet the procedures and frequencies outlined in the Material Quality Assurances Processes, Details and Frequencies manual.

(c) Reports. The following reports shall be processed by the producer.

(1) Administration Form 113, daily. Provide a copy for the producer's plant file for review.

(2) Load Tickets for each load. Provide a copy for the project and producer's file.

(3) Administration forms for all concrete materials sampled at the plant.

(4) Test Worksheets for all tests performed daily at the plant.

(5) Provide a Monthly Production Report to CTD via e-mail to concrete@mdot.maryland.gov by the 10th of each month. Report the total cubic yards and the total weight of each type of supplementary cementitious material used in concrete production for Administration projects for the previous calendar month.

(d) Inspectors Office. The producer shall provide an onsite office meeting the basic requirements of Section 103 Type A - Engineers Office for the exclusive use of SHA Engineers and Inspectors, as approved by the Engineer. The requirement for a mobile office trailer is waived.

Responsibilities of the Administration.

(a) Comprehensive Inspection and Acceptance Inspection and Testing.

(1) The Quality Control Manager will be notified immediately to correct any deficiencies found during an Administration inspection to the satisfaction of the Engineer. Production will be suspended for deficiencies where the quality of the product is affected, as determined by the Administration.

(2) If critical deficiencies are found or consecutive inspections reveal identical or additional deficiencies, a Non-Compliance Report (NCR) will be issued to the Quality Control Manager detailing the findings and actions to be taken by the producer.

(3) The Administration reserves the right to assign an Inspector to monitor operations for a maximum of five Administration production days. If at the end of this period the quality control process is not satisfactory, a NCR will be issued and plant approval will be rescinded. The plant shall be recertified before Administration production can continue.

(b) Recertification of Concrete Plant. Documentation of corrective action shall be submitted to the CTD by a professional engineer registered in the State of Maryland. A comprehensive inspection will be conducted by the Administration to recertify the concrete plant once the documentation is approved.

(c) Independent Assurance Audits (IAA). The Administration will evaluate the equipment and the proficiency of QC technicians through audits performed on a random basis. The QC technician shall cooperate with the IAA technician in the evaluations.

(d) Technician Certification. Conducted according to the Mid-Atlantic Region Technician Certification Program (MARTCP) and the Maryland Technician Certification Program.

915.04 BASE COURSE PLANTS

915.04.01 Non-Stabilized. Base course plants producing graded aggregate base material without a stabilizing agent shall meet 915.01 and the following:

(a) Produce the material in a processing plant using qualified aggregate sources and approved job mix formula.

(b) Submit the Quality Control Plan to the Soils and Aggregate Technology Division (SATD) of OMT for approval prior to production.

(c) The production shall meet the gradation requirements of the approved job mix formula.

(d) Maintain the required moisture content according to the approved job mix formula prior to shipment.

(e) Maintain stockpiles to prevent segregation.

(f) Frozen aggregates shall not be used.

(g) Mixed material shall be handled and transported in a manner that will minimize segregation and the loss of moisture. All loads shall be covered with suitable material of sufficient size to completely protect it from the weather and in accordance with State laws.

915.04.02 Stabilized.

(a) Mechanical mixers shall be used, as approved. All plants shall be equipped with automatic cutoff devices interlocked so the plant will stop operating if delivery of any component of the mix fails.

(b) The amount of stabilization shall be measured according to MSMT 254.

(c) The charge in a batch mixer or rate of feed to a continuous mixer shall not exceed the capacity that will permit complete mixing of all materials.

(d) Mixed material shall be handled and transported in a manner that will minimize segregation and the loss of moisture. All loads shall be covered with suitable material of sufficient size to completely protect it from the weather and in accordance with State laws.

(e) The required moisture content shall be maintained according to the approved job mix formula prior to shipment.

(f) When emulsified asphalt is used as a stabilizing agent, all aggregate shall contain moisture in excess of the saturated surface dry condition at time of mixing.

915.04.03 Certification of Base Course Plants. The quality control and condition of all materials used in base courses, as well as all necessary adjustments required in using the materials, is the responsibility of the base course producer. The quality assurance process will be subject to unannounced periodic inspection by representatives of the SATD when Administration projects are in progress. The plant's certified technician shall participate in the inspection.

915.04.03.01 Initial and Annual Inspections. Any plant initially setting up and annually thereafter will be subject to a comprehensive inspection to determine whether the plant equipment and personnel meet all applicable requirements. After the initial inspection, the plant shall meet 915.01.04.

(a) The Administration can conduct the initial or annual inspection. The cost for inspection will be charged to a current Contract if applicable or to the base course producer if a current Contract is unavailable.

(b) The Administration will accept certification by a professional engineer registered in the State of Maryland with at least five years operational or technical experience in base course production. The Administration will review the Engineer's inspection report and issue a written Plant Certification Approval. Final acceptance will be determined by the Administration.

915.04.03.02 Responsibilities of the Base Course Producer.

(a) Notification. Notify SATD one day prior to producing materials for Administration projects. Report total tons shipped one business day after completed daily shipments. Send report to gab@mdot.maryland.gov.

(b) Quality Control. The producer is responsible for quality control of plant operations to ensure that the material meets specification requirements. All producers supplying base courses shall have a certified base course Plant Technician present while base course material is being plant mixed and delivered to the project. The Plant Technician shall perform quality control sampling, testing, and documentation as specified.

(1) Control tests shall be performed by a certified base course plant technician. This technician shall obtain samples and test according to the current version of the Material Quality Assurance Process Manual for Soils and Aggregate Technology Division, Aggregate Materials, Controlled Mixtures.

(2) Technician certification will be awarded upon satisfactory completion of a written and practical examination given by the Administration.

(3) Supply all necessary test equipment and provide on-site facilities suitable for conducting the required tests.

(c) Reports.

(1) Prepare and submit the following reports to SATD at gab@mdot.maryland.gov:

(i) SHA Form 43, daily, stating that the material was sampled and tested using the Administration's sampling and testing guidelines and meets the applicable specifications.

(ii) SHA Form 88, for all additives introduced at the plant.

(2) Producer shall keep a record of the following forms at the Plant:

(i) Daily Plant Certification Form (SHA Form GA-1) showing that a technician was on duty at the plant.

(ii) The Producer's Daily Quality Control test worksheet, for all tests performed at the plant.

(iii) Base Course Plant Daily Production log sheet posted on the GAB Bulletin Board.

915.04.03.03 Responsibilities of the Administration.

(a) Comprehensive Inspection – SATD/OMT will perform the Initial or Annual inspection.

(b) Quality Assurance Inspection and Testing – Will be performed according to the current version of the Material Quality Assurance Process Manual for SATD, Aggregate Materials, Controlled Mixtures.

(1) If deficiencies are found, as defined in the base course plant checklist during a quality assurance inspection, the producer will be notified immediately, and operations will be suspended if corrections are not made to the satisfaction of the Engineer.

(2) If consecutive inspections reveal identical or additional deficiencies, a Non-Compliance Report (NCR) will be issued to the Quality Control Manager detailing the findings and actions to be taken by the producer.

(3) A reinspection will be held in two Administration production days. All deficiencies shall be corrected by the reinspection date. OMT will determine whether plant certification will be revoked.

(c) Independent Assurance Audits (IAA). The Administration will evaluate the equipment and the proficiency of QC technicians through audits performed on a random basis. The QC technician shall cooperate with the IAA technician in the evaluations.

(d) Recertification of Aggregate Base Course Plant. Documentation of corrective action shall be submitted by a Professional Engineer registered in the State of Maryland with at least five years operational or technical experience in base course production. When this documentation is approved, a comprehensive inspection will be conducted to recertify the base course plant.

(e) Technician Certification. Conducted according to the Mid-Atlantic Region Technician Certification Program (MARTCP) and the Maryland Technician Certification Program.

915.05 CERTIFIED PRECAST CONCRETE PLANTS

Shall meet the applicable requirements of 915.01, 915.03 and the following.

Certified Precast Concrete Plant. The producer shall be responsible for quality control of plant operations to ensure that the material meets specification requirements. The quality control process will be subject to unannounced periodic inspection by representatives of the Concrete Technology Division (CTD). Full participation in the inspection by the plant's certified technician will be required.

All plants producing precast concrete items of any description for Administration contracts shall be certified as appropriate by one or more of the following at the time of their Annual Inspection:

(a) The American Concrete Pipe Association (ACPA)

(b) The National Precast Concrete Association (NPCA)

(c) The Precast/Prestressed Concrete Institute (PCI).

Plants may be required to hold multiple certifications in order to produce a variety of products.

Initial and Annual Inspection. The Administration will perform comprehensive initial and annual inspections on all plants to ensure that the plant equipment and personnel meets all applicable specification requirements. The Administration will accept certification that the plant facilities meet all applicable requirements from a professional engineer registered in the State of Maryland with at least five years operational or technical experience in concrete production. Final acceptance and approval will be as determined by the Administration.

The cost for inspection will be charged to a current Contract if applicable or to the precast producer if a current Contract is unavailable.

915.05.01 Responsibilities of the Precast Concrete Producer.

(a) Notification. Notify CTD 14 days prior to producing any precast items for each Administration project. Notify CTD at least 5 working days in advance of scheduling the comprehensive inspection.

(b) Quality Control. Have the certified quality control technician present while concrete is being batched and cast. The technician shall supervise all aspects of precast concrete production.

(c) Quality Control Procedures. Quality control procedures shall be detailed in the Quality Control Plan and include the following:

(1) The method of inspecting reinforcement steel placement and forms prior to pouring concrete.

(2) The method of curing the concrete.

(3) The method of maintaining accurate quality control records.

(4) Samples of documents approved by the Engineer.

(5) Patching procedures.

(6) Methods of preparing the concrete units for shipment.

(7) A method of identifying each piece as tested and approved by quality control.

(d) When required, the producer shall submit a repair procedure for the precast product for approval that conforms to PCI Manual 137 and all other applicable specifications. All materials used for repairs shall be supplied from approved sources.

(e) Develop and use an acceptable Quality Control Plan (QCP) that addresses all elements necessary for plant quality control. Submit the QCP for review and approval at the time of the annual comprehensive inspection. The QCP shall include the names, qualifications and responsibilities of a Quality Control Manager and Quality Control Technicians.

(1) All precast concrete products shall meet the Standards or approved working drawings. All materials shall be from an Administration approved source and meet all applicable specifications.

(2) The plan shall indicate how the producer intends to handle all of its materials.

(3) Sample and testing frequency and certification of materials shall meet the Material Quality Assurances Processes, Details and Frequencies manual.

(4) The producer shall submit a repair procedure for approval conforming to PCI Manual 137 and all other applicable specifications. All materials used for repairs shall be supplied from approved sources.

(f) Quality Control Technician. Certified Quality Control Technicians shall hold the following certifications:

(1) Maryland Department of Transportation State Highway Administration – Office of Materials Technology Certified Concrete Plant Technician (Certified Plant Technician)

(2) American Concrete Institute (ACI) Level I

Technicians shall also hold one of the following certifications as required:

(1) PCI Level I,

(2) NPCA Production & Quality School (PQS) Level I,

(3) ACPA Q-Cast Certified Technician.

(g) Test Equipment and Facilities. Supply all necessary test equipment and provide Administration-approved facilities suitable for conducting the various tests required. Off-site test facilities shall be approved by the Engineer.

(h) Reports. The following reports shall be processed by the producer:

(1) Load Tickets for each load. Provide a copy for producer's file for review.

(2) Administration Forms for all concrete materials sampled at the plant.

(3) Test Worksheets for all tests performed daily at the plant.

(4) Provide a Monthly Production Report to CTD via e-mail to concrete@mdot.maryland.gov by the 10th of each month. Report the total cubic yards and the total weight of each type of supplementary cementitious material used in concrete production and the total number of precast items shipped to Administration projects for the previous calendar month.

(i) Inspectors Office. The producer shall provide an onsite office meeting the basic requirements of Section 103 Type A - Engineers Office for the exclusive use of SHA Engineers and Inspectors, as approved by the Engineer. The requirement for a mobile office trailer is waived.

915.05.02 Responsibilities of the Administration

(a) Comprehensive Inspection.

(b) Verification Testing.

(1) Verification of certification will be performed a minimum of once per year at the Administration's discretion.

(2) The Administration reserves the right to discontinue acceptance of precast units if verification indicates that materials or test procedures do not meet the Contract Documents.

(c) Acceptance Inspection and Testing.

(1) If deficiencies are found during an Administration inspection, the Quality Control Manager will be notified immediately to correct the deficiencies to the satisfaction of the Engineer. Production will be suspended for critical deficiencies where the quality of the product is affected as determined by the Administration.

(2) If critical deficiencies are found or consecutive inspections reveal identical or additional deficiencies, the Engineer will issue a Non-Compliance Report (NCR) to the Quality Control Manager detailing the findings and actions to be taken by the producer.

(3) The Administration reserves the right to assign an Inspector to monitor plant operations for a maximum of five Administration production days. If at the end of this period the quality control process is not satisfactory, a NCR will be issued and plant approval will be rescinded. The plant shall be recertified before Administration production can continue.

(d) Recertification of Precast Concrete Plant. Documentation of corrective action shall be submitted to the CTD by a Professional Engineer registered in the State of Maryland. After approval of the corrective action documentation, a comprehensive inspection will be conducted to recertify the concrete plant.

(e) Independent Assurance Audits (IAA). The Administration will evaluate the equipment and the QC technicians' proficiency through audits performed on a random basis. The QC technician shall cooperate with the IAA technician in the evaluations.

(f) Technician Certification. Conducted per the Mid-Atlantic Region Technician Certification Program (MARTCP) and the Maryland Technician Certification Program.

CATEGORY 900
MATERIALS

SECTION 916 — SOIL AND SOIL AGGREGATE BORROW

916.01 BORROW EXCAVATION

A soil or soil aggregate mixture meeting the following:

Maximum dry density and optimum moisture content of the material according to T 180, Method C unless the material has more than 35 percent retained on the No. 4 sieve, in which case Method D shall be used. Material with a maximum dry density of less than 100 lb/ft^3 is unsatisfactory and shall not be used in embankments. Potentially expansive materials, such as steel slag, are prohibited.

Refer to the Recycled Materials Special Provisions located elsewhere in the Contract Documents.

BORROW REQUIREMENTS						
Class Borrow	**Max Dry Density Minimum P.C.F. T 180**	**LL Maximum T 89**	**PI Maximum T 90**	**Gradation Requirements T 88**	**Reference MSMT Soil Classification**	**Reference AASHTO Classification**
Select Borrow	105	34	7	30% max passing No. 200 sieve	A-2, A-3, A-2-4	A-1-a, A-1-b, A-3, A-2-4
Capping Borrow	105	34	7	30% max passing No. 200 sieve [1]	A-2, A-3, A-2-4	A-1-a, A-1-b, A-3, A-2-4
Modified Borrow	125	30	9	50% min retained on No. 4 sieve	Any material except A-5	A-2-4, A-4 [2]
Common Borrow	100	N/A	N/A	N/A [5]	N/A	N/A
Clay Core[3]	100 [4]	N/A	N/A	30% min passing No. 200 sieve	N/A	N/A

[1] When material has no liquid and plastic limit and the amount of material passing the No. 4 sieve and retained on the No. 10 sieve is less than 10 percent of the total sample mass, the material shall have at least 15 percent passing the No. 200 sieve.
[2] A-4 material must be a manufactured product.
[3] Unified Soil Classification GC, SC, CH, or CL free of roots, stumps, wood, rubbish or other objectionable materials.
[4] Test according to T-99-C
[5] When Dredged Material or Dredged Material Blend is used as common borrow, the gradation requirements shall be 30% maximum passing No. 200 sieve and it meets the contamination level requirements.

CATEGORY 900
MATERIALS

SECTION 917 — MISCELLANEOUS PROTECTIVE COATINGS

917.01 EPOXY PROTECTIVE COATINGS FOR CONCRETE

Protective coatings shall be two component epoxy systems for use in conjunction with concrete. One component shall be a clear or pigmented condensation product of the reaction of epichlorohydrin with bisphenol A, the resin of which shall be composed of 100 percent reactive constituents. The other component shall be a clear polyamide hardener.

The producer shall submit a sample of each component for laboratory analysis. The sample shall be coded as the original sample. The original and all subsequent samples shall conform to the following:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Pot Life, hr min	Fed. Spec TT-C-535	8
Color	AMS-STD-595A	Gray No. 26440
Dry Film Thickness 1st coat, mil min 2nd coat, mil min	D1005	 2 3
Sagging	D4400	Must pass test for Recommended film Thickness
Flexibility	Federal Spec TT-P-115	Must not crack, check or delaminate
Infrared Spectrogram	Equipment Manufacturer's Procedure	Each component shall match original sample
Tensile Strength, psi min	None	400

917.02 FUSION BONDED EPOXY POWDER COATINGS FOR STEEL

A775. The epoxy protective coating shall be a one-coat, heat curable, thermosetting powdered coating that is electrostatically applied on metal surfaces as specified. For reinforcement steel, the color shall be bright, in order to contrast with the normal color of reinforcement and rust (e.g. orange, red, green, yellow etc. and not brown or any color in the rust family). Reinforcement steel coated before fabrication shall have all hairline cracks and minor damage on fabrication bends patched, even if there is no bond loss. Select epoxy coating material from the Qualified Products List (QPL) maintained by the Office of Materials Technology (OMT).

917.02.01 Touch Up System. D3963. Material used for the touch up system shall be a two part epoxy system designated and color matched for patching the epoxy coating used.

Patching material shall be available through the manufacturer of the epoxy powder. The patching material shall be fully cured one hour after application at 35 F ambient.

917.02.02 Certification. The manufacturer shall furnish certification as specified in TC-1.03.

917.03 FUSION BONDED POLYESTER POWDER SYSTEM

917.03.01 Materials. The polyester powder system shall consist of an epoxy zinc rich primer and a super durable TGIC (Triglycidyl Isocyanurate) polyester topcoat. The finish powder shall be a TGIC polyester powder. The polyester powder manufacturer shall be selected from the QPL maintained by OMT.

917.03.02 Primer. Primer shall be an epoxy zinc rich primer supplied by the same manufacturer as the finish powder. Primer shall meet the following:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Salt Spray 3000 hrs	B117	< 1/32 in. undercut, no blisters
Humidity resistance 3000 hrs	D2247	< 1/32 in. undercut, no blisters
Hardness	D3363	2H-3H
Adhesion	D3359	5B

917.03.03 Qualification Requirements. The following physical tests will be required to qualify the polyester and are not required for certification.

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Abrasion Resistance	D1044 - Taber Abraser CS-10, 1000 gm load, 1000 cycles,	100 mg max weight loss
Adhesion	D3359, Method A (Bonderite 1000 panel)	Rating *5A*
Gloss	D525, 60° initial	30 - 45 per AMS-STD-595A
Hardness	D3363	Min 2H - No gouge
Impact	D2794	Pass 80 in. lb
Salt Spray Resistance	B117, D1654 1000 hr (Bonderite 1000 panel)	Table 2, Rating 7
Thickness	D7091	7 ± 2 mills
Color	E1331 or E1338	As specified in the Contract Documents from AMS-STD-595A Color No. 20040
Infrared Spectrogram	Equipment manufacture's procedures	Manufacturer's IR
Weather Resistance	D4587, test condition D. Test shall be conducted with a UVA lamp (340 nm peak) for 1000 hr	50% min gloss retention
Specific Gravity	D5965	Manufacturer's result
Chloride Permeability	A775, A 1.3.5	*<0.000lM*

917.03.04 Certification. The polyester powder manufacturer shall furnish production batch certification as specified in TC-1.03 showing conformance to the following:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Infrared Spectrogram	D2621	Match Qualification sample
Taber Abrasion Resistance, mg loss, max	4060	100
Specific gravity	D5965 (Method A)	Qualification sample ± 0.02
Color	E1331 or E1338	Match AMS-STD-595A color no. specified in Contract Documents

917.03.05 Coating System.

Powder	Coat	Dry Film Thickness	Usage
Epoxy primer	I	2.5-4.0	Primer
Polyester Powder	II	5.0-7.0	Finish

917.03.06 Acceptance. Acceptance will be based on the quality control test results required on the manufacturer's certification. The coating applicator shall be responsible for reviewing certifications to ensure conformance to TC-l .03. The coating applicator shall also maintain a file of all reviewed certifications.

917.04 ANTI-GRAFFITI PROTECTIVE COATINGS

The manufacturer shall provide certifications for all anti-graffiti protective coatings material as specified in TC-1.03.

917.04.01 Materials. Use any product that meets specifications limits described below.

LABORATORY TESTING		
TEST PROPERTY	**TEST METHOD**	**SPECIFICATION LIMITS**
Graffiti Resistance (solvent cleanable) Complete removal of solvent-based acrylic, polyurethane, and alkyd spray paint; after exposure; and recleanability	D6578	Cleanability Level 8, 9, or 10
VOC (EPA rule 40 CFR 59)	D3960	Less than specified limits of local, state, or federal codes and regulations
Fluid Resistance, Spot Test using Paint Thinner and Gasoline	D1308	No blistering, discoloration, softening or adhesion loss
Set-to-Touch Time	D1640*	4 hr. maximum
Dry-Through Time	D1640*	24 hr. maximum
Adhesion	D6677	Passes, Rating 8
Outdoor Weathering Exposure (solvent and water cleanable)	D6578	No blistering, cracking, checking, chalking, or delamination; color change less than 2# Delta E CIE LAB units: Retention of 60°Gloss ratio >=.90
Lab-Accelerated Weathering Exposure, Cycle 2, UV light, 2000 cycles	D4587	No visible color change and loss of gloss, and no film erosion and cracking
Standard Outdoor Exposure, outdoor exposure of 6 months minimum	G7	No visible color change and loss of gloss, and no film erosion and cracking

MEK Resistance	D4752	min 4.
Breathability:	D1653	>95% water vapor transmission.

∗3 mil wet film tested at 77 degrees

CATEGORY 900
MATERIALS

SECTION 918 — TRAFFIC BARRIERS

918.00 CERTIFICATION

The manufacturer shall furnish certification as specified in TC-1.03.

918.01 TRAFFIC BARRIER W-BEAM/THRIE-BEAM

M 180, Type II or VI for rail elements and end treatments. Coat galvanized rail and end treatment elements designated for fusion bonded polyester powder coating as specified in Section 465. Galvanized rail and end treatments to be fusion bonded powder coated shall be fabricated and have holes punched prior to being hot dipped galvanized.

918.02 TRAFFIC BARRIER POSTS

A36 for steel and M 111 for galvanized coating. Coat galvanized post elements designated for fusion bonded polyester powder coating as specified in Section 465. Galvanized posts to be fusion bonded powder coated shall be fabricated and have holes punched prior to being hot dipped galvanized.

918.03 HARDWARE FOR TRAFFIC BARRIERS

M 183 for quality of steel and M 232 for galvanized coating.

918.04 TIMBER RAIL AND POSTS

M 168.

918.05 WIRE ROPE

Federal Specification RR-W-410, Type I, General Purpose, Class 2, 6 by 19, improved plow steel, fiber core. The individual wire strands shall have a zinc coating of 0.8 oz/ft^2 when tested according to T 65.

CATEGORY 900

MATERIALS

SECTION 919 — GEOTEXTILES

919.01 GEOTEXTILE REQUIREMENTS

Geotextiles used on Administration projects shall participate in the National Transportation Product Evaluation Program (NTPEP) and conform to the Contract Documents and MSMT 732. Geotextiles shall be manufactured from fibers consisting of long chain synthetic polymers, composed of a minimum 95 percent by weight of polyolefins or polyesters, and formed into a stable network so the filaments or yarns retain their dimensional stability relative to each other, including selvages. Geotextiles used on Administration projects shall conform to the following:

MARYLAND APPLICATION CLASS		TYPE OF GEOTEXTILE	GRAB STRENGTH lb	PUNCTURE STRENGTH lb	PERMITTIVITY sec^{-1}	APPARENT OPENING SIZE, MAX mm	TRAPEZOID TEAR STRENGTH *** lb
			D4632	D6241	D4491	D4751	D4533
SD	TYPE I	NONWOVEN	160	310	0.50	0.43	55
		WOVEN, MONOFILAMENT	250	495	0.50	0.43	90
	TYPE II	NONWOVEN	160	310	0.20	0.25	55
		WOVEN, MONOFILAMENT	250	495	0.20	0.25	90
PE	TYPE I	NONWOVEN	200	430	0.70	0.43	80
		WOVEN, MONOFILAMENT	250	620	0.70	0.43	90
	TYPE II	NONWOVEN	200	310	0.20	0.25	55
		WOVEN, MONOFILAMENT	250	495	0.20	0.25	90
	TYPE III	NONWOVEN	200	220	0.10	0.22	40
		WOVEN, MONOFILAMENT	250	370	0.10	0.22	70
SE		NONWOVEN	160	310	0.20	0.30	80
		WOVEN	250	495	0.20	0.30	90
ST		WOVEN	300*	600	0.05	0.15**	110
F		WOVEN	200	450	0.05	0.60	75
E		NONWOVEN	200	450	1.1	0.21	80
		WOVEN, MONOFILAMENT	370	900	0.28	0.21	100

Note 1: All property values in the above table are based on minimum average roll values in the weakest principal direction except for apparent opening size.

Note 2: The ultraviolet stability shall be 50 percent after 500 hrs of exposure for all classes, except Class F, which shall be 70 percent (D4355).

*15 percent elongation for silt fence and monofilament woven geotextile in Machine Direction
**This is a MINIMUM apparent opening size, not a maximum.
***Machine Direction

Contact the Office of Materials Technology's Soils and Aggregate Technology Division for approval of geotextiles used for reinforcement applications.

919.02 SEAM AND OVERLAP

D4884. Geotextiles joined by sewing shall conform to the following:

(a) Either "J" or "Butterfly" type seams joined with a lock stitch.

(b) Tensile strength requirements when tested across the seam.

(c) Thread used for seaming shall be of equal or greater durability than the geotextile itself.

919.03 SECURING PINS OR STAPLES

Minimum 10 in. length and designed to securely hold the geotextile in place during construction.

CATEGORY 900
MATERIALS

SECTION 920 — LANDSCAPING MATERIALS

920.01 SOILS

Topsoil, Subsoil, and Bioretention Soil Mix shall conform to requirements of this section. Soils shall be sampled, tested and approved by the Soils and Aggregates Technology Division of the Office of Materials Technology, or by other approved tests or laboratories. Soils shall be amended as specified by the Nutrient Management Plan (NMP).

920.01.01 Existing Topsoil and Salvaged Topsoil.

(a) Existing Topsoil. Existing topsoil is the surface material of existing landscaped areas on SHA property that will be used for seeding or other landscape construction without excavation or significant grading.

(b) Salvaged Topsoil. Salvaged topsoil is the surface material of existing landscaped areas on SHA property that will be used for seeding or other landscape construction after being excavated, stockpiled, and placed in designated areas.

(c) Composition. Existing topsoil and salvaged topsoil shall conform to the following:

<table>
<tr><th colspan="7">COMPOSITION - EXISTING TOPSOIL & SALVAGED TOPSOIL</th></tr>
<tr><th>TEST PROPERTY</th><th>TEST METHOD</th><th colspan="5">TEST VALUE AND AMENDMENT</th></tr>
<tr><td>Prohibited Weeds</td><td>—</td><td colspan="5">Free of live stems or roots of Shattercane, Johnsongrass, Canada Thistle, Bull Thistle, Plumeless Thistle, Musk Thistle, Common Reed and Japanese Knotweed when inspected before transportation.</td></tr>
<tr><td>Debris</td><td>—</td><td colspan="5">1.0% or less by weight of cement, concrete, asphalt, crushed gravel or construction debris when inspected.</td></tr>
<tr><td rowspan="4">Grading Analysis</td><td rowspan="4">R-58</td><td colspan="2">Sieve Size</td><td colspan="2">Passing by Weight
Minimum %</td></tr>
<tr><td colspan="2">2 in.</td><td colspan="2">100</td></tr>
<tr><td colspan="2">No. 4</td><td colspan="2">90</td></tr>
<tr><td colspan="2">No. 10</td><td colspan="2">80</td></tr>
<tr><td rowspan="5">Textural Analysis</td><td rowspan="5">T-88</td><td colspan="2">Particle</td><td colspan="2">% Retained by Weight</td></tr>
<tr><td>Size</td><td>mm</td><td>Minimum</td><td>Maximum</td></tr>
<tr><td>Sand</td><td>2.0 – 0.050</td><td>15</td><td>77</td></tr>
<tr><td>Silt</td><td>0.050 – 0.002</td><td rowspan="2">Combined Silt and Clay
23</td><td>80</td></tr>
<tr><td>Clay</td><td>less than 0.002</td><td>30</td></tr>
<tr><td>Soil pH</td><td>ASTM D4972</td><td colspan="5">pH of 4.8 to 7.6. Apply limestone to Existing Topsoil and Salvaged Topsoil with pH 4.8 to 6.1 per NMP. Apply sulfur to Existing Topsoil and Salvaged Topsoil with pH 7.1 to 7.6 per NMP.</td></tr>
<tr><td>Organic Matter</td><td>T-267</td><td colspan="5">1.0 to 8.0 percent OM by weight. Apply compost to Existing Topsoil and Salvaged Topsoil with 1.0 to 3.7 percent OM per NMP.</td></tr>
<tr><td>Nutrient Content</td><td>—</td><td colspan="5">Administration will assess. Apply fertilizer per NMP for nitrogen requirement and optimum fertility index values (FIV) for phosphorus and potassium.</td></tr>
<tr><td>Soluble Salts</td><td>EC 1:2 (V:V)</td><td colspan="5">800 ppm (1.25 mm hos/cm) or less. Apply gypsum to Existing Topsoil and Salvaged Topsoil with 500 to 800 ppm (0.78 to 1.25 mhos/cm) per NMP.</td></tr>
<tr><td>Harmful Materials</td><td>—</td><td colspan="5">Topsoil shall not contain substances in concentrations that are harmful to human health, water quality, or plant growth. Industrial waste such as ash, slag, raw sludge, or similar materials shall not be soil components.</td></tr>
</table>

920.01.02 Furnished Topsoil. A natural, friable, surface soil that is uniform in color and texture, and not derived from the project. Producers shall be included in the Qualified Products List maintained by the Administration for Furnished Topsoil.

(a) Composition. Furnished topsoil shall conform to the following.

<table>
<tr><th colspan="6">COMPOSITION - FURNISHED TOPSOIL</th></tr>
<tr><th>TEST PROPERTY</th><th>TEST METHOD</th><th colspan="4">TEST VALUE AND AMENDMENT</th></tr>
<tr><td>Prohibited Weeds</td><td>—</td><td colspan="4">Free of live stems and roots of species in 920.01.01 as well as live stems and roots of Bermudagrass, Quackgrass, and Yellow Nutsedge.</td></tr>
<tr><td>Debris</td><td>—</td><td colspan="4">920.01.01</td></tr>
<tr><td>Grading Analysis</td><td>R-58</td><td colspan="4">920.01.01</td></tr>
<tr><td rowspan="5">Textural Analysis</td><td rowspan="5">T-88</td><td colspan="2">Particle</td><td colspan="2">% Retained by Weight</td></tr>
<tr><td>Size</td><td>mm</td><td>Minimum</td><td>Maximum</td></tr>
<tr><td>Sand</td><td>2.0 – 0.050</td><td>20</td><td>75</td></tr>
<tr><td>Silt</td><td>0.050 – 0.002</td><td rowspan="2">Combined Silt and Clay 25</td><td>75</td></tr>
<tr><td>Clay</td><td>less than 0.002</td><td>30</td></tr>
<tr><td>Soil pH</td><td>ASTM D4972</td><td colspan="4">pH 6.1 to pH 7.4</td></tr>
<tr><td>Organic Matter</td><td>T-267</td><td colspan="4">4.0 to 8.0 percent OM by weight</td></tr>
<tr><td>Nutrient Content</td><td>—</td><td colspan="4">920.01.01</td></tr>
<tr><td>Soluble Salts</td><td>EC 1:2 (V:V)</td><td colspan="4">500 ppm (0.78 mm hos/cm) or less.</td></tr>
<tr><td>Harmful Materials</td><td>—</td><td colspan="4">920.01.01</td></tr>
</table>

(b) Storage. Furnished topsoil shall be a homogenous mixture stored at a specific, identifiable site in a stockpile constructed as specified in 308.03.20 and 701.03.03(c).

(c) Approval. Tests shall be completed, and approval will be granted before furnished topsoil is delivered. Ensure that Form 27B has been completed and that a source of supply letter for the furnished topsoil soil has been submitted and approved.

(d) Delivery. Certification shall be submitted that the furnished topsoil is delivered from an approved stockpile. A bill of lading or other acceptable documentation that identifies the approved source of supply shall be submitted when furnished topsoil is delivered.

920.01.03 Salvaged Subsoil. Salvaged subsoil is the subsurface material of existing areas that will be used for landscape construction after being excavated, stockpiled, and placed in designated areas.

(a) Composition. Salvaged subsoil shall conform to the following:

<table>
<tr><th colspan="6">COMPOSITION - SALVAGED SUBSOIL</th></tr>
<tr><th>TEST PROPERTY</th><th>TEST METHOD</th><th colspan="4">TEST VALUE AND AMENDMENT</th></tr>
<tr><td>Prohibited Weeds</td><td>—</td><td colspan="4">920.01.01</td></tr>
<tr><td>Debris</td><td>—</td><td colspan="4">5.0 percent or less by weight of any combination of cement, concrete, asphalt, or other construction debris when inspected.</td></tr>
<tr><td rowspan="4">Grading Analysis</td><td rowspan="4">R-58</td><td colspan="2">Sieve Size</td><td colspan="2">Passing by Weight Minimum %</td></tr>
<tr><td colspan="2">2 in.</td><td colspan="2">90</td></tr>
<tr><td colspan="2">No. 4</td><td colspan="2">85</td></tr>
<tr><td colspan="2">No. 10</td><td colspan="2">60</td></tr>
<tr><td rowspan="5">Textural Analysis</td><td rowspan="5">T-88</td><td colspan="2">Particle</td><td colspan="2">% Retained by Weight</td></tr>
<tr><td>Size</td><td>mm</td><td>Minimum</td><td>Maximum</td></tr>
<tr><td>Sand</td><td>2.0 – 0.050</td><td>10</td><td>85</td></tr>
<tr><td>Silt</td><td>0.050 – 0.002</td><td>10</td><td>85</td></tr>
<tr><td>Clay</td><td>less than 0.002</td><td>5</td><td>40</td></tr>
<tr><td>Soil pH</td><td>ASTM D4972</td><td colspan="4">pH of 4.5 to 7.8.</td></tr>
<tr><td>Organic Matter</td><td>T-267</td><td colspan="4">0.1 to 5.0 percent by weight.</td></tr>
<tr><td>Soluble Salts</td><td>EC 1:2 (V:V)</td><td colspan="4">1000 ppm (1.56 mm hos/cm) or less.</td></tr>
<tr><td>Harmful Materials</td><td>—</td><td colspan="4">920.01.01</td></tr>
</table>

920.01.04 Furnished Subsoil. A natural subsurface soil that is uniform in texture and not derived from the project. Furnished subsoil shall conform to the following:

(a) Composition. Furnished subsoil shall conform to the following:

COMPOSITION - FURNISHED SUBSOIL		
TEST PROPERTY	**TEST METHOD**	**TEST VALUE AND AMENDMENT**
Prohibited Weeds	—	920.01.01
Debris	—	920.01.03
Grading Analysis	R-58	920.01.03
Textural Analysis	T 88	920.01.03
Soil pH	ASTM D4972	920.01.03
Organic Matter	T-267	920.01.03
Soluble Salts	EC 1:2 (V:V)	800 ppm (1.25 mm hos/cm) or less
Harmful Materials	—	920.01.01

(b) Storage. Refer to 920.01.02(b).

(c) Approval. Refer to 920.01.02(c).

(d) Certification and Delivery. Refer to 920.01.02(d).

920.01.05 Bioretention Soil Mix (BSM). BSM shall be a homogenous mixture as follows:

(a) Components. BSM shall be composed of Sand, Furnished Topsoil, and Hardwood Mulch. BSM may include approved soil amendments. No other components shall be used.

(1) Sand. Sand shall be washed silica sand that conforms to ASTM C-33 or ASTM M-6 with less than 1 percent by weight of any combination of diabase, greystone, calcareous, or dolomitic sand.

(2) Furnished Topsoil. Refer to 920.01.02.

(3) Hardwood Mulch. Hardwood Mulch shall be the bark and wood of hardwood trees that is milled and screened to a uniform particle size of 2 in. or less. Hardwood Mulch shall be aged for 6 months or longer, with negligible quantity of sawdust and no foreign materials.

(4) Amendments. Refer to 920.02. Limestone, Sulfur, and Iron Sulfate may be used to adjust pH of BSM. No other amendments shall be used.

(b) Composition. BSM shall conform to the following:

COMPOSITION- BIORETENTION SOIL MIX (BSM)						
TEST PROPERTY	**TEST METHOD**	**TEST VALUE**				
Weeds	—	Free of seed and viable plant parts of species in 920.06.02(a)(b)(c) when inspected.				
Debris	—	No observable content of cement, concrete, asphalt, crushed gravel or construction debris.				
Hardwood Mulch	—	20 percent of the loose volume of BSM when inspected.				
Textural Analysis	T-88	**Particle**		**% Retained by Weight**		
		Size	**mm**	**Minimum**	**Maximum**	
		Sand	2.0 – 0.050	79	94	
		Silt	0.050 – 0.002	4	20	Combined Silt and Clay 21
		Clay	less than 0.002	1	10	
Soil pH	ASTM D4972	pH of 5.7 to 7.4.				
Organic Matter	T-267	Minimum 1.5 percent by weight.				
Soluble Salts	EC 1:2 (V:V)	500 ppm (0.78 mm hos/cm) or less.				
Harmful Materials	—	920.01.01(a).				

(c) Storage. Refer to 920.01.02(b).

(d) Approval. Refer to 920.01.02(c).

(e) Certification and Delivery. Refer to 920.01.02(d).

920.02 SOIL AMENDMENTS

920.02.01 Limestone. Limestone shall be an agricultural product manufactured and labeled for sale in Maryland for increasing soil pH. Limestone shall contain at least 85 percent calcium and magnesium carbonates. Dolomitic limestone shall contain at least 10 percent magnesium as magnesium oxide and 85 percent calcium and magnesium carbonates.

Limestone shall be supplied as a fine powder, or as pellets produced from fine powder, that conforms to the following:

LIMESTONE GRADING ANALYSIS	
SIEVE Size Number	**PASSING BY WEIGHT Minimum %**
10	100
20	98
100	50

920.02.02 Sulfur. Sulfur shall be an agricultural product manufactured and labeled for sale in Maryland for reducing soil pH. Sulfur labeled as a fertilizer may also be used to supply sulfur as a plant nutrient. Sulfur shall be supplied as a fine powder or pelletized powder with a minimum purity of 90 percent elemental sulfur.

920.02.03 Iron Sulfate. Iron sulfate shall be an agricultural product manufactured and labeled for sale in Maryland for reducing soil pH. Iron sulfate labeled as a fertilizer may also be used to supply sulfur or iron as a plant nutrient. Iron sulfate shall be supplied as a fine powder or pelletized powder with a minimum purity of 15 percent water soluble iron derived from ferrous sulfate.

920.02.04 Gypsum. Gypsum shall be an agricultural product manufactured and labeled for sale in Maryland as an aid for improving soil structure and removing soil soluble salts, or as a fertilizer to supply calcium and sulfate. Gypsum shall be supplied as a fine powder or pelletized powder with a minimum purity of 68 percent calcium sulfate dihydrate.

920.02.05 Compost. Compost products shall by Type A, Type B, or Type C in conformance with this specification. All compost types shall be biologically mature and no longer able to reheat to thermophilic temperatures per DeWar Self Heating > 5 stable; shall have a moisture content of 30 to 55 percent; shall have a weight of 1400 lb/yd^3 or less when delivered.

(a) Type A Compost. Type A Compost shall be composed primarily of biosolids, manure, and similar compost source materials with low Carbon to Nitrogen ratios. Type A Compost shall be used as a soil amendment when specified in a Nutrient Management Plan (NMP).

The typical fertilizer analysis of Type A Compost shall be provided on bagged products offered for sale. The typical fertilizer analysis of bulk Type A Compost products offered for sale by CY or Ton shall be provided to the Administration as a requirement of prequalification, or the analysis may accompany the delivery of bulk compost products.

Type A Compost shall conform to the table below:

COMPOST PHYSICAL PROPERTIES PARTICLE SIZE AND GRADING ANALYSIS Type A and Type B Compost		
Type A and Type B Compost shall have pH of 6.0 to 7.5; shall have soluble salt concentration less than 10.0 mm hos/cm; shall have a moisture content of 30 percent to 55 percent; and shall be screened as follows.		
SIEVE		**PASSING BY VOLUME**
SIZE	**mm**	
0.5 in.	12.5	100 percent minimum
No. 4	4.75	90 percent maximum
No. 40	0.425	25 percent maximum
No. 200	0.075	2.2 percent maximum

(b) Type B Compost. Type B Compost shall be composed primarily of tree leaves, lawn clippings, and similar compost source materials with high Carbon to Nitrogen ratios. Type B Compost shall be used as a soil amendment when specified in a Nutrient Management Plan (NMP).

The typical fertilizer analysis of Type B Compost shall be provided on bagged products offered for sale. The typical fertilizer analysis of bulk Type B Compost products offered for sale by CY or Ton shall be provided to the Administration as a requirement of prequalification, or the analysis may accompany the delivery of bulk compost products.

Type B Compost shall conform to the table in 920.02.05(a) above.

(c) Type C Compost. Type C Compost shall be composed primarily of chipped, ground or granulated wood, bark, and similar compost source materials with very high Carbon to Nitrogen ratios. Type C Compost shall be used to construct compost socks, compost logs, compost berms and other manufactured products for sediment and erosion control.

Type C Compost shall conform to the table, below:

COMPOST PHYSICAL PROPERTIES PARTICLE SIZE AND GRADING ANALYSIS Type C Compost	
Type C Compost shall have pH of 5.0 to 8.0; shall have soluble salt concentration less than 4.0 mm hos/cm; shall have a moisture content of 30 percent to 55 percent; and shall be screened as follows.	
SIEVE SIZE	**PASSING BY VOLUME**
6 in.	100 percent minimum
3/4 in.	75 percent minimum

920.02.06 Peat Moss. A milled sphagnum peat moss with negligible woody substances.

920.02.07 Aged Pine Bark Fines. Derived from the bark of pine trees that have been composted and milled to a fineness approved for use by the Landscape Programs Division.

920.02.08 Water Absorbent Gel. A cross linked polyacrylamide agricultural product used to maintain moisture around bare root plants and as a soil conditioner. Formulas used shall conform to the manufacturer's recommendations.

920.03 FERTILIZERS

920.03.01 Composition. Standard Fertilizers and Special Fertilizers shall be commercial grade products labeled for sale and use as agricultural fertilizer and shall conform to Federal and Maryland State regulations and the Standards of the Association of Official Analytical Chemists. All analyses are subject to approval by the Landscape Programs Division prior to application.

(a) Standard Fertilizer. Standard fertilizers shall be produced of ingredients, analysis, and composition as follows:

(1) Ingredients. Standard fertilizers shall include one or more of the following:

FERTILIZER INGREDIENTS Abbreviation and Chemical Name of Ingredient			
	ammonium nitrate		polymer coated urea
	ammonium sulfate		potassium chloride
	biosolids		potassium nitrate
	calcium nitrate	SOP	potassium sulfate
DAP	diammonium phosphate	SCU	sulfur coated urea
	isobutylidene diurea		triple super phosphate
	methylene urea		urea
MAP	monoammonium phosphate	UF	ureaform

(2) Analysis and Composition. Standard fertilizers shall contain nitrogen (N), phosphorus (P), potassium (K), and sulfate (SO_4) derived from ingredients above.

STANDARD FERTILIZER ANALYSIS AND COMPOSITION	
FERTILIZER	**USE**
0-0-50 SOP[a]	Source of potassium (K) and sulfate (SO_4) fertilizer. Used alone or in fertilizer mixtures for turfgrass and other groundcover establishment.
11-52-0 MAP[a]	Source of nitrogen (N) and phosphorus (P) fertilizer. Used alone or in fertilizer mixtures for turfgrass and other groundcover establishment.
20-16-12 (83 percent UF with MAP & SOP)[b]	Source of slow-release nitrogen (N), phosphorus (P), potassium (K) and sulfate (SO_4). Fertilizer mixture used for turfgrass and other groundcover establishment.
38-0-0 UF[a]	Source of slow-release nitrogen (N) fertilizer. Used in fertilizer mixtures for turfgrass and other groundcover establishment.
37-0-0 SCU	Source of slow-release nitrogen (N) and sulfate (SO_4). Fertilizer used for Temporary Seed and Refertilizing for groundcover establishment.
Note: [a]Purity shall be at least 98 percent UF, MAP, or SOP as indicated. [b]Mixture of UF, MAP, and SOP with no more than 2 percent of any combination of other materials.	

(b) Special Fertilizers. Special fertilizers shall be of ingredients, analysis, and composition as follows:

(1) Ingredients. Special fertilizers shall provide label analysis guaranteeing nitrogen, phosphorus, and potassium from ingredients in 920.03.01(a) and also include plant micronutrients, coatings, or materials to augment their performance.

(2) Analysis and Composition. As follows:

STANDARD FERTILIZER ANALYSIS AND COMPOSITION	
FERTILIZER[a]	**USE**
14-14-14 Polymer-coated fertilizer with minor nutrients	Slow-release fertilizer used to install trees, shrubs, perennials and other plant materials.
14-14-14 Granular fertilizer with minor nutrients	Slow-release fertilizer used to install trees, shrubs, perennials and other plant materials.
20-10-5 21 to 23 grams per fertilizer tablet. 13 percent water insoluble and 7 percent water soluble N, with minor nutrients	Slow release fertilizer tablet used to install trees, shrubs, perennials and other plant materials.
20-20-20 Water soluble powder fertilizer with minor nutrients	Fertilizer solution used to refertilize trees, shrubs, perennials and other plant materials.
Note: [a]Shall be a mixture of any ingredients listed in 920.03.01(a)(1) and (b)(1) with no more than 5 percent by weight of any combination of other materials.	

920.04 MULCHES

Materials used as mulch shall have a uniform texture and be free from foreign materials or concentrations of metals, chemicals, or other substances that are harmful to human health, water quality, or plant growth.

920.04.01 Straw Mulch. Shall consist of thoroughly threshed stems and leaves of barley, oats, rye, and wheat. Straw mulch shall be in an air dry condition suitable for application with a mulch blower or other equipment. Straw mulch shall be visually inspected to ensure it is free of objectionable quantities of mold, foreign substances, and weed seeds.

920.04.02 Wood Cellulose Fiber Mulch. A uniformly processed wood product that is able to form a homogenous slurry with seed, fertilizer, and other materials under agitation with water.

The fiber shall perform satisfactorily in hydraulic seeding equipment without clogging or damaging the system. The slurry shall contain a green dye to provide easy visual inspection for uniformity of application.

The manufacturer shall furnish certification as specified in TC-1.03 of the Technical Association of Pulp and Paper Industry (TAPPI) in conformance with the following:

WOOD CELLULOSE FIBER	
TEST PROPERTY	**TEST VALUE**
Particle Length	Approx. 0.5 in.
Particle Thickness	Approx. 0.063 in.
Net Dry Weight Content	Minimum as stated on bag
pH, TAPPI Standard T 509	4.0 – 8.5
Ash Content, TAPPI Standard T 413	7.0 percent maximum
Water Holding Capacity	90 percent minimum

The material shall be delivered in packages of uniform weight, which shall not exceed 75 lb net weight and shall bear the name of the manufacturer, the net weight, and a supplemental statement of the net weight content.

920.04.03 Shredded Hardwood Bark (SHB) Mulch. Shall consist of natural bark derived from hardwood trees that has been milled and screened to a maximum 4 in. particle size. SHB mulch shall contain negligible quantities of sawdust or other non-bark woody materials.

920.04.04 Composted Wood Chip (CWC) Mulch. Shall consist of natural wood mechanically reduced to a maximum size of 2 in. x 2 in. x 0.5 in. by a chipping machine before being composted. Grading analysis of CWC mulch shall be as follows:

COMPOSTED WOOD CHIP MULCH	
SIEVE SIZE in.	**PASSING BY VOLUME Maximum %**
2	100
1	30
0.5	10

920.05 SOIL STABILIZATION MATTING

920.05.01 Soil Stabilization Matting (SSM). SSM products shall be selected from the Office of Materials Technology's Qualified Products List (QPL) for Soil Stabilization Matting Manufacturers.

SSM shall consist of machine-produced matting of uniform thickness, weave, or distribution of fibers, supplied in rolls at least 40 in. wide. SSM shall be smolder resistant.

The chemical components shall be nonleaching, nontoxic to vegetation and germinating seed, and noinjurious to the skin.

(a) Type A. Degradable; excelsior or nonwoven coconut fibers with biodegradable netting on top and bottom; netting shall be cotton, cotton blend or coir. Type A soil stabilization matting products shall be listed in the current AASHTO National Transportation Product Evaluation Program (NTPEP) Report for Erosion Control Products. Large scale results shall be obtained by a Geosynthetic Institute Accredited or other approved laboratory for Criteria marked *.

COMPOSITION - TYPE A SSM		
CRITERIA	**METHOD**	**MEASUREMENT**
Thickness	D6525	At least 0.25 in.
Weight	D6475	At least 7.9 oz/yd^2
Tensile Strength – MD	D6818	At least 6.25 lb/in.
Tensile Strength – TD	D6818	At least 4.7 lb/in.
Light Penetration	D6567	At least 5 percent
Slope Erosion – C Factor*	D6459	No more than 0.2
Shear for 0.5 in Soil Loss*	D6460	At least 1.75 lb/ft^2
Netting Opening	—	No more than 2.0 in. x 1.0 in.
Thread	—	Biodegradable
Stitching and Spacing	—	No more than 4.0 in. apart

(b) Type B. Permanent; non-woven, nondegradable, UV stabilized, synthetic fibers; with non-degradable, UV stabilized, synthetic netting on top and bottom. Type B soil stabilization matting products shall be listed in the current AASHTO National Transportation Product Evaluation Program (NTPEP) Report for Erosion Control Products. Large scale results shall be obtained by a Geosynthetic Institute Accredited or other approved laboratory for Criteria marked *.

COMPOSITION - TYPE B SSM		
CRITERIA	**METHOD**	**MEASUREMENT**
Thickness	D6525	At least 0.3 in.
Weight	D6655	At least 10.0 oz/yd^2
Tensile Strength – MD	D6818	At least 12.5 lb/in.
Tensile Strength – TD	D6818	At least 12.5 lb/in.
Tensile Strength > 500 hr. exp	D4355	At least 80 percent of original
Light Penetration	D6567	At least 10 percent
Slope Erosion – C Factor*	D6459	No more than 0.2
Shear for 0.5 in Soil Loss*	D6460	At least 2.25 lb/ft^2
Netting Opening	—	No more than 1.0 in. x 0.75 in.
Thread	—	Nondegradable, UV stabilized, synthetic
Stitching and Spacing	—	No more than 4.0 in. apart

(c) Type C. Permanent; nondegradable, synthetic lattice; and easily filled with soil.

COMPOSITION - TYPE C SSM		
CRITERIA	**METHOD**	**MEASUREMENT**
Thickness	D6525	At least 0.4 in.
Weight	D6655	At least 7.0 oz/yd^2
Tensile Strength – MD	D6818	At least 12.5 lb/in.
Tensile Strength – TD	D6818	At least 9.5 lb/in.
Tensile Strength > 500 hr. exp.	D4355	At least 80 percent of original
Porosity or Open Area	—	At least 80 percent

(d) Type D Degradable; woven coir.

COMPOSITION - TYPE D SSM		
CRITERIA	**METHOD**	**MEASUREMENT**
Thickness	D6525	At least 0.30 in.
Weight	D6475	At least 19.0 oz/yd^2
Porosity or Open Area	—	At least 35 percent

(e) Type E. Degradable; excelsior, straw, or straw/coconut blend fibers; biodegradable netting on top and bottom; netting shall be cotton, cotton blend or coir. Type E soil stabilization matting products shall be listed in the current AASHTO National Transportation Product Evaluation Program (NTPEP) Report for Erosion Control Products. Large scale results shall be obtained by a Geosynthetic Institute Accredited or other approved laboratory for Criteria marked *.

COMPOSITION - TYPE E SSM		
CRITERIA	**METHOD**	**MEASUREMENT**
Thickness	D6525	At least 0.25 in.
Weight	D6475	Excelsior: 6.0 to 7.9 oz/yd^2
		Straw; Straw & Coconut: At least 6.0 oz/yd^2
Tensile Strength – MD	D6818	At least 6.25 lb/in.
Tensile Strength – TD	D6818	At least 2.5 lb/in.
Light Penetration	D6567	At least 5 percent
Slope Erosion – C Factor*	D6459	No more than 0.2
Shear for 0.5in Soil Loss*	D6460	At least 1.5 lb/ft^2
Netting Opening	—	Excelsior: 2.0 in. x 1.0 in. or less
		Straw; Straw & Coconut: 0.75 in. x 0.75 in. or less
Thread	—	Biodegradable
Stitching and Spacing	—	Excelsior: 4.0 in. apart or less
		Straw, or Straw & Coconut: 2.0 in. apart or less

920.05.02 Fasteners for Soil Stabilization Matting and Turfgrass Sod. Fasteners shall be selected as specified in Section 709.03.06 and conform to the following:

(a) Wood Peg. Wood, biodegradable, untreated; single leg is driven into the soil so that wider top is flush with turfgrass sod and SSM.

6 Inch. Approx. 6 in. long, 3/8 in. thick; top 1 in. wide, tapered to base.

(b) T-Head Pin. Molded plastic; biodegradable. Single leg with barbs is driven into the soil so that molded T-Head top is flush with turfgrass sod and SSM.

6 Inch. Approx. 6 in. long, 3/8 in. thick; head 1 in. wide.

8 Inch. Approx. 8 in. long, 3/8 in. thick; head 1 in. wide.

(c) Circle-Top Pin. Steel wire; single leg is driven into the soil so that coil or loop top is flush with turfgrass sod and SSM.

6 Inch. 11 gauge; leg 6 in. long.

8 Inch. 11 gauge; leg 8 in. long.

(d) Round-Head Pin. Molded plastic; biodegradable. Single leg with barbs is driven into the soil so that molded disk top is flush with turfgrass sod and SSM.

6 Inch. Approx. 6 in long; head 1 in. diameter.

8 Inch. Approx. 8 in long; head 1 in. diameter.

(e) U-Shape Staple. Steel wire; two main legs are driven into the soil so that top of staple is flush with turfgrass sod and SSM.

6 Inch. 11 gauge bent into U shape; legs 6 in. long; top 1 in. to 1-1/2 in. wide.

8 Inch. 8 gauge bent into U shape; legs 8 in. long; top 1 in. to 1-1/2 in. wide.

12 Inch. 8 gauge bent into U shape; legs 12 in. long; top 1 in. to 1-1/2 in. wide.

(f) Fabric Pin. Steel nail; single leg is driven into the soil so that steel washer top is flush with SSM.

12 Inch. 11 gauge approx. 12 in. long.

18 Inch. 3/16 in. approx. 18 in. long.

920.06 SEED AND TURFGRASS SOD STANDARDS

920.06.01 Names and Naming. The authority for common and scientific names shall be the USDA NRCS The Plants Database website at plants.usda.gov. Cultivar names shall be those of the registered cultivar.

Plant and seed identification, tags, and labels shall correspond to the common name and scientific name of the species in The Plants Database. Any conflict in names or naming shall be resolved by the Engineer in consultation with the Landscape Programs Division.

920.06.02 Prohibited Weeds.

(a) Weeds Prohibited in Turfgrass Sod and SHA Seed Mixtures. Turfgrass Sod, SHA Turfgrass Seed Mix, SHA Temporary Seed Mix, and Additive Seed shall be free from seed or viable parts of the following species:

WEEDS PROHIBITED IN TURFGRASS SOD & SHA SEED MIXTURES	
COMMON NAME	**SCIENTIFIC NAME**
Annual Bluegrass	*Poa annua L.*
Balloonvine	*Cardiospermum halicacabum* L.
Bermudagrass	*Cynodon dactylon* (L.) Pers. (approved for Bermudagrass sod)
Canada Thistle	*Cirsium arvense* (L.) Scop.
Carolina Horsenettle	*Solanum carolinense* L.
Common Corncockle	*Agrostemma githago* L.
Common Reed = Phragmites	*Phragmites australis* (Cav.) Trin. ex Steud.
Crested Anoda = Spurred Anoda	*Anoda cristata* (L.) Schltdl.
Dodder	*Cuscuta spp.* L.
Field Bindweed	*Convolvulus arvensis* L.
Japanese Bristlegrass = Giant Foxtail	*Setaria faberi* Herrm.
Java-Bean = Sicklepod	*Senna obtusifolia* (L.) Irwin and Barneby
Johnsongrass	*Sorghum halepense* (L.) Pers. and hybrids
Meadow Garlic = Wild Onion	*Allium canadense* L.
Plumeless Thistle, Musk Thistle	*Carduus* L.
Quackgrass	*Elymus repens* (L.) Gould
Rough Cocklebur	*Xanthium strumarium* L.
Serrated Tussock	*Nassella trichotoma* (Nees) Hack
Wild Garlic	*Allium vineale* L.
Yellow Nutsedge	*Cyperus esculentus* L.

(b) Weeds Prohibited in Meadow and Wildflower Seed. Meadow and Wildflower Seed shall be free of species listed in (a) and the following species:

WEEDS PROHIBITED IN MEADOW & WILDFLOWER SEED	
COMMON NAME	**SCIENTIFIC NAME**
Asiatic Tearthumb = Mile-a-Minute	*Polygonum perfoliatum* L.
Burdock and related species	*Arctium* L.
Canarygrass = Reed Canarygrass and related spp.	*Phalaris* L.
Common Wormwood = Mugwort	*Artemisia vulgaris* L.
Dogbane and related spp.	*Apocynum* L.
Eastern Poison Ivy	*Toxicodendron radicans* (L.) Kuntze
Fig Buttercup = Lesser Celandine	*Ranunculus ficaria* L. var. bulbifera Marsden-Jones
Garlic Mustard	*Alliaria petiolata* (M. Bieb.) Cavara and Grande
Giant Hogweed	*Heracleum mantegazzianum* Sommier and Levier
Japanese Honeysuckle, Tatarian Honeysuckle, related spp.	*Lonicera* L.
Japanese Knotweed	*Polygonum cuspidatum* Siebold and Zucc.
Lesser Knapweed = Spotted Knapweed	*Centaurea nigra* L.
Multiflora Rose	*Rosa multiflora* Thunb.
Nepalese Browntop = Japanese Stiltgrass	*Microstegium vimineum* (Trin.) A. Camus
Poison Hemlock	*Conium maculatum* L.
Purple Loosestrife and related spp.	*Lythrum* L.
Silvergrass and related spp.	*Miscanthus Andersson*
Thistle and related spp.	*Cirsium Mill., Onopordum L.*

(c) Weeds Prohibited in Shrub Seed. Shrub Seed shall be free of species listed in (a) and (b) and the following species:

WEEDS PROHIBITED IN SHRUB SEED	
COMMON NAME	**SCIENTIFIC NAME**
Burningbush	*Euonymus alatus* (Thunb.) Siebold
Common Buckthorn	*Rhamnus cathartica* L.
Japanese Barberry	*Berberis thunbergii* DC.
Oriental Bittersweet	*Celastrus orbiculatus* Thunb.
Oleaster; Russian Olive, Autumn Olive, and related spp.	*Elaeagnus* L.
Privet, and related species	*Ligustrum* L.
Tree of Heaven	*Ailanthus altissima* (Mill.) Swingle

920.06.03 Turfgrass Sod. Turfgrass sod shall be Maryland Certified Tall Fescue Sod unless Bermudagrass Sod or Zoysiagrass Sod is specified.

Sod shall be field grown in the State of Maryland in compliance with the Maryland Turfgrass Law and Regulations of the State of Maryland. Each load of tall fescue sod shall bear a Maryland State Certified Label.

Sod shall be sufficiently knitted when harvested to resist breakage under normal handling and be in good health at the time of delivery. Sod shall be machine cut in strips at least 14 in. wide. Tall Fescue Sod shall be uniform thickness of 0.75 in. to 1.25 in., excluding top growth, with thatch thickness less than 3/8 in.

Prior to harvest, Tall Fescue Sod shall be mowed to a height of 2.0 in. to 3.5 in. Bermudagrass Sod and Zoysiagrass Sod shall be mowed to a height of 0.75 in. to 3.0 in.

920.06.04 Approved Cultivars. Refer to 'University of Maryland Turfgrass Technical Update TT-77 Recommended Turfgrass Cultivars for Certified Sod Production and Seed Mixtures in Maryland'. Only cultivars included in TT-77 may be used. When no cultivar is specified, any common type cultivar of the species may be used.

920.06.05 Seed Testing and Sampling. Seed shall comply with the Maryland Seed Law and Regulations of the State of Maryland. Seed suppliers shall assume charges for seed inspections and testing.

(a) Certified Seed. Component cultivars of SHA Turfgrass Seed Mix, SHA Special Purpose Seed Mix, SHA Temporary Seed Mix, and any seed used as additives for these mixes, shall be certified and carry the tags of their state of origin that show the percent purity, percent germination, percent weed seed, and types and content of noxious weed seed.

(b) SHA Seed Mixtures. Turfgrass Seed Mix, SHA Special Purpose Seed Mix, and SHA Temporary Seed Mix shall be sampled and tested by an inspector of the Maryland Department of Agriculture, Turf and Seed Section (MDA) for percent purity, percent germination, percent weed seed, and types and content of noxious weed seed. These seed mixtures shall conform to MDA Standards for Maryland Certified Seed and carry the certified tag of the State of Maryland.

(c) Unmixed Seed. Seed supplied for use as Meadow Seed, Wildflower Seed, and Shrub Seed shall be supplied in containers of a single species, unmixed. Each species shall be tested by the producer or supplier and carry a tag that shows the percent purity, percent germination, percent weed seed; and types and content of noxious weed seed.

920.06.06 Standards for Seed Species. Seed supplied in lots of individual species or used to produce mixes shall conform to the requirements of this section for minimum percent germination, minimum purity, and maximum percent of weed seed.

Meadow seed, wildflower seed, and shrub seed that does not conform to these standards may be used after review and approval by the Engineer in consultation with the Landscape Programs Division. The seed will be subject to use at increased seeding rates or measures to compensate for substandard seed purity, germination, or weed content.

(a) SHA Turfgrass Seed Mix and SHA Special Purpose Seed Mix. Species included in SHA Turfgrass Seed Mix and SHA Special Purpose Seed Mix shall be MDA Certified Seed of approved cultivars and conform to the following requirements for minimum percent purity, maximum percent weed seed, and minimum percent germination:

TURFGRASS SEED SPECIES			
COMMON NAME, and SCIENTIFIC NAME	**PURITY Min %**	**WEED Max %**	**GERM Min %**
Chewings Fescue *Festuca rubra* L. ssp. *fallax* (*Thuill.*) Nyman	98	0.5	85
Red Fescue *Festuca rubra* L. ssp. *rubra*	98	0.5	85
Hard Fescue *Festuca brevipila* Tracey	98	0.5	85
Kentucky Bluegrass *Poa pratensis* L. ssp. *pratensis*	95	0.4	80
Sheep Fescue *Festuca ovina* L.	98	0.5	85
Tall Fescue *Schedonorus arundinaceus* (Schreb.) Dumort., nom. cons.	98	0.5	85

(b) Temporary and Grass Additive Seed. Species included in SHA Temporary Seed Mix, or used as Additive Seed with SHA Turfgrass Seed Mix or SHA Special Purpose Seed Mix shall conform to the following requirements for minimum percent purity, maximum percent weed seed, and minimum percent germination:

TEMPORARY AND GRASS ADDITIVE SEED SPECIES			
COMMON NAME, and SCIENTIFIC NAME	**PURITY Min %**	**WEED Max %**	**GERM Min %**
Cereal Rye *Secale cereale* L.	98	0.1	85
Common Barley, winter type *Hordeum vulgare* L.	98	0.3	85
Common Oat, winter type *Avena sativa* L.	98	0.5	85
Common Wheat, winter type *Triticum aestivum* L.	98	0.1	85
Foxtail Millet *Setaria italica* (L.) P. Beauv.	99	0.1	80
Perennial Ryegrass *Lolium perenne* L. ssp. perenne	97	0.5	85
Weeping Alkaligrass *Puccinellia distans* (Jacq.) Parl.	97	0.5	85

(c) Meadow Forb Seed. Seed shall be supplied in lots of individual species, unmixed, labeled with common name and scientific name in conformance with the following:

(1) Purity. Weed and/or other crop seed content shall be 2.5 percent or less by weight. Seed that does not conform to this specification may be used after approval by the Engineer in consultation with the Landscape Programs Division at increased seeding rates, or with measures to compensate for increased weed or crop seed content.

(2) Origin. Except as noted with asterisk*, Seed shall either be collected from native sources in USDA Hardiness Zone 5b, 6a, 6b and 7a in the States of Maryland, Pennsylvania, New York, New Jersey, Delaware, Virginia, West Virginia, or North Carolina, or shall be grown and produced from seed certified to have been collected from sites in the USDA Hardiness Zones of those States.

Seed that does not conform to origin requirements may be used after review and approval by the Engineer in consultation with the Landscape Programs Division.

(3) Species. Seed shall conform to the following species, subspecies and varieties:

MEADOW FORB SEED SPECIES	
COMMON NAME	**SCIENTIFIC NAME**
Allegheny Monkeyflower = Square Stem Monkeyflower	*Mimulus ringens* L. var. *ringens*
Birds-Foot Trefoil *	*Lotus corniculatus* L.
Bearded Beggarticks = Showy Tickseed	*Bidens aristosa (Michx.)* Britton
Blackeyed Susan	*Rudbeckia hirta* L. var. *hirta* *Rudbeckia hirta* L. var. *pulcherrima Farw.*
Blanket Flower	*Gaillardia aristata Pursh*
Browneyed Susan	*Rudbeckia triloba* L. var. *triloba* *Rudbeckia triloba* L. var. *pinnatiloba Torr.* and A. Gray
Common Boneset	*Eupatorium perfoliatum* L. var. *perfoliatum*
Common Evening Primrose	*Oenothera biennis* L.
Common Yarrow *	*Achillea millefolium* L.
Crimsoneyed Rose Mallow	*Hibiscus moscheutos* L.
Eastern Purple Coneflower	*Echinacea purpurea* (L.) Moench
Flat-top Goldentop = Grass-Leaved Goldenrod	*Euthamia graminifolia* (L.) Nutt. *Euthamia graminifolia* (L.) Nutt. var. *graminifolia Euthamia graminifolia* (L.) Nutt. var. *hirtipes* (Fernald) C.E.S. Taylor and R.J. Taylor
Gray Goldenrod	*Solidago nemoralis Aiton* var. *nemoralis*
King of the Meadow = Tall Meadow Rue	*Thalictrum pubescens Pursh*
Lanceleaf Tickseed = Lanceleaf Coreopsis	*Coreopsis lanceolata* L.
Maryland Senna	*Senna marilandica* (L.) Link
Maximilian Sunflower	*Helianthus maximiliani* Schrad.
New England Aster	*Symphyotrichum novae-angliae* (L.) G.L. Nesom
New York Aster	*Symphyotrichum novi-belgii* (L.) G.L. *Nesom* var. *elodes* (Torr. and A. Gray) G.L. Nesom *Symphyotrichum novi-belgii* (L.) G.L. Nesom var. *novi-belgii Symphyotrichum novi-belgii* (L.) G.L. Nesom var. *villicaule* (A. Gray) J. Labrecque and L. Brouillet
New York Ironweed	*Vernonia noveboracensis* (L.) Michx.
Partridge Pea	*Chamaecrista fasciculata* (Michx.) Greene *Chamaecrista fasciculata* (Michx.) Greene var. *fasciculata Chamaecrista fasciculata* (Michx.) Greene var. *macrosperma* (Fernald) C.F. Reed

Red Clover	*Trifolium pratense* L.
Seedbox	*Ludwigia alternifolia* L.
Smooth Blue Aster	*Symphyotrichum laeve* (L.) A. Löve and D. Löve var. *laeve* *Symphyotrichum laeve* (L.) A. Löve and D. Löve var. *concinnum (Willd.)* G.L. Nesom
Smooth Oxeye = Ox-eye Sunflower	*Heliopsis helianthoides* (L.) Sweet var. *helianthoides* *Heliopsis helianthoides* (L.) Sweet var. *scabra* (Dunal) Fernald
Spotted Trumpetweed = Spotted Joe Pye Weed	*Eupatoriadelphus maculatus* (L.) King and H. Rob. var. *maculatus*
Stiff Goldenrod	*Oligoneuron rigidum* (L.) Small var. *rigidum*
Sundial Lupine = Wild Blue Lupine	*Lupinus perennis L. ssp. perennis* *Lupinus perennis L. ssp. perennis* var. *perennis* *Lupinus perennis* L. ssp. *perennis* var. *occidentalis* S. Watson
Swamp Milkweed	*Asclepias incarnata* L. *Asclepias incarnata* L. ssp. *incarnata Asclepias incarnata* L. ssp. *pulchra* (Ehrh. ex Willd.) Woodson
Swamp Sunflower = Narrow-Leaved Sunflower	*Helianthus angustifolius* L.
Swamp Verbena = Blue Vervain	*Verbena hastata* L. var. *hastata*
Talus Slope Penstemon = Tall White Beardtongue	*Penstemon digitalis* Nutt. ex Sims
Joe Pye Weed = Trumpetweed	*Eutrochium maculatum* (L.) E.E. Lamont var. *maculatum*
White Clover *	*Trifolium repens* L.
Wild Bergamot	*Monarda fistulosa* L. ssp. *fistulosa* *Monarda fistulosa* L. ssp. *fistulosa* var. *mollis* (L.) Benth. *Monarda fistulosa* L. ssp. *fistulosa* var. *rubra* A. Gray *Monarda fistulosa* L. ssp. *brevis* (Fosberg and Artz) Scora, ined.

(d) Meadow Grass, Sedge, and Rush Seed. Seed shall be supplied in lots of individual species, unmixed, labeled with common name, scientific name, and cultivar in conformance with the following:

(1) Purity. Refer to 920.06.06(c)(1). Grasses with awns shall be debearded or deawned.

(2) Origin. Refer to 920.06.06(c)(2). Cultivars may be produced in any state east of the Mississippi River.

(3) Species. Seed shall conform to the following species, subspecies, varieties, and cultivars:

MEADOW GRASS, SEDGE AND RUSH SEED SPECIES	
COMMON NAME and CULTIVARS	**SCIENTIFIC NAME**
Big Bluestem cv. Niagara	*Andropogon gerardii* Vitman
Broomsedge Bluestem = Broomsedge	*Andropogon virginicus* L. *Andropogon virginicus* L. var. *virginicus* *Andropogon virginicus* L. var. *decipiens* C.S. Campbell
Common Rush = Soft Rush = Lamp Rush	*Juncus effusus* L. var. *conglomeratus* (L.) Engelm. *Juncus effusus* L. var. *decipiens* Buchenau *Juncus effusus* L. var. *pylaei* (Laharpe) Fernald and Wiegand *Juncus effusus* L. var. *solutus* Fernald and Wiegand
Deertongue cv. 'Tioga'	*Dichanthelium clandestinum* (L.) Gould
Fowl Bluegrass	*Poa palustris* L.
Fox Sedge	*Carex vulpinoidea* Michx. var. *vulpinoidea*
Gamagrass cv. 'Meadowcrest', 'Pete'	*Tripsacum dactyloides* (L.) L.
Indiangrass cv. 'Rumsey'	*Sorghastrum nutans* (L.) Nash
Little Bluestem cv. 'Aldous'	*Schizachyrium scoparium* (Michx.) Nash var. *scoparium* *Schizachyrium scoparium* (Michx.) Nash var. *divergens* (Hack.) Gould
Longhair Sedge = Bristly Sedge	*Carex comosa* Boott
Rattlesnake Mannagrass	*Glyceria canadensis* (Michx.) Trin.
Shallow Sedge = Lurid Sedge	*Carex lurida* Wahlenb.
Switchgrass cv. 'Blackwell', 'Shelter'	*Panicum virgatum* L. var. *virgatum* *Panicum virgatum* L. var. *spissum Linder*
Virginia Wildrye	*Elymus virginicus* L., *Elymus virginicus* L. var. *halophilus* (E.P. Bicknell) Wiegand
Woolgrass	*Scirpus cyperinus* (L.) Kunth

(e) Wildflower Seed. Seed shall be supplied in lots of individual species, unmixed, labeled with common name, scientific name, and cultivar in conformance with the following:

(1) Purity. Species shall be 98 percent purity or greater, with 75 percent germination or greater, and with weed and/or other crop seed content of 2.5 percent or less by weight. Seed that does not conform to purity requirements may be used after approval by the Engineer in consultation with

the Landscape Programs Division at increased seeding rates, or with measures to compensate for increased weed or crop seed content.

(2) Origin. Any State of the United States.

(3) Species. Seed shall conform to the following species, subspecies, varieties, and cultivars:

WILDFLOWER SEED SPECIES	
COMMON NAME and CULTIVARS	**SCIENTIFIC NAME**
Blackeyed Susan	*Rudbeckia hirta* L. var. *hirta* *Rudbeckia hirta* L. var. *pulcherrima* Farw.
Calendula	*Calendula officinalis* L.
Common Sunflower cv. 'Autumn Beauty'	*Helianthus annuus* L.
Corn Poppy, cv. 'Shirley Mix'	*Papaver rhoeas* L.
Doubtful Knight's-spur = Rocket Larkspur	*Consolida ajacis* (L.) Schur
Firewheel = Annual Gaillardia	*Gaillardia pulchella* Foug. *Gaillardia pulchella* Foug. var. *pulchella*
Garden Cornflower = Bachelors Button	*Centaurea cyanus* L.
Garden Cosmos = Pink Cosmos, cv. 'Sensation'	*Cosmos bipinnatus* Cav.
Golden Tickseed	*Coreopsis tinctoria* Nutt.
Lemon Beebalm	*Monarda citriodora* Cerv. ex Lag.
Moroccan Toadflax = Spurred Snapdragon	*Linaria maroccana* Hook. f.
Siberian Wallflower	*Erysimum* ×*marshallii* (Henfr.) Bois
Sulphur Cosmos = Yellow Cosmos, cv. 'Bright Lights'	*Cosmos sulphureus* Cav.

(f) Shrub Seed. Seed shall be supplied in lots of individual species, unmixed, labeled with common name and scientific name in conformance with the following:

(1) Purity. Weed and/or other crop seed content shall be 0.5 percent or less by weight. Minimum purity and minimum germination shall conform to the requirements of (3), below.

(2) Origin. Refer to 920.06.06(c)(2).

(3) Species. Seed shall conform to the following species, subspecies, and varieties:

SHRUB SEED SPECIES		
SPECIES **Including Subspecies and Variety**	**PURITY** **Min %**	**GERM** **Min %**
American Black Elderberry *Sambucus nigra* L. ssp. *canadensis* (L.) R. Bolli	98	60
American Cranberrybush *Viburnum opulus* L. var. *americanum* Aiton	99	70
Black Chokeberry *Photinia melanocarpa* (Michx.) K.R. Robertson and Phipps	99	70
Bristly Locust *Robinia hispida* L. var. *fertilis* (Ashe) R.T. Clausen *Robinia hispida* L. var. *hispida*	99	90
Chokecherry *Prunus virginiana* L. var. *viginiana*	99	70
Common Buttonbush *Cephalanthus occidentalis*	98	60
Common Ninebark *Physocarpus opulifolius* (L.) Maxim., orth. cons.	99	75
Common Winterberry *Ilex verticillata* (L.) A. Gray	99	60
Desert False Indigo *Amorpha fruticosa* L.	98	70
Fragrant Sumac *Rhus aromatica* var. *aromatica*	99	85
Gray Dogwood *Cornus racemosa* Lam.	99	70
Inkberry *Ilex glabra* (L.) A. Gray	98	60
Mapleleaf Viburnum *Viburnum acerifolium* L.	99	70
Maryland Senna *Senna marilandica* (L.) Link	99	70
Nannyberry *Viburnum lentago* L.	99	75
Red Chokeberry *Photinia pyrifolia* (Lam.) K.R. Robertson and Phipps	85	60
Red Elderberry *Sambucus racemosa* L. var. *racemosa*	95	70
Redosier Dogwood *Cornus sericea* L. ssp. *sericea*	99	70
Silky Dogwood	98	70

Cornus amomum Mill.		
Smooth Sumac *Rhus glabra* L.	99	80
Southern Arrowwood *Viburnum dentatum* L. var. *dentatum* *Viburnum dentatum* L. var. *venosum* (Britton) Gleason *Viburnum recognitum* Fernald	99	70
Spicebush *Lindera benzoin* (L.) Blume var. benzoin	95	60
Staghorn Sumac *Rhus typhina* L.	99	85
Steeplebush *Spiraea tomentosa* L.	85	70
Swamp Rose *Rosa palustris* Marsh.	99	65
Witch Hazel *Hamamelis virginiana* L.	99	70

920.06.07 Seed Mixes. Refer to 920.06.01 through .06 and the document 'Specifications for Seed and Seed Mixes' maintained by the Landscape Programs Division, which includes lists of approved cultivars.

(a) SHA Turfgrass Seed Mix.

SHA TURFGRASS SEED MIX		
MIX	**SPECIES**	
%	**Common Name**	**Scientific Name**
95	Tall Fescue	*Schedonorus arundinaceus* (Schreb.) Dumort., nom. cons.
5	Kentucky Bluegrass	*Poa pratensis* L. ssp. *Pratensis*

(b) SHA Special Purpose Seed Mix.

SHA SPECIAL PURPOSE SEED MIX		
MIX	**SPECIES**	
%	**Common Name**	**Scientific Name**
75	Hard Fescue	*Festuca brevipila* Tracey
25	Chewings Fescue	*Festuca rubra* L. ssp. *fallax* (Thuill.) Nyman

Note: When pre-mixed SHA Special Purpose Seed Mix is not available, a small quantity exception will allow the mix to be performed at the seeding location using Certified seed of the required species.

(c) SHA Temporary Seed Mix.

SHA TEMPORARY SEED MIX		
MIX %	**SPECIES**	
	Common Name	**Scientific Name**
95	One or more of the following: Common Wheat, winter type Common Barley, winter type Common Oat, winter type Cereal Rye, winter type	 *Triticum aestivum* L. *Hordeum vulgare* L. *Avena sativa* L. *Secale cereale* L.
5	Foxtail Millet	*Setaria italica* (L.) P. Beauv.

920.07 PLANT MATERIALS

920.07.01 Certificate and Licenses. Sellers, distributors, installers or producers of nursery stock shall possess the Plant Dealer License, Plant Broker License, or Nursery Inspection Certificate of the Maryland Department of Agriculture, or substitute a similar certificate or licenses from another State where they do business.

920.07.02 Plant Material Inspection. Refer to 920.06.01 regarding common and scientific names of plants. Plant material will be inspected for conformance with 920.07.03 through .05, and tagged with Administration Plant Material Inspection Seals (Seals) as follows:

(a) Inspection. The Plant Material Inspection will be conducted in Maryland at the nursery where the plant material is grown, or at the brokerage where the plant material is sold. When plant material is produced by a nursery outside Maryland, the Inspection will be conducted at the Contractor's holding area, or at the project site before planting, unless otherwise specified in the Contract Documents.

The Contractor shall ensure that the plant material is present for inspection on the scheduled date, and that it meets the requirements of 920.07. The condition and identity of plant material will be subject to re-inspection for the duration of the Contract.

(b) Scheduling. The Inspection will be scheduled by the Engineer in consultation with the Landscape Programs Division. At least 14 days notice to schedule an Inspection within Maryland, and at least 45 days notice to schedule an Inspection outside Maryland.

(c) Seals. The Administration will determine which plants, if any, will be tagged with Seals. When Seals are placed upon representative plants within a block of plant material, the plant material delivered for installation shall be similar in size, shape and character to the plant material that received Seals. Plant material that is delivered with broken or missing Seals, or that is not similar to the plant material within the block that was tagged with Seals will be rejected.

(d) Rejected Plants. Plant materials which do not meet these requirements will be rejected. Plant material rejected at the nursery or holding area shall not be delivered to

the project; if delivered, it shall immediately be removed. Plants shall not be installed until the Plant Material Inspection has been completed and satisfactory identification has been provided.

920.07.03 Plant Material Standards. Plant material shall be grown, identified, graded, and delivered in good condition as specified in this section.

(a) Hardiness Zones and Origin. Trees, shrubs, perennials and ornamental grasses shall be nursery grown within plant hardiness zones 5, 6, or 7 according to the 'USDA Plant Hardiness Zone Map' in the following states, unless specified otherwise: Maryland, Ohio, Pennsylvania, New York, New Jersey, Delaware, Virginia, West Virginia, North Carolina, Tennessee, Kentucky, Georgia. Annuals and bulbs shall be nursery grown.

(b) Names and Identification. Refer to 920.06.01. Plant material shall be clearly and correctly identified by the grower or distributor. Plant materials that are misidentified, or not satisfactorily tagged or labeled, or do not conform to the accepted characteristics of the species or cultivar, will be rejected.

(c) ANSI Standards. Plant material shall conform to 'American Standard for Nursery Stock (ANSI Z60.1) of the American Nursery and Landscape Association. Plant grades shall be those established in ANSI Z60.1, and shall include plants from that size up to but not including the next larger grade size. When specimen plants are specified by the Contract Documents, the specimen requirement shall also be met. Plant material which does not meet the standards of this section shall be rejected.

(d) Health and Sanitation. Plant material shall be dug and transported in conformance ANSI Z60.1. Bare root deciduous plants shall be delivered in a dormant condition. Roots shall be adequately protected and kept moist.

Plant material shall be in good health and be declared and certified free from disease and insects as required by law for transportation, and shall be free from pest-related stress and pest damage.

Plants shall be healthy, free from physical defects and stresses, and have well-developed branches and a vigorous root system. Plants shall not exhibit wilt, shriveling, insufficient root mass, broken or loose root balls, or inadequate protection.

Container grown plants shall be well rooted, vigorous and established in the size pot specified, shall have well balanced tops for their pot size, and shall not be root bound. Plants grown in fields or containers which include Ailanthus, Canada Thistle, Johnsongrass, or Yellow Nutsedge will be rejected.

(e) Shade and Flowering Trees. Shade and flowering trees shall be symmetrically balanced. Major branch unions shall not have 'V' shaped crotches, bark inclusion or unions derived from water sprouts (epicormic growth) capable of causing structural weakness.

Trees shall be free of unhealed branch removal wounds greater than 1 in. diameter, or wounds or scars caused by staking, wire or ties, or any other defect which could cause structural failure or disfigurement.

Shade trees and central leader flowering trees shall have a single main trunk. Trunk height to the lowest branch shall conform to the following:

HEIGHT TO LOWEST BRANCH	
CALIPER in.	HEIGHT ft
1-1/2 and 1-3/4	4
2 to 2-1/2	5
3	6

(f) Unacceptable Plants. Plant material that becomes unacceptable after installation shall be rejected as specified in 710.03.18.

920.07.04 American Holly (*Ilex opaca* Aiton). Unless other cultivars or ratios are specified in the Contract Documents, each lot of plants shall include 90 percent female plants and 10 percent male plants of cultivars selected from the following list, unless specified otherwise.

AMERICAN HOLLY CULTIVARS		
FEMALE		MALE
Angelica	Miss Helen	David
Arlene Leach	Old Heavy Berry	Jersey Knight
B and O	Patterson	Leather Leaf
Dan Fenton	Satyr Hill	Nelson West
Jersey Princess	Wyetta	North Wind

920.07.05 Plant Storage and Handling. Adequate facilities shall be provided for plant storage. Plants shall be handled with care to avoid damage.

(a) Bulbs. Bulbs shall be stored under appropriate climate control.

(b) Perennials, Ornamental Grasses, Plug Plants and Annuals. Perennials, ornamental grasses, plug plants and annuals shall be kept moist.

(c) Bare Root Plants and Live Stakes. Bare root plants and live stakes shall be kept moist and heeled into moist soil or other suitable material until installed. During transport, the roots shall be covered with canvas, burlap or straw.

(d) Balled and Burlapped and Container Grown Plants. Balled and burlapped plants and container grown plants shall be kept moist and installed within seven days of delivery, or the root balls or containers shall be covered with mulch or straw until removed for installation.

920.08 MARKING AND STAKING MATERIALS

920.08.01 Outline Stakes. Outline stakes shall be full cut 1.75 in. x 1.75 in. sound hardwood, 48 in. long, as approved.

920.08.02 Stakes. Stakes for supporting trees shall be rough sawn, straight grain hardwood reasonably free from bark, knot holes, excessive warping, or other imperfections. Stakes shall be full cut 2.0 in. x 2.0 in. thickness.

920.08.03 Wire. Wire shall be No. 12 and 14 gauge new annealed galvanized wire.

920.08.04 Wire Rope. Wire rope shall be 0.25 in. zinc coated steel wire seven strand as commonly used for guying large trees.

920.08.05 Cable Clamps. Cable clamps shall be zinc galvanized steel.

920.08.06 Hose. Hose shall be 5/8 in. inside diameter corded synthetic rubber hose.

920.08.07 Turnbuckles. Turnbuckles shall be zinc galvanized with 4.5 in. openings and 5/16 in. threaded ends with screw eyes.

920.08.08 Anchors. Tree anchors shall be earth anchors of a type commonly used for anchoring large trees.

920.09 WATER, PESTICIDES, AND ADJUVANTS

920.09.01 Water. Water used for the installation and establishment of vegetation shall not contain concentrations of substances that are harmful to plant growth. Water derived from public and municipal water systems in Maryland shall be acceptable for irrigation, fertilization, or mixing with pesticides. Water derived from wells or other sources may be used when it has soluble salts concentration less than 500 ppm, sodium less than 50 percent of total salts, and pH between 5.0 to 7.8.

920.09.02 Seed Carrier. Seed carrier shall be one or more inert, horticultural-grade materials used to improve seed mixing and distribution through a spreader or drill. Seed carriers shall be free flowing, easily mixable with seed, and nontoxic to seed, plants, humans, and wildlife. Seed carrier shall include one or more of the following:

(a) Calcined Clay. Calcined clay shall be a furnace-baked clay product.

(b) Cocoa Shell. Cocoa shell shall be processed cocoa seeds.

(c) Oyster Shell. Oyster shell shall be crushed shells of oyster or other mollusk.

(d) Vermiculite. Vermiculite shall be heat-expanded mineral mica.

(e) Perlite. Perlite shall be heat-expanded mineral perlite.

920.09.03 Pesticides. Pesticides shall be EPA-approved and registered for use in Maryland to control plants, fungi, insects or other pests. Pesticides shall be approved for use, and acceptable application rates established by the Landscape Programs Division as follows:

(a) Herbicide. Herbicide shall control or prevent regrowth of plants or vegetation.

(b) Insecticide. Insecticide shall control or protect against insect or other arthropod pests.

(c) Fungicide. Fungicide shall control or protect against fungal or bacterial pests.

(d) Other Pesticides. Other pesticides shall control or protect against other pests such as deer, beaver, etc.

920.09.04 Marking Dye. Marking dyes shall be used to color spray solutions, be nonphytotoxic, oil or water soluble, and compatible with the pesticide products they are applied with. Marking dye products and application rates shall be approved by the Landscape Programs Division.

920.09.05 Spray Adjuvant and Wetting Agent. Spray adjuvant and wetting agents shall be compatible with the pesticides or other products they are applied with.

920.09.06 Antidesiccant. Antidesiccant and antitranspirant products shall be materials that provide a film over plant surfaces to limit water loss. These products and application rates shall be approved by the Landscape Programs Division.

CATEGORY 900
MATERIALS

SECTION 921 — MISCELLANEOUS

921.01 WATER FOR CONCRETE MIXES

D512. Determine the chloride concentration of water used in mixing and curing of Portland cement concrete as specified.

Chloride content shall not exceed the following limits:

(a) Bridge Superstructure and Prestressed Concrete 500 ppm

(b) Latex Modified Concrete 50 ppm

(c) Other Concrete and Water Used in Curing 1000 ppm

921.02 MOISTURE AND DUST CONTROL AGENTS

921.02.01 Calcium Chloride. M 144, Type S, Grade I, Class A for solid calcium chloride. Calcium chloride in solution shall contain a minimum of 30 percent salts. Prepare the solution using potable water as directed. The residue shall meet M 144 when analyzed according to E449.

921.02.02 Magnesium Chloride. Magnesium chloride shall be supplied in flakes and meet the following:

TEST PROPERTY	SPECIFICATION LIMITS
Magnesium Chloride $MgCl_2$, %	46.0 – 47.0
Calcium Chloride $CaCl_2$, %	2.0 – 3.0
Potassium Chloride KCl, %	0.5 – 1.0
Sodium Chloride NaCl, %	0.5 – 1.0
Sulfates, % max	0.05

Magnesium chloride shall contain 30 percent to 32 percent solids when used as a solution.

921.03 LIME

921.03.01 Hydrated lime shall meet the chemical requirements of C 206, Type N when used in finishing; or C 207, Type N when used for masonry.

921.03.02 Hydrated lime for soil stabilization shall have a minimum combined calcium oxide and magnesium oxide content of 65 percent when tested according to C 25 and meet the following gradation:

SIEVE SIZE	PERCENT RETAINED max
3/8 in.	0
No. 30	3
No. 200	25

921.03.03 Quicklime shall have a combined calcium oxide and magnesium oxide content of 75 percent minimum and a gradation of 100 percent passing the 3/8 in. sieve when tested according to C 25.

921.04 EPOXY ADHESIVES

Epoxy resin bonding material shall consist of a thermosetting epoxy resin and a hardener. The individual components of mixed epoxy shall not settle or skin and contain no volatile solvents, lumps, or foreign materials. The epoxy shall meet C881. Epoxy adhesive used for bearing and expansion pads shall be non-sagging unless specified otherwise.

The manufacturer shall furnish certification as specified in TC-1.03. The certification or data sheet shall accompany each sample and show actual test results for each required property of the type, grade, and class of epoxy submitted.

The manufacturer shall also supply actual bond test results for each batch submitted for use.

When used as an Epoxy Bonding Compound, use Type II for non-load bearing and Type V for load bearing.

921.05 STRUCTURAL TIMBER AND LUMBER

M 168. The manufacturer shall furnish certification as specified in TC-1.03.

921.06 TIMBER PRESERVATIVES

All preserved wood used for highway construction and maintenance applications shall be treated according to M 133, and the American Wood Protection Association (AWPA) and ICC-ES standards for preservative, retention, and penetration with United States Environmental Protection Agency (EPA) pesticide registrations. Timber preservatives shall meet the following:

(a) Water borne preservatives shall be used where a clean surface is desired, or when the wood is to be painted. Moisture content of wood shall not be greater than 19 percent at the time of treatment.

(b) All treated wood shall be free of excess preservative on the surface. Creosote-treated wood shall be double vacuum treated according to EPA requirements for use in aquatic and marine environments.

(c) Wood used for sign posts, fence posts, wood posts, guardrail posts, bridge decking, gates, stair treads, and offset blocks shall be treated according to M 133 and AWPA standards with EPA pesticide registrations.

(d) Wood used for piles, timbers, and composites shall be treated according to M 133 and AWPA standards with EPA pesticide registrations.

(e) Wood used for hand-contact surfaces such as handrails, playground equipment and picnic tables shall be treated according to M 133 and AWPA standards with EPA pesticide registrations for residential applications. Fasteners for preservative treated wood shall be hot-dipped galvanized steel conforming to A153 or A653, Class G185. Type 304 or 316 stainless steel fasteners are also permitted.

(f) Pressure treatment shall conform to the requirements of the AWPA "Use Category" as follows:

Wood	End Use Category	AWPA Standard
Bridge structures including decking, guard rail posts and offset blocks	UC4B - Ground Contact Heavy Duty	U1: Commodity Specification A (sawn solid products)
Foundation piles	UC4C - Ground Contact Extreme Duty	U1; Commodity Specification E (round timber piles)
Wood Composites	UC4A - Ground Contact, General Use	U1; Commodity Specification F (wood composites)
Sign posts, fence posts and gates	UC4A - Ground Contact, General Use	U1: Commodity Specifications A (sawn solid products) and B (round posts)
Piling, bracing and bulk heading	UC4B - Ground Contact Heavy Duty	U1; Commodity Specifications A (sawn solid products), B (round products) and E (round timber piles)
Piling, bracing, bulkheads and fender systems	UC5B Marine (Salt water) Immersion	U1: Commodity Specifications G (sawn products, round timber piles and plywood)

921.07 CONDUITS

921.07.01 Metallic Conduit.

MATERIAL	SPECIFICATION
Electrical Metallic Tubing	UL 797
Intermediate Metal Conduit	UL 1242
Rigid Metal Conduit	UL 6
Rigid Steel Conduit, Zinc Coated	ANSI C80.1
Metallic Outlet Boxes	UL 514A
Fittings for Conduit and Outlet Boxes	UL 514B

921.07.02 Nonmetallic Conduit. The manufacturer shall furnish certification as specified in TC-1.03. Each length shall be stamped or embossed with the grade or type and applicable UL or NEMA designation.

MATERIAL	SPECIFICATION
Schedule 40 and 80 Rigid Polyvinyl Chloride (PVC) Conduit	UL 651
Electrical Plastic Tubing (EPT) and Electrical Plastic Conduit (EPC-40 and EPC-80)	NEMA TC 2
Nonmetallic Outlet Boxes, Flush Device Boxes and Covers	UL 514C
Electrical Nonmetallic Conduit (ENC)	NEMA TC 13
PVC Fittings for use with Rigid PVC Conduit and Tubing	NEMA TC 3
Flexible PVC Coated Conduit	UL 360
Liquid Tight Flexible Nonmetallic Conduit for Detector Sleeves	UL 1660

921.07.03 PVC Coated Metallic Conduit. NEMA RN 1. PVC externally coated, galvanized, rigid steel conduit and electrical metallic tubing.

921.08 STRAW BALES

When used for approved erosion and sediment control applications, straw bales shall be approximately 14 in. x 18 in. x 36 in. and as specified.

921.09 POLYETHYLENE (PE) MANHOLES

D1248, Type III, Class C, Category 3, Grade P34. Submit working drawings prior to fabrication.

Compressive strength shall be determined according to D2412, modified pipe stiffness test. Pipe stiffness shall be a minimum of 12 psi at 5 percent deflection, including joints. Axial compressive strength shall be a minimum of 10 000 lb at less than 3 percent deflection.

PE manholes for storm drains shall be manufactured with an invert bowl that will not interrupt flow. Manholes for sanitary sewers shall have a factory molded invert for channeled flow.

The manufacturer shall furnish certification as specified in TC-1.03. Certification shall accompany each shipment of PE manholes and show actual test results, the quantity of manhole sections, and date of manufacture. Manholes shall be marked with the manufacturer's name and trademark.

921.10 PREFORMED FIBERGLASS

Meet the following.

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Density, g/cm, min	D792	1.25
Absorption, % max	D570	1.0
Tensile Strength, average of five specimens each direction*, psi min	D638	10 000
Thickness (unless otherwise specified), in.	—	3/16
Thickness Tolerance, in.	—	(+)1/16, -0
Color No.	AMS-STD-595A	26622

921.11 DETECTABLE MARKING TAPE

A direct-burial-rated subgrade detectable marking tape between 2 in. and 12 in. in width, having a 5.0 mil overall nominal thickness. The tape shall be composed of 0.8 mil clear virgin polypropylene film, reverse printed and laminated to a 0.35 mil or 35 gauge solid aluminum foil core, and then laminated to a 3.75 mil clear virgin polyethylene film with polyethylene. Tapes using reprocessed plastics or resins are not acceptable.

921.11.01 Strength. Not less than 150 lb of tensile break strength per 6 in. width.

921.11.02 Resistance. Resistant to ink rub-off, corrosion, acids, alkalis, chemicals, oils, and other elements that may be present below grade.

921.11.03 Printing, Color, and Reflectivity. Diagonally striped design with bold, black lettering and meeting American Public Works Association (APWA) Uniform Color-Code standard for identification of buried utilities. Color codes as follows.

(a) Blue for potable water lines.

(b) Green for sanitary sewer and drain lines.

(c) Yellow for gas, oil, steam, petroleum, and gaseous material lines.

(d) Red for electric power lines, cables, conduit, and lighting cables.

(e) Orange for communication, alarm or signal lines, cables, conduits, fiber optic, and telephone lines.

(f) Purple for storm drain pipe culverts.

A continuous message shall be permanently reverse printed 1.5 in. tall bold black letters; repeated every 20 in. to 36 in. and cannot be scratched off. The tape shall be inscribed with the proper message for the applicable utility over which it is installed with warnings such as "CAUTION……LINE BURIED BELOW" and shall contain a diagram and burying instructions.

The imprint shall allow total reflectivity. Tape must be clearly and easily detectable before it can be read.

921.11.04 Detectability. Capable of being detected below grade by either conductive or inductive location techniques and locatable by standard methods typical of utility quality level B investigations.

CATEGORY 900
MATERIALS

SECTION 922 — PREFABRICATED EDGE DRAINS

922.01 CERTIFICATION

The manufacturer shall furnish certification as specified in TC-1.03.

922.02 PREFABRICATED EDGE DRAINS

Shall be flexible, rectangular conduit consisting of supporting drainage core encased in a geotextile.

Drainage Core. Material shall be manufactured from polymers having a high resistance to deterioration by pavement deicing salts, petroleum-based materials, and naturally occurring soil chemicals. The core shall have sufficient flexibility to withstand bending and handling without damage or significant weakening.

The core geotextile contact point spacing for post and cuspated sheet type cores shall not exceed 1.125 in. Elongated pipe core sections shall have a 7.5 in./ft minimum open area to allow lateral flow into the core. Cores with support on only one side shall have a minimum of 5 percent of the area of that support side in unobstructed flow. Drainage core shall meet the following requirements:

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Thickness, in. min	—	0.75
Compressive Strength, psi, @ 20% maximum deformation, min	(a)	40
In-plane Flow Rate, gal/min/ft of width, min	D4716 (b)	15

(a) D5034 for crushed sheet and post type cores. D2412 for elongated pipe type cores.
(b) 10 psi load after 100 hr at a hydraulic gradient of 0.1

Geotextile Wrap. Section 919, Class SD, Type II.

The fabric shall be bonded to contact points of supporting core for post and cuspated sheet type cores to ensure that the geotextile does not sag into the core flow area. The geotextile shall be tightly stretched over the core for elongated pipe type cores.

922.03 FITTINGS

Fittings for the pavement edge drain systems, including, but not limited to end seals, splices, outlets, and shunts shall meet the manufacturer's recommendations and be of sufficient strength to withstand construction handling and permanent loading. All fittings shall be as approved.

922.04 OUTLET PIPE

Pipe for outlets shall be 6 in. minimum diameter and meet Section 905.

CATEGORY 900
MATERIALS

SECTION 923 — SLURRY SEAL AND MICRO-SURFACING

923.01 AGGREGATES

Aggregates shall be crushed stone, compatible with the emulsion, and meet the gradation requirements in D3910 or D6372. Aggregates shall also meet the physical requirements for Slurry Seal (SS) and Micro-Surfacing (MS) in Table 901 D.

923.02 MINERAL FILLER

901.01.

923.03 WATER

921.01.

923.04 EMULSIFIED ASPHALT

Emulsified asphalt shall be neat or polymer modified. The polymer shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process. The polymer modified emulsion shall contain 3.0 percent polymer solids minimum by weight of asphalt. The emulsified asphalt shall meet M 208, Grade CSS-1h or CQS-1h. Each load of emulsified asphalt shall be accompanied by a Certificate of Analysis/Compliance that indicates the emulsion meets specification requirements.

923.05 MIX DESIGN APPROVAL

Submit mix design data for approval at least three weeks in advance of the paving operation. Include the following:

(a) Source, percentage, and grade of emulsified asphalt.

(b) Source, gradation and proportion of each component aggregate.

(c) Source and percentage of additional additives.

(d) Target gradation and residual asphalt content of mix.

(e) Mix design worksheets.

Test the mix design in accordance with D3910 or D6372. The mix design report shall show that the test results meet the following:

Slurry Seal

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Consistency Test (Mix Time), 77F, s, maximum	D3910	180
Set Time, 77F, m, minimum	D3910	15
Wet Track Abrasion, g/ft^2, max One-hour soak	*ISSA TB-100	75
Residual Asphalt: Type II	T 164 or T 308	7.5% – 13.5%
Type III	T 164 or T 308	6.5% – 12.0%

Micro-Surfacing

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Set Time 77F s, minimum	D6372	30
Wet Track Abrasion, g/ft^2, maximum One-hour soak	*ISSA TB-100	50
Residual Asphalt (by dry weight of aggregates): Type II or Type III	T 164 or T 308	5.5% – 10.5%

*International Slurry Seal Association

CATEGORY 900
MATERIALS

SECTION 924 — COLD PATCH MATERIAL

924.01 DESCRIPTION

Cold Patch Materials (CPM), including Water-Activated Cold Patch Material (WACPM), are high performance asphalt patching materials used to repair potholes, deteriorated concrete, and asphalt pavement in all seasons. The material shall be capable of making permanent repairs with minimal effort and with minimal disruption to traffic.

CPM/WACPM are produced by approved manufacturers using specially formulated binders. The CPM material may be produced in bulk and stockpiled or packaged in buckets or bags weighing 40 lb to 50 lb, or packaged as approved. The WACPM is produced and packaged in buckets or bags weighing 35 lb to 60 lb. Select from the Qualified Products List (QPL).

924.02 MATERIALS

Aggregate	M 29
	T 11
	T 2
Binder	D244
	D402
	T 59
	T 78

924.02.01 Binder. Binder shall provide aggregate coverage according to TP 40. No additives, modifiers, or extra ingredients may be introduced into the liquid oil blend after shipment. Binder shall meet a maximum of 0.1 percent volume by weight of the original sample when tested to 500 F (260 C) according to T 59 or, the binder shall contain no more than 6.0 milliliters of oil distillate when tested according to D244, D402 or T 78, depending on the type of binder used. The residual binder content shall be approximately 5 percent to 9 percent of the mix.

924.03 MIX PERFORMANCE REQUIREMENTS

Cold Patch Material patches shall remain in place when paved over and shall not adversely affect the final surface. The material shall not require primer or tack and shall be compatible with asphalt and/or concrete at a minimum thickness of 1/2 in. The material must be capable of filling potholes in wet or dry conditions in ambient temperatures as low as to 5 F and up to 100 F.

The material shall permanently adhere to deteriorated concrete or bituminous pavement until the surrounding pavement fails. Removal shall not be required when the surface is overlaid with asphalt.

The Administration reserves the right to sample composite material or mixture at any time.

WACPM Job Mix Formula. The job mix formula shall establish a single percentage of aggregate passing each required sieve, a single percentage of binder to be added to the aggregate and a range of add water required to activate strength.

Submit results of the proposed job mix formula to the Office of Materials Technology through the Engineer for approval. The report shall show that all materials were tested and meet the following.

Aggregate Gradation				
Sieve Size	**Percent Passing**			
	4.0mm (1/8”)	6.0mm (1/4”)	9.0mm (3/8”)	12.0mm (1/2”)
1/2”	100	100	100	95-100
3/8”	100	100	85-100	65-85
#4	90-98	80-100	35-60	38-60
#8	60-70	20-55	15-35	25-45
#16	40-57	12-32	14-25	10-20
#200	4-9	3-6	3-6	3-6

Job Mix Formula Analysis		
Test	**Test Designation**	**Specification Limits**
Gradation	T 30	Report
Particle Coating	T 195	>95%
Asphalt Content	T 308	5.0 – 9.0%
Draindown	T 305	≤8%

924.03.01 Storage. CPM/WACPM furnished in bags or containers shall be stored in accordance with the manufacturer’s recommendations. CPM/WACPM shall remain workable in storage for at least six months.

CPM may also be furnished from stockpiled material that has been stored outside

924.03.02 Usage. CPM shall be uniformly mixed and require no mixing prior to use. The material shall be capable of being poured or shoveled into a hole. The material shall require minimal pothole preparation consisting of removing most of the water and debris as possible from the pothole. The material shall be capable of displacing any water remaining in the hole. The material shall be placed and compacted in accordance with the manufacturer’s recommendations. The material shall not ravel nor adhere to tires when opened to traffic.

924.03.03 Quality Control Plan (QCP). Submit a Quality Control Plan (QCP) that includes the following.

(a) Description of Material.

(b) Contact Personnel.

(c) Safety Data Sheets (SDS).

(d) Technical Data Sheets, including VOC content.

(e) Job Mix Formula.

(f) QC Material Sampling Process.

(g) Storage Requirements.

The QCP shall also state that if a test result indicates that a shipment is not in compliance with specifications, the following shall apply.

(a) Immediately notify the Administration of the shipment in question.

(b) Identify the material.

(c) Cease shipment until material complies with specifications.

(d) Notify the Administration prior to resuming shipment.

(e) Implement any mutually agreed upon procedures for the disposition of the material.

In the event a mutual agreement is not achieved, the Administration shall have final authority in the decision on specification compliance.

924.04 CERTIFICATION

Provide certification that the material meets requirements as specified in TC-1.03 and the following.

(a) A guarantee the material conforms to the Materials, Binder, Mix Performance and Storage requirements and COMAR environmental regulations.

(b) Employ an unaffiliated AASHTO-accredited laboratory to perform all testing for certification.

Acceptance testing will be completed on delivered material as determined. Each delivery shall be considered one lot. The material may be subject to a workability evaluation either in the lab or in the field. Non-conforming materials will be rejected whether in-place or not. Remove all CPM inventory on hand that fails to meet requirements and replace.

Replacement Warranty. Material that does not remain workable in storage for at least six months shall be replaced. Product that does not perform in normal pothole patches for at least twelve months will be evaluated for performance. Material that consistently fails to meet requirements will be removed from the QPL.

CATEGORY 900
MATERIALS

SECTION 925 — DETECTABLE WARNING SURFACE

925.01 GENERAL

Detectable warning surfaces shall conform to the current accessibility guidelines of the Americans with Disabilities Act (ADA). The Office of Materials Technology (OMT) maintains a Qualified Products List (QPL). Manufacturers seeking inclusion of their product on the QPL shall submit certified test results showing conformance to the properties in 925.07, as well as installation instructions and the types of adhesives and sealants required.

925.02 COMPOSITION

Warning surfaces shall be either flexible or rigid. If there is a change in the composition of a qualified product, the manufacturer shall notify OMT and submit new test results showing conformance with 925.07.

925.02.01 Pavers. Type III Brick Pavers shall conform to the requirements of C 902, Class SX, Type 1, and Application PX. The pavers shall be 2-1/4 in. x 4 in. x 8 in. with square edges and a surface meeting 925.03.

925.03 CONFIGURATION AND DIMENSIONS

The warning surface shall consist of a system of truncated domes having a base diameter of 0.9 in. to 1.4 in., a top diameter 50 percent to 65 percent of the base diameter, and a height of 0.2 in. The domes shall be arranged in a square grid with center to center spacing of 1.60 in. to 2.40 in.

925.04 COLOR

The color shall be homogeneous across the surface of the material and contrast with adjoining surfaces.

925.05 IDENTIFICATION

The top surface shall have an identifier that uniquely distinguishes the manufacturer. Brick pavers are excluded.

925.06 REQUIREMENTS

TYPE	DESCRIPTION	PHYSICAL TEST REQUIREMENTS
Type I	Cast in Place	A, B, C, D, E, G
Type IIa	Surface Mount, Rigid	A, B, C, D, E, G
Type IIb	Surface Mount, Flexible	A, B, C, D, F, G
Type III	Brick Pavers	925.02.01
Type IV	Prefilled Pavers	A, B, C, D, G

925.07 PHYSICAL PROPERTIES

	PROPERTY	TEST METHOD	SPECIFICATION LIMIT
A	Slip Resistance Coefficient	C1028 (dry method)	0.80 min
B	Abrasive Wear, index	C501	150 min
C	Fade (UV) Resistance/Color Retention	D4587	Fade or Change in color after 2000 hrs less than ΔE =5*
D	Freeze/Thaw Resistance	C1026	No disintegration
E	Adhesion/Bond Strength, pull off	C482/C 882(as appropriate)	No adhesion failure
F	Adhesion/Bond Strength, peel	D903/D429 (modified as appropriate)	No adhesion failure
G	Contrast	Contrast percentage formula** using E1349 to determine cap Y brightness/light reflectance values (LRV)	Current ADA requirement***

*Chromaticity coordinates (L*a*b* system) checked in conformance with D2244, before and after test.

**Contrast % = [(B1 – B2)/B1] x 100,

where B_1 = (LRV) of the lighter area, and B_2 = (LRV) of the darker area

***For the purpose of determining whether a material meets acceptable contrast criteria, use actual cap Y brightness of detectable warning surface, and assume a value of 15 for the cap Y brightness of cured concrete, or a value of 3 for asphalt wearing surfaces to determine percentage difference. Detectable warning surfaces to be installed on other materials are required to undergo additional testing.

CATEGORY 900
MATERIALS

SECTION 926 — FOAMED ASPHALT STABILIZED BASE COURSE MIX

926.01 MIX REQUIREMENTS

Develop a mix consisting of Reclaimed Asphalt Pavement (RAP), Recycled Portland Concrete (RC), aggregate, and foamed asphalt binder. Include lime, Portland cement, and fly ash as necessary to increase the fines to meet the design parameters in Table 926 A and Table 926 B. Select a PG 64-22 asphalt binder that provides the required asphalt foaming characteristics and mix properties. Do not use polymer modified asphalt binders.

Table 926 A - Aggregate Blend Requirements

GRADATION (T 27)	
Sieve Size	**Percent Passing**
1 1/2 in. (38 mm)	100
3/4 in. (19 mm)	65 – 100
No. 4 (4.74 mm)	50 – 70
No. 200 (75 µm)	1 – 8
OTHER	
PI (T 90)	< 10 %

Table 926 B - Foamed Asphalt Stabilized Base Course Mix Requirements

DESIGN PARAMETERS	VALUE
Aggregate Blend Compaction: T 180D, Max Dry Density, pcf	≥120
Specimen compaction:	
Marshall compaction: T 245 - number of blows per face, or	75
Gyratory compaction: T 312 - number of gyrations	30
Indirect Tensile Strength: modified T 283	
Minimum Wet Tensile Strength, psi	45
Minimum Wet Tensile Strength, psi, for material stockpiled >2 days	55
Minimum Tensile Strength Ratio (TSR), %	70
Foamed Asphalt Expansion Characteristics @ 160, 170, & 180 C	
Minimum Half-Life of Foamed Expansion, sec (1)	8
Minimum Expansion Ratio (2)	10

Note 1: Total time for foamed asphalt to settle to half of the maximum foamed volume. See Section A.1.3.4 of the *Wirtgen Cold Recycling Technology*

Manual (2010) for the half-life test procedure. Alternate suitable equipment can be substituted for the Wirtgen WLB 10 S laboratory unit.

Note 2: Maximum foamed asphalt volume divided by non-foamed asphalt volume. See Section A.1.3.4 of the *Wirtgen Cold Recycling Technology Manual* (2010) for the expansion ratio test procedure. Alternate suitable equipment can be substituted for the Wirtgen WLB 10 S laboratory unit.

Submit job mix formulas for approval at least 30 days prior to production to the Office of Materials Technology, Soils and Aggregate Division. Job mix formulas must meet the requirements of Table 926 A and Table 926 B. Work will not be allowed to commence without approved job mix formulas. Perform the following tests for each job mix formula:

(a) Aggregate. T 2. Sample 50 lb of material representing the RAP, RC, and aggregate to be used in the job mix formula. Test as specified in 901A and 901B.

(b) Performance Graded Asphalt Binder. M 322. Provide five 4-quart samples of the asphalt binder.

(c) Water. 921.01

(d) Lime, Cement and Fly Ash. Determine the percentage of lime, cement and fly ash required to meet the mix design parameters.

926.02 MIX DESIGN

Prepare a minimum of four Marshall or four gyratory compactor specimens at 0.5 percent increments for a range of asphalt contents; with at least one specimen above and one below optimum to determine the job mix formula. The moisture content of the specimens shall be within 1.5 percent of the optimum moisture content of the aggregate blend. For gyratory specimens, obtain a 2 in. thick test specimen cut from the middle of each compacted cylinder.

926.03 FOAMED ASPHALT EXPANSION CHARACTERISTICS

Test the asphalt binder according to Table 926 B for the following:

(a) Measure the expansion ratio and foam half-life of the asphalt binder over a range of water contents for the three temperatures.

(b) Plot expansion ratio and half-life vs. water content. The optimum foaming water content for a given temperature is the average of the two water contents that meet the respective minimum expansion ratio and half-life requirements.

926.04 INDIRECT TENSILE STRENGTH (IDT)

T 283.

(a) Place the samples to be soaked in a 77 F water bath for 24 hours. Dry the samples to constant mass at 104 +/-2 F.

(b) Graph IDT strength versus foamed asphalt content for both dry and soaked specimens. Graph TSR versus foamed asphalt content.

(c) For wet IDT strength vs. foamed asphalt content curves exhibiting a maximum value, select the design foamed asphalt content corresponding to the maximum. Otherwise, select a design foamed asphalt content that meets the wet IDT strength and TSR requirements in Table 926 B.

(d) In no case shall the design foamed asphalt content be less than 2 percent or greater than 3.5 percent.

926.05 FOAMED ASPHALT CEMENT CONTENT

Once the foamed asphalt content of the Job Mix Formula has been determined, prepare a minimum of 5 compacted specimens based on the Job Mix Formula. These specimens must meet the design parameters according to Table 926 B. Calculate the mean, standard deviation of the Indirect Tensile Strength results (modified T 283, according to Table 926 B). These values must be reported in the FASBC Mix Design for the Administration's approval.

The Contractor shall also submit five bag samples representative of the aggregate blend of the Job Mix Formula and five bag samples representative of the Job Mix Formula with the added foamed asphalt as part of the mix approval process. These sample bags shall contain at least 20 lb of FASBC material. The samples will be tested to develop an ignition oven correction factor and a base reference for the foamed asphalt cement content for acceptance purposes.

The Office of Materials Technology will evaluate the suitability of the material and proposed job mix formula. If the job mix formula is not approved, submit a new job mix formula as directed.

CATEGORY 900
MATERIALS

SECTION 927 — OPEN GRADED FRICTION COURSE MIX

Open Graded Friction Course (OGFC) shall conform to the applicable sections of 901 and PP 77, except as specified.

GRADATION:

Sieve Size	Mixture Control Tolerance, %	Design Gradation Limits, % Passing		
		9.5 mm OGFC[a]	12.5 mm OGFC[a]	12.5 mm PEM[b]
3/4 in. (19 mm)	±0.0		100*	100*
1/2 in. (12.5 mm)	±6.0	100*	85-100	80-100
3/8 in. (9.5 mm)	±5.5	85-100	55-75	35-60
No. 4 (4.75 mm)	±6.0	20-40	15-25	10-25
No. 8 (2.36 mm)	±4.5	5-10	5-10	5-10
No. 200 (75 µm)	±2.0	2-4	2-4	1-4
Range for % AC	±0.4	6.0-7.25	5.75-7.25	5.5-7.0
Drain-down (D6390), %[c]		<0.3	<0.3	<0.3

*Mix Control Tolerance not applicable to this sieve for this mix.

(a) Less than Design Level 4 (ESAL).

(b) Porous European Mix (PEM) – Design Level 4 (ESAL).

(c) Conduct drain-down test on loose mix at a temperature 15 C higher than anticipated production temperature.

Crushed glass, roofing shingles, RAP, or other recycled materials are not allowed in OGFC mixes.

PHYSICAL PROPERTIES:

TEST	TEST METHOD	LIMITS
Asphalt Binder[a]	M 332	64E-22
Tensile Strength Ratio (TSR)	T 283b	≥85%
Permeability[c]	MSMT 408	300 ft/day (100m/day)

(a) Mineral Fibers used at 0.4% of total mix, Cellulose, 0.3% of total mix, or other approved stabilizer systems as specified in 904.05.04.

(b) Tensile Strength Ratio using T 283 with the following exceptions:

(1) Compact using 50 gyrations of a Superpave gyratory compactor.

(2) Apply partial vacuum of 26 in. (660 mm) Hg for 10 minutes to whatever saturation level is achieved.

(3) Use five freeze/thaw cycles, keeping the specimens submerged in water during the freeze cycles.

(c) Permeability is required when material is to be used in Porous Asphalt Pavement Systems.

CATEGORY 900
MATERIALS

SECTION 928 — HIGH FRICTION SURFACE TREATMENT

928.01 Polymeric Resin Binder. Provide a resin binder system, meeting the requirements of Table 1, Low Modulus Epoxy; Table 2, Methyl Methacrylate (MMA); and Table 3, Polyester Resin, of AASHTO Standard MP 41-22, recommended by the manufacturer as suitable for use on the intended pavement surface. All materials shall be virgin; free of secondary components, volatile solvents, and external/conventional flexibilizers. Component batches shall be interchangeable. Submit product data sheets and specifications from the manufacturer showing instructions, application recommendations and methods, and product properties. Submit certified copies of laboratory test reports per formulation, documenting that the resin binder system meets the requirements mentioned above. Laboratory tests shall be conducted at facilities that are AASHTO resource (AMRL) or CCRL certified. Submit proof of AMRL/CCRL accreditation for approval prior to submitting laboratory results.

Upon request, provide a sample for each lot/batch. Failure to comply with the specified material properties shall result in rejection of the material lot/batch provided. The test results shall be within 6 months of the date of Aware of the Project and must be from the same batches used in construction. The manufacturer shall maintain and make available upon request complete test results of sampling, testing, actions taken to correct problems and quality control inspection results.

928.02 Calcined Bauxite Aggregate. The material shall be clean, dry, free from foreign matter, and conform to the requirements in Table 928A. The sample submitted for testing shall be from the same source used for the project. Provide a 35 lb. bag of aggregate meeting the requirements in Table 928A to OMT's Soils and Aggregate Technology Division as specified. Deliver the aggregate to the site in clearly labeled packaging that protects the aggregate from contamination and from exposure to moisture.

TABLE 928A

AGGREGATE REQUIREMENTS		
TEST	**REQUIREMENTS**	**TEST METHOD**
Resistance to Degradation – Micro-Deval	3% Maximum Loss	ASTM D7428
Gradation	100% Passing No. 4 95.0% minimum Passing No. 6 5.0% maximum Passing No. 16	T 27
Apparent Specific Gravity	3.1 minimum	T 84
Sodium Sulfate Soundness	12% maximum	T 104
Moisture Content	0.2% maximum	T 255
Aluminum Oxide	87% minimum	C 25
Dynamic Friction Value (20 km/hr)	0.9 Minimum at 0 cycles and 0.7 Minimum at 100,000 cycles on sample with a mean profile depth of 0.9 mm to 1.4 mm per E 2157.	ASTM E 1911[1] AASHTO PP 103
Mean Profile Depth	0.9 mm to 1.4 mm	ASTM E 2157

CATEGORY 900
MATERIALS

SECTION 930 — PRICE ADJUSTMENT FOR STEEL

930.01 PRICE ADJUSTMENT FOR STEEL

930.01.01 General. A Price Adjustment (PA) may be made to provide additional compensation to the Contractor or a credit to the Administration for the fluctuation in the raw material cost of Steel Products used on specific items of work identified in the Contract according to this provision. The master list of standard Pay Items, which the Department has determined are eligible for PA will be posted on the SHA website (www.roads.maryland.gov). The PA only applies to projects for which a Price Adjustment for Steel item is included in the Schedule of Prices. When the item is included in the Contract, the Contractor has the option to opt in or opt out of this specification. The Bidder may choose to have PA applied to any, all, or none of the eligible items shown on form OOC123. Materials purchased by the Contractor and/or the Supplier prior to bid opening, from the list of eligible items, are specifically excluded for consideration.

(a) If the Contractor chooses to opt in, the Contractor must submit a Contractor Opt-In Form OOC123 and cover letter, on Contractors letterhead, to the OOC & a copy to the District Engineer no later than 15 calendar days after the date of the Notice of Award. No price adjustments will be considered if the Contractor fails to submit the required information within that time period.

(b) This PA applies only to Items that are listed as adjustable in the contract bid items. The PA does not apply to changes in the cost of manufacturing, fabrication, shipping, storage, or any cost other than material.

(c) This PA applies only to material cost changes that occur between the dates of the project bid opening by the Administration and the purchase date(s) of the material.

(d) The Contractor shall submit the material cost information and all necessary documentation to the District for review. If a PA is necessitated, it will be made on the next estimate.

930.01.02 Price Adjustment Determinations. The PA will be made when there is an increase or decrease of five percent or greater in the price listed in the AAM from Bid Opening Month to the Purchase Date Month. A maximum increase or decrease of 100 percent is permitted. The PA is applied only for a cost increase or decrease which is five percent or greater, and to a maximum of 100 percent.

(a) Steel Prices. The Administration will maintain a monthly adjustment index using data obtained from the American Metals Market (AMM). The posted price will be

established from the AMM price data published on the last Wednesday of the month. The monthly values will be posted at www.roads.maryland.gov (Business/Contracts, Bids, and Proposals/Resources and Documents) each month. The PA will be computed based on the established price set by the AMM as posted on the Administration's website. No variations that occur within a month will be accounted for other than by the monthly AMM set price.

The Administration's published price data will be used to determine price differentials for any adjustments to be made.

(b) Percent of Change for Prices. The percent of change will be calculated as follows:

Percent Change = [(MI / BI) -1] x 100

Where:

MI = Material Purchase Date Price. (The AMM posted price for the month that the material is purchased)

BI = Bid Opening Price. (The AMM established price for the month in which the bid opening occurs)

(c) Maximum Increase or Decrease. The maximum increase or decrease of 100 percent is determined as follows:

[(MI / BI) – D] = +/- 1 max

D = 1.05 when increase is 5%; 0.95 when decrease is 5% adjustment.

(d) Price Adjustment. Computations for the Price Adjustment will be as follows:

PA = [(MI / BI) – D] x (CB) x (Q / 100)

Where:

PA = Price Adjustment for the current month

MI = Material Purchase Date Price. (The AMM established price for the month that the contractor or fabricator purchases material)

BI = Bid Opening Price. (The AMM established price for the month in which the bid opening occurs)

CB = Cost Basis in dollars per CWT (100 lbs.) at time of bid, calculated as follows:

CB = Price invoiced per CWT x (BI/MI)

D = 1.05 when increase is 5%; 0.95 when decrease is 5%

Q = Total Pounds of applicable steel product(s) which are incorporated into the work and shipped to an approved site (as recorded and verified by Contractor and Fabricator/Supplier)

(e) Documentation. In addition to the Contractor Opt-In Letter Form OOC123, provide documentation to verify the weight and date of purchase of the applicable material and the associated pay items and descriptions. Prior to submittal to the Engineer, have all materials and documentation in the submittal verified by the Office of Materials Technology (OMT).

Submit all documentation to the Engineer prior to incorporation of the material into the work. Submit separate documentation packages for each applicable product and for each quantity represented by the various items below. Include the following in each package:

(1) Documentation package number. Label each documentation package with a unique number.

(2) Identification of the product and pay item subject to adjustment.

(3) The Purchase Order.

(4) The product quantity in pounds.

(5) Steel Certification and Mill Test Reports for the product.

(6) Material Acceptance documentation by the OMT.

(7) A statement signed by the Contractor stating that the documentation provided is true and accurate.

930.01.03 Price Adjustment Criteria and Conditions. The following criteria and conditions will be considered in determining the PA.

(a) Payment. When the price increases a minimum of five percent or greater, the PA will result in an increased payment to the contractor. When the price decreases by minimum of five percent or greater, the PA will result in a credit to the Administration. The PA has a maximum payment adjustment for increases or decreases of 100 percent.

The PA will be applied to the Contract under the item for Price Adjustment for Steel. This amount will be a fixed set bid item supplied by the Administration in the Schedule of Prices to be submitted to all bidders. The quantity and unit price for these bid items shall not be revised by bidders.

Upon submittal of the documentation from the contractor and review/verification by the Administration, any adjustment required will be applied to the subsequent project pay estimate.

(b) Inspection of Records. The Administration reserves the right to inspect the records of the Contractor to ascertain actual pricing and cost information used in the performance of the applicable items of work.

(c) Additional Work. When new items of work, as specified herein, are added to the Contract as additional work, in accordance with the Contract provisions, the PA will be determined by the index at the acceptance of prices and the index at the purchase of material date.

(d) Force Account. Additional work performed on a force account, which includes reimbursement for material, equipment, labor, overhead and profit will be considered full compensation for the current costs.

CATEGORY 900
MATERIALS

SECTION 950 — TRAFFIC MATERIALS

950.01 PRECAST CONCRETE TRAFFIC BARRIER

As specified in the Contract Documents. Welded wire fabric as specified in 908.05.

950.02 RESERVED

950.03 REFLECTORIZATION OF SIGNS AND CHANNELIZING DEVICES

Provide retroreflective sheeting that meets the requirements of the latest version of ASTM D4956 and is selected from the Administration's Qualified Products List QPL. The type of sheeting to be used for different classifications of signs shall be as specified in the QPL and as described below.

Provide fluorescent colors, when yellow, orange or pink sheeting is specified. Color coordinates and values shall be as described in the MDMUTCD and 23 CFR Part 655, Subpart F, Appendix.

Provide non-reflective sheeting, when black sheeting is specified.

All sheeting for legend and backgrounds shall be from the same manufacturer and be a matched component system intended to be used together.

Use ASTM Type IV or VIII construction sheeting with a Class 1 backing for drums for maintenance of traffic. The sheeting must be reboundable as defined in the supplementary requirements of ASTM D4956, latest version.

Use ASTM Type IV, V or VIII for delineators, and lane separator systems. Use ASTM Type IV, VI or VIII sheeting for cones for maintenance of traffic. The sheeting must be reboundable as defined in the supplementary requirements of ASTM D4956, latest version.

Use ASTM Type VI sheeting with a Class 5 backing for Roll up signs for Maintenance of Traffic.

Use ASTM Type VIII, IX or XI sheeting for rigid temporary traffic signs.

Use ASTM Type XI sheeting for Guide Signs, Exit Gore Signs, General Information Signs, School Signs, Warning Signs and Red Regulatory Signs.

Use ASTM Type IV, VIII, IX or XI sheeting for all other Regulatory Signs and for Route Markers.

Use ASTM Type I or higher sheeting for No Trespassing Signs, signs directed at Pedestrian Traffic, signs directed at Bicycle Traffic, R7 series Parking signs, R8 series Parking signs and supplemental panels for R7 and R8 series signs.

950.04 OVERHEAD/CANTILEVER SIGN STRUCTURES

Design, material minimum thickness requirements and construction shall meet AASHTO Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and the following:

(a) A709, Grade 50 for structural steel.

(b) A595, Grade A or API 5LX52 for steel tubes or pipes.

(c) All steel shall be galvanized according to A123.

Hardware, as specified in 909.06, 909.07 and 909.08.

950.05 BACKFILL MATERIAL FOR TRENCHES FOR BURIED CABLE

The lower 1 ft depth of trench shall be fine aggregate meeting Section 901. Material above the 1 ft depth shall be select material as specified in Section 916.

950.06 ELECTRICAL CABLE AND WIRE

A standard commercial product manufactured not more than one year prior to the date of the Contract. All cable and wire shall be made of copper.

950.06.01 Direct Burial Cable. A single conductor stranded, with an unshielded, chemically crosslinked thermosetting polyethylene insulation rated for 600 volts. The cable shall be suitable for direct earth burial or installation in ducts or conduit and shall meet UL Type USE, XHHW or THW and bear the applicable UL labels denoting type, size, stranding, manufacturer's name and surface marking or molded ridges for phase and neutral identification. Sizes shall be as specified.

950.06.02 Building Cable and Wire. 600 V, plastic insulated, nylon jacketed and shall meet UL Type THWN/THHN and bear the applicable UL labels denoting type, size, stranding, manufacturer's name and surface marking or molded ridges for phase and neutral identification. Sizes shall be as specified.

950.06.03 Cable Duct. Shall consist of cables preinstalled in either a polyvinyl chloride (PVC) or polyethylene (PE) plastic duct meeting NEMA TC 7 and the NEC. PVC shall meet D3485. PE duct shall be manufactured from black, virgin, high density PE resin meeting D1248, Type III, Grade P34, Class C, Category 5. Minimum inside diameter of duct shall be 1-1/2 in. Cable shall be rated for 600 volts.

950.06.04 Ground Wire and Rods. Ground wire shall be bare medium drawn copper. Ground wire shall be of the size (solid or stranded) configuration shown in the Contract Documents. Ground rods shall be 0.75 in. diameter, a minimum of 10 ft in length, with a steel core and copper jacket.

950.06.05 Traffic Signal Cable. According to IMSA Specification 19-1, Conductors shall be stranded No. 14 AWG.

950.06.06 Loop Detector Lead-In Cable. According to IMSA Specification 50-2. Shall be two conductor, No. 14 AWG, PE jacketed.

950.06.07 Loop Detector Wire. Single conductor, 600 V, No. 14 AWG, 19 strand wire in a flexible PE tubing.

950.06.08 Voice Grade Communication Cable. Self-supporting cable shall be solid No. 19 AWG and meet IMSA specification 40-4. Underground cable shall meet IMSA specification 60-2.

950.06.09 Electric Service Wire. Electric service wire for traffic signals, intersection control beacons, hazard identification beacons, and luminaires mounted on traffic signal structures shall have three individual wires. Each wire shall be seven stranded. Electric service wire color identification by spray paint, tape, heat shrink tubing, or any other after manufacturing method is prohibited.

950.07 LIGHTING STRUCTURES

According to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, based on 90 mph wind loads, luminaire weight of 70 lb and luminaire projected area of 3 ft^2.

Ground mounted lighting structures consist of a one piece, round tapered shaft, a cast steel anchor base for steel structures and a cast aluminum base for aluminum structures, bracket arms, complete with all necessary accessories including anchor bolts, pole top, shims, grounding lug, and handhole.

Steel shafts shall meet A595, Grade A. After forming and welding, the shaft shall have a smooth finish with only one longitudinal weld and no transverse welds. Steel bracket arms and mounting brackets shall meet A53, Schedule 40. Structures shall be either mechanically or hot-dipped galvanized. The coating shall meet the thickness, adherence, and quality requirements of A123.

Aluminum shafts and bracket arms shall be spun from one piece of extruded tubing meeting B241, 6000 T6 series alloy. The shaft and bracket shall be cold worked to form the required taper.

Each lighting structure shall be provided with a permanent 2 in. x 4 in. tag fabricated from clear anodized 1/16 in. thick aluminum. The edge shall be smooth with rounded corners and the tag shall fit the lighting structure shaft. Tags shall be secured to shafts by means of four 1/8 in.

diameter 18-8 stainless steel round head drive screws or self-tapping screws. The identifying letters or numerals as specified.

950.08 SIGNS

TC-1.03. The manufacturer or supplier shall furnish certification as specified.

950.08.01 Sheet Aluminum Sign Panels. B209, with an anodized mill finish. Alloys shall be either 6061 T6 or 5052-H38.

950.08.02 Extruded Aluminum Sign Panels and Edge Strip. B221, alloy 6063 T6.

950.08.03 Hardware. Sign hardware shall be clear anodized and meet one of the following.

(a) B209, alloy 2024 T4 or,

(b) B211, alloy 2024 T4, 6262 T9, 6061 T6, 7075 T6 or 2017 T4.

950.09 STEEL WIRE STRAND

(a) .01 Span. A475, Grade: Siemens-Martin, Class C, 3/8 in. diameter and seven wire strand.

(b) .02 Tether. A475, Grade: Siemens-Martin, Class C, 1/4 in. diameter and seven wire strand.

950.10 CONDUIT

As specified in Section 805 and 921.07.

950.11 ELECTRICAL CONDUIT DETECTOR TAPE

Consists of one layer of aluminum foil laminated between two layers of inert plastic film. The foil shall be 3 in. wide with a tensile strength of 60 lb. The plastic film shall have a minimum thickness of 4.5 mil.

950.12 LUMINAIRES AND LAMPS

A complete lighting device consisting of a housing, support clamp, reflector, refractor or flat lens, socket, lamp, integral ballast, terminal block, associated hardware, and necessary wiring. All parts of the luminaire shall incorporate the latest ratings and design improvements. Luminaires shall incorporate individual twist lock photoelectric cells when specified. Exposed hardware shall be stainless steel.

A Light Emitting Diode (LED) Roadway Luminaire shall be a complete lighting device consisting of a cast aluminum housing, LED arrays, LED drivers, terminal blocks, integral transformer, associated hardware, all necessary wiring, and an optical assembly. Each LED Roadway Luminaire shall have a NEMA 3-prong twist lock photo control receptacle and shall be furnished with a shorting cap.

950.12.01 Luminaire Construction.

(a) Bracket arm mounted luminaire housing shall be cast aluminum with natural finish. The housing shall contain and support the reflector, refractor or flat lens, socket, ballast, terminal block, and support clamp. Provisions shall be made for leveling and adjusting the luminaire to the specified transverse and longitudinal position to the roadway.

The refractor or flat lens retaining ring shall be securely latched with an operable hinge made from noncorrodible material.

The reflector shall be of specular polished alzak aluminum or equivalent aluminum reflective surface and be held firmly in the housing but easily removed without the use of special tools. Silicone rubber, ethylene propylene terpolymer, dacron felt gaskets, or other gasketing materials as approved by the Engineer, shall seal the optical assembly at the socket entry and between the refractor and reflector to make a dust tight optical system. The reflector shall be clean and free from scratches.

Glass for the refractor or flat lens shall be heat resistant, borosilicate glass and shall be free of imperfections. The optical system of the luminaire shall clearly indicate the street side and curb side.

The socket shall be a mogul screw shell with large center contact spring providing a firm contact with the lamp base and have lamp grips to prevent the lamp from loosening. The shell shall be of the skeleton type or shrouded in porcelain. The contacts shall be identifiable. Socket extension adapters will be permitted for special applications when directed. Luminaires providing various ANSI/IES type of distribution by socket adjustment shall also include a means of identification to associate each lamp position with each distribution type. The socket adjustment shall provide positive positioning by means of index holes, lugs, or notches. Slots with infinite settings are prohibited.

The ballast shall be a high power factor, auto regulator type, capable of operating from a multiple circuit and shall operate a high intensity discharge lamp of the type, wattage, and voltage specified. Multitap ballasts shall be provided where supply voltage is 277 volts or less. The ballast shall start the lamp at temperatures as low as -20 F, and shall deliver rated lamp current at circuit voltage variation of plus or minus 10 percent. The primary power factor shall not be less than 90 percent with normal secondary load. The ballast assembly shall be provided with plug in connectors and installed on a hinged door to permit ready interchange of ballast.

Provide glare shields on luminaires where specified or as directed. The glare shield shall cut off the upward component of light but shall not reduce the total output of the luminaire more than 3 percent.

(b) Bridge underpass luminaires shall be a complete lighting device, consisting of a cast aluminum housing, a door with cast aluminum frame, and thermal shock resistant glass refractor attached to the frame with a stainless steel latch, hinges and retaining chain, a specular polished alzak aluminum reflector, a shrouded adjustable porcelain socket, and an integral ballast as specified above. The refractor and reflector shall direct all useful light well below all normal driver viewing angles to ensure that glare will be at a minimum.

(c) Sign lighting luminaires shall be of the type specified in the Contract Documents. The refractor shall be permanently sealed to the door assembly with silicone adhesive around its perimeter. The reflector shall be a single piece dieform of sheet aluminum alloy 3002 or as approved, processed to Alcoa Class SI alzak finish. A heavy duty mogul lampholder shall be securely mounted to the reflector with a galvanized steel bracket. The refractor/door assembly shall be nonpermanently sealed to the luminaire housing and reflector assembly with a single piece neoprene gasket to effectively seal the luminaire and locked in place by stainless steel spring-loaded latches. The refractor/door assembly shall open and be held captive by double pivot internally mounted stainless steel hinges, and shall be removable.

Weepholes shall be provided in the bottom of the housing in the lowest area of the luminaire as normally mounted.

The sign lighting luminaire shall be designed to properly illuminate the sign with the lamp source type and size as specified in the Contract Documents. The Contractor shall submit for the approval, working drawings showing locations and aiming angles of luminaires with relation to each of the signs of the various sizes.

(d) Design LED bracket arm mounted Luminaires for an operational life of at least eleven years with 90 percent lumen maintenance value of 50 000 hours (L90) at an average operating time of 12 hours per night. The illuminance shall not decrease by more than 10 percent over the minimum operational life of eleven years. All components of the LED Roadway Luminaires must be rated for the full service life without maintenance. All LED Roadway Luminaires shall be cobrahead style unless otherwise specified in the Contract Documents

Provide LED Roadway Luminaires that use no more than 280 watts and are designed to operate at all voltages from 120 volt to 480 volt. For 480 volt operation, an integral transformer shall be provided to reduce the voltage. The power factor of the LED Roadway Luminaire shall be 0.90 or higher. The Correlated Color Temperature (CCT) shall be between 3000 K and 4000 K and the Color Rendering Index (CRI) shall be greater than 65.

All components of the LED Roadway Luminaire shall be UL approved. The LED Roadway Luminaire housing and lens/refractor shall be sealed to prevent intrusion of moisture for the full service life and comply with Ingress Protection Rating IP-65 or greater. The lens/refractor shall be constructed of a material that will not show visible yellowing due to UV exposure, or exposure to hydrocarbon emission, for the full service life.

Provide LED Roadway Luminaire drivers that are Solid State (electronic) type with an input voltage range from 120-277VAC (±10 percent), input frequency of 60Hz, minimum power factor of 90 percent at full load, Total Harmonic distortion less than 20 percent, case temperature rated for -40 C to 50 C, and contain 3 kV input high voltage surge protection.

LED Roadway Luminaire on board circuitry shall include a Surge Protection Device (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The SPD shall protect the luminaries from damage and failure for transient peak voltages up to 10kV and transient peak currents up to 10kA.

Complete all photometric testing of the LED Luminaires as specified in IESNA technical memorandums LM-63, LM-79 and LM-80. Perform all testing and calculations using photopic values. No correction for scotopic values will be permitted.

Design the LED Roadway Luminaire to mount on a standard tenon mount. No field adjustment, except for leveling, shall be required for installation. All hardware shall be stainless steel.

For placement on the Qualified Product's List, the product evaluation application must be submitted on the Administration's Maryland Product Evaluation List (MPEL). After submittal, a minimum of 2 luminaires must be provided for evaluation. The Luminaires will be evaluated for 90 days, and returned to the supplier, if desired. The evaluation will be for general durability and suitability of the luminaires. All shipping costs will be the responsibility of the supplier.

950.12.02 Lamps shall be provided for luminaires of the type and wattage specified. Lamps shall be first line, high quality and be as approved. Lamp wattage, horizontal or vertical initial lumens, rated lamp life, and percent of initial lamp lumens at end of rated lamp life shall be as specified or as follows:

TYPE	WATTS	INITIAL LUMENS	RATED LIFE (10hr/start)	PERCENT INITIAL LUMENS
Deluxe Mercury	175	8600	24000	74
Deluxe Mercury	250	12100	24000	74
Deluxe Mercury	400	22500	24000	60
H.P. Sodium	100	9500	20000	74
H.P. Sodium	150	16000	24000	74
H.P. Sodium	200	22000	24000	72
H.P. Sodium	250	30000	24000	73
H.P. Sodium	310	37000	24000	72
H.P. Sodium	400	50000	24000	73
Metal Halide	250	20000	10000	80
Metal Halide	400	40000	15000	80

Refer to section 950.12.01(d) for required lamp wattages and rated lamp life for LED Roadway Luminaires.

950.13 CONTROL AND DISTRIBUTION EQUIPMENT

950.13.01 Circuit Breakers. Molded case type having a minimum rating of 10 000 amp interrupting capacity (AIC) and be quick make, quick break, thermal magnetic, trip indicating, and have common trip on all multiple breakers with internal tie mechanism. They shall have the current and voltage ratings and number of poles as specified in the Contract Documents and be treated to resist fungus and be ambiently compensated for the enclosure and proximity to adjacent breakers. All circuit breakers shall be the bolt in type.

950.13.02 Photoelectric Controls. Solid state, cadmium sulfide type with hermetically sealed silicone rectifier rated 120 V, 60 cycle AC and 1000 watts maximum load. Built in surge protection shall be provided, and a fail safe operating feature shall be included so that the lighting circuits will remain energized in the event the photo control components become inoperative. Nominal operating levels of this control shall turn on at a minimum vertical illumination value of 3 ft-c and turn off at a maximum vertical illumination value of 6 ft-c. These limitations shall be set by the manufacturer, and tolerances of plus or minus 20 percent for the specified value will be acceptable.

Photoelectric controls for luminaires and lighting controls shall be twist lock type. A suitable mounting bracket with locking type receptacle and all other necessary mounting hardware shall be furnished.

950.13.03 Contactors and Relays. Contactors of the current ratings and number of poles specified. They shall be fully rated for all classes of load to 600 V and shall have an interrupting rating of 600 percent of rated current. A HAND-OFF-AUTOMATIC selector switch shall be provided in the photoelectric cell circuit. Relays shall be the type, size, and contact ratings as specified.

950.13.04 Panel Boards. Federal Specification W-P-115 and shall be suitable for operation on the voltage and type service specified. They shall be UL listed and labeled. Panel boards shall be equipped with the number and size circuit breakers specified. Circuit breakers in panel boards shall meet Federal Specification W-C-375 and shall be bolted to copper busses. Buss ratings shall be as specified.

950.13.05 Lightning Arresters. Shall be secondary type, having the specified number of poles and 0 to 650 V RMS. Arresters shall be provided with suitable mounting brackets and all other necessary mounting hardware.

950.13.06 Control Power Transformers. Control power transformers shall be the dry type, two windings, of the size and voltage ratings specified.

950.13.07 Enclosures. Shall meet the NEMA type specified and be dead front type weatherproof metal enclosed self-supporting structures, as specified. Free standing enclosures shall be fabricated from sheet aluminum and be as specified herein. Panel and control equipment cabinets shall be the manufacturer's standard enclosure for the type and application specified. They shall have door clamps, solid neoprene gaskets, welded seams, stainless steel external hardware, and continuous hinges with stainless steel pins. Enclosures shall have two weep holes in the bottom and shall be equipped for padlocking.

950.13.08 Pad Mounted Enclosures. For ventilation, all cabinets shall be provided with louvered vents in the front door with a removable air filter.

(a) Louvers shall meet the NEMA Rod Entry Test for 3R rated ventilated enclosure.

(b) Filters for all cabinets shall be 16 in. long, 12 in. wide and 1 in. thick. The filter shall cover the vents and be held firmly in place with top and bottom brackets and a spring loaded upper clamp.

(c) Exhaust air shall be vented out of the cabinet between the top of the cabinet and the main access door. The exhaust area shall be screened with a material having a maximum hole diameter of 1/8 in.

950.13.09 Thermostats and Fans. A thermostatically controlled cooling fan shall be provided for all cabinets. The fan and thermostat shall be rated for 125 percent of capacity and shall be mounted at the top of the cabinet.

(a) Thermostats shall be the inline type, single pole, 120 V, 10 amps with a minimum range of 40 F to 80 F.

(b) The fan shall have a minimum rated capacity of 100 CFM air flow and a minimum rated design life of 100 000 hours.

(c) The thermostat shall be manually adjustable, within a 10 degree range, from 70 F to 160 F.

950.13.10 Disconnect Switches and Utility Connections. NEMA standard KS 1-1990. Disconnect switch enclosure shall be Type 4 stainless steel, with external operating handle, enclosure cover interlock, and external switch mechanism handle with provisions for securing in both the **ON** and **OFF** positions by padlock. The switch mechanism shall be of heavy duty design with quick make, quick break type operations, and visible blades.

The disconnect switch shall be fusible with integral fuse puller. Single phase disconnect switches shall have 2 poles with a solid neutral and shall be rated at 240 V. Three phase disconnect switches shall have 3 poles with a solid neutral and shall be rated at 600 V. The design of the neutral bar may be factory or field installable.

Disconnect switch fuseholders for traffic signals, intersection control beacons, and intersection lighting operating at 120 V shall be single phase 60 amps (fused 35 amps).

Disconnect switch fuseholders for hazard identification beacons and luminaires mounted on traffic signal structures operating at 120 V shall be rated single phase 30 amps (fused 20 amps).

Disconnect switches for lighting control cabinets shall have the same number of poles and amperage rating specified in the electrical service equipment item.

Disconnect switches for electrical service distribution cabinets shall be 200 amp, 2 pole, and single phase.

950.14 ELECTRICAL CABLE AND WIRE CONNECTORS

950.14.01 Cable Connectors and Connector Kits. For use in lighting structures, hand holes, junction or pull boxes, and for terminating underground cables in lighting structures shall be rated for a minimum of 600 V service. Cable connectors shall be compression type, applied by means of a compression tool. Connectors shall be fabricated from high strength copper alloy. Plated connectors fabricated from metals other than copper are prohibited. Bolted type connectors shall be utilized for splicing bare ground conductors.

950.14.02 Connector Kit Components. Each cable connector kit shall be furnished with all component parts described under the various listed types. Each kit shall contain sufficient silicone compound to lubricate metal parts and the housing for each assembly along with complete installation instructions.

(a) All housings shall be made of water resistant synthetic rubber suitable for burial in the ground or exposure to sunlight. Each housing shall form a watertight seal around the cable at the point of disconnection and between the insert body and enveloping Y housing.

(b) All copper pins, sockets, and fuse contacts shall have a minimum conductivity of 90 percent. The crimpable portion shall be fully annealed while the rest of the device is maintained in its original state.

(c) Plastic sleeves shall be rigid, molded insulating plastic material of sufficient outside diameter to form a watertight fit with its related housing. Wall thickness shall be 0.10 in. maximum, and sleeve lengths of 4 in. and 7 in. shall be available.

(d) All fuses shall be rated 600V, 100 000 amps AIC.

950.14.03 Connector Types. Each cable connector kit furnished shall be one of the following types:

(a) Type I - Unfused, quick disconnect inline connector kit containing:

(1) A copper pin crimpable to a conductor.

(2) A receptacle having a centrally located, recessed locking socket constructed so that it is filled and retained by its housing and a disposable assembly pin.

(3) A plug housing for retention of the copper pin.

(4) A receptacle housing with disposable protective sleeve.

(b) Type II - Fused, quick disconnect inline connector kit containing:

(1) A pair of spring loaded copper fuse contacts suitable for gripping the specified cartridge fuse. One contact shall be crimpable on a conductor and after insertion into its proper position within the load side plug housing, be capable of being securely retained therein. The other contact shall be preassembled for retention within the line side of the connector body.

(2) A load side housing permanently marked “Load Side”.

(3) A disposable assembly pin.

(4) A fuse of the specified amp rating.

(c) Type III - Fused, quick disconnect Y connector kit containing:

(1) A pair of spring loaded copper fuse contacts suitable for gripping the specified cartridge fuse. One contact shall be crimpable on a conductor and after insertion into its proper position within the load side plug housing, be capable of being securely retained therein. The other contact shall be preassembled for retention within a Y insert body.

(2) A line side Y housing with two water seal cable ports.

(3) Two terminal lugs, each having a mounting hole.

(4) A bolt and a self-locking nut.

(5) A Y insert body with preassembled line side fuse contact and a ring tongue terminal.

(6) A load side plug housing permanently marked “Load Side”.

(7) A disposable assembly pin.

(8) A fuse of specified amp rating.

(d) Type IV - Unfused, quick disconnect Y connector kit containing:

(1) A copper pin crimpable to a conductor and suitable for retention in the load side receptacle housing.

(2) A Y insert body with preassembled load side copper socket and ring tongue terminal.

(3) A line side Y housing with two water seal cable ports.

(4) Two terminal lugs, each having a mounting hole.

(5) A bolt and self-locking nut.

(6) A load side receptacle housing.

950.15 TRAFFIC SIGNAL HEADS

Pedestrian signal indications and vehicular signal heads shall meet the Institute of Transportation Engineers (ITE) Specifications.

(a) All materials shall be clean, smooth, and free from flaws, cracks, blowholes, and other imperfections.

(b) Signal heads shall be furnished with the section assembled together including all hardware as specified in the Contract Documents.

(c) All metallic signal head hardware shall be stainless steel material.

(d) Vehicular, optically-programmed and pedestrian signal heads shall be capable of mating to the same type of the signal heads from either the top or bottom of each housing.

(e) All hardware furnished shall be installed on the corresponding fitting and threaded component.

Mounting hardware shall meet the following:

ITEM	DESCRIPTION	A	B	C	D
1	Aluminum Alloy - Casting	A319	A380	A713	6063 T6
2	Yield Strength, ksi	18	23	25	25
3	Tensile Strength, ksi	27	47	35	30
4	Brinell Hardness	70	80	75	73
5	Elongation (% in 2 in.)	1.5	4	3	12
6	Stainless Steel	A316	—	—	—
7	Galvanized Steel	A157	A153	G60	—
8	Steel-Flat Sheet	16 gauge	—	—	—
9	Coating	*	Anodized Finish	—	—

*Using AMS-STD-595A, the signal head housing shall be yellow meeting Color Chip No. 13538. The signal head door and visor shall be optical flat (dull) black, Color No. 37038. Aluminum signal heads shall be painted using fusion bonded polyester coating method.

Hardware.

Hub plate shall meet A, 1 through 5 and 9B.

(a) Span wire hanger clamp shall meet C, 1 through 5.

(b) Balance adjuster shall meet 6A, 7A, and 7B.

(c) 2-way lower arm shall meet 7C and 8A.

(d) 2-way tri-stud arm shall meet A, 1 through 5.

(e) Span wire entrance fitting shall meet C, 1 through 5.

(f) Mast arm mount signal bracket (1-way, 2-way, and 5-section) shall meet 1A and 1D.

(g) Side pole upper and lower arm assembly shall meet 1B through 5B or 1D through 5D.

Vehicular Signal Heads and Pedestrian Signal Indications Housings and Doors.

(a) Aluminum signal head housings and doors shall be die-cast aluminum as specified in the ITE Vehicle Traffic Control Signal Head Specification.

(b) Dual hinge-latch mechanisms shall be mounted on the signal head housing and not the signal head door.

Captive door latch mechanisms (one for 8 in. and two for 12 in. vehicular signal heads, and one for 9 in. and two for 12 in. pedestrian signal indications) shall secure the door to the housing by use of stainless steel eyebolts and wing nut assemblies.

(c) All openings to the housing interior shall be provided with a gasket meeting the physical properties listing in UL 508 and that forms a weather tight seal.

Visors.

(a) Visors shall be as specified in the ITE Vehicle Traffic Control Signal Head Specification and shall be tunnel type. Visors shall be 10 in. deep for 12 in. vehicular signal heads, 8 in. deep for 8 in. vehicular signal heads, 9 in. deep for 12 in. pedestrian signal indications, and 9.5 in. deep for optically programmed signal heads.

(b) Visors shall be secured to the signal head door by a minimum of four screws mounted perpendicular to the face of the signal head door.

(c) Visors for aluminum vehicular signal and pedestrian signal sections shall be made from aluminum alloy sheet. Visors for polycarbonate signal sections shall be either formed from sheet plastic or assembled from one or more injection, rotational, or blow-molded polycarbonate sections.

Optical System. Vehicular and pedestrian traffic control signal indications shall meet the following.

(a) Signal Head Lamps. Approved by the Office of Traffic and Safety.

(b) Reflector. Shall be made of aluminum.

Reflector support assembly shall be die cast aluminum, separate from the reflector and fully encompass the periphery of the reflector.

Reflector support assembly shall be spring hinged to allow access to the rear of the signal head main body without the use of tools.

(c) Lens. Shall be standard (ball) red, yellow, or green, or specified arrow red, yellow, or green traffic signal lens.

The lens shall be glass.

Directional arrow lenses shall have the same brilliance, regardless which direction they are positioned in the signal face.

The lens shall fit into a one-piece slotted neoprene lens gasket designed to provide a weather resistant fit to the housing door. Lenses shall be secured by a flat clip/screw

design fastened from the inside of the signal head door perpendicular to the face of the door. The flat clip/screw design shall not pass through the lens itself.

All pedestrian signal heads shall provide the messages of "walk" and "don't walk" in the international walking person and the raised hand symbols.

Optical System for Optically Programmed Signal Heads.

(a) The indication from the lens shall meet the requirements of ITE transmittance and chromaticity standards.

(b) Optically programmed signal heads shall have an optical system containing a color filter, lamp fixture, lamp collar, optical limiter/diffuser, and objective lens.

(c) Lamp fixtures shall be comprised of a separately accessible housing and integral lamp support, indexed ceramic socket, and self-aligning and quick release lamp retainer. Electrical connection between case and lamp housing shall be accomplished with an interlock assembly that disconnects the lamp holder when opened.

(d) The optical limiter shall provide an accessible imaging surface at focus on the optical axis for objects 900 ft to 1200 ft distance and permit an effective veiling mask to be variously applied as determined by the desired visibility zone. The optical limiter shall be composed of heat-resistant glass.

(e) Optically programmed signal heads shall utilize incandescent PAR type lamps. The lamp shall be coupled to the diffusing element. The diffusing element may be discrete or integral with the convex surface of the optical limiter.

(f) The objective lens shall be a high resolution annular incremental lens hermetically sealed within a flat laminate of weather resistant acrylic or as approved by Office of Traffic and Safety. The lens shall be symmetrical in outline and may be rotated to any 90 degree orientation about its axis without displacing the primary image.

Electrical.

(a) The entire signal head assembly shall be either listed or labeled by a Maryland State Fire Marshall or a recognized electrical inspection agency.

(b) Wiring connections at the lamp socket shall lock and not be of the male/female demountable type.

(c) A unitized bail wire with integral spring shall secure the socket to the rear of the reflector. The lamp socket shall have a serrated base to permit locking.

(d) Each single section and the middle section of three section signal heads shall have a minimum of a six section, twelve position terminal block capable of accepting three

number 14 AWG spade terminal ends. The top section of two section pedestrian signal indications shall be furnished with a minimum of five section, ten position terminal blocks capable of accepting three number 14 AWG spade terminal ends.

(e) Optically programmed signal heads shall not contain a resistance device for use as an intensity controller with integral means for regulating its intensity between limits as a function of individual background illumination.

CATEGORY 900
MATERIALS

SECTION 951 — PAVEMENT MARKING MATERIALS

951.01 PAVEMENT MARKING PAINT

Pavement marking paint is a non-toxic, ready-mixed pigmented binder emulsified in water, capable of anchoring reflective glass beads applied separately.

951.01.01 Restrictions. Pavement marking paint shall not contain any hazardous material listed in Code of Federal Regulations CFR 40, Section 261.24, Table 1.

951.01.02 Physical Requirements. Pavement marking paint shall conform to the manufacturer's formulations as approved and shall be controlled from batch to batch. Paints shall be compatible with cleaning solvents used in equipment cleaning.

Production batch samples will be subject to random tests, such as but not limited to, X-ray spectroscopy, infrared spectroscopy, ultraviolet spectral analysis, and atomic absorption spectroscopy.

Pavement marking paint shall also conform to the following.

(a) Viscosity. D562. The viscosity shall be 85 ± 10 KU.

(b) Pigment For Yellow Pavement Marking Paint. The colorants used to attain the yellow color shall be titanium dioxide and one or more of the following. Pigment Yellow 65, Pigment Yellow 75, and opaque Pigment Yellow 74.

(c) Color and Appearance. AMS-STD-595A; 38907 for yellow or 37925 for white. Evaluate color and appearance using the following: CIE 1976 L*a*b*, illuminant D65, and standard observer angle 1931 CIE 2 degrees. The geometry shall be 45/0 or 0/45, or d/8, excluding specular gloss.

Take measurements from samples applied to an opacity chart, e.g., Leneta Form 2A, at a wet film thickness of 15 mils ± 1 mil. The applied sample shall have been allowed to dry for at least 12 hours before measurements are taken. The evaluation shall be as follows:

(1) Production. The color of the dry paint shall match the L*a*b* values provided, under the specified conditions. For white paint the values are: L* = 94.80, a* = -2.35, b* = 3.20. For yellow paint the values are: L* = 80.70, a* = 19.40, b* = 88.65. The colors shall match when compared instrumentally.

(2) Control. The maximum permissible variation from the specified L*a*b* values shall be 2.0 ΔE_{cmc}. Take measurements from a sample applied over the black portion of an opacity chart.

Batches will be approved based on a laboratory visual evaluation for blemishes and irregularities in the test specimen (e.g., cracks, flaking, surface depressions, pooling, etc.) that would interfere with the measurement of color and appearance on the opacity chart. The final decision will be as determined.

(3) Reflectance. The reflectance, without beads and using CIE XYZ Yxy shall be a minimum Y of 80 percent for white batches; and a minimum of 50 percent for yellow batches; with a maximum of 60 percent. Take measurements from a sample applied over the black portion of an opacity chart.

(4) Color Difference over Black and White. The measured color difference between readings taken over the black portion of the opacity chart from those taken over the white portion shall be a maximum value of 1.0 ΔE_{cmc} for white products and 1.3 ΔE_{cmc} for yellow products.

(5) Yellowness Index. E313. Determine the yellowness index of the white paint using Equation 1 and the coefficients for CIE D 65 illumination, 1931 from Table 1. The yellowness index shall not exceed 8.0.

(6) No-Track. Paint shall conform to 60 second no-track requirements. Determine the no track condition by passing over the applied line with a standard passenger car or pickup truck at approximately 30 degrees. The pavement surface shall show no evidence of the paint being picked up and re-deposited on the pavement by the vehicle when viewed from a distance of 50 ft.

(d) Flexibility. TT-P 1952D. The binder shall not display cracking or flaking when subjected to the flexibility test; except the panels shall be 35 to 31 gauge (0.0078 to 0.0112 in.) and the tin plate approximately 3 x 6 in. Tin plates shall be lightly buffed with steel wool and thoroughly cleaned with solvent and dried before use.

(e) Weight per Gallon. D1475. The weight per gallon shall be within ± 0.3 lb/gal of the value obtained on the National Transportation Product Evaluation Program's (NTPEP) North Test Deck. The Administration will stipulate another target value if the NTPEP requirements are waived.

(f) Shelf Life. Paint shall not skin, curdle, settle, be difficult to apply or unusable within 12 months of the manufacture date. The supplier shall replace unacceptable containers of paint as directed. Do not use paint from a batch 12 months beyond the manufacture date.

951.01.03 Qualification. Manufacturers desiring to have their paints approved for Administration use shall have their products evaluated on the NTPEP North Test Deck. Materials meeting the requirements and performing satisfactorily throughout the evaluation period will be placed on the Qualified Products List (QPL) maintained by the Office of Materials Technology. Only NTPEP evaluated formulations will be considered candidates for selection, unless otherwise waived. The Office of Materials Technology will determine qualification.

951.01.04 Material Acceptance. The manufacturer shall provide access to the Administration's representative for collecting production batch samples prior to shipment. The samples shall be sent to the Administration laboratory for QA testing. Each sample shall be accompanied by certification as specified in TC-1.03. Production batch samples will be subject to random tests as specified in 951.01.02. The Administration will determine conformance with the requirements. Approval will be required before a batch or portion of a batch is shipped.

951.01.05 Certification. The manufacturer shall certify that any paint batch supplied conforms to all applicable specifications in accordance with TC-1.03 and as specified; and provide a statement certifying that any paint supplied is identical in composition to the material submitted for NTPEP testing. The same code name used on the test deck must identify the product. Failure to certify will be grounds for product batch rejection.

Certification for yellow paint shall include the name or the type of colorant used to achieve the yellow color. All paint composition and chemical analysis information will keep confidential.

Certification shall also contain the following.

(a) Manufacturer's name.

(b) Manufacturer's address.

(c) Material color.

(d) Manufacture date f (mm-dd-yy).

(e) Lot or batch identification number.

(f) Lot/batch size.

(g) Recommended paint temperature at the spray gun.

(h) Material Safety Data Sheets.

951.01.06 Production Facility.

(a) The producer shall provide a facility capable of producing pavement marking paint in the quantity and quality specified; subject to Administration approval.

(b) The producer shall provide a laboratory capable of performing the required tests; subject to Administration approval.

951.01.07 Packaging. Label each container with the following information.

(a) Manufacturer's Name.

(b) Manufacturer's address.

(c) Material color and component type, if applicable.

(d) Manufacture date (mm-yy).

(e) Lot or batch identification number.

951.02 PAVEMENT MARKING TAPE

Pavement marking tape shall be capable of adhering to new or existing asphalt pavement or Portland cement concrete surfaces. The tape shall be backed with a pressure sensitive adhesive. The tape shall be applied according to the manufacturer's recommendations. A primer may be used to condition the pavement surface prior to placement according to the manufacturer's recommendations.

(a) The tape shall be permanent, durable, highly retroreflective, and designed to withstand high traffic volumes and severe wear conditions. The tape shall be manufactured as longitudinal tape or legends/symbols and the surface texture may be either flat or patterned.

(b) The tape shall remain in place on the pavement surface without being displaced by traffic, and shall not be affected by weather conditions.

951.02.01 Categories. Pavement marking tape shall consist of a mixture of polymeric materials, pigments and reflective spheres distributed throughout the base cross-sectional area with retro-reflective spheres bonded to the topcoat surface. Pavement marking tape shall conform to one of the following categories.

(a) Inlaid Pavement Marking Tape – Warranty. The material shall be capable of being inlaid into new asphalt pavement surfaces.

(b) Surface-applied Pavement Marking Tape. The material shall be capable of being applied to existing asphalt or Portland cement concrete pavement surfaces.

(c) Contrast Pavement Marking Tape. The material shall consist of yellow and black or white and black tapes bonded together to form a one piece roll or may be two separate tapes that are placed together on the pavement. The single roll or the separate tapes shall be 3 in. wider that the normal width of the tape. The black portion shall be evenly divided with 1 1/2 in. on each side of the white or yellow tape. The material shall be capable of being applied to Portland cement concrete surfaces.

951.02.02 Restrictions. The combined total of heavy metals listed in the Environmental Protection Agency Code of Federal Regulations CFR 40, Section 261.24, Table 1, if present, shall not exceed 100 ppm when tested by X-Ray Fluorescence, ICP, or a comparable method capable of this level of detection.

951.02.03 Physical Requirements. The material shall meet the following:

(a) Glass Beads. Refer to 951.09. Glass beads shall not contain more than 200 parts per million when tested in accordance with EPA Methods 3052, 6010B and 6010C.

(b) Retroreflectance. The manufacturer shall certify that the white and yellow materials have the minimum initial retroreflectance values of 350 mcd/L/m^2 for white and 250 mcd/L/m^2 for yellow markings in any 528 ft section. Retro-reflectance shall be measured using a reflectometer with CEN 30-meter geometry (88.76 degree entrance angle and 1.05 degree observation angle).

(c) Color. The color of the material shall match AMS-STD-595A color chips for white (37925), yellow (38907) or black (37038).

(d) Frictional Resistance. E303. The surface of the retroreflective pliant polymer shall provide a minimum initial average skid resistance value of 45 BPN.

(e) Appearance. The material shall be of good appearance and free from cracks. Edges shall be true, straight and unbroken.

(f) Application. If the markings are to be applied in a specific direction, the material shall be marked as to the application direction.

(g) Packaging. All materials supplied shall be packaged in conformance with accepted commercial standards. Materials manufactured in rolls shall have no more than three splices per 150 ft of length.

(h) Shelf life. Materials shall have a minimum shelf life of one year.

951.02.04 Qualification. Manufacturers desiring to have their materials approved for Administration use shall have their products evaluated on the NTPEP North Test Deck unless otherwise waived. Materials meeting the requirements and performing satisfactorily throughout the evaluation period will be placed on the Administration's Qualified Products List. The Office of Materials Technology will determine qualification.

951.02.05 Certification. The manufacturer shall furnish certification per TC-1.03 and provide Material Safety Data Sheets for all products submitted for use. The manufacturer shall certify that any pavement marking tape supplied conforms to the samples evaluated on the NTPEP test deck. Formulas shall be identified by referring to the code used on the deck.

Submit certification for inlaid pavement marking tape per Section 552.

The manufacturer shall also provide the following:

(a) A facility capable of producing the tape in the quantities and quality required by the Administration.

(b) A laboratory capable of performing the tests required in 951.02.03.

(c) Both facilities will be subject to Administration approval.

951.03 EPOXY PAVEMENT MARKINGS

Epoxy pavement markings consist of a two-component, 100 percent solids system.

951.03.01 Physical Components.

(a) Composition.

COMPONENT A		
	PERCENT BY WEIGHT	
PIGMENT	**WHITE**	**YELLOW**
Epoxy Resin	75 - 82	75 – 79
Titanium Dioxide	18 - 25	14 – 17
Organic Yellow	—	7 – 8

(1) D 476. Component A White shall consist of Type II Rutile Titanium Dioxide only. No extender pigments are permitted. Component A Yellow shall consist of yellow pigments and tinting colors proportioned to produce the color specified in 951.08.02(a). Titanium Dioxide used in Component A Yellow shall conform to Type II Rutile.

(2) The epoxy system shall contain no volatile solvents. The cured film shall be no less than 99.5 percent of the wet film thickness of the test panel.

(b) Epoxide Number. D1652. The pigment free weight per epoxy equivalent (WPE) for Component A White and Yellow shall conform to a target value of ± 50 as manufactured and as approved.

(c) Amine Number. D2074. The amine value of the curing agent Component B shall consist entirely of stable amines. The total amine value shall conform to a target value ± 50 as provided by the manufacturer and as approved.

951.03.02 Restrictions. The combined total of heavy metals listed CFR 40, Section 261.24, Table 1, shall not exceed 100 ppm when tested by X-Ray Fluorescence, ICP, or comparable method capable of this level of detection.

951.03.03 Mixed Composition.

(a) Mixing Ratio. The mixing ratio for the epoxy pavement marking material shall be proportioned according to the manufacturer's recommendations. The ratio shall not vary more than 2.5 percent.

(b) Color - White and Yellow.

(1) Production. The color of the cured epoxy material film of the production sample shall match the specified color chips conforming to AMS-STD-595A when visually compared or by instrumental measurement.

(2) Control. Control color matching determinations will be made using a Pacific Scientific Color Machine at an observation angle of 2 degrees, and the C.I.E. Chromatically Coordinate Color Matching System under light source Illuminate C, with the following tolerances permitted between the standard chip and the cured epoxy film sample:

	WHITE Color No. 37925		**YELLOW Color No. 38907**	
	X	Y	X	Y
Standard Chip	0.310	0.330	0.480	0.450
Delta Tolerance	± 0.020	± 0.020	± 0.030	± 0.030

(c) Yellowing Index. E313. After curing for 72 hours, the yellowing index of the white material when tested using the C.I.E. Scale Illuminate C and 45/2 degrees geometry shall not exceed 8.0 preceding QUV and shall not exceed 15.0 QUV after 72 hours.

(d) Toxicity. The material shall not exude fumes which are toxic or injurious to persons or property when heated to the application temperature.

(e) Directional Reflectance. E1347. The directional reflectance(s) shall be minimums of 80 for white and 50 for yellow after QUV using the C.I.E. Scale Illuminate C and 45/2 degrees geometry.

(f) Abrasion Resistance. C501. The abrasion resistance of the material (mixed without glass beads) shall be 80 mg maximum loss when tested using a 1000 g load, 1000 cycles, CS-l7 wheel and a 15 ± 0.5 mil wet film thickness on a S-l6 plain steel plate.

(g) Hardness. D2240. The Type D Durometer Hardness shall be 75 minimum. Cast test films on a suitable substrate at 20 ± 1 mil wet film thickness. The film shall be cured 24 to 72 hours at 75 ± 2 F prior to testing.

(h) Tensile Strength. D638. The average tensile strength shall be a minimum of 6000 psi when tested using Type IV molded specimens. Specimens shall be cured 24 to 72 hours at 75 ± 2 F in relative humidity of 50 ± 3 percent prior to testing.

(i) Compressive Strength. D695. The compressive strength of the material shall be a minimum of 12 000 psi. Test specimens shall be cured 72 hours at 75 ± 2 F in relative humidity of 50 ± 3 percent prior to testing.

(j) Adhesion to Concrete. ACI Method 503. Epoxy pavement markings shall have a 4000 psi minimum adhesion to the concrete surface with 100 percent concrete failure. The prepared specimens shall be conditioned for 24 to 72 hours at 75 ± 2 F prior to testing.

(k) Infrared Spectroscopy. Both component A and component B shall be analyzed to verify for control purposes that materials submitted for use are of an identical formulation as originally approved. Deviations from comparison with the original sample shall be cause for rejection.

(l) Curing. D711. Epoxy marking materials shall be fully cured at a surface temperature of 35 F or above. The pavement marking material shall exhibit a no-tracking time of less than 10 minutes. The manufacturer shall furnish a table depicting typical no-track time versus various temperatures in the recommended application temperature range.

951.03.04 Qualification. Manufacturers desiring to have their materials approved for Administration use shall have their products evaluated on a NTPEP North Test Deck unless otherwise waived. Materials meeting the requirements and performing satisfactorily throughout the evaluation period will be placed on the Administration's Qualified Products List. The Office of Materials Technology will determine qualification.

951.03.05 Material Acceptance. The manufacturer shall provide access to the Administration's representative for collecting samples from each production batch prior to shipment. The samples shall be sent to the Administration's laboratory for QA testing. Each sample shall be accompanied by certification as specified in TC-1.03. Production batch samples will be subject to random tests, such as but not limited to, X-ray spectroscopy, infrared spectroscopy, ultraviolet spectral analysis, and atomic absorption spectroscopy. The Administration will determine conformance with the requirements. Approval will be required before a batch, or a portion of a batch is shipped.

Take random samples on the project according to the Material Quality Assurance Processes and test as specified. Non-conformance may result in the suspension from the certification program until qualification is reestablished.

951.03.06 Certification. TC-1.03. The manufacturer shall certify that any pavement marking batch supplied conforms to all specifications and provide a statement certifying that any paint supplied is identical in composition to the material submitted for NTPEP testing. The same code name used on the test deck must identify the product. Failure to certify will be grounds for product batch rejection.

Certification shall also include the following.

(a) Manufacturer's name.

(b) Manufacturer's address.

(c) Material color.

(d) Manufacture date f (mm-dd-yy).

(e) Lot or batch identification number.

(f) Lot/batch size.

(g) Material Safety Data Sheets.

951.03.07 Packaging. Label each container with the following:

(a) Manufacturer's Name.

(b) Manufacturer's address.

(c) Material color and component type, if applicable.

(d) Manufacture date (mm-yy).

(e) Lot or batch identification number.

951.03.08 Production Facility.

(a) The manufacturer shall provide a facility capable of producing thermoplastic pavement markings in the quantity and quality specified; subject to Administration approval.

(b) The manufacturer shall provide a laboratory capable of performing the required tests; subject to Administration approval.

951.04 THERMOPLASTIC PAVEMENT MARKINGS

Thermoplastic pavement markings shall be homogeneously composed of pigment, filler, resins, glass beads and conform to the following.

951.04.01 Composition.

COMPONENT	TEST METHOD	COLOR	
		WHITE	YELLOW
Binder, % min	Certified	18.0	18.0
Premixed Reflective Beads, % min	MSMT 614	30.0	30.0
Titanium Dioxide, % min	X-Ray Fluorescence	10.0	N/A
Calcium Carbonate Inert fillers, % max	D34	42.0	*
Yellow Pigment, % —	—	N/A	*

*Amount of yellow pigment, calcium carbonate and filler shall be at the option of the manufacturer.

(a) Restrictions. Thermoplastic pavement markings shall not contain any hazardous material listed in CFR 40, Section 261.24, Table 1. Diarylide type pigments shall only be used when the pavement marking material application temperature does not exceed 392 F.

(b) Binders. Binder shall be alkyd consisting of maleic modified glycerolester of resin and other plasticizers.

(c) Titanium Dioxide. Rutile type.

(d) Inner Mix Glass Beads. Refer to 951.09. Glass beads shall not contain more than 200 parts per million when tested in accordance with EPA Methods 3052, 6010B and 6010C.

951.04.02 Properties.

(a) Physical Properties.

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Bond Strength, psi min.	T 250	180
Softening Point, F		215 ± 15
Low Temperature Stress Resistance	T 250	No Cracks
Abrasion Resistance	MSMT 614	0.5 g. Loss, max

(b) Specific Gravity. The specific gravity of the white and yellow pavement marking material shall be 1.7 to 2.2 when tested according to MSMT 614.

(c) Color. After heating for 4 ± 0.5 hours at 425 ± 3 F, the thermoplastic shall meet E1347 and the following.

(1) Production. The color of the cured thermoplastic material film shall match the AMS-STD-595A Color chips when compared by instrumental measurement.

(2) Control. Control color matching determinations will be made using a Pacific Scientific Color Machine, and an observation angle of 2°, and the CIE Chromaticity Coordinate Color Matching System under light source Illuminate C, with the following tolerances permitted between the standard chip and the cured thermoplastic film sample.

	WHITE Color No. 37925		**YELLOW Color No. 38907**	
	X	Y	X	Y
Standard Chip	0.310	0.330	0.480	0.450
Delta Tolerance	± 0.020	± 0.020	± 0.030	± 0.030

(d) Reflectance.

COLOR	**TEST METHOD**	**DAYLIGHT REFLECTANCE at Degree**	**PERCENT Min.**
White	AMS-STD-595A No. 37925	45 - 0	80
Yellow	AMS-STD-595A No. 38907	45 - 0	50

(e) Yellowing Index. E313. The yellowing index of the white material shall not exceed 8 prior to QUV and 15 after QUV.

951.04.03 Qualification. Manufacturers desiring to have their products approved for Administration use shall have their products evaluated on the NTPEP North Test Deck. Materials meeting the requirements and performing satisfactorily throughout the evaluation period will be placed on the Administration's Qualified Products List. Only NTPEP evaluated products will be considered candidates for selection, unless otherwise waived. The Office of Materials Technology will determine qualification.

951.04.04 Material Acceptance. The manufacturer shall provide access to the Administration's representative for collecting samples from each production batch prior to shipment. The samples shall be sent to the Administration's laboratory for QA testing. Each sample shall be accompanied by certification as specified in TC-1.03. Production batch samples will be subject to random tests, such as but not limited to, X-ray spectroscopy, infrared spectroscopy, ultraviolet spectral analysis, and atomic absorption spectroscopy. The Administration will determine conformity with the requirements. Approval is required before a batch or a portion of a batch is shipped.

Random samples may be taken on the project and tested for conformance with these specifications. Nonconformance may result in the suspension from the certification program until qualification is reestablished.

951.04.05 Certification. TC-1.03. The manufacturer shall certify that any pavement marking batch supplied conforms to all applicable specifications and shall provide a statement certifying that any material supplied is identical in composition to the material submitted for NTPEP testing. The same code name used in the published report from the test deck must identify the product. Failure to certify will be grounds for batch rejection.

Certification shall also contain the following.

(a) Manufacturer’s name.

(b) Manufacturer’s address.

(c) Material color.

(d) Manufacture date f (mm-dd-yy).

(e) Lot or batch identification number.

(f) Lot/batch size.

(g) Material Safety Data Sheets.

951.04.06 Production Facility.

(a) The manufacturer shall provide a facility capable of producing thermoplastic pavement markings in the quantity and quality specified; subject to approval.

(b) The manufacturer shall provide a laboratory capable of performing the required tests, subject to approval.

951.04.07 Packaging. Label each container with the following information.

(a) Manufacturer's Name and Address.

(b) Material color and component type, if applicable.

(c) Manufacture date (mm-yy).

(d) Lot or batch identification number.

951.05 THERMOPLASTIC PAVEMENT MARKINGS - 40-MIL HIGH BINDER

Thermoplastic material shall be composed of a homogeneous mixture of pigment, filler, resins and glass beads and shall conform to the following.

951.05.01.

(a) Composition.

COMPONENT	TEST METHOD	COLOR	
		WHITE	YELLOW
Binder, % min	Certified	25.0	25.0
Premixed Reflective Beads, % min	MSMT 614	25.0	25-40 MIL.0
Titanium Dioxide, % min	X-Ray Fluorescence	10.0	N/A
Calcium Carbonate Inert fillers, % max	D34	42.0	*
Yellow Pigment, % —	—	N/A	*

*Amount of yellow pigment, calcium carbonate and filler shall be at the option of the manufacturer, provided all other requirements are in conformance.

(b) Restrictions. Pavement marking paint shall not contain any hazardous material listed in CFR 40, Section 261.24, Table 1. Diarylide type pigments shall only be used when the manufacturer or pavement marking material application temperature does not exceed 392 F.

(c) Binders. The binder shall be alkyd consisting of maleic modified glycerolester of resin and other plasticizers.

(d) Titanium Dioxide. Rutile type.

(e) Inner Mix Beads. Refer to 951.09. Glass beads shall not contain more than 200 parts per million when tested in accordance with EPA Methods 3052, 6010B and 6010C.

951.05.02 Properties.

(a) Physical Properties.

TEST PROPERTY	TEST METHOD	SPECIFICATION LIMITS
Bond Strength, psi min.	T 250	180
Softening Point, F		215 ± 15
Low Temperature Stress Resistance	T 250	No Cracks
Abrasion Resistance	MSMT 614	0.5 g max. loss

(b) Specific Gravity. MSMT 614. The specific gravity of the white and yellow pavement marking material shall be 1.7 to 2.2.

(c) Color. E1347. After heating for 4 ± 0.5 hours at 425 ± 3 F, the thermoplastic shall be as specified and the following.

(1) Production. The color of the cured thermoplastic material film of the production sample shall match the AMS-STD-595A Color chips specified when compared by instrumental measurement.

(2) Control. Control color matching determinations will be made using a Pacific Scientific Color Machine, and an observation angle of 2°, and the CIE Chromaticity Coordinate Color Matching System under light source Illuminate C, with the following tolerances permitted between the standard chip and the cured thermoplastic film sample.

	WHITE Color No. 37925		YELLOW Color No. 38907	
	X	Y	X	Y
Standard Chip	0.310	0.330	0.480	0.450
Delta Tolerance	± 0.020	± 0.020	± 0.030	± 0.030

(3) Reflectance.

COLOR	TEST METHOD	DAYLIGHT REFLECTANCE at Degree	PERCENT MIN
White	AMS-STD-595A No. 37925	45 - 0	80
Yellow	AMS-STD-595A No. 38907	45 - 0	50

(d) Yellowing Index. E313. The yellowing index of the white material shall not exceed 8 prior to QUV and 15 after QUV testing.

951.05.03 Qualification. Manufacturers desiring to have their materials approved for Administration use shall have their products evaluated on the NTPEP North Test Deck unless otherwise waived. Materials meeting the requirements and performing satisfactorily throughout the evaluation period will be placed on the Administration's Qualified Products List. The Office of Materials Technology will determine qualification.

951.05.04 Material Acceptance. The manufacturer shall provide access to the Administration's representative for collecting samples from each production batch prior to shipment. The samples shall be sent to the Administration's laboratory for QA testing. Each sample shall be accompanied by certification as specified in TC-1.03. Production batch samples will be subject to random tests, such as but not limited to, X-ray spectroscopy, infrared spectroscopy, ultraviolet spectral analysis, and atomic absorption spectroscopy. The Administration will determine conformance with the requirements. Administration authorization shall be required before a batch, or a portion of a batch is shipped.

Random samples may be taken on the project in conformance with the Sample Frequency Guide and tested for conformance with these specifications. Nonconformance may result in the suspension from the certification program until qualification is reestablished.

951.05.05 Certification. The manufacturer shall certify in accordance with TC-1.03 that any pavement marking batch supplied complies with all applicable specifications and conforms to the formulation identified by the same product code or name placed on the NTPEP test deck from which it was approved. The same code or name as used in the published report from that test deck must identify the product. Failure to certify will be considered grounds for product batch rejection.

Certification shall also include the following.

(a) Manufacturer's name.

(b) Manufacturer's address.

(c) Material color.

(d) Manufacture date f (mm-dd-yy).

(e) Lot or batch identification number.

(f) Lot/batch size.

(g) Material Safety Data Sheets.

951.05.06 Production Facility.

(a) The manufacturer shall provide a facility capable of producing thermoplastic pavement markings in the quantity and quality specified; subject to Administration approval.

(b) The manufacturer shall provide a laboratory capable of performing the required tests; subject to Administration approval.

951.05.07 Packaging. Label each container with the following information.

(a) Manufacturer's Name.

(b) Place of Manufacture.

(c) Color of Material and Component Type, if applicable.

(d) Date of Manufacture (month-year).

(e) Batch or Lot Identification Number.

951.06 PREFORMED THERMOPLASTIC PAVEMENT MARKINGS

The material shall be highly durable retroreflective polymeric materials designed for use as transverse lines, numbers, legends, symbols and arrow markings subjected to high traffic volumes and severe wear conditions such as shear action from crossover or encroachment.

(a) The material shall adhere to all asphalt pavement and Portland cement concrete (PCC) pavement surfaces and any existing pavement markings when applied according to the manufacturer’s recommendations.

(b) The material shall be capable of conforming to pavement contours, breaks and faults, shall not be affected by weather conditions, and shall remain in place on pavement surfaces without being displaced by traffic.

(c) The material shall have a minimum shelf life of one year.

The material shall conform to the requirements of the MdMUTCD and the following:

(a) Composition. Refer to the relevant sections of M 249. The material shall consist of polymeric materials, pigments, binders and glass beads distributed throughout the entire cross-sectional area.

Restrictions. The combined total of lead, cadmium, mercury and hexavalent chromium shall not exceed 100 ppm when tested by X-ray diffraction, ICP, or comparable method capable. Non-leachable lead based pigments will not be permitted. Diarylide type pigments shall only be used when the manufacturer’s recommended application temperature does not exceed 392 F.

(b) Color. AMS-STD-595A color chip Nos. 17886 for white and 13538 for yellow.

(c) Frictional Resistance. E303. The surface of the applied material shall provide a minimum average skid resistance value of 50 BPN when tested as specified.

(d) Patching. The material shall be capable of use for patching worn areas of the same type.

(e) Thickness. The minimum thickness without adhesive shall be 120 mils.

(f) Adhesion. C666, Method B. The material shall retain a minimum of 65 percent adhesive bond after 100 freeze-thaw cycles.

(g) Beads. M 247, Type I.

(1) Refractive Index. MSMT 211.

(2) Acid Resistance. MSMT 211. 15 percent of the beads (maximum) shall show formation of a distinct opaque white layer on the entire surface.

Field Testing. Materials selected for use on Administration projects shall be field tested for performance at AASHTO regional test facilities, such as National Transportation Product Evaluation Program (NTPEP). The materials shall meet a minimum retained reflectance of 100 mcd/m^2/lux after evaluation testing.

Materials performing satisfactorily throughout the test period will be placed on the Qualified Products List (QPL) maintained by the Office of Materials Technology.

Certification. TC-1.03. Samples submitted for testing shall be accompanied by the manufacturer's certified analysis. Any marking materials supplied shall be identical in composition to the material submitted for initial testing.

951.07 SNOWPLOWABLE RAISED AND NON-SNOWPLOWABLE RAISED PAVEMENT MARKERS

Snowplowable Raised Pavement Markers (SRPM) include markers installed in steel or polycarbonate holders or by direct application into a groove. Non-Snowplowable Raised Markers (NSRPM) are used with temporary pavement markings.

951.07.01 Pavement Marker Reflector Lenses. Pavement marker reflector lenses shall be 4.00 in. x 2.00 in. x 0.46 in. The slope of the reflecting surface shall be 30 degrees and the area of each reflecting surface shall be 1.7 $in.^2$. The outer surface of the shell shall be smooth except in identification areas. All pavement marker reflector lens shall be imprinted with the manufacturer's name and the model number.

(a) Lenses for SRPMs with Holders. D4383. Pavement marker reflector lenses shall be comprised of materials with adequate chemical, water and UV resistance for the intended use capable of being installed in a steel casing or recessed polycarbonate holder and shall conform as specified. The reflector lens shall contain one or two prismatic reflective faces to reflect incident light from opposite directions. The reflector lens shall be in the shape of a shallow frustum of a pyramid. The bottom of the reflector lens shall be equipped with either an elastomeric pad to permit its attachment to the surface of the holder or the manufacturer's recommended adhesive may be used. The surfaces of the lens faces shall provide extremely durable abrasion resistance. Holders for the markers shall be either a steel casting or a plastic holder that is recessed in a groove.

(b) Lenses for Direct SRPMs without Holders. D4383. Pavement marker reflector lenses be comprised of materials with adequate chemical, water and UV resistance for the intended use and shall conform as specified. The reflector lens shall contain one or two prismatic reflective faces to reflect incident light from opposite directions. The reflector lens shall be in the shape of a shallow frustum of a pyramid. The housing for the lens shall be designed for application directly to the pavement in the specified groove.

951.07.02 SRPM Adhesive. M 237, Type IV. Use to fasten the SRPM holders and Direct SRPMs to the pavement as specified. Rapid set adhesives shall not be used. The surface of all marker lenses shall be free of gloss or substances that will inhibit bonding of the adhesive.

951.07.03 SRPM Holders

(a) Polycarbonate. A polycarbonate plastic material with dimensions of 5.00 in. x 3.00 in. x 0.70 in. capable of holding a SRPM lens recessed in a 1/8 in. groove below the pavement surface. The polycarbonate holder shall have tabs capable of extending out onto the pavement for the purpose of proper positioning. The surface of the housing shall be free of dirt, oil, grease or any other substance that may reduce its bond to the epoxy adhesive.

951.07.04 Reflector Lens Adhesive. Used to fasten the reflector lens to the holder in accordance with the manufacturer's recommendations.

951.07.05 Non Snowplowable Raised Markers. D4280. NSRPMs. shall be comprised of materials with adequate chemical, water and UV resistance for the intended use and shall conform as specified. The reflector lens shall contain one or two prismatic reflective faces to reflect incident light from opposite directions. The reflector lens shall be in the shape of a shallow frustum of a pyramid. The bottom of the reflector lens shall be equipped with either a pressure-sensitive elastomeric pad to permit its attachment to the surface or be capable of being installed using a hot bitumen adhesive according to the manufacturer's recommendations.

951.07.06 Field Evaluation. SRPMs shall be evaluated on the National Transportation Product Evaluation Program's (NTPEP) North Test Deck. NSRPMs may be field evaluated on any NTPEP

Test Deck. SRPMs and NSRPMs that perform satisfactorily throughout the evaluation period will be placed on the Administration's QPL. Random testing of samples will be performed and conformance will be determined by the Office of Materials Technology (OMT).

951.07.07 Quality Assurance Sampling. Refer to 549.03.02.

951.07.08 Material Shipment. SRPMs and NSRPMs shall be shipped in containers sealed by the manufacturer. The label on each container shall include the following.

(a) Manufacturer's Name.

(b) Place of Manufacture.

(c) Color of Material and Component Type.

(d) Date of Manufacture (month-year).

(e) Batch and Lot Identification Number.

(f) Size/quantity of lot represented.

951.07.09 Certification. Furnish certification for all SRPMs and NSRPMs as specified in TC-1.03. All SRPMs and NSRPMs supplied shall conform to the identical composition of the samples submitted for NTPEP evaluation. Identify SRPMs and NSRPMs by referring to the code used on the test deck SRPMs and NSRPMs that fail to conform will be rejected.

The manufacturer shall also provide the following.

(a) Material Safety Data Sheets for all materials submitted for testing and use.

(b) A facility capable of producing the SRPMs and RPMs in the quantity and quality required.

(c) A laboratory capable of performing the required tests; subject to Administration approval.

951.08 REMOVABLE PAVEMENT MARKING TAPE

Removable pavement marking tape shall remain in place on the pavement surface without being displaced by traffic or affected by weather conditions. The tape shall be capable of being removed without the use of heat, solvents, grinding, or sand blasting and shall not leave an objectionable residue.

The tape shall be of good appearance and free from cracks. Edges shall be true, straight and unbroken. Line tape shall be in rolls having no more than three splices per 150 ft of length. All

tape shall be packaged in conformance with accepted commercial standards and have a minimum shelf life of one year.

Select Removable pavement marking tape from the QPL.

Performance Requirements. The tape shall be applied in conformance with the manufacturer's recommendations to provide a neat, durable marking that will not flow or distort due to temperature. The tape shall be weather resistant and show no signs of lifting, tearing, shrinkage or other indications of poor adhesion that may reduce its useful life. The tape shall be capable of being removed without tearing into small pieces.

951.08.01 White and Yellow Tape. Removable pavement marking tape shall conform to the requirements of MdMUTCD and the following:

(a) Composition. The tape shall consist of a mixture of polymeric materials, pigment, and glass beads distributed uniformly throughout the surface.

(b) Glass Beads. 951.09. Glass beads shall not contain more than 200 parts per million when tested in accordance with EPA Methods 3052, 6010B and 6010C.

(c) Color. The color of the tape shall match AMS-STD-595A color number 37925 - White and color number 38907 - Yellow.

(d) Retroreflectivity. The minimum retroreflectivity shall be 500 mcd/lux/sq./m. for white tape and 300 mcd/lux/sq./m. for yellow tape.

(e) Frictional Resistance. E303. The British Pendulum Number shall be a minimum of 50.

951.08.02 Blackout Tape. Blackout tape shall conform to the requirements of the MdMUTCD and the following:

(a) Composition. Blackout tape shall consist of a mixture of high quality polymeric materials, pigments, and inorganic fillers distributed throughout its cross sectional area, with a matte black non-reflective surface and shall not contain metallic foil. The tape shall be pre-coated with a pressure sensitive adhesive. A nonmetallic medium shall be incorporated to facilitate removal.

Patterned tapes shall have a minimum of 20 percent of the total surface area raised and coated with nonskid particles. The channels between the raised areas shall be substantially free of particles.

(b) Color. The color of the blackout tape shall match AMS-STD-595A color number 37038 – Black, or as approved.

(c) Frictional Resistance. E303. The British Pendulum Number shall be a minimum of 50.

951.08.03 Qualification. Manufacturers desiring to have their tape approved for Administration use shall have their products evaluated on the NTPEP North Test Deck. Materials meeting the requirements and performing satisfactorily throughout the evaluation period will be placed on the QPL. Only NTPEP evaluated products will be considered candidates for selection, unless otherwise waived. The Office of Materials Technology will determine qualification.

951.08.04 Certification. TC-1.03. The manufacture shall certify that any pavement marking material batch supplied conforms to all specifications and that the material supplied conforms to the identical formulation as the samples submitted for evaluation on the NTPEP North test deck. The formulas shall be identified by referring to the code used on the deck. Nonconforming materials will be rejected.

Certification shall also contain the following:

(a) Manufacturer's name.

(b) Place (address) of manufacture.

(c) Color of material.

(d) Date of manufacture (month-day-year).

(e) Lot or batch identification.

(f) Batch/ lot size.

(g) Material Safety Data Sheets.

951.08.05 Quality Assurance. Random samples may be taken on the project and evaluated for conformance with these specifications. Nonconformance may result in suspension from the certification program until conformance is reestablished.

951.08.06 Production Facility.

(a) The manufacturer shall have a facility capable of producing the tape in the quantity and quality required; subject to Administration approval.

(b) The manufacturer shall have a laboratory capable of performing the required tests; subject to Administration approval.

951.08.07 Packaging. Packaging shall conform to the manufacturer's shipping requirements to prevent damage during handling and delivery. Installation instructions shall be included with all shipments. The shipping package shall be marked with the following:

(a) Description of item.

(b) Date of manufacture.

(c) Successful Bidder's Name.

(d) Purchase Order Number.

(e) Lot Number.

(f) Color.

951.09 GLASS BEADS

Glass beads applied to the surface of liquid pavement markings shall conform to the following.

951.09.01 Requirements. M 247, Type I.

(a) MSMT 211. The refractive index shall be 1.50 minimum.

(b) D1155. Beads shall have a minimum average roundness of 80 percent.

(c) EPA Method 3052, 6010B and 6010C. Beads shall contain no more than 200 parts per million arsenic or lead.

951.09.02 Certification. TC-1.03. The manufacturer shall provide certification that the glass beads supplied conform as specified. The manufacturer shall also provide Material Safety Data Sheets for all materials submitted for certification. Certification shall also include the following:

(a) Manufacturer's name.

(b) Place (address) of manufacture.

(c) Specification reference.

(d) Lot or batch identification.

(e) Size of lot/batch.

951.10 POLYUREA PAVEMENT MARKING MATERIALS

Polyurea pavement marking materials shall consist of a 100 percent solids two-component system.

951.10.01 Physical Components

(a) Composition. The polyurea coating shall be formed by the reaction of two components (Part A and Part B).

(1) At least one component shall be composed of secondary amines, pigments and fillers as needed to meet performance requirements of this specification.

(2) The two components shall be formulated so they cure properly cure when mixed at a volumetric ratio of two volumes of Part A and one volume of Part B (2:1).

(3) The components shall not contain appreciable amounts of volatile diluents. The polyurea coating shall be essentially a 100 percent solids product.

(4) The polyurea coating materials shall be manufactured without the use of lead chromate pigments or other similar, lead-containing chemicals.

(5) The white polyurea shall contain not less than 16 percent by weight rutile titanium dioxide pigment to ensure adequate opacity, hiding power and reflective properties.

Store the binder components in a cool, dry, well ventilated area indoors 40 F to 100 F (4 C to 38 C). Use within 12 months of receipt.

(b) Pigment. D476.

(1) Component A - White shall consist of Type II Rutile Titanium Dioxide only. No extender pigments are permitted.

(2) Component A - Yellow shall consist of yellow pigments and tinting colors proportioned to produce the color specified in 951.10.03(b). Titanium dioxide used in Component A -Yellow shall conform to Type II Rutile.

951.10.02 Restrictions. The combined total of heavy metals listed in CFR 40, Section 261.24, Table 1, shall not exceed 100 ppm when tested by X-Ray Fluorescence, ICP, or comparable method capable of this level of detection.

951.10.03 Mixed Composition.

(a) Mixing Ratio. The ratio for mixing the polyurea pavement marking material according to the manufacturer's recommendations is 2:1. The ratio shall not vary more than 2.5 percent.

(b) Color - White and Yellow:

(1) Production. The color of the cured production polyurea material film of the production sample shall match the specified color chips conforming to Federal Standard 595 when compared visually or by instrumental measurement.

(2) Control. Control color matching determinations will be made using a Pacific Scientific Color Machine at an observation angle of 2 degrees, and the C.I.E. Chromatically Coordinate Color Matching System under light source Illuminate C, with the following tolerances permitted between the standard chip and the cured epoxy film sample:

	WHITE Color No. 37925		**YELLOW Color No. 38907**	
	X	Y	X	Y
Standard Chip	0.310	0.330	0.480	0.450
Delta Tolerance	± 0.020	± 0.020	± 0.030	± 0.030

951.10.04 Color and Weathering Resistance. The mixed polyurea compounds, both white and yellow, when applied to 3 in. x 6 in. aluminum panels at 15 ±1 mil in thickness with no glass beads or elements and exposed for 500 hours in a Q.U.V. Environmental Testing Chamber, as described in ASTM-G154, Cycle #1, shall conform to the minimum requirements. Color shall not change appreciably.

951.10.05 Track-Free Time. D711. The polyurea marking material shall reach a track-free condition in 10 minutes or less for a 15 mil thickness when tested as specified. The track-free time shall not increase substantially with temperature decreasing to 30 F.

951.10.06 Adhesion to Concrete. ACI Method 503. The polyurea coating shall have such a high degree of adhesion to the concrete test specimen that the specimen shall exhibit a substantial failure when tested. The prepared specimens shall be conditioned at room temperature (75 F ±2 F) for a minimum of 24 hours and maximum of 72 hours prior to testing.

951.10.07 Adhesion to Asphalt. ACI Method 503. The polyurea coating shall have such a high degree of adhesion to the asphalt test specimen that the specimen shall exhibit a 100 percent failure when tested. The prepared specimens shall be conditioned at room temperature (75 F ± 2 F) for a minimum of 24 hours and maximum of 72 hours prior to testing**.**

951.10.08 Qualification. Manufacturers desiring to have their materials approved for Administration use shall have their products evaluated on either a NTPEP Northern Test Deck, a test deck in Maryland or other state's test deck data unless otherwise waived. Modifications to previously approved products may be accepted for qualification. The Office of Materials Technology will determine qualification.

951.10.09 Material Acceptance. The manufacturer shall provide access to the Administration's representative for collecting samples from each production batch prior to shipment. The samples shall be sent to the Administration's laboratory for QA testing. Each sample shall be accompanied by certification as specified in TC-1.03. Production batch samples will be subject to random tests, such as but not limited to, X-ray spectroscopy, infrared spectroscopy, ultraviolet spectral analysis,

and atomic absorption spectroscopy. The Administration will determine conformance with the requirements. Approval will be required before a batch, or a portion of a batch is shipped.

Take random samples on the project in conformance with the Frequency Guide of the Materials Quality Assurance Manual and test as specified. Non-conformance may result in the suspension from the certification program until qualification is reestablished.

951.10.10 Certification. The manufacturer shall certify that any pavement marking batch supplied conforms to all specifications in TC-1.03 and provide a statement certifying that any paint supplied is identical in composition to the material submitted for NTPEP testing. The same code name used on the test deck must identify the product. Failure to certify will be grounds for product batch rejection.

Certification shall also include the following:

(a) Manufacturer's name.

(b) Manufacturer's address.

(c) Material color.

(d) Manufacture date (mm-dd-yy).

(e) Lot or batch identification number.

(f) Lot/batch size.

(g) Material Safety Data Sheets.

951.10.11 Production Facility

(a) The manufacturer shall provide a facility capable of producing thermoplastic pavement markings in the quantity and quality specified; subject to Administration approval.

(b) The manufacturer shall provide a laboratory capable of performing the required tests, subject to Administration approval.

951.10.12 Packaging. Label each container with the following:

(a) Manufacturer's Name.

(b) Manufacturer's address.

(c) Material color and component type, if applicable.

(d) Manufacture date (mm-yy).

(e) Lot or batch identification number.