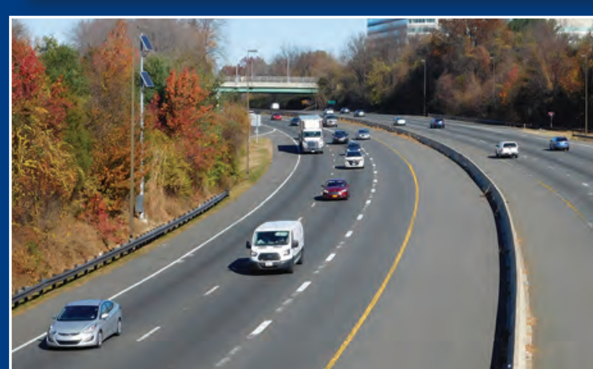
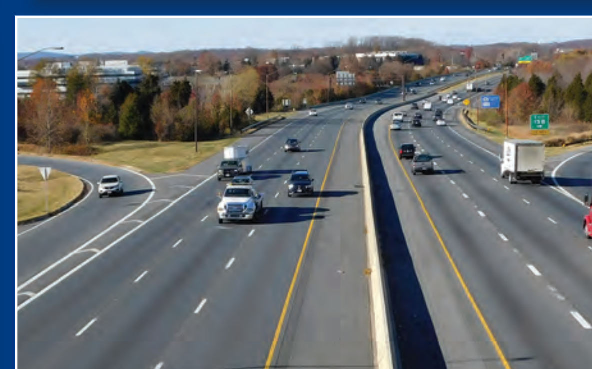
January 19, 2017

IS 270 - Innovative Congestion Management Contract
Contract No. MO0695172 - Technical Proposal

IS 270 - Innovative Congestion Management Contract
Montgomery and Frederick Counties, Maryland

Contract No. MO0695172




Technical Proposal

Prepared by:

Original
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Also enclosed is an electronic copy of the VISSIM traffic model for 2015 and 2040 build design years and Concept Evaluation Templates (.pdf and Excel files) populated with the VISSIM traffic model result for 2015 and 2040 build design years.

2. Mobility

2. MOBILITY

i. Our improvements for maximizing vehicle throughput and minimizing vehicle travel times and how they will reduce recurring congestion in terms of travel time, vehicle throughput, density, intersection operations, queues and vehicle network performance along IS 270 and on the connecting ramps and arterial roadways.

The Corman | Parsons Brinckerhoff Team's selected program alternatives provide significant improvements along the IS 270 corridor regarding **MOBILITY, RELIABILITY, SAFETY,** and **CONGESTION RELIEF.** While IS 270's mainline and local lanes are the focal point of this project, we considered impacts to arterials and local roads, including intersection level of service, queue lengths, and other metrics as they are also vital components to reduce delay and increase reliability.

PROVEN AND INNOVATIVE SOLUTION

Our real world **Proven and Innovative Solution** maximizes vehicle throughput and minimize travel times while improving safety, reliability, and regional economic vitality. This approach leverages effective practices, introduces ways to manage traffic considered new terrain for SHA, and streamlines it with proven experience and software already delivering improvements in other locations. Our proposal takes the following four established components and integrates them together for maximum value and results. Considered an international success on the Australian M-1 motorway, these components will be groundbreaking for SHA:

1. Provide additional **ITS Field Devices** to support Coordinated Highways Action Response Team (CHART) operations and travel information tools, and interconnect them with a robust communications backbone that supports existing and future applications and needs. ***IMPROVEMENTS:*** *Supplements existing SHA CHART initiatives to facilitate quicker incident response and clearance, which improves reliability and enhances safety.*
2. Use **Dynamic Hard Shoulder Running (HSR)** to provide an additional travel lane during peak hours, special events or non-recurring incidents. ***IMPROVEMENTS:*** *Reduces congestion and improves safety, mobility and reliability.*
3. Provide **Geometric Improvements** in selected locations. ***IMPROVEMENTS:*** *Improves capacity, traffic flow, and safety where the current configurations result in operational and/or safety issues.*
4. Provide an established next generation **Coordinated Adaptive Ramp Metering** System. ***IMPROVEMENTS:*** *Decreases the probability of IS 270 reaching breakdown traffic flow which reduces congestion and improves safety, mobility, and reliability.*

These four components will work together and are based on proven implementation in other locations that mitigates risk, optimizes the budget, and reflects long-term operability and maintainability needs. They will work in unison with the proven Australian Managed Motorways software and experience to improve the throughput on IS 270 while improving safety, reliability, and reducing recurring and non-recurring congestion.

Figure 1: Corman | Parsons Brinckerhoff IS 270 Innovative Congestion Management program

Entering unchartered waters here in the US, the Corman | Parsons Brinckerhoff Team proposes to utilize the real world tested and proven propriety Australian Managed Motorway Software. Developed by team member Transmax, a corporation wholly owned by the Australian Queensland Dept. of Transport, the operating system has been up and running on the M1 in Australia for 9 years and is credited with increasing vehicle throughput by 20%, reducing crashes by 32%, and is well received by motorists.

IS 270 INNOVATIVE CONGESTION MANAGEMENT PROGRAM

In addition to a robust field operational force of emergency traffic patrols and response units, Maryland's CHART program benefits from additional field devices to support the detection, verification, and response to incidents, the provision of travel information, and in limited situations, re-directing traffic for lane closures or major diversion needs, including speed detection systems, closed circuit television (CCTV) cameras, dynamic message signs (DMS), and road weather information systems (RWIS).

THE FIRST COMPONENT of our IS 270 Innovative Congestion Management program is to install additional **ITS Field Devices** which may also be used by CHART operators to assist responses. We will install additional CCTV cameras and DMS where gaps currently exist, in particular for areas with documented safety or recurring daily congestion issues. Installing additional advanced detection technology along IS 270 Northbound (NB) and Southbound (SB) will deliver game changing amounts of data, support other approach elements, and provide SHA with a heightened awareness of road conditions.

THE SECOND COMPONENT adds much-needed capacity during peak hours or during incidents or non-recurring congestion by implementing **Dynamic Hard Shoulder Running (HSR).** Our proposed HSR will be dynamic and able to open an additional lane to traffic based upon pre-set time of day or actual need. Our HSR will be SB from MD 109 to MD 121, then again from MD 124 south to approximately Tuckerman Lane. For NB, HSR will be from the merging of IS 270 and the IS 270 Spur North to Middlebrook Road. In contrast to a static time-of-day schedule for HSR, our dynamic approach continuously monitors conditions and uses real-time and ***anticipated*** congestion levels to determine whether or not to open the shoulder lane for easier travel. While peak-period capacity will be the primary function of the HSR system, off-peak needs may arise ***and the system can adapt to real-time needs, such as any emergencies or off peak congestion.*** We propose HSR will be initiated only after CCTV cameras visually confirm the shoulder is clear of stopped vehicles. While our system includes the generation of automated alerts regarding shoulder obstacles, the final operating procedures for opening and closing will be developed in close coordination with SHA and CHART operational staff.

Enhancing interchange and ramp traffic flow and safety is accomplished through ***THE THIRD COMPONENT***. Throughout our planning process, multiple **Geometric Improvements** were identified to improve flow and safety. Initial concepts ranged from reconstructing deficient interchange configurations so as to move vehicles off the mainline more efficiently, to simple extensions of acceleration lanes to reduce friction along the mainline. This proved to have a positive effect on traffic flow and safety, and aligns with the technological improvements proposed throughout the corridor. Our proposed geometric improvements include:

- ➔ **Entrance Ramp Improvements to SB and NB IS 270** – PTCs #05 and 06 recommended widening and restriping the entrance from local roadways to improve ingress of entering vehicles onto the highway and reduce congestion and rear end collisions from vehicles merging onto the mainline. While these PTCs did not move forward, it was found that the Ramp Metering system, and ramp improvements, including widening for storage and discharge lanes, provided greater benefit.
- ➔ **Eliminate NW Loop Ramp at MD 118 -** Consolidate egress of vehicles from two points to one and eliminate the weave area along MD 118 that currently backs up and affects mobility along IS 270 NB and MD 118.
- ➔ **Entrance/Exit Ramps to SB and NB Father Hurley Blvd.** – PTCs 03B, 07 and 08 provides for widening and restriping the entrance from local roadway to improve ingress of entering vehicles onto the highway and reduce

backup and rear end collisions from vehicles merging onto the mainline. Included in PTCs # 07 and 08 is a new modified CD configuration to separate mainline and ramp traffic conflicts/friction.

Like all highways, IS 270 fails to function properly when flow breaks down from higher demand and turbulence. A maximum flow rate of 2,100 vehicles per hour per lane is carried on a typical interstate segment at 55 MPH prior to congestion saturation. However, as congestion occurs, average speeds and total volumes per hour are significantly reduced. Only 1,300 vehicles per hour per lane are typically passing through at 20 MPH, which is about a 40% reduction of the lane's full capacity. Hence, the highway is carrying only 60% of its capacity when it is needed most.

The ***FOURTH COMPONENT*** manages this flow breakdown by controlling access to the highway and synchronizing flow in an automated and integrated fashion to sustain flow rates closer to the facility's maximum capacity of 2,100 vehicles per hour per lane. Our ***Coordinated Adaptive Ramp Metering*** proposal enhances the other three more traditional components and is controlled and managed by the software proven in the Australian Managed Motorways system.

By utilizing intelligent data collection, communications and control systems, our Australian Managed Motorways solution synchronizes the flow of entering vehicles in real-time to those already on the facility to match the highway's operational capacity. Access is controlled at all on-ramps and highway interchanges of the corridor through ramp meters. Typically, ramp metering facilities involve individually-controlled ramps which do not work together as a system, and when the queues get too long, just flushes the retained ramp traffic onto the freeway. This uncoordinated system only increases the congestion along the mainline and negates benefits realized by ramp metering.

Our Australian Managed Motorways proposal incorporates advanced algorithms to predict the onset of congestion BEFORE it happens, and immediately controls access and coordinates queues and ramp waiting times across the corridor to avoid disruption to adjacent arterials.

Our Australian Managed Motorways proposal incorporates advanced algorithms to predict the onset of congestion *BEFORE* it happens, and immediately controls access and coordinates queues and ramp waiting times across the corridor to avoid disruption to adjacent arterials. It involves new concepts in entry ramp design that include physical improvements to ramp storage, discharge, and acceleration/merging to optimize the ability of vehicles to use the highway's available capacity while limiting impacts to mainline operations and adjacent arterials. This comprehensive demand and system management process improves highway performance regarding vehicle throughput, travel time and safety to maximize network efficiency.

Our proposed solution reduces total travel time from the IS 270 split to IS 70 in Frederick by 28% SB in the morning and 12% NB in the afternoon.

The Corman | Parsons Brinckerhoff Team's solution is built upon the foundation of an integrated package of ITS, dynamic shoulder utilization, intelligent ramp metering, and spot roadway improvements to maximize efficiency and throughput. It is enhanced by the Australian Managed Motorways system, including vehicle detection and data collection systems, coordinated adaptive ramp metering, incident detection, CCTV surveillance and strategic design considerations, such as on ramp queue discharge and storage, merge lanes, and expanded off ramps for increased exit/entrance flows.

If Active Traffic Management (ATM) is the *"next generation of ITS"*, utilizing existing tools more efficiently, then the Australian Managed Motorways is the *"next generation of ATM"*, applying advanced intelligence and coordinated adaptability, and viewing the corridor as a system. Looking ahead to the not-too-distant-future, our approach recognizes the evolution of transportation operations and traffic management and provides a solid foundation for the *"next-next generation"* which is currently unfolding in terms of connected and automated vehicle systems. It provides motorists with immediate benefits while setting the stage for the SHA to capitalize on future trends and opportunities.

Figure 2: IS 270 Innovative Congestion Management Solution covers the next generation of approaches and sets the stage for the ultimate Connected and Autonomous Vehicles (CV/AV) scenario

SPECIFIC BENEFITS OF OUR PROPOSED SYSTEM

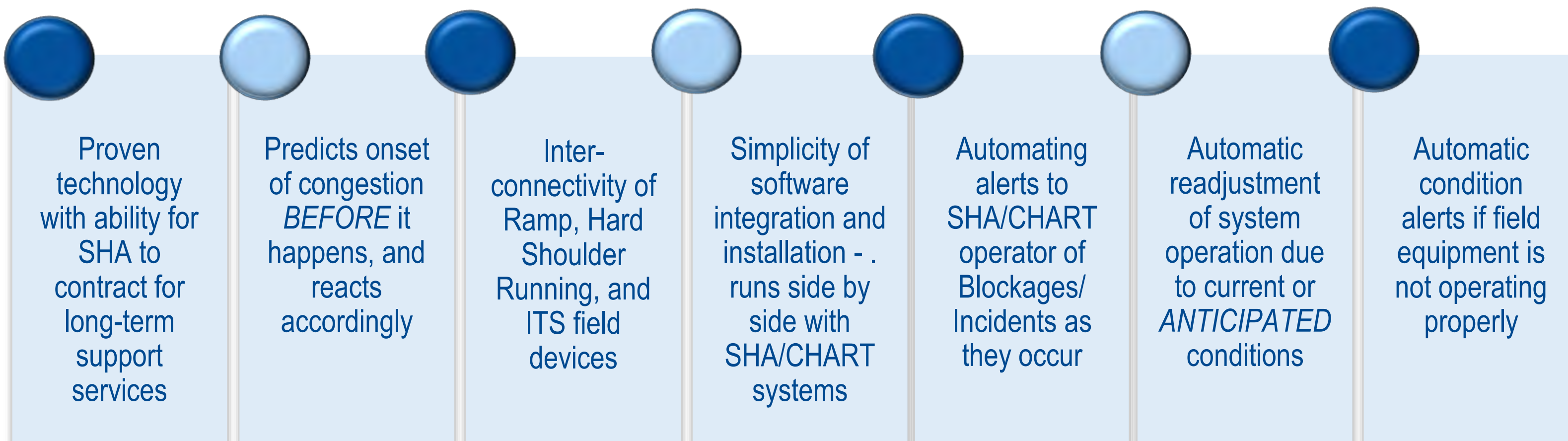


Figure 3: Specific benefits of our proposed system

SYSTEM COMPONENT SELECTION

The Corman | Parsons Brinckerhoff Team started tossing ideas around almost a year before this project was advertised. At our own cost and risk, even before knowing whether or not we would propose, our team assembled company experts specializing in managed lanes and motorways, ITS technologies, Active Traffic Management, safety analyses, advanced construction methods, and other relevant disciplines. A brainstorming session kick started the pursuit and from there, our team continued to refine alternatives.

When we were shortlisted, a two-day "Design Charrette" was held with these same experts to recap what was evaluated since the last session, clarify what is wanted and most valued by SHA, and to discuss old and new ideas to come up with the best alternative we could propose. After the second brainstorming session, our team further enhanced, refined, and, in some cases, eliminated concepts based on the criteria.

Concept Evaluation Matrix: The Corman | Parsons Brinckerhoff Team understands what SHA, the community, and motorists expect and what is required for this contract and the selected Design-Builder to meet those goals. We know mobility, safety, operability/maintainability, and delivering a well-managed project are top priorities, and that there are many factors that impact those variables and need consideration. For that reason, each concept was evaluated using the same criteria. **(See the Evaluation Criteria Matrix in the Appendix which considered aspects beyond mobility and safety, including environmental, Right-of-Way (ROW), and utility impacts, public acceptance, construction cost and construction duration).**

Each concept was also evaluated on their benefits as part of an overall system approach to ensure each component worked together to enhance the benefits achieved. Those that ranked low due to the following considerations were immediately eliminated:

- ✓ High cost vs. benefit provided
- ✓ Environmental approval issues
- ✓ Long construction duration
- ✓ Excessive ROW or utility impacts
- ✓ High risk exposure to SHA or our team

Our 36 initial concepts were pared down to the 20 Proposed Technical Concepts (PTCs) we submitted, and then pared down again to the final 13 PTCs included in our proposal **(See Appendix for PTC submittals that are being utilized).**

ALTERNATIVE | SOLUTION

The Corman | Parsons Brinckerhoff Team's proposed alternative is a mix of traditional and innovative concepts that offer the most benefit from a mobility, reliability, and safety standpoint, while considering initial costs, technology upgradability, and future maintenance and operations. Below is a summary of each aspect of our proposal, how it will be implemented along the corridor, where it was implemented before, and what the expected benefits are:

1. Additional ITS Field Devices

➔ Current CHART operational strategy focuses on detection, verification, and response to incidents, provision of travel information, and in certain instances, re-directing traffic for lane closures or major diversion needs. Current CHART software manages cameras, detectors, DMS, and RWIS.

Our **Proven and Innovative Solution** includes tools CHART is familiar with to provide additional detection, surveillance, and DMS that will further enhance incident management and travel information capabilities. These devices will conform to SHA and MDMUTCD design and operational standards and require no special operational or maintenance training. More importantly, they will be strategically placed to supplement existing CHART tools and provide an immediate mobility benefit right out of the starting gate.

Current detection: Incidents are currently detected along the corridor by monitoring speed detection, communicating with police/fire/rescue/first responders, operating emergency traffic patrols (ETPs), and monitoring data from crowd-sourced tools, such as Waze. SHA operations personnel connect into the Regional Integrated Transportation Information System (RITIS), an automated data sharing, dissemination, and archiving system operated by the University of Maryland, that includes performance measurement, dashboard, and visual analytics tools that help agencies gain situational awareness, measure performance, and communicates information between agencies and to the public.

Our IS 270 Innovative Congestion Management Solution has a significant amount of new detection to support our Coordinated and Adaptive Ramp Metering solution (described in more detail later in this section). These detectors are invaluable in providing a window into the real-time conditions of the entire corridor, which will allow our system to make decisions about ramp metering, coordination, queues and wait times based on real- time density, volume and classification data. They will also supplement existing CHART tools for detecting, responding, and managing incidents and planned closures. This level of data has never been available before in the US and will benefit real-time mobility improvement. The enhanced ITS deployment will not only provide the needed infrastructure for coordinated adaptive ramp metering, it will eliminate any gaps in the current CHART device coverage improvement. It will also be a planning tool for future mobility studies/improvements because a portion of the installed devices will provide in-depth levels of data previously not available, plus volume and classification, including all 13 bins of FHWA classification, by lane.

Studies have shown that for every minute a freeway travel lane is blocked during peak hours, four minutes of travel delay results after the incident is cleared. Our solution assists CHART with quicker incident detection and enhanced verification which leads to rapid and more efficient response and clearance times.

Added Benefits: Our solution will also supplement verification and response to incidents through additional CCTV cameras. Most CCTV coverage along the corridor is through Montgomery County owned and operated cameras, which means they are more focused along the arterials that intersect with IS 270, and their operational priorities are not always focused on IS 270. SHA has a longstanding relationship with the County where they can view conditions along the interstate; however, some gaps exist between interchanges and at known congestion or accident locations. **OUR SOLUTION FILLS THOSE GAPS.** Preliminary planning identified at least 10 new locations where CCTV with full pan-tilt-zoom (PTZ) capability benefits CHART incident verification and response scenarios. As we progress into final design, we will review these locations with CHART operations personnel to confirm their value and provide CCTV camera views for SHA review and approval.

Current CHART Operation: Notifying motorists of incidents and congestion is another important element of the current CHART operation made possible through tools, including DMS.

Our program identified new full-sized walk-in cabinet DMS at key locations where advanced queue warning and/or alternative route information can have significant benefits in terms of speed harmonization and reduced secondary collisions, however, we were unable to incorporate these into our final recommended solution due to funding and cost-benefit reasons. During final design, we will continue to look for opportunities to add these back into the proposed improvements. A 2013 study commissioned by the SHA on the effectiveness of DMS indicated that they *"can be an accurate, effective, and safe tool for disseminating real-time travel information to motorists."*

During procurement, SHA included a question in one of our PTCs regarding concerns that traffic would slow down when messages are displayed on DMS. However, within the SHA study quoted above, they discovered that *"speeds increased or were unaffected in 82.9% of cases."*

2. Dynamic Hard Shoulder Running (HSR)

➔ ***Temporary shoulder use, also known as Hard Shoulder Running (HSR),*** is a measure designed to temporarily adapt roadway capacity to high traffic volumes. By allowing vehicles on the shoulder, more people and vehicles are served, reducing congestion during peak hours.

Our HSR implementation along IS 270 will be designed based on FHWA's *Use of Freeway Shoulders for Travel* guide and will permit general purpose traffic to use right shoulders of IS 270 in select locations during peak hours and times of heavy congestion or incidents. Trucks and buses will not be permitted to use the temporary shoulder lane, except at existing ramp merge points or the entrance and exit to/from the SB IS 270 weigh station. Emergency vehicles are an exception as they will be permitted to use the shoulder for incident management and emergency operations and transport. Our **Proven and Innovative Solution** considers real-time conditions and historical data to assist in determining when the shoulder lanes should be used.

While a more static, time-of-day operational scheme can be employed (several states use this approach), studies have shown that the ability to dynamically provide the additional capacity is more efficient. Additionally, in Maryland, the ability to revert back to "normal" operation in times of low congestion (e.g., during a Federal holiday when traffic is light) or to employ the additional capacity during unexpected high congestion (e.g., during an incident or lane closure) is *extremely* beneficial.

The shoulder will be preserved during off-peak hours or when HSR is not in effect. As an added safety measure, pull off and safety refuge locations will also be provided for use during HSR operation. Refuges will be constructed at approximately half mile intervals where interchanges are not as frequent, unless ROW, utility, or cost considerations preclude their installation **(See HSR Plan Set in the Appendix for proposed locations and typical auxiliary lane treatments).** Dynamic overhead lane control signals and other ITS devices will control shoulder operations as a travel lane. HSR will provide additional capacity to the corridor during times when the roadway is congested or other lanes are blocked by incidents or maintenance. This improvement can be constructed within the IS 270's existing footprint, minimizing ROW, utility, and environmental impacts. ***HSR and a managed system are the most effective ways to increase capacity and safety across the largest expanse of IS 270 over the long term – and for the least cost!***

HSR and a managed system are the most effective ways to increase capacity and safety across the largest expanse of IS 270 over the long term – and for the least cost!

In the SB direction, HSR is proposed between MD 109 and MD 121 where it will tie into an existing third lane, and then again, from MD 124, along the outside shoulder of the CD lanes, terminating near Tuckerman Lane. HSR is proposed NB from the existing IS 270 lane drop where it ties into traffic from the Spur, along the outside shoulder of the CD lanes, terminating at Middlebrook Road.

REQUIRED GEOMETRIC IMPROVEMENTS FOR HARD SHOULDER RUNNING	
Remove rumble strips	Remove pavement markings and restriping
Modify drainage structures in the shoulder (rideability, control spread)	Improve ramp acceleration/deceleration lanes
Reconstruct concrete barrier (to correct shape and height)	Adjust shoulder cross-slope (to reduce or eliminate shoulder rollover)
Reset w-beam barrier (for sight distance, height or minimum offset)	Round existing shoulder rollover (in some locations)

Table 1: Required geometric improvements for hard shoulder running

Based on the pavement borings, corings and as-builts provided with the RFP, the existing shoulder pavement section along IS 270 varies throughout the corridor. In the northern portion of IS 270 (north of MD 121), the pavement section is at least 8.5 inches of Hot Mix Asphalt (HMA) on 5 inches of Graded Aggregate Base (GAB). All other sections have 10 to 14 inches of HMA over 10 to 16 inches of GAB.

Corman | Parsons Brinckerhoff Team Approach: Due to the lack of quality information and to preserve additional budget within this contract but still be able to gain the immense benefit achieved by implementing HSR here, we evaluated the northern portion based on a 10-year Pavement Design Life. The assumption is that this segment of the corridor will be resurfaced in the next five-seven years (as is typical for Interstates in MD), and at that time, this section can be overlaid as necessary to achieve a 20-year design life. In all other sections HSR is proposed, the borings and as-builts showed the pavement structure is more significant with a thicker GAB level, allowing the existing shoulder structure to carry the anticipated traffic volume with a 20-year design life (**See Appendix: Pavement Memo).** Additional borings during the design and preconstruction phases will confirm assumptions and may increase or decrease the amount of overlay, resurfacing, and reconstruction in the shoulder to accommodate HSR.

Operationally, dynamic lane control signals (with green/yellow arrows and a red "X") will indicate HSR is in effect. These signs will be installed at approximately ½ mile intervals above the shoulder, and static ground mounted and overhead mounted signage will be installed prior to HSR installations for additional driver notification.

Gore areas or ramp shoulders at entrance/exit ramps will provide a refuge space for vehicles while HSR is in effect. When the gore or ramp shoulder do not provide enough refuge space or when there is excessive distance between ramps, emergency safety refuges will be constructed as discussed above. Safety refuges will be 12 to 16-ft. wide depending on location, a minimum of 110-ft. long, and have 300-ft. minimum tapers. They will be constructed outside of the existing roadway shoulders and in some locations require minor ROW and utility relocations/protection, retaining walls, and other infrastructure to construct **(See Appendix for safety refuge locations in the HSR Plan Set and a Utility Conflict Matrix and a summary listing the ROW impacts).**

Six safety refuges are proposed within the HSR limits: two NB and four SB. An additional benefit that VDOT takes advantage of is that the safety refuges are also be used for snow emergency crew staging where snow plows can wait outside of the shoulder even when HSR is not in effect which creates a safer environment for motorists and maintenance activities. During current winter operations, the roadway is plowed from pavement edge to pavement edge as quickly as possible, so HSR will not impact snow removal. Should there be an abundance of snow that takes longer to clear all lanes and shoulders, HSR will not be activated to allow the additional time needed to clear. Pavement sensors will assist in making a decision on whether the HSR should be in operation. On a normal rain event, HSR may decrease the chances of an incident due to reduced congestion. ***Should an event occur on the shoulder that blocks the shoulder the CCTV cameras will automatically detect the blockage and notify the CHART operator, who can then close the shoulder to through traffic via the lane control signal,*** and notify emergency responders to utilize the available shoulder.

The existing IS 270 typical section varies within the proposed HSR limits. AASHTO's *A Policy on Design Standards – Interstate System* requires all interstate traffic lanes to be at least 12-ft. wide; the paved width of the right shoulder shall not be less than 10-ft. On a four-lane section, the paved width of the left shoulder needs to be at least 4-ft. On sections with six or more lanes, a minimum 10-ft. paved left shoulder width is required.

Our HSR typical section provides 12-ft. paved travel lanes as frequently as possible, with 11-ft. travel lanes in the remaining sections, as discussed below. As indicated in FHWA's *Use of Freeway Shoulders for Travel* guide, an existing 10-ft. shoulder can be used for HSR. Our proposed typical section is a 12-ft. minimum width shoulder for part-time use. We exceed the minimum because it has been proven to provide additional safety for motorists and will encourage more drivers to use the shoulder during HSR adding much needed capacity over and above the minimum. The shoulder width will be made up of a minimum 10.5-ft. for travel in the shoulder lane itself, with a 1.5-ft. lateral offset to all obstructions. **(See Appendix for HSR Plan Set and Typical Sections).**

Due to sectional constraints in the existing two-lane section of IS 270 and at several pinch points at existing bridge structures, a narrower mainline or CD /local lane width will be implemented to maintain the required effective 12-ft. dynamic HSR shoulder width. **(See Appendix for HSR Plan Set and Pinch Point Typical Sections)** One example of this reduced typical section is along the SB CD lanes between Shady Grove Road and MD 28. In our proposed solution, the CD / Local lanes would be reduced to 11-ft. and the additional 2-ft gained would be allocated to the shoulder. An 11-ft. lane width can be found along urban interstates in many locations across the US and would contribute to traffic calming. Where the mainline or CD / Local lanes require restriping, like the location indicated previously, microsurfacing will be laid across the entire width of the through lanes to cover and eradicate from view any remaining incorrect pavement markings **(See Appendix for PTC #11).** At pinch point locations, the left shoulder width would be affected, in combination with an 11-ft. through lane. AASHTO / MDMUTCD recommended tapers will be used wherever necessary **(See Appendix for HSR Plan Set and Pinch Point Typical Sections).**

As indicated previously, our HSR implementation will be designed to conform to design considerations established in the FHWA publication *Use of Freeway Shoulders for Travel, February 2016* in conjunction with AASHTO's *A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011 and A Policy on Design Standards – Interstate System, 2016.* A design exception will be pursued for any design elements that do not comply with the minimum AASHTO controlling criteria values, including shoulder and lane widths, and stopping sight distance. Known deficient controlling criteria were detailed in our PTCs along with draft Design Exceptions. When reviewing our PTCs, none were pointed out by SHA as being unreasonable and we assume they can be obtained upon further analysis, refinement, and mitigation. As design progresses during the Design and Preconstruction phase, we may discover additional design exceptions are required for bridge width, super-elevation, cross slope, vertical clearance, and lateral offset to obstruction. We will analyze additional required Design Exceptions and provide documentation and mitigation **(See PTCs in the Appendix for Draft Design Exceptions).** We also understand that HSR may trigger noise abatement and Noise Analysis will be required during the design/preconstruction phase **(See Appendix: Assessment for Potential Noise Walls).**

Other HSR implementations in the region include:

- **NB MD 4 (Suitland Parkway) from North of MD 223 and Dowerhouse Lane, Prince Georges County, MD:** Maryland has a section of HSR along MD 4 NB which matches the typical section of what is proposed for IS 270. The total crash rate for this section of MD 4 between 2013 and 2015 was 43.5 crashes per 100 Million Vehicle Miles of Travel (MVMT) which is below the statewide average crash rate of 44.3 crashes per 100 MVMT for similar facilities.
- **I-66 in Fairfax County, VA:** As one of the most-heavily congested corridors in Virginia, VDOT implemented HSR along I-66 to relieve recurring congestion during on-peak and off-peak hours. Static part-time shoulder use originally opened in 1992 between I-495 and US 50 and was converted in 2015 to a dynamic system with an ATM System implementation designed by PB including members of the IS 270 project team. These shoulders operate nearly at the same capacity as the mainline through lane, indicating that the HSR can significantly increase the mainline's throughput whenever necessary with the dynamic implementation. Maryland can reap these same benefits along IS 270 by implementing our **Proven and Innovative Solution.**
- **I-95 and SR-3 in Boston, MA:** This is one of the earliest HSR implementations in the country which resolved daily congestion and prompted motorists to use the shoulder without authorization. MassDOT gave the people what they wanted and allowed static part-time shoulder use during the peak hours of the day after constructing minor improvements along the corridor to obtain a preferred 12-ft. shoulder width, emergency safety refuges for incident management and emergency response, and minor pavement repairs. The initial implementation was so successful that MassDOT expanded their HSR program to over 45 miles of roadway and improvements increased based on lessons learned.

New pavement marking configurations, signing plans and DMS messages have evolved and SHA will reap the benefits as the Corman | Parsons Brinckerhoff Team will include all of the above, as appropriate in our proposed solution.

3. **Geometric Improvements:** Out of the many geometric improvements that were studied, those shown below are being included in the final alternative to improve mobility along IS 270. These improvements are at the following locations:

➔ **Entrance/Exit Ramps to SB & NB IS 270** – PTCs #3B, 05, 06, 07 & 08 recommended widening and restriping the entrance from local roadway to improve ingress of entering vehicles onto the highway and reduce backup and rear end collisions from vehicles merging onto the mainline. Included in PTC #'s 07 and 08 is a new modified CD configuration to separate mainline and ramp traffic conflicts / friction. For PTC #05 and 06 the Ramp Metering system subsequently studied and proposed to be implemented .duplicated many of their key components and provides similar functionality **(See Appendix for a mapping of these improvement).**

Mobility and Safety Benefits: Reduces the friction of merging vehicles during the morning rush hours. PTC #03B widens an existing off ramp to speed the departure of vehicles from the IS 270 mainline. PTC #05 was meant to increase the merge length of the acceleration lane just prior to the pinch point with the CSX rail bridge allowing for a smoother transition of ramp traffic onto the main line in the SB direction. This improvement was deemed un-necessary due to the inclusion of the HSR in this section which starts at this on-ramp. This allows for entering vehicles during the AM peak to utilize the HSR to extend the merge distance, and relieve congestion and improve safety.

➔ **Eliminate NW Loop Ramp at MD 118- PTC #09:** This removes the loop ramp from NB IS 270 to WB MD 118 and adds a left-turn movement from the NB off-ramp that accesses EB MD 118. This reconfiguration consolidates egress of vehicles from two points to one and eliminates the weave area along MD 118 that currently backs up and effects mobility along IS 270 NB **(See Appendix for a conceptual display of this improvement).**

Mobility & Safety Benefits: Modifies the exit points for MD 118 from NB IS 270, improving safety and operations by eliminating the substandard merging and weaving movement between the back-to-back IS 270 loop ramps along WB MD 118. The eliminated weave area reduces the number of potential lane changes in a high-conflict location as entering/exiting traffic are separated. Implementation advances the project's mobility and safety goals for the mainline IS 270 traffic and adjacent arterial.

4. **Coordinated Adaptive Ramp Metering:** This strategy deploys ramp metering signals along on-ramps to control the rate of vehicles entering the highway, smooths traffic flow onto the mainline to prevent breakdown, and makes the most use of the available highway's capacity. Ramp metering is not new; it was first implemented in 1963 on Chicago's IS 290 (Eisenhower Expressway). Today, ramp meters are commonplace in Northern VA, New York City, Seattle, Phoenix, Denver, Atlanta, Houston, Los Angeles, San Francisco, Milwaukee, Columbus and Minneapolis-St. Paul metropolitan areas and can be found in over two dozen smaller cities. This strategy improves mobility, reliability and safety not only along IS 270, but along the arterials as well.

The Corman | Parsons Brinckerhoff Team's solution is innovative and unprecedented in the US. Our approach to ramp metering introduces Australian Managed Motorway software and expertise that adds *"coordination"* to the mix and considers *ALL* the interchanges / ramps as a system. This next-generation approach to ATM adjusts the entry of vehicles in advance of congestion to smooth out flow and minimize disruption on the intersecting arterials. It operates through a combination of real-time and historic archived conditions, includes elements of dynamic bottleneck identification and automated incident detection, and in some instances, will coordinate with adjacent arterial traffic signal operations. The Australian Managed Motorway system prevents and/or mitigates traffic breakdown conditions on local lanes or mainline highway, and reduces arterial congestion by making the most of the capacity of the highway itself.

The Australian Managed Motorway concept's foundation is a network of precise vehicle detectors located at approximately 1/2 mile intervals along IS 270 and on entrance/exit ramps to continuously monitor traffic conditions. As mentioned in the CHART/ITS section, some devices provide never-before-experienced levels of data in Maryland due to their exceptional capabilities. Mainline detection is accomplished in part through The Infra-Red Traffic Logger (TIRTL), a traffic surveillance system that counts, classifies, determines the lane and measures the speed of passing vehicles using a non-invasive light-based technology and is recognized globally for its technical excellence and application to ITS challenges.

The TIRTL uses two electronic devices (receiver and transmitter units) mounted on either side of a road. Two infra-red light beams passing above the road surface detect and record vehicles and their respective attributes. The infra-red light beams are separated by about 6-inches and span a road at wheel height. As a vehicle moves along the road, its tires block and unblock each of the beams.

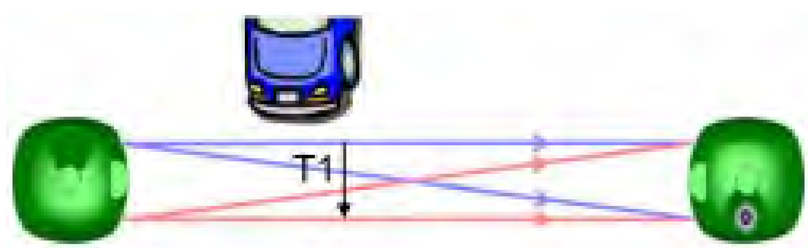


Figure 4: TIRTL detection operation

The TIRTL receiver detects and records the times that the first and second parallel beams are blocked and unblocked by the vehicle's tires. Using these times, combined with the distance between the beams, it calculates the speed of each vehicle, recording up to four measurements for a two-axle vehicle **(See Figure 4).**

Real-time data from each detection location is communicated via a fiber optic network to an integrated control software package called STREAMS®, which is developed and managed by TRANSMAX, a public sector enterprise of the Queensland (Australia) state government. This control system would be located in the Glen Burnie Data Center, but accessed, as indicated in our **PTC #02 – CHART Integration and PTC #19 - Communications and Networking**, will be available on any computer on the MDOT/SHA Enterprise Network. The STREAMS® architecture allows the client software to be operated at the State Operations Center (SOC) in Hanover, or at another SHA facility, such as Traffic Operations Center 3 (TOC 3) in College Park as selected by SHA during the design phase.. Data is then processed using advanced, ***existing proven state-of-the-practice traffic management algorithms*** to identify traffic flow changes and determine how and where metering rates for each ramp need to be adjusted in a coordinated manner to sustain maximum traffic flows while minimizing adjacent arterial impacts. ***STREAMS® software has operated for over six years in real-life conditions similar to IS 270 on ongoing Managed Motorways installations and has been constantly upgraded since being developed in 2007***. Our proposal provides that the STREAMS® software be licensed to SHA, with maintenance and upgrades provided regularly through a follow on agreement with Transmax at the conclusion of our contract period. Transmax's Software Assurance services are estimated to be approximately $1.5 Million annually, which includes annual servicing fees and access to annual upgrades and regular security patches. This estimate is approximate and would vary depending upon the service and licensing arrangement preferred by SHA.

STREAMS® monitors density and occupancy continuously from the mainline TIRTL detectors to understand the current traffic operations. As congestion manifests at any location, it turns on ramp meters at one or more upstream locations to prevent breakdown flow. If the initial set of ramp meters is not adequate to manage the developing congestion, additional upstream ramp meters are turned on until the congestion can be managed and prevented.

> *"Installing Transmax's STREAMS® software is as simple as installing a printer on your computer."*
>
> *Marc Plotkin, Georgia DOT Traffic Operations*

The Heuristic Ramp Metering Coordinator (HERO) algorithm is used by the STREAMS® software to calculate the desired meter rate at each coordinated ramp based on estimates of critical occupancy, queue length, waiting time, and ramp demand **(See Figure 5).** This algorithm minimizes the risk of mainline breakdown by balancing the ramp queue against spillback onto adjacent arterials and the optimization of freeway traffic flow, as successfully proven on the M1 and M80 freeways in Melbourne, Australia.

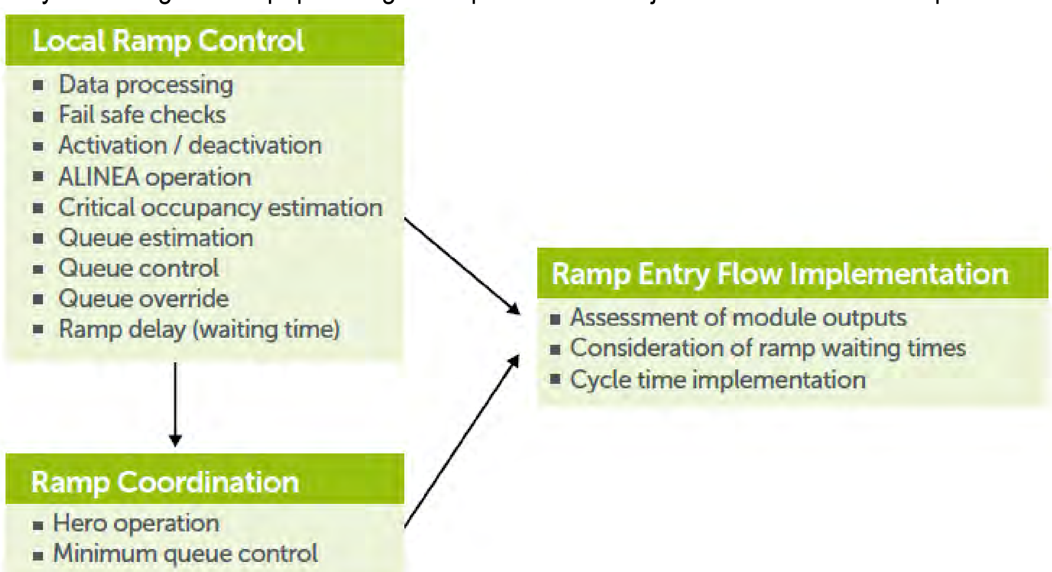


Figure 5: HERO Algorithm

When ramp queues meet a pre-determined threshold, STREAMS® spreads its metering operation upstream to balance queues and wait times across multiple ramps while maintaining mainline throughput. Queuing at the initial ramp is then relieved slightly, as queues are spread among a coordinated group of ramps. This balances queues, eliminates spillover to local roadways and distributes delay to provide equity among ramps. The practice is significant, unlike traditional ramp metering that is not interconnected and coordinated, and does not provide the full benefit to the mainline, ***Our proposal includes widening and restriping at the ramp metering location to increase the queue storage based upon the systems 2040 needs, as indicated on Tables 6 and 7 on Page 19***. Australian Managed Motorways provides adaptive, coordinated ramp metering, which manages delay queues over several different ramps within a ramp metering system while protecting full flow on the arterials making it one of the most cost-effective highway management strategies.

Australian Managed Motorways provides adaptive, coordinated ramp metering which manages delay queues over several different ramps within a ramp metering system while protecting full flow on the arterials.

Our application of coordinated adaptive ramp metering with the software and expertise behind Australian Managed Motorways along IS 270 will create a virtually enclosed (from a traffic flow perspective) highway allowing real-time monitoring and management of highway performance, access control to the highway facility, expedited incident response, enhanced communication of travel conditions and HOV lane sustainability. With careful traffic monitoring and on-ramp control, traffic flow disruptions, such as a large ques entering traffic platoons or backups due to incidents, can be minimized. This metering will provide higher, harmonized traffic flows that can be sustained longer, particularly during peak hours, increasing efficiency, reducing congestion, increasing safety, and reducing fuel consumption, associated emissions benefits and greater regional economic vitality.

Economic development benefits gained from a Managed Motorways systems of solutions approach to the IS 270 corridor, will be realized in many ways:

- ✓ Better public spending of transportation funding
- ✓ Reduced time lost for motorists
- ✓ Reliability for employers
- ✓ Savings due to enhanced safety and efficiencies for the motor carrier/shipping industry.

These benefits will be seen almost immediately compared to other traditional approaches to highway capacity improvements which take longer to implement. Investment returns from Managed Motorways will be realized much more quickly by the public and business communities.

As deployed/measured in Melbourne, Australian Managed Motorway has independently improved travel speeds 13% – 26% and vehicular throughput 5% – 30% and a 15%-50% reduction in road accidents.

Past Results: The complete 47-mile M1 Managed Motorways in Australia integrates over 1,100 separate vehicle detection, traffic signal and communication devices to provide coordinated ramp metering at 62 locations. The M1 Managed Motorways program constitutes the fourth iteration of ramp metering on this corridor. Like other locations, VicRoads had previously implemented static and adaptive ramp meters to limited effect. However, ***with the Managed Motorways concept, Victoria Department of Transport (VICRoads) was the first agency in the world to integrate robust traffic detection with highly advanced dynamic metering algorithms with complementary traffic management components that work with one another. The technology is currently being planned and/or implemented in Georgia, Colorado and Utah. Any lessons learned on these active and future projects will be incorporated on this initial IS 270 application and included in future years through updates in the licensing agreement.***

The Infrastructure Australia 2011 National Urban Policy Paper, *Our Cities, Our Future,* indicates that *"specific benefits of managed motorways (freeways) tools"* include:

- ✓ **Variable message signs** deliver an 8% – 13% increase in travel speed (Australian Dept. of Infrastructure and Transport. Our Cities, Our Future: A National Urban Policy for a Productive, Sustainable, and Livable Future, 2011).
- ✓ **Ramp metering** delivers a 13% – 26% increase in travel speed, an increase in volume (throughput of traffic) of between 5% and 30% and a 15% – 50% reduction in road accidents."

An initial 9.4-mile trial segment was evaluated by VicRoads in 2008 to determine the benefits of an Australian Managed Motorway system which implemented coordinated ramp metering at six locations along the WB M1 Freeway east of downtown Melbourne (inbound direction).

Although the trial segment was already operating with fixed-time ramp meters, trial results, as published, indicated the coordinated dynamic ramp metering system increased traffic flows and substantially improved reliability **(See Table 2 for a comparison between fixed-time metering vs. coordinated adaptive metering)**

PERFORMANCE INDICATORS	AM PEAK			PM PEAK		
	Fixed Time Metering	Coordinated Dynamic Metering	Performance Improvement	Fixed Time Metering	Coordinated Dynamic Metering	Performance Improvement
Traffic flow (vphh/ln)	2,068	2,165	4.7%	1,914	2,074	8.4%
Travel speed (mph)	30.4	41.0	34.9%	31.2	49.5	58.7%

Table 2: Performance Summary for M1 Managed Motorways Trial (2008)

The travel speed increased 35% and 58% in the AM and PM peaks by just introducing Coordinated Adaptive Ramp Metering to the existing uncoordinated fixed time ramp metering.

IS 270 Implementation: Coordinated adaptive ramp metering with the Australian Managed Motorway algorithms will be implemented along IS 270 from MD 80 SB to the IS 270 Spur, along NB and SB. Approximately 36 ramps will be metered, requiring over 75 ramp meter signals, CCTV cameras to monitor ramp storage and queues, hundreds of wireless puck detectors for ramp detection, and nearly 50 TIRTL detection systems along the IS 270 mainline.

To operate effectively, the system needs additional storage at most ramps, with existing pavement being used as much as possible. This additional storage is included in our proposal and uses existing shoulders, restriping and/or widening **(See Appendix for detailed plans).** Ramp storage, in conjunction with the coordinated ramp meters, will prevent spill over onto the arterial and impacting capacity or safety on the local roadway system. Our design for additional ramp storage is based upon a 2040 design life.

Our proposed system is also fully adaptable and can be enhanced to address changing roadway and traffic conditions through the post contract annual servicing agreement available to SHA to provide annual upgrades and regular security patches. The algorithm can and will be consistently adjusted for motorists along IS 270 to receive the maximum benefit. Future system improvements can also be considered by SHA to for further development and improve conditions along the corridor or to keep up with population and employment growth. These improvements include metering at additional ramps and additional ATM strategy implementations.

Public Outreach: As part of our proposed alternative implementation plan, a Public Outreach Plan will be rolled out to not only meet SHA and the NEPA/MEPA environmental document requirements, but will also educate how to use the new technology along the corridor, and to engage and inform stakeholders on project progress. Project updates will be made available to SHA to distribute utilizing the current SHA Website. They will be, accompanied by webinars, and informational materials so motorists understand what is proposed, what the anticipated benefits are, and how to react to the proposed condition. This outreach will have a stimulating economic development benefit by promoting system solutions so motorists have a stake in rapid implementation. Stakeholders and a target audience will include corridor employers, business associations, possible teaming with the Maryland Dept. of Commerce, community organizations and other interested parties.

Realized System-Wide Benefits

As described above, all four of our proposed concepts work in unison to create an integrated solution that improves mobility, safety, and reliability along the IS 270 corridor while reducing congestion and generating economic vitality. With Managed Motorways producing the umbrella strategy that the coordinated, adaptive ramp metering, ITS, and geometric improvements help support, there is significant mobility improvement realized in the VISSIM (7.00-13) model **(See Appendix for the VISSIM traffic model for 2015 and 2040 build years and the populated Concept Evaluation Templates).** The following is a summary of improvements:

AM SB Results: During AM rush hour, the peak direction is SB towards I-495. **Table 3** presents results for the percent change in average travel time, speed, and vehicle density for our proposal compared with a no-build scenario.

AM Southbound Results			
Southbound (SB)	% Change	I-270 Mainline	I-270 CD Road
	Cumulative Trip Travel Time*	-28%	-61%
	Average Roadway Segment Vehicle Throughput	+3%	+6%
	Average Roadway Segment Vehicle Density	-22%	-59%

*Cumulative trip travel time calculated as the summation of individual link travel times in VISSIM

Table 3: AM SB Results

These results illustrate an impressive improvement in all three measures for the SB movement. In the AM peak, ***mainline travel time improves by 28% and 61% along the CD road. Density is also drastically improved.***

PM Northbound Results			
Northbound (NB)	% Change	I-270 Mainline	I-270 CD Road
	Cumulative Trip Travel Time*	-12%	-46%
	Average Roadway Segment Vehicle Throughput	+6%	+4%
	Average Roadway Segment Vehicle Density	0%	-34%

*Cumulative trip travel time calculated as the summation of individual link travel times in VISSIM

Table 4: PM NB Results

PM NB Results: During PM rush hour, the peak direction is NB towards I-70. **Table 4** displays results for the percent change in average travel time, speed, and vehicle density for our proposal compared with a no-build scenario.

Results show an improvement in all three measures for the NB movement. ***Mainline travel time improves by 12% and 46% along the CD road.*** We have chosen the optimum suite of improvements, however the mainline benefits can be greatly improved, on a system-wide analysis, by future HSR installation NB from Middlebrook Road north all the way to Frederick. There are no other logical termini, except in Frederick itself. However, between our current terminus and Frederick, we encountered inadequate existing shoulder width and structural condition, the need to widen bridges, and potential impact on the Historic Battlefield in that section requiring costly upgrades or environmental concerns that cannot be provided in the current fixed budget without reducing other more cost-effective solutions. We recommend this additional improvement be looked at first with any follow-up project(s).

Another evaluation criteria is how the arterials are effected. ***An incredible 11 intersections (23%) are improved in 2040 because of our Proven and Innovative Solution*** **(See Table 5).**

AM Build Effect On Arterials		
	# Intersections in 2015	# Intersections in 2040
Improved	3	11
No Change	36	29
Degraded	5	7

Table 5: AM build effect on arterials

To visualize the benefits of our proposed alternative over the existing conditions, we developed the following graphics to show the Level of Service obtained in the existing and proposed configurations, and time savings:

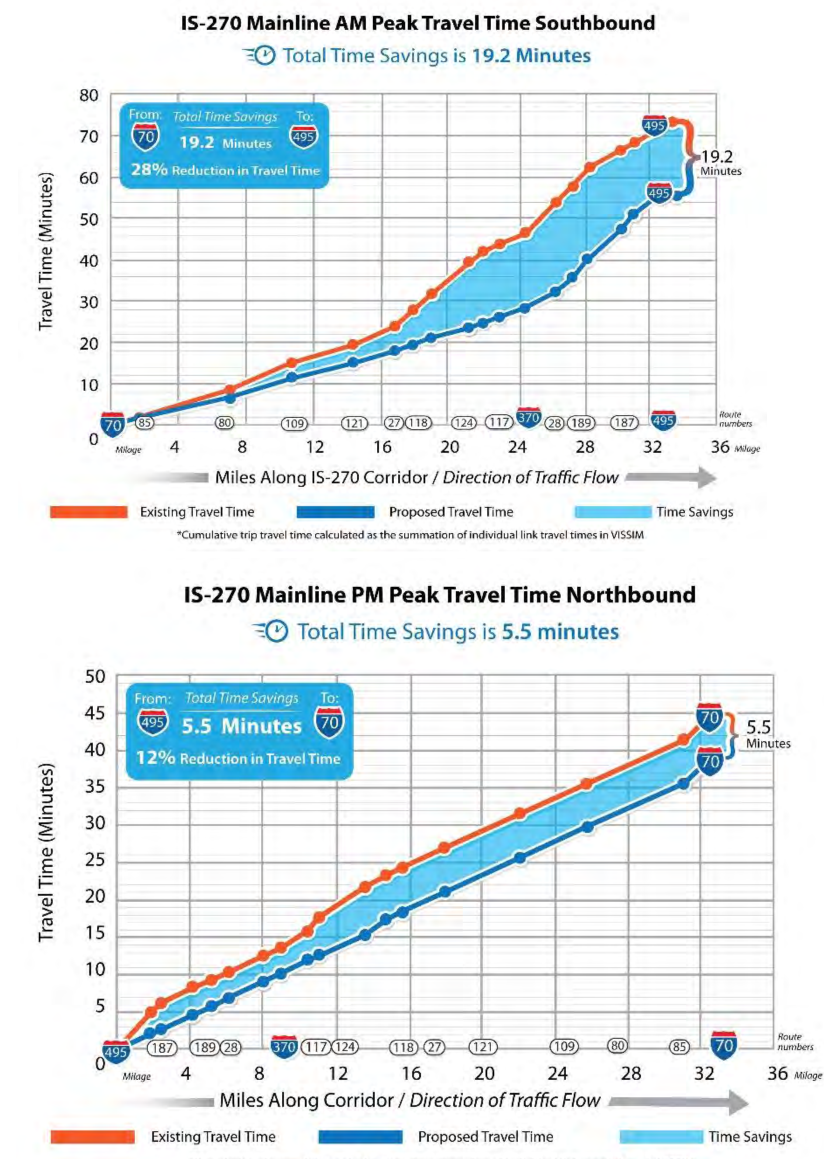
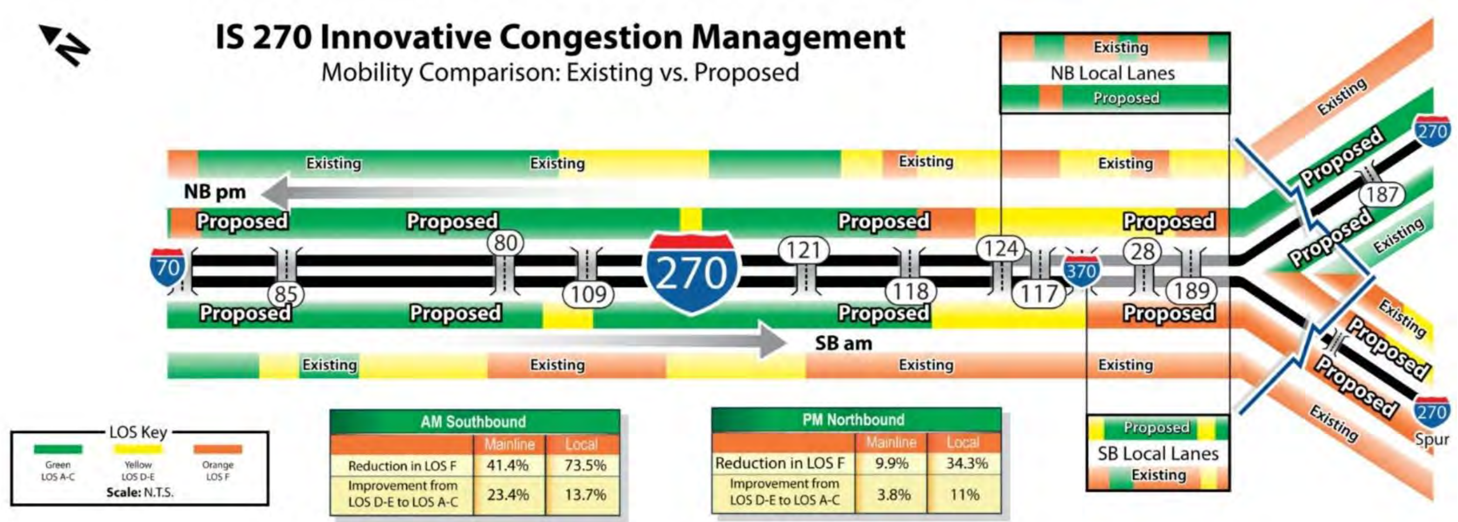


Figure 6: Mobility Comparison: Existing vs. Proposed



Cumulative trip travel time calculated as the summation of individual link travel times in VISSIM

Figure 7: AM & PM Peak Travel Times SB & NB

CONCEPTS THAT DID NOT MAKE THE GRADE

Out of the mounds of ideas and concepts tossed around, only a few were selected for our final proposed alternative. Those that were eliminated were evaluated based on the same criteria as above; however, they did not offer the cost-to-benefit improvements justifying their inclusion within the fixed budget. The following were a few concepts that did not make the grade and why:

- ***Reversible Lanes:*** While they would have increased capacity in the peak flow direction, it was not enough to offset the construction cost of installing crossovers, correcting cross-slopes, reconstructing pavement, moving inlets and reconstructing drainage systems and median barrier, shifting lanes along the mainline IS 270 and eliminating the ghost markings. There were also considerable human factors and safety issues to overcome with using reversible lanes. These costs were too much of an expense for the limited length of the corridor which could be addressed within the project budget, thus reducing the mobility benefit realized. It was also found that only a limited number of vehicles would actually use the lane due to the lack of ingress/egress points potentially available.

  A moveable barrier system was also evaluated, however, it would still incur the costs described above, but required daily operations and storing equipment safely. The anticipated storage location is not available at a reasonable distance to maintain the operation and reduce the traffic impacts to transition the barrier.

- ***Overhead Lane Use Control System:*** Overhead lane control signals which provide dynamic control of mainline through lanes were explored, along with ATM strategies, such as dynamic lane assignment, queue warning, and variable speed limit/speed advisory. While some safety benefits can be gained from the queue warning, modeling showed smaller impacts on throughput and reliability vs. the added capacity of HSR and the adaptive ramp metering and Australian Managed Motorway approaches included in our solution set. In a financially unconstrained deployment scenario, this approach was desirable and was proposed as PTC-15. Due to the significant expense of installing gantries and signage, cost of more extensive fiber communications facilities, and the existing sign clutter along southern portions of IS 270, this strategy was removed from consideration given the current $100 Million fixed budget cap.

- ***Permanent Lane Addition:*** Construction of one additional through lane in each direction would provide the most significant improvement to the traffic operations and safety, however, the cost of constructing the lane and modifying the interchange ramps make this cost prohibitive given the fixed budget. In addition, there are locations along the IS 270 mainline where narrow cross sections require parapet wall, bridge abutment, and other facility relocations to construct the new lane.

  The other option was to reduce shoulder widths and accommodate the additional lane within the pavement section which required reconstructing a portion of the shoulder for full-time use, cross slope corrections, barrier reconstruction, surface treatment, and still would require modifying the interchange ramps to tie-into the additional lane. This too was cost prohibitive, reduced the length of improvements and eliminated the availability of the shoulder for emergency vehicles.

- ***Fixed-Time Ramp Metering:*** Time-of-day operation for ramp metering is used in a few locations around the US with some investment return. Our deliberation and analysis concluded that the largest expense in deploying ramp metering is the physical hardware, detection, and telecommunications connectivity which is required whether or not you employ fixed time or dynamic/adaptive timing schemes. Our modeling indicated that an Australian Managed Motorways implementation with corridor-wide coordination of metering rates, queues and wait times will provide a much higher return on investment.

- ***Time-of-Day HSR:*** We explored the possibility of fixed time-of-day operation for HSR, but similar to fixed-time ramp metering, it was concluded that having flexibility in dynamic operation was a much better investment of SHA's resources, and the safety benefits of a dynamic system over a static implementation were too great to ignore. Regardless of the type of HSR, a similar level of signage, detection, and pavement treatment is needed. By focusing our approach dynamically, we now provide SHA with the flexibility to adjust the hours of operation as needed for additional capacity during major events or closures, and to react/respond to non-recurring congestion more efficiently.

- ***Traffic Demand Management (TDM):*** There are countless TDM strategies aimed at getting motorists off the road during peak hours, but in the end, they rely on unpredictable changes in driver behavior that are beyond SHAs control. No matter how advanced, creative, and convincing a TDM strategy is, changes in behavior are far from certain. Determining a ***reliable*** estimate of how many IS 270 travelers would follow the strategy and either travel at different times, carpool, or take another mode of transportation is not possible. TDM is also dependent on third parties, including major employers, local governments, and the media to support it and push the policy forward. This further reduces SHA's ability to manage the impacts of changes. While we will continue to encourage TDM strategies throughout this process we cannot directly propose them and have the ability to measure their impact per this contract.
- ***Ramp Metering at the IS 270 and MD 85 Interchange:*** When identifying and evaluating alternatives, it was determined that installing ramp metering at the IS 270 and MD 85 interchange is not prudent at this time. Any ramp metering or managed motorways improvements to this interchange will be removed as part of the future interchange reconstruction making the investment a short term fix, therefore it was determined to eliminate this interchange from our proposed solutions.

  While improvements at this location are not advised at this time, it would benefit the system significantly if ramp metering considerations were added to the ongoing new interchange design, and we recommend the slight modifications to that contract be incorporated.
- ***Ramp Metering at the IS 270 and IS 70 Interchange:*** When identifying and evaluating alternatives, it was determined that installing ramp metering at the IS 270 and IS 70 interchange would not be feasible. Under existing conditions, the IS 270 SB bridge over MD 85 serves as a narrow constriction point due to a limited cross section with no shoulders, and therefore, the benefits of metering IS 70 would not be fully realized until that constraint is remedied. With reconstruction of the MD 85 interchange, this constriction would be relieved, and we recommend that this interchange be studied for future Ramp Metering/Managed Motorways Improvements which are implemented in conjunction with the MD 85 interchange construction.
- ***Ramp Metering along the Spur(s):*** It was determined that constraints outside the project scope have a huge effect on how the spur and the east extension of IS 270 impact the IS 270 ICM project. Metering ramps along these roadways, and almost any other improvement, would prove futile with the American Legion Bridge to the south and the IS 270 split to the south acting as bottlenecks. Should other projects alleviate these issues, the Australian Managed Motorways concept should be considered in these locations to improve the system, and the ramp metering algorithm for meters already installed along the corridor should be adjusted based on the traffic impacts any new improvements will have on IS 270.

ii. How our improvements will provide a more predictable commuter trip, including innovative technologies or techniques that will be provided.

As indicated in the previous section, our **Proven and Innovative Solution** approach will include several components, including temporary added capacity from using shoulders, as well as next generation Australian Managed Motorways experience in managing demand through coordinated and adaptive ramp metering. These concepts, when combined with additional CHART/ITS devices and innovative spot geometric improvements, will create a more predictable commuter trip by increasing throughput; improving safety and decreasing the number, duration, and severity of car accidents.

A ROAD MORE EASILY TRAVELED

Congestion is easy to recognize—roads are jam packed with cars, trucks, and buses. Most definitions refer to such words as *"clog," "impede,"* and *"excessive fullness."* In the transportation realm, congestion typically relates to an excess of vehicles on a section of roadway at a particular time resulting in slower speeds—sometimes much slower—than normal or *"free flow"* speeds. Because travel conditions are unreliable on congested highways, motorists must plan ahead by leaving early to avoid being late. This means taking more time out of everyone's day to devote to travel—even if it means getting somewhere early, it is still time we could be spending doing something else. All because of unreliable travel conditions on our roadway infrastructure network, commuters can be late for work or appointments, business travelers can run late to meetings, and truckers can incur extra charges because goods are not delivered on time.

FHWA defines travel time reliability as *"how much travel times vary over the course of time."* This variability from one day to the next is due to the fact that underlying conditions vary widely. The many sources of congestion - especially traffic-influencing events, such as accidents, weather, and work zones - that contribute to congestion also produce unreliable travel times because these are never the same from day-to-day. For many years, transportation professionals referred to this event-driven variability in travel conditions as non-recurring congestion since. Travel Time reliability as experienced by motorists includes the cumulative impacts of non-recurring congestion and temporal variations (day of week, month and/or seasonal) in recurring congestion.

Non-Recurring Congestion: Our solution addresses non-recurring congestion by managing incidents as they occur. The ramp metering and HSR managed by the Australian Managed Motorway software will adjust and adapt based on traffic conditions, regardless of when or why flows start to breakdown. When there is a crash, our system identifies the issue, informs the CHART system operator, and draws immediate attention to it on the screen back at the SOC or Traffic Operations Center (TOC3). Our system increases traffic detection implemented, as well as cameras, so the operator has the data they need to make an informed decision on what steps to take next.

The Australian Managed Motorway solution remembers historical congestion information and uses it to manage the network, in particular during loss of communication with the central server.

The detection will be measuring traffic speeds and density, and communicate it back to the STREAMS® software that will already be adapting ramp metering rates to accommodate the new bottleneck. STREAMS® will be reporting the information to the SOC and/or TOC3 operator who can visualize exactly where the incident is and what happened so as to inform police, fire and rescue, emergency medical services, or the towing and recovery personnel. Depending upon pre-set SHA/CHART protocols, the HSR component of our system can be implemented and additional capacity provided where it is needed most.

In addition to providing CHART operators with more information, our system can provide users with better quality information. Traffic information media can be better informed on happenings, allowing them to provide more timely and more accurate information. New DMS will be along the corridor for CHART to inform motorists of incidents and travel conditions ahead. This gives them more information to base route and mode choices on and can make a change if needed, thereby moving more vehicles more efficiently

This type of detection, DMS and video coverage will assist an already successful CHART program to manage incidents even better and more efficiently than ever. ***By better managing these incidents, they can be cleared more efficiently, getting traffic back to normal quicker, creating a more predictable commuter trip***.

Recurring Congestion: Recurring congestion occurs during peak hours for a simple reason: the number of vehicles trying to use the highway system exceeds the available capacity. Handling this everyday traffic is what our IS 270 Innovative Congestion Management System does best. Our approach includes "Proven and Innovative" software to adapt ramp metering rates as traffic conditions approach mainline capacity to maintain near-optimum flow along the mainline. This management framework is complemented by added capacity in dynamic HSR that can simultaneously relieve pressure from increased demand.

As congestion increases, road capacity will hit a maximum and then break down right when you need it most. A maximum flow rate of 2,100 vehicles per hour per lane is carried on a typical interstate segment at 55 MPH prior to congestion saturation. However, as congestion occurs, average speeds and total volumes per hour are significantly reduced. Only 1,300 vehicles per hour per lane are typically passing through a facility at 20 MPH, which is about a 40% reduction of the lane's full capacity. By maintaining the optimum ***capacity over a four-lane highway, an additional 800 vehicles per hour (vph) per lane of capacity is made available or an additional 3,200 vehicles per hour. Maintaining this available capacity for motorists is the heart of the Australian Managed Motorways system.***

Our approach enhances the entire road network, including parallel arterials and intersections. While ramp metering controls access, a maximum wait time will be implemented for the individual ramp meters so motorists are not held up too long and impacting adjacent arterials. By optimizing the flow rate, capacity increases allowing more vehicles to access and travel the corridor - this not only reduces recurring congestion on the mainline, but improves conditions on the side streets and arterials by getting more vehicles off of them.

Adding new capacity through HSR when combined with state-of-the-art freeway capacity management will have an unprecedented dramatic effect on IS 270 travel time, reliability and throughput. For travel between the Spurs and Frederick, travel time will decrease by 6 minutes NB and 19 minutes SB during peaks periods.

Any capacity improvement increases reliability and predictability due to the correlation between congestion and safety. In addition to Managed Motorways adding capacity, HSR will increase capacity by approximately another 1,450 vph. ***By using our system-wide improvements, SHA will gain approximately 2,900 vph of capacity where HSR is implemented in both directions while maintaining 3,200 vph per lane of capacity through better management of mainline capacity. This is accomplished without the expense or need for time-consuming environmental studies required to widen the roadway.***

The Corman | Parsons Brinckerhoff Team's corridor-wide system of **Proven and Innovative Solution** will provide Maryland motorists with improved Level of Service, reduced travel times and increased travel time reliability. Our unique and innovative approach will provide benefits along the entire corridor allowing the maximum benefit for motorists across the entire region who regularly travel IS 270.

iii. Performance life of the improvements; the time it takes for congestion levels to return to preconstruction levels and the basis for our assessment of performance.

To get the most benefit for the $100 Million Maryland is investing into this project, improvements should last as long as possible. This criteria cannot be overlooked.

The Australian Managed Motorways System can last an indefinite length of time as long as the software and equipment are maintained and upgraded based on future lessons learned from M1 in Australia and the current planned implementations of Australian Managed Motorway in Colorado, Georgia, and Utah. The underlying software and algorithms will be updated to reflect the new conditions through the servicing agreement offered to SHA subsequent to our contract completion by Transmax. That agreement would be between Transmax and SHA providing SHA the level of service desired and could include annual upgrades and regular security patches. Per that separate agreement, ***Transmax can remain engaged, analyzing data regularly and updating the rates, software, and algorithm for optimum flow for the corridor. This maintains the system and extends the performance life.***

Regarding pavement condition, a microsurfacing overlay, discussed above on Page 8 and detailed in the appendix **(See Appendix for HSR Plan Set and Typical Sections)** is proposed over much of the project limits to eliminate safety implications associated with ghost markings from shifted lane markings. This will also improve the friction factor along the corridor, and provide an improved and consistent pavement surface. Microsurfacing is anticipated to extend the life of the pavement a minimum seven years, per a report developed discussing Long-Term Benefits of Microsurfacing Applications written for the TRB annual meeting by Labi, Kong, lamptey, and Nunoo. All research documented in the Microsurfacing memo located in the Appendix supports this assessment, which will allow SHA to push out resurfacing projects that are planned to have occurred in between and spend the money on other projects. ***This additional potential savings for this delay of planned***

maintenance due to the existing pavement improvements has not been taken into account in our economic analysis - but is a real cost savings to SHA.

Using the Australian Managed Motorways approach, it is possible to maintain IS 270 mainline traffic operations at or near optimum performance indefinitely. This is due to the primary system objective of metering access to the mainline to maintain optimum freeway capacity and throughput. Even though demand may increase in the future, it is still possible to manage access to IS 270 to maintain optimal conditions.

As demand in the IS 270 corridor increases, demand for access to the facility itself will also increase. And because of this, ramp queues and wait times will increase. When these queues become too long, two issues arise: First, ramp queues can back up onto arterial facilities adversely impacting operations. Second, wait times to access the freeway at some ramps can become excessive. As some ramps in the system approach the maximum queue they can support without impacting the arterial system, other ramps it the system can change their metering to take some of that load. This means that ***cumulative storage on all ramps in the system*** is a primary factor in determining the ability of the system to meet future needs. The cumulative storage required for IS 270 in the study area was examined under multiple scenarios based on VISSIM runs for 2015, 2020, 2025, 2030, 2035, and 2040. Runs for 2015 and 2040 were based on SHA provided volumes, and the interim runs were performed using growth rates based on historical traffic growth along the IS 270 corridor. The criterion of four minutes of storage for each ramp, which is used in Australia, was also calculated and proved to be a more stringent standard that the storage requirements indicated by VISSIM modeling.

A running total of storage available vs. storage required was also analyzed. This was done for the average for each year as determined by VISSIM, the maximum required for each year as determined by VISSIM, and using the Australian four-minute standard for each year. The maximum queue of these three methods was compared to the available storage. The results for SB are shown in Table 6 and Table 7 for NB.

SOUTHBOUND	2015	2020	2025	2030	2035	2040
Available Storage Surplus | Deficit with Turn Lanes	11,500	10,500	9,500	8,400	5,300	3,000

Table 6: SB cumulative required storage vs. proposed available storage

NORTHBOUND	2015	2020	2025	2030	2035	2040
Available Storage Surplus | Deficit with Turn Lanes	11,300	10,700	10,100	9,500	8,800	4,600

Table 7: NB cumulative required storage vs. proposed available storage

In the SB direction under this conservative analysis, by 2025, improvements will be needed to handle demand on the following ramps: MD 118 Germantown Road, Middlebrook Road, Watkins Mill, MD 124 Montgomery, Village Ave Loop, and MD 117 W Diamond Ave, I-370.

In the NB direction, even with a worst case scenario, it appears that existing ramp storage, plus the additional storage detailed previously, will be sufficient until 2040. At that time, three interchanges may need attention: Montrose Road, MD-189 (Falls Road), and MD-28 (W Montgomery Loop).

3. Safety

3. SAFETY

The Corman | Parsons Brinckerhoff Team's selected program alternatives provide significant improvements along the IS 270 corridor regarding **SAFETY, MOBILITY, RELIABILITY,** and **CONGESTION RELIEF.** While IS 270's mainline and local lanes are the focal point of this project, we considered impacts to arterials and local roads, including intersection level of service, queue lengths, and other metrics as they are also vital components to reduce delay and increase reliability.

PROVEN AND INNOVATIVE SOLUTION

Our real world **Proven and Innovative Solution** maximizes vehicle throughput and minimize travel times while improving safety, reliability, and regional economic vitality. This approach leverages effective practices, introduces ways to manage traffic considered new terrain for SHA, and streamlines it with proven experience and software already delivering improvements in other locations. Our proposal takes the following four established components and integrates them together for maximum value and results. Considered an international success on the Australian M-1 motorway, these components will be groundbreaking for SHA:

1. Provide additional **ITS Field Devices** to support Coordinated Highways Action Response Team (CHART) operations and travel information tools, and interconnect them with a robust communications backbone that supports existing and future applications and needs. ***IMPROVEMENTS:*** *Supplements existing SHA CHART initiatives to facilitate quicker incident response and clearance, which improves reliability and enhances safety.*
2. Use **Dynamic Hard Shoulder Running (HSR)** to provide an additional travel lane during peak hours, special events or non-recurring incidents. ***IMPROVEMENTS:*** *Reduces congestion and improves safety, mobility and reliability.*
3. Provide **Geometric Improvements** in selected locations. ***IMPROVEMENTS:*** *Improves safety, capacity, and traffic flow, where the current configurations result in safety and/or operational issues.*
4. Provide an established next generation **Coordinated Adaptive Ramp Metering** System. ***IMPROVEMENTS:*** *Decreases the probability of IS 270 reaching breakdown traffic flow which reduces congestion and improves safety, mobility, and reliability.*

These four components will work together and are based on proven implementation in other locations that mitigates risk, optimizes the budget, and reflects long-term operability and maintainability needs. They will work in unison with the proven Australian Managed Motorways software and experience to improve the throughput on IS 270 while improving safety, reliability, and reducing recurring and non-recurring congestion.

Figure 8: Corman | Parsons Brinckerhoff IS 270 Innovative Congestion Management Program.

Entering unchartered waters here in the US, the Corman | Parsons Brinckerhoff Team proposes to utilize the real world tested and proven propriety Australian Managed Motorway Software. Developed by team member Transmax, a corporation wholly owned by the Australian Queensland Dept. of Transport, the operating system has been up and running on the M1 in Australia for 9 years and is credited with increasing vehicle throughput by 20%, reducing crashes by 32% and is well received by motorists.

IS 270 INNOVATIVE CONGESTION MANAGEMENT PROGRAM

In addition to a robust field operational force of emergency traffic patrols and response units, Maryland's CHART program benefits from additional field devices to support the detection, verification, and response to incidents, the provision of travel information, and in limited situations, re-directing traffic for lane closures or major diversion needs, including speed detection systems, closed circuit television (CCTV) cameras, dynamic message signs (DMS), and road weather information systems (RWIS).

THE FIRST COMPONENT of our IS 270 Innovative Congestion Management program is to install additional **ITS Field Devices** which may also be used by CHART operators to assist responses. We will install additional CCTV cameras and DMS where gaps currently exist, in particular for areas with documented safety or recurring daily congestion issues. Installing additional advanced detection technology along IS 270 Northbound (NB) and Southbound (SB) will deliver game changing amounts of data, support other approach elements, and provide SHA with a heightened awareness of road conditions.

THE SECOND COMPONENT adds much-needed capacity during peak hours or during incidents or non-recurring congestion by implementing **Dynamic Hard Shoulder Running (HSR).** Our proposed HSR will be dynamic and be able to open an additional lane to traffic based upon pre-set time of day or actual need. Our HSR will be SB from MD 109 to MD 121, then again from MD 124 south to approximately Tuckerman Lane. For NB, HSR will be from the merging of IS 270 and the IS 270 Spur North to Middlebrook Road. In contrast to a static time-of-day schedule for HSR, our dynamic approach continuously monitors conditions and uses real-time and ***anticipated*** congestion levels to determine whether or not to open the shoulder lane for easier travel. While peak-period capacity will be the primary function of the HSR system, off-peak needs may arise ***and the system can adapt to real-time needs, such as any emergencies or off peak congestion.*** We propose HSR will be initiated only after CCTV cameras visually confirm the shoulder is clear of stopped vehicles. While our system includes the generation of automated alerts regarding shoulder obstacles, the final operating procedures for opening and closing will be developed in close coordination with SHA and CHART operational staff.

Enhancing interchange and ramp traffic flow and safety is accomplished through ***THE THIRD COMPONENT***. Throughout our planning process, multiple **Geometric Improvements** were identified to improve flow and safety. Initial concepts ranged from reconstructing deficient interchange configurations so as to move vehicles off the mainline more efficiently, to simple extensions of acceleration lanes to reduce friction along the mainline. This proved to have a positive effect on traffic flow and safety, and aligns with the technological improvements proposed throughout the corridor. Our proposed geometric improvements include:

- **Entrance Ramp Improvements to SB IS 270** – PTCs #05 and 06 recommended widening and restriping the entrance from local roadways to improve ingress of entering vehicles onto the highway and reduce congestion and rear end collisions from vehicles merging onto the mainline. While these PTCs did not move forward, it was fund that the Ramp Metering system and ramp improvements, including widening for storage and discharge lanes provided greater improvements.
- **Eliminate NW Loop Ramp at MD 118**- Consolidate egress of vehicles from two points to one and eliminate the weave area along MD 118 that currently backs up and affects mobility along IS 270 NB and MD 118.

- **Entrance/Exit Ramps to SB and NB Father Hurley Blvd.- PTCs #03B, 07** and **08** provides for widening and restriping the entrance from local roadway to improve ingress of entering vehicles onto the highway and reduce backup and rear end collisions from vehicles merging onto the mainline. Included in PTCs # 07 and 08 is a new modified CD configuration to separate mainline and ramp traffic conflicts/friction.

Like all highways, IS 270 fails to function properly when flow breaks down from higher demand and turbulence. A maximum flow rate of 2,100 vehicles per hour per lane is carried on a typical interstate segment at 55 MPH prior to congestion saturation. However, as congestion occurs, average speeds and total volumes per hour are significantly reduced. Only 1,300 vehicles per hour per lane are typically passing through at 20 MPH, which is about a 40% reduction of the lane's full capacity. Hence, the highway is carrying only 60% of its capacity when it is needed most.

The ***FOURTH COMPONENT*** manages this flow breakdown by controlling access to the highway and synchronizing flow in an automated and integrated fashion to sustain flow rates closer to the facility's maximum capacity of 2,100 vehicles per hour per lane. Our ***Coordinated Adaptive Ramp Metering*** proposal enhances the other three more traditional components and is controlled and managed by the software proven in the Australian Managed Motorways system.

Our Australian Managed Motorways proposal incorporates advanced algorithms to predict the onset of congestion BEFORE it happens, and immediately controls access and coordinates queues and ramp waiting times across the corridor to avoid disruption to adjacent arterials.

By utilizing intelligent data collection, communications and control systems, our Australian Managed Motorways solution synchronizes the flow of entering vehicles in real-time to those already on the facility to match the highway's operational capacity. Access is controlled at all on-ramps and highway interchanges of the corridor through ramp meters. Typically, ramp metering facilities involve individually-controlled ramps which do not work together as a system, and when the queues get too long, just flushes the retained ramp traffic onto the freeway. This uncoordinated system only increases the congestion along the mainline and negates benefits realized by ramp metering.

Our Australian Managed Motorways proposal incorporates advanced algorithms to predict the onset of congestion *BEFORE* it happens, and immediately controls access and coordinates queues and ramp waiting times across the corridor to avoid disruption to adjacent arterials. It involves new concepts in entry ramp design that include physical improvements to ramp storage, discharge, and acceleration/merging to optimize the ability of vehicles to use the highway's available capacity while limiting impacts to mainline operations and adjacent arterials. This comprehensive demand and system management process improves highway performance regarding vehicle throughput, travel time and safety to maximize network efficiency.

Our proposed solution reduces total travel time from the IS 270 split to IS 70 in Frederick by 28% SB in the morning and 12% NB in the afternoon.

The Corman | Parsons Brinckerhoff Team's solution is built upon the foundation of an integrated package of ITS, dynamic shoulder utilization, intelligent ramp metering, and spot roadway improvements to maximize efficiency and throughput. It is enhanced by the Australian Managed Motorways system, including vehicle detection and data collection systems, coordinated adaptive ramp metering, incident detection, CCTV surveillance and strategic design considerations, such as on ramp queue discharge and storage, merge lanes, and expanded off ramps for increased exit/entrance flows.

If Active Traffic Management (ATM) is the *"next generation of ITS"*, utilizing existing tools more efficiently, then the Australian Managed Motorways is the *"next generation of ATM"*, applying advanced intelligence and coordinated adaptability, and viewing the corridor as a system. Looking ahead to the not-too-distant-future, our approach recognizes the evolution of transportation operations and traffic management and provides a solid foundation for the *"next-next generation"* which is currently unfolding in terms of connected and automated vehicle systems. It provides motorists with immediate benefits while setting the stage for the SHA to capitalize on future trends and opportunities.

Figure 9: IS 270 Innovative Congestion Management Solution covers the next generation of approaches and sets the stage for the ultimate CV/AV scenario

SPECIFIC BENEFITS OF OUR PROPOSED SYSTEM

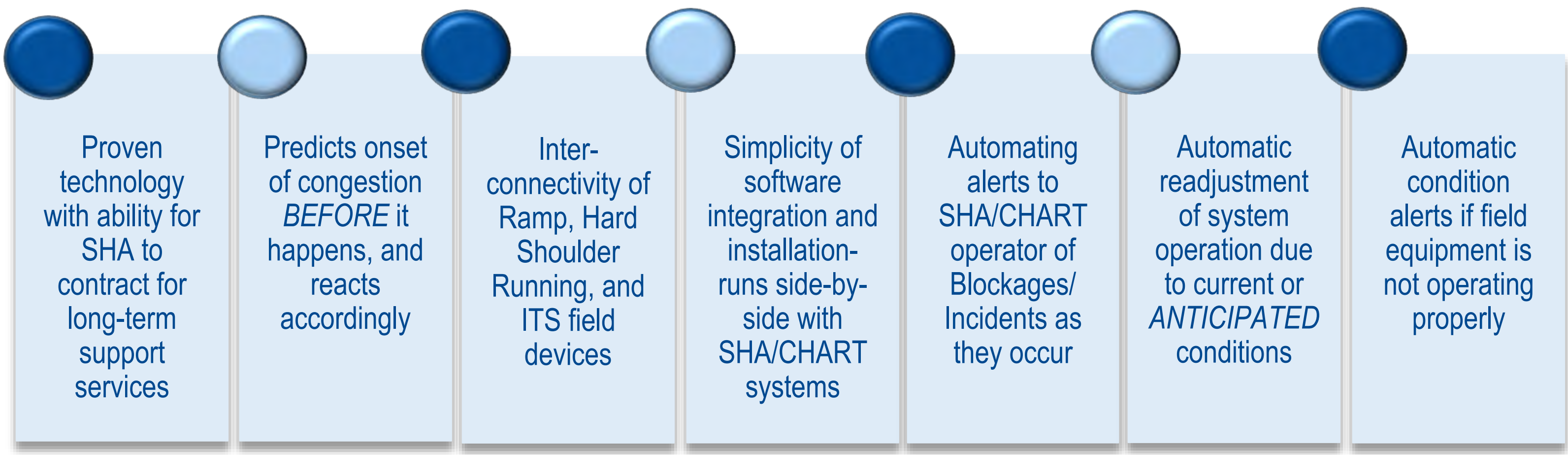


Figure 10: Specific benefits of our proposed system

i. How our improvements will reduce the number, duration and severity of incidents and how our approach will facilitate the management of incidents after construction is completed.

Successful highway management strategies deliver a more reliable commuter experience with enhanced level of service by improving capacity utilization in combination with improved incident response. *US DOT's "Intelligent Transportation Systems for Traffic Incident Management"* and FHWA's *"Use of Freeway Shoulders for Travel"* tell us that the combination of reduced congestion and improved incident management provide reduced crash rates for primary and secondary incidents along the highway. The Corman | Parsons Brinckerhoff Team's proposed solution builds upon the robust incident response capabilities the CHART system has developed by better managing congestion on IS 270. This improves motorist travel time and trip reliability by preventing breakdown traffic flows and reducing/eliminating turbulent traffic flows along the mainline. The end result is a faster and more reliable trip along IS 270 and reduced congestion-related crashes.

Breakdown traffic flows and turbulent traffic operations are characterized by highly-variable speeds and frequent stop-start cycles along the mainline. These conditions are known to increase congestion-related incidents, including rear-end and sideswipe collisions.

IS 270 Crash Data Summary: An important part of devising solutions for the IS 270 corridor is knowing its' crash history. **Table 8** illustrates the number and percentage of crashes, broken out by type, occurring along IS 270 between I-495 and I-70 from 2013 through 2015:

Crash Type	Number	% of All Crashes
Rear End	1,269	53.8
Fixed Object	723	30.6
Sideswipe	297	12.6
Other	68	2.9
Opposite Direction	2	Less than 1
Total	**2,359**	**100**

Table 8: Number and percentage of crash types

As is common along a highway with traffic barriers and regular congestion during weekday peak hours, rear end, sideswipe and fixed object crashes are the most common along the corridor. Rear-end accidents account for the 1,269 crashes out of 2,359 total along the entire IS 270 corridor. Fixed object crashes (typically involving a traffic barrier) represented 723 crashes, and sideswipes represented an additional 297. The breakdown of crashes by crash severity is also important to understand for the IS 270 corridor:

Crash Severity	Number	% of All Crashes
Property Damage Only	1,549	65.7
Injury	804	34.1
Fatal	6	0.2

Table 9: Number and percentage of crash severity

For facilities with significant recurring congestion, crashes tend to be lower in speed and severity, primarily property damage only. **Figure 11** on the next page shows the density of crashes by location along the corridor, with red segments representing high crash frequency and green low crash frequency sections. ***Note that our proposed improvements are placed to correlate with locations of high volumes of crashes – we made improvements where it would do the most good to reduce crashes!*** The highest crash frequency locations are in the vicinity of interchanges and in the southern section of the corridor where congestion levels are the highest. The Corman | Parsons Brinckerhoff Team's solution combines multiple levels of improvements into an approach to manage capacity and throughput along IS 270. This will allow SHA to prevent traffic flows from reaching breakdown conditions and will maintain reliable and consistent speeds and volume throughput along the IS 270 mainline.

One significant benefit in speed harmonization is a reduction in the frequency of crashes along the IS 270 mainline. The AASHTO Highway Safety Manual (HSM) documents that crash frequency reduces as speeds increase along a facility. This will reduce the frequency, duration and severity of incidents along IS 270 by reducing stop and start traffic flows, increasing vehicle headways during peak periods, and reducing the variability and differential in vehicle speeds. These factors tend to increase the frequency of crashes at lower speeds.

Geometric Improvements are included in our recommended improvements to mitigate bottlenecks and improve safety. This will reduce the frequency of merge/weave type accidents through realignment of highway ramps and improvements to acceleration/ deceleration lengths.

- **Entrance/Exit Ramps to SB & NB IS 270** – PTCs #3B, 05, 06, 07 & 08 recommended widening and restriping the entrance from local roadway to improve ingress of entering vehicles onto the highway and reduce backup and rear end collisions from vehicles merging onto the mainline. Included in PTC #'s 07 and 08 is a new modified CD configuration to separate mainline and ramp traffic conflicts / friction. For PTCs #06 and 07 the Ramp Metering system subsequently studied and proposed to be implemented .duplicated many of their key components and provides improved mainline traffic operations **(See Appendix for a mapping of these improvements).**

  BENEFIT: These improvements can reduce crashes by up to 11% according to the AASHTO Highway Safety Manual and the Crash Modification Factor (CMF) Clearinghouse.

- **Eliminate NW Loop Ramp at MD 118** – removing the northwest loop ramp will eliminate a weaving maneuver along MD 118 WB and will in turn facilitate vehicles exiting IS 270.

  BENEFIT: This will also consolidate egress of vehicles from two points to one and eliminate the weave area along MD 118 that currently backs up and affects mobility along IS 270 NB and MD 118. The Crash Modification Factor Clearinghouse indicates the Crash Modification Factor (CMF) for replacing a loop ramp with a straight ramp is 0.55, which correlates to a 45% reduction in crashes.

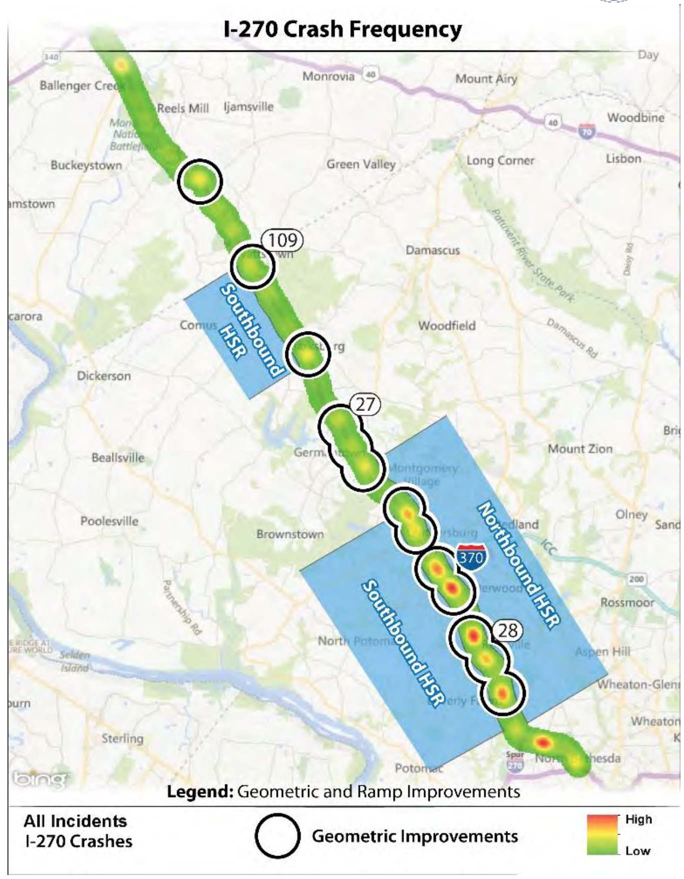


Figure 11: IS 270 crash density by location

> *Note that our proposed improvements are placed to correlate with locations of high volumes of crashes – we made improvements where it would do the most good to reduce crashes!*

Hard Shoulder Running (HSR) will be added to IS 270 mainline sections for additional capacity for through vehicles along the mainline. This additional capacity will be used during peak hours to reduce congestion and minimize the shockwave effects of oversaturated conditions, as well as during incidents that cause congestion and/or block lanes. The safety performance of HSR varies based on roadway and environmental factors, however, the FHWA publication "Use of Freeway Shoulders for Travel" states that implementing HSR along a highway can reduce congestion levels which reduce the frequency of congestion-related crashes. The Highway Safety Manual indicates that widening a highway from four to six lanes would reduce crashes between 10% and 20%, however, in the case of HSR, some benefits would be offset by narrower lanes and shoulders, and reduced acceleration/deceleration lanes. Overall, the net improvements to traffic operations are expected to result in a reduction in congestion-related crashes due to the reduced congestion which causes over 50% of current crashes. In order to mitigate the reduced shoulder widths along IS 270 during peak travel periods, nine (9) new safety refuge areas will be installed adjacent to the hard shoulder running.

In combination with the HSR being implemented, a microsurfacing course will also be applied in most locations to eliminate the safety hazard of not completely eradicating ghost markings left when lane lines are relocated. It also provides a new surface that improves skid resistance and rideability, reduces rutting, and revitalizes the pavement surface. It is well known that the pavement surface has a huge impact on safety, especially during weather events. A new surface for a significant portion of the project limits will reduce crashes.

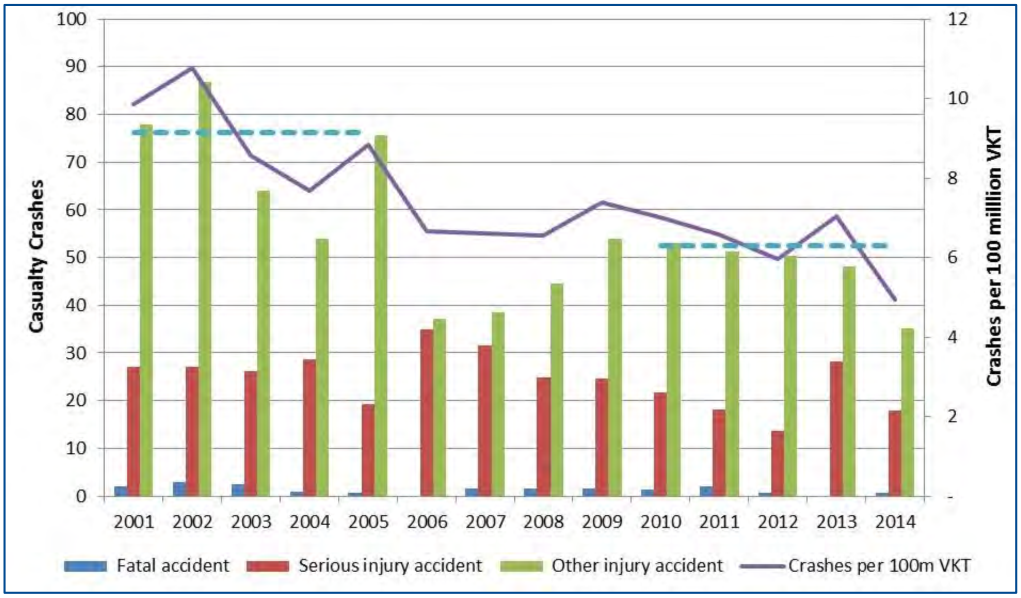


Figure 12: Crash Statistics –M1 Freeway per 100 million Vehicle Kilometers of Travel

The final component of our solution is implementing the **Australian Managed Motorways** concept, which implements a proprietary set of algorithms to manage highway throughput via coordinated and adaptive ramp metering. This is achieved by coordinating and balancing queues and wait times across all ramps in the corridor. The Crash Modification Factor clearinghouse indicates that ramp metering can reduce crashes of up to 36% (or 0.64). The M1 motorway in Melbourne, Australia uses the *exact* algorithm and coordinated adaptive ramp metering system we are proposing. ***The M1 Motorway saw a significant crash rate reduction after implementing the Australian Managed Motorways system: crashes were reduced 32%*!** **(See Figure 12 for long-term crash rates before *and* after the M1 Motorway system implementation).** We expect similar results on this project.

The M1 Motorway saw a significant crash rate reduction after implementing the Australian Managed Motorways system: ***Crashes were reduced 32%!***

In addition to reduced crashes, adaptive ramp metering will assist CHART in managing incidents to reduce the duration and post-incident recovery time. When an incident occurs during off-peak hours, the system detects the breakdown in flow conditions and starts to meter vehicles entering the highway. Managing this demand combined with the ability to open or close HSR lanes will give mobility to first responders and emergency services, resulting in more efficient incident resolution and decreased duration. New DMS along the corridor will communicate information to IS 270 motorists, including travel time, advance warning of incidents and other events, and any other information valuable in making route decisions. This will reduce frequency of crashes due to unforeseen conditions and decrease the duration of crashes and response times.

ii. Innovative technologies or techniques that we will provide and how we will address the project's safety goal.

The heart of our approach is the Australian Managed Motorways system which ties together the geometric, capacity, HSR and ramp metering to optimize highway operations. This solution has been highly functional in Australia for 10 years, where it has significantly improved freeway traffic operations and reduced crashes.

A typical ramp metering operation is fixed time, with the meter operating at a fixed rate and queue detection at the back of the ramp to identify when it needs to clear the ramp, discharging many vehicles onto an already congested corridor. The Australian Managed Motorways system uses an algorithm that adjusts the timing of the ramp meter based not only on mainline traffic conditions, but also vehicle wait times and queues on each ramp.

Additionally, the proprietary STREAMS® software adjusts ramp metering locations and rates to balance queues and wait times across multiple ramps along the entire corridor. This level of communication and data gathering is extremely innovative and requires robust computing power to process the information in the time needed to adjust metering rates in a mere 20 seconds. Procuring the computing power necessary to manage the data to operate this system would not have been cost effective a decade ago. This unique approach to managing mainline highway capacity provides significant improvements in highway and arterial traffic operations while improving safety.

> *"Installing Transmax's STREAMS® software is as simple as installing a printer on your computer."*
>
> *Marc Plotkin, Georgia DOT Traffic Operations*

Our Australian Managed Motorways based approach is built upon five main pillars of success:

1. **Meter All Ramps Along the Corridor** -This controls the demand for mainline capacity which prevents breakdown traffic flows resulting in significantly less congestion and reduces congestion-related crashes.
2. **Design Highway Mainline for Improved Operations** -Mainline capacity improvements reduce capacity bottlenecks and turbulence. This improves traffic operations and reduces congestion-related crashes.
3. **Ensure Accurate and Reliable Data** -For the system to work properly, it requires information about traffic performance along the facility, including mainline lanes and ramps. This allows the real-time monitoring of volume, speed, occupancy, density and classification along the facility. By monitoring them in real time, the system can adjust ramp metering along the facility in response to increases in demands, as well as incidents that may reduce capacity or degrade safety.
4. **Provide Adequate Exit Ramps and Interchanges** –Providing a safe and efficient movement of vehicles exiting the facility is equally important as this reduces backups from arterial facilities onto the mainline highway. This reduces mainline congestion and increases the safety and efficiency of the IS-270 mainline.
5. **Implement State-of-the-Art Control Algorithms and Central System** –State-of-the-art algorithms are at the heart of the Australian Managed Motorways system. They manage the ramp metering rates based on highway performance metrics, including volumes, speeds, densities and classifications along the mainline in conjunction with balancing queues and wait times along entrance ramps to reduce congestion and improve safety.

By managing all highway entrances and exits, our Australian Managed Motorways based solution allows the mainline to operate at near optimal throughput and speeds, maintaining the ideal capacity when needed most. By managing freeway access through Coordinated and Adaptive Ramp Metering, freeway lane occupancy is kept below critical levels and vehicle throughputs of 2,000 vehicles per hour per lane can be maintained. This maintenance of highway speeds and throughputs will reduce the frequency of Property Damage Only (PDO), Injury and Fatal crashes due to reducing IS 270 mainline turbulence combined with the maintenance of highway operating speeds near their optimum levels. This reduction in congestion will also result in a reduction in the frequency and crash rate for higher severity crashes, including crashes that are fatal and those that cause injuries. This innovative approach improves safety and mobility through the deployment of a robust highway detection system which collects information about volumes, occupancies, speeds and vehicle classifications in real time, allowing intelligent decisions and management by the Managed Motorways system.

An innovative approach, based upon lessons learned on M1 in Australia, to merge areas is being implemented to address the number of discharge lanes required at a given on-ramp. Staggered stop bars are being implemented in several locations, as well as taking an alternative approach to the lane reductions; essentially using the alternate merge configuration. These are innovative approaches to geometric design to make sure the ramp metering system functions as intended using treatments Maryland Motorists are familiar with and without compromising safety.

Microsurfacing is an innovative pavement surface treatment for high-volume roadways and interstates. In Maryland, it has been piloted and used on lower volume roads, but nearby states, such as Virginia and New Jersey, have each used the treatment on interstates to find great safety benefits. This low-cost alternative to a milling and placing a full resurfacing is proposed to cover any old or ghost markings left behind, allowing installation of new pavement markings with increased reflectivity at a reduced cost and impact to the public. It will also advance the safety goal of this project by providing the safety benefits of increased skid resistance, a reduction of rutting, and an increase in the roadways pavement friction factor.

iii. Techniques we will utilize to mitigate any conditions in its approach which may not meet typical design standards and how the mitigation will provide for a safer IS-270 corridor after construction is completed.

There are a handful of design elements included in our recommended solution which do not meet the most current AASHTO and/or SHA design guidelines, however each represents a careful choice regarding the practical addition of capacity against the constrained total project fixed budget. Mitigation strategies in FHWA's Mitigation Strategies for Design Exceptions guidelines will be implemented where possible and are explained below:

The following design elements do not meet AASHTO design criteria and most were presented in draft Design Exceptions included in PTCs with little to no objection from SHA reviewers. All substandard elements presented below will be mitigated within our recommended solution as indicated:

1. **Shoulder Widths** have been reduced in locations where HSR was implemented, particularly where the roadway cross section is constrained due to roadside features. Although the pinch points do not meet the AASHTO criteria for the construction of a new highway facility, they are permitted on this Congestion Management project as the corridor will realize significant mobility benefits in return. ***To minimize safety concerns, we have constrained the HSR (and thus narrow shoulders) to peak hours and during incidents only. Other mitigation measures include enhanced pavement markings, additional delineators, shoulder rumble strips on ramps with decreased shoulder widths, roadside grading improvements, increased offset to fixed objects, dynamic lane signals, appropriate signing and paving with a safety edge.*** These will improve the motorist's ability to stay within the roadway, to recover if they leave the roadway, and reduce the severity of a crash if the motorist does leave the roadway.

2. **Lane Widths-** Due to sectional constraints in the existing two-lane section of IS 270 and at several pinch points at existing bridge structures, a narrower mainline or CD /local lane width will be implemented to maintain the required effective 12-ft. dynamic HSR shoulder width. **(See Appendix for HSR Plan Set and Pinch Point Typical Sections)** One example of this reduced typical section is along the SB CD lanes between Shady Grove Road and MD 28. In our proposed solution, the CD/Local lanes would be reduced to 11-ft. and the additional 2-ft gained would be allocated to the shoulder. An 11-ft. lane width can be found along urban interstates in many locations across the US. Where the mainline or CD/Local lanes require restriping, like the location indicated previously, microsurfacing will be laid across the entire width of the through lanes to cover and eradicate from view any remaining incorrect pavement markings **(See Appendix for PTC #11).** At pinch point locations, the left shoulder width would be affected, in combination with an 11-ft. through lane. AASHTO / MDMUTCD recommended tapers will be used wherever necessary **(See Appendix for HSR Plan Set and Pinch Point Typical Sections).**

   Using 11-ft. wide lanes on a highway section will be offset by significant improvements to the mainline capacity and mobility. Mitigation strategies are similar to the shoulder width mitigation, including enhanced pavement markings, additional delineators, shoulder rumble strips on ramps with decreased lane widths, roadside grading improvements where possible, and paving with a safety edge. These mitigation measures will provide advance warning, improve the motorist's ability to stay within the lane, to recover if they leave the roadway, and reduce the severity of a crash if the motorist leaves the roadway.

3. **Stopping Sight Distance -**there are some locations where the implementation of HSR will reduce stopping sight distances through horizontal curves. These are typically where additional roadway widening is not feasible or is cost prohibitive. ***Each location will be treated with warning signs, however, we have incorporated a CCTV-based hard shoulder clearance monitoring system into our proposed solution. This will provide continuous CCTV coverage for all HSR segments to ensure that all shoulders are clear prior to implementing HSR. If there is any obstruction, the HSR system will remain closed to vehicles.*** Ensuring that the HSR lane is clear prior to commencing shoulder running operations is a critical step in keeping motorists safe. Using a CCTV-based system provides an automated

methodology to verify shoulders are clear and provides CHART operators an alert if any objects are detected so that SHA can be certain the shoulder is clear prior to opening to traffic or during operations.

4. **Super-elevation** where the HSR is being implemented, the through lane cross slope will be carried across the shoulder. If the existing cross slope is designed to the minimum super-elevation for a horizontal curve, the resulting cross slope across the Hard Shoulder Running Lane could be substandard due to the smaller radius of curvature of the shoulder lane. A design exception for the super-elevation along the HSR section may be necessary and will be further evaluated during design. ***Mitigation measures that are already factored into our construction budget include advance warning signs with advisory speeds at sharp curves; additional delineation, including post-mounted delineators, chevrons, and barrier reflectors; enhanced pavement markings; and a new pavement surface will be constructed for the best possible skid resistance with a safety edge where feasible.***

5. **Acceleration/Merge Distances** while acceleration and merge distances do not require design exceptions, they are an important design element of an interstate highway, and the design criteria should be met wherever possible. With ramp metering and HSR installation, the criteria for acceleration length was sacrificed in some locations because the criteria for acceleration from a stop condition to highway speeds is much longer than the existing lengths available. Additionally, HSR utilizes the existing acceleration and deceleration lanes which decreases the length even more. W***herever possible, the existing shoulder adjacent to the acceleration lane will be used for acceleration. Substandard merge areas and acceleration lengths from ramps will be well signed utilizing warning signing and YIELD signs. It is also recommended that the speed limit be lowered to 45 mph in the CD lanes; however, as that is out of our control, we cannot propose it, except to allow for signing revisions within the budget.*** The lower speed limit would be closer to operating speeds, especially during peak periods, due to the reduced lane widths proposed above. The required acceleration lengths were recalculated using a lower operating speed than the design speed along the CD lanes, which decreased the length needed to meet AASHTO. In some locations though, the proposed configurations are still difficult to meet standards. The substandard locations will be well documented during design, and approval will be requested from SHA.

6. **Ghost Markings -**eradication of old markings leaves a scar on the pavement that can confuse motorists, especially in poor weather and low-light scenarios. The scars are confused with the actual pavement markings and can cause safety issues. ***To resolve the issue, a microsurfacing course will be implemented across all travel lanes wherever lane or edge lines are shifted to cover the old markings and mitigate safety concerns.*** In addition, the new surface course provides a revitalized pavement surface that will improve rideability, skid resistance, and reduce rutting offering a safety benefit in itself.

Implementing these mitigation measures will produce a safer IS 270 due to reduced congestion levels and reduction or elimination of breakdown traffic flows. It is well documented that more congestion is attributes to an increased crash rate along a corridor. Many of our mitigation measures are not currently implemented along the existing roadway and their addition as part of our project will improve safety immediately. Items such as additional delineation, a lower speed limit along the CD lanes, advance warning of sharp curves, and video detection of obstructions in the shoulder are strategies that can provide a much larger improvement in safety than the substandard feature requiring their implementation. This is because many of the substandard items (deficient shoulder width, deficient sight distance, deficient super-elevation) are due to the HSR – which will only be in operation during peak hours of congestion. All other times, these deficiencies are not present, but mitigation measures will still be installed, operational, and improving safety. By decreasing congestion and mitigating substandard elements, our proposed solution will result in a safer IS 270 corridor, reducing the frequency, duration, and severity of crashes.

The Corman | Parsons Brinckerhoff Team will improve mobility and safety along the IS 270 corridor by applying innovative technologies creatively. Together with our partner, Transmax Pty LTD, we bring proven technologies which have been refined over the past decade along freeways all across Australia. The Australian Managed Motorways solution they bring will tie together geometric and technology solutions familiar to SHA allowing them to work cohesively to reduce congestion and crashes.

4. Operability/Maintainability/Adaptability

4. OPERABILITY / MAINTAINABILITY / ADAPTABILITY

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Our real world **Proven and Innovative Solution** maximizes vehicle throughput and minimize travel times while improving safety, reliability, and regional economic vitality. This approach leverages effective practices, introduces ways to manage traffic considered new terrain for SHA, and streamlines it with proven experience and software already delivering improvements in other locations. Our proposal takes the following four established components and integrates them together for maximum value and results. Considered an international success on the Australian M-1 motorway, these components will be groundbreaking for SHA:

1. Provide additional **ITS Field Devices** to support Coordinated Highways Action Response Team (CHART) operations and travel information tools, and interconnect them with a robust communications backbone that supports existing and future applications and needs. ***IMPROVEMENTS:*** *Supplements existing SHA CHART initiatives to facilitate quicker incident response and clearance, which improves reliability and enhances safety.*
2. Use **Dynamic Hard Shoulder Running (HSR)** to provide an additional travel lane during peak hours, special events or non-recurring incidents. ***IMPROVEMENTS:*** *Reduces congestion and improves safety, mobility and reliability.*
3. Provide **Geometric Improvements** in selected locations. ***IMPROVEMENTS:*** *Improves capacity, traffic flow, and safety where the current configurations result in operational and/or safety issues.*
4. Provide an established next generation **Coordinated Adaptive Ramp Metering** System. ***IMPROVEMENTS:*** *Decreases the probability of IS 270 reaching breakdown traffic flow which reduces congestion and improves safety, mobility, and reliability.*

These four components will work together and are based on proven implementation in other locations that mitigates risk, optimizes the budget, and reflects long-term operability and maintainability needs. They will work in unison with the proven Australian Managed Motorways software and experience to improve the throughput on IS 270 while improving safety, reliability, and reducing recurring and non-recurring congestion.

Figure 13: Corman | Parsons Brinckerhoff IS 270 Innovative Congestion Management program

Entering unchartered waters here in the US, the Corman | Parsons Brinckerhoff Team proposes to utilize the real world tested and proven propriety Australian Managed Motorway Software. Developed by team member Transmax, a corporation wholly owned by the Australian Queensland Dept. of Transport, the operating system has been up and running on the M1 in Australia for 9 years and is credited with increasing vehicle throughput by 20%, reducing crashes by 32%, and is well received by motorists.

IS 270 INNOVATIVE CONGESTION MANAGEMENT PROGRAM

In addition to a robust field operational force of emergency traffic patrols and response units, Maryland's CHART program benefits from additional field devices to support the detection, verification, and response to incidents, the provision of travel information, and in limited situations, re-directing traffic for lane closures or major diversion needs, including speed detection systems, closed circuit television (CCTV) cameras, dynamic message signs (DMS), and road weather information systems (RWIS).

THE FIRST COMPONENT of our IS 270 Innovative Congestion Management program is to install additional **ITS Field Devices** which may also be used by CHART operators to assist responses. We will install additional CCTV cameras and DMS where gaps currently exist, in particular for areas with documented safety or recurring daily congestion issues. Installing additional advanced detection technology along IS 270 Northbound (NB) and Southbound (SB) will deliver game changing amounts of data, support other approach elements, and provide SHA with a heightened awareness of road conditions.

THE SECOND COMPONENT adds much-needed capacity during peak hours or during incidents or non-recurring congestion by implementing **Dynamic Hard Shoulder Running (HSR).** Our proposed HSR will be dynamic and able to open an additional lane to traffic based upon pre-set time of day or actual need. Our HSR will be SB from MD 109 to MD 121, then again from MD 124 south to approximately Tuckerman Lane. For NB, HSR will be from the merging of IS 270 and the IS 270 Spur North to Middlebrook Road. In contrast to a static time-of-day schedule for HSR, our dynamic approach continuously monitors conditions and uses real-time and ***anticipated*** congestion levels to determine whether or not to open the shoulder lane for easier travel. While peak-period capacity will be the primary function of the HSR system, off-peak needs may arise ***and the system can adapt to real-time needs, such as any emergencies or off peak congestion.*** We propose HSR will be initiated only after CCTV cameras visually confirm the shoulder is clear of stopped vehicles. While our system includes the generation of automated alerts regarding shoulder obstacles, the final operating procedures for opening and closing will be developed in close coordination with SHA and CHART operational staff.

Enhancing interchange and ramp traffic flow and safety is accomplished through ***THE THIRD COMPONENT***. Throughout our planning process, multiple **Geometric Improvements** were identified to improve flow and safety. Initial concepts ranged from reconstructing deficient interchange configurations so as to move vehicles off the mainline more efficiently, to simple extensions of acceleration lanes to reduce friction along the mainline. This proved to have a positive effect on traffic flow and safety, and aligns with the technological improvements proposed throughout the corridor.

Like all highways, IS 270 fails to function properly when flow breaks down from higher demand and turbulence. A maximum flow rate of 2,100 vehicles per hour per lane is carried on a typical interstate segment at 55 MPH prior to congestion saturation. However, as congestion occurs, average speeds and total volumes per hour are significantly reduced. Only 1,300 vehicles per hour per lane are typically passing through at 20 MPH, which is about a 40% reduction of the lane's full capacity. Hence, the highway is carrying only 60% of its capacity when it is needed most.

The ***FOURTH COMPONENT*** manages this flow breakdown by controlling access to the highway and synchronizing flow in an automated and integrated fashion to sustain flow rates closer to the facility's maximum capacity of 2,100 vehicles per hour per lane. Our ***Coordinated Adaptive Ramp Metering*** proposal enhances the other three more traditional components and is controlled and managed by the software proven in the Australian Managed Motorways system.

By utilizing intelligent data collection, communications and control systems, our Australian Managed Motorways solution synchronizes the flow of entering vehicles in real-time to those already on the facility to match the highway's operational capacity. Access is controlled at all on-ramps and highway interchanges of the corridor through ramp meters. Typically, ramp metering facilities involve individually-controlled ramps which do not work together as a system, and when the queues get too long, just flushes the retained ramp traffic onto the freeway. This uncoordinated system only increases the congestion along the mainline and negates benefits realized by ramp metering.

Our Australian Managed Motorways proposal incorporates advanced algorithms to predict the onset of congestion BEFORE it happens, and immediately controls access and coordinates queues and ramp waiting times across the corridor to avoid disruption to adjacent arterials.

Our Australian Managed Motorways proposal incorporates advanced algorithms to predict the onset of congestion *BEFORE* it happens, and immediately controls access and coordinates queues and ramp waiting times across the corridor to avoid disruption to adjacent arterials. It involves new concepts in entry ramp design that include physical improvements to ramp storage, discharge, and acceleration/merging to optimize the ability of vehicles to use the highway's available capacity while limiting impacts to mainline operations and adjacent arterials. This comprehensive demand and system management process improves highway performance regarding vehicle throughput, travel time and safety to maximize network efficiency.

Our proposed solution reduces total travel time from the IS 270 split to IS 70 in Frederick by 28% SB in the morning and 12% NB in the afternoon.

The Corman | Parsons Brinckerhoff Team's solution is built upon the foundation of an integrated package of ITS, dynamic shoulder utilization, intelligent ramp metering, and spot roadway improvements to maximize efficiency and throughput. It is enhanced by the Australian Managed Motorways system, including vehicle detection and data collection systems, coordinated adaptive ramp metering, incident detection, CCTV surveillance and strategic design considerations, such as on ramp queue discharge and storage, merge lanes, and expanded off ramps for increased exit/entrance flows.

If Active Traffic Management (ATM) is the *"next generation of ITS"*, utilizing existing tools more efficiently, then the Australian Managed Motorways is the *"next generation of ATM"*, applying advanced intelligence and coordinated adaptability, and viewing the corridor as a system. Looking ahead to the not-too-distant-future, our approach recognizes the evolution of transportation operations and traffic management and provides a solid foundation for the *"next-next generation"* which is currently unfolding in terms of connected and automated vehicle systems. It provides motorists with immediate benefits while setting the stage for the SHA to capitalize on future trends and opportunities.

Figure 14: IS 270 Innovative Congestion Management Solution covers the next generation of approaches and sets the stage for the ultimate Connected and Autonomous Vehicles (CV/AV) scenario

SPECIFIC BENEFITS OF OUR PROPOSED SYSTEM

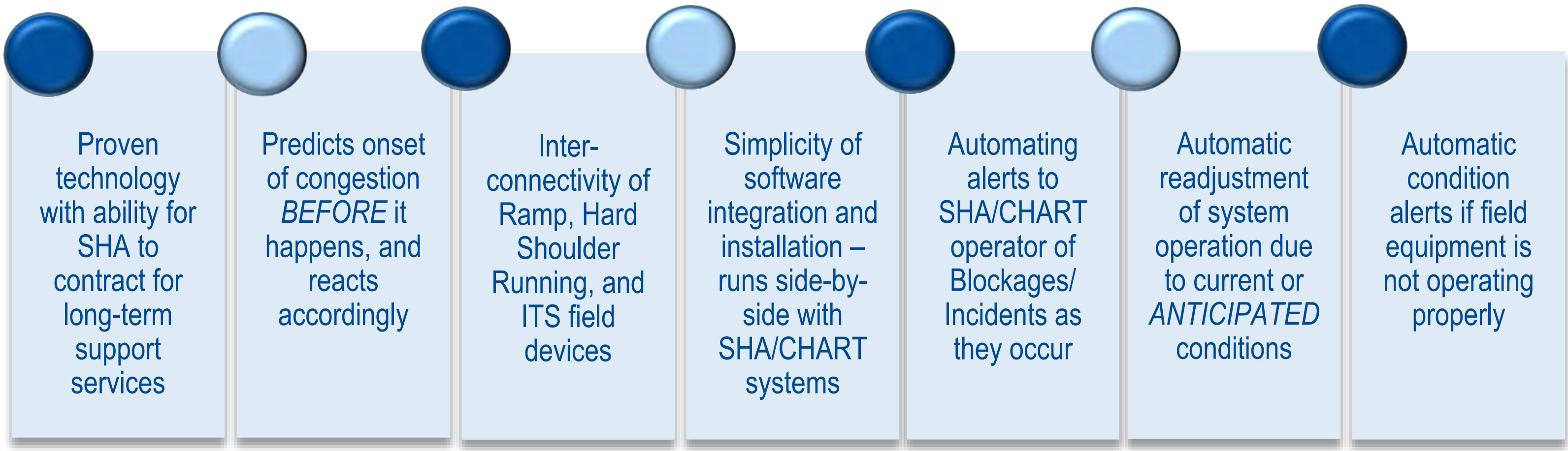


Figure 15: Specific benefits of our proposed system

i. Maintenance requirements of our improvements, focusing separately on the pavement and non-pavement elements of the plan. Address the personnel and equipment requirements after construction is completed.

MAINTENANCE IMPACTS OF ROADSIDE IMPROVEMENTS

Maintenance of the *"On Pavement"* and innovative roadside technology components in our solution set will not be a significant leap from current ITS and roadway maintenance practices within SHA. A program already exists to maintain ITS devices and SHA/CHART already has a robust approach to measuring the performance of their maintenance activities and currently achieves a high level of device availability (95.6% to 100% availability). Our objective in selecting, installing, and testing the devices and transitioning the program over to SHA is to provide equipment that will continue to operate at the same high level of reliability with limited maintenance.

An important criteria in selecting devices is to consider using the same equipment or replacement equipment most closely related to existing CHART devices. Another criteria is to select devices already compatible with the software that will control them. In general, our engineers will consider all the variables with emphasis on long-term maintenance, including:

- ➔ Selecting equipment vendors from a list of established firms, considering capability and experience for long-term support provided by their technical staff as well as the vendor's past experience with SHA.
- ➔ Considering designs, such as walk-in DMS and non-intrusive roadside-mounted equipment to minimize lane closures for regular maintenance. Where possible we intend to match existing SHA equipment specifications.
- ➔ Co-locating devices where operationally feasible to reduce the number of equipment cabinets and power/communication connections
- ➔ Using LED signal heads for ramp metering to increase life expectancy and to conform with Maryland's statewide push to convert signals to LED
- ➔ Utilizing LED luminaires for new roadway lighting installations.

Our Managed Motorways IS 270 Innovative Congestion Management **Proven and Innovative Solution** includes a number of devices/components that require preventive maintenance in addition to real-time maintenance should a failure occur. The following list describes those components and provides an estimate of maintenance needs.

Equipment Maintenance:

- **Closed Circuit Television (CCTV):** To ensure system up-time and reduce training needs for maintaining CCTV we will conform to existing SHA and TRANSMAX design standards/specifications and approved device vendors where feasible. We recognize there may be opportunities to improve upon current conditions and will meet with the SHA Communications Division and Traffic Engineering Design Division to solicit their input, and if possible, take advantage of the opportunity to advance the current state-of-the-practice. Preventive maintenance, in general, will include regular visits to check PTZ gears and clean camera lenses, check wire connections, and perform related cabinet maintenance. Camera location will dictate how much (if any) traffic control will be required. As part of our **Proven and Innovative Solutions**, we will also deploy fixed field of view CCTV cameras along any shoulder that is included in the HSR scheme. Because these cameras will be fixed (no PTZ), there are fewer points of possible failure which improves the system up-time and reduces maintenance needs.

- **Detection:** Different types of detection technology will be deployed based on specific needs by location, including in-pavement wireless magnetometers and non-intrusive infrared detectors. ***Devices selected will be those that have a proven track record of integrating with the STREAMS® software.*** Because some devices will be new to SHA maintenance personnel, we will provide information on device maintenance strategies recommended by the vendor, as well as best practices in other agencies around the world. In locations where in-pavement wireless magnetometers are utilized, thoughtful coordination with re-paving and milling operations is necessary to ensure the devices do not get milled without advance planning. Where non-intrusive infrared detection is deployed, thoughtful monitoring during snow build-up situations is necessary to monitor whether or not special clearance is required if Mother Nature does not resolve the blockage. Of all the components recommended in our solution, detection presents the largest number of new devices in the CHART network. However, our approach includes careful selection of proven devices and reliable vendors, and a remote monitoring system as part of the back-office software to raise awareness of any potential issues.

  The STREAMS® software that will be managing the detection devices has failure notification functionality, which will provide operations and maintenance staff with an immediate awareness if detection data suddenly becomes unavailable and a mitigation strategy can then be deployed

  We recommend scheduling a regular detection visit to check the roadside infrared device and clean the lenses, check wire connections, and perform necessary cabinet maintenance. For the in-pavement magnetometers, a visual inspection of in-pavement devices along with the regular cabinet maintenance routine will complement any known deficiencies uncovered through the software monitoring system.

- **Ramp Control Signals:** Our strategy includes conventional signal heads mounted roadside or overhead just before the merge point for on-ramps, in support of our "state of the art" Coordinated Adaptive Ramp Metering scheme. To maintain ramp signals, we will use signal heads familiar to the SHA signal shop and rely on existing SHA design standards, specifications and vendors for these installations. As noted, we will also install LED signals to reduce mean time between replacements and reduce preventative maintenance requirements. Preventive maintenance visits will include checking the signal housing and cleaning lenses, checking wire connections, and related cabinet maintenance (Note the cabinets will in most instances be co-located with detection devices/controllers, allowing multiple preventive maintenance activities to take place in a single visit).

- **Dynamic Message Signs (DMS):** The SHA already has experience with the operation and maintenance of DMS with hundreds deployed statewide, and this project will include additional DMS to fill existing gaps in coverage and provide additional motorist information. To ensure system up-time and reduce training needs for maintaining DMS, we will conform to existing SHA design standards, specifications and vendors for these installations.

- **Shoulder-Only Lane Control Signals (LCS):** In support of dynamic HSR, a single overhead LCS will be employed with the express purpose of only displaying a green thru arrow, yellow merge arrow, or a red "X". Signs will be placed at every entrance location, and at approximately ½ mile intervals in between interchanges. SHA has experience maintaining conventional lane control signals, which should minimize any learning curve with the addition of these devices. Vendors providing devices to SHA suggested that with intermittent use, the LED blank-out signs can last more than 20 years without replacing; even when continuously burning, they will last "in excess of 10 years" according to SHA and vendor experience.

- **Equipment Cabinets and Communication Hubs:** A number of ITS devices will be connected at the same cabinets. For example, cabinet locations for in-pavement magnetometers and the infrared detectors will most likely coincide with cabinet locations for ramp metering equipment, allowing maintenance personnel to accomplish multiple preventive maintenance tasks in a single visit. For cabinet maintenance, specific locations will dictate how much traffic control is required—closing just a shoulder vs. having to close an entire lane will have an impact on equipment needed (arrow boards and an attenuator truck vs. simply placing cones along the shoulder). A typical cabinet and communication hub maintenance visit will include checking wire connections, making sure the heater/fan are functioning, a quick review of communications connectivity and relevant controller functionality, and vegetation management around the cabinet, including any graffiti removal.

Roadside Device Maintenance Costs: Until we have specific device locations, quantities, and vendors, it is impossible to estimate costs with any kind of reliability. Two examples of corridor deployments that could provide a frame of reference might be ATM deployments in Minnesota and Washington. For example, as part of its Urban Partnership Agreement to reduce congestion on I-35W South, the Minnesota Dept. of Transportation (MnDOT) deployed ATM strategies, including intelligent lane control signals and transit and highway travel-time dynamic message signs as ITS technologies contributing to congestion reduction. The system had 174 lane control signals on gantries spaced every 0.5 miles on I-35W from Burnsville to downtown Minneapolis. The agency estimates they spent $300,000 annually on Operations & Maintenance costs for this ATM system. In Washington State, there are three facilities with ATM and the agency budgets $317,000 annually for each. According to WashDOT, maintenance on their ATM involves annual visits to clean, test, and replace parts. Maintenance also repairs malfunctioning signs, maintains communications networks, and pays electricity costs.

MAINTENANCE CONSIDERATIONS OF NON-ROADSIDE IMPROVEMENTS

Our devices in the field will be connected to the MDOT Enterprise Network through the fiber cable connections identified by Maryland SHA in the response to PTC # 13 and Question #47. From there, the additional ITS devices already familiar to CHART (e.g., CCTV and DMS) will connect back into the SOC or TOC for control and operation. Any additional back-office systems for that linkage will be located in the SHA Hanover State Operation Center (SOC) or at the MVA Glen Burnie Data Center. Utilization of existing vendors and technology as well compatibility with the STREAMS® system will be paramount to minimize any disruption in maintenance practices for CHART personnel and to ensure greater system availability (up-time).

Devices new to CHART- including the ramp metering and HSR devices - will be connected back to our partner Transmax to integrate into their STREAMS® software package, reducing the need for SHA to consider any maintenance concerns after initial installation and burn in. Beyond the contract period, discussions will need to take place beginning with whether or not SHA wants to continue to maintain access to the STREAMS® software or seek to integrate the new devices and develop algorithms for inclusion into its own CHART ATMS software. Device connectivity can be maintained indefinitely with Transmax provided that subsequent to the completion of our contract, a separate agreement with Transmax covering ongoing service is executed. If SHA chooses to seek integration into CHART, a new system architecture for field devices will need to be developed separate from our contract in consideration of how to connect into the operating system and "hand-off" from the proposed connectivity scheme. We believe continuing the ability to utilize Transmax progress in upgrading the software with lessons learned from existing Australia installations as well as the new installations currently planned by Transmax and Parsons Brinckerhoff in Georgia, Colorado and Utah offers SHA unique benefits they would not be able to obtain if they purchased the software outright and ran it independently. However, we also respect the SHA's independence to decide subsequent to our contract, whether or not it would like to integrate the functionality into its own software.

Non-Roadside Maintenance Costs: Much like our roadside device cost estimates, until we have specific design factors completed, quantities, and vendors selected, it is impossible to estimate costs with any kind of reliability. However, our proposal suggests the possibility of leasing and support for the STREAMS® software package, and that cost is estimated to be approximately $1.5 million annually based on our current proposed implementation of devices, including license, upgrades, support, and maintenance fees. Additional functionality is extra.

MAINTENANCE CONSIDERATIONS OF GEOMETRIC IMPROVEMENTS

As for the standard geometric Improvements, maintenance requirements should be fairly minimal, and in some cases would actually reduce the need for maintenance. Any pavement widening will require a slight increase in snow plowing operations. In the case of Hard Shoulder Running, the pavement widening required in most locations was due to the inclusion of emergency turnouts. These turnouts during, or in preparation of, a snow event, could be used as a staging area for plows. In most times of snow emergency, the dynamic shoulder-use would not be activated, and it would still be available for staging. In those instances when the shoulder is not open, a 12 ft. wide shoulder will be available to stage vs. the existing 10 ft. wide shoulder creating a safer scenario. However, in times of preparation for storms anticipated during the peak period with the shoulders in use, it may be necessary to use the turnouts for staging.

Maintenance access to locations is often a forgotten aspect of design. Almost every element in geometric design needs to have some sort of maintenance activity and access to perform that maintenance needs to be considered. Roadside grading for this project will be designed for ease of maintenance wherever possible for grass cutting and proposed linear SWM maintenance. Access locations through the w-beam barrier will be provided within reasonable distance. Should any structures be required, including culverts, retaining walls, and other structures, access for inspections and maintenance activities will be considered as much as possible.

Through much of the limits, a microsurfacing course will be applied to eradicate the ghost markings and provide a smooth riding surface. This surface treatment not only improve skid resistance and cover ghost markings for Safety benefits, but it will also extend the life approximately 7+ years allowing SHA to push out the next resurfacing scheduled for the location. This is a huge maintenance benefit because that portion of the operations budget can be put towards other needs until the microsurfacing course starts to break down.

From an adaptability standpoint, storage distances were designed to exceed the existing traffic volumes and queues and therefore speaks to the adaptability of the corridor to adapt to a growing traffic environment and handle future traffic as the volumes steadily increase.

OTHER MAINTENANCE CONSIDERATIONS

Maintenance of Strategies: In addition to maintaining the physical infrastructure and electronic components, a need also exists to maintain the strategies themselves to keep them operating at maximum efficiency. Traffic volumes and patterns change over time, and to keep the Managed Motorways system operating at its maximum efficiency, agencies need to have procedures in place to keep strategies *"fine-tuned"* to changing traffic conditions. Maintaining these strategies will provide continual improvements to the operations and efficiencies of the system, thus extending the benefits of our **Proven and Innovative Solution** approach. Examples of strategy maintenance activities we recommend include the following:

- ✓ Recalibration of algorithm thresholds.
- ✓ Re-optimization of traffic signal or ramp signal timing plan parameters.
- ✓ Development of special response plans to be activated during emergency or special events.

Asset and Configuration Management: Our approach emphasizes device availability to ensure maximum benefits are being delivered to SHA/CHART. An important component in delivering the benefits of Managed Motorway strategies is configuration management. Configuration management (CM) is a systems engineering process for establishing and maintaining a product's performance, functional and physical attributes with its requirements, and design and operational information throughout the life of the system. With the potential for software and firmware adjustments to play a significant role in the operational integrity of today's electronic components a traditional Asset Management system is no longer sufficient—you need to capture version control, upgrade status, telecommunications connectivity, and most importantly data transmission integrity. It's no longer good enough to simply be aware if a device is on and transmitting - you need confirmation that the device is transmitting GOOD data. The STREAMS® software provides that information and alerts the operator when devises in the field malfunction.

Staffing and Maintenance Training: As noted earlier in this section, it is our contention that maintenance of the innovative technology components in our proposed Managed Motorways system will not be a significant leap from current ITS maintenance practices within SHA. While some additional training and resources will be necessary for the actual device maintenance, the biggest potential gap from current expertise is in the operational experience in utilizing and "fine tuning" the ramp metering and lane control signals. An important component of training for maintenance will be the Operations & Maintenance Manual that will be provided and will include guidance on recommended device and back-office maintenance expectations, proposed frequency for preventative maintenance, and key considerations for future replacement devices or components. We expect existing SHA communications and ITS maintenance personnel will be more than qualified to handle these additional devices with the appropriate training and vendor guidance.

ii. Compatibility and integration of our improvements with current transportation infrastructure, including CHART's system.

The current CHART operational strategy is focused primarily on detection, verification, and response to incidents, the provision of travel information, and in limited situations redirecting traffic for lane closures or major diversion needs. The current CHART software manages cameras, detectors, dynamic message signs, and road weather information systems. However, planned improvements to the software and operational dynamics within the agency have rapidly begun trending in the direction of additional operational control and traffic management mentality. The inclusion of next-generation decision support system algorithms have dominated recent software updates, and a culture of transportation systems management & operations (TSM&O) has resulted in a desire to consider more integrated corridor management approaches. Introducing our proposed IS 270 Innovative Congestion Management solution to the operation is not a significant stretch by any definition, and will most instances be welcomed by operational and systems personnel.

Our **Proven and Innovative Solution** will include tools CHART is already familiar with - to provide additional detection, surveillance, and DMS that will further enhance existing incident management and travel information capabilities. And, as mentioned previously, our approach will also introduce a stronger component of real time operational control accomplished through the addition of tools new to the state, such as ramp meters and shoulder lane control signals to support hard shoulder running, along with the Australian Managed Motorways software and expertise.

Our solution will also include an existing proven Managed Motorways software package to manage the devices new to CHART, and to incorporate the management software and algorithms necessary to implement the coordinated and adaptive ramp metering operational schemes that will have a huge benefit to throughput along IS 270. This will allow us to leverage a proven and currently operational solution from Australia and rapidly deploy the benefits along with projects being implemented in Colorado, Georgia and Utah by Transmax and Parsons Brinckerhoff, rather than trying to seek full CHART software integration and testing before "flipping the switch." This approach maximizes the benefits realized by our solution while minimizing both risks and the costs of customizing and deploying our software solution. Our approach is to utilize the existing Managed Motorways software "side-by-side" with CHART for a period of time. We also propose during the integration and training period of our contract the inclusion of our staff support inside the SOC or Traffic Operations Center during peak periods to train / operate side-by-side with CHART's Highway Operations Technician (HOT) operators during our contract period.

This strategy will allow immediate deployment of a proven traffic management solution and give CHART leaders time to evaluate a long term software and operational integration strategy for the Managed Motorways component in our system. Following the initial deployment period SHA can engage the existing CHART software contractor (CSRA) to evaluate whether or not they wish to incorporate the appropriate components and drivers within their system to accommodate the new devices and algorithms—or if they wish to negotiate subsequent to our contract completion a software servicing arrangement with TRANSMAX to continue utilizing components of the STREAMS® software package.

We propose that once installed the initial software technical support, training, for SOC (or TOC3) staffing will be included within the scope and schedule of this contract. After the contract period, the SHA may also wish to add positions to its existing outsourced HOT contract to take over operations. In the event you wish to take ownership of the software in the future and integrate with CHART that would be handled outside the scope and schedule of this contract.

This iterative approach should be intimately familiar to CHART and SHA management—it is a replication of how the Statewide Operations Center and original CHART ATMS software were launched in August of 1995. At that time the SHA contracted with a private consulting firm to customize an existing software package (in use throughout the Los Angeles region), recognizing that they would eventually create their own system once they had an opportunity. The goal was to provide immediate benefits to the citizens of Maryland while learning what their specific operational needs might be for future software functionality. It was through the participation and engagement of the operational staff that the current CHART software was crafted, reflecting real-world needs here in Maryland. The Corman/PB team includes a senior engineer who was part of that original process and will ensure we thoroughly engage and benefit from operational lessons learned both then as well as now.

Our approach is also influenced by mountains of evidence and experience that show the development and testing of custom software can be a time-consuming and risky endeavor which costs money and causes delays in project delivery. By installing an existing proven software package which has been used for more than 6 years in a real-world environment, the cost and schedule risks are greatly reduced. The side-by-side period is intended to provide sufficient engineering support to also ensure that ramp meters are being constantly "tuned" for better efficiency, and CHART personnel are being trained on this process so they can take it over at the conclusion of the contract period. This approach will deliver mobility, safety, and efficiency benefits to commuters immediately, and any back-office computing and operational issues will be transparent to them

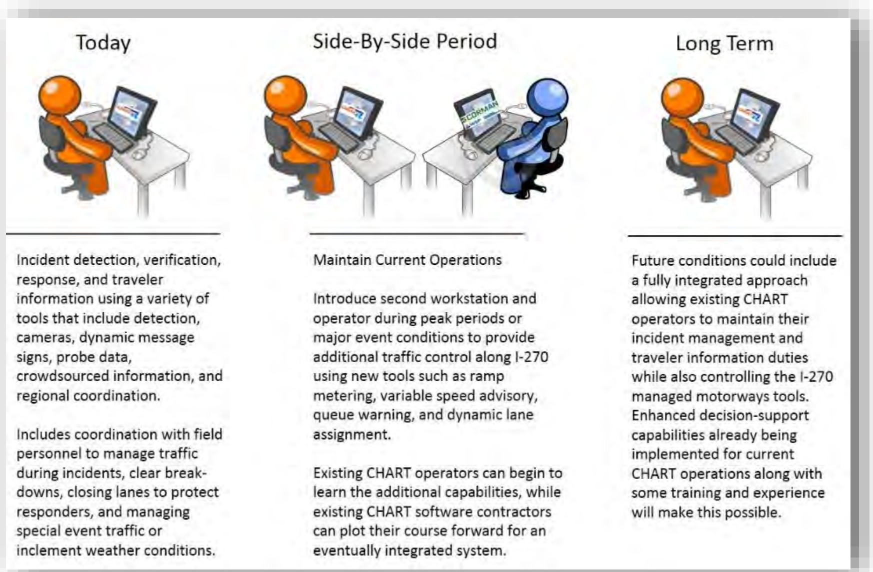


Figure 16 - Side-by-side operation being proposed

Figure 16 presents a graphic representation of our proposed operational approach, depicting current conditions along with the proposed side-by-side period that would occur during the initial software deployment. The long term represents a time period after conclusion of the contract.

Given the flexibility and cloud-based architecture of both the current CHART software and the proven STREAMS® software being proposed, the peak period operations could take place at TOC 3 or the SOC. However, since the road network will need to be managed at the SOC during off-peak periods when TOC 3 is not live, we recommend the entire program be managed out of the SOC. We are aware of an upcoming renovation of the SOC with temporary operations planned during the construction period, but we are also aware that the process and timeline for that rehabilitation may be delayed based upon funding and final design approvals and will therefore work closely with CHART personnel to implement the most logical solution from an operational standpoint.

iii. Innovative technologies or techniques we will implement and the proposed plan and requirements for maintenance and operations and adaptability to future transportation technological advancements. How will we ensure that the newest innovations are incorporated into the design prior to agreement of a Construction Agreed Price for construction?

Technology continues to advance at break-neck speed. A number of different futurists have provided memorable quotes about this technology "revolution" going as far back as 1965 when Gordon Moore (who later founded Intel) proclaimed that the number of transistors in an integrated circuit doubles approximately every two years. This went on to famously be known as Moore's Law. Today we recognize that advances in computing hardware, software, and telecommunications capabilities continue to evolve at a very rapid pace which makes the deployment of ITS solutions challenging—especially in an environment where procurement cycles and large-scale deployments often require longer life-cycle installations.

ADAPTABILITY CONSIDERATIONS

Our process for selecting specific devices for installation will focus on providing the maximum safety and congestion-relief benefits to motorists, while also taking into consideration the long-term operational and maintenance factors that will impact their effectiveness and their adaptability to new advances in technology. In order for a device or technology to be considered "future proof" it must be capable of handling applications and functions that have not been thought of or developed yet. But how is that possible? Many purchasing managers and IT departments might question how a device can handle a request that has not yet been conceived, but this is the essence of future proofing. There are three core components that make a technology future proof. They include: connectivity, over-the-air updates, and security.

1. Connectivity - The first key to future proofing your technology is for the device to be connected to the internet. Our proposed communications architecture features primarily hard-wired networks using fiber, and where necessary for first/last connection some measures of wireless. But more importantly the architecture is intended to put the devices on the MDOT Enterprise Network where there is both direct connectivity in addition to cloud connectivity (with appropriate security considerations). An easily accessible, direct and cloud-based solution allows the device to receive and report real-time status that encompasses a contextual functionality; we want to know if the device is transmitting useful data, not just turned on or off.

2. Over-the-Air Updates - The second key to future proofing technology involves the ability to provide over-the-air software updates to the device. Initially, this may seem like an extension of the connectivity, but the ability to update software remotely is what makes this a very distinct and unique feature. This method of updating simplifies software upgrades, bug fixes, and allows for the easy addition of new features and functionality. Our device controllers in the field cabinets will be selected with this variable in mind, and the Managed Motorways software, by nature of its cloud-based operation, will have the ability for updates directly at the point of origin with the developers. As noted in Connectivity, it is important that the appropriate firewall/security considerations are designed in to the solution up-front, and the successful operation of STREAMS® in Australia for more than a half dozen years are proof that developers are constantly enhancing and targeting effort toward keeping it safe and secure.

3. Security - A third, but often overlooked, requirement for future proofing is security. The increased ability to access the device presents its own security challenges which need to be addressed prior to purchasing a system. Historically, most transportation technology deployments relied on complexity to secure the system, but as technology becomes web-based, security factors have to be looked at from a different perspective. Electronic locks, instead of keys, on physical equipment are also a simple and smart way to increase security. Our approach will consider multiple layers of user security to minimize the potential for bad actors to gain access.

As the authors of the recent FHWA report "Impacts of Technology Advancements on Transportation Management Center Operations," engineers at Parsons Brinckerhoff have identified and analyzed the potential impacts due to technology advancements in the next 10 years, we have considered successful practices and strategies for agencies to best position themselves for maximum benefit, and have even presented tools that public sector managers can use to build the internal, technological, and broader agency framework that supports successful utilization of emerging technologies and related trends. As we approach the Construction Agreed Price milestone it will be critical to freeze the device deliberations - which opens the door for questions of ensuring the newest and greatest innovations are incorporated into the design. Those lessons learned will be included in our equipment selection and operational strategies from the very beginning of concept design and follow-through to the conclusion of integration and operation.

In addition to adaptability to specific changes in device technology, our emphasis on installing a robust communications network to support the Managed Motorways solution will also have a tremendous impact on the state's ability to likewise progress into a not-so-distant future where the *connected vehicle environment* will complement the infrastructure-based solution.

In the coming years, motorists will have a number of potential connected and automated vehicle applications to assist them in moving through the corridor. A common question is whether or not these forthcoming applications eliminate the need for infrastructure-based devices - similar to the devices we have included in our system of solutions approach. The fact remains that connected & automated vehicle applications are not available yet today, and given the life cycle of existing technology and development cycle for new technology it is prudent to continue on our current path forward. However, it is also helpful to understand how potential mobile and/or vehicle-based applications might interact with our planned deployment and how it might impact drivers.

Maryland Department of Transportation

5. Well-Managed Project

5. WELL-MANAGED PROJECT

i. Key elements of our Project Management Plan: Communications, Coordination, and Risk Management

A project's success relies on planning, communication, coordination, cooperation, and the capability to do the work. The Corman | Parsons Brinckerhoff Team has collaborated on several award-winning projects in Maryland, validating our ability to deliver an exceptional product within the contract limits. Once selected, as one of the first orders of business, we will develop a Project Management Plan (PMP) to meet or exceed the goals within the project constraints. The PMP for the IS 270 Innovative Congestion Management program will be a written document provided to project staff which defines the goal, team organization, internal/external communication protocols, deliverables, contractual requirements, schedule, required approvals, and third-party interaction. Key elements of the Project Management Plan include:

- **> Communication**
- **> Schedule Adherence**
- **> Risk Management**
- **> Quality Management**
- **> Minimizing Impacts**
- **> Coordination**

COMMUNICATION AND COORDINATION

The first foundational element is open and honest communication between the Corman | Parsons Brinckerhoff Team, SHA, FHWA, Counties, utility companies, review and regulatory agencies (including M-NCPPC, MDE, DNR, ACOE), local stakeholders and businesses, and motorists. Information sharing will be broken into three groups: 1) internally within the Corman | Parsons Brinckerhoff Team, 2) between SHA and the Corman | Parsons Brinckerhoff Team, and 3) with outside stakeholders.

Information will be shared ***internally*** amongst design-build team members through *"ProjectSolve" (*Parson Brinckerhoff's private file sharing site) during design, and through Corman's *"Viewpoint"* during construction. Submittals and other data will be shared ***externally*** (SHA and approved third-party stakeholders) through the *specified ProjectWise or Aconex* systems. On our current SHA Design-Build and Construction Management At-Risk projects, we use this same dual system approach (SHA-selected system and In-house Share Point Software) to great success. Aconex project management software will be purchased with unlimited access for the duration of the contract to be used by all parties for document management, collaboration, and project management***. We assume SHA's intent is to replace the ProjectWise system with the Aconex Management Software; however, we will work with either one as directed.*** Stakeholders, at SHA's discretion, will be given access to appropriate sections of the project team's software. Available information through the web-based databases include:

- ✓ Meeting minutes
- ✓ Preliminary concepts through final design plans
- ✓ Cost estimates
- ✓ Schedules and schedule information
- ✓ Spreadsheets showing status of design reviews, utility relocations, ROW acquisition, permitting, RFIs, etc.
- ✓ Communication with internal/external stakeholders
- ✓ Risk register
- ✓ Other information needed to collaborate, share and manage the project

ii. How our Work Plan will develop the project design internally within the Corman | Parsons Brinckerhoff Team and collaboratively with SHA and other stakeholders to advance the project goals. Discuss services we will provide and how we will provide design quality control and quality assurance.

Electronic databases are not a means to replace face-to-face meetings, web-based meetings, or teleconferences– direct communication methods that foster clear and concise transfer of information and opinion gathering. These online resources are meant to supplement direct communication and act as a valuable tool for version control.

For communication and coordination internally within the team, as well as external with SHA and stakeholders, we propose the following regularly scheduled meetings – those during the Design and Pre-Construction phase are labeled **D/PC** and those during the Construction Service phase are labeled **CS.** Additional telephone calls, "Go to Meetings", and/or face-to-face meetings will be implemented as required to keep the project on track.

1. **Weekly with SHA Project Manager (D/PC & CS):** Discusses status of the design/construction, submittals and reviews, meeting SHA's goals and objectives, upcoming schedule and stakeholder outreach, etc.
2. **Weekly between the Design | Construction Integrator (DC/I), Construction Manager (CM) Lead Estimator, and Design Manager (DM) (D/PC):** Held in the designer's offices to schedule/coordinate design with construction estimate, means and methods and coordinate independent design elements. Each participant reports progress made in their areas of responsibilities during the past period and forecasts progress expected during the next periods.
3. **Monthly Partnering/Progress Meetings with SHA and Selected Stakeholders (Counties, permitting agencies, Community Groups, CHART, etc.) (D/PC & CS):** – A former SHA *"Partnering Coordinator in Design"*, Matt Harrell, PE, is a team member who will help SHA's Partnering Coordinator facilitate partnering during the design stage. Agendas and goals will be developed weekly and will vary depending upon the project status and issues at that time.
4. **Construction Progress Meetings (CS)** will be held weekly. Our field staff of managers, engineers, foreman, and superintendents will explore opportunities to improve efficiency, quality, and shorten the schedule Tracked and monitored items include: RFIs; design enhancements/modifications, shop drawing status; material submittal, approval, and delivery schedules; Non-conformance Reports, and design/construction submittals.
5. **Public Relations Meetings (D/PC & CS):** The Corman | Parsons Brinckerhoff Team knows the importance of keeping stakeholders informed on progress and potential impacts. Public Relations/Outreach Coordinator Odessa Phillips, PE of Assedo Consulting, LLC (Assedo), will be the liaison between the Corman | Parsons Brinckerhoff Team and the public to facilitate communication during design/construction. Corman has a history working with Assedo in the same capacity on Design-Build Intercounty Connector Contract A.

   Odessa has already prepared a robust Public Outreach Program **(See Table 10)** which includes an SHA website, e-mail, mailers, an 800 number, etc., along with *"Pardon our Dust"* meetings prior to construction and major MOT changes. If approved by SHA, we will invite school transportation departments and EMS responders to answer any questions about project status, schedules, and construction phasing. Assedo will work with SHA so community voices are heard, concerns resolved. Education is also important, as some improvements are new to Maryland. It is important to get out in front of the project, reach out to the people who will use these new improvements, and educate them as to what is to be expected, how they work, and what benefits can be anticipated.

ROBUST PUBLIC OUTREACH PROGRAM	
Pre-construction Mobilization	Identify key stakeholders
	Create stakeholder database
	Prepare public outreach plan
	Prepare social media plan
	Create correspondence templates
	Create social media presence
Pre-Construction Coordination	Coordination meetings with SHA
	Coordinate educational materials for project elements
	Coordinate and develop A/V clips for educational purposes
Collateral Materials	Develop educational materials for project elements
	Create PowerPoint presentation
	Create meeting boards
	Prepare webpage messages/updates
	Develop podcast and webinar materials
Public Meetings, Webinars	Informational workshops (project hosted)
	Perform webinars
	Community meetings (community hosted)
	Elected officials briefings
	Public meeting logistics (Identify sites, book, meeting signage, production)
Correspondence	Create & issue MOT message templates
	Implement social media plan
	Draft responses to public correspondence
	Update outreach database
	Monitor media and respond, as appropriate

Table 10: Robust Public Outreach Program

6. **Schedule Meetings (D/PC & CS)** will be held monthly and at required milestones to update the full project schedule and short term three week look-ahead schedule, review planned vs. actual progress, identify status of SHA and third-party stakeholder reviews, permits, ROW acquisition, utility impacts, predicted weather, material requirements, etc., identify and plan upcoming equipment needs, material deliveries, and labor resources, and develop work plans for the

upcoming week. The three week look-ahead schedule identifies upcoming work, production goals, Quality Control review or testing needs, equipment and labor resource requirements, subcontractor schedules, and major material delivery dates.

7. **Quarterly Formal Partnering Meeting (D/PC and CS):** The Corman | Parsons Brinckerhoff Team will encourage formal partnering on this innovative project.
8. **Quarterly Partnering Check-ins (D/PC and CS)** by an external facilitator with project staff following the first formal Partnering Meeting.
9. **Weekly Foremen's Meetings (CS)** will discuss the schedule, quality, ROW and Utility status, coordination and material delivery, labor and equipment needs.
10. **Morning Huddles (CS)** with crews to set the safety and production goals for the day. Corman has recently instituted additional safety huddles during the work day to keep safety at the forefront of everyone's thoughts and actions.

In addition to the regularly scheduled meetings above, Design/Construction task force teams will meet to plan, implement, and/or resolve issues in their specific disciplines, including

- ✓ Quality
- ✓ ITS /Managed Motorways Technical Integration and Communications
- ✓ CHART Operational Integration
- ✓ MOT
- ✓ ROW
- ✓ Utilities
- ✓ Estimating
- ✓ Public Outreach / Driver Education
- ✓ Others as required

As successfully proven on the Intercounty Connector and other mega or complex projects, SHA and stakeholders will be invited to attend task force meetings regularly to ensure communication is not just within the design-build team, but shared with SHA, their reviewers, and stakeholders. Additional meetings may include:

1. **Design Constructability Reviews** led by the DC/I, CM, and DM, constructability reviews will be performed by the Corman | Parsons Brinckerhoff Team, subcontractors, and suppliers to evaluate the plans for cost effectiveness, material availability, and constructability. We will provide formal review comments to the design team that will track and assign a champion and date for resolution. We will internally review submittals for constructability and compliance with quality metrics before forwarding to SHA for review/approval.
2. **Pre-application/Interagency Meetings** with SHA and permitting agencies to ensure required permits are identified up front and accounted for in the schedule and resolve design or other unclear issues early on.
3. **Preconstruction Practical Design/Value Engineering Review Workshop** led by our in-house FHWA trained facilitator will be held prior to developing the CAP plan set. This collaboration between the design team, SHA, and construction experts will generate innovative ideas and enhanced concepts that maximize budget, reduce schedule and future maintenance issues, and improve mobility and safety throughout the project.
4. **CHART Coordination and Equipment Selection Meetings** with designers, contractor, SHA and CHART personnel for compatibility of systems, integration and equipment with existing and proposed SHA and CHART deployments. To decrease risk and cost associated with the STREAMS® software deployment, only STREAMS® and SHA pre-approved devices are proposed to be utilized. Design and pre-construction issues will be identified and monitored through these tracking aids:
   - ✓ **ROW Acquisition Tracking** spreadsheets showing progress of properties being acquired by SHA
   - ✓ **Utility Conflict Matrix** identifying the type and location of potential utility impacts, mitigation status, need for relocation, schedule, and responsibility of relocation design/construction, including status and sorted by utility
   - ✓ **Permit Tracking** spreadsheets showing permit requirements, schedule and commitments, sorted by review agency
   - ✓ **Review and Approval Tracking Spreadsheets** of submittals

As part of the PMP, we will identify stakeholders with pending/ongoing projects or sponsored events within and near the project. Major SHA projects known at this time are the Watkins Mill Interchange and MD 85 (Buckeystown Road) Interchange Reconstruction. A major developer project at the MD 121 Interchange has also been identified. Other projects from Montgomery or Frederick County, WSSC, utilities, and private developers will be identified and outreach initiated to ensure coordination of projected schedule and actual construction activities. We will communicate with them to pinpoint conflicts and work toward beneficial solutions.

RISK MANAGEMENT

The Corman | Parsons Brinckerhoff Team will employ the Construction Management Association of America's (CMAA's) endorsed approach to Risk Management through a *"Risk Register"* which includes a formal list of identified risks, potential project impacts, and mitigation strategies. Successful Risk Management considers risks throughout the project's life and delivery processes. The team's risk management has already commenced, the process will continue throughout design/construction, and as issues unfold, be dynamic as the team responds to changes in an organized and proactive way.

Figure 20: Risk Management Plan

Our PMP will detail procedures to develop, manage, and modify the Risk Register regularly for the project's benefit.

In developing our Risk Management Plan, we will employ this five-step approach:

- ✓ **Identify** –names the risk, determines cause and effect, and categorizes it
- ✓ **Assess** – assigns probability, severity of impact, and determines response
- ✓ **Analyze** –quantifies severity, determines exposure, establishes tolerance level, and determines contingency (applicable during preliminary design and pricing)
- ✓ **Manage** – defines response plans and actions, establishes ownership, and manages response (after Notice to Proceed)
- ✓ **Monitor/Review** – monitors/reviews/updates risks, monitors response plans, updates exposure, analyzes trends, and produces reports (after Notice to Proceed and during design and construction).

Risk analysis begins during the proposal stage. From experience on other projects, the following are risks most likely to occur and have a major impact on schedule, quality, safety, and costs:

- Indecision – fear of new technology
- Scope creep at the expense of the project's core goals
- Unfamiliarity with the new procurement methods
- Inability to limit end-users to reasonable programming requirements
- Schedule delays or indecision by third-party agencies
- Incomplete documentation on decisions made
- Poor flow of information and coordination among disciplines.

The PMP will detail the use of an **Issue Resolution Matrix** which states the methods, individuals, and timeframes for escalation, should unforeseen issues arise. This resolves issues quickly at the level most familiar with the site or design. We find that those closest to the issue can come to a quick and efficient resolution without project delays. Having this matrix in place early empowers our design leaders and field staff in making decisions, keeps the project moving forward, and minimizes risk to the State, design-builder, and public.

We will partner with the SHA to identify, analyze, innovate, and manage any potential risks that may occur. Working together, our PMP will call for developing a risk matrix and strategy that:

- ✓ Identifies reasonable potential risks that may arise

- ✓ Separates any risk in the cost models
- ✓ Determines the correct contingency amounts for those risks that cannot be eliminated
- ✓ Regardless of ownership, develops approaches that either eliminate or minimize those risks
- ✓ Determines which party *"owns"* each risk item

We will take a collaborative approach to identify potential risks. We will brainstorm potential risks and populate the risk register by performing an initial strategy review of the proposed innovative concepts with team members, including SHA, designer, estimators, superintendents, internal professional engineers and managers. For this project, we focused on items such as:

1. **Utility/ROW:** Our technical proposal plans avoid ROW and utility impacts as much as possible
2. **Communication protocols and integration** with SHA/MDOT programs. The software chosen is proven as a standalone system that can run alongside existing CHART ATMS software.
3. **Geotechnical conditions:** Differing site conditions can have impacts on roadway and shoulder sections and sign/gantry foundation design – We researched existing shoulder sections from as-builts and used the borings provided to define the amount of shoulder reconstruction necessary
4. **Environmental:** Although many of the geometric improvements are near ditches, wooded areas and other environmentally-sensitive areas, we limited significant impacts with our planned improvements
5. **Community Acceptance and Proper Use of the New Electronic Sign and Signals:** A rigorous community outreach/education plan is proposed
6. **Schedule:** There are long-lead items and MOT phasing for placement. Each geometric improvement, ITS deployment or ramp meter installation can be constructed independently, but must be interconnected for the Managed Motorway software to make them most effective.

After identifying the risk and populating the risk matrix, our team will go through a process of analyzing the risk that leads to innovations and developing mitigation and strategies, along with efficient allocation. As a team, we will compare costs, schedule, and risk between different design alternatives, permitting or outreach strategy and construction practices to develop the best approach that eliminates or reduces risk.

Lead Cost Estimator David Gates will spearhead developing and managing the risk register with support from the design and construction team. He successfully implemented this process on SHA's recently completed MD 24 CMAR project, Telegraph Road, I-695, and Intercounty Connector Contracts A and B. He brings tremendous value because he understands SHA and third-party reviews and alternative delivery procurement.

QUALITY MANAGEMENT

Corman understands that quality in everything we do is the true constant in achieving success. In a design-build project, our responsibility to ensure quality in the design and construction phases is essential to successfully implementing this project. Our PMP will highlight the quality steps required from the project goals, through the communication plan and into the actual Design and Construction Quality sections of the plan.

Design Quality Management: Corman and Parsons Brinckerhoff have corporate quality cultures that places a premium on delivering high-quality, long-lasting projects that reduce lifecycle costs for owners. We have a history of developing accurate, constructible designs that minimize post-design changes. The Parsons Brinckerhoff team is ISO 9001:2008 certified and complies with its requirements of internal and external auditing.

To achieve a quality design, the Corman | Parsons Brinckerhoff Team quality policy will ensure that SHA's requirements and expectations are understood and met the first time. A high quality design reduces RFIs during construction, creating stakeholder confidence in the plans and complete project. Having the contractor involved with the design from Day 1 also increases design quality control.

We will deliver design quality by developing a Design Quality Management Plan (DQMP) that confirms that the final product meets or exceeds the expectations of the State of Maryland, SHA, and stakeholders. It is a road map for design procedures to be followed during plan development. We will submit the DQMP for SHA's review and comment and customize it based on feedback. The DQMP will include:

- ✓ Design, drawing and report checking procedures, including design checklists
- ✓ Intra-discipline reviews
- ✓ Inter-discipline reviews
- ✓ Technical, coordination and constructability reviews
- ✓ Over-the-shoulder review procedures
- ✓ A comment resolution process
- ✓ RFC procedures
- ✓ Procedures to track noncompliance, corrective measures, and preventive measures to prevent the recurrence of repeat noncompliant work

The DQMP will also establish requirements for design QC (checking and reviews) and QA (audits). These processes are used as checks and balances to confirm the design meets the contract and SHA's expectations. Independent engineers not involved in the design will check the design products in detail, as our QC procedures require an independent check of engineering calculations, drawings, computations, specifications, estimates, and design reports. The QC process will enable our team to confirm assumptions, design methodology, and calculations before they are carried forward in the design or plan preparation. The original designer, checker, back-checker, and verifier will be identified on design products and submittals. Design QA/QC includes three technical reviews: interdisciplinary, constructability, and independent. Each will be completed for each design package at every milestone.

To enhance design/construction coordination for quality, we added M.C. Dean, Inc. to our team. They are a nationally-recognized electrical Design Build firm with their Transportations Systems Group based in Washington DC. Over 70% of their fees are from Design-Build projects. M.C. Dean's in-house Professional Engineers will lead the electrical/ITS design effort in close coordination with Parsons Brinckerhoff and Transmax Pty Ltd (Transmax). All three companies, along with SHA, will be involved in equipment selection to ensure what is designed and specified integrates with the Managed Motorway System, SHA maintenance concerns, and is readily available. As the Engineer of Record, Parsons Brinckerhoff will perform QA/QC reviews of work prepared by M.C. Dean for compliance with the RFP, SHA specifications and the Managed Motorway system designed by Transmax.

CONSTRUCTION QUALITY MANAGEMENT

The Construction Quality Plan will stress utilization of Pre-activity Plans and meetings. Prior to starting any new activity or introducing a new crew, our project field staff will develop a pre-activity meeting agenda consisting of:

1. Description of the specific work items covered by the plan
2. List of plans, specifications, standards, and reference documents detailing the work to be performed
3. Status of submittals, permits, material approvals, tests and inspections to perform the work. There will also be a listing of environmental constrains that would impact the specific operation
4. A specific Work Plan detailing the equipment, manpower and sequence. There will also be a Job Hazard Analysis listing the potential safety concerns and mitigation strategies
5. Identify survey or other support to perform the work so it can be scheduled accurately

The PMP will require that during the weekly construction progress meetings, the Pre-activity meeting results and directions are discussed, revised as necessary, and reinforced with the crews at the weekly foreman's meetings and morning huddles. This effort will include Corman staff and subcontractors providing construction services. Our construction manager and their staff will regularly visit construction crews (including subcontractors) for compliance with the Pre-Activity requirements, plans, specifications, and permits. The PMP will also require each of the construction subcontractors to have a Corman Project Field Engineer assigned to them to assist and coordinate their work with the rest of the team for compliance.

Given this project has a significant number of technology devices spread over a long corridor controlled by different software systems, and is expected to operate in concert with one another, ***we have assigned a Lead System Integrator for seamless operation of the equipment with the controlling software.***

iii. How we will minimize environmental impacts (water resources, forest/trees, air, noise, etc.), ROW impacts, and utility impacts to implement and construct the project in a time efficient manner.

MINIMIZING ENVIRONMENTAL IMPACTS

Minimizing environmental, ROW, and utility impacts is crucial to project success. The Corman | Parsons Brinckerhoff Team understands the effects these impacts have on SHA, the community, the environment, and schedule. It is in everyone's best interest to reduce impacts as much as possible, which is why this minimization effort will be built into our PMP.
The PMP will define anticipated agency coordination for obtaining permits, as well as arranging utility modifications. Utilities, transportation and regulatory agencies anticipated to be involved include;

- ✓ **Regulatory Agencies** – MDE, DNR, NPS, M-NCPPC, USACE, etc.
- ✓ **Utilities** – Verizon, PEPCO, WSSC, Cox, Comcast, BGE, Level 3, etc.
- ✓ **Transportation Agencies** – WMATA, MTA, MARC Trains, CSX, Montgomery County, etc.

Minimizing environmental, utility, and ROW impacts is a key component of the Corman | Parsons Brinckerhoff PMP. Some items that will be considered to minimize these impacts include:

- ✓ **Reducing Pavement Widening**: Our **Proven and Innovative Solution** requires only minor road widening. Working as much as possible within the existing footprint of the road and ROW reduces tree/forest, wetlands/waterways, FIDS, park/4f resources, cultural, and other environmental impacts. Limiting pavement widening also reduces stormwater management and erosion & sediment control requirements, further minimizing impacts and required utility relocations.
- ✓ **Avoidance**: If a known environmental resource or utility is present, our team will do as much as possible to avoid that constraint. There is a fixed budget for this project, and impacts to additional environmental resources may require mitigation or at the very least additional coordination and design efforts. Utility impacts can be costly as well. Fiber optic can be expensive and time consuming if impacted, especially such the large duct as the one along the southbound (SB) side of IS 270. Our design will avoid this duct if at all possible.
- ✓ **Coordination:** Close coordination early and often with permitting agencies, utility companies, and impacted communities, property owners, and businesses goes a long way to improving relations and reducing the effect they have on the project schedule. By coordinating with permitting agencies early on, our team will know what resources are present, where they are, and what it means if they are impacted. Should a resource be impacted that needs mitigation, our team will know it early on, will perform avoidance analysis to see if the design can be modified, and, if required, will find a site for mitigation/begin mitigation design immediately.

  Early and often coordination with the utility companies will also go a long way. By bringing them onboard early, they will understand what is proposed and why, and can team up with the Corman | Parsons Brinckerhoff Team to problem solve. Required offsets from utilities will be known, and Parsons Brinckerhoff will work to stay out of those zones while designing elements. Should relocations be needed, our team will work with the utility companies to understand exactly what is needed, what the design requirements and standards are, and who will be responsible for each element of the relocation (i.e., who will design – Parsons Brinckerhoff or utility, and who will relocate – Corman or utility). If ROW is required, what kind (easement, fee) will be needed and how much will be understood at the earliest possible stage to reduce delays. Plats will be developed and coordinated with SHA's acquisition staff..

  As indicated above for utility impacts, any ROW required will be identified early on by utilizing a property mosaic, and the boundary survey will be started, plats developed, coordination with SHA entities to streamline the process, and assistance provided to SHA while coordinating the acquisition.

- ✓ **Innovative Improvements:** Our **Proven and Innovative Solution** in itself will reduce environmental, utility, and ROW impacts. Due to the advanced technologies being implemented, and the highly-skilled abilities and innovative construction practices of Corman, impacts will be reduced or eliminated. We will provide mobility and safety benefit by our Coordinated Adaptive Ramp Metering implementation that stays within the ROW and can be designed to avoid most all utilities and environmental resources **(See Appendix for ROW and Utility impacts indicated on our plans).**

ISSUE RESOLUTION

It is rare to have a design that never requires impacting a utility, environmental resource, or adjacent properties on a project of this magnitude, ***however, we have come close!*** What differentiates us is our experience with dealing with these issues head on. How these impacts are identified, evaluated, coordinated, and addressed or mitigated is crucial to a successful project. Our team will follow standards, policies, and procedures for addressing these issues and will use tracking mechanisms to ensure they are addressed and do not slip through the cracks.

- ✓ **Utility Impacts**: A Utility Conflict Matrix has already been started **(See Appendix)** which identifies potential impacts, where they are located, what utility, and who owns it. We provided a preliminary assessment of the severity of this conflict and potential occurrence. This matrix will be a living document that will be continually updated throughout design and construction.
- ✓ **Environmental Resource Database**: With a project of this magnitude, covering over 30 miles of interstate, there is an abundance of environmental resources to identify. Parsons Brinckerhoff has started developing a database to track resources throughout the corridor and identify possible impacts. As the design is refined, it will be updated to better understand the impacts and how they are being mitigated. This project will be tracked as an Environmental Program, and Environmental Compliance Manager Pam McNicholas manages a similar program for the MDTA. She has developed relationships with the permitting agencies that will assist in our coordination effort to resolve issues quickly and efficiently. Coordination with third-party stakeholders will be performed by SHA; however, Pam is here to help as much as possible and will assist EPD, EPLD, HHD, PRD, and LAD/LOD in this coordination effort.

The measures indicated above will assist in delivering the IS 270 project on-time and on-budget. The Corman | Parsons Brinckerhoff Team prides our self in our quality of design and process by which we handle impacts like this. The Issue Resolution Ladder and Issue tracking mechanisms will be established from Day 1 as part of the Partnering Process and will ensure no schedule delays. Open and honest communication will be maintained throughout the project to prevent breakdowns in communication.

iv. Our approach to achieve timely implementation of our proposed improvements, including anticipated design and construction packages

SCHEDULE ADHERENCE

One of the maximum benefits of the Progressive Design-Build delivery approach is getting the contractor involved early in the design. We teamed with Parson Brinckerhoff, M.C. Dean and Transmax to draw from their experience to generate more innovative ideas, current and relative lessons learned/best practices, and the resources to get the job done. We brought together a roster of staff with preconstruction and construction expertise, with an emphasis on SHA Design-Build and successful implementation and operation of Managed Motorways. This seamless approach is a benefit to SHA because from Day 1 all team members will have intimate knowledge of the project history, goals, and details.

Design Coordination and Schedule:

Design/Construction Integrator Lou Robbins, PE will utilize his extensive design-build and SHA experience to fill this role. With the many agencies and stakeholders involved in this project, it can be a challenge to continuously advance the design while accommodating the needs of all parties involved. By having one person champion the design coordination, the design stays on schedule, within budget, and priority is given to activities that provide the most benefit. Lou served in a similar role on other projects, including leading the Design and Construction Quality Control on SHA's Intercounty Connector Contract C.

Preconstruction Schedule: Lou will work with Construction Manager David Levine to create and manage an integrated project schedule that includes design, permits, utility relocations, material procurement, ROW acquisition, and stakeholder activities. It will give the team the ability to understand project progress and ensure it is completed on time **(See Appendix for a preliminary proposal schedule for the project).**

***Other Key Design Coordination Activities*:**

Civil/Structural Coordination: We check the location of sign footings, drilled shafts, and other new structure elements for MOT during construction, constructability and conflicts with existing utilities and features, particularly at the interface between roadway approaches and new overhead structures.

Managed Motorways/CHART Integration and Coordination: Coordination with SHA / CHAT and buy-in on the proposed design, functionality, and operational integration is of upmost importance. Steve Kuciemba will act as liaison between the Corman | Parsons Brinckerhoff Team and CHART staff to integrate operational coordination of concepts and ideas early in design, no interruption to ongoing operations occurs during implementation, and training and coordination occurs on the State Operation Center (SOC) or Traffic Operations Center 3 (TOC3) floor. The Corman | Parsons Brinckerhoff Team will include side-by-side training and operational support after the facilities are installed and turned on for a seamless transition, but CHART buy-in and understanding of the project from Day 1 is at the top of our requirements for coordination.

Utility / ROW Coordination: Utility coordination is of critical importance since relocations are often long lead items and not under direct control of the Corman | Parsons Brinckerhoff Team. ROW acquisition is again being handled by others and out of our control. During preconstruction, we will identify utility agencies with facilities within the corridor, ensure utility owners attend regular project meetings, acquire as-built information and verify with physical pothole data as needed, work with the task forces and utility owners to identify potential conflicts, and assist with conflict resolution and coordination. Our number one goal is utility relocation avoidance and to minimize utility impacts and relocations. To date, we have minimized both utility conflicts and the need for ROW. Our Preliminary concept plans in the Appendix only show 20 probable utility relocations (including 14 relocation of existing SHA owned facilities) and 2 potential ROW takings which consist of minor impacts only.

Interstate Maintenance Coordination: It is critical to have maintenance staff participation during preconstruction. We recommend that SHA maintenance staff review the design submittal packages for long-term quality and low-cost maintenance solutions are included in the design. With their assistance, we will analyze life cycle costs to determine the best construction sections and materials that provide the greatest benefit. This streamlines the design process, reduces errors and omissions, improves constructability and quality, maximizes the budget, and reduces negative schedule impacts due to last minute reviews by the SHA maintenance groups. .

DESIGN PACKAGING

Upon award, we welcome the opportunity to meet with the entire project staff at kickoff and to discuss current status to better understand the schedule required. To support SHA in identifying elements or segments for early/independent design packages, it is important to ask the team the following questions:

Does it save time/money
Does it reduce congestion/increase reliability
Does it help/hurt quality of final product impacts

Does it help/hurt stakeholder relations
Does it increase/decrease environmental or incur delays due to permitting

If the pros outweigh the cons, we proceed with independent design packages. Below are our current suggested packages:

PACKAGE A: Ramp Metering and ramp detectors with no ROW, Utility or Environmental issues to cause a delay

PACKAGE B: Ramp Metering and ramp detectors with ROW, Utility or Environmental issues that could cause a delay

PACKAGE C: Geometric improvements that would improve mobility with no ROW, Utility or Environmental issues to cause a delay in construction

PACKAGE D: Geometric improvements with ROW, Utility or Environmental issues that could cause a delay in construction

PACKAGE E: Significant geometric improvements with ROW, utility, environmental, or public relations issues that could cause a delay in construction.

PACKAGE F: Software development, installation, commissioning, integration and side by side implementation for the Australian Managed Motorways system.

As the design evolves, packages may be combined or further broken apart either by geographic location or due to unexpected delays or opportunities. For example; for the Hard Shoulder Running (HSR) improvement between MD 109 and MD 121 in the vicinity of the weigh station on SB IS 270, 1) if the proposed additional shoulder borings confirm the information provided with the RFQ/RFP, and shoulder reconstruction is not required; 2) the design exceptions are approved; and 3) no environmental impacts are determined that require permitting, this geometric improvement would be broken out as a separate package and the expected reduction in reoccurring congestion would be realized sooner for the benefit of motorists. As noted not only in the RFP, but in NEPA documentation, the break-out would need to connect logical termini, be of sufficient length, be of independent utility, and not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.

v. Modifications needed to the proposed Watkins Mill Interchange project to be compatible in a safe and efficient manner with our Innovative Congestion Management improvements.

MODIFICATIONS TO WATKINS MILL INTERCHANGE

The improvements we propose for the IS 270 corridor through the IS 270 Innovative Congestion Management project relieve congestion, improve throughput and reliability, and make the project corridor safer regardless of what is proposed at the Watkins Mill interchange. However, there are minor revisions that will coordinate the designs of the projects to create a more seamless implementation of both projects. With similar construction timeframes, coordination is key so that the public is not adversely affected by construction or needless rework due to uncoordinated project designs.

Recommended improvements to the proposed Watkins Mill Interchange plans provided as part of the RFP were indicated in our **PTC #18 (Draft Plans also available in the Appendix).** Recommended revisions that would coordinate the design of both projects include:

- ✓ **Shoulder Width:** Widen or restripe the proposed roadway NB to provide a 12-ft. shoulder
- ✓ **Shoulder Cross-Slope:** Revise the cross slope of the outside shoulder NB to match the adjacent through lane
- ✓ **Cross-Slopes of IS 270 NB On Ramps:** Provide additional widening and revised cross slopes in the gore area of the NB on ramp
- ✓ **Ramp Storage and Discharge Lanes:** Design the on ramps to include the storage for ramp metering, as well as the number of discharge lanes to operate the Managed Motorways system
- ✓ **ATM/ITS:** There are many devices proposed with the IS 270 project whose infrastructure could easily be included in the Watkins Mill project, including caissons, conduit, power drops, signal poles and cantilever signs.

Through the Practical Design Review process, the interchange configuration at Watkins Mill went through major changes and entrance ramps had the potential to be removed, requiring traffic to use the existing entrance ramps to access IS 270. We understand the reasoning behind the reconfiguration; however, we also know the political and public pressure MDOT and SHA are under to return the interchange configuration to its previous design. Implementing our **PTC #12 – Australian Managed Motorways Concept** would allow these entrance ramps to be constructed without adversely affecting traffic operations along IS 270. We recommend that the infrastructure required to implement the Managed Motorways concept be constructed with the Watkins Mill project so SHA is not be placed in the disconcerting position of reconstructing the New Watkins Mill interchange during our follow up project.

State Highway Administration
Maryland Department of Transportation

INTERSTATE 270

7. Appendix

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

7. APPENDIX

Please see the 11x17 Technical Proposal Appendix Binder for the following appendices:

- Exhibit A: Realized System-Wide Benefits
- Addendum 1
- Addendum 2
- Addendum 3
- Addendum 4
- Questions and Responses (Non-Confidential)
- Questions and Responses (Confidential)
- Proposed Technical Concepts (PTCs)
- Microsurfacing Memo
- Pavement Memo
- Evaluation Criteria Matrix
- Utility Conflict Matrix
- Assessment of Potential Noise Walls
- Schedule
- Anticipated Right-of-Way Needs
- Plans
  - Hard Running Shoulder
  - Geometric Improvements
  - Managed Motorways
  - Watkins Mill Breakout

Also enclosed is an electronic copy of the VISSIM traffic model for 2015 and 2040 build design years and Concept Evaluation Templates (.pdf and Excel files) populated with the VISSIM traffic model result for 2015 and 2040 build design years.

January 19, 2017

IS 270 - Innovative Congestion Management Contract

Montgomery and Frederick Counties, Maryland

Contract No. MO0695172

Technical Proposal - APPENDIX

Prepared by:

Original
Container 1 of 12

Table of Contents

Also enclosed is an electronic copy of the VISSIM traffic model for 2015 and 2040 build design years and Concept Evaluation Templates (.pdf and Excel files) populated with the VISSIM traffic model result for 2015 and 2040 build design years.

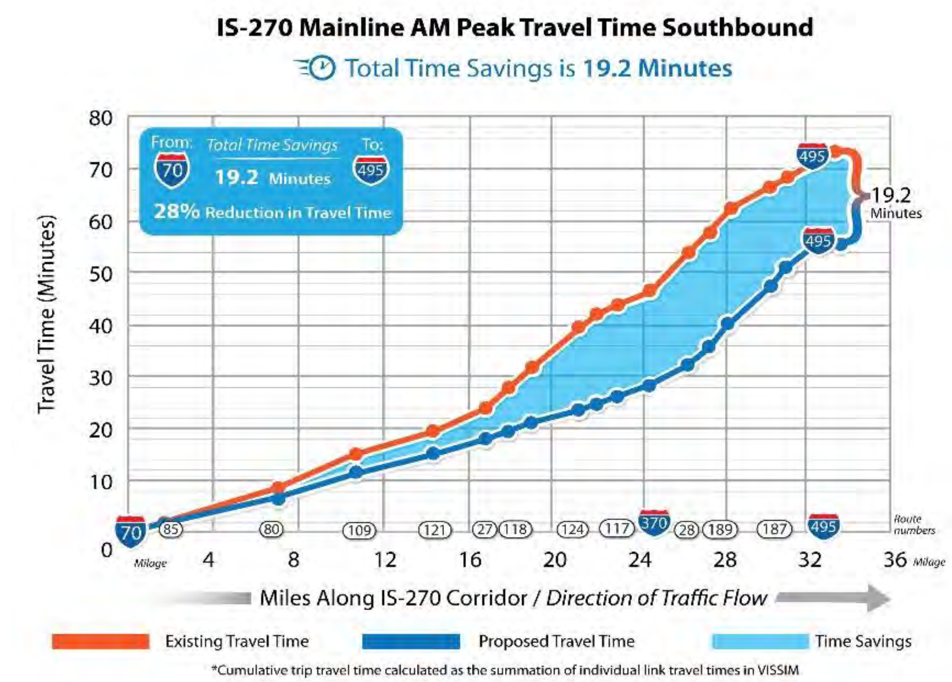
IS 270 Frequently Used Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ATM	Active Traffic Management
BGE	Baltimore Gas & Electric
CCT	Closed Circuit Television
CD	Collector-Distributor
CHART	Coordinated Highways Action Response Team
CM	Construction Management/Construction Manager
CMAA	Construction Management Association of American
CMAR	Construction Manager at Risk
CMF	Crash Modification Factor
CSRA	Chart Software Contractor
CV/AV	Connected and Autonomous Vehicles
DBIA	Design-Build Institute of America
DBPM	Design-Build Project Manager
DBT	Design-Build Team
DDI	Diverging Diamond Interchange
DM	Design Manager
DMS	Dynamic Message Signs
DNR	Department of Natural Resources
DOT	Department of Transportation
DQMP	Design Quality Management Plan
EB	Eastbound
ECM	Environmental Compliance Manager
ETP	Emergency Traffic Patrol
FHWA	Federal Highway Administration
GAB	Graded Aggregate Base
GUI	Graphical User Interface
HAR	Highway Advisory Radio
HERO	Heuristic Ramp Metering Coordinator
HMA	Hot Mix Asphalt
HOT	Highway Operations Technician
HOV	High Occupancy Vehicle
HSR	Hard Shoulder Running
ICC	Inter-County Connector
IEEE	Institute of Electrical and Electronics Engineers
IR	Infrared
IS	Information System
ISO	International Organization for Standardization
ITS	Intelligent Transportation Systems
LCS	Lane Control Signal
LED	Light Emitting Diode
LOS	Level of Service
M1	Monash Freeway

IS 270 Frequently Used Acronyms

MARC	Maryland Rail Commuter Service
MDE	Maryland Department of the Environment
MDMUTCD	Maryland Manual on Uniform Traffic Control Devices
MEPA	Maryland Environmental Policy Act
MM	Managed Motorway
M-NCPPC	Maryland-National Capital Park and Planning Commission
MOT	Maintenance of Traffic
MPH	Miles Per Hour
MTA	Maryland Transit Administration
MTBF	Mean Time Between Failure
MVA	Motor Vehicle Administration
MVMT	Million Vehicle Miles of Travel
MWCOG	Metropolitan Washington Council of Governments
NB	Northbound
NEPA	National Environmental Policy Act
NIRS	Near Infrared Spectroscopy
NPS	National Park Service
NTP	Notice to Proceed
PEPCO	Potomac Electric Power Company
PMP	Project Management Plan
PTC	Proposed Technical Concept
PTZ	Pan-Tilt-Zoom
QC	Quality Control
RFC	Released for Construction
RFI	Request for Information
RFP	Request for Proposal
RITIS	Regional Integrated Transportation Information System
ROW	Right-of-Way
RWIS	Road Weather Information Systems
SB	Southbound
SOC	Statewide Operations Center
STREAMS	Software developed by TRANSMAX to operate the Managed Motorways System
TDM	Traffic Demand Management
TIRTL	The Infrared Traffic Logger
TOC	Traffic Operations Center
USACE	U.S. Army Corp of Engineering
VDOT	Virginia Department of Transportation
VicRoads	Victorian Department of Transportation
VPH	Vehicles Per Hour
WB	Westbound
WMATA	Washington Metropolitan Area Transit Authority
WSSC	Washington Suburban Sanitary Commission

Realized System-Wide Benefits



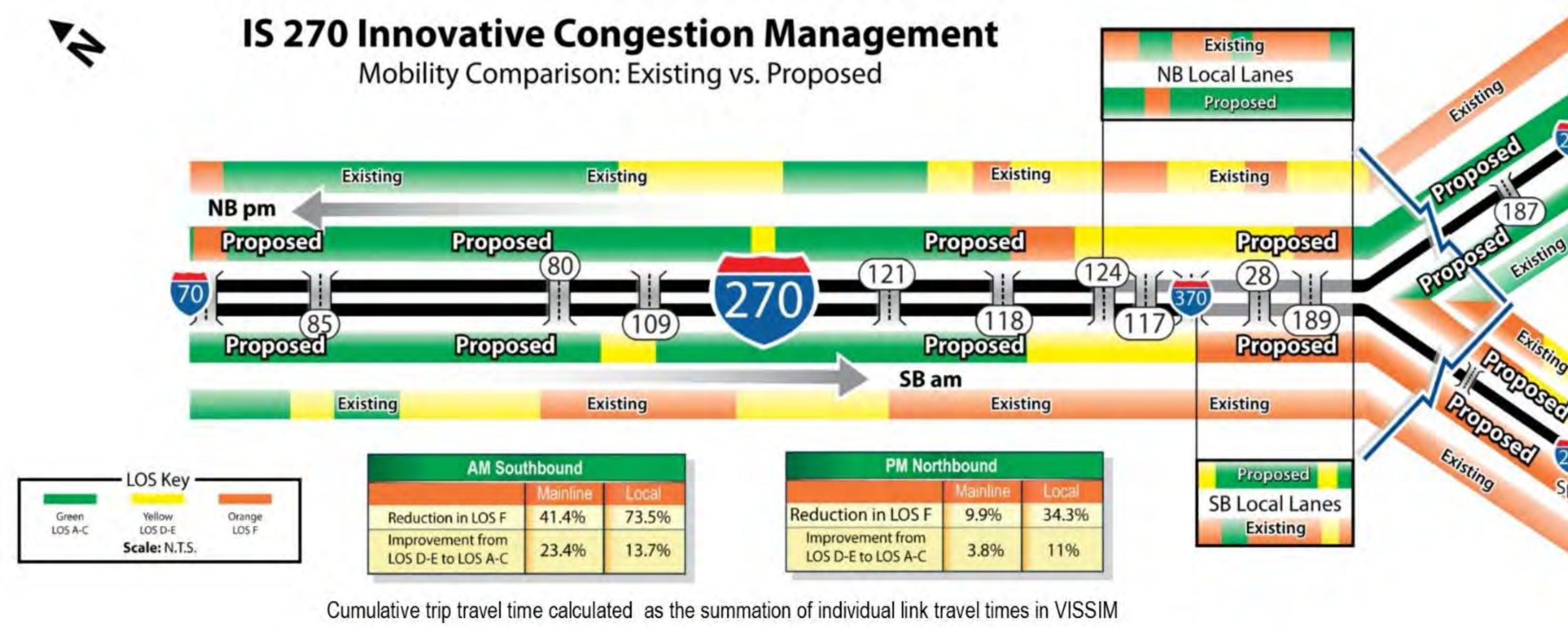
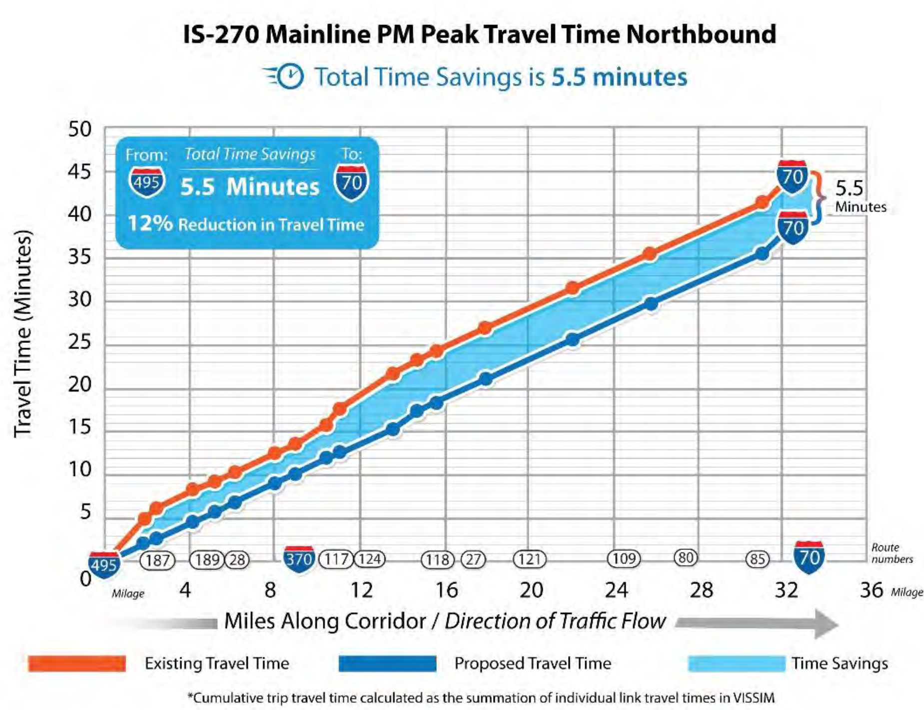
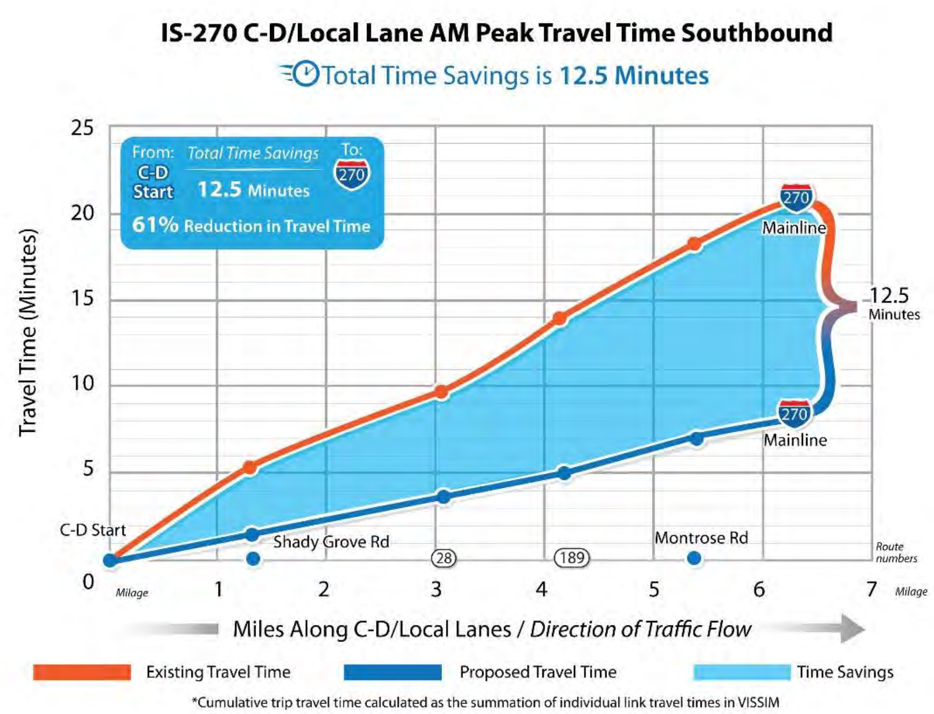


Figure 7: AM & PM Peak Travel Times SB & NB





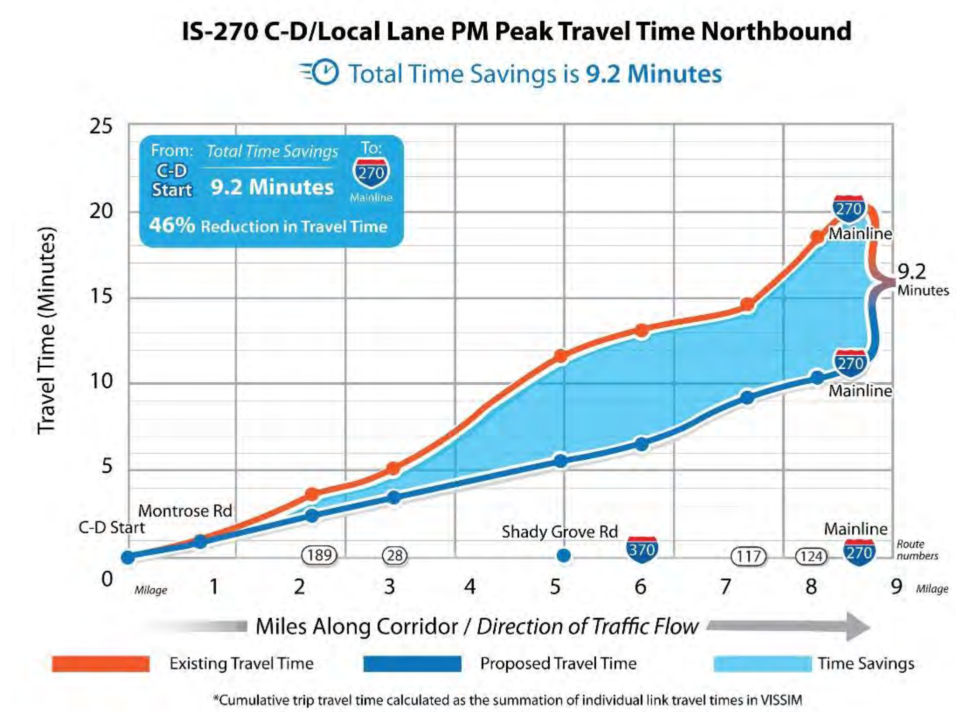


Figure 6: Mobility Comparison: Existing vs Proposed

Addendums

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF HIGHWAY DEVELOPMENT
707 NORTH CALVERT STREET
BALTIMORE, MARYLAND 21202

September 1, 2016

Contract No.: MO0695172
F.A.P. No.: Not Applicable
Description: IS 270 Innovative Congestion Management Contract – Progressive Design-Build: Request for Proposals (RFP)

ADDENDUM NO. 1

To All Prospective Proposers:

Please be advised that the Technical and Price Proposal Submittal Date for this contract is still scheduled for **January 5, 2017**.

The attention of prospective proposers is directed to the following revisions, additions and/or deletions to the Request for Proposals (RFP).

REQUEST FOR PROPOSALS

Page No.	Description
18	ADDED "ITS Information" to the Additional Material.
Appendix	Stipend Agreement, page 2 of 6: REVISED "Alternative Technical Concept" and "ATC" to "Proposed Technical Concept" and "PTC." Also, REVISED stipend amount in section 2.2 (a) to $750,000.

NOTICE TO PROSPECTIVE PROPOSERS

The attention of prospective proposers is directed to the following revisions, additions, and/or deletions to the Additional Information on ProjectWise:

ADDED "I-270 ITS Devices.xlsx" and "ITS_I270.kmz" and "I270_FiberLine.kmz" and "I270_MH_FM.kmz" at the following location on ProjectWise:
pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\06 - ITS Information\

Questions relating to this Addendum No. 1 may be directed in writing to:

Jason A. Ridgway, P.E.
Director, Office of Highway Development
Maryland Department of Transportation
State Highway Administration
e-mail address: MO069_IS_270@sha.state.md.us

During the Technical Proposal Phase, only e-mailed inquires will be accepted. No requests for additional information or clarification to any other Department or Administration office, consultant, or employee will be considered.

for

GREGORY I. SLATER, DEPUTY ADMINSTRATOR FOR PLANNING, ENGINEERING, REAL ESTATE, AND ENVIRONMENT.

THIS ADDENDUM IS ISSUED TO CLARIFY, ADD TO, DELETE FROM, CORRECT AND/OR CHANGE THE CONTRACT DOCUMENTS TO THE EXTENT INDICATED AND IS HEREBY MADE PART OF THE SAID CONTRACT DOCUMENTS. COMAR 21.05.02.08 REQUIRES THAT ALL ADDENDA ISSUED BE ACKNOWLEDGED; THEREFORE, PRIOR TO SUBMITTING YOUR PRICE PROPOSAL, ATTACH THE ADDENDUM RECEIPT VERIFICATION FORM TO THE FRONT OF THE PRICE PROPOSAL FORM PACKET. FAILURE TO DO SO MAY RESULT IN THE PRICE PROPOSAL BEING DECLARED NON-RESPONSIVE.

- Watkins Mill IAPA and Permits

F. Watkins Mill Interchange Plans

G. Watkins Mill Interchange Design Files

The following materials are being provided in electronic format on Projectwise. The Administration makes no representation regarding its accuracy.

H. Additional Material

- 100-Scale Mapping
- Existing Right-of-Way mosaic file
- Inventory of Existing Structures
- Utility plans and/or as-builts
- As-builts
- ITS Information

The following materials are being provided in electronic format on Projectwise, unless otherwise noted. This material is considered necessary for the Design-Build Team to submit a technical proposal and prepare a bid.

I. I-270 Concept Evaluation Templates

J. Manuals and Guidance

- VISSIM Modeling Techniques
- Manual for the Inspection of Highway Right of Way in Karst Areas

In general, the Microstation files included on the ProjectWise are in conformance with the MDSHA Microstation V8 CAD Standards Manual.

It is likely that most Proposers will use plot drivers that differ from the drivers used to produce the provided plans. Some of the drawings screen existing features through level symbology color 250. The manipulation of the drawing files to produce any requirements (as found elsewhere in the RFP) for as-built plans will be the responsibility of the selected Design-Builder.

Proposers are also provided with a file index provided on ProjectWise. The file is a Word Document describing all the files and files names as outlined above.

III. RULES OF CONTACT

The Procurement Officer is the Administration's single contact and source of information for this procurement.

The following rules of contact will apply during the Contract procurement process, which begins upon the submittal of the SOQ, and will be completed with the execution of the Contract. These rules are designed to promote a fair, unbiased, and legally defensible

1.5 shall not be entitled to use information submitted by Proposer to the SHA in which the SHA determines is exempt from disclosure under the Maryland Public Information Act ("PIA"), Title 10, Subtitle 6, Part III of the State Government Article of the Annotated Code of Maryland, unless the RFP otherwise provides.

1.6 The SHA acknowledges that the use of any of the Work Product by the SHA or the Design-Builder is at the sole risk and discretion of the SHA and the Design-Builder, and shall in no way be deemed to confer liability on the unsuccessful Proposer.

2. <u>Compensation And Payment.</u>

2.1 Compensation payable to Proposer for the Work Product described herein shall be $750,000.00 if any of the following conditions are met:

(a) The Proposer was in the competitive range and was not the most advantageous to the State or was not selected for award;

(b) The Proposer was selected for award, but the Contract was not executed or it was terminated by SHA for its convenience prior to issuance of a notice to proceed for events outside the control of the Design-Builder and the Design-Builder is not seeking reimbursement for design activities undertaken after notice of selection;

(c) The Proposer was not in the competitive range, but it submitted an Proposed Technical Concept (PTC) approved by the Administration and that the Administration wishes to utilize the PTC in the final design.

2.2 In its sole discretion, the SHA may pay compensation to Proposer, in an amount to be determined by the SHA, for the Work Product described herein under the following conditions:

(a) For any Proposer meeting the criteria identified in Section 2.1, above.

Any amount paid under this subparagraph (a) will not exceed $750,000.00 and will be subject to audit of the costs incurred by the Proposer in preparing its Technical Proposal and Price Proposal. Auditors shall have access to all books, records, documents and other evidence and accounting principles and practices sufficient to reflect properly all direct and indirect costs of whatever nature claimed to have been incurred. Failure of the Proposer or its team members to maintain and retain sufficient records to allow the auditors to verify all or a portion of the claim or to permit the auditors access to the books and records of Proposer and its team members shall constitute a waiver of the right to be paid a stipend and shall bar any recovery hereunder.

Any Proposer wishing to apply for a stipend under this subparagraph (a) shall submit the completed Agreement to the SHA concurrently with the price proposals being submitted. Eligibility of receipt of a stipend is dependent upon

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF HIGHWAY DEVELOPMENT
707 NORTH CALVERT STREET
BALTIMORE, MARYLAND 21202

October 7, 2016

Contract No.: MO0695172
F.A.P. No.: Not Applicable
Description: IS 270 Innovative Congestion Management Contract – Progressive Design-Build: Request for Proposals (RFP)

ADDENDUM NO. 2

To All Prospective Proposers:

Please be advised that the Technical and Price Proposal Submittal Date for this contract has been POSTPONED from January 5, 2017 to **January 19, 2017**.

The attention of prospective proposers is directed to the following revisions, additions and/or deletions to the Request for Proposals (RFP).

REQUEST FOR PROPOSALS

Page No.	Description
38	REVISED the submittal deadline for Proposed Technical Concepts to November 17, 2016.
41	REVISED the submittal deadline for the Technical and Price Proposals to January 19, 2017.
57	REVISED the submittal deadline for Proposed Technical Concepts to November 17, 2016.
57	REVISED the submittal deadline for the Technical and Price Proposals to January 19, 2017.
Appendix	Price Proposal, Page 1 of 43: REVISED the submittal deadline for the Technical and Price Proposals to January 19, 2017.

Questions relating to this Addendum No. 2 may be directed in writing to:

Jason A. Ridgway, P.E.
Director, Office of Highway Development
Maryland Department of Transportation
State Highway Administration
e-mail address: MO069_IS_270@sha.state.md.us

During the Technical Proposal Phase, only e-mailed inquires will be accepted. No requests for additional information or clarification to any other Department or Administration office, consultant, or employee will be considered.

GREGORY I. SLATER, DEPUTY ADMINSTRATOR FOR PLANNING, ENGINEERING, REAL ESTATE, AND ENVIRONMENT.

THIS ADDENDUM IS ISSUED TO CLARIFY, ADD TO, DELETE FROM, CORRECT AND/OR CHANGE THE CONTRACT DOCUMENTS TO THE EXTENT INDICATED AND IS HEREBY MADE PART OF THE SAID CONTRACT DOCUMENTS. COMAR 21.05.02.08 REQUIRES THAT ALL ADDENDA ISSUED BE ACKNOWLEDGED; THEREFORE, PRIOR TO SUBMITTING YOUR PRICE PROPOSAL, ATTACH THE ADDENDUM RECEIPT VERIFICATION FORM TO THE FRONT OF THE PRICE PROPOSAL FORM PACKET. FAILURE TO DO SO MAY RESULT IN THE PRICE PROPOSAL BEING DECLARED NON-RESPONSIVE.

A Letter of Interest (LOI), on official letterhead of the Design-Builder, notifying the Administration whether or not the Design-Builder intends to submit a Technical and Price Proposal must be delivered no later than **December 15, 2016 prior to 12 noon** (EST). The LOI must be delivered to the following email address:

MO069_IS_270@sha.state.md.us

The LOI must be signed by individual(s) authorized to represent the Major Participant firm(s) and the lead Constructor firm(s). A Major Participant is defined as the legal entity, firm or company, individually or as a party in a joint venture or limited liability company or some other legal entity, that will be signatory to the Design–Build Contract with the Administration. Major Participant(s) will be expected to accept joint and several liability for performance of the Design–Build Contract. Major Participants are not design subconsultants, construction subcontractors or any other subcontractors to the legal entity that signs the Design–Build Contract.

If the Design–Build contracting entity will be a joint venture, or some other entity involving multiple firms, all Major Participant firms involved must have an authorized representative sign the LOI.

iii. Proposed Technical Concepts Submittal and Review

Section iii through section vii sets the process for the submittal and review of Proposed Technical Concepts (PTC). The process is intended to:

- Allow Proposers to incorporate innovation and creativity into the Proposals.
- Allow the Administration to consider Proposer PTCs in making the selection decision.
- Avoid delays and potential conflicts in the design associated with deferring of reviews of PTCs to the post-award period.
- Obtain the best-value for the public.

The Proposer is also encouraged to submit standards or specifications that are approved for usage by other state Departments of Transportation as PTCs.

The Proposer may submit PTCs for review by the Administration on or before **November 17, 2016 prior to 12 noon.** (prevailing local time). Inquiries received after that date and time will not be accepted.

All PTCs shall be submitted in writing via email only to the project email address, with a cover letter clearly identifying the submittal as a request for review of a PTC. If the Proposer does not clearly designate its submittal as a PTC, the submission will not be treated as a PTC by the Administration

The Administration will review each PTC submitted to assess the implementation potential of the technical aspects of the concept and its compatibility with the project goals. The Administration will not approve PTCs but will return comments on the PTC on its implementation potential and its compatibility with the project goals. If the Administration needs more information, the Administration will submit written questions to the Proposer and/or request a one-on-one meeting in order to better understand the details of the PTC.

Proposer's Name

Price Proposal

Contract No. MO0695172

Container ____of____

d. Location and deadline for submittal of Technical and Price Proposals

2

Technical Proposals and Price Proposals must be delivered no later than **January 19, 2017 prior to 12 noon** (prevailing local time). The proposal must be delivered to the following location:

Office of Procurement and Contract Management
Fourth Floor, C-405
707 N. Calvert Street
Baltimore, Maryland 21202

e. Number of Copies

One original and eleven (11) copies of the complete Technical Proposal shall be submitted along with one (1) electronic copy PDF file on a CD or flash drive. A single original of the Price Proposal shall also be submitted.

f. Proposal Guaranty

The Proposal Guaranty shall be delivered with the Price Proposal in a sealed business-sized envelope clearly marked as follows:

Prospective Proposer's Name

Proposal Guaranty

IS 270 – Innovative Congestion Management Project

Contract No. MO0695172

4. Effect of Submitting Proposal

Signing of the Design-Build Proposal Submission Form and Price Proposal Form, and delivery of the Proposal represents (a) an offer by the proposer to perform the Work for the Price submitted within the time(s) specified in accordance with all provisions of this RFP and (b) the Prospective proposer's agreement to all the provisions of the RFP and Contract governing requirements and procedures applicable through execution of the Design – Build Contract. **The Technical Proposal will become part of the Design – Build Contract.**

By so signing the above referenced terms and by delivering the Proposals, the Prospective Proposer makes the following affirmative representations.

XVII. PROPOSED PROCUREMENT SCHEDULE

Issue RFQ/RFP	June 7, 2016
Final Date for RFQ Questions	July 11, 2016
SOQ submittal to MSHA	July 25, 2016
Reduced Candidate List (RCL) Notified	August 11, 2016
One-on-One Meetings	August 24-25, 2016
One-on-One Meetings	September 28-29, 2016
One-on-One Meetings	October 26-27, 2016
Last Day to submit PTCs	November 17, 2016
Final Date for RFP Questions	December 8, 2016
Letter or Interest	December 15, 2016
Technical and Price Proposal Submittal	January 19, 2017
Selection of Successful Proposer	February 2017
Notice to Proceed (Anticipated)	March 2017

This is the proposed procurement schedule for this project as of the date of the issuance of this RFQ/RFP.

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
PROPOSAL FORM

Proposal by Corman Construction, Inc.
Name

12001 Guilford Road
Address (Street and/or P.O. Box)

Annapolis Junction	MD	20701
City	State	Zip

(301)	953-0900	(301)	953-2611
A.C.	Phone No.	A.C.	Fax No.

to furnish and deliver all materials and to do and perform all work, in conformance with the Standard Specifications, revisions thereto, General Provisions and the Special Provisions in this contract to IS 270 Innovative Congestion Management located in, Frederick and Montgomery Counties, Maryland, for which Technical and Price Proposals will be received until 12:00 o'clock 2 noon on January 19, 2017. Technical and Price Proposals shall be submitted to:

State Highway Administration
Office of Procurement and Contract Management
Fourth Floor, C-405
707 N. Calvert Street
Baltimore, MD 21202

In response to the advertisement by the Administration, requesting proposals for the work in conformance with the Contract Documents, now on file in the office of the Administration. I/We hereby certify that I/we am/are the only person, or persons, interested in this proposal as principals, and that an examination has been made of the work site, the Specifications, and Request for Proposals, including the Special Provisions contained herein. I/We propose to furnish all necessary machinery, equipment, tools, labor and other means of construction, and to furnish all materials required to complete the project at the following unit price or lump sum price.

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF HIGHWAY DEVELOPMENT
707 NORTH CALVERT STREET
BALTIMORE, MARYLAND 21202

November 9, 2016

Contract No.: MO0695172
F.A.P. No.: Not Applicable
Description: IS 270 Innovative Congestion Management Contract – Progressive Design-Build: Request for Proposals (RFP)

ADDENDUM NO. 3

To All Prospective Proposers:

Please be advised that the Technical and Price Proposal Submittal Date for this contract is still scheduled for **January 19, 2017**.

The attention of prospective proposers is directed to the following revisions, additions and/or deletions to the Request for Proposals (RFP).

REQUEST FOR PROPOSALS

Page No.	Description
9	REVISED the 3rd bullet to shift the responsibility of constructing noise barriers required for the project from the Design-Builder to the Administration.
14	ADDED noise studies to the Design-Builder's services.
16	ADDED construction of any required noise abatement to the Administration's services.
45	REVISED the page limit for the Mobility goal from 16 pages to 20 pages.
Appendix	Contract Provisions: REPLACED TC-5.01.

Questions relating to this Addendum No. 3 may be directed in writing to:

Jason A. Ridgway, P.E.
Director, Office of Highway Development
Maryland Department of Transportation
State Highway Administration
e-mail address: MO069_IS_270@sha.state.md.us

During the Technical Proposal Phase, only e-mailed inquires will be accepted. No requests for additional information or clarification to any other Department or Administration office, consultant, or employee will be considered.

FOR/

GREGORY I. SLATER, DEPUTY ADMINSTRATOR FOR PLANNING, ENGINEERING, REAL ESTATE, AND ENVIRONMENT

THIS ADDENDUM IS ISSUED TO CLARIFY, ADD TO, DELETE FROM, CORRECT AND/OR CHANGE THE CONTRACT DOCUMENTS TO THE EXTENT INDICATED AND IS HEREBY MADE PART OF THE SAID CONTRACT DOCUMENTS. COMAR 21.05.02.08 REQUIRES THAT ALL ADDENDA ISSUED BE ACKNOWLEDGED; THEREFORE, PRIOR TO SUBMITTING YOUR PRICE PROPOSAL, ATTACH THE ADDENDUM RECEIPT VERIFICATION FORM TO THE FRONT OF THE PRICE PROPOSAL FORM PACKET. FAILURE TO DO SO MAY RESULT IN THE PRICE PROPOSAL BEING DECLARED NON-RESPONSIVE.

Act (MEPA)

- Project(s) will require NEPA approval from the Federal Highway Administration (FHWA) when federal actions will be required (e.g. design exceptions, Interstate Access Point Approval [IAPA]). If no federal action is required, then MEPA approval will be needed. Multiple environmental documents may be developed for the contract. Each separate project for an environmental document must be a standalone construction project that connects logical termini and be of sufficient length, have independent utility, and not restrict consideration of alternatives for other reasonably foreseeable transportation improvements. Any NEPA/MEPA document will be prepared by SHA. The Design-Builder will have no decision making responsibility with respect to the NEPA/MEPA process but will provide information needed about the project and possible mitigation actions.
- Public Involvement will be needed as part of NEPA/MEPA and should ensure travel shed is covered, not just the immediate project area.
- 3 The requirements of the SHA Noise Policy must be met for the Design-Builder's improvements. However, noise barriers, if required, will be excluded from any work package or CAP, and will not be paid for from the contract budget. The Administration will be responsible for the costs associated with noise barriers and the additional impacts or requirements they incur, including additional right-of-way, utility relocations, grading, drainage, stormwater management, retaining walls, etc.
- DNR managed land (Seneca Creek State Park) is within the contract limits.

5. Minimize Environmental Impacts

- No permits have been obtained. Agency coordination will be required to secure necessary permits for any environmental impacts.
- The Design-Builder will prepare permit applications for submittal by the Administration.
- Environmental impacts due to Design-Builder's project should be minimized to the extent practical.
- Mitigation may be required by permitting agencies depending on impacts to environmental features as a result of Design-Builder's project.

6. Minimize utility and property impacts and relocations

- Utility and property impacts due to Design-Builder's project should be minimized to the extent practical.
- All costs for third party utility relocations and property impacts will be subtracted from the fixed value contract.

E. Project Status

The current status of aspects of the project is as follows:

Mapping and Survey

- Develop any Right-of-way needs for the project(s)
- Preparation of any Design Exceptions as required for the project(s)
- Design of any surface drainage conveyances, stormwater management, and erosion and sediment control and obtain any related environmental agency approvals required for the project(s) (including NPDES and MDE Approvals).
- Hydrologic and Hydraulic analyses, Drainage and Storm Water Management (SWM) Analyses, Design, and Approvals.
- Closed-Circuit Television (CCTV) inspections of existing drainage pipes as needed.
- The pavement engineering for the Project shall include, but is not limited to, the pavement investigation, pavement type selection, new pavement design, pavement rehabilitation design, and material selection.
- Perform pavement and subsurface geotechnical investigations needed to determine subsurface features and characteristics, and properties to support pavement and geotechnical engineering functions.
- Analyze pavement performance data and existing material conditions to determine the structural and functional conditions for the development of pavement engineering recommendations;
- Analyze subsurface geotechnical field and laboratory test data to determine existing soil, rock, and groundwater conditions etc. for the development of geotechnical engineering recommendations;
- Structural design for all bridges, culverts, walls and any and all other incidental structures required for the project(s).
- Traffic engineering design of any temporary and permanent signing, lighting, traffic signals, pavement markings, and Intelligent transportation systems (ITS) required for the project(s)
- Traffic Operations Analyses including the preparation of a Traffic Operations Analysis Report
- Temporary Traffic Control Design and Implementation including the preparation of a Traffic Management Plan (TMP), red flag summary, Maintenance of Traffic Alternatives Analysis (MOTAA). Additionally, attending and running TMP meetings.
- HOV equivalency analysis and submit to FHWA for approval, if required
- Safety analysis using the Highway Safety Manual (HSM) and submit to FHWA for approval, if required
- Landscape Architecture design of any roadside landscaping and stormwater management landscaping required for the project(s)
- Forest Impact Analysis, Significant tree identification, development of forest impact plans, tree preservation plan and design of any reforestation mitigation required for the project(s)
- Preparation of any necessary documents to obtain final reforestation site review approval from the Maryland Department of Natural Resources
- Prepare and coordinate the Joint Permit Application(s) (JPA) including but not limited to preparation and submittal of the JPA application(s) to SHA with attachments including location map, impact plates, trilogy request and

3

- Complete all work related to providing a noise study(ies) that makes a final determination on reasonableness and feasibleness related to noise abatement.

- Acquisition of Environmental Permits
- Acquisition of Right-of-Way
- Review Construction CAP proposals and compare to ICE
- Reconcile Final CAP for each phase
- Construction Management and Inspection Services
- Design and construct required noise abatement, including additional impacts or requirements they incur, such as additional utility relocations, grading, drainage, stormwater management, retaining walls, etc.

3

Scope Validation and Identification of Scope Issues

A Scope Validation Period of 120 days from the date of the Notice to Proceed for Design and Preconstruction Services will be provided on this contract. During the Scope Validation Period, the Design-Builder shall thoroughly verify and validate that the Design-Builder's understanding of the scope of work and its ability to complete it within the Design and Preconstruction Services Fee. Any Scope Issues determined during this period shall not be deemed to include items that the Design-Builder should have reasonably discovered prior to submission of its Technical Proposal.

If the Design-Builder intends to seek an adjustment to the Design and Preconstruction Fee due to a Scope Issue, it shall promptly, but in no event later than the expiration of the Scope Validation Period, provide the Administration in writing with a notice of the existence of such Scope Issue and basis for such Scope Issue. Within 30 days of the notice, the Design-Builder shall provide documentation that specifically explains its support for the Scope Issue, which shall include among other things: (a) the assumptions the Design-Builder made during the preparation of its Proposal that form the basis of its allegation, along with documentation verifying it made such assumptions in developing its Proposal; (b) explanation of the Scope Issue that the Design-Builder could not have reasonably identified prior to submission of the Technical Proposal; (c) specific impact on the Design and Preconstruction Services. For the avoidance of doubt: (1) The Design-Builder shall not be entitled to raise any Scope Issues that were not previously addressed with a notice; and (2) Design-Builder shall have no right to seek any relief for any Scope Issues not identified in a notice provided to the Administration during the Scope Validation Period.

Within a reasonable time after the Administration's receipt of the documentation, the parties shall meet and confer to discuss the resolution of such Scope Issues. If the Administration agrees that the Design-Builder has identified a valid Scope Issue, a change order will be executed to increase the value of the Design and Preconstruction Fee; however, the Construction Services will be adjusted to retain the overall fixed value of the contract. Notwithstanding anything to the contrary in the Contract Documents or a matter of law, the Design-Builder shall have the burden of proving that the alleged Scope Issue could not have reasonably been identified prior to the submission of the Technical Proposal and such Scope Issue materially impacts its Design and Preconstruction Services Fee.

The parties acknowledge that the purpose of the Scope Validation Period is to enable the Design-Builder to identify those Scope Issues that could not have reasonably been identified prior to the submission of the Technical Proposal. By submission of the Technical Proposal, the Design-Builder acknowledges that the Scope Validation Period is a reasonable time to enable the Design-Builder to identify Scope Issues that materially impacts its Design and Preconstruction Fee. The Design-Builder will assume and accept all risks to complete the Design and

Proposer is alerted to their responsibility to confirm that all team members have received addenda. The Proposer is solely responsible to ensure that their team has the correct information.

i. Statement including the proposed legal structure of the Design–Builder.

j. Include a general authorization for the Administration to confirm all information contained in the Technical Proposal submittal with third parties, and indicate limitations, if any, to such authorization.

As an attachment to the cover letter and excluded from the page limitation for this section, provide documentation that the Design Team has Professional Liability Insurance.

3 **2. Mobility (20 Pages Maximum) – CRITICAL**

Goal: Provide improvements that maximize vehicle throughput, minimize vehicle travel times and create a more predictable commuter trip along I-270.

Value Statement: Effective and reliable traffic flow along I-270 is necessary for its function as a primary commuter route and for the vitality of economic development. Describe the improvements you will provide to address and manage congestion along I-270 while reducing delay and increasing reliability.

i. Provide the Design-Builder's improvements for maximizing vehicle throughput and minimizing vehicle travel times. Specifically, discuss how the Design-Builder's improvements will reduce recurring congestion in terms of travel time, vehicle throughput, density, intersection operations, queues and vehicle network performance, both along I-270 and on the connecting ramps and arterial roadways. – **CRITICAL**

ii. Discuss how the Design-Builder's improvements will provide a more predictable commuter trip, including innovative technologies or techniques that will be provided. – **SIGNIFICANT**

iii. Discuss the performance life of the improvements; that is, the time it will take for congestion levels to return to pre-construction levels and the basis for the Design-Builder's assessment of performance. – **IMPORTANT**

3. Safety (10 Pages Maximum) – IMPORTANT

Goal: Provide for a safer I-270 corridor.

Value Statement: Safer flow of traffic will increase mobility along I-270 by reducing incidents that increase delay and reduce travel time reliability. Discuss how your improvements will increase safety along I-270.

TERMS AND CONDITIONS

TC SECTION 5
LEGAL RELATIONS AND PROGRESS

TC-5.01 INSURANCE

100 **DELETE:** In its entirety.

INSERT: The following.

TC-5.01 INSURANCE FOR DESIGN-BUILD

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 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 7 days notice of cancellation or nonrenewal to:

Maryland 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 the cost will be incidental to the Contract lump sum price.

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

.01 Indemnification

The Design-Build Team shall indemnify, defend and hold the Administration and its officers, directors, employees, agents and consultants from and against all claims, actions, torts, costs, losses, and damages for bodily injury (including sickness, disease or death) and/or tangible property damage (other than to the Work itself) arising out of or resulting from the performance of the Work by the Design-Build Team, any subcontractor, subconsultant, engineer, supplier, any individual or entity directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. Damages covered by the preceding sentence include, but are not limited to, all fees and charges of engineers, attorneys and all other professionals and all mediation, arbitration, court or other dispute resolution costs.

The indemnity obligation set forth in the preceding paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Design-Build Team or any subcontractor, subconsultant, engineer, supplier, or other individual or entity under Workers' Compensation acts, disability benefit acts, or other employee benefit acts.

.02 Additional Insurance Requirements

.02.1 Professional Liability Insurance

Professional Liability Insurance Policy, which covers the Indemnification Clause of this contract (paragraph .02 above), as it relates to errors, omissions, negligent acts or negligent performance in the work performance under this contract by the Designer, its subcontractors, employees and agents. The limitation of the Courts and Judical Proceedings Article states Annotated Code of Maryland Section 5-108(b) shall apply.

.02.2 Workers' Compensation Insurance

Workers' compensation, as required by the laws of the State of Maryland, including Employer's Liability Coverage and coverage for the benefits set forth under the U.S. Longshoremen and Harbor Workers' Compensation Act, the Jones Act, and other federal laws where applicable.

.02.3 Comprehensive Automobile Liability Insurance

Comprehensive Business Automobile Liability covering use of any motor vehicle to be used in conjunction with this contract, including hired automobiles and non-owned automobiles. Loading and unloading of any motor vehicle must be covered by endorsement to the automobile liability policy or policies.

.02.4 Administrative & General Provisions

a. Each policy, with the exception of Workers' Compensation and Professional Liability Insurance, shall name the State Highway Administration.

b. Defense of Claims

Each insurance policy shall include a provision requiring the carrier to investigate and defend all named insured against any and all claims for death, bodily injury or property damage, even if groundless.

c. Compliance

The Design-Build Team shall be in compliance with this Section provided it procures either one policy or insurance covering all work under the contract or separate insurance policies for all segments constituting the entire project. In either case, a certificate of insurance must be filed for each policy with the Administration indicating that all required insurance has been obtained.

The Design-Build Team is responsible for assuring that insurance policies required by this Contract comply with all the requirements. The Design-Build Team is also responsible to determine that all subconsultants, subcontractors, suppliers, and all other individuals or entities performing Work for the Project carry all applicable insurance coverages set forth in this section, including, in all cases, Workers' Compensation, Automobile, and Commercial General Liability Insurance. The Design-Build Team shall indemnify and hold harmless the Administration from any claims arising from the failure to fulfill said responsibilities.

d. Reporting Provisions

Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the Administration, its officers, agents and employees.

e. Separate Application

The insurance provided by the Design-Build Team shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

.02.5 Notice of Cancellation or Modification

All policies of insurance provided in this Section shall be endorsed to provide that the insurance company shall notify the Administration, the Design-Build Team, and each named insured at least thirty (30) days prior to the effective date of any cancellation or modification of such policies.

TC-5.03 SUBCONTRACTING AND SUBCONTRACTORS

102 **INSERT**: The following before the paragraph titled '**Subcontractors Prompt Payment**.'

Percentage of Own Workforce Required. The Design-Build Team must perform at least fifty percent of the value of the on-site construction work with its own workforce, not including the percent goal required in the contract proposal to be performed by DBE's. The Designer must perform at least fifty percent (50%) of the value of the design work with its own workforce, not including the work required by DBE's.

106 **ADD**: The following sections at the end of section '**TC-5.05 DETERMINATION AND EXTENSION OF CONTRACT TIME.**'

TC-5.06 OWNERSHIP OF DOCUMENTS

All plans, specifications, inspection records, or other documents ("Documents") generated by the Design-Build Team and all consultants, subcontractors, suppliers, manufacturers performing Work on the Project are the property of the Administration. Upon request by the Administration, the Design-Build Team or any other person or entity performing Work will produce and deliver such Documents as requested, both in hard copy and electronic format.

TC-5.07 ACCESS TO AND RETENTION OF RECORDS

The Design-Build Team and its employees and Subcontractors shall make all project records available for inspection by the Project Manager and all other persons authorized by the Administration, and shall permit such representatives to interview employees during working hours. Project records include daily time reports, records of force account work, quality control or assurance documentation, inspectors reports, employment records, payrolls, equal opportunity records, construction conference records, partnering records, and any other documents in any way related to the Project substantiating payment. These records shall be retained at least three years after final acceptance of the project.

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF HIGHWAY DEVELOPMENT
707 NORTH CALVERT STREET
BALTIMORE, MARYLAND 21202

December 19, 2016

Contract No.: MO0695172
F.A.P. No.: Not Applicable
Description: IS 270 Innovative Congestion Management Contract – Progressive Design-Build: Request for Proposals (RFP)

ADDENDUM NO. 4

To All Prospective Proposers:

Please be advised that the Technical and Price Proposal Submittal Date for this contract is still scheduled for **January 19, 2017**.

The attention of prospective proposers is directed to the following revisions, additions and/or deletions to the Request for Proposals (RFP).

REQUEST FOR PROPOSALS

Page No.	Description
14	REVISED the order of the last two bullets at the bottom of the page so the language for the JPA services, which flows onto the next page, is continuous.
16	REVISED the last bullet of the Administration's Services to exclude construction, as the construction will not occur during the preconstruction phase.

Questions relating to this Addendum No. 4 may be directed in writing to:

Jason A. Ridgway, P.E.
Director, Office of Highway Development
Maryland Department of Transportation
State Highway Administration
e-mail address: MO069_IS_270@sha.state.md.us

During the Technical Proposal Phase, only e-mailed inquires will be accepted. No requests for additional information or clarification to any other Department or Administration office, consultant, or employee will be considered.

For/

GREGORY I. SLATER, DEPUTY ADMINSTRATOR FOR PLANNING, ENGINEERING, REAL ESTATE, AND ENVIRONMENT.

THIS ADDENDUM IS ISSUED TO CLARIFY, ADD TO, DELETE FROM, CORRECT AND/OR CHANGE THE CONTRACT DOCUMENTS TO THE EXTENT INDICATED AND IS HEREBY MADE PART OF THE SAID CONTRACT DOCUMENTS. COMAR 21.05.02.08 REQUIRES THAT ALL ADDENDA ISSUED BE ACKNOWLEDGED; THEREFORE, PRIOR TO SUBMITTING YOUR PRICE PROPOSAL, ATTACH THE ADDENDUM RECEIPT VERIFICATION FORM TO THE FRONT OF THE PRICE PROPOSAL FORM PACKET. FAILURE TO DO SO MAY RESULT IN THE PRICE PROPOSAL BEING DECLARED NON-RESPONSIVE.

- Develop any Right-of-way needs for the project(s)
- Preparation of any Design Exceptions as required for the project(s)
- Design of any surface drainage conveyances, stormwater management, and erosion and sediment control and obtain any related environmental agency approvals required for the project(s) (including NPDES and MDE Approvals).
- Hydrologic and Hydraulic analyses, Drainage and Storm Water Management (SWM) Analyses, Design, and Approvals.
- Closed-Circuit Television (CCTV) inspections of existing drainage pipes as needed.
- The pavement engineering for the Project shall include, but is not limited to, the pavement investigation, pavement type selection, new pavement design, pavement rehabilitation design, and material selection.
- Perform pavement and subsurface geotechnical investigations needed to determine subsurface features and characteristics, and properties to support pavement and geotechnical engineering functions.
- Analyze pavement performance data and existing material conditions to determine the structural and functional conditions for the development of pavement engineering recommendations;
- Analyze subsurface geotechnical field and laboratory test data to determine existing soil, rock, and groundwater conditions etc. for the development of geotechnical engineering recommendations;
- Structural design for all bridges, culverts, walls and any and all other incidental structures required for the project(s).
- Traffic engineering design of any temporary and permanent signing, lighting, traffic signals, pavement markings, and Intelligent transportation systems (ITS) required for the project(s)
- Traffic Operations Analyses including the preparation of a Traffic Operations Analysis Report
- Temporary Traffic Control Design and Implementation including the preparation of a Traffic Management Plan (TMP), red flag summary, Maintenance of Traffic Alternatives Analysis (MOTAA). Additionally, attending and running TMP meetings.
- HOV equivalency analysis and submit to FHWA for approval, if required
- Safety analysis using the Highway Safety Manual (HSM) and submit to FHWA for approval, if required
- Landscape Architecture design of any roadside landscaping and stormwater management landscaping required for the project(s)
- Forest Impact Analysis, Significant tree identification, development of forest impact plans, tree preservation plan and design of any reforestation mitigation required for the project(s)
- Preparation of any necessary documents to obtain final reforestation site review approval from the Maryland Department of Natural Resources
- Complete all work related to providing a noise study(ies) that makes a final determination on reasonableness and feasibleness related to noise abatement.
- Prepare and coordinate the Joint Permit Application(s) (JPA) including but not limited to preparation and submittal of the JPA application(s) to SHA with attachments including location map, impact plates, trilogy request and

- Acquisition of Environmental Permits
- Acquisition of Right-of-Way
- Review Construction CAP proposals and compare to ICE
- Reconcile Final CAP for each phase
- Construction Management and Inspection Services
- 4 3 Design required noise abatement

Scope Validation and Identification of Scope Issues

A Scope Validation Period of 120 days from the date of the Notice to Proceed for Design and Preconstruction Services will be provided on this contract. During the Scope Validation Period, the Design-Builder shall thoroughly verify and validate that the Design-Builder's understanding of the scope of work and its ability to complete it within the Design and Preconstruction Services Fee. Any Scope Issues determined during this period shall not be deemed to include items that the Design-Builder should have reasonably discovered prior to submission of its Technical Proposal.

If the Design-Builder intends to seek an adjustment to the Design and Preconstruction Fee due to a Scope Issue, it shall promptly, but in no event later than the expiration of the Scope Validation Period, provide the Administration in writing with a notice of the existence of such Scope Issue and basis for such Scope Issue. Within 30 days of the notice, the Design-Builder shall provide documentation that specifically explains its support for the Scope Issue, which shall include among other things: (a) the assumptions the Design-Builder made during the preparation of its Proposal that form the basis of its allegation, along with documentation verifying it made such assumptions in developing its Proposal; (b) explanation of the Scope Issue that the Design-Builder could not have reasonably identified prior to submission of the Technical Proposal; (c) specific impact on the Design and Preconstruction Services. For the avoidance of doubt: (1) The Design-Builder shall not be entitled to raise any Scope Issues that were not previously addressed with a notice; and (2) Design-Builder shall have no right to seek any relief for any Scope Issues not identified in a notice provided to the Administration during the Scope Validation Period.

Within a reasonable time after the Administration's receipt of the documentation, the parties shall meet and confer to discuss the resolution of such Scope Issues. If the Administration agrees that the Design-Builder has identified a valid Scope Issue, a change order will be executed to increase the value of the Design and Preconstruction Fee; however, the Construction Services will be adjusted to retain the overall fixed value of the contract. Notwithstanding anything to the contrary in the Contract Documents or a matter of law, the Design-Builder shall have the burden of proving that the alleged Scope Issue could not have reasonably been identified prior to the submission of the Technical Proposal and such Scope Issue materially impacts its Design and Preconstruction Services Fee.

The parties acknowledge that the purpose of the Scope Validation Period is to enable the Design-Builder to identify those Scope Issues that could not have reasonably been identified prior to the submission of the Technical Proposal. By submission of the Technical Proposal, the Design-Builder acknowledges that the Scope Validation Period is a reasonable time to enable the Design-Builder to identify Scope Issues that materially impacts its Design and Preconstruction Fee. The Design-Builder will assume and accept all risks to complete the Design and

Non-Confidential Questions

Contract No. MO0695172

IS 270 Innovative Congestion Management Contract

Request for Proposals – Questions and Responses

The following questions were received on September 2, 2016.

Question 1:
Please provide the SHA I-270 accident data in Excel Spreadsheet format from SHA OOTS TDSD's ACRES system to aid with the expedited review and analysis of data during the Technical Proposal phase of the I-270 project.

Response 1:
Crash data in Excel format has been posted on ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\E_Appendices\04 - Existing Crash Data\Accident Data\

Question 2:
Please provide Synchro files which were used to develop signal timing for signalized intersections in the VISSIM network to aid with the review and analysis of solutions during the Technical Proposal phase of the I-270 project.

Response 2:
Synchro files are not available. The existing signal timing sheets were used for 2015 design year and minor signal timing adjustments were made to traffic signals with excessive delays and queues for 2040 no-build design year.

Question 3:
Will SHA provide consistent parameters such as number of runs, seeds, seeding time for the VISSIM runs so that all teams provide comparable results for SHA to evaluate?

Response 3:
As stated on Page 48 of the Request for Proposals (RFP), "The Proposer shall use VISSIM version 7.00-13, shall follow SHA's VISSIM Modeling Techniques, shall not modify calibration parameters, such as vehicle inputs, vehicle routes, driving behavior, link behavior type, lane change distance, speed distributions and decisions without providing justification to the SHA and must use the simulation parameters and random seeds as provided in the VISSIM files when reporting results."

The following questions were received on September 7, 2016.

Question 4:
Please provide the following: schedule and plans for MD 85 at I-270 project, MD 121 at I-270 project, and schedule for I-270 at Watkins Mill project.

Response 4:
The Watkins Mill Interchange is planned to be re-advertised in 2017; however, a precise schedule is undetermined and will depend on the magnitude of the design changes (if any) that will be required to accommodate the I-270 Innovative Congestion Management (ICM) Contract.

The I-270/MD 121 Interchange Improvements Project is in the planning phase. Information can be found at the following project website:

http://apps.roads.maryland.gov/WebProjectLifeCycle/ProjectInformation.aspx?projectno=MO4261115

Final review plans for the I-270/MD 85 (Phase 1) Interchange Reconstruction Project (Contract No. FR3885171) have been posted to ProjectWise at the location below. Additionally, Plans, Specifications, & Estimate (PS&E) plans for a stream stabilization project (Contract No. MO1605174) have been posted to ProjectWise at the location below:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\E_Appendices\11 - Other Projects\

The latest advertisement, bid, and notice to proceed (NTP) dates for these projects can be found in the Contractor's Ad Schedule on SHA's website:

http://www.roads.maryland.gov/pages/contractadschedule.aspx

Question 5:
Please provide the following: 100 scale mapping north of the Watkins Mill project.

Response 5:
The SHA will not provide additional 100 scale mapping. A planimetrics file for the area north of the 100 scale mapping has been posted to ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\07 - Planimetrics\mTO_planimetrics_I270.dgn

Question 6:
Please provide the following: crash data in MS Excel format.

Response 6:
See question 1.

Question 7:
Please provide the following: traffic counts in 15 minute increments and in MS Excel format.

Response 7:
Two MS Access databases have been posted to the ProjectWise location below, one for I-270 and one for Montgomery and Frederick Counties. A data dictionary has been included to explain

the columns in the tables. Also, the locations of the counts have been included in shape and KMZ formats.

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\E_Appendices\02 - Existing Traffic Counts\15 minute counts\

Question 8:
Please provide the following: speed data in 15 minute increments (collected at the same time as the traffic counts).

Response 8:
Speed, Travel Time Index (TTI), and Planning Time Index (PTI) data for the I-270 mainline (from the spurs to I-70), the I-270 collector distributor (CD) lanes, and I-495 (from American Legion Bridge to the spurs) has been posted to ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\E_Appendices\10 - 2015 Avg Weekday INRIX Data\

Question 9:
Please provide the following: Excel sheet for I-270 Concept Evaluation 042516 Final.pdf.

Response 9:
The Excel files used to generate said document had been posted to ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\I_I-270 Concept Evaluation Templates\files\

Question 10:
Please provide the following: origin-destination data and 5 year interval traffic projections through 2040.

Response 10:
Origin-destination data and land use information in 5 year increments have been posted to ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\E_Appendices\09 - MWCOG Travel Demand Model Outputs\

Question 11:
Please provide the following: small structure inventory for Frederick County.

Response 11:
The following file on ProjectWise has been updated to include the maps for Frederick County:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\03 - Inventory of Existing Structures\Inventory Maps\Small Structures.pdf

Three additional small structures (10182X0, 10358X0, and 10359X0) have been added to the following ProjectWise folder:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\03 - Inventory of Existing Structures\Other Structures\

Question 12:
Please provide the following: utility designation north of the Watkins Mill Project, right-of-way (ROW) mosaic north of the Watkins Mill Project, pavement borings/geotech info north of the Watkins Mill Project, and wetland delineation and environmental features north of Game Preserve Road.

Response 12:
The extent of additional base information required to complete design will be highly dependent on the concept; therefore, the additional data collection needed to complete the project is included in the pre-construction services to be provided by the Design-Builder.

Question 13:
Please provide the following: pavement structure numbers of all shoulders.

Response 13:
The SHA has not performed any design to date. Pavement design is included in the pre-construction services to be provided by the Design-Builder. Prospective proposers may, at their will and discretion, perform preliminary calculations during the procurement phase.

Question 14:
Please provide the following: noise model north of Watkins Mill.

Response 14:
The SHA will not provide additional noise models. Should the project require noise analyses, the Design-Builder shall develop the required noise models, analyses and reports as part of the pre-construction services.

The following questions were received on September 12, 2016.

Question 15:
Our Team is requesting access to view and use the “Explore and Visualize Crashes” tool within the RITIS (Regional Integrated Transportation Information System). This tool will be beneficial to the project by allowing our team to view more detailed crash data to better identify the deficiencies along I-270.

Response 15:
Proposers may request one team member to be provided RITIS access. If access is desired, please submit a request to the project email address along with the name and email address of the user to whom RITIS access will be given.

Question 16:
In reference to RFQ/RFQ Article XII.B.7, is it acceptable to use VISSIM Version 8.00-10 in lieu of Version 7.00-13?

Response 16:
VISSIM version 7.00-13 shall be used. However, additional supporting information related to the technical proposal may be included in the Appendix.

The following questions were received on September 27, 2016.

Question 17:
Please provide clarification on the schedule of prices as shown in the RFP. All three bid items are shown as lump sum, but the RFP describes a design development process involving SHA, the DB team and public/stakeholders as required by SHA design development policies. Throughout the design process, it is likely that the construction scope will evolve with stakeholder and SHA input. For clarity, will the lump sum prices also evolve as the scope becomes better defined in the design period?

Response 17:
The contract budget is $100,000,000 and this budget is fixed. As noted in the question, the proposed concept and final construction scope shall continue to evolve during design, as is usual for all design processes and projects, prior to reconciliation of a Construction Agreed Price (CAP). However, the Design and Preconstruction Services Fee should be considered to be a "Guaranteed Maximum Price" or upset limit. It shall include all design and preconstruction services needed to deliver the scope of improvement proposed by the Design-Builder.

The Construction Management Fee shall include all profit, general and administrative costs, regional and home office overhead, and other indirect costs, as specified in Article XII.C.2 beginning on page 48 of the RFP.

The Construction Services Fee is determined by subtracting the Design and Preconstruction Services Fee and Construction Management Fee from the total contract budget. Regardless of what the final construction scope becomes, each construction package price will be reconciled and have its own agreed upon CAP. The sum of all the CAPs, any necessary right-of-way acquisition costs, and utility relocations costs will not exceed the Construction Services Fee, which is a "Guaranteed Maximum Price" or upset limit.

If there is a scope change during the design and preconstruction services, then it will be handled by the appropriate contract specifications. However, the Administration does not intend to increase the value of the contract and the Design-Builder will need to propose modifications to stay within budget.

Question 18:
What level of design and plans related to PTCs are required for the Technical Proposal submittal?

Response 18:
Per General paragraph of Article XII.B (Technical Proposal) in the RFP (page 42), "The Technical Proposal submittal shall contain concise narrative descriptions and graphic illustrations, drawings, charts, plans and specifications that will enable the Administration to clearly understand and evaluate the capabilities of the Design - Builder and the characteristics and benefits of the proposed solutions." Proposers are responsible for determining the necessary level of detail that will enable the Administration to clearly understand and evaluate the capabilities of the Design - Builder and the characteristics and benefits of the proposed solutions.

Question 19:
Since each PTC is being evaluated on its own merits, and with its own VISSIM analysis, please clarify what should be submitted with the final Technical Proposal? Is a VISSIM model for each PTC required, or one model that combines each of the PTCs selected by the DB for inclusion in their Technical Proposal?

Response 19:
One VISSIM model that combines each of the PTCs selected by the Design-Builder for inclusion in the Technical Proposal shall be submitted. Please refer to Article XII.B.7 in the RFP (page 48).

Question 20:
We request that SHA consider revising the Technical Proposal due date to either December 21st or January 18th.

Response 20:
In Addendum No. 2 the Technical Proposal due date was revised to January 19, 2017.

Question 21:
Is there any VISSIM calibration report available? If so, please provide.

Response 21:
A VISSIM calibration memorandum has been posted on ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\E_Appendices\ 03 - VISSIM Traffic Models\I-270 Modeling Calibration Methodologies Memorandum.pdf

Question 22:
Can SHA provide any origin-destination traffic data for the GP and HOV lanes within the corridor used to develop existing and 2040 traffic volumes for the corridor?

Response 22:
See response to question 10.

Question 23:
We have been unable to locate any CAD files on PW that support the TNM validation that has been done, including Microstation files with the NSA shapes, the measured receptors and the TNM validation model layouts. Will SHA provide these files to all proposers?

Response 23:
MicroStation files with the NSA shapes, the measured receptors and the TNM validation model layouts will not be provided.

Question 24:
Special Provision Insert, TC-5.01 Insurance, page 2, 6th paragraph requires "*Any policy exclusions shall be shown on the face of the Certificate of Insurance or provided with the Certificate of Insurance.*" All policies have numerous standard exclusions which are usual and customary in the industry. Listing all these exclusions in or attached to the certificate of insurance would be an unnecessary administrative burden. Please consider the following amendment, which we believe is the true intent of this requirement, "*~~Any policy~~ Policy exclusions applicable to the requirements herein shall be shown on the face of the Certificate of Insurance or provided with the Certificate of Insurance.*"

Response 24:
This is a standard Special Provision for all Administration contracts and will not be modified.

The following questions were received on October 6, 2016.

Question 25:
If our proposed solution requires additional staff to operate, beyond the existing MDOT / CHART manpower capabilities, is the additional staffing to be included in the current $100M budget? If yes, for what period of time (years) would the staff need to be provided? Will additional staffing (temporary or permanent) be SHA employees, contract employees, or staff provided by the Design Builder? Will staff be located in an existing MDOT / CHART facility. If yes, which existing facility?

Response 25:
No, the contract budget does not include long-term Operations and Maintenance (O&M) costs. The budget does include design, construction, integration, testing, system documentation, training and anything else needed to turn over to the State a fully functional & operational system.

Though long-term O&M costs are not included in the budget, as part of their Technical Proposal Submittal, Proposers are responsible for evaluating impacts to O&M, and justifying and documenting anticipated O&M requirements. Please refer to the Operability/Maintainability/Adaptability goal in the RFP. The SHA needs to clearly understand the impacts the project will have on its O&M programs.

Question 26:
If our proposed solution requires "back-office" computers and other equipment, shall they be housed in an existing MDOT / CHART facility. If yes which one? If no, would the Design Builder be required to provide such facilities and would the cost be included in the current $100 Million budget?

Response 26:
Housing back-office computers and equipment in MDOT, SHA and/or CHART facilities is potentially feasible, but not required. Proposers would need to confirm that the proposed location would be implementable, assuring basic system support such as telecommunication connectivity, a reliable power supply, accessibility for maintenance and system redundancy.

Proposers will design the system and should propose where the best location would be. There are numerous alternatives – e.g. the Statewide Operations Center, the Hanover Traffic Signal Shop, the Glen Burnie Data Center, District 3, etc. Proposers shall determine the most practical solution that meets the goals of the project. As noted above, using a State facility is feasible.

Regardless of where the equipment is housed, the Design-Builder shall provide all required equipment and facilities to turn over to the State a fully functional & operational system, as noted in response 25, the cost for which must be paid for from the contract budget.

Question 27:
If existing MDOT / CHART facilities are being utilized for proposed operational activities, is the Design Builder responsible for any improvements to the facility (physical improvements or new equipment/connectivity) as part of the $100 Million budget? Please provide any existing plans or requirements for where equipment or staffing might be housed at the proposed MDOT / CHART facility including IT and computer facilities so we can estimate the cost of any improvements. Please arrange for access to the proposed facility for the Design Builders designers and estimators.

Response 27:
The cost of improvements to MDOT facilities shall be paid for from the project budget if the improvements are required for the Design-Builder to provide a fully functional system at project completion. The Design-Builder is not responsible for facility improvements unrelated to the project.

Your request for existing plans/information is too broad. Also, SHA does not know the equipment/staffing requirements for your proposed solutions and would be unable to determine potential housing locations. However, to help Proposers conceptualize potential housing locations, Proposers may visit SHA facilities. To make an appointment, Proposers may send an email request to the project email address, specifying which facility and potential dates.

Question 28:
Will maintenance of any new field ITS devices need to be covered in our $100 Million budget? If so, for what time period and to what extent is expected?

Response 28:
No. See response to question 25.

The following questions were received on October 10, 2016.

Question 29:
The RFP allows for resubmittal of PTC's after receiving initial feedback from SHA, but it does not specify a due date. Can a PTC be resubmitted after the 11/17 Last Day to submit PTC's, if the initial submittal was made prior to 11/17?

Response 29:
Yes.

Question 30:
We request permission to engage in joint discussions with FHWA and the SHA noise barrier team on proper implementation of Federal Highway Noise Regulations and Guidance. If you concur with this request, please provide appropriate point of contact.

Response 30:
Proposers may meet with the SHA Noise Team by sending a request to the project email address. If additional guidance from FHWA is needed, SHA will follow up and report back to the Proposer(s).

Question 31:
A fiber optic exists along I-270. Can this fiber optic be utilized for the project?

Response 31:
The Administration has determined that up to 4 fibers may be dedicated to this project.

The following question was received on October 13, 2016.

Question 32:
The RFP requests us to "*Discuss what modifications would be needed to the proposed Watkins Mill Interchange project to be compatible in a safe and efficient manner with your Innovative Congestion Management improvements.*" In order to properly reply to that question may we please have the latest Watkins Mill Interchange plans to review so the proper analysis can be made.

Response 32:
The Watkins Mill Interchange plans were previously posted on ProjectWise on June 7, 2016. The Proposer shall discuss what modifications would be needed to the proposed Watkins Mill Interchange as shown in that information.

The following questions were received on October 15, 2016.

Question 33:
Please furnish the 2015 Calibration Report for the I-270 Vissim models.

Response 33:
See response to question 21.

Question 34:
Please furnish contact information for Network Maryland.

Response 34:
Contact information for Network Maryland can be found on the Maryland Department of Information Technology's (DoITs) website.

Question 35:
Page 2 of the RFQ/RFP indicates that all costs for ROW acquisition will be subtracted from the established cost for Construction Services, and that ROW acquisition will be completed by the Administration. Please specify and generally describe applicable SHA costs related to ROW acquisition, e.g. purchase cost, legal fees, assessment fees, GEC fees, SHA staff, etc.

Response 35:
Only the final negotiated purchase cost of the ROW will be subtracted from the Construction Services Fee. All SHA labor and overhead—including that of our ROW specialists who will make first offers, negotiate, prepare documentation, etc.—will not be subtracted from the contract budget. Please note, development of ROW needs and plats are included in the Design & Preconstruction Services, and, therefore, will be subtracted from the contract budget.

The following questions were received on October 17, 2016.

Question 36:
As indicated in the RFQ/RFP, the Mobility Section in our Technical Proposal is of Critical Importance is 16 pages and will represent 50% of our Technical score The other sections representing the remaining 50% are 30 pages are rated only Important. We request that the page count for the Mobility Section be increased to accurately represent the relative level of importance and scoring of our proposal. A suggested page count for the Mobility Section is 25-30 pages.

Response 36:
The Administration will increase the page count to 20 pages for the Mobility section with a future addendum.

Question 37:
We request that full page explanatory graphics not count against the total page count of a specific section when included in the Technical Proposal (and not the appendix).

Response 37:
The specified page limits shall include full page explanatory graphics.

The following questions were received on October 18, 2016.

Question 38:
Can SHA provide GIS information for existing stormwater management BMPs, drainage areas and storm drains along the I-270 corridor in Montgomery County and Frederick County?

Response 38:
Available GIS information has been posted to ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\08 - SWM GIS maps\

Question 39:
Please confirm the IS 270 Congestion Management contract shall be all-inclusive and not rely on any follow-up SHA or County contracts, such as future overlays to repair any stripping eradication efforts, to meet SHA or RFP requirements.

Response 39:
No resurfacing projects on I-270 are funded or programmed in the near future. Proposed improvements for the I-270 Innovative Congestion Management contract shall be all-inclusive and not rely on improvements provided in other projects.

The following questions were received on October 31, 2016.

Question 40:
Please confirm that since this is not a capacity addition project, but a congestion management and reduction project of existing roadway traffic that noise analysis and potentially new noise walls, or modifications to existing noise walls or other mitigation efforts, will NOT be required.

Response 40:
Per the RFP Contract Provisions, General Provisions, Terms and Conditions and Technical Requirements, the Design-Builder shall comply with all Federal, State and local laws, ordinances and regulations applicable to the activities and obligations associated with this project. The Design-Builder is responsible for determining whether noise mitigation will be required to implement the Design-Builder's proposed improvements. Please note that noise analysis and mitigation may be required if, based on the scope of improvements, the NEPA defined project is considered Type I. Refer to the MDOT SHA Highway Noise Policy and 23 CFR 772 for additional information related to the definition of Type I projects.

Question 41:
Please confirm that if no new full time mainline or CD lanes are added to the existing I-270 typical section, noise analysis and potentially new noise walls or modifications to existing noise walls or other mitigation efforts will NOT be required.

Response 41:
See response to question 40. Full-time use is not a consideration for the determination of a Type I project. Part-time shoulder use would fall under the definition of a Type I project. Refer to FHWA's Use of Freeway Shoulder for Travel for additional information.

Question 42:
Please confirm that if revisions to current entrances and exit ramp configurations along the I-270 corridor are proposed, noise analysis and potentially new noise walls, or modifications to existing noise walls or other mitigation efforts will NOT be required.

Response 42:
See response to question 40.

Question 43:
If a noise analysis is performed utilizing current criteria on the existing I-270 configuration and traffic, (without any or with only minor improvement such as the installation of gantry's, detection or ramp metering made by the Design Builder) and the results indicate additional noise mitigation is required, will the design builder be required to provide such mitigation as part of the $100 Million dollar budget? If so what would be the limit of the mitigation – the entire corridor from the I-495 juncture to the I-70 interchange - or other limits.

Response 43:
All costs for noise mitigation required by the Design-Builder's project(s) to comply with all applicable Federal, State and local laws, ordinances and regulations, shall be a part of the contract budget. This includes any required Right-of-way and or Utility Relocations needed as a result.

Multiple environmental documents may be developed for the contract. Each separate project for an environmental document must be a standalone construction project that connects logical termini and be of sufficient length, have independent utility, and not restrict consideration of alternatives for other reasonably foreseeable transportation improvements. If the project is determined to be a Type I project, the level of mitigation required and the limits of that mitigation would be determined based on any noise analysis done for the environmental document(s) to meet applicable Federal, State and local laws, ordinances and regulations.

The following questions were received on November 2, 2016.

Question 44:
It was noted that the wetlands and waterways shapes and delineation report were a draft. Have they been finalized?

Response 44:
The wetland delineation report has been finalized and posted to ProjectWise at the location below:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\E_Appendices\06 - Wetland Delineations\

Also, the shape files have been updated and replaced at the location below. Included is a CAD file of the wetlands and waterways (mEF_I270_16.1019.dgn).

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\B_Survey and Topographic Files\02 - Environmental Features Files\

Question 45:
Since noise mitigation does not contribute directly to meeting the project goals, would MDOT consider utilizing a separate funding mechanism for noise barriers?

Response 45:
Yes. The Administration has decided to use another funding source(s) for the construction of noise barriers. This will be reflected in Addendum No. 3.

The Design-Builder shall identify in its proposal where noise barriers may be required, including approximate locations and areas. As part of its design and preconstruction services, the Design-Builder will be responsible to complete all work related to providing a noise study to make a final determination on reasonableness and feasibleness related to noise abatement for the Design-Builder's project(s) to comply with all applicable Federal, State and local laws, ordinances and regulations.

The SHA will be responsible for final design and construction of any required noise abatement and the additional impacts or requirements they incur, including additional utility relocations, grading, drainage, SWM, retaining walls, etc.

Please note, responses to questions 40, 41, and 42 still apply. Also note, this response (45) supersedes the first paragraph of response 43.

The following questions were received on November 14, 2016.

Question 46:
Please provide a copy of the SHA application for Federal funding under the Integrated Corridor Management (ICM) program.

Response 46:
The requested document has been posted to ProjectWise at the location below:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\09 - Integrated Corridor Management\

Question 47:
With regard to communications for ITS field devices such as CCTV cameras, message signs, and ramp meters, we understand there are four (4) existing dark fibers on the corridor that are available for use by the design-builder. If so:

a) How do we obtain the exact locations of existing fiber conduits, pull boxes, and splice vaults?
b) Are we able to break into the fiber duct at any point to add additional pull boxes and splice vaults?
c) Can we splice into existing fibers at any new/existing pull box or splice vault?
d) Can we add additional fiber within the existing conduits?
e) Are there spare conduits in the existing ITS duct bank?
f) Does SHA have any mandatory standards on communication architecture or equipment? For instance, is there a requirement for Cisco-supplied switches or for GB Ethernet?

Response 47:
There are four (4) existing dark fiber strands on the corridor that are available for use by the Design-Builder. The locations of these strands were previously posted to ProjectWise and can be found at the following location:
pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\06 - ITS Information\

These four (4) fibers are a part of the MDOT's Resource Share Agreement (RSA) with Level 3. Only these four dark fiber strands are available for the Design-Builder to use. There are no other existing strands or conduits available for the Design-Builder's use. Level 3 owns the strands and requires that any splicing of the strands be performed by Level 3's certified splicers. Any associated cost for that splicing shall be part of the project budget. The RSA does allow for the ability to add new pull boxes and/or splice vaults but does not allow adding fiber to the existing conduits. Any new pull boxes and/or splice vaults must be coordinated with Level 3, and locations must be approved by Level 3. If the Design-Builder's solutions require additional conduit/fiber, the Design-Builder will be required to construct these new resources as part of their project.

SHA does not have any mandatory standards on communication architecture or equipment. However, the Administration values a project which will provide for ease of operations and maintenance. It is the Design-Builder's responsibility, per the RFP, to describe how its approach, including communication architecture or equipment, will ensure the SHA will have a fully functional system that is easily maintainable.

Question 48:
We request the SHA re-evaluate the DBE participation goal of 25% for the Design and Preconstruction phase of the project.

The Construction portion of this phase involves only Estimating and Project Management (no construction). It is unrealistic to ask the Construction firm selected to subcontract out ¼ of its estimating and or management functions. Those two key functions are never subcontracted out by any Construction firms as no firm would allow these two key functions to be performed outside of their organizations from both a propriety and leadership standpoint. This fact is recognized in the DBE requirements included in SHA's CMAR program where DBE participation is not required for this phase of the project. The following is taken from one of the recent CMAR RFQ's. *"The overall DBE participation goal will be 0% of the total Contract price for the Preconstruction Services. Due to the nature of the Contractor's role in the Preconstruction Design phase, the Administration has determined that there are insufficient subcontracting opportunities to justify a DBE goal on the Preconstruction Design phase."*

The above will therefore require that the full 25% of Design and Preconstruction services be shifted to the Engineering portion of the fee putting a DBE component of approx. 35% to 40% on the designer. As an innovative project requiring "World Class" expertise to identify and implement new innovative solutions specialize senior staff will be required from the firms other national or international offices. That staff is generally only found in large multinational engineering and planning firms - not local small DBE organizations. There are specific areas where DBE firms can be utilized (e.g. Outreach, Survey, Subsurface investigations, etc.) but these tasks do not come close to equaling 25% of the total Design and Preconstruction fee.

We respectfully request the Design and Preconstruction DBE requirement be lowered to no more than 5% to 10% of the total Design and Preconstruction fee. If desired by SHA, the resulting decrease in DBE dollars can be shifted to the Construction portion of the project so as to provide the same total DBE participation for the full $100 million dollar project budget as previously desired.

Response 48:
On Design-Build projects, typically 30% of the portion of the contract price allocable to professional services requires good faith effort to achieving DBE/MBE participation. Understanding that, in addition to the professional services, that the Contractor's preconstruction services are included in the Design and Preconstruction Services Fee, the Administration determined that overall 25% was a realistic MBE goal contract to be in line with 30% of professional services allocable to MBE participation. This would allow all preconstruction services to be completed the Contractor with a similar level of MBE for professional services to other Design-Build contracts. We believe there are other areas for DBE participation above those identified such as highway, traffic, drainage, stormwater management, erosion and sediment control, permitting, noise analysis, etc.

Question 49:
On normal DB and CMAR projects the different sections of the technical proposal are divided between several different groups to review and score totally independently. Will that be same on this project. Will the Technical Proposal be reviewed by three independent groups, do the individual groups see the other sections, and are the given the appendix?

On this project, that is so non typical and innovative, we request SHA review the above assumed procedures and have one team review and score the entire document. As a minimum we believe, if independently scored, the teams should have access to the entire document, including the appendix.

Response 49:
Yes, the technical proposal will be broken down into individual Evaluation Factors and evaluated independently by different evaluation teams as described in the RFP beginning on page 50. This is SHA's standard evaluation process that serves the organization well, regardless of the nature of the project.

The following question was received on November 27, 2016.

Question 50:
On page 41 Item 4 of the RFP "Effect of Submitting a Proposal" it states we are to "*perform the work for the price submitted within the time(s) specified*". We have found no time to be specified in the RFP for completion and Section B on pages 42 thru 47, which details what is to be included in our technical proposal, does not request a schedule or completion date. We therefore assume individual completion dates will be assigned to each construction package at the time the CAP's are determined. Please confirm our assumption or inform us where the completion date is specified or requested.

Response 50:
The schedule for design and completion of construction for each CAP will be determined by the Design-Builder as part of the submittal of its Technical and Price Proposal. See Response 2 (R2) in the Notice to Prospective Proposers dated June 17, 2016. The completion date shall be provided on Page 41 of 43 of the Price Proposal Form Packet.

The following question was received on December 1, 2016.

Question 51:
As a follow up to question number 49: Will the reviewers of the individual sections have access to the full technical proposal, including the appendix?

Response 51:
As stated in the RFP on page 51, "Each Evaluation Team will only be given the section or sections for each specific Evaluation Factor or Factors they are rating and not the Technical Proposals in its entirety. Evaluations will be limited to the information provided in the specific Evaluation Factor section and will not consider information provided in other sections." Each Evaluation Team will have access to the appendix, which is not rated. It should be noted the Evaluation Teams determine the initial technical ratings. The Evaluation Committee, which determines the overall technical ratings, will have access to the entire Technical Proposal and appendix.

The following questions were received on December 5, 2016.

Question 52:
RFQ Article XII.B.5.ii (Page 47) requires the proposer to "Discuss the services to be provided by the Design-Builder." Please clarify what services are to be addressed in this section of the Technical Proposal.

Response 52:
Discuss the Design and Preconstruction Services, and any other services the Design-Builder will provide that will best meet or exceed the goals of the project.

Question 53:
In the definition of Construction Agreed Price on pages 3 and 4 of the RFP, it states that a CAP "shall include all final design…" Please define "final design".

- Is this the design effort required to progress the design to 100% from the 65% state used for negotiation of the CAP?
- If the cost to progress the design from 65% to 100% is included in the CAP, what further design effort, if any, is required if SHA elects to bid a package competitively?

Response 53:
Final design for a work package, the cost of which is included in the CAP, is the design effort required to complete design for that work package. For example, if the CAP is initiated at 65% design, final design is the effort required to progress design from 65% to 100% release for construction drawings, including revisions/redlines. If the CAP is initiated at 90% design, final design is the effort required to progress design from 90% to 100% release for construction drawings, including revisions/redlines. Proposers shall identify in their proposals at what percent design completion (e.g. 65%, 90%, 100%, etc.) CAPs will be initiated. If SHA rejects the Design-Builder's price and bids the package competitively, no further design effort will be required by the Design-Builder. The Administration will terminate the process and complete design by some other means for that work package.

Question 54:
In the second paragraph addressing Construction Agree Price on page 4, it is noted that, "A proportionate amount of the Construction Management Fee will be included in the CAP." Is it the intent of the PDB process for the total amount of all executed CAPs to equal the sum of the Construction Management Fee bid item and the Construction Services Fee bid item, less any amount paid to third parties for ROW acquisition and utility relocation? If so, this seems inconsistent with the paragraph's first sentence that says, "A zero-dollar change order will be executed to subtract the amount of the CAP, and any associated right-of-way and utility relocation costs, from the <u>Construction services</u> costs..." (Emphasis added.)

Response 54:
Assuming the entire budget were to be spent and there were multiple independent projects, then the sum of the CAPs and amount paid to third parties for ROW acquisition and utility relocation for each project would add up to the Construction Services Fee submitted as part of the Price Proposal. Likewise the Construction Management Fee for each project would add up to the Construction Management Fee submitted as part of the Price Proposal.

Page 4 of the RFP goes on to state, "For example, if the Construction Management Fee was five percent when compared to the Construction services costs, this amount will be added to the CAP and subtracted from the original Construction Management Fee as part of the change order. Payment for the Construction of the project will be paid through an agreed upon work breakdown structure." Thus the change order pulls the CAP, ROW costs, and utility relocation costs from the Proposal Construction Services Fee, and pulls a proportionate amount from the Proposal Construction Management Fee. The purpose of the net zero dollar change order is to approve the CAP and create a pay item for it.

Question 55:
In the event that SHA executes its right to competitively bid a PS&E package, will there be any further obligation under this contract to provide design, preconstruction, or construction management services?

Response 55:
All Design and Preconstruction Services in the contract shall be provided until the Administration terminates the contract.

There is no obligation to perform Construction Management (CM) services until a CAP is accepted. If a CAP is not accepted, then the Design-Builder is not obligated to provide CM services for that work package. If a CAP is not accepted, this does not release the Design-Builder from its obligation to perform CM services for other CAPs that have been accepted.

Question 56:
On the bottom of Page 4 of the RFP in Section I.A, there is the subtitle **Design and Preconstruction Services**. The ensuing paragraph seems to be addressing the contract as a whole, including the Construction Management Fee and Construction Services Fee. Is there an inconsistency here?

Response 56:
The SHA is entering into a contract with the Design-Builder to complete the Design and Pre-Construction Services as required in the Technical Proposal. If SHA is agreeable to the CAP(s), then a net zero dollar change order will be executed for a CAP to include the PS&E package of that CAP. The Design-Builder cannot proceed with any Construction Services until SHA has approved a CAP and issued Notice to Proceed for the CAP.

Question 57:
At the bottom of RFQ page 48 in Section XII.C.2, it is noted that regional and home office overhead costs are to be included in the Construction Management Fee. No further guidance on overhead cost is provided in the ensuing table. Please clarify where to allocate the cost for establishing and maintaining a project office on the jobsite.

Response 57:
An engineer's office would be included in a CAP.

Question 58:
At the bottom of RFQ page 48 in Section XII.C.2, it is noted that general and administrative costs are to be included in the Construction Management Fee. Does this include all costs for indirect items such as Bond, insurance premiums, permits, licenses, and success fees? Might not

a separate mobilization bid item for a fixed amount of say $1,500,000.00 be appropriate for such one-time expenses?

Response 58:
If a separate mobilization item were included in the Schedule of Prices (SOP), it would apply to all work packages; however, each work package must be independent and severable. Like all other work items necessary for construction (e.g. construction stakeout, maintenance of traffic, class 1 excavation, etc.), mobilization for each work package will be included the CAP for that specific package. Permits and licenses are also included in the CAP(s). Any cost associated with providing requirements to submit a proposal, such as Proposal Guaranty for the overall $100 M contract, may be included in the Design and Preconstruction item.

Regarding Success Fees, refer to Response 4 (R4) in the Notice to Prospective Proposers dated June 17, 2016.

Question 59:
Please confirm that the "Traffic Control Plan Certification" is not relevant to this contract.

Response 59:
The Traffic Control Plan Certification Contract Provision should be completed with Option 3 checked as it is the Design-Builder's responsibility to provide any traffic control plan.

Question 60:
TC-4-02 Failure to Maintain Traffic indicates a $1,000 per day deduction for failure to maintain the project. Please clarify if this is only applicable to active work zones or if it is applicable to the entire length of I-270.

Response 60:
TC-4.02, Failure to Maintain Project, is applicable to the work as defined in GP-5.11, Maintenance of Work During Construction.

Question 61:
TC-7.05 addresses retainage on Progress Payments. Is it the intention of the Authority to hold retainage on the Design and Preconstruction Services Fee? Is this necessary when the Authority is only paying for "services actually provided and invoiced" as stated on in XII.C on page 48?

Response 61:
Retainage applies to all work under the contract.

Question 62:
Should execution of the Buy American Steel Form (Page 3 of 43 of the Contract) be deferred until CAP negotiation?

Response 62:
The Price Proposal form needs to be completed in its entirety and no portion of it can be deferred to a CAP.

Question 63:
The standard MDOT MBE Form A on Page 15 of 43 includes a certification referencing the "total dollar amount of the Contract" although the goal at the time of submission is only applicable to design work. Please clarify how this form is to be completed.

Response 63:
The form should be completed for the Design and Preconstruction Services. See response 56.

The following question was received on December 6, 2016.

Question 64:
We have had difficulty reproducing some of the results in the evaluation templates provided by SHA. We would like to be able to replicate the results to ensure the validity and comparability of all team's results.

Response 64:
The model must be run in **32-bit mode** to replicate the VISSIM model results that SHA has provided for every MOE.

The following question was received on December 7, 2016.

Question 65:
Does the Watkins Mill Interchange Project impact Level 3?

Response 65:
Yes. Design plans for the proposed relocation of Level 3 have been posted to ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\F_Watkins Mill Interchange Plans\Level 3 Relocation\

The following questions were received on December 8, 2016.

Question 66:
In the *General Requirements* on page 2 of Section I.A, it states that the Design-Builder shall complete all design and construction work in two phases, Phase IV - Final Design and Phase V – Partnering during design and construction, Review Shop Drawings, Revisions, Redesign Under Construction, As-Built Plans and provisions for expert court testimony. Please clarify the intent or significance of Phase IV and Phase V in the context of either this two-phase procurement or the two-phase contract.

Response 66:
The intent is to ensure that the consulting services provided and tasks performed by the Design-Builder during both phases of the contract comply with the Administration's policies and

procedures and the requirements set forth in "Volume II -Specifications for Consulting Engineers' Services," dated 1986.

Question 67:
A definition of *Opinion on Probable Construction Cost* (OPCC) is provided on page 3 in Section I.A. Please confirm that the OPCC is simply the aggregate construction cost of anticipated improvements and that these costs are expected to be incorporated into CAPs as the "Construction, labor, equipment, and materials and all incidentals necessary to complete the Construction of the package."

Response 67:
The OPCC is the actual Construction cost the Design-Builder estimates to build all aspects of a Construction package.

Question 68:
On page 4 as part of the definition of a CAP, it states that SHA will consider establishing a risk sharing pool with the Design-Builder during the Design and Preconstruction phase. Please clarify whether the funding for this risk sharing pool is from within or outside of the $100 million fixed value of the contract.

Response 68:
Risk sharing pools must come from the contract's fixed budget.

Question 69:
In the *General Requirements* in Section I.A and again in Section I.F *Scope of Services / Description of Work*, there are multiple references to "milestones". Please define these milestones.

Response 69:
Proposers shall determine what milestones are needed to deliver a well-managed project.

Question 70:
Section XII.C.1 defines the *Design-Builder Design and Preconstruction Services Fee*, noting that payment will be based on services actually provided and invoiced.

a. Subsequent language requires the Design-Builder to provide a fee breakdown. Is this Design-Builder requirement relevant to Proposal content or is this just guidance on how the successful proposer (the Design-Builder) is to bill for post-Award design services?
b. The final sentence of this segment indicates the Design-Builder shall provide a breakdown for each firm showing the estimated direct labor breakdown, estimated direct expenses, approved audited overhead, and profit. Is this also guidance on how the successful proposer (the Design-Builder) is to bill for post-Award design services for work performed by the Lead Designer and any subconsultants?

Response 70:
The fee breakdowns are not merely guidance. They are required of all Proposers in their Price Proposals.

Question 71:
Section XII.C.2 indicates that the Proposer will provide a breakdown of all components used in establishing the fee. Is this Proposer requirement relevant to Proposal content? If so, where in the Proposal should this information be provided?

Response 71:
This requirement shall be provided with the Price Proposal.

Question 72:
In response to Question #48, it was noted that “the Contractor’s preconstruction services are included in the Design and Preconstruction Services Fee.” Assuming that the table provided at the top of page 49 is applicable to the entire contract and not just to the Construction Phase, please provide guidance or examples for other types of Contractor costs that can be included in the fee for design and preconstruction services. Alternately, please confirm that the table on page 49 is only applicable to the Construction Phase thereby allowing Contractor project costs to be classified as preconstruction services during the Design Phase.

Response 72:
The table on page 49 is applicable to the Design-Builder’s Construction Management services, which support the Construction Services and are not needed for nor applicable to the Design & Preconstruction Services.

Question 73:
Regarding ground mounted signs along the corridor: If a sign is proposed to be relocated without changing the content of the sign, does the sign material need to be upgraded to MUTCD standards?

Response 73:
Upgrading existing facilities to current standards when no safety or operational issues exist is not a contract goal. Existing signs that are not impacted and will remain in place do not necessarily need to be upgraded to MUTCD standards. However, once the Design-Builder changes the conditions in which that sign exists, including the sign’s location or message, the sign should be upgraded to current MUTCD standards.

Question 74:
For signs mounted on cantilever or sign bridges: If a sign must be relocated to a different location without changing the content of the sign, does the sign material need to be upgraded to MUTCD standards?

Response 74:
Yes. See response 73.

Question 75:
If a sign remains in place with a different message, does the sign material need to be upgraded to MUTCD standards?

Response 75:
Yes. See response 73.

Question 76:
If a sign with the same message must be temporarily removed and replaced on a new structure in the same location without changing the message, or a different location on the same structure without changing the message, does the sign material need to be upgraded to MUTCD standards?

Response 76:
Yes. See response 73.

Question 77:
Are there any restrictions for including discussion of costs in the technical proposal?

Response 77:
No.

Question 78:
For the final proposal, can the PTC's and other Appendix data be presented in only electronic format and provide the required copies for the technical and cost proposal only?

Response 78:
Proposals shall include hard copies of the Concept Evaluation Templates. All other appendix materials may be saved onto a flash drive.

Question 79:
We would like to request the following data for six scenario years including the years 2015, 2020, 2025, 2030, 2035, and 2040:

A. Four OD trip tables for all scenarios, which are inputs to the 4th iteration highway assignment. These OD trip table names are i4_AM.VTT, i4_MD.VTT, i4_PM.VTT and i4_NT.VTT.
B. Two highway assignment loaded networks for all scenarios, which are outputs from the 4th iteration highway assignment. These loaded network names are i4_HWY.NET and i4_HWYMOD.NET.
C. The full MWCOG model transmittal folder with input files, scripts and all the supporting input data.

Response 79:
The MWCOG model input files and the documentation necessary to run the model successfully have been posted to ProjectWise at the following location:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\10 - MWCOG model\

Proposers can use these files to run the interim year models and generate loaded networks and time of day trip tables. This model set represents version 2.3.57a, the 2015 CLRP and Round 8.4 land use assumptions.

The following question was received on December 11, 2016.

Question 80:
We understand this is past the due date for questions and apologize for this late clarification request; however, we believe it may be in the Administration's best interest to provide additional information to the proposers on formatting of the Technical Proposal and Appendix. The only guidance provided is that the Technical Proposal (including appendix) shall be in a 3-ring binder and any "*Charts, exhibits, and other illustrative and graphical information may be on 11"-by-17" paper, but must be folded to 8.5"-by-11", with the title block showing. An 11"-by-17" sheet will be considered only one page*."

It may be inconvenient to unfold and then refold each sheet individually as your team reviews the material and we may not be able to fit, in a reasonably sized single 3-ring binder, if tri-folded. We respectfully request the appendix be allowed in its own 11"x17" binder with unfolded sheets.

Response 80:
The appendix can be in its own 11"x17" binder with unfolded sheets. Also, see Response 78.

The following question was received on December 16, 2016.

Question 81:
Question 70 addressed a cost breakdown that must be provided by the Design-Builder. Question 71 addressed a cost breakdown that must be provided by the Proposer. In both cases, the SHA response indicates that the required breakdown must be provided with the Price Proposal. It is mandated on RFP page 40 that the "Price Proposal shall be submitted on the Price Proposal Form supplied by the Administration…" Would the aforementioned Article XII.C breakdowns be a supplement to the 43-page Price Proposal Form since there does not seem to be an appropriate place for inclusion within those 43 pages.

Response 81:
Yes, the cost breakdown should be a supplement submitted with the Price Proposal Form.

The following question was received on December 19, 2016.

Question 82:
We have been unsuccessful in exporting the document "Ver2.3.57a_Conformity_2015CLRP_Rnd8_4_Xmittal.zip" located in the following folder on ProjectWise:
pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\10 – MWCOG model\

We believe this is due to the zip folders size (25.48 GB). Would you please consider breaking this folder into smaller zip files, or extracting the files into the 10-MWCOG model folder so that we can download the information and put it to use on this project?

Response 82:
The files that were in the zip file "Ver2.3.57a_Conformity_2015CLRP_Rnd8_4_Xmittal.zip" have been extracted and placed at the following location on PW:
pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\10 - MWCOG model\Ver2.3.57a_Conformity_2015CLRP_Rnd8_4_Xmittal\

The following questions were received on December 23, 2016.

Question 83:
The fifth paragraph of TC-5.01 indicates that Workers' Compensation policies are the only exceptions to an endorsement requirement. Please note that such endorsements are not commercially available on a Professional Liability insurance policy because of the nature of the coverage. Accordingly, we request listing of Professional Liability insurance as an exception.

Response 83:
Professional Liability insurance may be an exception.

Question 84:
TC Section 5 Article .02.1 is an additional requirement for the Professional Liability Insurance Policy to provide various indemnifications. Please note that such indemnifications are not commercially available because of the nature of the coverage. Accordingly, we request deletion of this requirement.

Response 84:
This is a standard Special Provision for all Administration contracts and will not be modified.

Question 85:
TC Section 5 Article 02.4a establishes a requirement to name the State Highway Administration in various insurance policies, presumably meaning that the Administration must be named as an Additional Insured. Consistent with the questions addressing endorsements and indemnifications and with the nature of errors and omissions coverage, we request that Professional Liability Insurance be listed with Workers' Compensation as an exception to this requirement.

Response 85:
The said article states, "Each policy, with the exception of Workers' Compensation and Professional Liability Insurance, shall name the State Highway Administration."

Question 86:
TC Section 5 Article 02.4b uses "named insured" as an identifier, as was the case in 02.4a. Please consider revising the reference to Additional Insureds, assuming this is the intent of the requirement.

Response 86:
The said language, “named insured,” is consistent with other provisions in SHA’s Standard Specifications for Construction and Materials, 2008.

Question 87:
TC Section 5 Article 02.5 requires the insurance company to notify the Administration, the Design-Build Team, and each insured about policy cancellation or modification. The industry-standard Notice of Cancellation to Others will trigger appropriate notifications if a policy is cancelled, but it will not react to modifications. We suggest that the obligation for notification of policy modifications be eliminated or assigned to the design-builder. Alternately, could the Administration provide an example Notice of Cancellations to Others endorsement that they have accepted in the past?

Response 87:
This is a standard Special Provision for all Administration contracts and will not be modified.

The following question was received on December 24, 2016.

Question 88:
A safety and resurfacing project (Contract No. MO1865177) has appeared on the contractor’s advertisement schedule. It appears to be located on I-495 near the southern end of the I-270 contract. The advertisement date is 2/14/17 and the NTP date is 5/22/17. Are plans available?

Response 88:
Yes. Plans have been posted to ProjectWise at the following location:
pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\E_Appendices\11 - Other Projects\MO1865177 - IFB_PS&E- Design Plans.pdf

The following question was received on January 4, 2017.

Question 89:
Article VIII.B on page 23 of the RFP mandates meeting or exceeding the DBE Participation Goal for work performed under the Design and Preconstruction Fee bid item. Please clarify this requirement. Does the reference to a goal only pull in the goal for 25% DBE participation, or does this reference also pull in the subgoals for 9% female participation and 6% African-American participation?

Response 89:
The Design-Builder shall meet or exceed the DBE goals, including sub-goals, required by the Contract Provision AFFIRMATIVE ACTION REQUIREMENTS UTILIZATION OF MINORITY BUSINESS ENTERPRISES FOR STRAIGHT STATE CONTRACTS (page 3 of 10).

The following question was received on January 9, 2017.

Question 90:
The RFP states that the Contract MBE goal as shown in the Appendix is only applicable to the Design and Preconstruction item in the Price Proposal. The Design and Preconstruction item includes significant cost for items such as 'costs associated with providing requirements to submit a proposal, such as the Proposal Guaranty' (per Response 58) and the contractually required ACONEX project management software. There is no ability to provide MBE participation for these items or to help meet the MBE goal via the considerable construction to be performed under the CAPS, forcing the entire MBE participation for the Design and Preconstruction to be achieved via professional services participation. Is it SHA's intent that the MBE goal be achieved on the entire value of the Design and Preconstruction item, or may the MBE goal be interpreted to apply only to those professional services being provided by the Lead Design Firm and its subconsultants?

Response 90:
25 percent of the Design & Preconstruction Services Fee provided with the Price Proposal must be MBE. As mentioned in Response 48, the MBE goal has been adjusted down from what a typical design-build project would require to account for Preconstruction Services and Aconex costs. Also note, the Design-Builder is not required to include the Proposal Guaranty in the Design & Preconstruction Services Fee. The Design-Builder may elect to include the Proposal Guaranty in the Construction Services Fee.

The following questions were received on January 10, 2017.

Question 91:
Has the Maryland State Highway Administration issued a wage determination for the project based upon the (Anticipated) Notice to Proceed Date of March 2017?

Response 91:
Prevailing wage rates will be established with the CAP.

Question 92:
Will the Maryland State Highway Administration consider establishing indexed base cost for petroleum based products (diesel fuel, hot mixed asphalt pavements and slurry seal) and structural steel?

Response 92:
Any adjustments will be included in the CAP. Depending on the scope of the CAP, typical SHA adjustments for asphalt binder, pavement density, asphalt mixture, pavement surface profile, and diesel fuel will be included. While SHA does not have a standard structural steel adjustment, this can be discussed with the CAP and potentially included in a risk sharing pool.

The following question was received on January 11, 2017.

Question 93:
Please confirm the design builder must provide Aconex project management software for this project. The cost of providing that software from March 2017 thru March 2020 is almost 1/4 of a million dollars. In addition after that date access to the data base to retrieve the project records would not be available unless additional payments are made by SHA on a yearly basis. Several members of our team have existing service agreement with other software firms for similar Project Management tools that could be made available for use on this project for no cost and would provide the SHA the availability to recover their Project Records at no cost after March 2020.

Response 93:
Confirmed. The Design-Builder is to provide Aconex project management software per the RFP.

Confidential Questions

October 18, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration (SHA) is in receipt of your follow-up questions from our One-on-One meeting for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172). The SHA offers responses below.

Question 1:
Please confirm, as discussed at the 2nd "One on One", that we may contact all 3rd party stake holders (not employed by MDOT) with any questions we may have regarding the project.

Response 1:
Proposers may contact 3rd parties not employed by the Maryland Department of Transportation (MDOT) or the Federal Highway Administration (FHWA). However, should you wish to disclose information concerning a Proposed Technical Concept (PTC) after submission to SHA, you must follow instructions as outlined in the RFP, Article XII.A.2.vi (PTC Confidentiality).

Question 2:
Please allow us to speak with representatives from District 3 and District 7 maintenance or management to discuss resurfacing priorities in their districts. If contact is not permitted, please advise of any potential or scheduled Milling / Overlay of I-270 mainline and/or CD's thru 2023. If that information is not available, please advise when I-270 mainline and CD's (list by sections) was last milled and overlaid and what frequency SHA usually utilizes between pavement milling and overlay on Interstate highways with high traffic volumes.

Response 2:
No resurfacing projects on I-270 are funded or programmed in the near future. Proposed improvements for the I-270 Innovative Congestion Management contract shall be all-inclusive and not rely on improvements provided in other projects.

Question 3:
Please provide As-Built plans for the existing Fiber running along the I-270 Corridor. Please also provide As-Built plans for any existing Fiber routes that connect the existing Fiber running along I-270 to existing Operations / Control centers. If connectivity is along lease lines please provide copies of the leases. Please provide the number / size of existing available spare fiber or conduits on the above fiber routes.

Response 3:
The available utility as-built plans had been posted to ProjectWise at the location below. Additional as-built plans for fiber are unavailable.

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\04 - Utility plans and or as-builts\

Question 4:
Please provide the past Construction History Report's for the following Locations:

a. Montgomery County:
    i. I-270
        1. MP 2.0 to 12.0 NB
        2. MP 2.0 to 9.0 SB
        3. MP 15.0 to 16.0 SB
        4. MP 18.0 to 22.0 NB/SB
    ii. I-270Y
        1. MP 0 to 2 NB/SB
b. Frederick County:
    i. I-270
        1. MP 0-2 NB/SB
        2. MP 9.0 to 10.1 NB
    ii. I-70
        1. MP 15 to 15.5 EB
    iii. US 15
        1. MP 11 to 12 NB

Response 4:
As-builts for I-270 had been posted to ProjectWise at the location below:

pw:\\SHAVMPWX.shacadd.ad.mdot.mdstate:SHAEDMS01\Documents\Design-Build\MO0695172\H_Additional Material\05 - As-Builts\

To request additional as-builts not to be shared with other Proposers, submit an independent request by following the instructions provided at the following website:
http://www.roads.maryland.gov/index.aspx?pageid=783

Question 5:
Please provide historic crash data along I-495 between the American Legion Bridge and I-95.

Response 5:
To request additional crash data not to be shared with other Proposers, submit an independent request by filling out the attached form and send it to the email address at the bottom of the form.

Question 6:
May we mount Dynamic Lane Control Arrows on exiting bride superstructures if their max size is approx. 15" x 15" and they do not add any additional surface area for wind loading. In replying please assume prior to final design we would provide calculations indicating the existing superstructure's structural ability to accept the additional signage.

Response 6:
The SHA's Office of Structures (OOS) will allow Dynamic Lane Control Arrows to be mounted on the superstructure of its bridges. Signs must not reduce the vertical under clearance beneath a structure. Final approval will be given on a case by case basis based on a submittal package that details the sign, method of connection and calculations showing that no adverse effects to the structure will result (i.e. reduction in load rating of the structure).

Question 7:
May we mount Dynamic Lane Control Arrows on exiting bridge substructures – assume max size is approx. 15" x 15".

Response 7:
The SHA's OOS will allow Dynamic Lane Control Arrows to be mounted on the substructure of its bridges. Signs must not reduce the vertical or horizontal clearance beneath a structure. Final approval will be given on a case by case basis based on a submittal package that details the sign, method of connection and calculations showing that no adverse effects to the structure will result.

Louis Robbins, P.E., DBIA
Page Four

Any additional questions or communications should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

Confidential Question 8: Can we speak with Network Maryland regarding potential telecommunication issues associated with this project became Non-Confidential Question 34 (See Page 7. Appendix | 36).

Confidential Question 9: Is there a usage or licensing fee associated with utilizing existing dark fiber or empty conduit along the I-270 corridor or back to the TOC3 or SOC became Non-Confidential Question 47 (See Page 7. Appendix | 40).

November 4, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction, MD

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration (SHA) is in receipt of your follow-up questions from our One-on-One meeting for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172). The SHA offers responses below.

Question 10:
Please provide the most current set of preliminary drawings for the proposed renovation to the SOC.

Response 10:
Enclosed is the conceptual proposed layout. The video wall layout is still in discussion and no plan is available; however, the video wall will be similar to the current arrangement except the lower part of the video wall will be recessed to provide more operational floor space.

Question 11:
The Price Proposal description for the Design and Pre-construction Fee on page 48 of the RFP allows the Design-Builder to choose the level of Design required to negotiate the CAP. Will the cost of finalizing the design past that point be included in the Construction Services Fee?

Response 11:
Yes. Completing design of a work package will be included in each corresponding CAP.

Question 12:
As indicated in our One on One, the boring information provided with the RFQ/RFP for soil borings within the limits of the GPR data does not match or validate the GPR data. Please indicate which data should be used for design. If we are instructed to only use the boring data, please indicate if risk sharing will be allowable for this item, as there are extended gaps between borings with no information on shoulder pavement structure with the exception of as-built plans.

Response 12:
The quality level varies between differing types of data collection methods and sources. For example, a utility designation is considering quality level B, while test holes are of a higher quality (level A). When test hole data differs from the utility designation, the test hole takes precedence. Likewise, soil borings are of a higher quality over GPR and take precedence when there is a discrepancy.

As noted in the question, there may be extended gaps in the borings. These borings were obtained by the Administration for the purpose of assisting prospective proposers with developing a proposal. While these borings can be used by the successful proposer for design, they were not meant to be the only borings needed to design the project(s). The Administration could not have obtained all the requisite borings for design because the construction scope and the extent of the contract improvements were unknown. After NTP, additional soil borings will be required to complete design. Per the RFP, all soil borings and other data collection activities needed for design of the Design-Builder's project(s) (e.g. metes and bounds survey, utility test holes, etc.) shall be included in the Design & Preconstruction Services to be performed by the Design-Build Team.

Any additional questions or communications should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

Proposal Technical Concepts

PTC No.: 01 – VISSIM Modeling	Date Submitted: October 18, 2016
Related Disciplines: Traffic Engineering, Modeling	Corman Construction

A) Description: ***Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.***

The identification and selection of improvements which are included in the final technical proposal will be based in part on the traffic operations benefits (volumes, travel times, queues, etc…) as demonstrated using the VISSIM model provided by SHA as part of this RFP. This model was developed and calibrated by SHA using static assignment of traffic within the model. This technique is well suited to performing a detailed analysis of traffic operations for geometric improvements and static lane closure or lane assignment scenarios.

The Managed Motorways solution being evaluated for this project includes Coordinated and Adaptive Ramp Metering as a core component. In order to manage and maintain mainline traffic throughput without reaching oversaturated conditions, the Managed Motorways system uses coordinated and adaptive ramp meters combined with Active Traffic management (ATM) and geometric improvements to balance and optimize vehicle storage across all entrance ramps in the network. In actual operation, metering rates are updated in real time using a predictive algorithm and historical congestion information in order maintain optimal throughput on the mainline lanes. Modeling this real-time adaptation and evaluating its associated improvement to traffic operations cannot adequately be directly performed within the static VISSIM model provided for use under this RFP.

We propose to evaluate the coordinated and adaptive ramp metering performance using an iterative approach through a combination of an in-house Managed Motorways optimization model that evaluates optimal metering rates which can be input into the VISSIM model provided by SHA for use under this project. Our in-house Managed Motorways Optimization model is a Microsoft Excel® based tool which has been refined and used on multiple projects, including those currently being performed for DOT's in Colorado, Utah and Georgia. Under this approach we will use a proprietary model developed in-house at WSP|Parsons Brinckerhoff to develop and optimize ramp metering rates and ramp storage for use in VISSIM modeling.

Figure 1 shows a sample output screen from the Managed Motorways Optimization Model. The model evaluates express lane and local lane through volumes based on metering rates, queues and wait times.

Interchange	CD Lanes: Vol Change	Mainline: Vol Change	Meter Rate	Queue	Wait Time	CD Lanes: Running Total	CD Lanes: Over / Under	Mainline: Running Total	Mainline: Over / Under
								11,330	1,170
Mainline to CD	3,320	(3,320)				3,320	1,080	8,010	90
MD 927 (Montrose Rd)	(1,545)					1,775	2,625		0
MD 927 (Montrose Rd)	1,770		1,675	95	3	3,450	950		0
Mainline to CD	300	(300)				3,750	650	7,710	390
CD to Mainline	(300)	300				3,450	950	8,010	90
MD 189 (Maryland Ave.)	(736)					2,714	1,686		0
MD 189 (Maryland Ave.)	900		859	41	3	3,573	827		0
Mainline to CD	770	(770)				4,343	57	6,940	1,160
CD to Mainline	(926)	926				3,417	983	7,866	234
MD 28 (W. Montgomery Ave.)	(1,578)					1,838	2,562		0
MD 28 (W. Montgomery Ave.)	825		775	50	4	2,613	1,787		0
Mainline to CD	925	(925)				3,538	862	6,941	1,159
CD to Mainline	(1,368)	1,368				2,170	2,230	8,310	1,990
Shady Grove Rd	(1,420)					750	3,650		0
Shady Grove Rd	1,500		1,416	84	4	2,166	2,234		0
Mainline to CD	2,234	(2,234)				4,400	0	6,076	2,024

Figure 1 - Managed Motorways Optimization Model Output

These rates will subsequently be modeled using VISSIM to evaluate traffic performance. The traffic performance and measures of effectiveness output from the VISSIM model will in turn be used to revise and update the ramp metering rates within the Managed Motorways optimization model. Figure 2 provides a graphical depiction of this process.

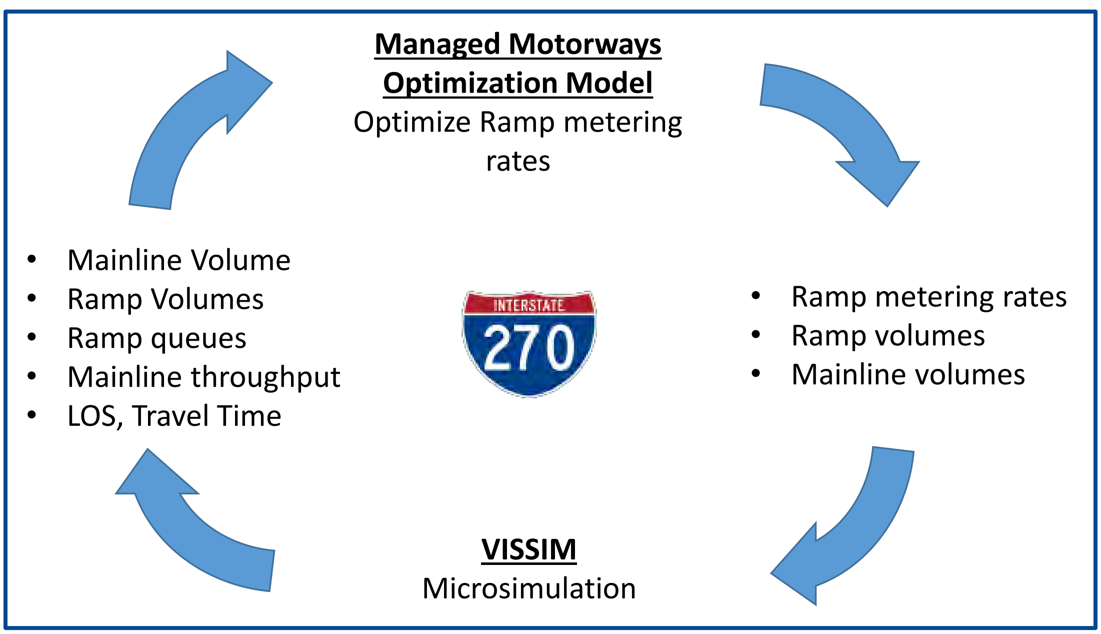


Figure 2 - Iterative Approach to Modeling

This process will allow us to adequately analyze the traffic operations performance measures for the Managed Motorways components of the project while accounting for the highly adaptive nature of the solution in the field.

B) *Location: The locations where, and an explanation of how, the PTC will be used on the Project.*

Corridor Wide. This applies to the VISSIM modeling of Managed Motorways improvements, with particular emphasis on the coordinated and adaptive ramp metering component.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

This process will allow us to adequately analyze the traffic operations performance measures for the Managed Motorways components of the project while accounting for the highly adaptive nature of the solution in the field.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

We do not anticipate any negative impacts either during or after construction as a result of this PTC. By utilizing the adaptive evaluation during the proposal process a more accurate picture of the improvements can be obtained vs the static model.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

We have adapted our usual process in order to comply with the requirements of this RFP. Our in-house Managed Motorways Optimization Model has been developed and refined through application on projects being performed for DOT's in Colorado, Utah and Georgia.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

The risk is not utilizing this PTC and basing selection and analysis on a static model that is not taking into account corrections that can be made in the field as traffic demand and response changes to actual field conditions

G)* Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.

There is limited to No risk to the Design-Builder associated with implementing this PTC

H) Cost/Schedule Benefits: ***Discussion of any cost or schedule benefits to this contract from usage of this PTC.***

This PTC will allow us to comply with the RFP requirements while adequately analyzing the adaptive ramp metering components of the Managed Motorways solution.

I) Miscellaneous: ***Any additional information that would assist the Administration in the review of this PTC***

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

October 31, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction, MD

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 1 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on October 18, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the approach presented in this PTC to analyzing the traffic operations appears to be methodical and sound. When you deliver the results, please document and provide the Administration with the assumptions used in the optimizations such as any maximums or minimum delays or queues, as well as any priority or weighted preference between mainline I-270 vs. arterial demand. The evaluation team will need to be able to easily follow the methodologies used for the analyses.
2. Please consider addressing the following questions in the analyses and/or narrative:
   - How will the optimal ramp metering rates from the Managed Motorways optimization model be implemented into VISSIM (as ramp meter signals or by a reduction in the ramp volume based on the estimated entering volumes at each ramp)?
   - How will impacts to ramps and arterials be quantified?
   - Section D, Potential Impacts: Are there any potential safety implications along the ramps and arterials due to the adaptive ramp metering? Is there any potential impact on the local community due to increased congestion along the arterials due to the adaptive ramp metering?

My telephone number/toll-free number is 410-545-8800 or 1-888-228-6971
Maryland Relay Service for Impaired Hearing or Speech 1.800.735.2258 Statewide Toll Free

Street Address: 707 North Calvert Street • Baltimore, Maryland 21202 • *Phone* 410.545.0300 • www.roads.maryland.gov

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 02 - CHART Integration	Date Submitted: October 20, 2016
Related Disciplines: ITS, CHART	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

The current CHART operational strategy is focused primarily on detection, verification, and response to incidents, the provision of travel information, and in limited situations re-directing traffic for lane closures or major diversion needs. The current CHART software manages cameras, detectors, dynamic message signs, and road weather information systems.

Our proposed Managed Motorways solution will include tools CHART is already familiar with - to provide additional detection, surveillance, and DMS that will further enhance existing incident management and travel information capabilities. However, our solution will also introduce a stronger component of real time operational control above and beyond incident management and travel information. This will be accomplished through the addition of tools new to the CHART system such as ramp meters, lane control signals, hard shoulder running, and possibly other Active Traffic Management approaches such as variable advisory speeds , dynamic lane assignment, and more.

Our proposed solution will include an existing proven Managed Motorways software package to manage the devices new to CHART, including the algorithms necessary to implement the Coordinated and Adaptive Ramp Metering operational schemes and improve throughput along IS 270. This will allow us to leverage a proven and currently operational solution from Australia and rapidly deploy the benefits rather than trying to seek full CHART software integration and testing before “flipping the switch.” Our proposed approach is to utlize the existing Managed Motorways software “side-by-side” with CHART for a fixed period of time. We also propose the inclusion of staff support inside the SOC (or TOC3) during peak periods to operate side-by-side with CHART’s Highway Operations Technician (HOT) operators.

This strategy will allow immediate deployment of a proven traffic management solution and give CHART leaders time to evaluate a long term software and operational integration strategy for the Managed Motorways system.

Following the initial deployment period SHA can engage the existing CHART software contractor (CSRA) to incorporate the appropriate components and drivers within their system to accommodate the new devices and algorithms. It is our understanding that current CHART software is modular and new decision support tools are being added on a regular schedule. We propose that the initial software deployment, software technical support, training, and additional SOC (or TOC3) staffing will be included within the scope and schedule of this contract. The long term integration with CHART will be handled outside the scope and schedule of this contract.

After the period, CHART may also wish to add positions to its existing outsourced HOT contract to take over operations, or work with the Corman/PB team to continue utilizing their staff. Training will be provided during the side-by-side period in the event you wish to take it over.

Figure 1 presents a graphic representation of our proposed operational approach, depicting current conditions along with the proposed side-by-side period that would occur during the contract duration. The Long Term represents a time period after conclusion of the contract.

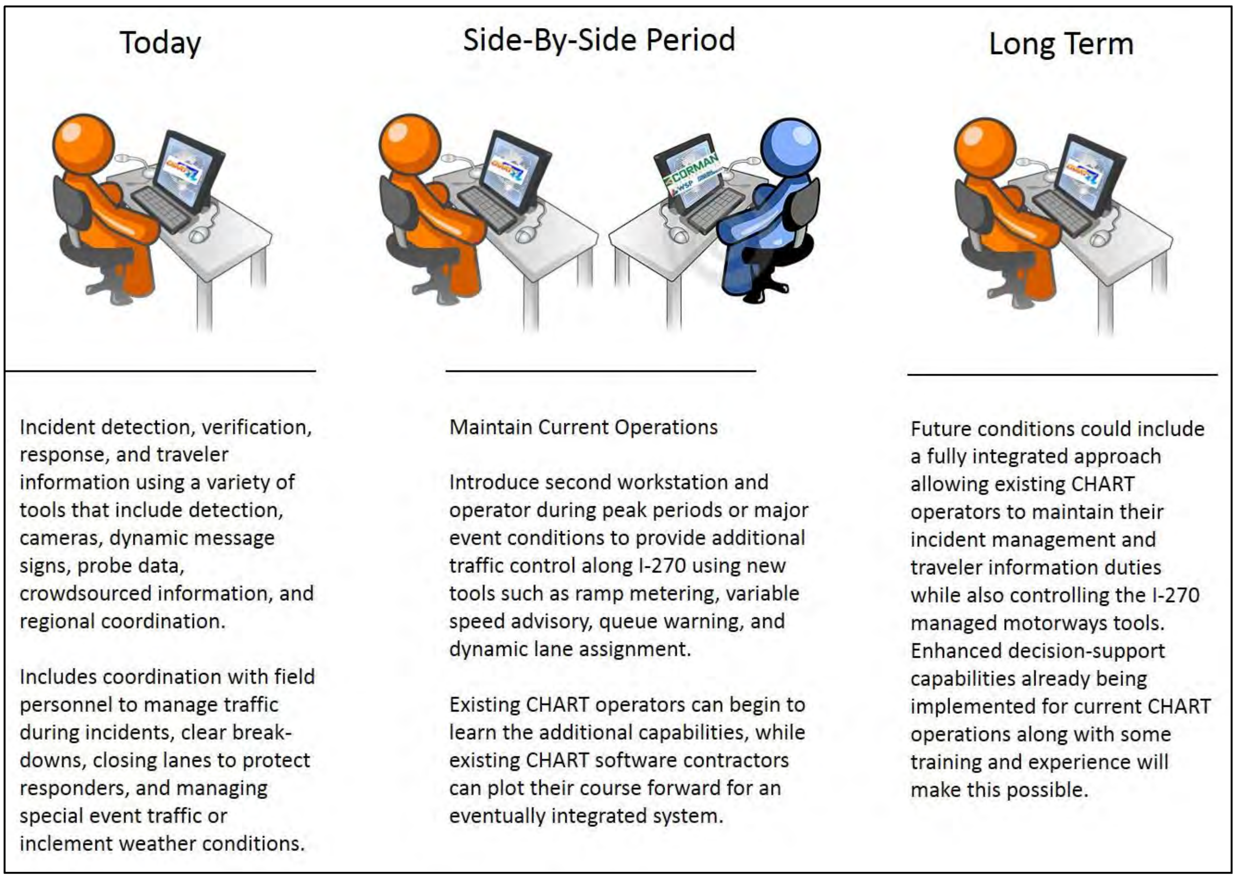


Figure 1 - Graphic representation of the side-by-side operation being proposed

B) *Location: The locations where, and an explanation of how, the PTC will be used on the Project.*

Given the flexibility of the current CHART software and the proven Managed Motorways software being proposed for our effort, the peak period operations could take place at TOC 3 or the SOC. However, since the software will need to be managed at the SOC during off-peak periods when TOC 3 is not live we recommend the entire program be managed out of the SOC. We are aware of an upcoming renovation of the SOC with temporary operations planned during the construction period. We will need to understand how this PTC would be impacted by the renovation.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

The development and testing of custom software is a time consuming and risky endeavor which costs money and causes delays in project delivery. By installing an existing proven software package which has been used for more than 6 years in a real-world environment, the cost and schedule risks are greatly reduced. The side-by-side period is intended to provide sufficient engineering support to also ensure that ramp meters are being constantly "tuned" for better efficiency, and CHART personnel are being trained on this process so they can take it over at the conclusion of the contract period. This approach will deliver benefits to commuters immediately, and any back-office computing and operational issues will be transparent to them. Proven improvements in mobility, safety, and reliability are installed more efficiently with this approach.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

Corman / PB will provide the initial standalone software, work station and side by side training for CHART operators. SHA will be responsible for the development and maintenance of all future custom software and device drivers required should they decide to fully integrate the Managed Motorways system into the existing CHART software. SHA can always decide not to integrate and simply continue licensing the software beyond the side-by-side period if it chooses.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

Colorado DOT - In an effort to recapture the benefits of the T-REX project, CDOT, as part of their Road-X initiative, is undertaking a pilot deployment project that will implement the coordinated ramp metering approach developed by VicRoads as part of their managed motorways concept in Australia. The intent of the pilot project is to demonstrate the effectiveness of the Australian managed motorways concept, and specifically the coordinated ramp metering approach, to control traffic flows within the corridor to reduce congestion, improve safety and increase the overall efficiency of freeway traffic flows.

Contact:
Peter Kozinski, P.E.
Director, RoadX Program
Colorado DOT
P 303.757.9033
Peter.Kozinski@state.co.us

Utah DOT - UDOT has recently completed the I-15 Managed Motorways Study which considers the applicability and benefits of Managed Motorways concepts successfully implemented by VicRoads in Melbourne, Australia. Having completed the planning study they are now preparing to embark upon a procurement effort to implement the results of their study along I-15.

Contact:
Rob Clayton
Director, Transportation Operations
Utah Department of Transportation
(801) 887-3707
rclayton@utah.gov

VicRoads - Roads Corporation of Victoria, the road and traffic authority in the state of Victoria, Australia - The first deployment of the Australian Managed Motorways concept was the M1 Freeway Management System, and it has since been replicated on several other freeways throughout Australia. At the highest levels, many aspects of the Australian Managed Motorways may seem familiar and similar to ITS tools and practices deployed in the United States. However, it is at the detailed technical level that many of these aspects differ and make the Managed Motorways approach unique. Advancements in contemporary traffic flow science provide the context necessary to compare Managed Motorways to conventional ramp metering applications. High level differentiators for Managed Motorways include its sophisticated algorithms, precise vehicle detection and "real-time" adjustments to traffic management schemes.

Contact:
John Gaffney
Manager Network Optimisation
VicRoads, Melbourne, Australia

john.gaffney@roads.vic.gov.au
https://www.youtube.com/watch?v=SYbceSqk_Mk

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

Our proposed side-by-side period puts a proven system in place to begin delivering commuter benefits immediately. And it provides SHA ample opportunity to observe, learn, ask questions, and map out a long-term strategy in partnership with the experts that have already proven this solution elsewhere. If the Administration chooses to integrate the Managed Motorways functionality into a future version of the CHART software it would be done after the completion of this contract. Likewise, if the Administration chooses to integrate the Managed Motorways functional in the CHART software before accepting completion of this contract (i.e., denying this PTC approach), there is a significant risk in achieving the promised results of the effort.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

The proposed solution greatly reduces the deployment and schedule risks to both the Administration and the Design-Builder.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

Deploying a proven software product with hands-on training of the proposed operators will greatly reduce cost and schedule impacts to the project while simultaneously delivering proven benefits to the commuter right away.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*

November 1, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction, MD

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 2 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on October 21, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable integration solution to address the goals of this contract.
2. Regarding the roadway management system, as we understand there are various hosting models. We would recommend that the discussion of the command and control of the traffic management elements include more specifics on:
   - Configuration management: From the PTC, it appears that at some point, the CHART system, roadway weather information systems and possibly other systems (e.g. the Montgomery County Signal System) will need to share key data as triggers (e.g. when and where an incident occurs, specific lanes blocked, etc.) Please address how changes to one system, impacting the format of how data is output and/or input, will be coordinated to prevent "breakage" of the integrated connection of systems.
   - Security: The CHART system resides inside the secured firewalls of the MDOT Enterprise Network. As such, data passed into the CHART system needs to meet the security requirements of the Maryland Department of Information Technology (DoIT). This does not apply to data passing out of the CHART system. CHART provides a Representation State Transfer (REST) feed for real-time incident information.
   - Hosting: If a stand-alone traffic management command and control system for the I-270 will be hosted, we would like to have additional information on the perpetual operations and maintenance, as well as potential licensing, requirements to assess the sustainability of the solution.

- Business Process: The CHART Program has specific responsibilities in coordinating the response of various agencies at highway incident scenes and providing traveler information. The ATM systems represent another tool, but also additional responsibilities in the incident management process. Please describe how the existing Traffic Incident Management (TIM) process will be coordinated in the Operations Center, and in the software, with managing ATM tools as well.

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 03B – NB Exit Ramp to MD 27 (Ridge Rd)	Date Submitted: November 04, 2016
Related Disciplines: Highway, H&H, Traffic	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This PTC proposes to restripe the exit ramp from northbound IS 270 to MD 27 (Ridge Road) to improve egress of exiting vehicles from the highway. The ramp would be restriped to a two-lane exit, with the existing right lane exit being maintained and the adjacent lane along IS 270 becoming a choice lane to exit or stay on mainline. Please refer to the attached mapping for a conceptual display of this PTC.

The existing typical section of the ramp includes an open section, single 15 ft. wide lane with a 4 ft. left shoulder and 10 ft. right shoulder. The proposed reconfiguration will restripe the ramp from the gore area to the existing 2 lane section to provide two 12 ft. lanes, with a 2 ft. left shoulder and 3 ft. right shoulder.

Based on available as-builts, it is assumed the shoulders do not require full reconstruction. The shoulder widths stated above do not meet AASHTO and will require a design exception. Please refer to the attached draft design exception for your review. It is anticipated that the at least a portion of the ramp would require wedge/leveling and resurfacing to correct cross slope issues and shoulder rollovers. Existing brown w-beam guardrail along the ramp will not be impacted and will remain. Multiple signs will be revised to indicate the modified lane use along IS 270 by placing a sign plate over the existing sign/lane use.

No impervious or full-depth reconstruction is anticipated with this option and therefore stormwater management should not be required.

We understand that coordination with FHWA will be required due to the minor modifications proposed to the off-ramp. FHWA's Interstate System Access Information Guide specifically states that FHWA Review and Action for the addition of lanes at a ramp termini may not be required, coordination should still be performed to identify any additional analysis or documentation required.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

As discussed above, this PTC will be implemented along the exit ramp from NB IS 270 to MD 27 (Ridge Road).

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

This PTC will help facilitate the heavy traffic movement utilizing this ramp in the PM peak. By doing so, it advances the mobility goal of this project by steamlining egress from IS 270, more efficiently moves vehicles off the highway, and allows for better movement of vehicles still traveling on the mainline.

In addition, improving mobility along the mainline will help reduce crashes related to recurring congestion, thus advancing the safety goal.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: As with any construction activity on a heavily congested corridor, users would be temporarily impacted as the improvement is constructed. Temporary impacts are mitigated by use of advance notice of the work, using limited and off-peak work hours, and night-time closure of the ramps to expedite construction. A preapproved detour would be implemented for any ramp closure. There are no long term user impacts from the construction of this PTC.

ii. Right-of-Way Impacts: There are no right-of-way impacts or additional right-of-way needed for the use of this PTC.

iii. Geotechnical Impacts: As indicated above, based on as-builts for IS 270, we assume reconstruction of the shoulders is not required. Soil borings will be required to verify this assumption.

iv. Utility Impacts: No impacts to utilities are anticipated by implementation of this PTC.

v. Environmental Impacts/Permitting: An MDE permit for E&SC and SWM is not anticipated to be required due to the minimal amount of disturbance and new impervious associated with this PTC. No other permits are anticipated.

NEPA approval will be required because there is a federal action involved in this PTC. A design exception is being requested, and coordination will be necessary with FHWA to determine the extent, if any, of an IAPA.

vi. Impacts to Local Communities: There are no adverse impacts to local communities resulting from the use of this PTC. Constructing this PTC will provide safer and more efficient travel conditions for motorists accessing communities along MD 27 (Ridge Road).

vii. Safety Impacts: A safer I-270 is anticipated with negligible negative safety impacts due to the addition of a choice lane.

viii. Life-cycle Project Costs: There is no change in the life cycle Project costs resulting from the use of this PTC.

ix. Infrastructure Costs: Project costs will be anticipated for the wedge/leveling, resurfacing, restriping, and signage adjustments necessary to implement this PTC.

For the minimal amount of pavement being added, additional maintenance, repair and operational costs (plowing) are very minor.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

Ramp restriping occurs regularly throughout Maryland and US to add capacity for the ramp. An example of a narrow typical section along a directional ramp exists on the on-ramp from MD 187 (Old Georgetown Road) to I-270 SB. Please refer to the picture below:

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

There are no known risks to the Administration resulting from the implementation of this PTC.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

There is limited survey, utility designation, environmental information, and pavement borings/cores available in this location. The associated risks include the potential for an unknown impact to be found. These are potential cost and schedule risks.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

Implementation of this PTC will improve mobility and safety at a minor cost, within a short period of time.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*

N/A

SHA State Highway Administration

CORMAN CONSTRUCTION | WSP | PARSONS BRINCKERHOFF

I–270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

LOCATION:
I–270 AT MD 27 (RIDGE RD)/FR. HURLEY BLVD

PTC 03B – NB OFF RAMP
TO MD 27 (RIDGE RD)

LEGEND

- FULL DEPTH RESURFACING
- PARTIAL DEPTH RESURFACING
- W–BEAM GUARDRAIL
- CONCRETE BARRIER

PTC 03B: NB Exit Ramp to MD 27 (Ridge Road)
Corman Construction

DRAFT Request for Design Exception

We are requesting your approval of a design exception for one area where the design does not meet AASHTO's "A Policy on Geometric Design of Highway Streets" (2011) recommendations. This exception is for shoulder width along the exit ramp from northbound I-270 to MD 27 (Ridge Road).

CONCEPT DESCRIPTION

This PTC proposes to restripe the exit ramp from northbound IS 270 to MD 27 (Ridge Road) to improve egress of exiting vehicles from the highway. The ramp would be restriped to a two-lane exit, with the existing right lane exit being maintained and the adjacent lane along IS 270 becoming a choice lane to exit or stay on mainline. Please refer to the attached mapping for a conceptual display of this PTC.

The table below summarizes the current and the design year traffic volumes for the exit ramp and northbound IS 270:

	2016	2040
Ramp ADT	16,200	18,000
Northbound IS 270 ADT	62,925	74,125

The goal of this concept is to help facilitate the heavy traffic movement utilizing this ramp in the PM peak. By implementing it, we hope to advance the mobility goal of this project by streamlining egress from NB IS 270, more efficiently moving vehicles off of mainline, and allowing for better movement of vehicles on the mainline at the location of the diverge.

PROJECT DESIGN CRITERIA

2011 "A Policy on Geometric Design of Highways and Streets" – AASHTO

DESIGN EXCEPTION

Shoulder Width – Left and Right Shoulders along entrance ramp from MD 117 to Southbound IS 270

a. Existing Condition

The existing typical section of the ramp includes an open section, single 15 ft. wide lane with a 4 ft. left shoulder and 10 ft. right shoulder. The proposed reconfiguration will restripe the ramp from the gore area to the existing 2 lane section to provide two 12 ft. lanes, with a 2 ft. left shoulder and 3 ft. right shoulder. Brown w-beam traffic barrier exists along both sides of the ramp. Sight distances along the inside of the ramp is meet and exceed standards as any obstructions are offset from the ramp to a great degree. Roadside grading along the ramp is flat up to the face of w-beam. The posted speed limit along IS 270 is 55 mph, and the advisory speed along the ramp is 50 mph.

Crash data provided with the projects RFP/RFQ is dated 2011-2013 and does not show any crashes along the on-ramp or crashes that would be impacted by shoulder width or barrier offset. There were 5 crashes were shown along NB IS 270 mainline in the vicinity of this ramp. Most were most likely related to congestion (rear ends possibly caused by ramp backups) or weather conditions.

b. AASHTO Design Criteria

AASHTO (dated 2011) page 10-102 recommends directional ramps with a design speed over 40 mph should have a paved right shoulder width of 8 to 10 ft., and a paved left shoulder width of 1 to 6 ft.

c. Proposed Condition

The proposed reconfiguration would restripe the existing available pavement to provide two 12 ft. lanes, with a 2 ft. left shoulder and 3 ft. right shoulder. The deficient shoulder width would not meet AASHTO recommendations for a total distance of approximately 1000 ft.

d. Design Constraints

The roadway typical section of the exit ramp from northbound IS 270 to MD 27 is restricted on both sides of the ramp by significant, mature tree coverage and steep slopes. It is possible that the existing barrier would not comply with SHA Barrier Placement Guidelines or AASHTO's Roadside Design Guide, thus requiring additional offset from the widened ramp. There are slope and backfill requirements for relocation of the barrier which could impact these trees by tying in the sideslope back to existing ground. The impacts would be exacerbated because we would be chasing grade.

e. Design Exception

We recommend that a design exception be considered for the reduced left and right shoulder widths along this ramp. There is no crash history to suggest a wide shoulder is necessary, the sight distance is sufficient, and there is sufficient flat grading along the left side of the ramp, in addition to the shoulder to remain, to allow for emergency pull-offs if necessary. Implementing this typical section does not add undo safety risks and would be an implementation of Practical Design by constructing a ramp that meets the goals of this project without significant widening, SWM, tree impacts or other incidental items that do not effectively advance the project goals.

f. Proposed Mitigation

Mitigation that can be implemented if necessary to offset the narrow shoulder widths include warning signage for narrow shoulders and rumble strips. The advisory speed of the ramp could lowered as well. Additional grading of the roadside area adjacent to the narrow shoulders could also be performed to fill in washed out areas and make the roadside smoother and more acceptable for an emergency pull-off area if necessary.

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 16, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 3B for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 4, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract.
2. Prior to establishing a CAP, a pavement analysis will be needed to confirm the existing shoulder is traffic bearing and to design a pavement section for the areas of full depth widening. Soil borings will be required. Per the RFP, all soil borings and other data collection activities needed to implement this PTC (e.g. metes and bounds survey, utility test holes, etc.) shall be included in the Design & Preconstruction Services to be performed by the Design-Build Team.
3. A National Environmental Policy (NEPA) document and an Interstate Access Point Approval (IAPA) approved by the Federal Highway Administration (FHWA) will be required prior to establishing a Construction Agreed Price (CAP). In preparation of the IAPA, the Design-Builder must meet the requirements of the FHWA Interstate System Access Informational Guide including demonstrating there are no safety or operational impacts to the interstate with the modification to the interchange.
4. Prior to establishing a CAP, a pavement analysis will be needed to confirm the existing shoulder is traffic bearing or, in the case it is not traffic bearing, to design a full depth pavement section. Soil borings will be required. Per the RFP, all soil borings and other data collection activities needed to implement this PTC (e.g. metes and bounds survey, utility test holes, etc.) shall be included in the Design & Preconstruction Services to be performed by the Design-Build Team.

My telephone number/toll-free number is 410-545-8800 or 1-888-228-6971
Maryland Relay Service for Impaired Hearing or Speech 1.800.735.2258 Statewide Toll Free

Street Address: 707 North Calvert Street • Baltimore, Maryland 21202 • *Phone* 410.545.0300 • www.roads.maryland.gov

5. As noted in the PTC, shoulder widths less than AASHTO standards will require an approved design exception prior to establishing a CAP. The sample design exception appears to generally contain the requisite information. More detailed information related to impacts and costs of fully meeting AASHTO requirements, potential impacts to safety and operations for implementing the design exception, and mitigation, if any, which would be implemented as a result of the design exception will be required for formal approval.

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 07 – Father Hurley Blvd. Combined NB Entrance Ramp Merge Area	Date Submitted: November 1, 2016
Related Disciplines: Highway, H&H, Traffic	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This PTC proposes to convert the existing on-ramps from eastbound Father Hurley Boulevard and westbound Ridge Road onto northbound IS 270 to a Collector-Distributor (C-D) Lane. This reconfiguration would improve ingress of vehicles merging onto the highway while reducing the number of on-ramps onto northbound IS 270 at the interchange. Please refer to the attached mapping for a conceptual display of this PTC. The acceleration lane for the loop ramp would be shifted horizontally away from the mainline providing a buffer, then extended downstream to the existing directional ramp creating the C-D lane. The existing directional ramp would merge onto the C-D lane, yielding to traffic coming from the loop ramp. Once merged, the combined traffic from the loop and directional ramps would merge onto northbound IS 270 further downstream. Due to right-of-way constraints the C-D lane would be separated from the mainline using a striped buffer as opposed to a positive barrier. Flexible, tubular delineators can be installed if some physical separation is required to prevent merging over the buffer area. This is a cost effective way to gain enforcement, but maintenance concerns include replacement of the delineators after they are damaged and plowing operations become more difficult.

The existing typical section of the loop ramp at the location of the mainline merge includes an open section, single 12 ft. wide acceleration lane with an 18 ft. right shoulder. The proposed reconfiguration would modify the gore area and include an open section, single 12 ft. wide C-D lane with a 6 ft. right shoulder and a striped 4 ft. buffer between mainline IS 270 and the C-D lane. The existing typical section of the directional ramp at the location of the mainline merge includes an open section, single 12 ft. wide acceleration lane with a 10 ft. right shoulder. The proposed reconfiguration would modify the gore area and include an open section, 12 ft. C-D lane and 12 ft. acceleration lane with a 6 ft. right shoulder and a striped 4 ft. buffer between the C-D lane and mainline IS 270.

Based on available as-builts, it is assumed the shoulders do not require full reconstruction. The lane and shoulder widths shown above meet AASHTO and would require approximately 8-12 ft. of widening and resurfacing. Existing brown w-beam traffic barrier on the right and left sides of the loop ramp would not be impacted and would remain. Existing brown w-beam traffic barrier and concrete barrier on the right side of the directional ramp would be removed and relocated to correct its height adjacent to the widened ramp. The impacted w-beam and concrete traffic barrier would be replaced if the existing is not salvageable. Four existing light poles would be impacted by the widening and require relocation. An existing drainage culvert may be impacted by the widening. If impacted the culvert would need to be extended. Signing would need to be revised to indicate the modified ramp configuration.

In addition, an adjacent ditch would be transformed into a dry swale to meet the latest Stormwater Management (SWM) requirements.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

As discussed above, this PTC would be implemented along the entrance ramps from eastbound Father Hurley Boulevard and westbound Ridge Road onto southbound IS 270.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

This PTC would minimize the entry points onto southbound IS 270 while increasing the length of weave area, in-turn improving the traffic operations and safety performance of the mainline. By doing so, it advances the mobility goal of this project by streamlining ingress onto SB IS 270 and more efficiently moves vehicles onto the highway with less friction points;, and allows for better movement of vehicles still traveling on the mainline.

In addition, the improved mobility along the mainline would help reduce crashes. Crashes related to closely spaced ramps and deficient acceleration lengths should also decrease, thus advancing the safety goal.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

   i. User Impacts: As with any construction activity on a heavily congested corridor, users would be impacted during construction by the Maintenance of Traffic. This can be mitigated by advance notice, limited work hours, and if allowable night time closure of the ramps to advance construction schedule. A night time closure is not required but after further analysis may show benefits worthwhile to both the administration and Design-builder. A preapproved detour would be implemented if a closure is deemed necessary.

ii. Right-of-Way Impacts: ROW information was not provided in this location, however based on the location of the ROW fence we believe there to be no ROW needs for to this concept.

iii. Geotechnical Impacts: Geotechnical information will be needed to support the pavement design and possible retaining wall construction for the ramp widening. Without boring information, it is assumed that full reconstruction of the shoulders is not necessary based off the asbuilts which show a full shoulder section within the limits of this concept.

iv. Utility Impacts: Impacts to SHA electric (roadway lighting) anticipated. Other impacts will need to be evaluated as better information becomes available.

v. Environmental Impacts/Permitting: An MDE permit for E&SC and SWM would be required. If any tree impacts are identified due to the SWM work, a roadside tree permit may be necessary. Wetland/WUS impacts will need to be evaluated as better data becomes available. No other permits are anticipated.

vi. Impacts to Local Communities: There are no adverse impacts to local communities resulting from the use of this PTC. Constructing this PTC will provide safer and more efficient travel conditions for motorists accessing IS 270 from communities along Father Hurley Blvd and MD 27 (Ridge Road).

vii. Safety Impacts: A safer I-270 is anticipated due to minimizing the entry points onto the mainline while increasing the length of the weave area.

viii. Life-cycle Project Costs: There are no change in the life cycle Project costs resulting from the use of this PTC.

ix. Infrastructure Costs: Initial infrastructure costs include pavement widening, restriping, lighting replacement/relocation, and SWM.

For the minimal amount of pavement being added, additional maintenance, repair and operational costs (plowing) are very minor.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

Reconfiguring interchanges by providing a C-D lane occurs regularly throughout the US and even in Maryland. A similar location where an interchange was reconfigured to provide a C-D lane is the MD 45 (York Road) ramps onto the outer loop of I-695 (Baltimore Beltway).

Additionally, the I-495 Inner Loop (Capital Beltway) in the vicinity of Arena Drive in Landover, recently had a restriping to include a similar C-D lane separated by a similar sized buffer. The outside shoulder along this portion of I-495 is also similar to what is proposed in the concept.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

There are no known risks to the Administration resulting from the implementation of this PTC.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

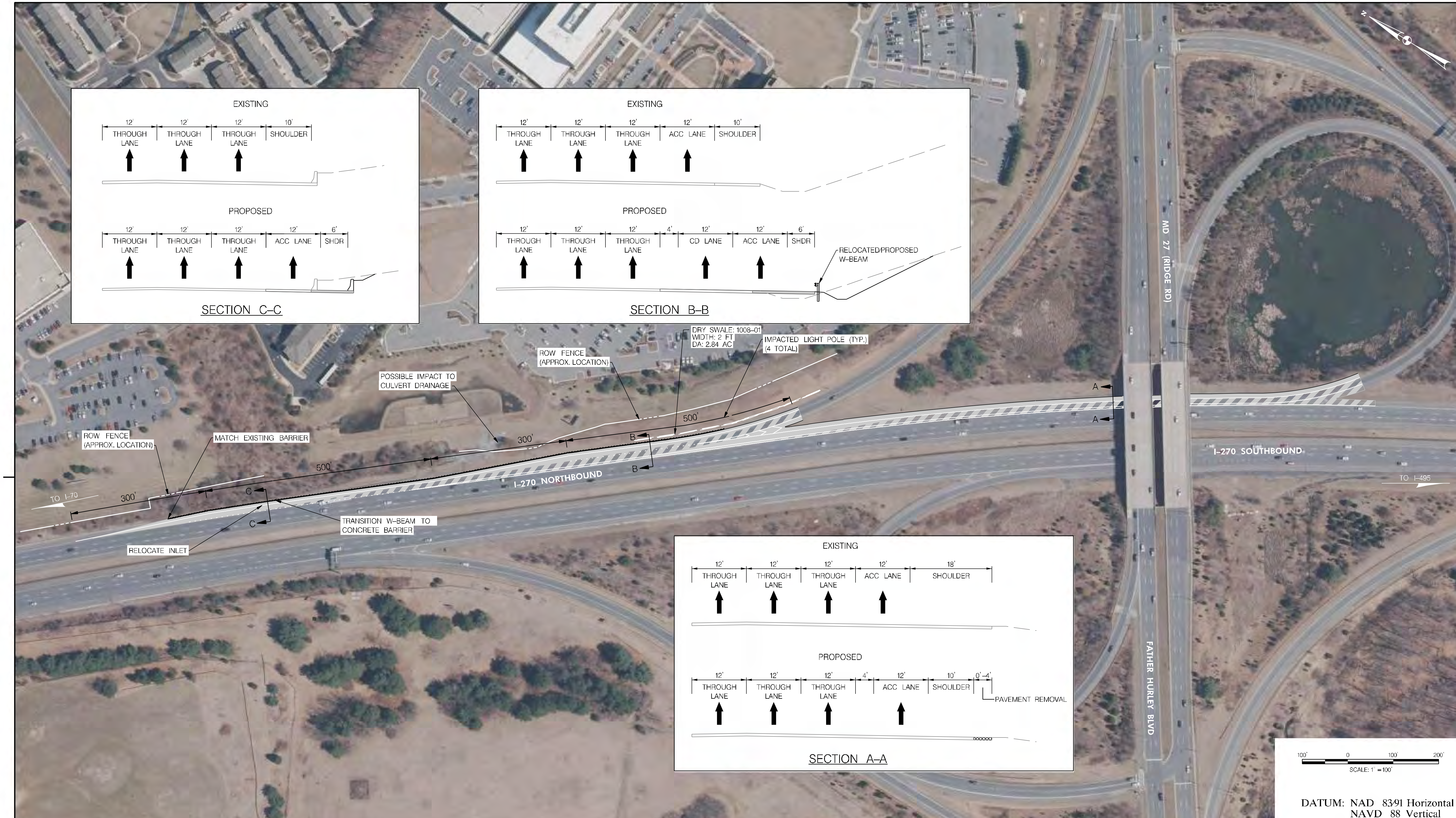
There is limited survey, utility designation, environmental information, and pavement borings/cores available in this location. The associated risks include the potential for an unknown impact to be found. These are potential cost and schedule risks.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

Improves Mobility and Safety at a minor cost, within a short period of time.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*.

N/A



SHA State Highway Administration

CORMAN CONSTRUCTION | WSP | PARSONS BRINCKERHOFF

I-270 INNOVATIVE CONGESTION MANAGEMENT

GEOMETRIC IMPROVEMENTS

LOCATION:
I-270 AT MD 27 (RIDGE RD)/FR. HURLEY BLVD

PTC 07
FATHER HURLEY BLVD. NB ENTRANCE RAMPS

LEGEND

FULL DEPTH RESURFACING	
PARTIAL DEPTH RESURFACING	
W-BEAM GUARDRAIL	
CONCRETE BARRIER	

PLOTTED: Friday, October 28, 2016 AT 10:12 AM
FILE: J:\20130144 – I-270 AIM\Tech Proposal\Concepts\Spot Improvements\pHD-P001_PTC NB Poor Man CD.dgn

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 7, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 7 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 1, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract.
2. A National Environmental Policy (NEPA) document and an Interstate Access Point Approval (IAPA) approved by the Federal Highway Administration (FHWA) will be required prior to establishing a Construction Agreed Price (CAP). In preparation of the IAPA, the Design-Builder must meet the requirements of the FHWA Interstate System Access Informational Guide including demonstrating there are no safety or operational impacts to the interstate with the modification to the interchange.
3. Prior to establishing a CAP, a pavement analysis will be needed to confirm the existing shoulder is traffic bearing or, in the case it is not traffic bearing, to design a full depth pavement section. Soil borings will be required. Per the RFP, all soil borings and other data collection activities needed to implement this PTC (e.g. metes and bounds survey, utility test holes, etc.) shall be included in the Design & Preconstruction Services to be performed by the Design-Build Team.
4. Does the 500-foot auxiliary lane length between the two 300-foot tapers comply with AASHTO? Please refer to Figure 10-53 (A2). If not, does the Design-Builder propose to increase the dimension or seek a design variance?

My telephone number/toll-free number is 410-545-8800 or 1-888-228-6971
Maryland Relay Service for Impaired Hearing or Speech 1.800.735.2258 Statewide Toll Free

Street Address: 707 North Calvert Street • Baltimore, Maryland 21202 • *Phone* 410.545.0300 • www.roads.maryland.gov

Louis Robbins, P.E., DBIA
Page Two

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 08 – Entrance Ramps from Father Hurley Blvd to SB IS 270	Date Submitted: November 1, 2016
Related Disciplines: Highway, H&H, Traffic	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This PTC proposes to convert the existing on-ramps from eastbound Father Hurley Boulevard and westbound Ridge Road onto southbound (SB) IS 270 to a Collector-Distributor (C-D) Lane. This reconfiguration would improve ingress of vehicles merging onto the highway while reducing the number of on-ramps onto southbound IS 270 at the interchange from 2 to 1. Please refer to the attached exhibit for a conceptual display of this PTC. The acceleration lane for the loop ramp would be shifted horizontally away from the mainline providing a buffer, then extended downstream to the existing directional ramp creating the C-D lane. The existing directional ramp would merge onto the C-D lane using acceleration and merge lengths that meet AASHTO, and yielding to traffic coming from the loop ramp. Once merged, the combined traffic from the loop and directional ramps would merge onto southbound IS 270 further downstream. Due to right-of-way constraints the C-D lane would be separated from the mainline using a striped buffer as opposed to a positive barrier. Flexible, tubular delineators can be installed if some physical separation is required to prevent merging over the buffer area. This is a cost effective way to gain enforcement, but maintenance concerns include replacement of the delineators after they are damaged and plowing operations become more difficult.

The existing typical section of the loop ramp at the location of the mainline merge includes an open section, single 12 ft. wide acceleration lane with a 10 ft. right shoulder. The proposed reconfiguration would slightly modify the gore area and include an open section, single 12 ft. wide C-D lane with a 6 ft. right shoulder and a striped 4 ft. buffer to the left of the C-D lane. The existing typical section of the directional ramp at the location of the mainline merge includes an open section, single 12 ft. wide acceleration lane with a 3 ft. right shoulder. The proposed reconfiguration would modify the gore area and include an open section, 12 ft. C-D lane and 12 ft. acceleration lane with a 6 ft. right shoulder and a striped 4 ft. buffer between the SB lanes and C-D lane.

Based on available as-builts, it is assumed the shoulders do not require full reconstruction. The lane and shoulder widths shown above meet AASHTO and would require a maximum of 19 feet of widening and resurfacing. Existing brown w-beam traffic barrier on the right and left sides of the loop ramp would not be impacted and would remain. Existing brown w-beam traffic barrier would be removed and relocated adjacent to the widened ramp. The impacted w-beam and would be replaced if the existing is not salvageable. The existing concrete barrier likely exists on a retaining wall and moment slab which would require reconstruction adjacent to the widened section.

Four existing light poles would be impacted by the widening and require relocation. An existing drainage culvert will be impacted by the widening and will require extending. Only signs impacted by the widening would need to be replaced.

In addition, two adjacent ditches would be converted to grass swales to meet the latest Stormwater Management (SWM) requirements.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

As discussed above, this PTC would be implemented along the entrance ramps from eastbound Father Hurley Boulevard and westbound Ridge Road onto northbound IS 270.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

This PTC would minimize the entry points onto northbound IS 270 while increasing the length of merge area, thus improving the traffic operations and safety performance of mainline. It advances the mobility goal of this project by streamlining ingress onto NB IS 270, more efficiently moves vehicles onto the highway, and allows for better movement of vehicles still traveling on the mainline due to reduced friction with merging vehicles.

In addition, improving mobility along the mainline will help reduce crashes related to closely spaced ramps and deficient weave lengths, thus advancing the safety goal.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: As with any construction activity on a heavily congested corridor, users would be temporarily impacted as the improvement is constructed. Temporary impacts are mitigated by use of advance notice of the work, using limited and off-peak work hours, and night-time closure of the ramps to expedite construction. A preapproved detour would be implemented for any ramp closure. There are no long term user impacts from the construction of this PTC.

ii. Right-of-Way Impacts: There are no right-of-way impacts or additional right-of-way needed for the use of this PTC.

iii. Geotechnical Impacts: Geotechnical information will be needed to support the pavement design and possible retaining wall construction for the ramp widening. Without boring information, it is assumed that full reconstruction of the shoulders is not necessary based off the asbuilts which show a full shoulder section within the limits of this concept.

iv. Utility Impacts: Impacts to SHA electric (roadway lighting) anticipated. Due to the lack of utility designation in this location, other impacts cannot be identified until additional information is gathered.

v. Environmental Impacts/Permitting: An MDE permit for E&SC and SWM would be required. If any tree impacts are identified due to the SWM work, a roadside tree permit may be necessary. Without wetland/WUS delineation, it is not known whether the culvert extension would require impacts. We will assume that this work would require a JPA, however with the minimal impact it is not a significant risk. No other permits are anticipated.

vi. Impacts to Local Communities: There are no adverse impacts to local communities resulting from the use of this PTC. Constructing this PTC will provide safer and more efficient travel conditions for motorists accessing IS 270 from communities along Father Hurley Blvd. and MD 27 (Ridge Road).

vii. Safety Impacts: A safer IS 270 is anticipated due to minimizing the entry points onto the mainline while increasing the length of the weave area.

viii. Life-cycle Project Costs: There are no change in the life cycle Project costs resulting from the use of this PTC.

ix. Infrastructure Costs: Project costs will be anticipated for the installation of new pavement; changes to the signing and pavement markings, SWM/Drainage, culvert extension and possible retaining wall construction.

For the minimal amount of pavement being added, additional maintenance, repair and operational costs (plowing) are very minor.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

Reconfiguring interchanges by providing a C-D lane occurs regularly throughout the US and even in Maryland. A similar location where an interchange was reconfigured to provide a C-D lane is the MD 45 (York Road) ramps onto the outer loop of the I-695 (Baltimore Beltway), at Arena Drive along the Capital Beltway and on I-95 near MD 24.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

There are no known risks to the Administration resulting from the implementation of this PTC.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

There is no existing survey, utility designation, environmental information, or pavement borings/cores available in this location. These are minimized due to the minimal physical improvements outside the existing pavement, but are risks nonetheless.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

Implementation of this PTC will improve mobility and safety at a minor cost, within a short period of time.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*.

N/A

SHA State Highway Administration

CORMAN CONSTRUCTION | WSP | PARSONS BRINCKERHOFF

I-270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

LOCATION:
IS 270 AT MD 27 (RIDGE RD)/FR. HURLEY BLVD

PTC 08
ENTRANCE FROM FATHER HURLEY BLVD. TO SB

LEGEND	
FULL DEPTH RESURFACING	
PARTIAL DEPTH RESURFACING	
W-BEAM GUARDRAIL	
CONCRETE BARRIER	

PLOTTED: Friday, October 28, 2016 AT 03:52 PM

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 7, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 8 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 1, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract.
2. A National Environmental Policy (NEPA) document and an Interstate Access Point Approval (IAPA) approved by the Federal Highway Administration (FHWA) will be required prior to establishing a Construction Agreed Price (CAP). In preparation of the IAPA, the Design-Builder must meet the requirements of the FHWA Interstate System Access Informational Guide including demonstrating there are no safety or operational impacts to the interstate with the modification to the interchange.
3. Prior to establishing a CAP, a pavement analysis will be needed to confirm the existing shoulder is traffic bearing or, in the case it is not traffic bearing, to design a full depth pavement section. Soil borings will be required. Per the RFP, all soil borings and other data collection activities needed to implement this PTC (e.g. metes and bounds survey, utility test holes, etc.) shall be included in the Design & Preconstruction Services to be performed by the Design-Build Team.
4. If this PTC is resubmitted, consider adding plan view dimensions as was done on PTC 7.

My telephone number/toll-free number is 410-545-8800 or 1-888-228-6971
Maryland Relay Service for Impaired Hearing or Speech 1.800.735.2258 Statewide Toll Free

Street Address: 707 North Calvert Street • Baltimore, Maryland 21202 • *Phone* 410.545.0300 • www.roads.maryland.gov

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 09 – MD 118: Eliminate NB Loop Off-Ramp	Date Submitted: November 03, 2016
Related Disciplines: Highway, H&H, Traffic	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This PTC proposes to remove the existing loop ramp from northbound I-270 to westbound MD 118 and add a left-turn movement from the existing northbound off-ramp that currently accesses eastbound MD 118. This reconfiguration would consolidate egress of vehicles from two points to one and would eliminate the existing weave area along MD 118 that currently backs up and effects mobility along IS 270 NB. Please refer to the attached mapping for a conceptual display of this PTC.

The existing typical section of the off-ramp to eastbound MD 118 is a single lane varying from 15 to 24 feet that has a left shoulder varying from 5 to 6 feet and a right shoulder varying from 3 to 12 feet. This ramp splits approximately 500 feet up the ramp, with the left leg meeting eastbound MD 118 at a t-intersection with only right turns permitted for access to the left turn lanes at Goldenrod Lane, and the right leg merges with eastbound MD 118 further upstream.

The existing typical section of the left leg of this ramp is an 18-foot-wide travel lane with a 5-foot-wide left shoulder and an 11-foot-wide right shoulder. The existing typical section of the right leg of this ramp is a 25-foot-wide travel lane with a 3-foot-wide left shoulder and a 5-foot-wide right shoulder, which will remain the same in the proposed condition. The existing typical section of the I-270 northbound lanes after the first off-ramp is four 12-foot-wide travel lanes and 13-foot-wide inside and outside shoulders; this typical section will remain the same in the proposed condition.

The proposed reconfiguration would remove the loop ramp and accommodate the movement by adding an additional lane along the directional ramp. At its terminus with IS 270, the existing diverge would be widened to 2 lanes with the second lane being a choice lane for vehicles to either continue along IS 270 NB or exit for MD 118. A left-turn lane would also be added to the T-intersection, along with a full signalized intersection to add the ability to turn left and accommodate the movement of vehicles onto WB MD 118 which was previously performed by using the loop ramp. The existing right turn lane at this T-intersection would be converted into a shared left-right turn lane, allowing a double left to help clear the ramp during a single signal phase.

The existing deceleration lane for the loop ramp would remain and become a merge back to the existing northbound IS 270 lanes north of the MD 118 underpass in advance of the downstream on-ramp.

The proposed typical section of the off-ramp in advance of the split is two 12-foot-wide lanes with a 2 foot-wide left shoulder and a 3 foot-wide right shoulder. The typical section for the two lanes headed to the T-Intersection has slightly more existing pavement available and therefore two 12 foot lanes are proposed with two 4 foot-wide shoulders. The proposed shoulder widths as indicated above do not meet AASHTO's requirements for shoulders along an exit ramp and a Design Exception would be necessary. Please see attached for draft version of the design exception. The typical section for the channelized right-turn movement will remain the same as existing.

One existing light pole may be impacted by the existing ramp widening and require relocation. An existing drainage culvert will be impacted by creating the median opening on MD 118 and will need to be relocated. Signing would need to be revised to indicate the modified ramp configuration. A signal would likely be required based on a preliminary review of traffic counts and applying them to the 2011 MdMUTCD signal warrants.

SWM for this concept would not be required because the minor amount of additional widening necessary to accommodate the typical section indicated above would be more than offset by the removal of impervious area by removing the loop ramp. Additionally, SWM credit would be accumulated and may be applied in lieu of performing SWM elsewhere along the project or on another SHA project. A small ESD facility is shown to meet MDE's requirements for the minimal amount of impervious being added, in case we elect to not remove pavement.

Implementation of this PTC will require FHWA coordination and action through the IAPA process because we are modifying an existing interchange configuration by removing the loop ramp. Additionally, NEPA approval will be required instead of MEPA because a federal action is required for the IAPA and Design Exception.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

As discussed above, this PTC would be implemented along the exit ramps from northbound I-270 to eastbound and westbound MD 118.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

This PTC would reconfigure the exit points for MD 118, improving safety and operations by eliminating the substandard merging and weaving movement between the back-to-back loop ramps along MD 118. Implementing this ATC advances the mobility and safety goals of the Project. Eliminating the weave reduces the number of potential lane changes in high-conflict locations as entering and exiting traffic are separated.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: As with any construction activity on a heavily congested corridor, users would be temporarily impacted as the improvement is constructed. Temporary impacts are mitigated by use of advance notice of the work, using limited and off-peak work hours, and night-time closure of the ramps to expedite construction. A preapproved detour would be implemented for any ramp closure. There are no long term user impacts from the construction of this PTC.

ii. Right-of-Way Impacts: There are no right-of-way impacts or additional right-of-way needed for the use of this PTC.

iii. Geotechnical Impacts: Geotechnical information will be needed to support the pavement design for the ramp reconfiguration and signal or lighting foundations.

iv. Utility Impacts: Impacts to SHA electric (roadway lighting) are anticipated but will be mitigated by the construction of new permanent lighting. Additional utility impacts would need to be evaluated as better information becomes available.

v. Environmental Impacts/Permitting: An MDE permit for E&SC and SWM would be required for the overall I-270 Project. At this location, the area of pavement removed exceeds the area of new pavement to be constructed so a net credit in impervious area is anticipated. Widening the ramp is expected to impact the existing vegetation minimally, including possible trees adjacent to the existing NB to EB off-ramp. A roadside tree permit may be necessary to construct the ramp widening. No other permits are anticipated.

vi. Impacts to Local Communities: There are no adverse impacts to local communities resulting from the use of this PTC. Constructing this PTC will provide safer and more efficient travel conditions for motorists accessing communities along MD 118.

vii. Safety Impacts: A safer I-270 is anticipated due to minimizing the number of adjacent auxiliary lanes used to exit the freeway. Weaving-related crash risk is eliminated along MD 118 over I-270 where the existing northbound off-ramp to westbound MD 118 weaves with westbound traffic accessing an on-ramp to southbound I-270.

Pedestrian crash risk is eliminated at the point where a pedestrian facility crosses the existing northbound off-ramp to westbound MD 118, as the sidewalk would become continuous towards the overpass. Pedestrian crash risk is mitigated for the south leg crossing at the off-ramp stop-controlled right-turn lane if signalization is provided when the left-turn movements are added.

viii. Life-cycle Project Costs: There are no change in the life cycle Project costs resulting from the use of this PTC.

ix. Infrastructure Costs: Removal of existing pavement, installation of new pavement. Signing and pavement marking revisions. Installation of new signal (if warranted) and associated equipment.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

A location where similar revisions to interchange operations were implemented is the interchange of I-95 and MD 202 in Prince George's County. The conditions for this interchange are also similar such that off-ramp drivers wishing to turn right are separated into two divided lanes depending on their destinations. This is due to the presence of physically-separated left-turn lanes at the adjacent signalized intersection on MD 202 south of the interchange (similar to the intersection of MD 118 and Goldenrod Lane). Many of these revisions were conditions of development for the Woodmore Town Center.

Another location with similar revisions, within a few miles of the one mentioned above, is the interchange of I-95 and MD 214 in Prince George's County. Two loop ramps were removed – off-ramp from I-95 northbound to MD 214 westbound, and on-ramp from MD 214 westbound to I-95 southbound. The movements were accommodated via improvements to the corresponding directional ramps.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

There are no known risks to the Administration resulting from the implementation of this PTC.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

There is limited survey, utility designation, environmental information, and pavement borings/cores available in this location. The associated risks include the potential for an unknown impact to be found. These are potential cost and schedule risks.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

Improves Mobility and Safety at a minor cost, within a short period of time.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*.

N/A

SHA State Highway Administration

CORMAN CONSTRUCTION | WSP | PARSONS BRINCKERHOFF

I-270 INNOVATIVE CONGESTION MANAGEMENT

GEOMETRIC IMPROVEMENTS

LOCATION:	PTC 09
NORTHBOUND I-270 AT MD 118	MD 118: ELIMINATE NW LOOP

LEGEND

- PARTIAL DEPTH RESURFACING
- PAVEMENT REMOVAL
- FULL DEPTH PAVEMENT
- W-BEAM GUARDRAIL
- CURB AND GUTTER
- PROPOSED EDGE OF PAVE

PTC 09: Removal of Loop Ramp from IS 270 NB to MD 118 WB
Corman Construction

DRAFT Request for Design Exception

We are requesting your approval of a design exception for one area where the design does not meet AASHTO's "A Policy on Geometric Design of Highway Streets" (2011) recommendations. This exception is for shoulder width along the exit ramp from northbound I-270 to MD 118.

CONCEPT DESCRIPTION

This scope of work includes removal of the existing loop off-ramp from northbound IS 270 to westbound MD 118, adding a left-turn movement from the existing northbound directional off-ramp. This reconfiguration would consolidate egress of vehicles from two points to one. The proposed improvements include resurfacing and minor base-widening, full depth paving, restriping of pavement markings, traffic signal installation, revised signing, drainage improvements, removal and resetting of traffic barrier, and curb installation.

The table below summarizes the current and the design year traffic volumes for the exit ramps effected by this project and northbound IS 270:

	2016	2040
Loop Ramp ADT	8,025	10,200
Directional Ramp ADT	4,150	4,650
Northbound IS 270 ADT	68,875	81,125

The goal of the proposed work is to improve mobility and safety along mainline northbound IS 270 at the MD 118 interchange. Under existing conditions at the interchange Level of Service deteriorates during the PM peak hours due to the high traffic volumes and the existing off-ramp configuration. Elimination of the loop ramp will improve the quality of service in the ramp areas and decrease congestion on the mainline by simplifying egress. Additionally, consolidation of egress of vehicles from two points to one, and eliminating the weave condition along MD 118, will improve safety by reducing crashes related to closely spaced ramps and weaving vehicles.

PROJECT DESIGN CRITERIA

2011 "A Policy on Geometric Design of Highways and Streets" – AASHTO

DESIGN EXCEPTION

Shoulder Width – Left and Right Shoulders along exit ramp from northbound IS 270 to MD 118

a. Existing Condition

The existing typical section of the off-ramp to eastbound MD 118 is a single 15 foot wide lane that has a left shoulder 4 feet in width and a 10 foot wide right shoulder. This ramp splits approximately 500 feet up the ramp, with the left leg meeting eastbound MD 118 at a t-intersection with only right turns permitted for access to the left turnlanes at Goldenrod Lane, and the right leg merges with eastbound MD 118 further upstream.

The existing typical section of the left leg of this ramp is an 18-foot-wide travel lane with a 5-foot-wide left shoulder and an 11-foot-wide right shoulder. The existing typical section of the right leg of this ramp is a 25-foot-wide travel lane with a 3-foot-wide left shoulder and a 5-foot-wide right shoulder, which will remain the same in the proposed condition. The existing typical section of the I-270 northbound lanes after the first off-ramp is four 12-foot-wide travel lanes and 13-foot-wide inside and outside shoulders; this typical section will remain the same in the proposed condition.

Existing W-Beam Traffic Barrier is located along portions of both the outside and left shoulder, offset 2-6 feet from the edge of pavement.

Crash data provided with the project's RFQ/RFP is dated 2011-2013 and does not show any crashes along the exit ramp or crashes that would be impacted by shoulder width or barrier offset. Crash Data shows a rate of rear end crashes, crashes involving property damage, and total crashes which are significantly higher than statewide along this segment of northbound IS 270. A large amount of rear end crashes involving property damage occur on the approach to the existing loop ramp.

b. AASHTO Design Criteria

AASHTO (dated 2011) page 10-102 recommends directional ramps with a design speed over 40 mph should have a paved right shoulder width of 8 to 10 ft., and a paved left shoulder width of 1 to 6 ft. The design speed of this ramp would vary along the ramp as exiting vehicles will be traveling faster than those nearing the termini of the ramp at MD 118.

c. Proposed Condition

The proposed reconfiguration would remove the loop ramp and accommodate the movement by adding an additional lane along the directional ramp. The proposed typical section of the directional ramp in advance of the split is two 12-foot-wide lanes with a 2-foot-wide left shoulder and a 3-foot-wide right shoulder. The typical section for the two lanes headed to the T-Intersection after the ramp splits has slightly more existing pavement available and therefore two 12 foot lanes are proposed with two 4 foot-wide shoulders. A 3 leg signal will be installed and median modified to allow the left turns. The proposed shoulder widths as indicated above do not meet AASHTO's requirements for shoulders along an exit ramp.

At the directional ramp's terminus with IS 270, the existing diverge would be widened to 2 lanes with the second lane being a choice lane for vehicles to either continue along IS 270 NB or exit for MD 118.

The existing deceleration lane for the loop ramp would remain and become a merge back to the existing northbound IS 270 lanes north of the MD 118 underpass in advance of the downstream on-ramp.

d. Design Constraints

There is an existing steep embankment along the ramp shoulders lined by small trees on the outside shoulder. Minimizing the amount of widening will in turn minimize the amount of earth disturbance as well as tree impacts.

e. Design Exception

We recommend that a design exception be considered for the reduced left and right shoulder widths along this ramp. There is no crash history to suggest a wide shoulder is necessary and the sight distance is sufficient. Implementing this typical section does not add undo safety risks and would be an implementation of Practical Design by constructing a ramp that meets the goals of this project without significant widening, SWM, and other incidental items that do not effectively advance the project goals. The concept as a whole actually improves safety within the interchange limits substantially, by eliminating an egress point on the 270 NB Main Line that currently experiences a high number of crashes, eliminates a weave condition, and adds storage volume to a ramp that currently has a significant queue.

f. Proposed Mitigation

Mitigation that can be implemented if necessary to offset the narrow shoulder widths include warning signage for narrow shoulders and rumble strips. Additionally, a lower advisory speed can be implemented at the base of the ramp.

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

SHA State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 10, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction, MD

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 9 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 3, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract.
2. Prior to establishing a CAP, a pavement analysis will be needed to confirm the existing shoulder is traffic bearing and to design a pavement section for the areas of full depth widening. Soil borings will be required. Per the RFP, all soil borings and other data collection activities needed to implement this PTC (e.g. metes and bounds survey, utility test holes, etc.) shall be included in the Design & Preconstruction Services to be performed by the Design-Build Team.
3. A National Environmental Policy (NEPA) document and an Interstate Access Point Approval (IAPA) approved by the Federal Highway Administration (FHWA) will be required prior to establishing a Construction Agreed Price (CAP). In preparation of the IAPA, the Design-Builder must meet the requirements of the FHWA Interstate System Access Informational Guide including demonstrating there are no safety or operational impacts to the interstate with the modification to the interchange.
4. As noted in the PTC, shoulder widths less than AASHTO standards will require an approved design exception prior to establishing a CAP. The sample design exception appears to generally contain the requisite information. More detailed information related to impacts and costs of fully meeting AASHTO requirements, potential impacts to safety and operations for implementing the design exception, and mitigation, if any, which would be implemented as a result of the design exception will be required for formal approval.

5. The end of Section A, Description, notes the potential for not removing the existing pavement. As noted in the RFP, page 42, last paragraph, no consideration will be given to tentative or ambiguous commitments. Please clarify whether the intent is to remove the existing loop ramp pavement or keep it intact. If the latter, please discuss what will become of the pavement with respect to the Operability/Maintainability/Adaptability goal.

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

PTC No.: 11 – Microsurfacing	Date Submitted: November 9, 2016
Related Disciplines: Highway, Pavement/Geotech	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This PTC proposes to use microsurfacing paving as the final surfacing for the completed roadway where lane restriping is required and complete eradication of any temporary or permanent line striping is required without leaving scarred pavement or "ghost markings." Microsurfacing provides a cost effective, durable wearing surface and will completely cover any remnants of temporary or permanent striping that has been eradicated.

Although similar to a slurry seal in application, microsurfacing cures via a chemical reaction. As a result, microsurfacing can be applied to the roadway in a single work shift and be open to traffic at the end of the shift, whereas slurry seals require a longer cure period, typically about 24 hours. Microsurfacing provides the following benefits:

- Seals the pavement surface, reducing water infiltration;
- Improves skid resistance versus the existing, worn pavement surface;
- Corrects minor surface irregularities including rutting and minor cracking; and
- Extends the pavement life by 5 to 7 years on average.

Similar to slurry seals, microsurfacing consists of the application of a mixture of water, asphalt emulsion, small aggregate and chemical additives over an existing asphalt concrete pavement surface. Polymer is commonly added to the asphalt emulsion to provide better mixture properties. Where slurry seals rely on evaporation of the water in the asphalt emulsion to cure, the asphalt emulsion used in microsurfacing contains additives which allow it to cure chemically and thus more predictably and more quickly than slurry seals.

As with slurry seals (MSHA Standard Specifications Section 507) Microsurfacing will require proper surface preparation and the application cannot be made when the air and surface temperatures are below 50°F.

This PTC directly aligns with the following project goals:

- Improvements that maximize vehicle throughput – Using a final paving process that will allow drivers to use the roadway immediately following a work shift will provide more reliable travel times in the corridor.
- Safety – Simplifying the application of the new surfacing will provide a safer work zone for the public and our workers. It will also improve the road's skid resistance.
- Maintainability – Microsurfacing will extend the life of the existing pavement, reducing MSHA's need for future pavement maintenance.

- Well Managed Project – Using innovative techniques to advance the work will allow the Corman Team to successfully advance the project and meet SHA's goals.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

This PTC may be implemented on portions of the I-270 corridor where the existing lane striping is to be shifted to allow for a wider outside shoulder to implement Hard Shoulder Running and standard eradication efforts are not acceptable.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

This PTC would use a final paving process that will allow drivers to use the roadway immediately following a work shift will provide more reliable travel times in the corridor. The microsurfacing application process requires less trucks to enter and exit the work area, simplifying the application of the new surfacing, providing a safer work zone for the public and our workers. The new surface will have a greater friction factor than that of the existing surface, improving the skid resistance and reducing the likelihood of related crashes. The purpose of the microsurfacing is to eliminate ghost markings created by shifting lanes, which can cause safety concerns. The microsurfacing application will extend the life of the existing pavement, reducing MSHA's need for future pavement maintenance.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: As with any construction activity on a heavily congested corridor, users would be temporarily impacted as the improvement is constructed. Temporary impacts are mitigated by use of advance notice of the work, using limited and off-peak work hours, and night-time closure of the ramps to expedite construction. A preapproved detour would be implemented for any closure that would be needed to apply the microsurfacing. There are no long term user impacts from the use of this PTC.

ii. Right-of-Way Impacts: There are no right-of-way impacts or additional right-of-way needed for the use of this PTC.

iii. Geotechnical Impacts: No geotechnical information will be needed to support the use of this PTC.

iv. Utility Impacts: There are no utility impacts from the use of this PTC.

v. Environmental Impacts/Permitting: There are no adverse environmental impacts or permits needed for the use of this PTC. Microsurfacing, because it is a cold applied surfacing material, is regarded as a more environmentally friendly product than hot mix, due the minimal amount of energy required to mix, transport and apply microsurfacing.

vi. Impacts to Local Communities: There are no impacts to local communities resulting from the use of this PTC.

vii. Safety Impacts: A safer I-270 is anticipated. The new surface will have a greater friction factor than that of the existing surface, improving the skid resistance and reducing the likelihood of related crashes. The purpose of the microsurfacing is to eliminate ghost markings created by shifting lanes, which can cause safety concerns.

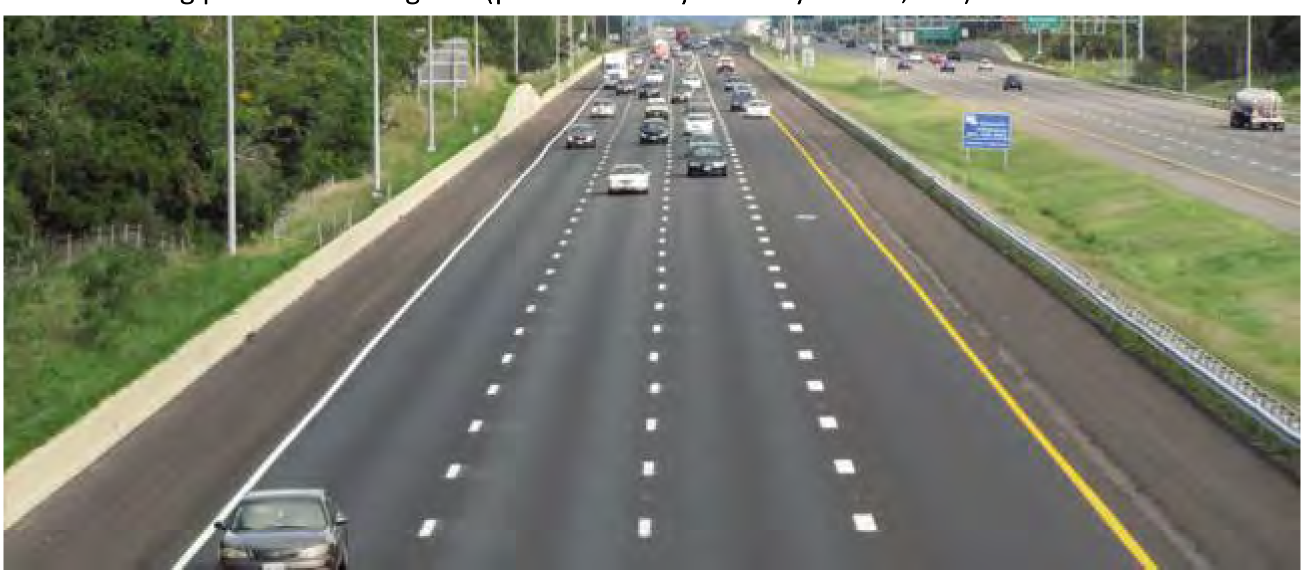
viii. Life-cycle Project Costs: There are no changes in the life cycle Project costs resulting from the use of this PTC other than the benefit SHA will receive from an increased pavement life.

ix. Infrastructure Costs: Project costs will be anticipated for the application of the microsurfacing.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

Microsurfacing is being performed across the US. Just a few examples are Virginia, Pennsylvania, Ohio, West Virginia, and a statewide contract in New Jersey. The New Jersey Department of Transportation used microsurfacing on I-195 in the vicinity of Jackson Township. The project extended 18 miles west from the Garden State Parkway, with both directions being microsurfaced. I-195 is 2 lanes in each direction with full shoulders and auxiliary lanes at regular intervals. Similar in typical section to the Local Lanes of IS 270.

Additionally, VDOT has microsurfaced I-66 and I-81 among other roads. See photo below of microsurfacing performed along I-66 (photo courtesy of Slurry Pavers, Inc.).



Locally, SHA's District 2 performed microsurfacing along MD 328 in Talbot County, MD 281 in Cecil County, and MD 405 in Queen Anne's County. Montgomery County Department of Transportation used microsurfacing in the Stonecrest/Snowdens Mill Pavement Preservation Project in September 2015. Harford and Howard Counties have also implemented microsurfacing on their roads.

All applications have been noted to hold up well with adequate pre-treatment, surface repairs, and crack sealing completed prior to laying the microsurfacing course. It has been noted to extend the life of the pavement surface an additional 5 to 7 years.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

There are no known risks to the Administration resulting from the implementation of this PTC.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

There are no known risks to the Design-Builder resulting from the implementation of this PTC.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

Implementation of this PTC will improve mobility and safety at a more reasonable cost than traditional milling and overlay, within a short period of time.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*.

N/A

November 17, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction, MD

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 11 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 9, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract; however, after NTP the Design-Builder will be required to perform pavement structural and functional analysis in accordance with the MDSHA pavement and geotechnical design guide and demonstrate that Microsurfacing provides at least a 7-year life extension (mid-point of the design life range of 4-10 years shown in the design guide).

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 12 – Australian Managed Motorways	Date Submitted: November 9, 2016
Related Disciplines: Traffic, ITS, CHART	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This Proposed Technical Concept (PTC) proposes to adapt the Australian Managed Motorways (AMM) concept as deployed by the state of Victoria in Melbourne for IS 270. This concept builds upon the Intelligent Transportation Systems (ITS) applications of ramp metering, Active Traffic Management (ATM), and the dynamic demand management capability of advanced computer algorithms to fully manage access to and demand for IS 270. AMM utilizes new, extensive, and integrated data collection sensors along the roadway and advanced system management tools to monitor and control real time traffic conditions that respond to predicted breakdowns in traffic flow (as compared to reacting to breakdowns after they occur, as discussed in our PTC on Active Traffic Management).

Like all freeways, IS 270 fails to function properly when flow breaks down due to higher demand and resulting turbulence. A maximum flow rate of 2100 vehicles per hour per lane is carried on a typical interstate segment at 55 mph prior to congestion saturation. However, as congestion occurs, average speeds and total volumes per hour are significantly reduced. Only 1300 vehicles per hour per lane are typically passing through a facility at 20 miles per hour, which is a reduction of nearly 40% of the lane's full capacity. In this situation, the highway is carrying close to 40% less vehicles at a time where maximum flow is most desired. AMM seeks to manage all access to a freeway and harmonize flow in an automated and integrated fashion, to produce flow rates closer to the facility's maximum carrying volume of between 2000 to 2100 vehicles per hour per lane.

By utilizing intelligent information, communications and control systems, AMM, automatically on a real time basis, synchronizes the flow of entering vehicles to those already on the facility to match the freeway's operational capacity. Access is directly controlled at the on-ramps and freeway interchanges of a highway corridor through ramp meters, but AMM also incorporates proven advanced algorithms to adaptively control access and manage ramp waiting times by coordinated meters throughout the corridor in real-time. Furthermore, AMM involves new concepts in entry ramp design that include physical improvements to ramp storage, discharge, and acceleration in order to optimize the ability of vehicles to fully utilize the freeway's available capacity. This comprehensive demand and system management process results in considerable improvements in freeway performance and safety, helping to maximize the overall efficiency of the facility.

AMM involves an integrated package of ITS and roadway improvements to maximize efficiency and throughput. Components of AMM include extensive vehicle detection and data collection systems, coordinated ramp metering, incident detection, closed circuit television surveillance and strategic design considerations (such as on ramp queue discharge and storage, merge lanes, expanded off ramps for increased exit flows, etc.). Systems can also include complimentary applications such as variable speed limits and lane control, traveler information, lane-use management, and priority vehicle queue bypass lanes; however, all of these components are neither essential nor incorporated within this PTC. They will be added as appropriate, as described in our upcoming Active Traffic Management PTC to maximize mobility within the fixed budget available.

Detailed Description

In simple terms, the AMM system on IS 270 would primarily manage freeway traffic to minimize congestion by regulating the rate that traffic enters the freeway to reduce the possibility that too many vehicles enter the freeway too quickly creating or increasing the impact of a bottleneck at a given location. The end result is a prevention and/or minimization of traffic breakdown conditions on the mainline freeway, and, reduction in arterial congestion due to the recapture of capacity on the freeway itself and enhanced awareness of ramp queuing conditions.

The foundation of the AMM concept is an extensive network of precise vehicle detectors located at approximately 1/3 mile intervals along IS 270 and on entrance / exit ramps to continuously monitor traffic conditions. Real-time data from each detection location is consolidated by the system with communication via a fiber optic network to an integrated control system called STREAMS, owned and managed by TRANSMAX, a public sector enterprise of the Queensland (Australia) state government. This control system, as indicated in our PTC 02 – CHART Integration and upcoming PTC - Communications and Networking, would be located in CHART's SOC. The data is then processed using advanced, state-of-the-practice traffic management algorithms to identify changes in traffic flows and to determine how and where ramp metering rates need to be adjusted in a coordinated manner to sustain maximum traffic flows. The STREAMS software package is proven in ongoing Managed Motorways installations and has been constantly upgraded since its initial deployment in 2007 for AMM systems. The software would be licensed to SHA and maintained and upgrades provided regularly.

As deployed by VicRoads, the Victoria (Australia) department of transportation, on the M1 freeway in Melbourne, AMM on IS 270 will likewise involve a heavily improved version of the European Heuristic Ramp Metering Coordination (HERO) algorithm. The modified HERO algorithm and its supporting subsystems have been previously adopted by the European Ramp Metering Project (EURAMP). HERO consists of several software modules that facilitate various traffic data calculations and control tasks for each controlled ramp reflecting specific ramp configuration parameters and real-time traffic data.

The components of the HERO algorithm are shown in Figure 1. It relies on the ALINEA algorithm for local ramp control, and then provides coordination between ramps throughout the system. The algorithm calculates the desired meter rate at each coordinated ramp based on estimates of critical occupancy, queue length, waiting time, and ramp demand. It works to minimize the risk of mainline breakdown by balancing the ramp queue against spillback onto adjacent arterials and the optimization of freeway traffic flow, as proven on the M1 freeway.

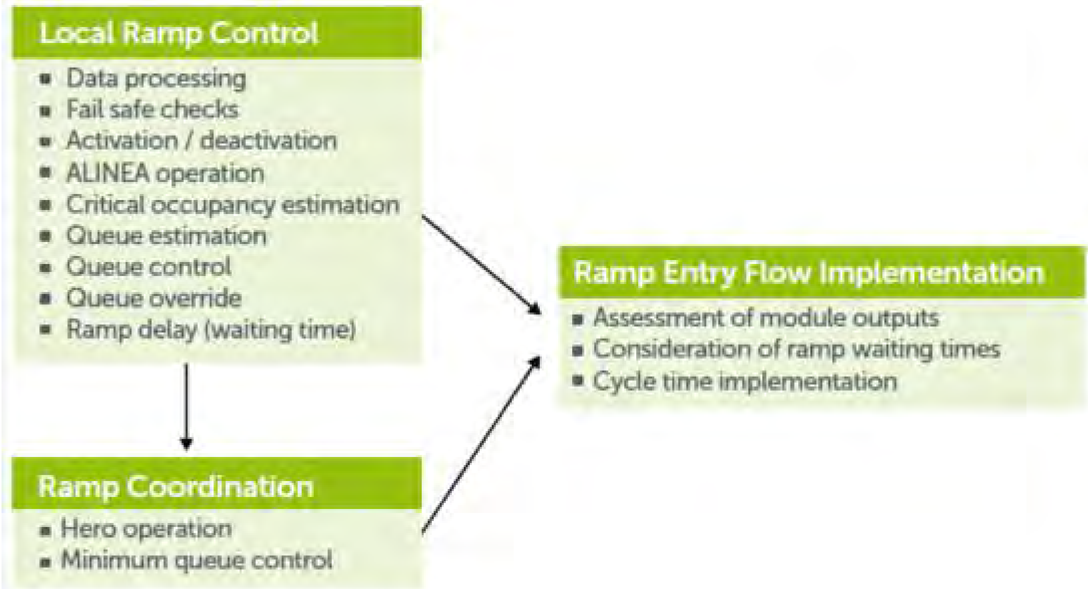


Figure 1: HERO Algorithm Components

When the queues of one particular ramp meet a certain predetermined threshold, it spreads its metering operation upstream. The queuing at that ramp is then relieved slightly, as queues are spread among a coordinated group of ramps. This approach is intended to balance queues and provide equity among ramps. The practice is important, as unlike Ramp Metering that is not interconnected and set to adaptively and coordinate as a system, delay queues can be managed over several different ramps.

CCTV cameras supplement the in-field vehicle detectors to identify incidents that could disrupt traffic flows. Complimentary ATM applications can be used to support coordinated ramp metering, especially once incidents are identified. Tools such as dynamic message signs (DMS) are helpful in managing traffic by warning motorists of adverse traffic conditions ahead. Overhead lane use control can be utilized to close lanes in advance of incidents (or roadway maintenance activities) ensuring traffic merges in a more orderly manner, while variable speed limits can be changed to inform motorists to gradually reduce speed ahead of the lane merge. As technologies become more widely available, future applications will have the potential to provide up to the minute traffic information allowing drivers to make decisions on their departure time, travel mode and routing prior to leaving the home. For additional information on the proposed ATM/ITS deployment, please refer to the respective previously submitted PTC's.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

Australian Managed Motorways strategies will be implemented along the IS 270 corridor, to optimize the mobility as budget permits.

Locating ITS devices on IS 270 will conform to the VicRoads standards for AMM deployment and is as shown in our upcoming Active Traffic Management PTC. The VicRoads standard for real-time lane occupancy data is ±2% within a 20 second period, which is our proposed standard for IS 270 as well. Information to this level of accuracy requires specific placement of vehicle detectors, with mainline vehicle detectors be placed just beyond turbulent merging areas, approximately 1,000 feet downstream of the nose of an on-ramp or other known bottleneck locations, such as weaving areas or inclines. Mainline detectors should also be placed at appropriate spacing between on-ramps and interchanges. Ramp meters would be installed at most, if not all entrance ramps within the limits of the Australian Managed Motorways implementation, with the exception of interstate to interstate ramps at the southern and northern terminus of the project. Ramp meters at these locations are outside the scope and budget intended for this PTC; however, if necessary and desired they could be implemented in the future.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

The application of AMM on IS 270 will create a virtually enclosed (from a traffic flow perspective) freeway allowing for extensive real-time monitoring and management of freeway performance, comprehensive management of access to and traffic flow along the freeway facility, expedited incident response, enhanced communication of travel conditions and sustainability of transit and carpool travel times. With careful monitoring of traffic on the freeway and control of the rate that traffic enters the freeway, disruptions to the traffic flow (such as a large platoon of traffic entering the freeway, or an incident) can be minimized and higher traffic flows with harmonized flow can be sustained for longer periods, particularly during peak periods, increasing overall efficiency. This allows greater volumes of traffic to move along IS 270 in a given period of time, providing congestion reduction, safety, fuel consumption and emissions benefits.

Specific benefits pertaining to project goals:

- Mobility – AMM provides integrated / coordinated response to traffic conditions in a predictive setting, thereby preventing the onset of saturated conditions. Mobility will be enhanced by congestion reduction, travel time reduction, and improvement in travel time reliability. As deployed and measured in Melbourne, AMM has independently improved travel speeds 13 – 26% and vehicular throughput 5 – 30% (depending upon specific locations, and described in section E, below).
- Safety – enhanced flow control and management through AMM directly reduces crashes related to unstable and congested traffic conditions, including rear-end crashes. As measured in Melbourne, AMM independently reduced crashes by up to 50%.
- Operability – AMM has a proven platform capable of managing all devices and system input variables in one system. This platform is incorporated within the PTC, and may be independently

operated at CHART without conflict or overlap with existing CHART modules. Please refer to the PTC on CHART Integration, as previously submitted.

- Maintainability – roadside and pole mounted devices will be located for ease of maintenance access, considering locations for service vehicles, bucket trucks or other maintenance equipment. Wireless magnetometers are maintenance free within their battery life and can be replaced quickly when needed; non-invasive light-based vehicle detectors are mounted on exterior of mainline, thereby reducing the requirement for lane closures for maintenance.
- Adaptability – all proposed devices have been deployed on similar projects and have shown to be dependable and adaptable to varying traffic conditions and future uses.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: Enhanced user benefits pertaining to travel speeds, vehicular throughput, and crash reduction, as described in this PTC.

ii. Right-of-Way Impacts: None anticipated

iii. Geotechnical Impacts: None anticipated

iv. Utility Impacts: Other than the need to provide power to the ATM units none anticipated

v. Environmental Impacts/Permitting: None anticipated. As indicated in FHWA's Interstate System Access Information Guide, coordination with FHWA Division Office should be performed to confirm that FHWA review and action is not required for an IAPA due to the implementation of ramp metering.

vi. Impacts to Local Communities: None anticipated

vii. Safety Impacts: Reduction in rear-end crashes, due to enhanced flow control and reduction in traffic breakdown, as described in this PTC.

viii. Life-cycle Project Costs: Life-cycle costs will include an annual licensure fee for operating the STREAMS software, upgrades and possible additional costs associated with increasing manpower to operate the system at CHART's SOC. Although, with the reduction of crashes, manpower currently assigned to incident management may become available to fill the gap.

ix. Infrastructure Costs: Initial project costs include the cost of ITS devices, poles, conduit, electric and fiber optic cabling, manholes/hand holes, and the start-up costs for the developing system/software architecture.

Repair Costs: All devices come with manufacturer warranties.

Maintenance Costs: Routine maintenance will be required; special event maintenance (snow clearance) may be required for specific vehicle detection devices (to be determined).

Operation Costs: AMM requires ongoing commitment to managing and operating the system. By a comparison, VicRoads has 0.5 FTE dedicated to managing the M1 Managed Motorways.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

Various components of Australian Managed Motorways (AMM) are currently utilized on roadway facilities around the world, including several urban freeway corridors in Maryland. However, the first facility to integrate these systems in a comprehensive manner is the M1 Motorway in Melbourne, Australia, owned and operated by VicRoads (the Victoria state department of Transportation). First operational in December 2009, the Melbourne M1 Managed Motorway extends 75 km (47 mile) along the Monash – CityLink – West Gate Motorway (MCW) corridor, which links downtown Melbourne to surrounding suburban communities and one of Australia's busiest maritime cargo ports. Carrying over 160,000 vehicles daily, including 18,000 to 20,000 trucks in the segments west of downtown, the six- to eight-lane M1 Motorway in Melbourne is one of the busiest and most vital transport corridors in the nation.

The complete 47 mile M1 Managed Motorways integrates over 1,100 separate vehicle detection, traffic signal and communication devices to provide coordinated ramp metering at 62 separate locations. To complement the system, freeway lane use management (a feature of Active Traffic Management) is included along 12 of the 47 miles of the freeway. To facilitate traffic flow changes resulting from the freeway corridor improvements and coordinated ramp metering, strategic ramp improvements were completed at over 30 locations to provide increased storage and acceleration and/or deceleration distance for vehicles entering and exiting the facility. Priority ramp bypass lanes were also included at five ramp locations for transit, HOV and trucks in order to reduce delay for transit and HOV users and to minimize disruption and emissions from trucks having to accelerate from a complete stop at ramp meters.

It should be noted that the M1 Managed Motorways program constitutes the fourth iteration of ramp metering on this corridor. Like other locations, VicRoads had previously implemented static and adaptive ramp meters to limited effect. However, with the Managed Motorways concept, VicRoads was the first agency to integrate robust traffic detection with highly advanced dynamic metering algorithms with complementary traffic management components that work collaboratively with one another. Lessons learned on this project will be implemented on the IS 270 project.

The Infrastructure Australia 2011 National Urban Policy Paper, *Our Cities*, *Our Future*, indicates that "specific benefits of managed motorways (freeways) tools include:

- *Variable message signs*: deliver an 8 to 13 percent increase in travel speed.

- *Ramp metering*: delivers a 13 to 26 percent increase in travel speed, an increase in volume (throughput of traffic) of between five and 30 percent and a 15 to 50 percent reduction in road accidents.”

Although the full 47 mile M1 project (completed in late 2010) involved freeway improvements including additional lane capacity and new collector-distributor ramps, an initial 9.4 mile trial segment was evaluated by VicRoads in 2008 to determine the specific benefits of the AMM system being installed. The trial involved the implementation of coordinated ramp metering at six locations along the westbound M1 Freeway east of downtown Melbourne (inbound direction). The initial trial segment was chosen as a test location based on the presence of existing ramp meters, queue storage in existing ramp configuration, and a lack of mainline freeway design issues contributing to downstream bottlenecks.

Although the trial segment was already operating with fixed-time ramp meters, the results of the trial, as published, indicated that the coordinated dynamic metering system increased traffic flows and substantially improved reliability. As indicated in Table 1, the trial demonstrated over 5% increase in peak traffic flow rate with throughput sustained throughout the peak periods. Furthermore, traffic speeds improved between 35% and 60% during peak periods, while overall reliability, as measured by the variability in traffic speeds during the peak period, improved between 150% during the AM peak period and over 500% during the PM peak period. In addition, the cumulative economic benefits of the trial effectively paid back the initial $1 million AUD ($950,000 USD) cost in 11 days of operations through traveler cost savings.

Table 1: Performance Summary for M1 Managed Motorways Trial (2008)

Performance Indicators	AM Peak			PM Peak		
	Fixed Time Metering	Coordinated Dynamic Metering	Performance Improvement	Fixed Time Metering	Coordinated Dynamic Metering	Performance Improvement
Traffic flow (pce/h/ln)	2,068	2,165	4.7%	1,914	2,074	8.4%
Travel speed (mph)	30.4	41.0	34.9%	31.2	49.5	58.7%
Less than 20% speed variation (%)	26.3	65.4	148.7%	13.4	82.6	516.4%

Since the completion of the 47 mile M1 Upgrade project in 2010, a second before and after study was conducted to evaluate the effectiveness of the AMM System along with the physical roadway improvements included in the project. Improvements to the segment associated with the M1 Upgrade project included construction of a single lane addition (from 3 or 4 lanes to 4 or 5) and one eastbound on-ramp, as well as the conversion of 9 fixed-time SCATS ramp signals to 14 fully coordinated ramps with VicRoads' modified HERO software. This section of the M1 included no other controlling ITS tools. Results of the before and after evaluation from 2007 and 2013 are summarized in Table 2. As indicated, the combined project components resulted in per lane traffic flow increases of between 16 and 19% during peak periods. In addition, average inbound travel speed increased by 19% during the AM period, and by nearly 20% in the outbound PM peak direction. These performance improvements are greater than should be expected from added capacity alone and similar improvements were achieved in the section of freeway not widened. The study also found that the five year average crash rate declined 31% from before and after project completion (9.15 to 6.31 crashes per 100 million VKT).

Table 2: Performance Summary for M1 Upgrade Case Study Segment (2013)

Performance Indicators	Inbound AM Peak			Outbound PM Peak		
	2007	2013	Performance Improvement	2007	2013	Performance Improvement
Traffic flow (vphpl)	1,476	1,755	19.0%	1,402	1,627	16%
Travel speed (mph)	39.0	46.1	19.0%	36	46	27.8%

Project Contact

John Gaffney, ITS Business Development Manager
VicRoads, 60 Denmark Street, Kew, VIC 3101 Australia
John.gaffney@roads.vic.gov.au, +61 (3) 9915 4758

Results from the 2013 evaluation effort for the M1 were used to revise VicRoads' ramp signals handbook. The resulting publication, incorporating design and operations standards for AMM, are available at:
https://www.vicroads.vic.gov.au/business-and-industry/technical-documents/freeway-ramp-signals-handbook

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

The benefits of AMM requires an ongoing commitment to operations, as described in section D. The administrative risk involves sufficient resource allocation over time to the operations. As a comparison, VicRoads has 0.5 FTE dedicated to managing the system operations. As previously stated the reduction in Incidence Response personal needs maybe utilized to eliminate the need for new hires.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

The design / builder assumes the risk of integrating the ITS components with the STREAMS control platform to provide the anticipated benefits.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

The AMM concept can be deployed with non-invasive vehicle detection devices. As an early action, these devices can provide enhanced and nuanced awareness of traffic conditions and bottlenecks through IS 270, in addition to powering the AMM's HERO algorithms. With enhanced traffic data, geometric improvements can be better targeted to respond to traffic conditions, which in turn yields a better return on investment for infrastructure costs.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*

N/A

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

SHA State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 21, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 12 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 9, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract.
2. There are a number of general statements that make PTC #12 relatively generic and harder to review. For example, on the top of page 2 the PTC states, "Systems can also include complimentary applications such as variable speed limits and lane control, traveler information, lane-use management, and priority vehicle queue bypass lanes…They will be added as appropriate…." Section B, Location, uses language that leaves ambiguity with respect to where AMM will be applied. The first sentence states AMM will be incorporated as the budget permits, and that ramp meters will be placed at most (if not all) entrance ramps. As noted in Article XII.B of the RFP (first paragraph), no consideration will be given to tentative or ambiguous commitments in the review of the Technical Proposal.
3. Page 3, Section A, Detailed Description: The PTC states "CCTV cameras supplement the in-field vehicle detectors to identify incidents that could disrupt traffic flows." Maryland's Traffic Incident Management processes and resources do not support using CCTV cameras to identify incidents (this would require an architecture that would make all images available at all times, and additional staff to monitor the images). Maryland uses cameras for verification, and to collect information on the incident response progress, once an incident has been identified by other means. Using cameras to identify incidents would require video analytics.

4. Page 5, Section D, Potential Impacts: Under "Life-Cycle Project Costs" the PTC states "Life-cycle costs will include an annual licensure fee for operating the STREAMS software, upgrades and possible additional costs associated with increasing manpower to operate the system at CHART's SOC." The proposer should confirm, based on communications architecture, and the plan to completely renovate the SOC within two-years, that operating the system at CHART's SOC is the best hosting option.
5. Page 6, Section D, Potential Impacts: As noted in Section D, ix. Infrastructure Costs, there will be Operations and Maintenance expenses associated with any ATM. It is understood that this project will not include funding for ongoing Operations and Maintenance. However, per the Operability/Maintainability/Adaptability Goal, we would anticipate the final technical solution would include a plan and estimate of the operations and maintenance requirements and costs, in order to program ongoing support and provide documentation and justification for the required Operational Budget enhancements.
6. Page 6, Section D, Potential Impacts: The PTC states at the top of page 6 that, "VicRoads has 0.5 FTE dedicated to managing the M1 Managed Motorways." This would equate to 20 hours out of a 168 hour week (assuming 24X7 operations). We would like additional details on this statement. Given that the system is primarily automated, it is potentially reasonable, but we would like additional information on what the staffing requirements would be for "operating" the system. The O&M aspects and risks to the agencies should be clearly identified and quantified in your Technical Proposal (if possible).
7. Page 6, Section E, Other Projects: The statistics provided on the Melbourne application of the AMM system demonstrate impressive performance improvements. Also, it is a strength that the M1 AMM application represents the fourth iteration of ramp metering, building on lessons learned from the previous implementations.
8. Page 6, Section E, Other Projects: The PTC states that; "Variable message signs: deliver an 8 to 13 percent increase in travel speed." This is a bit counter to some public perception that VMS cause motorists to slow on approach to read the signs, reducing overall travel speed. Is this referring to lane control signing? If it's referring to traditional VMS, we would like additional clarification on how the signs would increase travel speeds.
9. Page 8, Section F, Administration Risk: Please refer to comments on Section D, regarding Operations and Maintenance costs, above.
10. The public might perceive the system as focusing on mainline I-270 operations, only to produce backups on the local network. We understand from the detailed description that the system minimizes the risk of mainline breakdown by balancing the ramp queue against spillback onto adjacent arterials and the optimization of freeway traffic flow. It reduces arterial congestion due to the recapture of capacity on the freeway and enhanced awareness of ramp queuing conditions. Please elaborate on how the system balances operations between the mainline and arterials. Will circumstances regularly arise where the arterials become oversaturated? Are there mechanisms to prevent oversaturation? Or would such mechanisms compromise the system and the overall contract goal(s)?
11. Does the system handle non-recurrent congestion (incidents, work zones etc.)? If so, please elaborate.

12. The VISSIM models should be used to quantify the benefits in the templates SHA provided. If changes are made to the model parameters, they should be clearly documented with rationale. The mainline improvements and the cross street impacts have to be documented.
13. Page 5, Section D, Potential Impacts, Environmental Impacts/Permitting: Concerning an Interstate Access Point Approval (IAPA), ramp metering requires a Coordination Letter be sent to FHWA.
14. Page 5,Section D, Potential Impacts, Life-cycle Project Costs: How much is the licensure fee?

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 12B – Australian Managed Motorways	Date Resubmitted: December 15, 2016
Related Disciplines: Traffic, ITS, CHART	Corman Construction

This PTC is being resubmitted to respond to SHA comments and questions. All information highlighted in grey has been added or revised for this PTC 12B submittal.

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This Proposed Technical Concept (PTC) proposes to adapt the Australian Managed Motorways (AMM) concept as deployed by the state of Victoria in Melbourne for IS 270. This concept builds upon the Intelligent Transportation Systems (ITS) applications of ramp metering, Active Traffic Management (ATM), and the dynamic demand management capability of advanced computer algorithms to fully manage access to and demand for IS 270. AMM utilizes new, extensive, and integrated data collection sensors along the roadway and advanced system management tools to monitor and control real time traffic conditions that respond to predicted breakdowns in traffic flow (as compared to reacting to breakdowns after they occur, as discussed in our PTC on Active Traffic Management).

Like all freeways, IS 270 fails to function properly when flow breaks down due to higher demand and resulting turbulence. A maximum flow rate of 2100 vehicles per hour per lane is carried on a typical interstate segment at 55 mph prior to congestion saturation. However, as congestion occurs, average speeds and total volumes per hour are significantly reduced. Only 1300 vehicles per hour per lane are typically passing through a facility at 20 miles per hour, which is a reduction of nearly 40% of the lane's full capacity. In this situation, the highway is carrying close to 40% less vehicles at a time where maximum flow is most desired. AMM seeks to manage all access to a freeway and harmonize flow in an automated and integrated fashion, to produce flow rates closer to the facility's maximum carrying volume of between 2000 to 2100 vehicles per hour per lane.

By utilizing intelligent information, communications and control systems, AMM, automatically on a real time basis, synchronizes the flow of entering vehicles to those already on the facility to match the freeway's operational capacity. Access is directly controlled at the on-ramps and freeway interchanges of a highway corridor through ramp meters, but AMM also incorporates proven advanced algorithms to adaptively control access and manage ramp waiting times by coordinated meters throughout the corridor in real-time. Furthermore, AMM involves new concepts in entry ramp design that include physical improvements to ramp storage, discharge, and acceleration in order to optimize the ability of vehicles to fully utilize the freeway's available capacity. This comprehensive demand and system management process results in considerable improvements in freeway performance and safety, helping to maximize the overall efficiency of the facility.

AMM involves an integrated package of ITS and roadway improvements to maximize efficiency and throughput. Components of AMM include extensive vehicle detection and data collection systems, coordinated ramp metering, incident detection, closed circuit television surveillance and strategic design considerations (such as on ramp queue discharge and storage, merge lanes, expanded off ramps for increased exit flows, etc.). The VicRoads system as deployed also includes complimentary applications such as variable speed limits and lane control, traveler information, lane-use management, and priority vehicle queue bypass lanes; however, these components are not proposed within this PTC, as the principal benefit for IS 270 is the AMM-derived coordinated ramp metering, which involves a heavily-modified version of the HERO algorithm (described below).

Detailed Description

In simple terms, the AMM system will regulate entering volumes to IS 270 in order to minimize freeway mainline congestion. Unlike conventional ramp metering, which is based upon broad traffic metrics and is reactive to system breakdowns after they occur, the AMM system is based upon highly precise and frequent measures of freeway lane occupancy, speed, and volumes, so that the ramp metering system prevents too many vehicles from entering the freeway too quickly, which in turn avoids creating or increasing the impact of congestion at a given location. Furthermore, the system accounts for all ramps and data points as a system, with sophisticated coordination and control across all entrance ramps as a whole. The end result is a prevention and/or minimization of traffic breakdown conditions on the mainline freeway, and, reduction in arterial congestion due to the recapture of capacity on the freeway itself and enhanced awareness of ramp queuing conditions.

The foundation of the AMM concept is an extensive network of highly-precise, continuously-monitored lane occupancy, speed, and volume detectors located at approximately 1/3 mile intervals covering each lane along IS 270 and on entrance / exit ramps. A schematic of detector placement is shown in Figure 1.

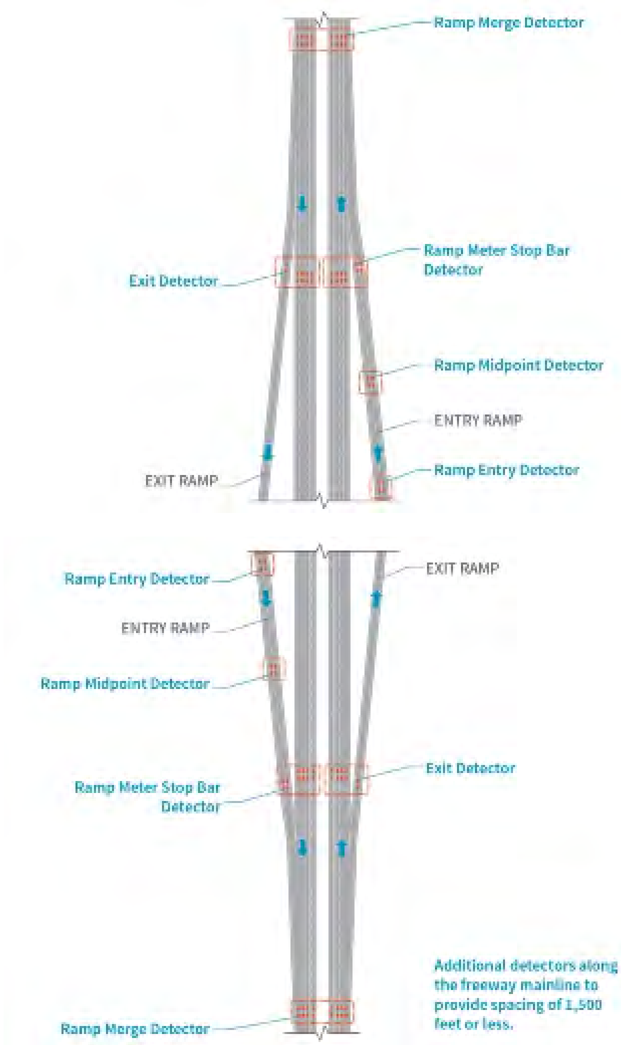


Figure 1: VicRoads Deployment of Vehicle Detectors for Australian Managed Motorways

Real-time data from each detection location is collected in 20-second increments and consolidated by the system controllers. The data is transmitted via a fiber optic network to an integrated control system called STREAMS, owned and managed by TRANSMAX, a public sector enterprise of the Queensland (Australia) state government. This control system, as indicated in our Communications and Networking PTC, would be located in CHART's SOC but would be independent of CHART’s existing systems. The data is then processed using advanced, state-of-the-practice traffic management algorithms, based upon the European Heuristic Ramp Metering Coordination (HERO) algorithm originally developed by the University of Crete and extensively modified by VicRoads for use in AMM deployments on the M1 and M80 freeways in Melbourne. These algorithms identify changes in traffic flows in real time, predict the likely breakdown of flow before it occurs, and determine how and where ramp metering rates need to be adjusted in a coordinated manner throughout the entire system to sustain optimum traffic flows. In addition to the modifications of HERO for AMM, the STREAMS software package is proven in ongoing Managed Motorways installations and has been constantly upgraded since its initial deployment in 2007. Both HERO and STREAMS will be licensed to SHA and maintenance and upgrades provided regularly through the course of the contract and afterwards thru the proposed licensing agreement.

HERO consists of several software modules that facilitate various traffic data calculations and control tasks for each controlled ramp reflecting specific ramp configuration parameters and real-time traffic data. The components of the HERO algorithm are shown in Figure 2 and Figure 3. AMM uses the well-established ALINEA algorithm for local ramp control due to its simplicity and efficiency at resolving local traffic flows immediately upstream and downstream of entrance ramps. However, STREAMS monitors all traffic detectors and identifies pending traffic flow breakdown for which ALINEA cannot resolve the predicted problem. At this point, HERO becomes the operative algorithm, and substitutes the local ramp control for system ramp control, providing coordination between all ramps throughout the system. HERO calculates the desired meter rate at each coordinated ramp based on estimates of critical occupancy, queue length, waiting time, and ramp demand. It works to minimize the risk of mainline breakdown by balancing the ramp queue against spillback onto adjacent arterials and the optimization of freeway traffic flow, as proven on the M1 freeway.

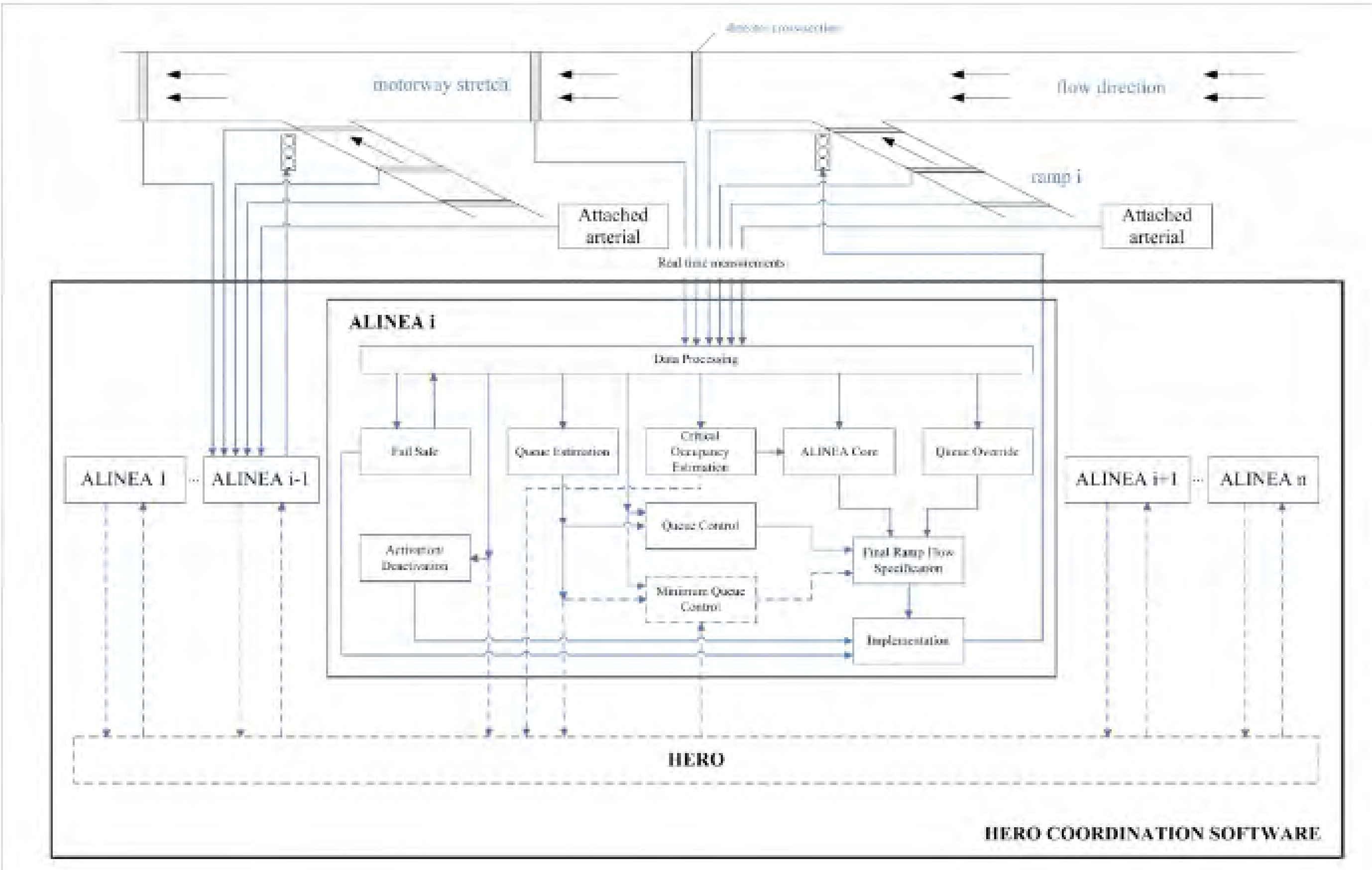


Figure 2: Modular Structure of HERO coordination

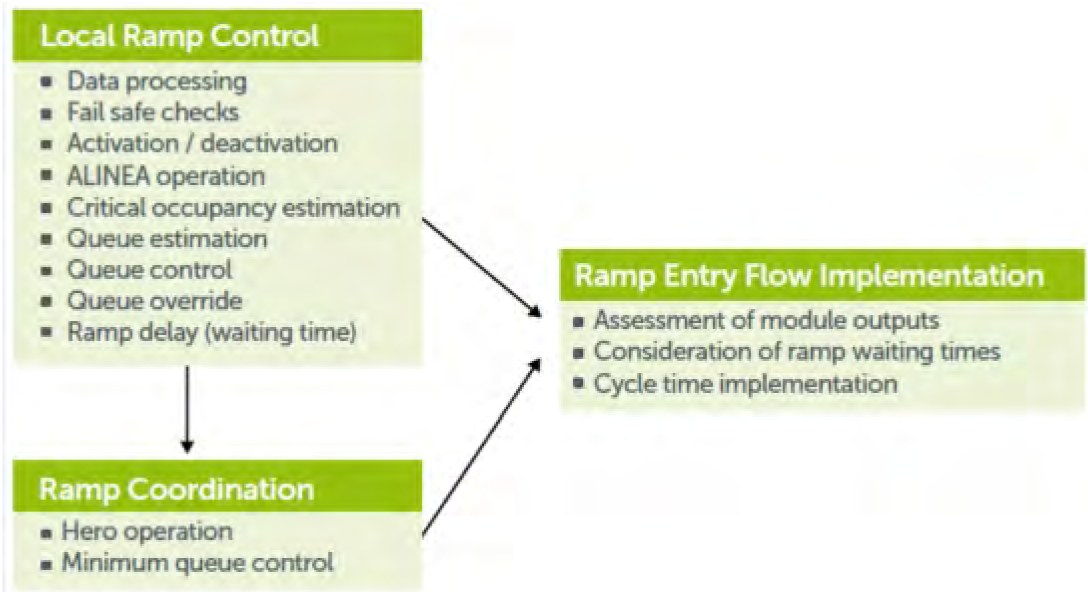


Figure 3: HERO Algorithm Components

When the queues of one particular ramp meet a certain predetermined threshold, it spreads its metering operation upstream. Whereas adaptive ramp metering will progress the operation upstream linearly for each entrance ramp, HERO applies the upstream progression non-linearly, using available ramp control as a system. The queuing at that ramp is then relieved slightly, as queues are spread among a coordinated, non-linear group of ramps. This approach is intended to balance queues and provide equity among ramps. The practice is important, as unlike conventional ramp metering that is not interconnected and set to adaptively and coordinate as a system, delay queues can be managed over several different ramps.

AMM neither requires Active Traffic Management (ATM) or Traffic Incident Management (TIM) strategies, nor are they proposed as a part of this specific PTC. However, AMM does compliment ATM and TIM applications, especially in the identification of incidents, which will benefit SHA operations. Sudden changes to flow metrics on IS 270, unanticipated by STREAMS continuous analysis, would suggest the potential occurrence of a crash or other incident that is currently constraining operations. Whereas current TIM relies upon other means of identifying incidents, real-time extensive monitoring of IS 270 through STREAMS will provide very rapid information to SHA for incident response. ATM tools such as dynamic message signs and overhead lane use control can be utilized to close lanes in advance of incidents (or roadway maintenance activities) ensuring traffic merges in a more orderly manner, while variable speed limits can be changed to inform motorists to gradually reduce speed ahead of the lane merge. These systems would be informed by the AMM continuous monitoring, and provide more rapid response (if deployed) than a similar ATM system without AMM solutions. For additional information on the proposed ATM deployment, please refer to our previously submitted PTC 15 – Active Traffic Management.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

Australian Managed Motorways coordinated ramp metering strategies will be implemented along the IS 270 corridor in the northbound and southbound. This will include metering of all entry ramps to the mainline and collector-distributor (CD) roads, but not the CD connections to and from the IS 270 mainline.

Locating ITS devices on IS 270 will conform to the VicRoads standards for AMM deployment and is as shown in PTC 15 – Active Traffic Management. The VicRoads standard for real-time lane occupancy data is ±2% within a 20 second period, which is our proposed standard for IS 270 as well. Information to this level of accuracy requires specific placement of vehicle detectors, with mainline vehicle detectors be placed just beyond turbulent merging areas, approximately 1,000 feet downstream of the nose of an on-ramp or other known bottleneck locations, such as weaving areas or inclines. Mainline detectors should also be placed at appropriate spacing between on-ramps and interchanges, as shown previously in Figure 1.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

The application of AMM on IS 270 will create a virtually enclosed (from a traffic flow perspective) freeway allowing for extensive real-time monitoring and management of freeway performance, comprehensive management of access to and traffic flow along the freeway facility, expedited incident response, enhanced communication of travel conditions and sustainability of transit and carpool travel times. With careful monitoring of traffic on the freeway and control of the rate that traffic enters the freeway, disruptions to the traffic flow (such as a large platoon of traffic entering the freeway, or an incident) can be minimized and higher traffic flows with harmonized flow can be sustained for longer periods, particularly during peak periods, increasing overall efficiency. This allows greater volumes of traffic to move along IS 270 in a given period of time, providing congestion reduction, safety, fuel consumption and emissions benefits.

Specific benefits pertaining to project goals:

- **Mobility** – AMM provides integrated / coordinated response to traffic conditions in a predictive setting, thereby preventing the onset of saturated conditions. Mobility will be enhanced by congestion reduction, travel time reduction, and improvement in travel time reliability. As deployed and measured in Melbourne, AMM has independently improved travel speeds 13 – 26% and vehicular throughput 5 – 30% (depending upon specific locations, and described in section E, below).
- **Safety** – enhanced flow control and management through AMM directly reduces crashes related to unstable and congested traffic conditions, including rear-end crashes. As measured in Melbourne, AMM independently reduced crashes by up to 50%.
- **Operability** – AMM has a proven platform capable of managing all devices and system input variables in one system. This platform is incorporated within the PTC, and may be independently

operated at CHART without conflict or overlap with existing CHART modules. Please refer to the PTC on CHART Integration, as previously submitted.

- **Maintainability –** roadside and pole mounted devices will be located for ease of maintenance access, considering locations for service vehicles, bucket trucks or other maintenance equipment. Wireless magnetometers are maintenance free within their battery life and can be replaced quickly when needed; non-invasive light-based vehicle detectors are mounted on exterior of mainline, thereby reducing the requirement for lane closures for maintenance.
- **Adaptability –** all proposed devices have been deployed on similar projects and have shown to be dependable and adaptable to varying traffic conditions and future uses.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: Enhanced user benefits pertaining to travel speeds, vehicular throughput, and crash reduction, as described in this PTC.

ii. Right-of-Way Impacts: None anticipated

iii. Geotechnical Impacts: None anticipated

iv. Utility Impacts: Other than the need to provide power to the ATM units none anticipated

v. Environmental Impacts/Permitting: None anticipated. As indicated in FHWA's Interstate System Access Information Guide, a Coordination Letter will be sent to the FHWA Division Office, to confirm that FHWA review and action is not required for an IAPA due to the implementation of ramp metering.

vi. Impacts to Local Communities: None anticipated

vii. Safety Impacts: Reduction in rear-end crashes, due to enhanced flow control and reduction in traffic breakdown, as described in this PTC.

viii. Life-cycle Project Costs: Life-cycle costs will include an annual licensure fee (pending) for operating the HERO and STREAMS software, upgrades and possible additional costs associated with increasing manpower to operate the system at CHART's SOC (pending confirmation) or another location with data connectivity to CHART for incident monitoring from AMM traffic sensors. As one of the primary benefits of AMM is the reduction of crashes (due to traffic flow sustainability), manpower currently assigned to incident management on IS 270 may become available to fill the gap.

ix. Infrastructure Costs: Initial project costs include the cost of ITS devices, poles, conduit, electric and fiber optic cabling, manholes/hand holes, and the start-up costs for the developing system/software architecture. The final technical solution will also include an operations plan and cost estimate for ongoing operations and maintenance requirements, so as to support the long-term deployment and benefit from the AMM solution.

Repair Costs: All devices come with manufacturer warranties.

Maintenance Costs: Routine maintenance will be required; special event maintenance (snow clearance) may be required for specific vehicle detection devices (to be determined).

Operation Costs: AMM requires ongoing commitment to managing and operating the system. Staffing related requirements for operations is discussed in Section I: Miscellaneous (below).

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

Various components of Australian Managed Motorways (AMM) are currently utilized on roadway facilities around the world, including several urban freeway corridors in Maryland. However, the first facility to integrate these systems in a comprehensive manner is the M1 Motorway in Melbourne, Australia, owned and operated by VicRoads (the Victoria state department of Transportation). First operational in December 2009, the Melbourne M1 Managed Motorway extends 75 km (47 mile) along the Monash – CityLink – West Gate Motorway (MCW) corridor, which links downtown Melbourne to surrounding suburban communities and one of Australia's busiest maritime cargo ports. Carrying over 160,000 vehicles daily, including 18,000 to 20,000 trucks in the segments west of downtown, the six- to eight-lane M1 Motorway in Melbourne is one of the busiest and most vital transport corridors in the nation.

The complete 47 mile M1 Managed Motorways integrates over 1,100 separate vehicle detection, traffic signal and communication devices to provide coordinated ramp metering at 62 separate locations. To complement the system, freeway lane use management (a feature of Active Traffic Management) is included along 12 of the 47 miles of the freeway. To facilitate traffic flow changes resulting from the freeway corridor improvements and coordinated ramp metering, strategic ramp improvements were completed at over 30 locations to provide increased storage and acceleration and/or deceleration distance for vehicles entering and exiting the facility. Priority ramp bypass lanes were also included at five ramp locations for transit, HOV and trucks in order to reduce delay for transit and HOV users and to minimize disruption and emissions from trucks having to accelerate from a complete stop at ramp meters.

It should be noted that the M1 Managed Motorways program constitutes the fourth iteration of ramp metering on this corridor. Like other locations, VicRoads had previously implemented static and adaptive ramp meters to limited effect. However, with the Managed Motorways concept, VicRoads was the first agency to integrate robust traffic detection with highly advanced dynamic metering algorithms with complementary traffic management components that work collaboratively with one another. Lessons learned on this project will be implemented on the IS 270 project.

The Infrastructure Australia 2011 National Urban Policy Paper, *Our Cities, Our Future,* indicates that "specific benefits of managed motorways (freeways) tools include:

- *Ramp metering*: delivers a 13 to 26 percent increase in travel speed, an increase in volume (throughput of traffic) of between five and 30 percent and a 15 to 50 percent reduction in road accidents." (Australian Department of Infrastructure and Transport. *Our Cities, Our Future: A National Urban Policy for a Productive, Sustainable, and Liveable Future*, 2011. https://infrastructure.gov.au/infrastructure/pab/files/Our_Cities_National_Urban_Policy_Paper_2011.pdf)

Although the full 47 mile M1 project (completed in late 2010) involved freeway improvements including additional lane capacity and new collector-distributor ramps, an initial 9.4 mile trial segment was evaluated by VicRoads in 2008 to determine the specific benefits of the AMM system being installed. The trial involved the implementation of coordinated ramp metering at six locations along the westbound M1 Freeway east of downtown Melbourne (inbound direction). The initial trial segment was chosen as a test location based on the presence of existing ramp meters, queue storage in existing ramp configuration, and a lack of mainline freeway design issues contributing to downstream bottlenecks.

Although the trial segment was already operating with fixed-time ramp meters, the results of the trial, as published, indicated that the coordinated dynamic metering system increased traffic flows and substantially improved reliability. As indicated in Table 1, the trial demonstrated over 5% increase in peak traffic flow rate with throughput sustained throughout the peak periods. Furthermore, traffic speeds improved between 35% and 60% during peak periods, while overall reliability, as measured by the variability in traffic speeds during the peak period, improved between 150% during the AM peak period and over 500% during the PM peak period. In addition, the cumulative economic benefits of the trial effectively paid back the initial $1 million AUD ($950,000 USD) cost in 11 days of operations through traveler cost savings.

Table 1: Performance Summary for M1 Managed Motorways Trial (2008)

Performance Indicators	**AM Peak**			**PM Peak**		
	Fixed Time Metering	Coordinated Dynamic Metering	Performance Improvement	Fixed Time Metering	Coordinated Dynamic Metering	Performance Improvement
Traffic flow (pce/h/ln)	2,068	2,165	4.7%	1,914	2,074	8.4%
Travel speed (mph)	30.4	41.0	34.9%	31.2	49.5	58.7%
Less than 20% speed variation (%)	26.3	65.4	148.7%	13.4	82.6	516.4%

Since the completion of the 47 mile M1 Upgrade project in 2010, a second before and after study was conducted to evaluate the effectiveness of the AMM System along with the physical roadway improvements included in the project. Improvements to the segment associated with the M1 Upgrade project included construction of a single lane addition (from 3 or 4 lanes to 4 or 5) and one eastbound on-ramp, as well as the conversion of 9 fixed-time SCATS ramp signals to 14 fully coordinated ramps with VicRoads' modified HERO software. This section of the M1 included no other controlling ITS tools. Results of the before and after evaluation from 2007 and 2013 are summarized in Table 2. As indicated, the combined project components resulted in per lane traffic flow increases of between 16 and 19% during peak periods. In addition, average inbound travel speed increased by 19% during the AM period, and by nearly 20% in the outbound PM peak direction. These performance improvements are greater than should be expected from added capacity alone and similar improvements were achieved in the section of freeway not widened. The study also found that the five year average crash rate declined 31% from before and after project completion (9.15 to 6.31 crashes per 100 million VKT).

Table 2: Performance Summary for M1 Upgrade Case Study Segment (2013)

Performance Indicators	Inbound AM Peak			Outbound PM Peak		
	2007	2013	Performance Improvement	2007	2013	Performance Improvement
Traffic flow (vphpl)	1,476	1,755	19.0%	1,402	1,627	16%
Travel speed (mph)	39.0	46.1	19.0%	36	46	27.8%

Project Contact

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VicRoads, 60 Denmark Street, Kew, VIC 3101 Australia
John.gaffney@roads.vic.gov.au, +61 (3) 9915 4758

Results from the 2013 evaluation effort for the M1 were used to revise VicRoads' ramp signals handbook. The resulting publication, incorporating design and operations standards for AMM, are available at: https://www.vicroads.vic.gov.au/business-and-industry/technical-documents/freeway-ramp-signals-handbook

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

The benefits of AMM requires an ongoing commitment to operations, as described in section D. The administrative risk involves sufficient resource allocation over time to the operations. Section D describes the operations plan commitment as a part of the final technical solution. Additionally, Section I discusses staffing resource requirements as informed by VicRoads operations of the M1 freeway in Melbourne.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

The design / builder assumes the risk of integrating the ITS components with the STREAMS control platform to provide the anticipated benefits.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

The AMM concept can be deployed with non-invasive vehicle detection devices. As an early action, these devices can provide enhanced and nuanced awareness of traffic conditions and bottlenecks through IS 270, in addition to powering the AMM's HERO algorithms. With enhanced traffic data, geometric improvements can be better targeted to respond to traffic conditions, which in turn yields a better return on investment for infrastructure costs.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*

Staffing Requirements for AMM Operations

Operations and maintenance staffing requirements will be prepared for the final technical solution, as a component of the final operations plan. However, in advance via this PTC, the staffing for operating the M1 managed motorway in Melbourne by VicRoads is articulated as a comparison. VicRoads currently designates 0.5 FTE during the workday (approximately 20 hours per week) for evaluation and refinement of M1 operations via STREAMS, which otherwise automates the deployment of the coordinated ramp metering solution. VicRoads staff do not directly operate the system; rather, they evaluate, refine, test, and deploy changes in response to traffic data over time. Incidents are still monitored, managed, and resolved via TIM processes in place for the M1 corridor, and are independent of the AMM solution – similar to the function CHART SOC would provide for IS 270.

VicRoads has suggested the following resourcing requirements for AMM deployment on IS 270:

- The operator(s) of the coordinated ramp metering system (presumable SHA) will need specific training in contemporary traffic theory, traffic analysis, understanding of STREAMS, understanding of the coordinated ramp metering system including optimization, and fine tuning. As part of the contract, the Corman team will offer side by side operation and training for a specified amount of time.
- Staff will need to be identified (or appointed) who have the necessary skill set, which VicRoads cautions are different to normal SOC operators (and may be located in a different work group).
- It would be wise to train more than one person so that knowledge is shared and there are resources available for oversight of the different peaks and to cover absences. Identified staff may share jobs, e.g., with traffic signals or other traffic management roles.

Freeway / Arterial System Balance

The operation of the IS 270 freeway mainline and associated CD roads is expected to enhance the performance of the arterial road network as a whole, reflecting experience on the M1 in Melbourne. If the freeway is operating efficiently and productively, this results in greater throughput, lower travel times, and reduces the likelihood of motorists choosing arterial roads for their travel. Entry ramps will be designed to suit the AMM operation and if traffic demand can be accommodated on the managed freeway (which has higher capacity than an unmanaged freeway), ramp queues can generally be managed within the ramp lengths.

VicRoads has published a desirable standard by which ramp storage and arterial impacts are considered. These are articulated below, with minor wording changes to facilitate the different traffic streams (Australians drive on the left side of the corridor):

The desirable standard is to provide for a length of storage between the stop line and ramp entrance to accommodate traffic with a wait time of 4 minutes (i.e., the ramp queue delay). This standard shall be provided by lengthening or widening to two lanes existing ramps when it is economically feasible within design constraints (e.g., downstream bridge or exit tapers). This facilitates operational flexibility to provide for the following situations:

- To limit vehicle entry to the freeway when the ramp merge or downstream freeway is at or approaching capacity
- To balance queues between adjacent ramps in a coordinated system
- To reduce the likelihood of overflow queues extending onto the arterial road
- To provide for short term variations in traffic demand within the peak period
- To accommodate traffic growth or future change in travel patterns, and
- To limit vehicle entry to the freeway during an incident and to facilitate recovery after an incident.

The length of the desirable ramp storage is calculated from the number of vehicles in the maximum wait time queue, the maximum wait time, and the average length of the ramp queue vehicle storage space. The number of vehicles in the queue based on the maximum wait time is calculated from the ramp arrival (demand) flow and the maximum wait time (generally 4 minutes).

As a general principle, freeway ramps should be designed to provide the desirable storage indicated above. In circumstances that prevent this being achieved, ramp overflow onto the arterial road needs to be considered. This may include:

- Consideration of improvements at the arterial road / entry ramp intersection, such as extending or providing right or left turn lanes to increase effective storage for the entry ramp traffic
- (Arterial signal) system integration. This may include implementation of leading and lagging (left) turn phases at the arterial road intersection to reduce the potential for overfilling of a short ramp (i.e., two short left turn phases within the cycle rather than a single longer phase)
- Provision of arterial road queue detectors
- Considering potential for trip diversion
- Considering equity between left and right turn movements into the ramp (e.g, signalizing a right turn slip lane)

Source: VicRoads. *Managed Freeways: Freeway Ramp Signals Handbook*, Chapter 6: Design of Ramp Signal Installations, July 2013.

Non-Recurring Congestion

Non-recurring congestion is defined in this PTC as a condition emerging from a crash, special event, or other non-predictable incident. The use of AMM data to identify the incident and alert CHART staff is discussed in Section A, above. In addition to providing timely information on incidents, the AMM system may also support the resolution of the incident's traffic effects. During the incident, the coordinated ramp metering system may prevent additional traffic from flooding the incident location (which would otherwise exacerbate the traffic flow breakdown and recovery). After the incident has been cleared, the coordinate ramp metering assists in recovering traffic flow back to freely flowing conditions in an orderly and coordinated manner.

For planned works, such as construction or other events, the coordinated ramp metering system can also assist in keeping the traffic moving by minimizing flow breakdown and managing demand to the available capacity during the work period (e.g., configuration changes, lane alignment changes, or lane closures). However, to be effective, adequate vehicle detection must be present in order to inform the system.

Consolidated Responses to SHA Comments dated 11/21/16 on PTC 12 – Australian Managed Motorways

1. **Comment:** Generally the concept appears to be a reasonable solution to address the goals of this contract.
   Response: No response required.

2. **Comment:** There are a number of general statements that make PTC #12 relatively generic and harder to review. For example, on the top of page 2 the PTC states, "Systems can also include complimentary applications such as variable speed limits and lane control, traveler information, lane-use management, and priority vehicle queue bypass lanes… They will be added as appropriate…." Section B, Location. Uses language that leaves ambiguity with respect to where AMM will be applied. The first sentence states AMM will be incorporated as the budget permits, and that ramp meters will be placed at most (if not all) entrance ramps. As noted in Article XII.B of the RFP (first paragraph), no consideration will be given to tentative or ambiguous commitments in the review of the Technical Proposal.
   Response: We understand and concur. Unfortunately we are still in the process of determining the exact extent of our recommendations and cannot provide further details at this time; however, our Technical Proposal will include the detail necessary for SHA evaluation of the concept.

3. **Comment:** Page 2, Section A, Detailed Description: The PTC states "CCTV cameras supplement the in-field vehicle detectors to identify incidents that could disrupt traffic flows." Maryland's Traffic Incident Management processes and resources do not support using CCTV cameras to identify incidents (this would require an architecture that would make all images available at all times, and additional staff to monitor the images). Maryland uses cameras for verification, and to

collect information on the incident response progress, once an incident has been identified by other means. Using cameras to identify incidents would require video analytics.
Response: We understand that the existing CHART CCTV cameras are not currently utilized for incident detection and we will make that more clear in our Technical Proposal. The CCTV cameras proposed as part of this PTC will be used in the same capacity as the existing: verification, information collection, and incident response progress.

4. **Comment:** Page 5, Section D, Potential Impacts: Under "Life-cycle project Costs" the PTC states "Life-cycle costs will include an annual licensure fee for operating the STREAMS software, upgrades and possible additional costs associated with increasing manpower to operate the system at CHART's SOC." The proposer should confirm, based on Communications architecture, and the plan to completely renovate the SOC within two-years, that operating the system at CHART's SOC is the best hosting option.
Response: We anticipate that the communications architecture will support hosting of the STREAMS software on servers located anywhere on the SHA Enterprise Network. We recommend that the workstations be located alongside existing CHART workstations either at the SOC or at TOC3.

5. **Comment:** Page 6, Section D, Potential Impacts: As noted in Section D, ix. Infrastructure Costs, there will be Operations and Maintenance expenses associated with any ATM. It is understood that this project will not include funding for ongoing Operations and Maintenance. However, per the Operability/Maintainability/Adaptability Goal, we would anticipate the final technical solution would include a plan and estimate of the operations and maintenance requirements and costs, in order to program ongoing support and provide documentation and justification for the required Operational Budget enhancements.
Response: This will be addressed in the Technical Proposal under Operability/Maintainability/Adaptability.

6. **Comment:** Page 6, Section D Potential Impacts: The PTC states at the top of page 6 that, "VicRoads has .5 FTE dedicated to managing the M1 Managed Motorways." This would equate to 20 hours out of a 168 hour week (assuming 24x7 operations). We would like additional details on this statement. Given that the system is primarily automated, it is potentially reasonable, but we would like additional information on what the staffing requirement should be for "operating" the system. The O&M aspects and risks to the agencies should be clearly identified and quantified in your Technical Proposal (if possible).
Response: This will be discussed in our Technical Proposal; however, the staffing of 0.5 FTE for operating the M1 managed motorway in Melbourne by VicRoads was articulated only as a comparison.

7. **Comment:** Page 6, Section E, Other Projects: The statistics provided on the Melbourne application of the AMM system demonstrate impressive performance improvements. Also, it is a strength that the M1 AMM application represents the fourth iteration of ramp metering, building on lessons learned from the previous implementations.
Response: No response required.

8. **Comment:** Page 6, Section E, Other Projects: The PTC states that; "Variable message signs: deliver an 8 to 13 percent increase in travel speed." This is a bit counter to some public perception that VMS cause motorists to slow on approach to read the signs, reducing overall travel speed. Is this referring to lane control signing? If it's referring to traditional VMS, we would like additional clarification on how the signs would increase travel speeds.
   Response: DMS Signs, if incorporated into our final recommended solution, will be discussed in our technical proposal. This section describes DMS signs which function as part of an Australian Managed Motorways system and not isolated DMS signs.

9. **Comment:** Page 8, Section F, Administration Risk: Please refer to comments on Section D, regarding Operations and Maintenance costs, above.
   Response: Addressed in item 6.

10. **Comment:** The public might perceive the system as focusing on mainline I-270 operations, only to produce backups on the local network. We understand from the detailed description that the system minimizes the risk of mainline breakdown by balancing the ramp queue against spillback onto adjacent arterials and the optimization of freeway traffic flow. It reduces arterial congestion due to the recapture of capacity on the freeway and enhanced awareness of ramp queuing conditions. Please elaborate on how the system balances operations between the mainline and arterials. Will circumstances regularly arise where the arterials become oversaturated? Are there mechanisms to prevent oversaturation? Or would such mechanisms compromise the system and the overall contract goals?
    Response: The operation of the IS 270 freeway mainline and associated CD roads is expected to enhance the performance of the arterial road network as a whole, reflecting experience on the M1 in Melbourne. If the freeway is operating efficiently and productively, this results in greater throughput, lower travel times, and reduces the likelihood of motorists choosing arterial roads for their travel.

    In addition to recapturing the freeway capacity and balancing the ramp queue against spill back through the innovative Australian Managed Motorways algorithms, our proposed solution also includes a number of geometric improvements to further mitigate any impact on the arterials. In several locations we are proposing to extend merge lanes, reconfigure one of the legs of the interchange, or completely revise the interchange configuration in its entirety. Our proposed solution also recognizes the importance of ramp storage and in several locations will create a two-lane ramp configuration to increase the vehicle storage and further mitigate any impacts on the arterials.

    Collectively, our solutions attack the problem from multiple different angles so that the impacts on the arterials during normal peak period operation should be minimized if not improved. There will also need to be a public education and awareness campaign to inform users of the overall system benefits as discussed in our PTC 19 – Public Outreach Plan.

11. **Comment:** Does the system handle non-recurrent congestion (incidents, work zones etc.)? If so, please elaborate.
    Response: Independent of what causes the interruption in traffic flow, the fact remains that it will be detected and dynamic ramp metering would make adjustments in real-time. Other complementary elements of our proposed solution (e.g., additional incident management ITS or in extreme cases hard shoulder running) would likewise contribute to the overall system efficiency. Complete blockage of the roadway or multiple lane closures during peak periods would still cause operations to breakdown to some degree. Since work zones and major events are planned (for the most part), SHA will have an opportunity to ensure the system is available should congestion occur as a result of a work zone or planned major event in the region.

12. **Comment:** The VISSIM models should be used to quantify the benefits in the templates SHA provided. If changes are made to the model parameters, they should be clearly documented with rationale. The mainline improvements and the cross street impacts have to be documented.
    Response: The VISSIM model outputs will be documented in the templates provided with the RFQ/RFP. We will include the impacts to cross streets in our final technical proposal and will document any changes that may have been required.

13. **Comment:** Page 5, Section D, Potential Impacts, Environmental Impacts/Permitting: Concerning an Interstate Access Point Approval (IAPA), ramp metering requires a Coordination Letter be sent to FHWA.
    Response: As indicated in FHWA's Interstate System Access Information Guide, a Coordination Letter will be sent to the FHWA Division Office, to confirm that FHWA review and action is not required for an IAPA due to the implementation of ramp metering.

14. **Comment:** Page 5, Section D, Potential Impacts, Life-cycle Project Costs: How much is the licensure fee?
15. **Response:** This will be addressed in the Technical Proposal under Operability/Maintainability/Adaptability.

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

SHA State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

December 29, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 12B for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 9, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract. There are no additional comments for this revised PTC.

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

My telephone number/toll-free number is 410-545-8800 or 1-888-228-6971
Maryland Relay Service for Impaired Hearing or Speech 1.800.735.2258 Statewide Toll Free

Street Address: 707 North Calvert Street • Baltimore, Maryland 21202 • *Phone* 410.545.0300 • www.roads.maryland.gov

PTC No.: 16 – Hard Shoulder Running (Segment A)	Date Submitted: November 14, 2016
Related Disciplines: Highway, H&H, Traffic, Pavement/Geotech	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This proposed PTC would permit general purpose travel to use the existing shoulders of southbound IS 270, from MD 109 (Old Hundred Rd) to MD 121 (Clarksburg Rd), during the AM peak hour time period. Trucks and buses would be permitted to use the temporary shoulder lane in the vicinity of the weigh station only, to help replicate the benefits of a climbing lane and allow ingress and egress from the weight station. The shoulder would be preserved as a refuge when hard shoulder running is not in effect. Static signing would be implemented to control the use of the shoulders as a travel lane. This strategy would provide additional capacity to this segment of the corridor during the AM peak hours and can be constructed within the existing footprint of IS 270, minimizing right of way, utility, and environmental impacts.

Prior to implementation, geometric improvements would be required along IS 270 such as removal of existing rumble strips where applicable, removal of pavement markings, restriping lanes, rounding of existing shoulder roll-over, modification of any drainage structures on the shoulder, improvements to existing ramp treatments, and resetting of existing traffic barrier for sight distance, to adjust height, or to provide a minimum of a 1.5 foot lateral offset to an obstruction.

Since shoulder use in this location will not be dynamic, a roadside sign will be used to display times of day the shoulder is open or closed. A small dynamic sign may be included to indicate the shoulder as "open or closed." Overhead dynamic lane use control signs will not be proposed for these limits.

Gore areas or ramp shoulders at entrance and exit ramps will provide a refuge space for vehicles while hard shoulder running is in effect. When the gore or ramp shoulders do not provide enough refuge space or when the distance between ramps is excessive, emergency turnouts will be constructed where feasible. Turnouts will be 12 to 16 feet wide, a minimum of 110 feet long, and have 300 foot tapers. They will be located outside of the existing footprint of the roadway and located to minimize the need for additional right of way, retaining walls, and other infrastructure to construct. In general FHWA recommends turnouts placed at half-mile intervals when ramp spacing exceeds a half mile. Our conceptual layout for hard shoulder running along IS 270 meets this recommendation as much as possible; however, due to excessive ROW, environmental, and utility impacts we are not able to meet the half mile spacing throughout the limits. Two turnouts are proposed within these limits of hard shoulder running. The turnouts are proposed in the following locations pending a more detailed investigation on design constraints and impacts:

- Southbound IS 270 between the Weight Station and MD 121 (Clarksburg Rd) – Two Turnouts

The construction of turnouts would require earthwork, full depth pavement, installation of traffic barrier (W-Beam and/or F-Shape Barrier), signing and marking, drainage improvements, and stormwater management (SWM). Retaining walls may be considered to limit impacts to existing right of way. Installation of the turnouts may also impact existing signage, storm drains, overhead light poles, and trees. Further environmental impacts are anticipated to be minimized as much as possible with the turnout being eliminated if determined to be too impactful.

The existing typical section of IS 270 is fairly consistent within the limits of this PTC, with two 12 ft. through lanes in each direction, 4 ft. left shoulders and 10 ft. right shoulders. For interstates, AASHTO's A Policy on Design Standards - Interstate System requires that all traffic lanes shall be at least 12 ft. wide. The paved width of the right shoulder shall not be less than 10 ft. On a four-lane section the paved width of the left shoulder shall be at least 4 ft. On sections with 6 or more lanes, the left shoulder shall be 10 ft. wide.

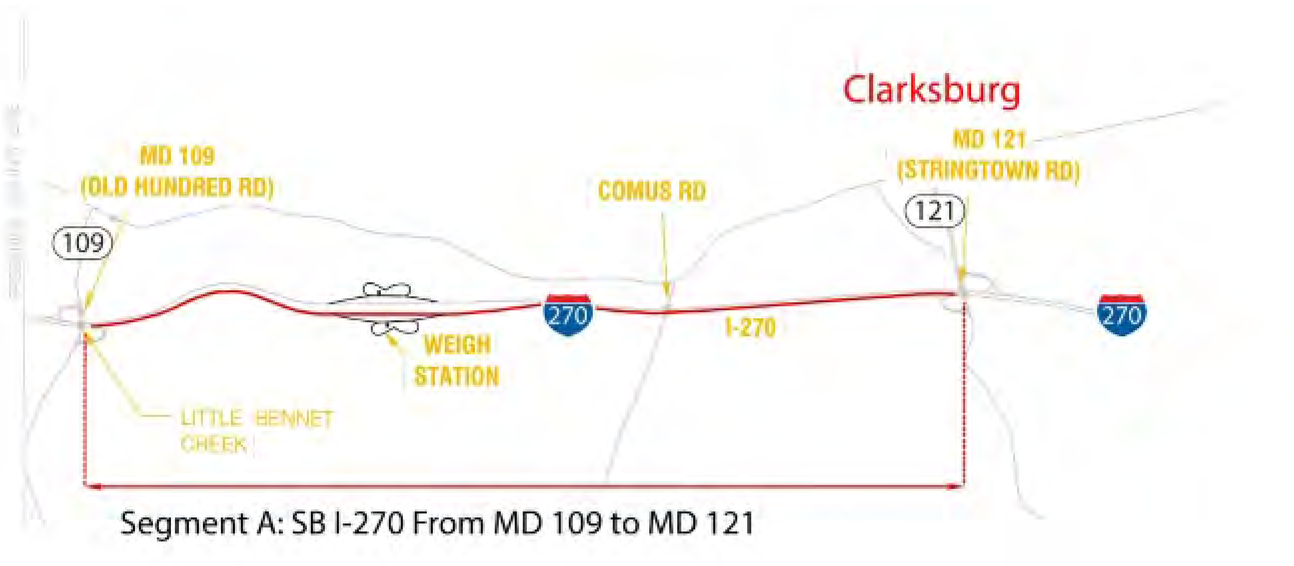
The proposed typical section to implement Hard Shoulder Running within the limits of this PTC would provide 11 ft. travel lanes in the four lane section, and then would use 12 ft. travel lanes in the 6 lane section and would use an 8 ft. left shoulder. The part time shoulder width would be 12 ft., providing a minimum of 10.5 ft. for the shoulder lane with a 1.5 ft. lateral offset to all obstructions. Maintaining the existing 12ft lanes and widening the existing paved shoulder would require regrading of the adjacent side slopes, relocation of existing drainage and barriers, and may incur right of way, utility and environmental impacts. Since extensive additional pavement would be required, new or retrofitted SWM facilities would be necessary. These additional facilities would most likely not be allowable within the current project budget unless other proposed initiatives are eliminated or severely curtailed. Please refer to the attached proposed typical sections for a visualization of this PTC.

Hard Shoulder Running will be designed to conform to design considerations established in the FHWA publication <u>Use of Freeway Shoulders for Travel, February 2016</u> in conjunction with AAHSTO's <u>A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011</u> and <u>A Policy on Design Standards – Interstate System, 2016</u>. A design exception would be pursued for any elements of design that do not comply with the minimum AASHTO controlling criteria values including shoulder widths and lane widths. A design exception would be required for Lane Width, shoulder width and stopping sight distance. As design progresses during the Design and Preconstruction phase of this project, it may be found that additional design exceptions may be required for Bridge Width, Superelevation, Vertical Clearance, and Lateral Offset to obstruction. A draft design exception is attached for your review.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

With this PTC, we are proposing to use Hard Shoulder Running along the outside shoulder of IS 270 in the following location. Actual segments proposed in our technical proposal may vary to optimize benefit vs. cost required to implement and stay within the allowable project budget.

Segment A Limits:



Segment B Limits:

Discussed in PTC 17.

Segment C Limits:

Discussed in PTC 17.

Segment D Limits:

Discussed in PTC 17.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

By introducing a temporary travel lane on the shoulder of IS 270 during periods of congestion capacity would increase the capacity of IS 270 with minimal costs and impacts compared to adding a new full time lane. The added capacity would improve mobility by reducing congestion, increasing vehicle through-put, improving travel-time reliability, and reduce the impacts of existing bottlenecks. An initial VISSIM run of this segment of Hard Shoulder Running for the AM peak hour using 2015 traffic counts indicates a decrease in total delay and travel time (up to 25% improvement) while increasing throughput within those limits. Level of Service would either be maintained or improved throughout the limits of implementation. Please find results shown below:

IS 270 Density Improvement:

I-270 SB Segment	Type	EX LOS	Alt LOS	% Change
I-270 Merge from MD 85	Merge	B	B	-1%
I-270	Freeway	E	D	-9%
I-270 Diverge to MD 80	Diverge	E	E	-10%
I-270	Freeway	F	F	-5%
I-270 Merge from MD 80	Merge	F	F	5%
I-270	Freeway	F	E	-27%
I-270 Diverge to MD 109	Diverge	D	B	-41%
I-270	Freeway	F	E	-44%
I-270 Merge from MD 109	Merge	F	C	-60%
I-270	Freeway	F	C	-49%
I-270 Diverge to SB Weigh Station	Diverge	B	C	18%
I-270	Freeway	E	C	-40%
I-270 Merge from SB Weigh Station	Merge	C	B	-22%
I-270	Freeway	E	C	-38%
I-270 Diverge to MD 121	Diverge	C	C	5%

IS 270 Throughput Improvement:

I-270 SB Segment	Ex Throughput	Alt Throughput	% Change
Between MD-80 and Md-109	3861	3896	1%
Between MD-109 on and off ramps	3800	3834	1%
Between MD-109 and MD-121	4257	4313	1%
Between MD-121 on and off ramps	4043	4072	1%
Between MD-121 and MD-27	4694	4545	-3%

IS 270 Travel Time Improvement:

I-270 SB from I-70	Ex Travel Time	Alt Travel Time	% Change
to MD 109	390.6	294.6	-25%
to MD 121	273.2	227.6	-16%

Reducing congestion on IS 270 has the potential to improve safety by reducing congestion-related crashes such as rear-ends. Any reduction in crash frequency would improve travel-time reliability. Should a dynamic shoulder lane be implemented in the future, the part time shoulder can also be used as a tool for incident management by allowing traffic to move past incidents more rapidly, advancing the project goals of mobility and safety.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: Permanent user impacts include a narrower travel lane. However, the slight decrease in capacity due to the narrower travel lane will be more than offset by the increased capacity of the shoulder lane. A less congested, more reliable IS 270 is anticipated for users due to the implementation of this PTC.

As with any construction activity on a heavily congested corridor, users would be temporarily impacted during construction by the Maintenance of Traffic. This can be mitigated by advance notice, limited work hours, and night time work to advance the construction schedule. Night time work is not required but after further analysis may show benefits worthwhile to both the administration and Design-builder.

ii. Right-of-Way Impacts: As indicated earlier, minor Right-of-Way impacts may be incurred due to construction of emergency turnouts. Closer analysis of those impacts will be required when additional information is gathered during the design and preconstruction phase of this project, and turnouts may be moved or not constructed at all, if deemed too impactful.

iii. Geotechnical Impacts: Full depth shoulder reconstruction would most likely be required in spot locations throughout the corridor. Concerns over inconsistencies in the GPR and Boring data provided will require additional borings during the design and preconstruction phase of this project. A preliminary pavement design determined that an allowable shoulder pavement section of 5.25 inches of bituminous concrete would be required to support hard shoulder running for passenger cars with a restriction on truck usage. This depth assumes that the existing subbase consists of at least 4 inches of crusher run stone. Shoulders within the limits of hard shoulder running which do not meet this requirement will be reconstructed. All provided pavement borings along the right shoulder of IS 270 show that the pavement structure meets or exceeds this allowable pavement section. Please refer to the attached Pavement Coring Log with the corings highlighted that fall within these limits.

iv. Utility Impacts: Minor utility impacts may be incurred due to construction of emergency turnouts, resetting of traffic barrier, or any full depth shoulder reconstruction. Conflicts will be investigated further when more information is gathered during the design and preconstruction phase of this project.

v. Environmental Impacts/Permitting: Potential environmental impacts include air quality, greenhouse gas emissions, and noise. If congestion is reduced, however, this should improve air quality and reduce greenhouse gas emissions. Additionally, minimal changes in roadway footprint would result in a minimal effect on water quality, plants and animals, and cultural resources. Due to this, part time shoulder use is typically a strong candidate project for a Categorical Exclusion. A noise analysis will be required during the design and preconstruction phase of this project to finalize abatement needs. An MDE permit for E&SC would be required. A roadside tree permit will be required for tree impacts caused by construction of SWM and turnouts. No other permits are anticipated as wetland and WUS impacts will be avoided as much as possible.

vi. Impacts to Local Communities: Noise may impact local communities as vehicles would travel closer to adjacent properties. There may also be a period of driver confusion initially for local users. Improvements, overall, would improve travel times and mobility for local users of IS 270.

vii. Safety Impacts: FHWA's Use of Freeway Shoulders for Travel, February 2016 has noted a potential increase in "crashes related to erratic driver behavior, driver confusion, or suboptimal geometry". Examples of these types of crashes include run-off-road, fixed object, and sideswipe. These impacts will be offset by the decrease in crashes related to congestion, as well as mitigation measures and designing to the highest possible standards. Improved signing and pavement markings would be used to mitigate for the potential safety impacts.

viii. Life-cycle Project Costs: Initial costs will include public outreach and communications, system engineering activities, emergency patrols, and training of new operations staff, maintenance, and law enforcement staff. Operation and Maintenance Costs include on-going labor costs associated with compliance and required DOT staff, ITS device maintenance including any camera monitoring of the shoulders, and roadway maintenance.

ix. Infrastructure Costs: Infrastructure costs include geometric improvements such as shoulder reconstruction, construction of emergency turnouts, and ramp treatments, installation of ITS devices, Shoulder reconstruction, ramp treatments, paving, removal of existing rumble strips, signing (static and dynamic) and marking, drainage/SWM, and traffic barrier relocation.

a. Repair Costs: The frequency at which the outside shoulder will require rehabilitation will increase due to permitting vehicles to travel on the shoulder.

b. Maintenance Costs: Include standard roadway maintenance such as 3R (resurfacing, restoration, rehabilitation), replacement of traffic barrier and line striping. Debris removal should be considered, but would predominantly be cleared by presence of traffic.

c. Operation Costs: DOT staffing to support any ITS components as well as compliance.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

- IS 66, Fairfax County, Virginia: Hard Shoulder Running with dynamic signing has been used on the outside shoulder of I-66 in Fairfax County, Virginia since 2015 (static signing was used from 1992 to 2015) to add capacity to a heavily commuter corridor that serves Washington D.C.. The shoulder is used in conjunction with a high-occupancy vehicle (HOV) lane. The part time shoulder is open whenever warranted by traffic conditions and is open to all vehicles. The length of use is 6.5 miles and a shoulder width of 12 feet is provided. The shoulder operates at near capacity and has increased through-put through the corridor. Recent crash data has indicated no significant effect on crash frequency.

  Project Contact:
  Kamal Suliman
  VDOT NRO Systems & Maintenance
  571-772-4048
  Kamal.Suliman@VDOT.Virginia.gov

  VDOT has also implemented hard shoulder running along the inner loop of the Capital Beltway I-495, at the end of the HOT lanes in advance of the American Legion Bridge.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

- Safety: Potential for an increase in crashes related to erratic driver behavior, driver confusion, or suboptimal geometry which would be offset by decrease in crashes related to congestion.
- Operation Costs (maintenance and day to day operations of any ATM/ITS devices)
- Additional Law Enforcement
- Part Time suspension of shoulder as a refuge for disabled vehicles. To mitigate this risk, CCTV will be installed to monitor the roadway at all times to visually confirm all vehicles are removed from the shoulder

- Noise Abatement: Per Addendum 3, dated November 9, 2016, the construction of required Noise Walls will be placed on the Administration. A noise analysis will be performed during the Design and Preconstruction Phase of this project, but any noisewalls required will be designed and constructed by the administration separately and should be considered a risk to the State's capital budget.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

There is limited survey, utility designation, environmental information, and pavement borings/cores available along sections of IS 270 where Hard Shoulder Running is proposed. These are risks to scope, schedule, and budget should an unknown utility or environmental feature be found, or the existing pavement structure be determined to not be adequate and additional full-depth reconstruction be required.

There is a risk associated with accepting the findings of the pavement corings as a typical pavement structure within these limits. While all corings within these limits show a fairly consistent pavement section, they are spaced very far apart (approximately a mile) and therefore additional borings will be required to confirm the pavement section during the Design and Preconstruction phase of this project. GPR data provided is not consistent with what is shown in the more accurate coring findings, and therefore cannot be trusted to develop an estimate for reconstruction. The three corings within these limits is the best data we have available to develop our cost estimate.

There is also a risk associated with the Design Exceptions required to implement Hard Shoulder Running. As previously noted, a design exception would be required for Shoulder Width, Lane Width, and Stopping Sight Distance. As design progresses during the Design and Preconstruction phase of this project, it may be found that additional design exceptions may be required for Bridge Width, Superelevation, Cross Slope, Vertical Clearance, and Lateral Offset to obstruction. Each exception would require effort to draft the exception, develop mitigation strategies, and coordinate these efforts with FHWA for their acceptance. The timeliness of FHWA's acceptance of any required design exception is imperative to maintain the project schedule.

Finally, the PTC may increase Noise and Greenhouse Emissions and impact Air Quality. If an Air Quality or Greenhouse Gas Emissions Analysis is required additional coordination efforts would need to be taken into consideration when developing the project schedule. Any prescribed mitigation would also impact the project budget.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

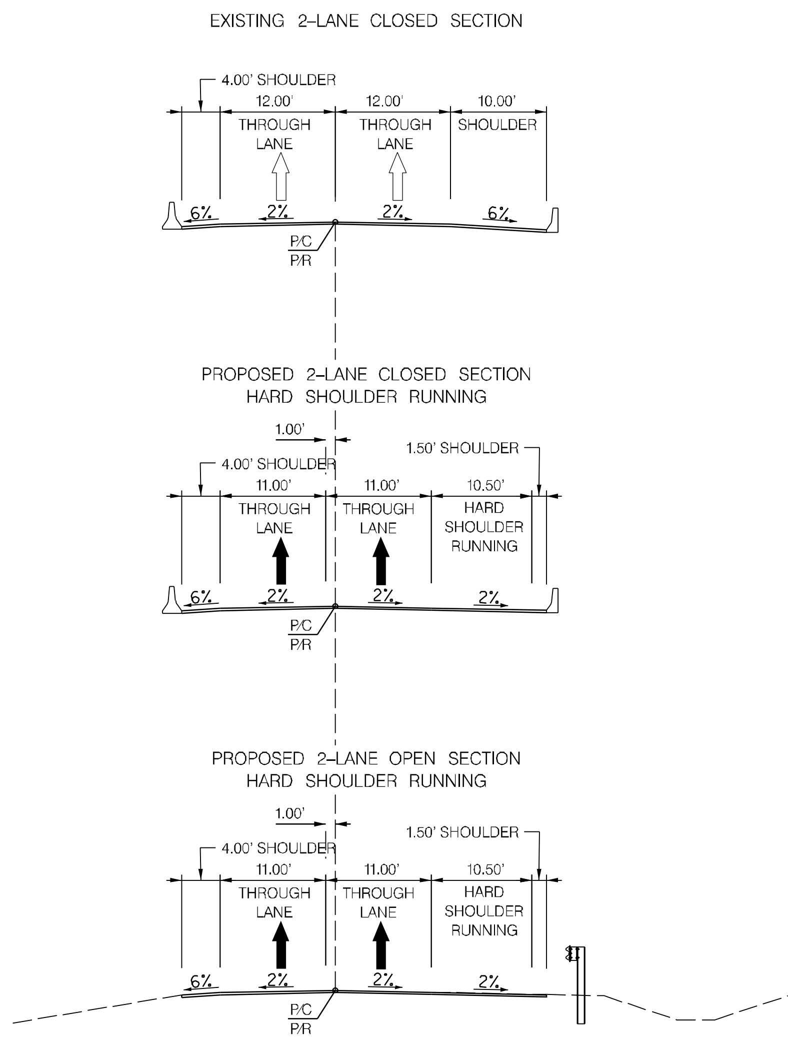
Cost Benefits: The geometric improvements required to implement Hard Shoulder Running are less extensive than adding an additional lane of traffic, which typically requires widening of the roadway. By reusing the existing roadway footprint impacts to right-of-way, utilities, and the environment can be minimized reducing the overall construction, right-of-way, and utility relocation costs. This results in added capacity during times of congestion similar to adding a new lane at a greatly reduced cost overall. Additionally, maintenance costs such as resurfacing, restoration, rehabilitation, replacement of traffic barrier, and snowfall removal should remain similar to existing costs as the roadway section would remain the same.

Schedule Benefits: Minimizing right-of-way, utility, and environmental impacts would benefit both the design and construction schedule of the project. During the design phase time allowances must be included in the schedule for any right of way acquisition or utility clearance, and to secure environmental permits for SWM and Erosion & Sediment Control, Wetlands and Waterways, and others such as tree impacts. Hard Shoulder Running can minimize right-of-way needs, reducing the schedule required for acquiring and clearing the right-of-way needed to construct the project. If utility impacts are minimized less time would be required prior to the start of construction for advanced utility work. This would allow the construction to start earlier allow the improvements to open to traffic sooner. Implementing Hard Shoulder Running can also minimize the projects overall earth disturbance and grading, as well as impacts to wetland, Waters of US, and trees, which can affect the type of permit and the amount of coordination required with any stakeholder agency. The reduced coordination required with involved agencies can reduce the projects overall design schedule. If environmental impacts can be minimized during design less mitigation would be required during construction (in-stream work restrictions, reforestation, etc).

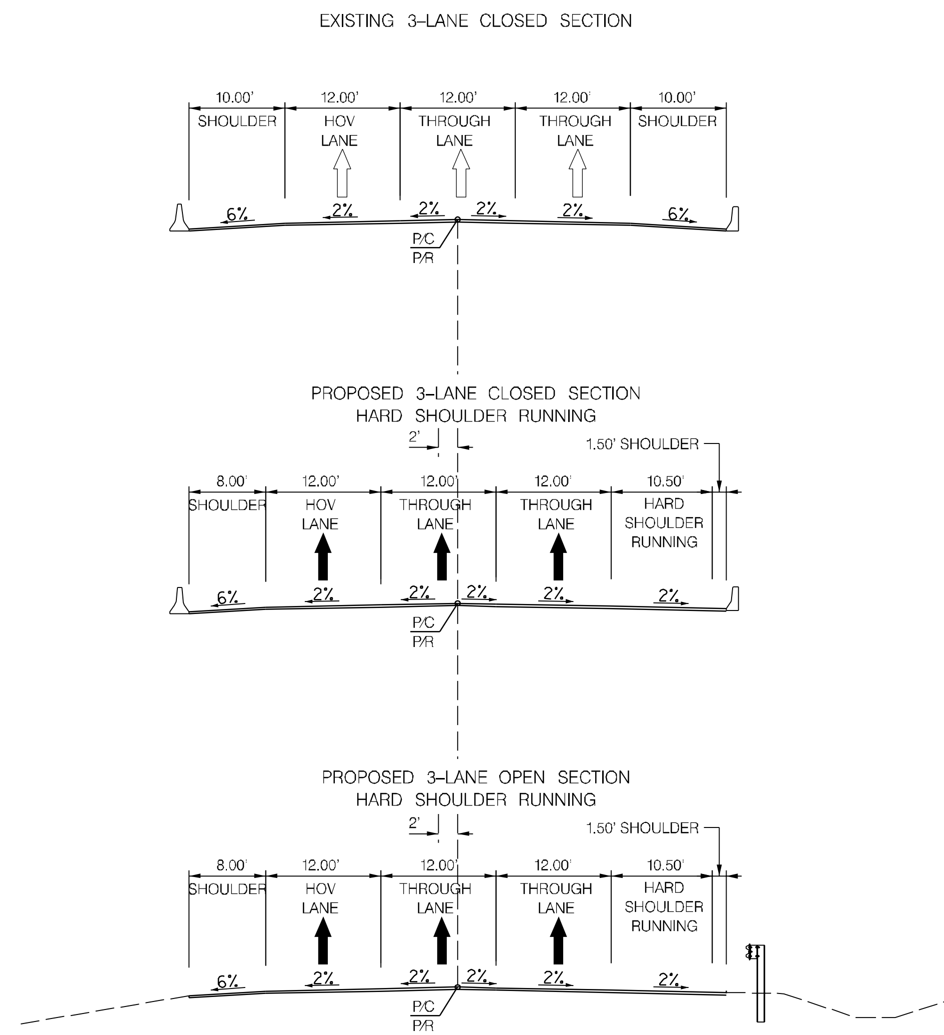
l) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*

N/A

SOUTHBOUND IS 270
MD 109 TO NORTH OF MD 121



SOUTHBOUND IS 270
NORTH OF MD 121 TO MD 121



DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

SHA State Highway Administration
CORMAN CONSTRUCTION | WSP | PARSONS BRINCKERHOFF

I-270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

EXISTING & PROPOSED
TYPICAL SECTIONS

PTC 16
HARD SHOULDER RUNNING

TYPICAL SECTIONS - SOUTHBOUND

SCALE 1" = 10' ADVERTISED DATE ______ CONTRACT NO. ______

DESIGNED BY MSS	COUNTY
DRAWN BY MSS	LOGMILE
CHECKED BY MTH	HORIZONTAL SCALE
F.A.P. NO.	VERTICAL SCALE

DRAWING NO. TS-01 OF 01 SHEET NO. OF

PTC 16: Hard Shoulder Running (Segment A)
Corman Construction

DRAFT Request for Design Exception

We are requesting your approval of a design exception for three areas where the design does not meet AASHTO's "A Policy on Design Standards – Interstate System" (2016) and/or "AASHTO's A Policy on Geometric Design of Highway Streets" (2011) recommendations. This exception is for lane width, shoulder width, and stopping sight distance along southbound IS 270 between MD 109 (Old Hundred Rd) and MD 121 (Clarksburg Rd).

CONCEPT DESCRIPTION

This PTC proposes to permit general purpose travel to use the existing shoulders of southbound IS 270, from MD 109 (Old Hundred Rd) to MD 121 (Clarksburg Rd), during the AM peak hour time period. Trucks and buses would be permitted to use the temporary shoulder lane in the vicinity of the weigh station only, to help replicate the benefits of a climbing lane and allow access and egress from the weight station. The shoulder would be preserved as a refuge when hard shoulder running is not in effect. Static signing would be implemented to control the use of the shoulders as a travel lane. Please refer to the attached Typical Sections for a visual representation of this PTC.

The goal of this concept is to increase the capacity of IS 270 with minimal costs and impacts compared to adding a new full time lane. The added capacity would improve mobility by reducing congestion, increasing vehicle through-put, improving travel-time reliability, and reduce the impacts of existing bottlenecks.

Reducing congestion on IS 270 has the potential to improve safety by reducing congestion-related crashes such as rear-end collisions. Any reduction in crash frequency would improve travel-time reliability.

PROJECT DESIGN CRITERIA

2011 "A Policy on Geometric Design of Highways and Streets" – AASHTO

2016 "A Policy on Design Standards – Interstate System" – AASHTO

DESIGN EXCEPTION

Lane Width – Two Southbound IS 270 General Purpose lanes from MD 109 (Old Hundred Rd) to MD 121 (Clarksburg Rd)

Shoulder Width

- IS 270 Right Shoulder from MD 109 (Old Hundred Rd) to MD 121 (Clarksburg Rd)
- IS 270 Left Shoulder from ½ mile South of MD 121 to MD 121

Stopping Sight Distance – Various Locations

Existing Condition

The existing typical section of southbound IS 270 is open section with two 12 ft. wide general purpose lanes with a 4 ft. left shoulder and 10 ft. right shoulder. A 750 ft. section of the outside shoulder becomes the deceleration lane for the exit on the approach to the weigh station and it becomes a closed section. There is minimal existing offset to the concrete barrier adjacent to the deceleration lane. A third 12 ft. general purpose lane is added and the left shoulder is widened to 10 ft. approximately ½ mile north of MD 121. For this ½ mile segment, the right shoulder becomes closed section again with a concrete barrier adjacent to the shoulder. W-Beam traffic barrier exists along segments of both the left and right shoulders. The posted speed limits along IS 270 is 65 mph from MD 109 to Comus Rd and 55 mph from Comus Rd to MD 121.

Crash data provided with the projects RFPQ/RFP is dated 2011-2013 and shows 16 crashes during the AM peak hours (6 AM to 10 AM). 12 of the 16 crashes were rear ends with the probable cause predominately being related to following too closely or driving too fast for conditions. The rear ends crashes were most likely related to congestion.

Lane Width

a. AASHTO Design Criteria
Page 4 in AASHTO's 2016 "A Policy on Design Standards – Interstate System" states that all traffic lanes on the Interstate System shall be 12 ft. wide. This manual supersedes AASHTO's Green Book when used on Interstate Highways.

b. Proposed Condition
The proposed reconfiguration would restripe the existing available pavement to provide two 11 ft. lanes, with a 4 ft. left shoulder and 12 ft. right shoulder. The deficient lane width would not meet AASHTO recommendations for a distance of approximately 3.4 miles.

c. Design Constraints

The roadway typical section of southbound IS 270 from MD 109 to MD 121 is restricted along the outside shoulder by existing topography which includes both steep cut and fill slopes. Any widening of IS 270 may require construction of retaining walls and would likely impact adjacent right of way, utilities, and environmental features. Widening would necessitate the construction of stormwater management (SWM) facilities due to the creating of additional impervious. Additional impacts to right of way and environmental features would most likely result. An environmental delineation is necessary to determine if any environmental impacts exists; however, a review of aerial imagery shows streams, major tree coverage, and potential wetland adjacent to the roadway.

d. Design Exception

We recommend that a design exception be considered to reduce traffic lane widths along this section of southbound IS 270. Crashes related to congestion such as a rear end crash would be reduced by adding capacity via hard shoulder running, offsetting any negative safety impacts caused by the lane width. Employing this PTC would be an implementation of Practical Design by adding a full traffic lane during the AM peak to address the project goals of mobility and safety without widening of the existing paved shoulder, regrading of the adjacent side slopes, reconstruction of the existing drainage system and traffic barrier, construction of retaining walls, SWM, tree impacts, possible right of way, utility, and environmental impacts, or other incidental items that do not effectively advance the project goals.

e. Proposed Mitigation

Improved signing and pavement markings will be used to mitigate for the potential safety impacts. Specific strategies provided in FHWA’s “Mitigation Strategies for Design Exceptions” guide that will be implemented include:

- Advanced warning: ROAD NARROWS signs
- Improve ability to stay within the travel lane:
    - Enhanced Pavement Markings
        - Raised Pavement Markings and/or
        - Recessed Pavement Markings
    - Roadside Delineators

Additionally, turnouts will be constructed on the outside of the existing footprint of the roadway to provide a refuge space for vehicles while hard shoulder running is in effect.

Shoulder Width

a. AASHTO Design Criteria

Page 4 in AASHTO's 2016 "A Policy on Design Standards – Interstate System" states that on a 4-lane interstate right shoulders shall be a minimum of 10 ft. wide, and left shoulders shall be minimum of 4 ft. wide. On a 6-lane or larger Interstate right shoulders shall be a minimum of 10 ft. wide and left shoulders shall be a minimum of 10 ft. wide. This manual supersedes AASHTO's Green Book when used on Interstate Highways.

b. Proposed Condition

The proposed reconfiguration of the 4 lane section would restripe the existing available pavement to provide a 4 ft. left shoulder and 12 ft. right shoulder. The proposed reconfiguration of the 6 lane section would provide an 8 ft. left shoulder and a 12 ft. right shoulder. During part time shoulder use, the right shoulder would become a 10.5 ft. traffic lane with a minimum offset to barrier width of 1.5 ft. The deficient shoulder width during part time shoulder use and the 8 ft. left shoulder would not meet AASHTO recommendations for a distance of approximately 3.4 miles.

c. Design Constraints

The roadway typical section of southbound IS 270 from MD 109 to MD 121 is restricted along the outside shoulder by existing topography which includes both steep cut and fill slopes. Any widening of IS 270 may require construction of retaining walls and would likely impact adjacent right of way, utilities, and environmental features. Widening would necessitate the construction of stormwater management (SWM) facilities due to the creating of additional impervious. Additional impacts to right of way and environmental features would most likely result. An environmental delineation is necessary to determine if any environmental impacts exists; however, a review of aerial imagery shows streams, major tree coverage, and potential wetland adjacent to the roadway.

d. Design Exception

We recommend that a design exception be considered for the reduced shoulder widths along this section of southbound IS 270. Crashes related to congestion, such as rear end crashes, would be reduced by adding capacity via hard shoulder running, offsetting any negative safety impacts caused by the narrow shoulder width. Employing this PTC would be an implementation of Practical Design by adding a full traffic lane during the AM peak to address the project goals of mobility and safety without widening of the existing paved shoulder, regrading of the adjacent side slopes, reconstruction of the existing drainage system and traffic barrier, construction of retaining walls, SWM, tree impacts, possible right of way, utility, and environmental impacts, or other incidental items that do not effectively advance the project goals.

For the "deficient" left shoulder width, AASHTO's 2016 "A Policy on Design Standards-Interstate System" states that "The geometric design standards used for resurfacing, restoration, and rehabilitation (3R) projects may be the AASHTO Interstate standards that were in effect at the time of original construction or inclusion into the Interstate system." While this project is not technically a 3R project, the scope of the project is far less than that of a new construction, reconstruction or widening project, and therefore using this statement in AASHTO to use a previous version of the Interstate Standards would seem acceptable. Previous versions of AASHTO's Interstate standards had softer language for the left shoulder width along a 6 lane wide section of interstate, and only stated that a 10 ft. wide left shoulder "should be provided." It was not a "shall" statement as it is now.

e. Proposed Mitigation

Improved signing and pavement markings will be used to mitigate for the potential safety impacts. Specific strategies provided in FHWA's "Mitigation Strategies for Design Exceptions" guide that will be implemented include:

- Improve Ability to Stay Within the Travel Lane:
  - Enhanced Pavement Markings
    - Raised Pavement Markings and/or
    - Recessed Pavement Markings
  - Roadside Delineators
- Improve Ability to Recover if Driver Leaves the Lane:
  - Safety edge
- Reduce the Crash Severity if the Driver Leaves the Roadway
  - Clear Recovery area, where feasible
  - Traversable slopes, where feasible
  - Breakaway safety hardware
  - Barriers where appropriate
- Provide Pull-off areas where Shoulder Width is Limited
  - Two turnouts will be constructed

Stopping Sight Distance (SSD) – Horizontal Curves

a. AASHTO Design Criteria

AASHTO's 2016 "A Policy on Design Standards – Interstate System" defers to the current edition of AASHTO's Green Book. Page 3-4, Table 3-1 of the 2011 AASHTO Green Book recommends the following:

- SSD = 570 ft. (for 60 mph design speed)
- SSD = 730 ft. (for 70 mph design speed)

b. Proposed Condition

The proposed reconfiguration would restripe the existing available pavement to provide a 12 ft. right shoulder within the noted limits. During part time shoulder use, however, the right shoulder would become a 10.5 ft. traffic lane with a minimum offset width of 1.5 ft. In locations where f-shape barrier abuts the right shoulder, during part time shoulder use the horizontal sight line offset for that lane would be reduced to 6.75 ft. Deficient stopping sight distance will occur at all curves with concrete barrier directly adjacent to the shoulder and with the following conditions:

- Radius of horizontal curve ≤ 6015 ft (for 60 mph design speed)
- Radius of horizontal curve ≤ 9875 ft (for 70 mph design speed)

c. Design Constraints

The roadway typical section of southbound IS 270 from MD 109 to MD 121 is restricted along the outside shoulder by existing topography which includes both steep cut and fill slopes. Any widening of IS 270 may require construction of retaining walls and would likely impact adjacent right of way, utilities, and environmental features. Widening would necessitate the construction of stormwater management (SWM) facilities due to the creating of additional impervious. Additional impacts to right of way and environmental features would most likely result. An environmental delineation is necessary to determine if any environmental impacts exists; however, a review of aerial imagery shows streams, major tree coverage, and potential wetland adjacent to the roadway.

d. Design Exception

We recommend that a design exception be considered for stopping sight distance at all locations where the existing horizontal curve does not provide a sufficient horizontal sight line offset due to the location of existing traffic barrier. Crashes related to congestion such as rear end crashes would be reduced by adding capacity via hard shoulder running, offsetting any negative safety impacts caused by the deficient stopping sight distance. Although a driver will be unable to detect a 2-ft. high object in the roadway due to the 34 inch high f-shape barrier height, a driver will still be able to see any stopped vehicles along the curve sections with sight distance. Additionally, employing this PTC would be an implementation of Practical Design by adding a full traffic lane during the AM peak to address the project goals of mobility and safety without widening of the existing paved shoulder, regrading of the adjacent side slopes, reconstruction of the existing drainage system and traffic barrier, construction of retaining walls, SWM, tree impacts, possible right of way, utility and environmental impacts, or other incidental items that do not effectively advance the project goals.

e. Proposed Mitigation

Active Traffic Management (ATM) devices such as Closed Circuit Television (CCTV) Camera and System Detection will be used to mitigate the potential safety impacts. CCTV Cameras will be installed along IS 270 to provide complete coverage of the corridor and will be used to automatically detect a stopped vehicle or hazard in the shoulder. The Hard Running Shoulder will be reviewed before opening the shoulder for part-time use and monitored continuously during operations to ensure the curves with deficient sight distance are kept clear from obstructions. The cameras will also accommodate quicker and more accurate incident detection, confirmation and monitoring as well as allow for more effective travel information dissemination. Remote Traffic Microwave Sensors (RTMS) and detectors will be installed along the mainline and ramps to provide enhanced travel information and better incident detection and management.

Together, these ATM tools will improve mobility by allowing greater traffic detection, monitoring, and motorist information. They will improve safety through better incident detection and management. They will provide real time detection of objects or obstructions on the roadway within areas of deficient stopping sight distance and deliver real time notifications to drivers.

Pavement Coring Log

COUNTY: Montgomery
LOCATION: MD 121 to Fredrick County Line
MILE POINTS: 18.43 to 22.51

CORING DATE: 5/13/2013
CONTRACT: N/A

Core	Direction	Road	Lane	Location	Depth			Description
1	North	I-270	Shoulder	M.P. 18.66	0"	-	20"	Hot Mix Asphalt
			Outside	5' from White Line	20"	-		Stone Base
2	North	I-270	Shoulder	M.P. 19.66	0"	-	8.5"	Hot Mix Asphalt
			Outside	4' from White Line	8.5"	-		Stone Base
3	North	I-270	Shoulder	M.P. 20.57	0"	-	9.5"	Hot Mix Asphalt
			Outside	5' from White Line	9.5"	-		Stone Base
4	North	I-270	Shoulder	M.P. 21.79	0"	-	9.5"	Hot Mix Asphalt
			Outside	4' from White Line	9.5"	-		Stone Base
5	South	I-270	Shoulder	M.P. 22.42	0"	-	8.25"	Hot Mix Asphalt
			Outside	4' from White Line	8.25"	-		Stone Base
6	South	I-270	Shoulder	M.P. 21.42	0"	-	9.5"	Hot Mix Asphalt
			Outside	4' from White Line	9.5"	-		Stone Base
7	South	I-270	Shoulder	M.P. 20.33	0"	-	8.5"	Hot Mix Asphalt
			Outside	4' from White Line	8.5"	-		Stone Base
8	South	I-270	Shoulder	M.P. 19.00	0"	-	9.5"	Hot Mix Asphalt
			Outside	4' from White Line	9.5"	-		Stone Base

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 28, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 16 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 14, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract.
2. Page 1, Description: Please clarify what hours of operations is referred as "AM peak hour time period."
3. Page 1, Section A, Description: Shoulder use without dynamic control, as described in the third paragraph, is a feasible option; however, we would offer the following input on the impact of constrained shoulder geometry without any additional ability to manage the lanes. The proposal should address alterations to operational procedures that might be necessary. Changes to shoulder areas will influence traffic incident management in the following ways:
    a. Providing a safe buffer zone for emergency responders. Full shoulders provide a work area for emergency responders which, by vehicular regulation and driver behavior, motorist don't use. Positive guidance and physical barriers (e.g. cones) will be the only protection in a normally traveled lane (i.e. hard shoulder).
    b. Use as a staging area for vehicle recovery. In Maryland, by policy and regulation in support of the towing and recovery industry, public agencies only relocate damaged and disabled vehicles to the shoulder, to stage them for final removal by industry towers. Limited shoulder availability would likely require new policies and procedures to minimize the blockage time impact while preparing for private towers to arrive.

My telephone number/toll-free number is 410-545-8800 or 1-888-228-6971
Maryland Relay Service for Impaired Hearing or Speech 1.800.735.2258 Statewide Toll Free

Street Address: 707 North Calvert Street • Baltimore, Maryland 21202 • *Phone* 410.545.0300 • www.roads.maryland.gov

c. Access to the incident scene. The CHART patrols, in Maryland, function as an extension of staff for the Maryland State Police, in the area of Traffic Incident Management. However, CHART patrols are not enforcement vehicles and do not have the authority of a "blue light" (police) or a "red light" (fire and rescue) emergency responders in traveling through traffic (even though they are equipped with lights and sirens). Consequently motorists may, or may not, yield right of way to CHART vehicles.
d. Impacts of more complex incidents. Procedures and impacts need to be analyzed and addressed for more complex incidents that require more complex recovery procedures and other public safety impacts. Some of these complicating factors include: heavy/large vehicles, injuries, hazardous materials, fires, criminal activities, significant debris (e.g. a load of mulch) etc. Each of these scenarios requires different personnel and equipment on scene: fire trucks, ambulances, police vehicles, heavy equipment, etc. Shoulders provide the additional geometry to stage and maneuver these resources.

4. Demonstrate how incident management will be handled in a static hard shoulder running context.
5. Page 1, Section A, Description: For the emergency turn outs, is the length, minimum of 110 feet, sufficient for recovery of semi-tractor trailer combinations or oversized loads? How were the dimensions of the emergency turn outs determined?
6. Typical Sections: The 4-lane section has no usable shoulder for incident response and management, and the 6-lane section has only median side shoulder, which is less useable than the outside shoulder for incident management activities. Please refer to the potential impacts of lane utilization for incident management described above.
7. Page 5, Section D, Potential Impacts, User Impacts: The sections with significantly reduced shoulder geometry will lose a location to stockpile snow during winter storm operations. The PTC should discuss potential mitigation strategies for this impact.
8. Page 7, Section F, Administration Risk: Although we recognize this section is simply listing potential risk areas, it would be good to have a better understanding of how much this concept would depend on "Additional Law Enforcement," since that would be the decision of another agency, and is a resource that has been historically difficult to obtain.
9. Design Exception, Page 7 e, Proposed Mitigation: The PTC describes the following: "CCTV Cameras will be installed along IS 270 to provide complete coverage of the corridor and will be used to automatically detect a stopped vehicle or hazard in the shoulder." Given the description of the part-time hard shoulder running operations that follows in the PTC, we agree that automatic detection of stopped vehicles would facilitate the safe transition from shoulder to traveled lane; however, some description of how the cameras will be used for automatic stopped vehicle detection needs to be provided (video analytics?)

10. The draft design exception only requests an exception for the 11-foot lanes. The 10.5-foot (part-time) travel lane will also require a design exception. More detailed information related to impacts and costs of fully meeting AASHTO requirements, potential impacts to safety and operations for implementing the design exception, and mitigation, if any, which would be implemented as a result of the design exception will be required for formal approval. The design exception(s) and safety analysis must be approved prior to establishing a CAP.
11. Typical Sections, MD 109 to North of MD 121: When adjusting the cross slope of the existing shoulder, please describe what the Design-Builder proposes to do with the existing concrete barrier should the barrier height be made less than standard.
12. Typical Sections, MD 109 to North of MD 121: The typicals show concrete traffic barriers; however, the vast majority of the segment is open section.
13. Discuss safety and operational aspects of truck movement in the narrower lanes.
14. If the VISSIM models are used to demonstrate the benefits of this concept, document all assumptions.

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 17 – Hard Shoulder Running (Segments B-D)	Date Submitted: November 14, 2016
Related Disciplines: Highway, H&H, Traffic, Pavement/Geotech	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

This proposed PTC would permit general purpose travel to use the existing shoulders of IS 270 during times of heavy congestion in select locations. Trucks and buses would not be permitted to use the temporary shoulder lane. The shoulder would be preserved as a refuge when hard shoulder running is not in effect. Static and dynamic signing as well as other ITS devices would be implemented to control the use of the shoulders as a travel lane. This strategy would provide additional capacity to the corridor during times of the day when the roadway is congested or other lanes are blocked by incidents or maintenance activities and can be constructed within the existing footprint of IS 270, minimizing right of way, utility, and environmental impacts.

Prior to implementation, geometric improvements would be required along IS 270 such as removal of existing rumble strips where applicable; removal of pavement markings and restriping lanes; rounding of existing shoulder roll-over; modification of any drainage structures on the shoulder; improvements to existing ramp treatments; and resetting of existing traffic barrier for sight distance, to adjust height, or to provide a minimum of a 1.5 foot lateral offset to an obstruction.

Dynamic shoulder use is being considered for portions of these limits, and in those locations overhead lane use control will be utilized to indicate when the shoulder is open for travel. If a static shoulder use is implemented (shoulder use during peak hours only) a roadside sign will be used for to display times of day the shoulder is open or closed, with a small dynamic sign to indicate "open or closed." Overhead dynamic lane use control signs will not be proposed for the shoulder for limits where only a static use of Hard Shoulder Running is proposed.

Gore areas or ramp shoulders at entrance and exit ramps will provide a refuge space for vehicles while hard shoulder running is in effect. When the gore or ramp shoulder do not provide enough refuge space or when the distance between ramps is excessive, emergency turnouts will be constructed where feasible. Turnouts will be 12 to 16 feet wide, a minimum of 110 feet long, and have 300 foot tapers. They will be located outside of the existing footprint of the roadway and in some locations may require additional right of way, retaining walls, and other infrastructure to construct. In general FHWA recommends turnouts placed at half-mile intervals when ramp spacing exceeds a half mile. Our conceptual layout for hard shoulder running along IS 270 meets this recommendation as much as possible; however, due to excessive ROW, environmental, and utility impacts we are not able to meet the half mile spacing throughout the limits. Nine turnouts are proposed within the limits of hard shoulder running, two in the northbound direction and five in the southbound direction (the proposed length of implementation is much smaller in the NB direction). The turnouts are proposed in the following locations pending a more detailed investigation in impacts:

- Northbound Local IS 270 between IS 370 and MD 117 (W. Diamond Rd) – One Turnout
- Northbound Mainline IS 270 between proposed Watkins Mill Rd and Middlebrook Rd – One Turnout
- Southbound Mainline IS 270 between MD 121 (Clarksburg Rd) and Father Hurley Ave/Ridge Rd – Two Turnouts
- Southbound Mainline IS 270 between Middlebrook Rd and proposed Watkins Mill Rd – One Turnout
- Southbound Mainline IS 270 between MD 117 (W. Diamond Rd) and IS 370 – One Turnout
- Southbound Local IS 270 between Shady Grove Rd and MD 28 (W. Montgomery Ave) – One Turnout

The construction of turnouts would require earthwork, full depth pavement, installation of traffic barrier (W-Beam and/or F-Shape Barrier), signing and marking, drainage improvements, and stormwater management (SWM). In certain locations retaining walls may be considered to limit impacts to existing right of way. Installation of the turnouts may impact existing signage, storm drains, overhead light poles, and trees. Further environmental impacts are anticipated to be minimized as much as possible with the turnout being eliminated if determined to be too impactful.

The existing typical section of IS 270 varies within the proposed limits of Hard Shoulder Running. For interstates the AASHTO Interstate Design Standard requires that all traffic lanes shall be at least 12 ft. wide. The paved width of the right shoulder shall not be less than 10 ft. On a four-lane section the paved width of the left shoulder shall be at least 4 ft. On sections with 6 or more lanes, a minimum 10 ft. paved shoulder width is required. The proposed typical section for Hard Shoulder Running would provide 12 ft. lanes as frequently as possible, with 11 ft. travel lanes in some sections. The part time shoulder width would be 12 ft., providing a minimum of 10.5 ft. for the shoulder lane with a 1.5 ft. lateral offset to all obstructions. Please refer to the attached proposed typical sections for a visualization of this PTC.

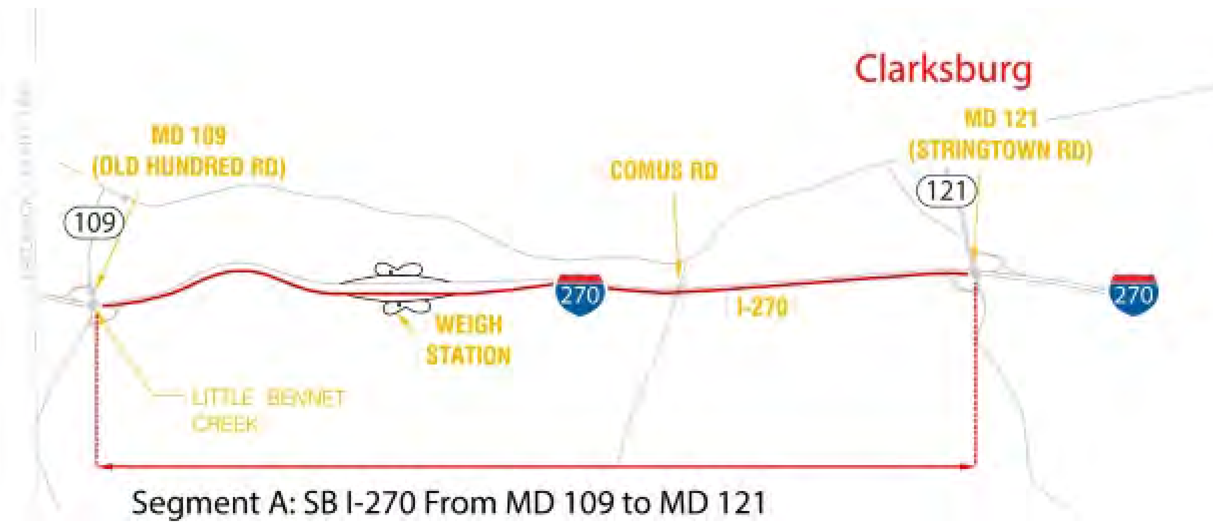
Due to sectional constraints at existing bridge structures several pinch points would require a narrower cross section be implemented in order to maintain a 12 ft. outside shoulder. The pinch points would primarily affect the left shoulder width in these cases. Please refer to the attached proposed pinch point typical sections.

Hard Shoulder Running would be designed to conform to design considerations established in the FHWA publication Use of Freeway Shoulders for Travel, February 2016 in conjunction with AAHSTO's A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011 and A Policy on Design Standards – Interstate System, 2016. A design exception would be pursued for any elements of design that do not comply with the minimum AASHTO controlling criteria values including shoulder widths, lane widths and stopping sight distance. As design progresses during the Design and Preconstruction phase of this project, it may be found that additional design exceptions may be required for Bridge Width, Superelevation, Cross Slope, Vertical Clearance, and Lateral Offset to obstruction. A draft design exception is attached for your review.

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

With this PTC, we are proposing to use Hard Shoulder Running along the outside shoulder of IS 270 in the following locations. Actual segments proposed in our technical proposal may vary to optimize benefit vs cost required to implement and stay within the allowable project budget.

Segment A Limits:



Segment A is discussed in PTC 16.

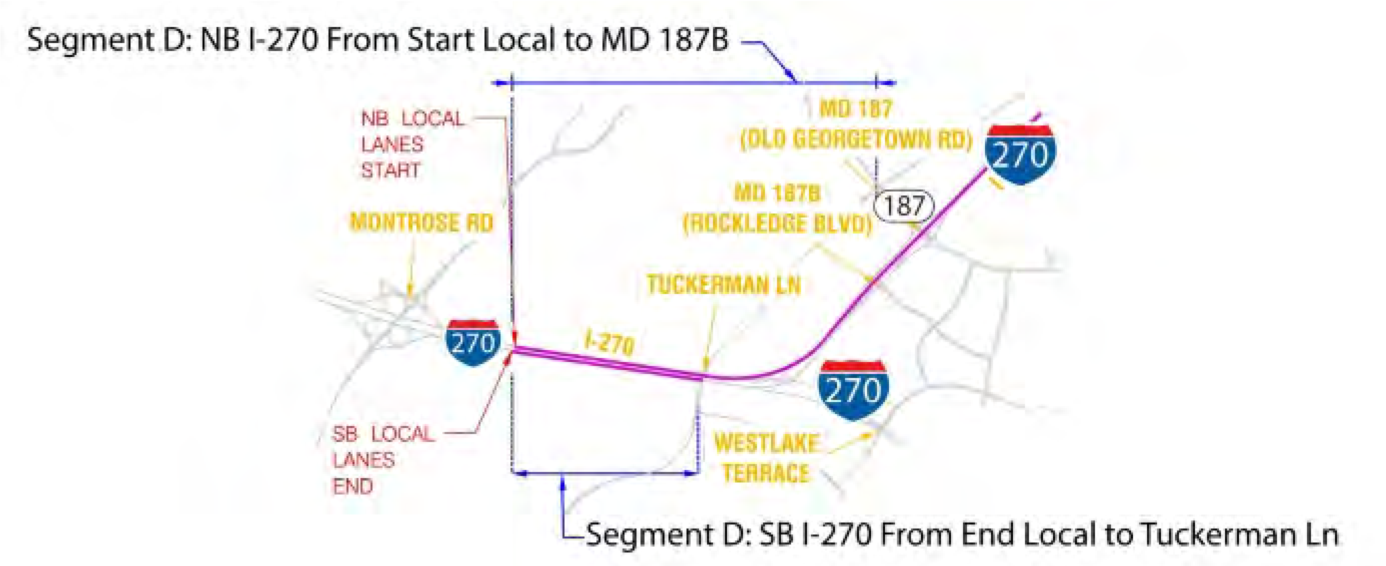
Segment B Limits:

Segment B: SB I-270 From MD 121 to Start Local

Segment C Limits:

Segment C: NB I-270 From Middlebrook Rd. to End of Local

Segment D Limits:



C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

By introducing a temporary travel lane on the shoulder of IS 270 during periods of congestion capacity would increase the capacity of IS 270 with minimal costs and impacts compared to adding a new full time lane. The added capacity would improve mobility by reducing congestion, increasing vehicle through-put, improving travel-time reliability, and reduce the impacts of existing bottlenecks.

Reducing congestion on IS 270 has the potential to improve safety by reducing congestion-related crashes such as rear-ends. Any reduction in crash frequency would improve travel-time reliability. Should a dynamic shoulder lane be implemented, the part time shoulder can also be used as a tool for incident management by allowing traffic to move past incidents more rapidly, advancing the project goals of mobility and safety.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: Permanent user impacts include a narrower travel lane in some locations where temporary shoulder use is implemented. However, the slight decrease in capacity due to the narrower travel lane will be more than offset by the increased capacity of the shoulder lane. A less congested, more reliable IS 270 is anticipated for users due to the implementation of this PTC.

As with any construction activity on a heavily congested corridor, users would be temporarily impacted during construction by the Maintenance of Traffic. This can be mitigated by advance notice, limited work hours, and night time work to advance the construction schedule. Night time work is not required but after further analysis may show benefits worthwhile to both the administration and Design-builder.

ii. Right-of-Way Impacts: As indicated earlier, minor Right-of-Way impacts may be incurred due to construction of emergency turnouts. Closer analysis of those impacts will be required when additional information is gathered during the Design and Preconstruction phase of this project, and turnouts may be moved or not constructed at all if deemed too impactful.

iii. Geotechnical Impacts: Full depth shoulder reconstruction would most likely be required in spot locations throughout the corridor. Concerns over inconsistencies in the GPR and Boring data provided will require additional borings during the design and preconstruction phase of this project. A preliminary pavement design determined that an allowable shoulder pavement section of 5.25 inches of bituminous concrete would be required to support hard shoulder running for passenger cars with a restriction on truck usage. This depth assumes that the existing subbase consists of at least 4 inches of crusher run stone. Shoulders within the limits of hard shoulder running which do not meet this requirement will be reconstructed. All provided pavement borings along the right shoulder of IS 270 show that the pavement structure meets or exceeds this allowable pavement section.

iv. Utility Impacts: Minor utility impacts may be incurred due to construction of emergency turnouts, resetting of traffic barrier, or any full depth shoulder reconstruction. Conflicts will be investigated further when more information is gathered during the design and preconstruction phase of this project.

v. Environmental Impacts/Permitting: Potential environmental impacts include air quality, greenhouse gas emissions, and noise. If congestion is reduced, however, this should improve air quality and reduce greenhouse gas emissions. Additionally, minimal changes in roadway footprint would result in a minimal effect on water quality, plants and animals, and cultural resources. Due to this, part time shoulder use is typically a strong candidate project for a Categorical Exclusion. A noise analysis will be required during the design and preconstruction phase of this project to finalize abatement needs. An MDE permit for E&SC would be required. A roadside tree permit will be required for tree impacts caused by construction of SWM and turnouts. No other permits are anticipated as wetland and WUS impacts will be avoided as much as possible.

vi. Impacts to Local Communities: Noise may impact local communities as vehicles would travel closer to adjacent properties. There may also be a period of driver confusion initially for local users. Improvements, overall, would improve travel times and mobility for local users of IS 270.

vii. Safety Impacts: FHWA's Use of Freeway Shoulders for Travel, February 2016 has noted a potential increase in "crashes related to erratic driver behavior, driver confusion, or suboptimal geometry". Examples of these types of crashes include run-off-road, fixed object, and sideswipe. These impacts will be offset by the decrease in crashes related to congestion, as well as mitigation measures and designing to the highest possible standards. Improved signing and pavement markings would be used to mitigate for the potential safety impacts.

viii. Life-cycle Project Costs: Initial costs will include public outreach and communications, system engineering activities, emergency patrols, and training of new operations staff, maintenance, and law enforcement staff. Operation and Maintenance Costs include on-going labor costs associated with compliance and required SHA or CHART staff, ITS device maintenance including any camera monitoring of the shoulders, and roadway maintenance. With the reduction in incidents due to reduced congestion current Incident Management staff could be freed up to staff the operations center and monitor the operations of the Hard Shoulder Running during peak hours.

ix. Infrastructure Costs: Infrastructure costs include geometric improvements such as shoulder reconstruction, construction of emergency turnouts, and ramp treatments, installation of ITS devices, Shoulder reconstruction, ramp treatments, paving, removal of existing rumble strips, signing (static and dynamic) and marking, drainage/SWM, and traffic barrier relocation.

a. Repair Costs: The frequency at which the outside shoulder will require rehabilitation will increase due to permitting vehicles to travel on the shoulder.

b. Maintenance Costs: Standard roadway maintenance such as 3R (resurfacing, restoration, rehabilitation), replacement of traffic barrier. Debris removal should be considered, but would predominantly be cleared by presence of traffic.

c. Operation Costs: DOT staffing to support any ITS components as well as compliance. However with the reduction in incidents due to reduced congestion current Incident Management staff could be freed up to staff the operations center and monitor the operations of the Hard Shoulder Running during peak hours.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

- IS 66, Fairfax County, Virginia: Hard Shoulder Running with dynamic signing has been used on the outside shoulder of I-66 in Fairfax County, Virginia since 2015 (static signing was used from 1992 to 2015) to add capacity to a heavily commuter corridor that serves Washington D.C.. The shoulder is used in conjunction with a high-occupancy vehicle (HOV) lane. The part time shoulder is open whenever warranted by traffic conditions and is open to all vehicles. The length of use is 6.5 miles and a shoulder width of 12 feet is provided. The shoulder operates at near capacity and has increased through-put through the corridor. Recent crash data has indicated no significant effect on crash frequency.

Project Contact:
Kamal Suliman
VDOT NRO Systems & Maintenance
571-772-4048
Kamal.Suliman@VDOT.Virginia.gov

VDOT has also implemented hard shoulder running along the inner loop of the Capital Beltway I-495, at the end of the HOT lanes in advance of the American Legion Bridge.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

- Safety: Potential for an increase crashes related to erratic driver behavior, driver confusion, or suboptimal geometry which would be offset by decrease in crashes related to congestion.
- Operation Costs (maintenance and day to day operations of any ATM/ITS devices)
- Additional Law Enforcement
- Part Time suspension of shoulder as a refuge for disabled vehicles. To mitigate this risk, CCTV will be installed to monitor the roadway at all times to visually confirm all vehicles are removed from the shoulder
- Noise Abatement: Per Addendum 3, the construction of required Noise Walls will be placed on the Administration. A noise analysis will be performed during the Design and Preconstruction Phase of this project, but any noisewalls required will be designed and constructed by the administration separately and should be considered a risk to the states capital budget.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

There is limited survey, utility designation, environmental information, and pavement borings/cores available along sections of IS 270 where Hard Shoulder Running is proposed. These are risks to scope, schedule, and budget should an unknown utility or environmental feature be found, or the existing pavement structure be determined to not be adequate and additional full-depth reconstruction be required.

There is a risk associated with accepting the findings of the pavement borings as a typical pavement structure within these limits. All provided pavement borings along the right shoulder of IS 270 show that the pavement structure meets or exceeds the required pavement section. However, these borings are spaced very far apart and the Ground Penetrating Radar (GPR) data is not consistent with the more accurate boring information. For example, the GPR shows a Bituminous Concrete depth of less than 4” while the overlapping Soil Boring indicates a depth of over 10” at the location of SB-13. If the GPR data is accurate then the estimate for shoulder reconstruction may exceed the actual cost. This could have implications as to where Hard Shoulder Running is implemented and place a strain on the overall strategies proposed for the corridor. Additional borings will be required to confirm the pavement section during the Design and Preconstruction phase of this project, but the current boring information is the best available data to develop our cost estimate.

There is also a risk associated with the Design Exceptions required to implement Hard Shoulder Running. As previously noted, a design exception would be required for Shoulder Width, Lane Width, and Stopping Sight Distance. When design continues during the Design and Preconstruction phase of this project, it may be found that additional design exceptions may be required for Bridge Width, Superelevation, Cross Slope, Vertical Clearance, and Lateral Offset to obstruction. Each exception would require effort to draft the exception, develop mitigation strategies, and coordinate these efforts with FHWA for their acceptance. The timeliness of FHWA’s acceptance of any required design exception is imperative to maintain the project schedule.

Finally, the PTC may increase Noise and Greenhouse Emissions and impact Air Quality. If an Air Quality or Greenhouse Gas Emissions Analysis is required additional coordination efforts would need to be taken into consideration when developing the project schedule. Any prescribed mitigation would also impact the project budget.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

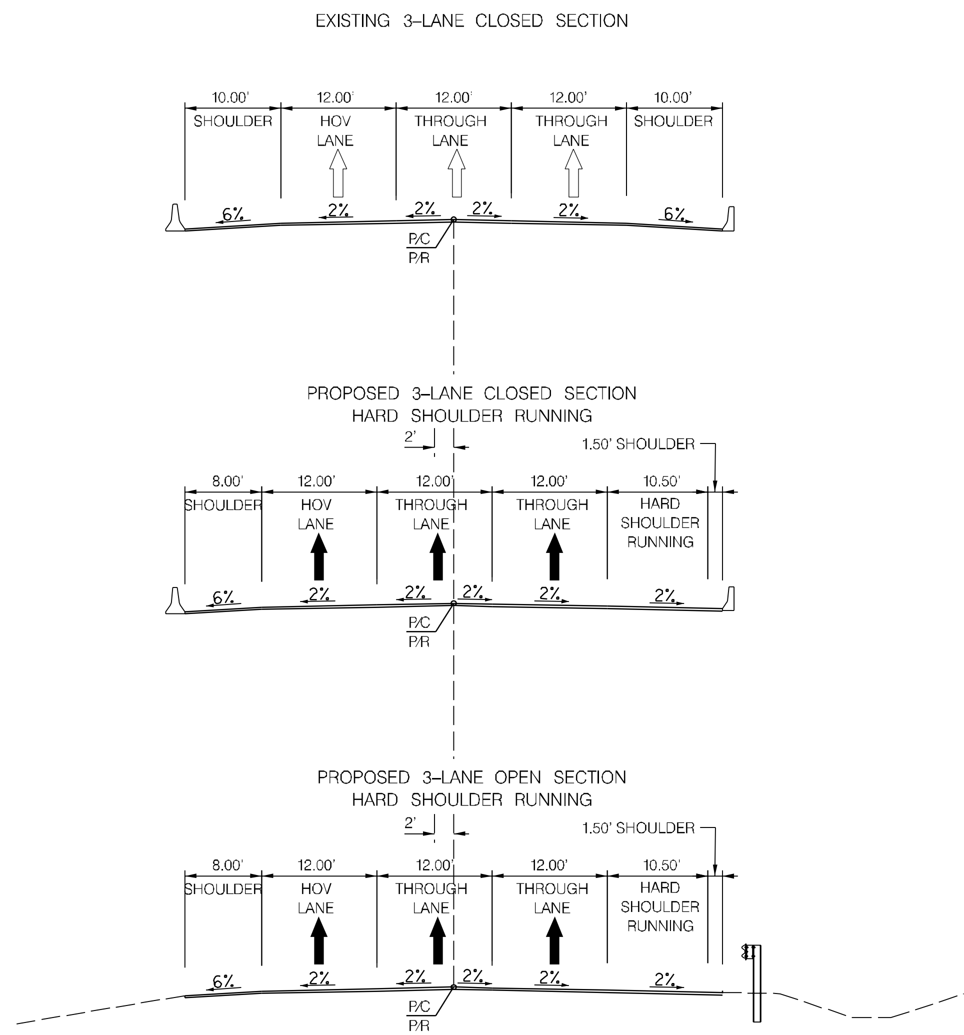
Cost Benefits: The geometric improvements required to implement Hard Shoulder Running are less extensive than adding an additional lane of traffic, which typically requires widening of the roadway. By reusing the existing roadway footprint impacts to right-of-way, utilities, and the environment can be minimized reducing the overall construction, right-of-way, and utility relocation costs. This results in added capacity during times of congestion similar to adding a new lane at a greatly reduced cost overall. Additionally, maintenance costs such as resurfacing, restoration, rehabilitation, replacement of traffic barrier, and snowfall removal should remain similar to existing costs as the roadway section would remain the same.

Schedule Benefits: Minimizing right-of-way, utility, and environmental impacts would benefit both the design and construction schedule of the project. During the design phase time allowances must be included in the schedule for any right of way acquisition or utility clearance, and to secure environmental permits for SWM and Erosion & Sediment Control, Wetlands and Waterways, and others such as tree impacts. Hard Shoulder Running can minimize right-of-way needs, reducing the schedule required for acquiring and clearing the right-of-way needed to construct the project. If utility impacts are minimized less time would be required prior to the start of construction for advanced utility work. This would allow the construction to start earlier allow the improvements to open to traffic sooner. Implementing Hard Shoulder Running can also minimize the projects overall earth disturbance and grading, as well as impacts to wetland, Waters of US, and trees, which can affect the type of permit and the amount of coordination required with any stakeholder agency. The less coordination required with involved agencies can reduce the projects overall design schedule. If environmental impacts can be minimized during design less mitigation would be required during construction (in-stream work restrictions, reforestation, etc).

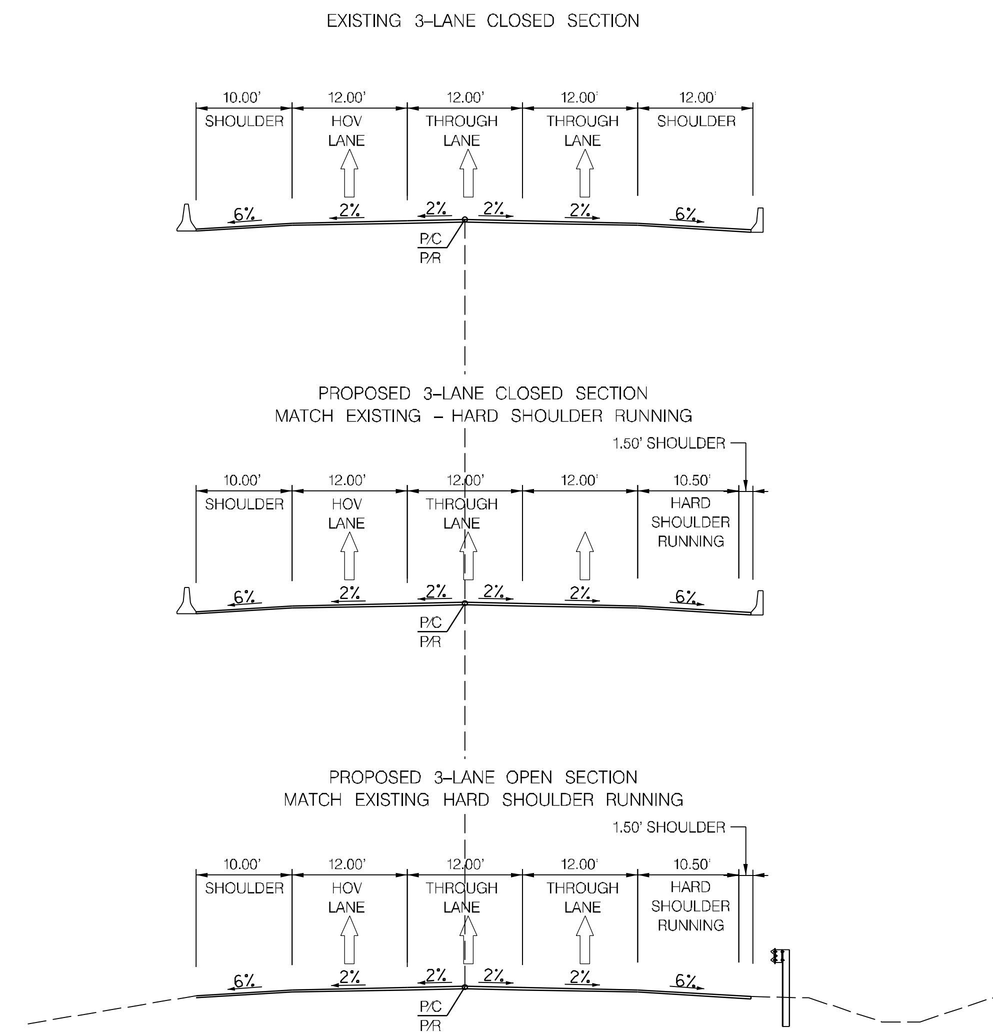
l) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*

N/A

SOUTHBOUND IS 270
MD 121 TO RIDGE RD/FR. HURLEY BLVD



SOUTHBOUND IS 270
RIDGE RD/FR. HURLEY BLVD TO MIDDLEBROOK RD



DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

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I–270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

EXISTING & PROPOSED TYPICAL SECTIONS

PTC 17
HARD SHOULDER RUNNING

TYPICAL SECTIONS – SOUTHBOUND

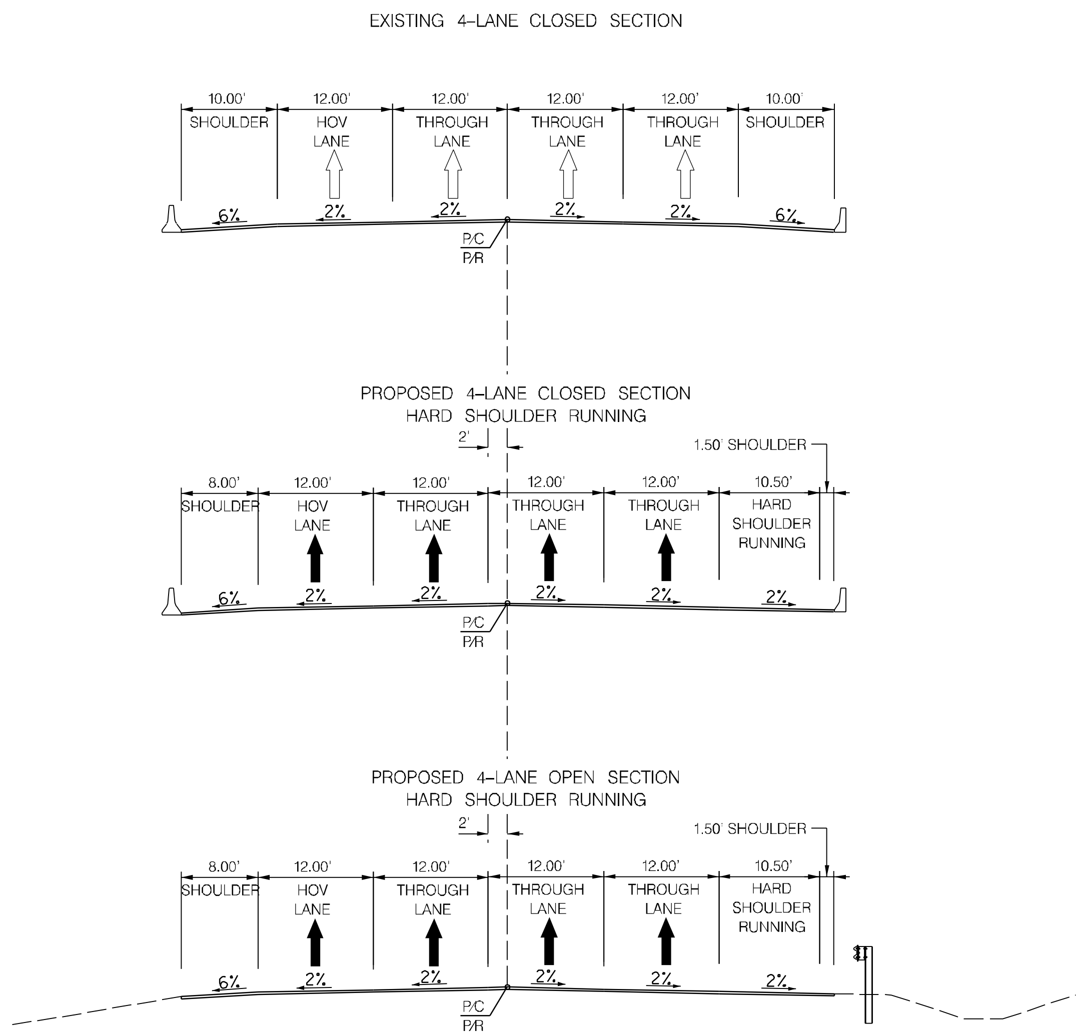
SCALE 1" = 10' ADVERTISED DATE ______ CONTRACT NO. ______

DESIGNED BY MSS
DRAWN BY MSS
CHECKED BY MTH
F.A.P. NO. ______
COUNTY ______
LOGMILE ______
HORIZONTAL SCALE ______
VERTICAL SCALE ______

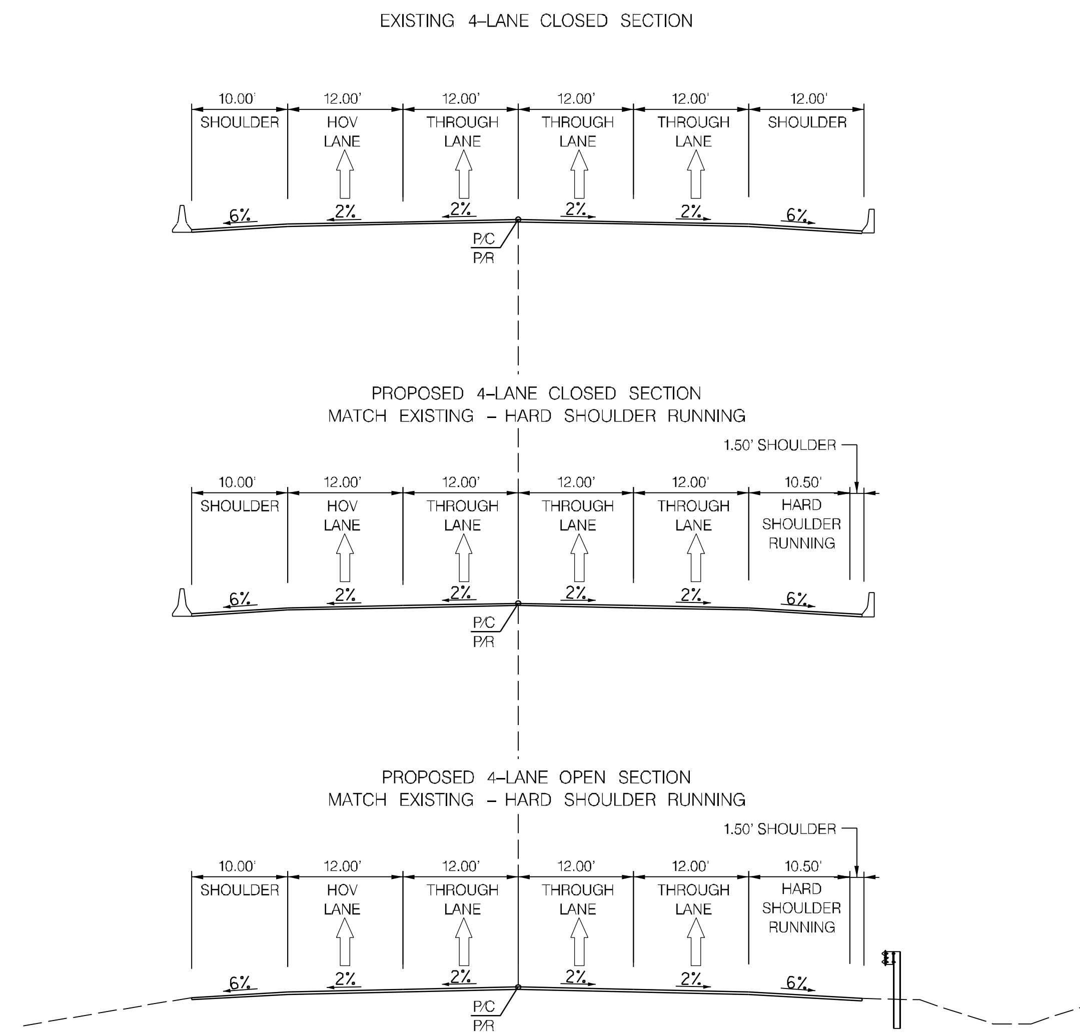
DRAWING NO. TS-01 OF 08 SHEET NO. OF

PLOTTED: Thursday, November 10, 2016 AT 01:39 PM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\pHT-X001_PTC Hard Shoulder Running.dgn

SOUTHBOUND IS 270
MIDDLEBROOK RD TO GAME PRESERVE RD



SOUTHBOUND IS 270
GAME PRESERVE RD TO START SB LOCAL



DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

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I-270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

EXISTING & PROPOSED
TYPICAL SECTIONS

PTC 17
HARD SHOULDER RUNNING

TYPICAL SECTIONS - SOUTHBOUND

SCALE 1" = 10' ADVERTISED DATE ____ CONTRACT NO. ____

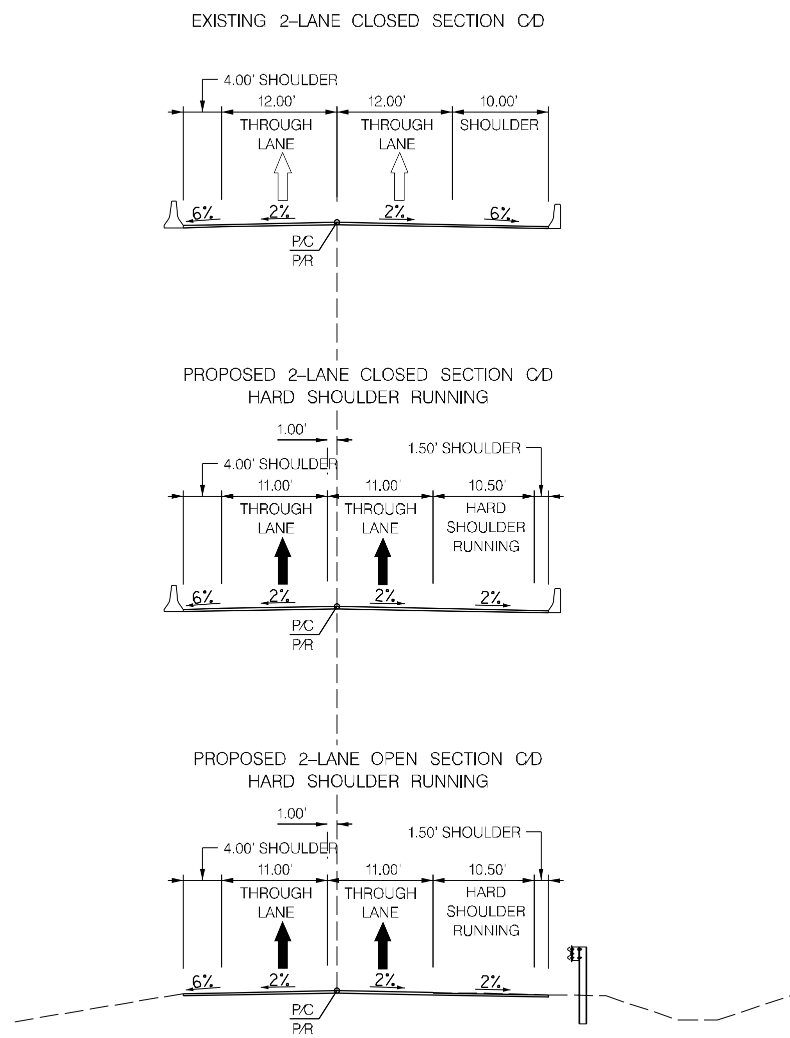
DESIGNED BY MSS
DRAWN BY MSS
CHECKED BY MTH
F.A.P. NO. ____
COUNTY ____
LOGMILE ____
HORIZONTAL SCALE ____
VERTICAL SCALE ____

DRAWING NO. TS-02 OF 08 SHEET NO. OF

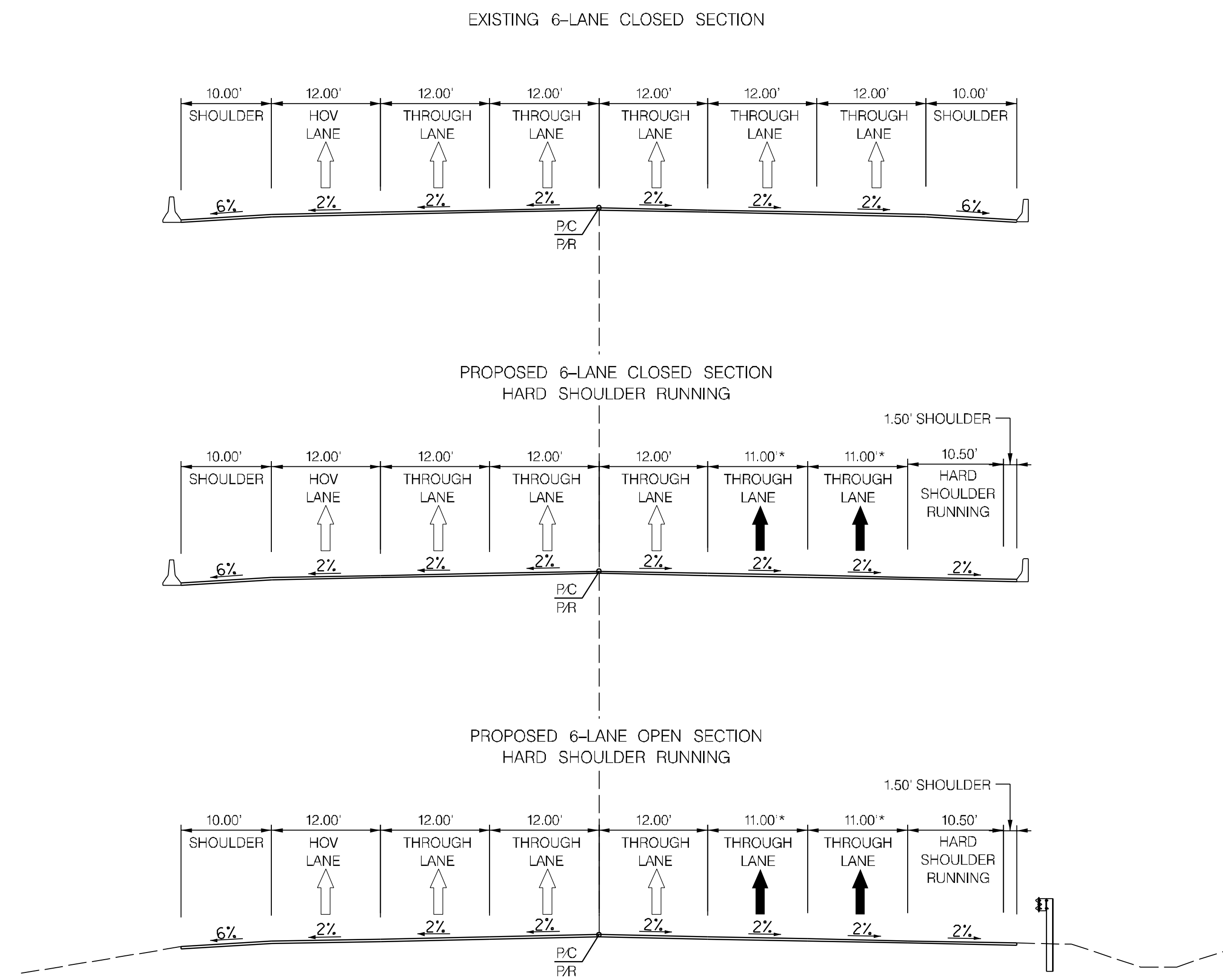
PLOTTED: Thursday, November 10, 2016 AT 01:40 PM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\pHT-X001_PTC Hard Shoulder Running.dgn

QUANTITY NOTES

SOUTHBOUND IS 270
SB LOCAL C/D LANES



SOUTHBOUND IS 270 /IS 270Y
END SB LOCAL TO 700 FT SOUTH



* 11' LANES CAN BE TWO RIGHT LANES OR CENTER OR LEFT LANES AS DESIRED TO PROVIDE WIDER RIGHT LANES FOR TRUCKS OR BUSSES.

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

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I-270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

EXISTING & PROPOSED
TYPICAL SECTIONS

PTC 17
HARD SHOULDER RUNNING

TYPICAL SECTIONS – SOUTHBOUND

SCALE 1" = 10' ADVERTISED DATE ______ CONTRACT NO. ______

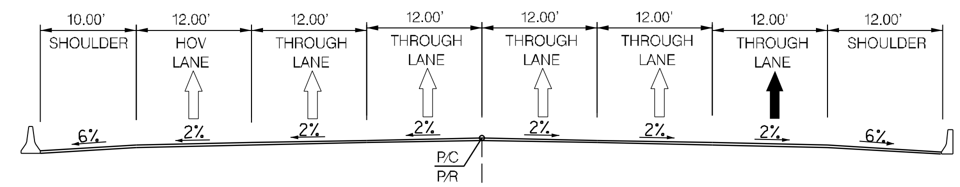
DESIGNED BY MSS
DRAWN BY MSS
CHECKED BY MTH
F.A.P. NO. ______
COUNTY ______
LOGMILE ______
HORIZONTAL SCALE ______
VERTICAL SCALE ______

DRAWING NO. TS-03 OF 08 SHEET NO. OF

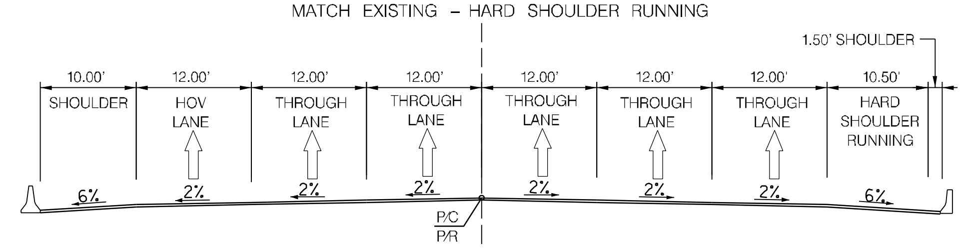
PLOTTED: Thursday, November 10, 2016 AT 01:10 PM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\pHT-X001_PTC Hard Shoulder Running.dgn

SOUTHBOUND IS 270 /IS 270Y
700 FT SOUTH OF SB CD LANES TO TUCKERMAN LN

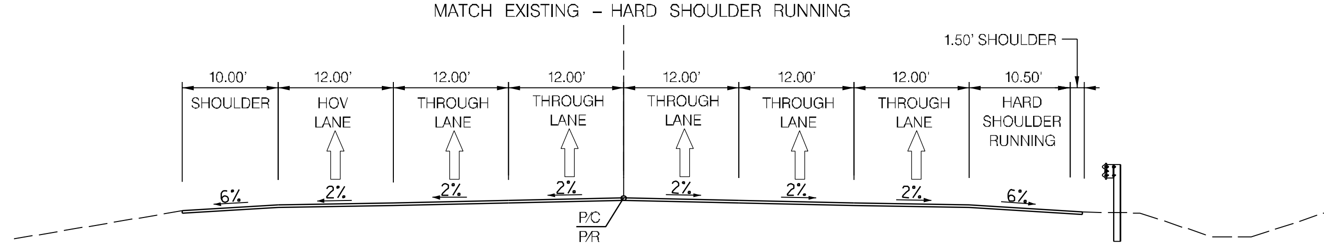
EXISTING 6-LANE CLOSED SECTION



PROPOSED 6-LANE CLOSED SECTION
MATCH EXISTING - HARD SHOULDER RUNNING



PROPOSED 6-LANE OPEN SECTION
MATCH EXISTING - HARD SHOULDER RUNNING



DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

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I-270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

EXISTING & PROPOSED
TYPICAL SECTIONS

PTC 17
HARD SHOULDER RUNNING

TYPICAL SECTIONS – SOUTHBOUND

SCALE 1" = 10' ADVERTISED DATE ______ CONTRACT NO. ______

DESIGNED BY MSS
DRAWN BY MSS
CHECKED BY MTH
F.A.P. NO. ______

COUNTY ______
LOGMILE ______
HORIZONTAL SCALE ______
VERTICAL SCALE ______

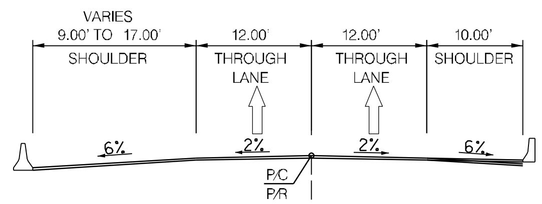
DRAWING NO. TS-04 OF 08 SHEET NO. OF

PLOTTED: Thursday, November 10, 2016 AT 01:48 PM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\pHT-X001_PTC Hard Shoulder Running.dgn

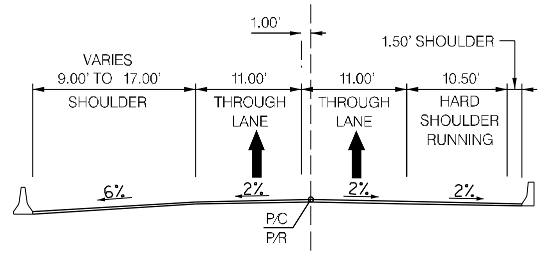
QUANTITY NOTES

NORTHBOUND IS 270
NORTH OF ROCKLEDGE BLVD TO IS 270 /IS 270Y JUNCTION

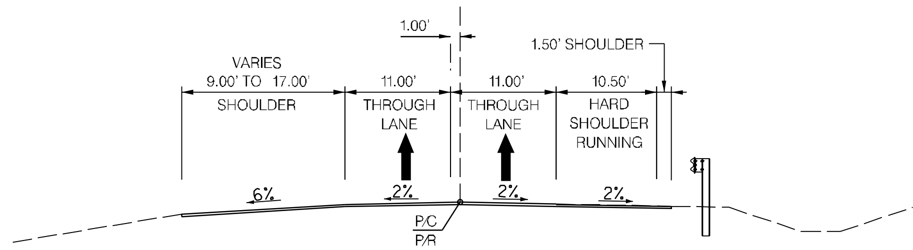
EXISTING 2–LANE CLOSED SECTION



PROPOSED 2–LANE CLOSED SECTION
HARD SHOULDER RUNNING

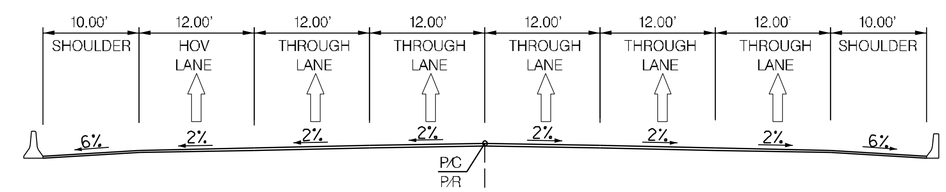


PROPOSED 2–LANE OPEN SECTION
HARD SHOULDER RUNNING

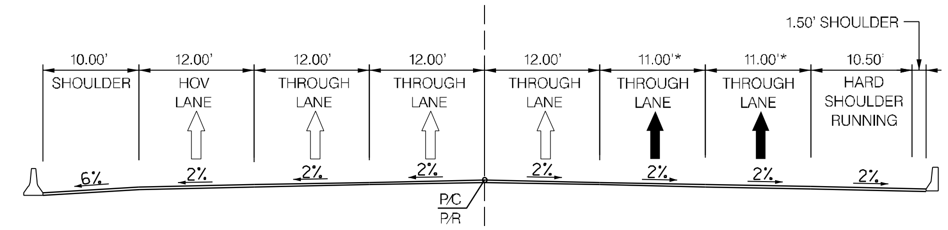


NORTHBOUND IS 270 /IS 270Y
IS 270 /IS 270Y JUNCTION TO START NB LOCAL

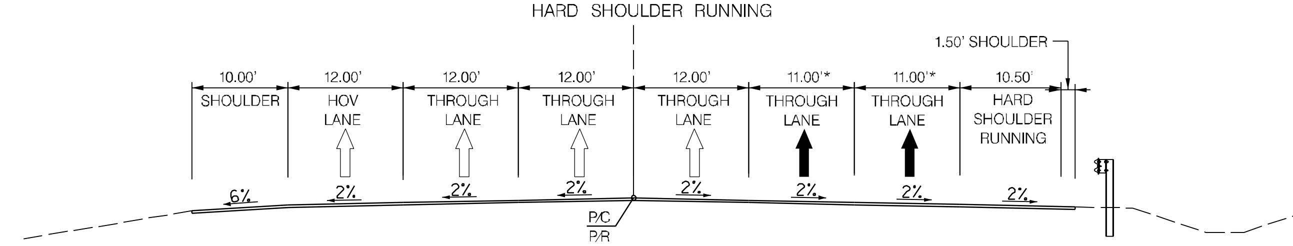
EXISTING 6–LANE CLOSED SECTION



PROPOSED 6–LANE CLOSED SECTION
HARD SHOULDER RUNNING



PROPOSED 6–LANE OPEN SECTION
HARD SHOULDER RUNNING



* 11' LANES CAN BE TWO RIGHT LANES OR CENTER OR LEFT LANES AS DESIRED TO PROVIDE WIDER RIGHT LANES FOR TRUCKS OR BUSSES.

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

SHA State Highway Administration

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I–270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

EXISTING & PROPOSED
TYPICAL SECTIONS

PTC 17
HARD SHOULDER RUNNING

TYPICAL SECTIONS – NORTHBOUND

SCALE 1" = 10' ADVERTISED DATE ______ CONTRACT NO. ______

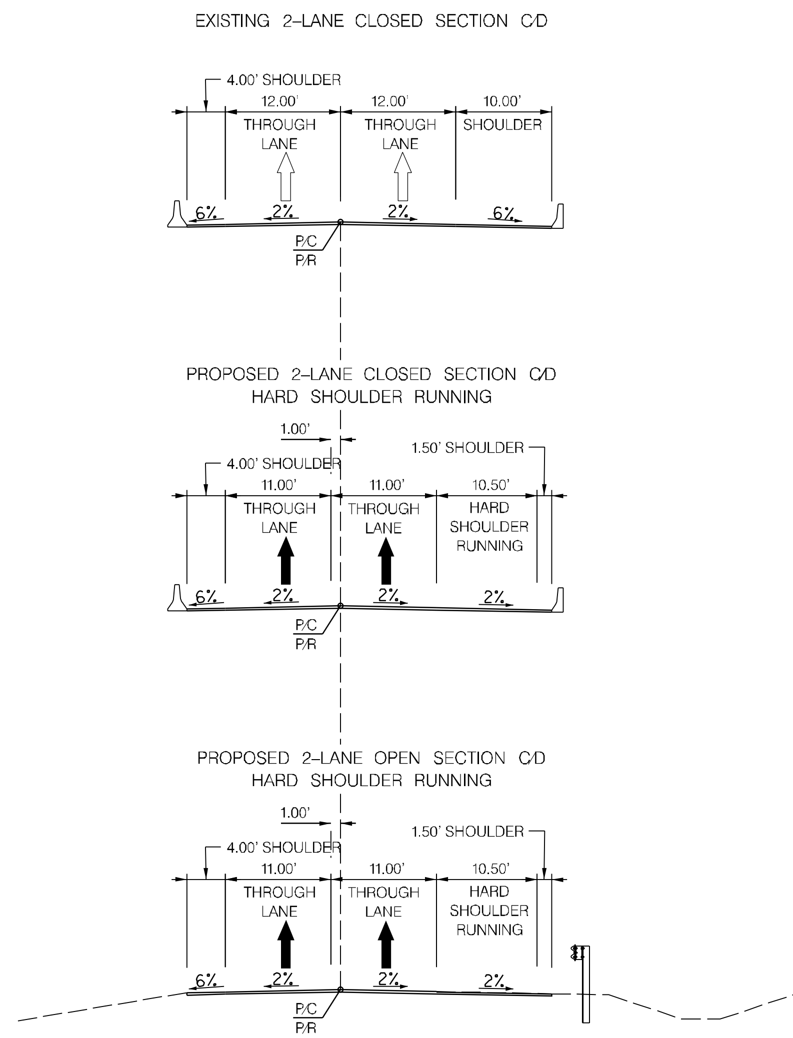
DESIGNED BY MSS
DRAWN BY MSS
CHECKED BY MTH
F.A.P. NO. ______

COUNTY ______
LOGMILE ______
HORIZONTAL SCALE ______
VERTICAL SCALE ______

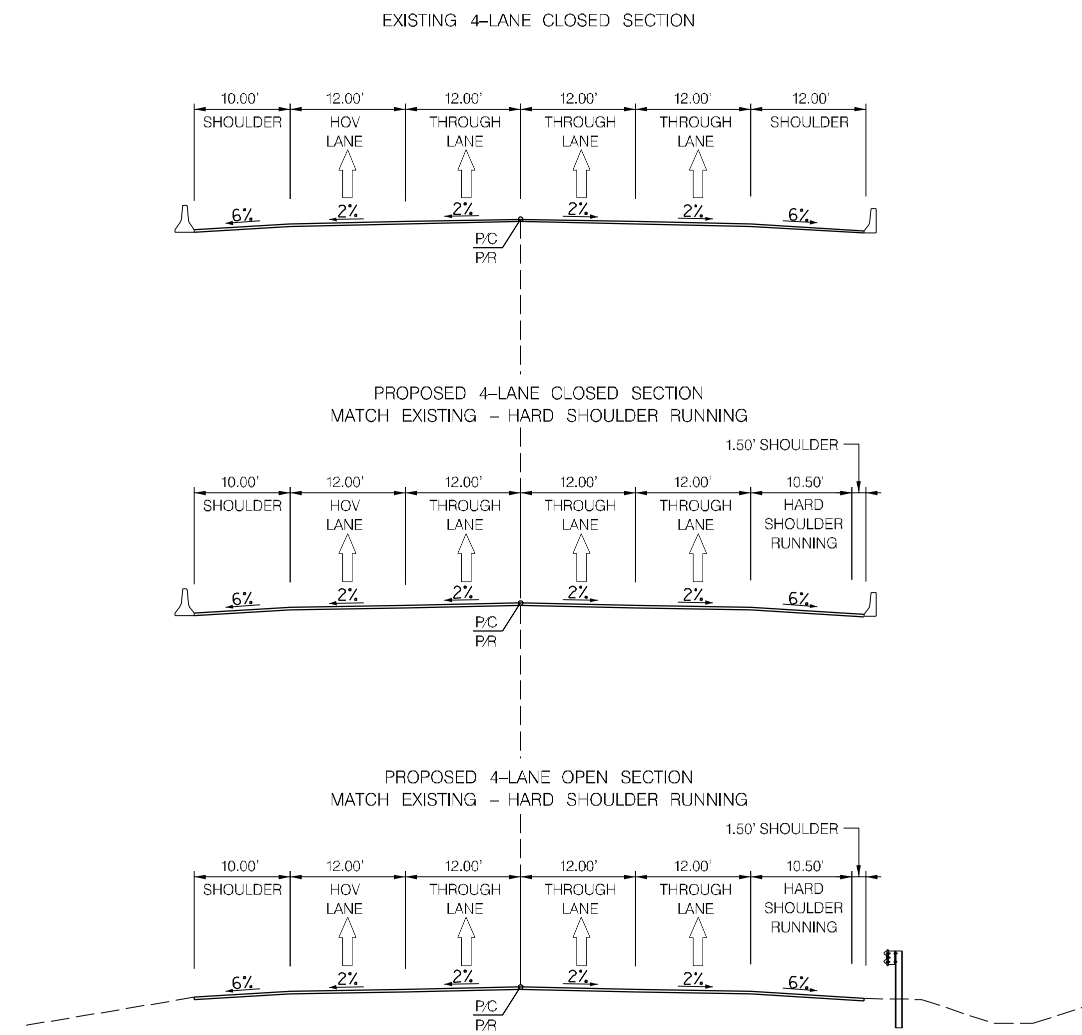
DRAWING NO. TS-05 OF 08 SHEET NO. OF

QUANTITY NOTES

NORTHBOUND IS 270
NB LOCAL C/D LANES



NORTHBOUND IS 270
END NB LOCAL TO SOUTH OF GAME PRESERVE RD



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I-270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

EXISTING & PROPOSED TYPICAL SECTIONS

PTC 17
HARD SHOULDER RUNNING

TYPICAL SECTIONS - NORTHBOUND

SCALE 1" = 10' ADVERTISED DATE ____ CONTRACT NO. ____

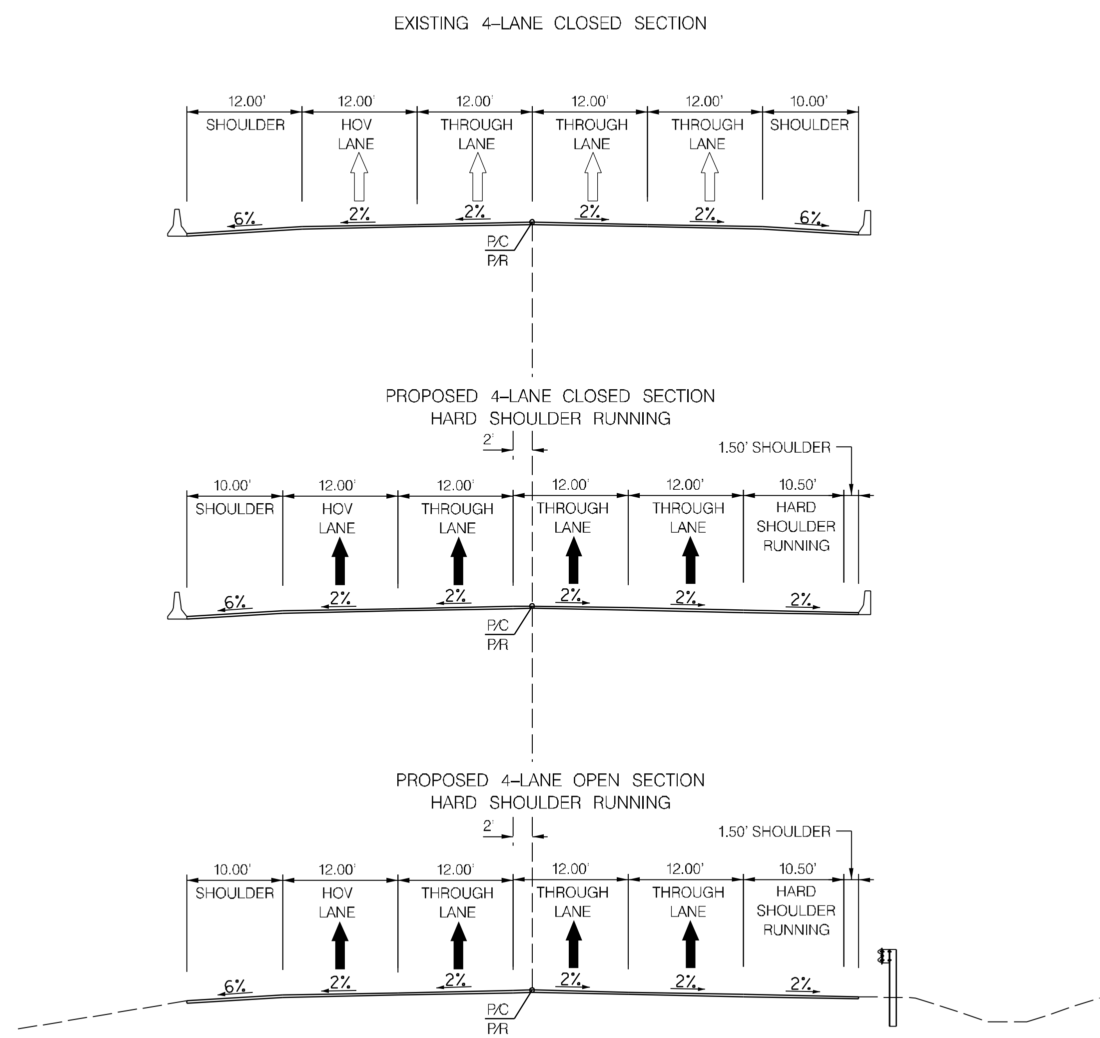
DESIGNED BY MSS
DRAWN BY MSS
CHECKED BY MTH
F.A.P. NO. ____

COUNTY ____
LOGMILE ____
HORIZONTAL SCALE ____
VERTICAL SCALE ____

DRAWING NO. TS-06 OF 08 SHEET NO. OF

QUANTITY NOTES

NORTHBOUND IS 270
SOUTH OF GAME PRESERVE RD TO MIDDLEBROOK RD



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NAVD 88 Vertical

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I-270 INNOVATIVE CONGESTION MANAGEMENT
GEOMETRIC IMPROVEMENTS

EXISTING & PROPOSED TYPICAL SECTIONS

PTC 17
HARD SHOULDER RUNNING

TYPICAL SECTIONS - NORTHBOUND

SCALE 1" = 10' ADVERTISED DATE ______ CONTRACT NO. ______

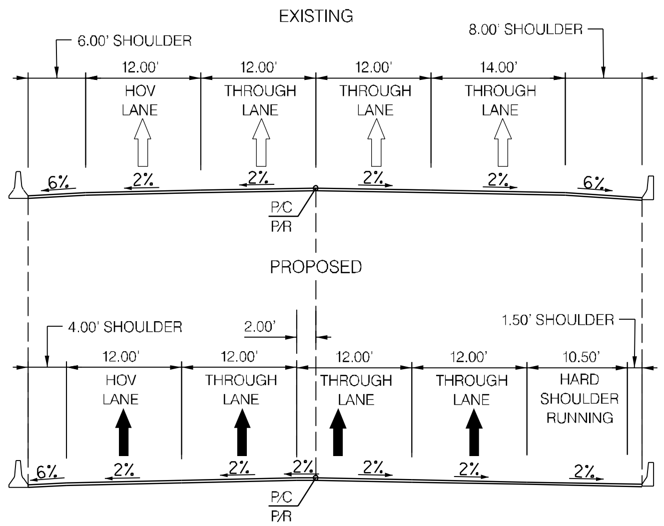
DESIGNED BY MSS
DRAWN BY MSS
CHECKED BY MTH
F.A.P. NO. ______
COUNTY ______
LOGMILE ______
HORIZONTAL SCALE ______
VERTICAL SCALE ______

DRAWING NO. TS-07 OF 08 SHEET NO. OF

PLOTTED: Friday, November 11, 2016 AT 08:31 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\pHT-X001_PTC Hard Shoulder Running.dgn

CSX TRAIN BRIDGE PINCH POINT

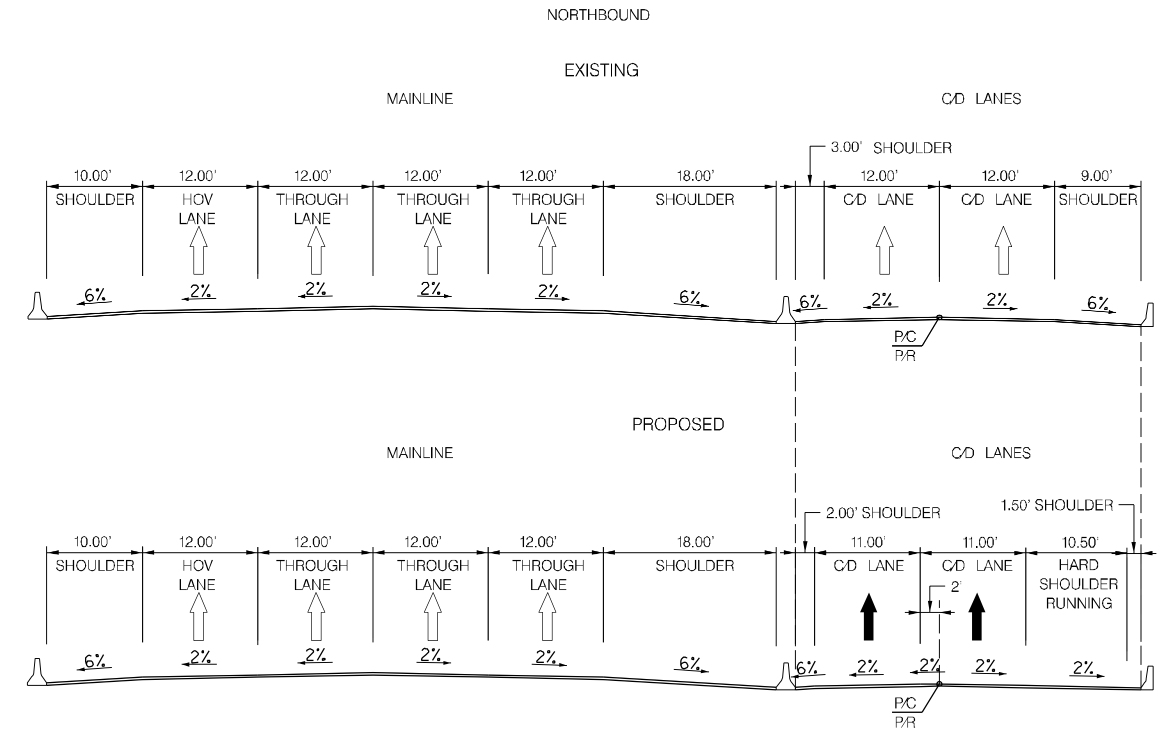
SOUTHBOUND



IS 370 RAMP 5 PINCH POINT (1000 FT SOUTH OF IS 370)

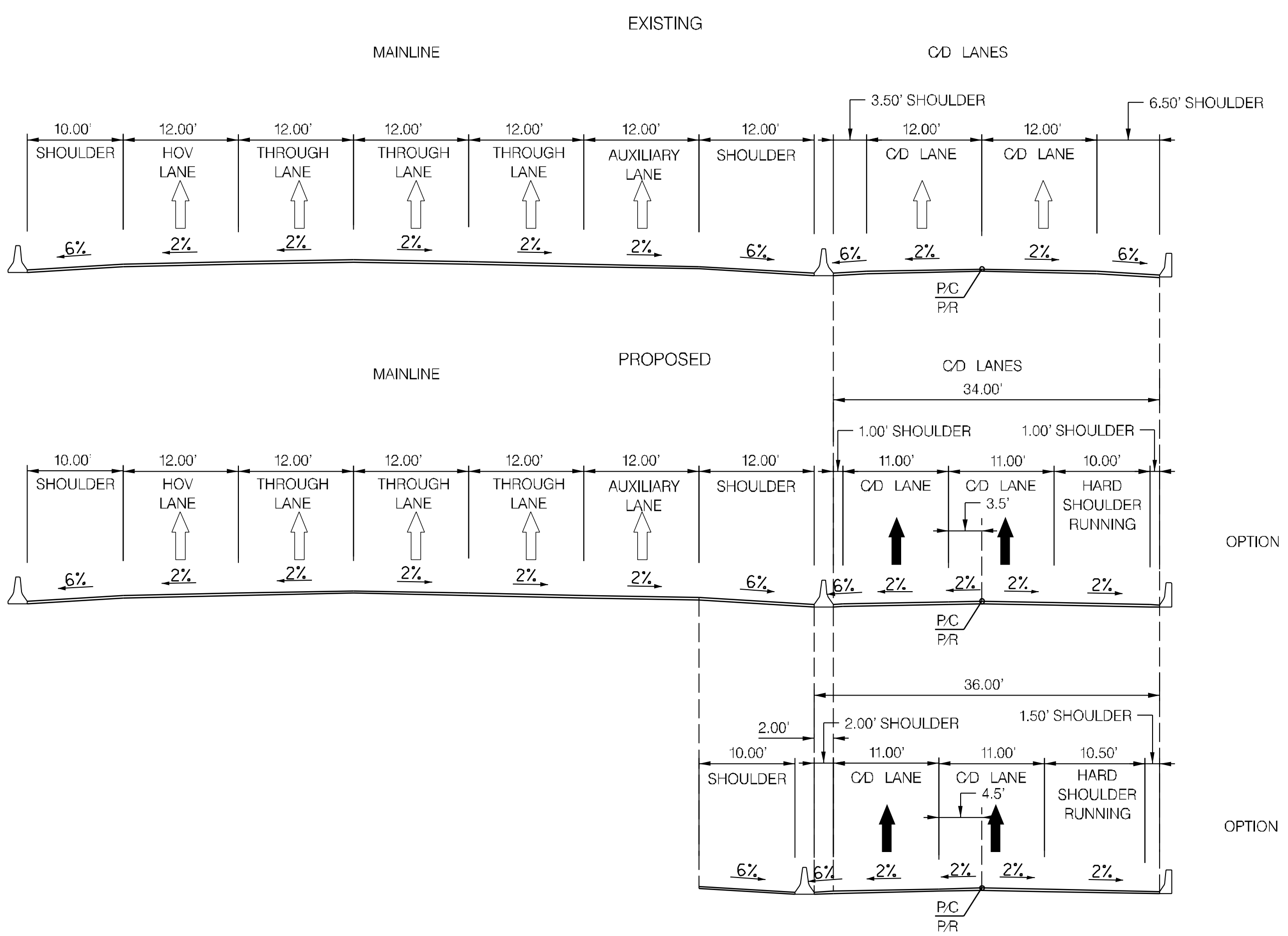
FLYOVER RAMP FROM SB IS 270 TO EB IS 370

NORTHBOUND



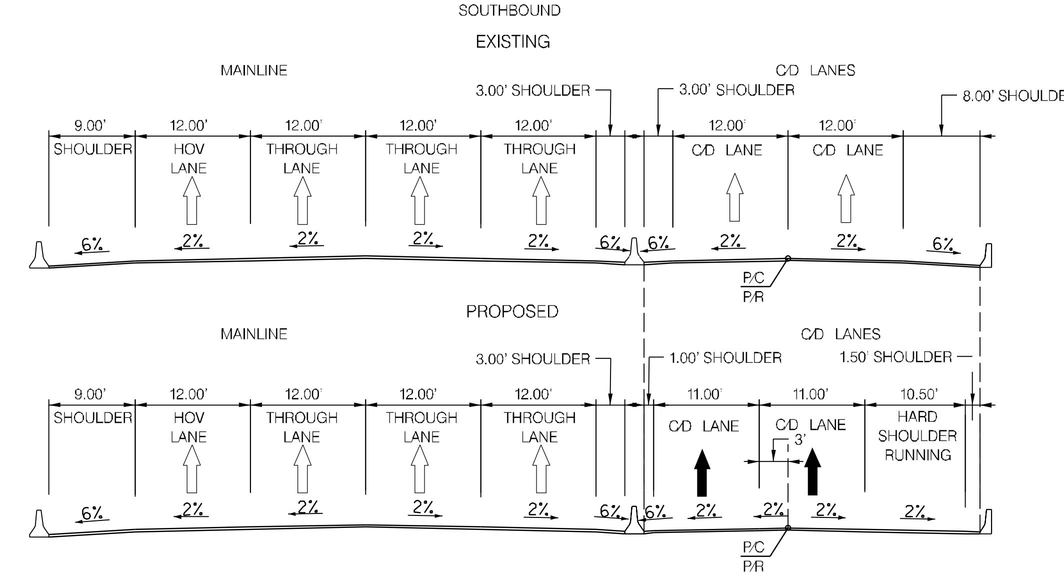
WEST GUDE DRIVE PINCH POINT

NORTHBOUND



MD 28 (W. MONTGOMERY AVENUE) PINCH POINT

SOUTHBOUND



DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

SHA State Highway Administration
CORMAN CONSTRUCTION | WSP | PARSONS BRINCKERHOFF

I-270 INNOVATIVE CONGESTION MANAGEMENT

GEOMETRIC IMPROVEMENTS

PINCH POINT LOCATIONS:
NB IS 270 AT W. GUDE DR. & RAMP 5 (IS 370)
SB IS 270 AT CSX TRAIN BRIDGE & MD 28

PTC 17
HARD SHOULDER RUNNING

TYPICAL SECTIONS – PINCH POINTS

SCALE 1" = 10' ADVERTISED DATE ________ CONTRACT NO. ________

DESIGNED BY MSS
DRAWN BY MSS
CHECKED BY MTH
F.A.P. NO. ________

COUNTY ________
LOGMILE ________
HORIZONTAL SCALE ________
VERTICAL SCALE ________

DRAWING NO. TS-08 OF 08 SHEET NO. OF

PLOTTED: Thursday, November 10, 2016 AT 03:39 PM
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PTC 17: Hard Shoulder Running (Segments B, C & D)
Corman Construction

DRAFT Request for Design Exception

We are requesting your approval of a design exception for three areas where the design does not meet AASHTO's "A Policy on Design Standards – Interstate System" (2016) and/or "AASHTO's A Policy on Geometric Design of Highway Streets" (2011) recommendations. This exception is for lane width, shoulder width, and stopping sight distance along sections of southbound mainline and local IS 270, from MD 121 (Clarksburg Rd) to Tuckerman Lane, as well as northbound mainline and local IS 270, from north of Rockledge Blvd to Middlebrook Rd.

CONCEPT DESCRIPTION

This PTC proposed to permit general purpose travel to use the existing shoulders of southbound IS 270, from MD 121 (Clarksburg Rd) to Rockledge Blvd as well as northbound IS 270, from north of Rockledge Blvd to Middlebrook Rd, during times of heavy congestion. The shoulder would be preserved as a refuge when hard shoulder running is not in effect. Static and dynamic signing as well as other ITS devices would be implemented to control the use of the shoulders as a travel lane. Please refer to the attached Typical Sections for a visual representation of this PTC.

The goal of this concept is to increase the capacity of IS 270 with minimal costs and impacts compared to adding a new full time lane. The added capacity would improve mobility by reducing congestion, increasing vehicle through-put, improving travel-time reliability, and reduce the impacts of existing bottlenecks.

Reducing congestion on IS 270 has the potential to improve safety by reducing congestion-related crashes such as rear-end collisions. Any reduction in crash frequency would improve travel-time reliability. The part time shoulder can also be used as a tool for incident management via dynamic control by allowing traffic to move past incidents more rapidly, advancing the project goals of mobility and safety.

PROJECT DESIGN CRITERIA

2011 "A Policy on Geometric Design of Highways and Streets" – AASHTO

2016 "A Policy on Design Standards – Interstate System" – AASHTO

DESIGN EXCEPTION

Lane Width

- Southbound IS 270 Local C/D Road – Two General Purpose lanes (Entire Limits)
- South IS 270 Mainline – Two (out of six) General Purpose lanes from end of IS 270 Local to Tuckerman Ln.
- Northbound IS 270 Mainline – Two General Purpose lanes from north of Rockledge Blvd to start of IS 270 Local
- Northbound IS 270 Local C/D Road – Two General Purpose lanes (Entire Limits)

Shoulder Width

- Southbound IS 270 Mainline – Right Shoulder from MD 121 to start of IS 270 Local
- Southbound IS 270 Mainline – Left Shoulder from MD 121 to Fr. Hurley Blvd.
- South IS 270 Local C/D Road – Right Shoulder (Entire Limits)
- Southbound IS 270 Mainline – Right Shoulder from end of IS 270 Local to Tuckerman Lane
- Northbound IS 270 Mainline – Right Shoulder from north of Rockledge Blvd to start of IS 270 Local
- Northbound IS 270 C/D Local Road - Right Shoulder (Entire Limits)
- Northbound IS 270 Mainline – Right Shoulder from end of IS 270 Local to Middlebrook Rd

Stopping Sight Distance – Various Locations

Existing Condition

Southbound IS 270:

SB IS 270 Mainline from MD 121 to Ridge Rd/Fr. Hurley Blvd has three 12 ft. general purpose lanes with a 10 ft. left shoulder and a 10 ft. right shoulder. The left shoulder is open section with w-beam median barrier located in the median. The right shoulder is closed section with F-Shape barrier, and grate inlets are provided adjacent to the barrier for drainage.

SB IS 270 Mainline from Ridge Rd/Fr. Hurley Blvd to Middlebrook Rd has three 12 ft. general purpose lanes with a 10 ft. left shoulder and a 12 ft. right shoulder. The typical section varies from open to closed with w-beam guardrail or f-shape concrete barrier existing where required.

SB IS 270 Mainline from Middlebrook Rd to Game Preserve Rd has four 12 ft. general purpose lanes with a 10 ft. left shoulder and 10 ft. right shoulder. The left shoulder is closed section with F-Shape

Median Barrier, and grate inlets are provided adjacent to the barrier for drainage. The right shoulder is open section with w-beam barrier where slopes require.

SB IS 270 Mainline from Game Preserve Rd to the start of the Local C/D road has four 12 ft. general purpose lanes with a 10 ft. left shoulder and 12 ft. right shoulder. The typical section varies from open to closed with w-beam guardrail or f-shape concrete barrier existing where required.

The SB IS 270 Local C/D road is closed section with two 12 ft. general purpose lanes, a 4-ft. left shoulder, and a 10-ft. right shoulder. F-shape traffic barrier is located on the outside of both the right and left shoulders, and grate inlets are provided adjacent to the barrier for drainage.

SB IS 270 Mainline from the end of the Local C/D road to Tuckerman is closed section with six 12 ft. general purpose lanes, a 10-ft. left shoulder, and a 10-ft. right shoulder. F-shape traffic barrier is located on the outside of both the right and left shoulders, and grate inlets are provided adjacent to the barrier for drainage.

Crash data provided with the projects RFQ/RFP is dated 2011-2013 and shows rear end crashes as the principal crash type within the limits of the proposed southbound hard shoulder running (282 total rear end crashes reported from just north of MD 121 to Tuckerman Ln). Following too closely or driving too fast for conditions were the predominant causes for rear end accidents. Rear end accidents that occurred between MD 28 and Tuckerman Ln, a 3.7 mile length, are significantly higher than the statewide average. The rear ends crashes were most likely related to congestion.

Northbound IS 270:

NB IS 270 Mainline from north of Rockledge Blvd to the junction with IS 270Y is open section with two 12 ft. general purpose lanes, a 9-ft. to 17-ft. left shoulder, and a 10-ft. right shoulder. W-beam barrier is provided where slopes require. F-shape traffic barrier begins on the right shoulder approximately 1,000 ft. south of the junction, and grate inlets are provided adjacent to the barrier for drainage.

NB IS 270 Mainline from the from the junction with IS 270Y and the start of the Local C/D road is closed section with six 12 ft. general purpose lanes, a 10-ft. left shoulder, and a 10-ft. right shoulder. F-shape traffic barrier is located on the outside of both the right and left shoulders, and grate inlets are provided adjacent to the barrier for drainage.

The NB IS 270 Local C/D road is closed section with two 12 ft. general purpose lanes, a 4-ft. left shoulder, and a 10-ft. right shoulder. F-shape traffic barrier is located on the outside of both the right and left shoulders, and grate inlets are provided adjacent to the barrier for drainage.

NB IS 270 Mainline from the end of the Local C/D road to Game Preserve Rd is closed section with four 12 ft. general purpose lanes, a 10-ft. left shoulder, and a 12-ft. right shoulder. F-shape traffic barrier is located on the outside of both the right and left shoulders, and grate inlets are provided adjacent to the barrier for drainage.

NB IS 270 Mainline from Game Preserve Rd to Middlebrook Rd is closed sections with four 12 ft. general purpose lanes, a 10-ft. left shoulder, and a 10-ft. right shoulder. The typical section varies from open to closed with w-beam guardrail or f-shape concrete barrier existing where required.

Crash data provided with the projects RFQ/RFP is dated 2011-2013 and shows rear end crashes as the principal crash type within the limits of the proposed northbound hard shoulder running being (183 total rear end crashes reported from Rockledge Blvd and Middlebrook Rd). Following too closely or driving too fast for conditions were the predominant causes for rear end accidents. Rear end accidents that occurred between Rockledge Blvd and the junction with IS 270Y are significantly higher than the statewide average. The rear ends crashes were most likely related to congestion.

Lane Width

a. AASHTO Design Criteria

Page 4 in AASHTO's 2016 "A Policy on Design Standards – Interstate System" states that all traffic lanes on the Interstate System shall be 12 ft. wide. This manual supersedes AASHTO's Green Book when used on Interstate Highways.

b. Proposed Condition

The proposed reconfiguration in some locations would restripe the existing available pavement to provide 11 ft. lanes and allow for the 12 ft. right shoulder. The deficient lane width would not meet AASHTO recommendations for a distance of approximately 0.84 miles in the southbound direction and 1.7 miles in the northbound direction.

c. Design Constraints

The roadway typical section within the limits of the design exception is restricted along the outside shoulder by right of way (region is urban with significant development) as well as existing topography which includes both steep cut and fill slopes. Any widening of IS 270 may require construction of retaining walls and would likely impact adjacent right of way, utilities, and environmental features. Widening would necessitate the construction of stormwater management (SWM) facilities due to the creating of additional impervious. Additional impacts to right of way and environmental features would most likely result. An environmental delineation is necessary to determine if any environmental impacts exists; however, a review of aerial imagery shows streams, major tree coverage, and potential wetland adjacent to the roadway.

d. Design Exception

We recommend that a design exception be considered to reduce traffic lane widths along this section of southbound IS 270. Crashes related to congestion such as a rear end crash would be reduced by adding capacity via hard shoulder running, offsetting any negative safety impacts caused by the lane width. Employing this PTC would be an implementation of Practical Design by adding a full traffic lane during the AM peak to address the project goals of mobility and safety without widening of the existing paved shoulder, regrading of the adjacent side slopes, reconstruction of the existing drainage system and traffic barrier, construction of retaining walls, SWM, tree impacts, possible right of way, utility, and environmental impacts, or other incidental items that do not effectively advance the project goals.

e. Proposed Mitigation

Improved signing and pavement markings will be used to mitigate for the potential safety impacts. Specific strategies provided in FHWA's "Mitigation Strategies for Design Exceptions" guide that will be implemented include:

- Advanced warning: ROAD NARROWS signs
- Improve ability to stay within the travel lane:
  - Enhanced Pavement Markings
    - Raised Pavement Markings and/or
    - Recessed Pavement Markings
  - Roadside Delineators

Additionally, turnouts will be constructed on the outside of the existing footprint of the roadway to provide a refuge space for vehicles while hard shoulder running is in effect.

Shoulder Width

a. AASHTO Design Criteria

Page 4 in AASHTO's 2016 "A Policy on Design Standards – Interstate System" states that on a 4-lane interstate right shoulders shall be a minimum of 10 ft. wide, and left shoulders shall be minimum of 4 ft. wide. On a 6-lane or larger Interstate right shoulders shall be a minimum of 10 ft. wide and left shoulders shall be a minimum of 10 ft. wide. This manual supersedes AASHTO's Green Book when used on Interstate Highways.

b. Proposed Condition

The proposed condition would allow for a 12 ft. hard running shouder along the right shoulder. However, during part time shoulder use the right shoulder would become a 10.5 ft. traffic lane with a minimum right shoulder width of 1.5 feet. The deficient shoulder width would not meet AASHTO recommendations for a distance of 15.67 miles in the southbound direction and 11.20 miles in the northbound direction.

The left shoulder width on southbound IS 270 will be reduced from 10 ft. to 8 ft. from MD 121 to Ridge Road (2.65 miles) as well as Middlebrook Rd to Game Preserve Rd (1.33 miles) due to a narrower roadway section. The deficient shoulder width would not meet AASHTO recommendations for a distance of 3.98 miles in the southbound direction only.

Finally, the left shoulder would be reduced to less than 4 feet in three locations where a 2-lane section is provided:

- Northbound Local IS 270 at W. Gude Drive
    - The existing left shoulder width of 3.5 feet will be reduced to 1.0 to 2.0 ft. for a distance of 600 ft.
- Northbound Local IS 270 at IS 370 Ramp 5
    - The existing left shoulder width of 3.0 ft. will be reduced to 2.0 ft. for a distance of 130 ft.
- Southbound Local IS 270 at MD 28
    - The existing left shoulder width of 3. 0 ft. will be reduced to 1.0 ft. for a distance of 750 ft.

c. Design Constraints

The roadway typical section within the limits of the design exception is restricted on outside shoulder by right of way (region is urban with significant development) as well as existing topography which includes both steep cut and fill slopes. Any widening of IS 270 may require construction of retaining walls and would likely impact adjacent right of way, utilities, and environmental features. Widening would necessitate the construction of stormwater management

(SWM) facilities due to the creating of additional impervious. Additional impacts to right of way and environmental features would most likely result. An environmental delineation is necessary to determine if any environmental impacts exists; however, a review of aerial imagery shows streams, major tree coverage, and potential wetland adjacent to the roadway.

d. Design Exception

We recommend that a design exception be considered for the reduced inside and outside shoulders widths along the noted limits of IS 270 Mainline and Local. Crashes related to congestion, such as rear end crashes, would be reduced by adding capacity via hard shoulder running, offsetting any negative safety impacts caused by the narrow shoulder width. Employing this PTC would be an implementation of Practical Design by adding a full traffic lane during the AM peak to address the project goals of mobility and safety without widening of the existing paved shoulder, regrading of the adjacent side slopes, reconstruction of the existing drainage system and traffic barrier, construction of retaining walls, SWM, tree impacts, possible right of way, utility, and environmental impacts, or other incidental items that do not effectively advance the project goals.

For the “deficient” 8 ft. left shoulder width, AASHTO’s 2016 “A Policy on Design Standards-Interstate System” states that “The geometric design standards used for resurfacing, restoration, and rehabilitation (3R) projects may be the AASHTO Interstate standards that were in effect at the time of original construction or inclusion into the Interstate system.” While this project is not technically a 3R project, the scope of the project is far less than that of a new construction, reconstruction or widening project, and therefore using this statement in AASHTO to use a previous version of the Interstate Standards would seem acceptable. Previous versions of AASHTO’s Interstate standards had softer language for the left shoulder width along a 6 lane wide section of interstate, and only stated that a 10 ft. wide left shoulder “should be provided.” It was not a “shall” statement as it is now.

e. Proposed Mitigation

Improved signing and pavement markings will be used to mitigate for the potential safety impacts. Specific strategies provided in FHWA’s “Mitigation Strategies for Design Exceptions” guide that will be implemented include:

- Improve Ability to Stay Within the Travel Lane:
    - Enhanced Pavement Markings
        - Raised Pavement Markings and/or
        - Recessed Pavement Markings

- Roadside Delineators
- Improve Ability to Recover if Driver Leaves the Lane:
  - Safety edge
- Reduce the Crash Severity if the Driver Leaves the Roadway
  - Clear Recovery area, where feasible
  - Traversable slopes, where feasible
  - Breakaway safety hardware
  - Barriers where appropriate
- Provide Pull-off areas where Shoulder Width is Limited
  - Multiple turnouts will be constructed

Stopping Sight Distance – Horizontal Curves

a. AASHTO Design Criteria

AASHTO's 2016 "A Policy on Design Standards – Interstate System" defers to the current edition of AASHTO's Green Book. Page 3-4, Table 3-1 of the 2011 AASHTO Green Book recommends that the Stopping Sight Distance (SSD) for a road with a 60 mph design speed be greater than 570 ft.

b. Proposed Condition

The proposed reconfiguration would restripe the existing available pavement to provide a 12 ft. right shoulder within the noted limits. During part time shoulder use, however, the right shoulder would become a 10.5 ft. traffic lane with a minimum offset width of 1.5 ft. In locations where f-shape barrier abuts the right shoulder, during part time shoulder use the horizontal sight line offset for that lane would be reduced to 6.75 ft. Deficient stopping sight distance will occur at all curves with a radius of horizontal curve ≤ 6015 ft (for 60 mph design speed) and a concrete barrier directly adjacent to the shoulder.

c. Design Constraints

The roadway typical section of southbound IS 270 from MD 109 to MD 121 is restricted along the outside shoulder by existing topography which includes both steep cut and fill slopes. Any widening of IS 270 may require construction of retaining walls and would likely impact adjacent right of way, utilities, and environmental features. Widening would necessitate the construction of stormwater management (SWM) facilities due to the creating of additional impervious. Additional impacts to right of way and environmental features would most likely result. An environmental delineation is necessary to determine if any environmental impacts exists; however, a review of aerial imagery shows streams, major tree coverage, and potential wetland adjacent to the roadway.

d. Design Exception

We recommend that a design exception be considered for stopping sight distance at all locations where the existing horizontal curve does not provide a sufficient horizontal sight line offset due to the location of existing traffic barrier. Crashes related to congestion such as rear end crashes would be reduced by adding capacity via hard shoulder running, offsetting any negative safety impacts caused by the deficient stopping sight distance. Although a driver will be unable to detect a 2-ft. high object in the roadway due to the 34 inch high f-shape barrier height, a driver will still be able to see any stopped vehicles along the curve sections with sight distance. Additionally, employing this PTC would be an implementation of Practical Design by adding a full traffic lane during the AM peak to address the project goals of mobility and safety without widening of the existing paved shoulder, regrading of the adjacent side slopes, reconstruction of the existing drainage system and traffic barrier, construction of retaining walls, SWM, tree impacts, possible right of way, utility and environmental impacts, or other incidental items that do not effectively advance the project goals.

e. Proposed Mitigation

Active Traffic Management (ATM) devices such as Closed Circuit Television (CCTV) Camera and System Detection will be used to mitigate the potential safety impacts. CCTV Cameras will be installed along IS 270 to provide complete coverage of the corridor and will be used to automatically detect a stopped vehicle or hazard in the shoulder. The Hard Running Shoulder will be reviewed before opening the shoulder for part-time use and monitored continuously during operations to ensure the curves with deficient sight distance are kept clear from obstructions. The cameras will also accommodate quicker and more accurate incident detection, confirmation and monitoring as well as allow for more effective travel information dissemination. Remote Traffic Microwave Sensors (RTMS) and detectors will be installed along the mainline and ramps to provide enhanced travel information and better incident detection and management.

Together, these ATM tools will improve mobility by allowing greater traffic detection, monitoring, and motorist information. They will improve safety through better incident detection and management. They will provide real time detection of objects or obstructions on the roadway within areas of deficient stopping sight distance and deliver real time notifications to drivers.

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 28, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 17 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 14, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract.
2. Page 1, Section A, Description: The PTC is unclear regarding whether these sections will be instrumented to support dynamic shoulder use or not. Statements such as "If static shoulder use is implemented…" does not indicate a firm commitment by the Design-Builder. As noted in Article XII.B of the RFP (first paragraph), no consideration will be given to tentative or ambiguous commitments. From an incident management perspective, we would encourage ATM instrumentation, and would like to know 1) How these elements would be coordinated with the other portions of the managed motorway system (since the operational characteristics would be different), and 2) the proposed deployment of ATM devices in these sections.
3. Page 1, Section A, Description: Shoulder use without dynamic control in these sections is a feasible option; however, we would offer the following input on the impact of constrained shoulder geometry without any additional ability to manage the lanes. The proposal should address alterations to operational procedures that might be necessary. Changes to shoulder areas will influence traffic incident management in the following ways:
    a. Providing a safe buffer zone for emergency responders. Full shoulders provide a work area for emergency responders which, by vehicular regulation and driver behavior, motorist don't use. Positive guidance and physical barriers (e.g. cones) will be the only protection in a normally traveled lane (i.e. hard shoulder).

b. Use as a staging area for vehicle recovery. In Maryland, by policy and regulation in support of the towing and recovery industry, public agencies only relocate damaged and disabled vehicles to the shoulder, to stage them for final removal by industry towers. Limited shoulder availability would likely require new policies and procedures to minimize the blockage time impact while preparing for private towers to arrive.
c. Access to the incident scene. The CHART patrols, in Maryland, function as an extension of staff for the Maryland State Police, in the area of Traffic Incident Management. However, CHART patrols are not enforcement vehicles and do not have the authority of a "blue light" (police) or a "red light" (fire and rescue) emergency responders in traveling through traffic (even though they are equipped with lights and sirens). Consequently motorists may, or may not, yield right of way to CHART vehicles.
d. Impacts of more complex incidents. Procedures and impacts need to be analyzed and addressed for more complex incidents that require more complex recovery procedures and other public safety impacts. Some of these complicating factors include: heavy/large vehicles, injuries, hazardous materials, fires, criminal activities, significant debris (e.g. a load of mulch) etc. Each of these scenarios requires different personnel and equipment on scene: fire trucks, ambulances, police vehicles, heavy equipment, etc. Shoulders provide the additional geometry to stage and maneuver these resources.

4. Demonstrate how incident management will be handled in a static hard shoulder running (HSR) context.
5. Page 1, Section A, Description: For the emergency turn outs, is the length, minimum of 110 feet, sufficient for recovery of semi-tractor trailer combinations or oversized loads? How were the dimensions of the emergency turn outs determined?
6. Typical Sections: The CD road section has no usable shoulder for incident response and management, and the mainline sections have only median side shoulders, which are less useable than the outside shoulder for incident management activities. Please refer to the potential impacts of lane utilization for incident management described above.
7. Page 5, Section D, Potential Impacts, User Impacts: The sections with significantly reduced shoulder geometry will lose a location to stockpile snow during winter storm operations. The PTC should address mitigation strategies for this impact.
8. Page 8, Section F, Administration Risk: Although we recognize this section is simply listing potential risk areas, it would be good to have a better understanding of how much this concept would depend of "Additional Law Enforcement," since that would be the decision of another agency, and is a resource that has been historically difficult to obtain.

9. Design Exception, Page 9 e. Proposed Mitigation: The PTC describes the following: "CCTV Cameras will be installed along IS 270 to provide complete coverage of the corridor and will be used to automatically detect a stopped vehicle or hazard in the shoulder." Given the description of the part-time hard shoulder running operations that follows in the PTC, we agree that automatic detection of stopped vehicles would facilitate the safe transition from shoulder to traveled lane; however, some description of how the cameras will be used for automatic stopped vehicle detection needs to be provided (video analytics?)
10. For HSR utilizing the outside shoulder, please describe the Design-Builder's proposed treatments of auxiliary lanes at interchanges. A typical plan view layout may facilitate comprehension of the Design-Builder's approach.
11. Typical Sections: Some typical sections show a 6% cross slope for the HSR. Are these typos?
12. Typical Sections: Some typicals show flattening the existing cross slopes adjacent to concrete traffic barriers for part time shoulder use. Concrete traffic barriers have some flexibility to add overlays, but if previous overlays have used that flexibility, flattening the cross slopes for HSR may reduce the barriers heights to less than acceptable. Please elaborate on this topic. Should concrete traffic barrier heights be insufficient, what does the Design-Builder propose? Does the Design-Builder know if the flatter cross slopes will create an issue? If not, will this be a Design-builder risk and how will the Design-Builder mitigate that risk?
13. Typical Sections: Closed sections with a 1.5-foot buffer between the HSR and concrete barrier will sometimes have inlets encroaching into the travel lane. Is there a cost-effective solution to this issue? Please address.
14. Typical Sections: The southbound typicals from END OF SB LOCAL TO 700 FT SOUTH depict an existing 10-foot shoulder; however, the survey shows this width being highly variable, mainly due to the slips ramps on and off of the CD road. Is the proposed typical practicable?
15. Please state whether the intent is to have the HSR operational during rain events or not.
16. As noted, this PTC will require design exceptions. More detailed information related to impacts and costs of fully meeting AASHTO requirements, potential impacts to safety and operations for implementing the design exception, and mitigation, if any, which would be implemented as a result of the design exception will be required for formal approval. The design exception(s) and safety analysis must be approved prior to establishing a CAP.
17. Page 9, Design-Builder Risk: Please note that all design exceptions are signed by SHA's Director of the Office of Highway Development. The FHWA has delegated authority to the State, which expedites the design exception approval process.
18. If the VISSIM models are used to demonstrate the benefits of this concept, document all assumptions.

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

PTC No.: 18 – Watkins Mill Interchange – Proposed Modifications to Existing Plans	Date Submitted: November 14, 2016
Related Disciplines: Highway, H&H, Traffic, Pavement/Geotech	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

The purpose of this PTC is to describe changes that would be recommended to the I-270 at Watkins Mill Interchange that is currently funded for construction and is expected to re-advertise in 2017.

The improvements that the Corman Team proposes for the IS 270 corridor through the IS 270 ICM project are expected to relieve congestion, improve throughput and reliability, and make the project corridor safer regardless of what is proposed at the I-270/Watkins Mill interchange. However, there are some minor revisions to the design that would coordinate the designs of the two projects and create a more seamless implementation of both projects. With similar construction timeframes, coordination is key so that the public is not adversely affected by construction or needless rework due to uncoordinated project designs.

Below are some minor revisions to the Watkins Mill interchange we would recommend to coordinate the design of both projects:

- Shoulder Width: The Corman Team is considering implementing Hard Shoulder Running (HSR) throughout the limits of the Watkins Mill Project. To allow for implementation without restriping during the IS 270 ICM Project, the Watkins Mill project could provide 12 ft. wide shoulders in the advertised plans. There are two ways to accommodate this request:
    - Widen an additional 2 ft: Currently proposed widening in the Watkins Mill Interchange project along the northbound lanes allows for a 10 ft. shoulder. An additional 2 ft of widening would create the 12 ft. shoulder without sacrificing lane or left shoulder width. The widening would be required from station 254+84 to station 271+00 along the NB roadway. No additional widening would be required along the SB lanes as they are already proposed to be 12 ft. or wider. For the remaining limits at the north and south ends of the project, where no widening is required as part of the project, reconfiguring the striping plan to allow for the 12 ft. outside shoulder should be performed.

      The additional width may trigger additional stormwater management and would require shifting w-beam barrier and the location of a proposed concrete barrier. Impacts to an existing telephone line would need to be evaluated, and if impacts cannot be avoided, than the following option would receive preference.

- Reconfigure lane/shoulder widths within proposed pavement width: To avoid the additional widening between station 254+84 to station 271+00, reconfiguring the striping plan to narrow the 4 general purpose lanes by ½ ft. each, or narrowing the inside shoulder from 10 ft. to 8 ft. could also allow for the necessary width.

- Shoulder Cross-slope: The right shoulder cross slope should be adjusted to match the lane adjacent to it, or at least minimize the amount of shoulder roll-over. This will allow for a safer transition between through lane and hard shoulder running.

- Re-Align the SB On Ramp: A minor horizontal change to this ramp to allow for a better and safer merge area when HSR is in affect would be a recommended change. To accomplish this without widening or utility impacts, decrease the radius of the curve on the ramp upstream, and soften the radius near the gore area of the ramp. This will allow for a smaller approach angle for an entering vehicle, making it easier to see a gap in traffic along the HSR.

  Additional widening in this location to allow for additional merge area during HSR is not recommended due to the impacts it would have on the proposed plans of the Watkins Mill Interchange and the likely utility impacts that would be incurred. An existing concrete barrier which was not going to be impacted would need to be shifted and would likely impact existing electric and telephone lines adjacent to IS 270. We believe the currently proposed pavement width can be safely utilized with just minor changes to the alignment.

- Revise cross-slopes of I-270 NB and SB On Ramps: For a better merge area with a HSR section, it would be advisable to match the shoulder cross-slope, or at least minimize the shoulder roll-over, to the lane directly adjacent near the gore area of an entrance ramp. Without a shoulder roll-over, the right shoulder adjacent to the ramp and auxiliary lane can be better utilized to extend the merge area while HSR is in effect.

  Additional widening at the gore area of the NB On Ramp to allow for additional merge area during HSR is not recommended due to the impacts it would have on the proposed plans of the Watkins Mill Interchange. A proposed retaining wall would need to be shifted which is a major change in design, requiring significant rework. We believe the currently proposed pavement width can be safely utilized with just minor changes to the cross-slope.

- ATM/ITS: As part of our ATM/ITS plan, multiple devices are anticipated to be installed within the limits of the Watkins Mill Interchange, including multiple detectors of varying types, ramp meters, lane use control signs, wireless antennae, and CCTV cameras. The incidental infrastructure for to these devices will include conduit, manholes, hand-holes, pull-boxes, gantries, cantilever signs, pedestal poles, and cason foundations. These types of infrastructure should be installed with the Watkins Mill Interchange project so ensure that they are not impacted by the more intrusive construction anticipated with the project. In addition, as the Watkins Mill project is currently completing design, it is expected to reach construction first and it makes sense to install conduit and other items while the ground is exposed for the project instead of trenching through newly placed pavement and infrastructure.

To coordinate designs, simply upsizing currently proposed conduit or utilizing proposed electric runs in some locations may be sufficient. Also, upsizing proposed sign structures to accommodate the additional lane use control signage could be allowable. Proposed lighting coverage looks to be sufficient at gore areas to provide for a safe use of dynamic HSR; however, extending the limits slightly may prove beneficial to increase safety at neighboring interchanges at a minor cost. Further evaluation will be necessary to finalize the coordination effort between these designs.

It is also understood that through the Practical Design Review process, the interchange configuration at Watkins Mill went through some major changes and entrance ramps were removed and traffic is expected to utilize existing entrance ramps to access IS 270. The Corman team understands the reasoning behind the reconfiguration; however, we also understand the political and public pressure MDOT and SHA is under to return the interchange configuration to its previous design. Implementation of our PTC 12 – Australian Managed Motorways Concept would allow for these entrance ramps to be constructed without adversely affecting traffic operations along IS 270. The only caveat would be to install the infrastructure as part of the Watkins Mill project for the proposed ramp metering we would recommend to implement the Managed Motorways concept in the ICM project..

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

As discussed above, these improvements would be implemented as part of the I-270 Watkins Mill project, within the limits of said project.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

Implementing this PTC directly attributes to the advancement of the Well-Managed Project goal of this project. It would also allow the Watkins Mill project to be more compatible in a safe and efficient manner with the IS 270 ICM project.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: By implementing this PTC, user impacts are minimized by decreasing the amount of re-work needing to be performed due to better coordination between these two project's designs.

ii. Right-of-Way Impacts: There are no Right of Way impacts attributable to this PTC. The minor widening and associated SWM should be able to be accomplished within the existing ROW available to the Watkins Mill Interchange.

iii. Geotechnical Impacts: There are no geotechnical impacts associated with implementing this PTC.

iv. Utility Impacts: Utility Impacts can be avoided given the various options provided above. If the widening option is considered, impacts to a telephone line would need to be evaluated.

v. Environmental Impacts/Permitting: There are no environmental impacts or permitting concerns associated with this PTC, with the exception of possible additional SWM if widening is considered.

vi. Impacts to Local Communities: Impacts to local communities are minimized by implementing this PTC.

vii. Safety Impacts: Implementing this PTC will create a safer final alternative for the IS 270 ICM project because there would be minimal lane striping eradication required, and pavement cross-slopes would be designed to consider the merge areas of HSR.

viii. Life-cycle Project Costs: There are no additional life-cycle project costs associated with implementing this PTC.

ix. Infrastructure Costs: This PTC would decrease the infrastructure costs within the IS 270 ICM budget, but would transfer the costs to the budget for the I-270 at Watkins Mill Interchange Project.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

This PTC is not recommending improvements that are outside of the scope of a regular paving or ITS project.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

The only risk to the Administration is if this PTC is not implemented. The public perception of restriping newly laid pavement, or tearing up new pavement to install conduit would not be favorable and would be a risk to the administration.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

A risk to the design-builder would be that we would need to advance our design in the vicinity of Watkins Mill very quickly to incorporate the changes required from our project within their advertised set of plans. By rushing design, mistakes can occur or it may not be fully thought through creating errors in the constructed improvements and inconsistencies between the projects. This risk can be mitigated by advancing the design responsibly and performing multiple QA/QC checks to ensure everything is incorporated.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

Implementing this PTC will advance the project goals at a minimal cost and would advance the schedule because certain aspects of the IS 270 ICM project would be constructed by the I-270 Watkins Mill Contractor.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*

N/A

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 28, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 18 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 14, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. Generally, the concept appears to be a reasonable solution to address the goals of this contract.
2. Page 2, Section A, Description, ATM/ITS: The PTC is non-committal regarding whether this interchange will be instrumented with ATM/ITS infrastructure devices or not. As noted in Article XII.B of the RFP (first paragraph), no consideration will be given to tentative or ambiguous commitments. If included in the Technical Proposal, this should be clarified.
3. These improvement would be considered a Type I project and require a noise analysis and appropriate mitigation as required by the SHA Noise Policy and the Code of Federal Regulations. As per the requirements of the Request for Proposals, the Design-Builder would be responsible to complete the noise study to allow a final determination to be made on the reasonableness and feasibleness related to noise abatement.

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

My telephone number/toll-free number is 410-545-8800 or 1-888-228-6971
Maryland Relay Service for Impaired Hearing or Speech 1.800.735.2258 Statewide Toll Free

Street Address: 707 North Calvert Street • Baltimore, Maryland 21202 • *Phone* 410.545.0300 • www.roads.maryland.gov

PTC No.: 19 – Public Outreach Plan	Date Submitted: November 16, 2016
Related Disciplines: Communications, Traffic	Corman Construction

A) Description: *Detailed descriptive information and other appropriate information as appropriate such as conceptual drawings, production details, standards, specifications and traffic operations analysis.*

Background

The MD State Highway Administration (SHA) is well known for having a robust public outreach program that seeks to educate and engage communities early in the planning process for large scale engineering projects. Corman Construction, Inc. has a long history of performing Design/Build work in Maryland for SHA and understands and respects the effort that SHA has taken to build trust with the communities throughout the state for various transportation projects using innovative solutions. This trust has been the result of staying on the cutting edge of technology and transportation research while engaging and educating the public affected by SHA projects along the way. We understand how essential it is to continue this relationship for this unique project and will take appropriate steps to use effective modern as well as traditional strategies geared to the specific project at hand to keep the public educated on and informed about the proposed solutions to congestion management that the Corman team will undertake.

SHA has requested proposals from Design/Build teams to develop a series of recommendations that will improve congestion and safety on the I-270 corridor through Montgomery and Frederick Counties. This concept offers a unique opportunity for the Corman team to combine solutions that have worked elsewhere across the nation and globe, and implement them along this challenging corridor to offer real change that can improve the lives of the locals and the commuters who need to traverse this corridor regularly. Some of the solutions the Corman team may propose could require introducing a new concept to the region which can be bolstered by educating the public on how driving behaviors need to change to realize the full traffic improvement along the corridor. This need for an educational component is matched with the need to provide the information to the largest segment of users possible in the most cost effective method possible.

Public Outreach Requirements

As part of this process, the Corman team will need to follow the standard practices used throughout the National Environmental Policy Act (NEPA) which seeks to make the public aware of changes to public facilities that may affect individuals and communities. Since the final environmental document that will be required as part of this project is unknown until all the improvements have been vetted by SHA, the team wants to be certain that the outreach to the community exceeds the minimum requirements of this law.

Public Outreach Approach and Education

The sheer length of the corridor will make reaching all the users of I-270 a unique challenge. While traditional outreach methods employed by SHA will be part of a larger strategy, more creative methods will be used to maximize the public participation in this process within current budget constraints.

Traditional outreach would include identifying key stakeholders based upon their use of or proximity to the improvement, assembling them in a local gathering place, preparing meeting boards or a public presentation and bringing experts from the project team to the room to answer any questions attendees may have. This process can be marginally successful if there is decent attendance from a very active community willing to take on the added responsibility of sharing information with their neighbors who are unable to attend the meetings for themselves. Our approach to reaching users will build upon this traditional method and advance it into the 21st century.

The primary stakeholders that we are trying to engage in this effort are the users traveling along the roadway from destinations in Carroll, Frederick and Montgomery Counties to locations in southern Montgomery County, Washington DC, and Northern Virginia. Our team will still work with SHA to prepare meeting materials that explain each technical concept being employed along the corridor, the operation theory behind it, and the benefits that can be realized if used as directed. We will describe how the combination of a few methods in a stretch of roadway can create a corridor improvement that can aid in the commute for drivers between certain interchanges along the corridor and for those users that traverse the entire corridor. This education component is a key feature of our plan as it will attempt to influence user behavior and improve the efficacy of the proposed improvements.

We will coordinate with SHA's Community Liaisons for District 3 and District 7 and host an informational outreach meeting along the corridor. During the meeting, we will provide a presentation that explains our improvements along the corridor, illustrates how new concepts need to be used, and allows our design experts to answer questions raised by attendees. These meetings will occur early in the process and provide our outreach team with the information needed to better refine the presentation for inclusion on a series of webinars to be hosted live and placed on the project website. These "Lunch with Us" live webinars will allow participants to submit questions using a variety of methods (webinar direct messaging, Facebook, twitter, and via prior email submission) and have answers provided by our project team. Our team will attempt to answer all questions during the live sessions but will also make any amendments to answers available on the project website later. This strategy is being implemented specifically to allow our team to reach the many users of the corridor who may not be able to attend public informational meetings held by the project team. It also increases the potential community participation by allowing users to access the project information at any time during the process.

We recognize that stakeholders on this project may be difficult to meet in person because of the size of the corridor and plan to use our webinar series as a way of keeping them engaged. Prior to the start of preliminary construction activities, the outreach team will begin the process of actively engaging with the design team to gain an understanding of new concepts to the region, maintenance of traffic needs, and other construction plans to begin developing messaging for the traveling public. This information will be used to develop strategies that can best resonate with the various users of the corridor and will continue for the duration of the project. Since we know that our strategies will require both large scale presentations and smaller, more targeted meetings with local leaders, the messages will be appropriately tailored so that each group can gain a full understanding of the upcoming construction. These sessions will be planned to engage the users as early in the process as possible and continue regularly to keep updates available to the public as the project moves through to construction.

Our outreach plan will go above and beyond just providing information on the project status, schedule and construction activities. With the advanced technology and innovative devices and strategies necessary to implement the Australian Managed Motorways concept (please refer to our PTC 12) along the corridor, education on how to properly use the new devices, strategies, and lane configurations is vastly important. Our outreach plan will include educational materials available to anyone interested to explain the devices and concepts, why they were implemented, and what the user should expect when approaching the new improvement.

One unique strategy that we will employ is involving young drivers into the process. We will work with the audio-visual department of a local high school to teach them about specific traffic control devices being proposed and then ask them to help our team create instructional video clips to be placed on our website and YouTube. These clips will teach new drivers how to use these devices effectively and safely, ultimately leading to improved congestion conditions along the corridor.

During construction, it is imperative that all users understand exactly what construction activities are underway and that there may be other routes to use that can minimize delays during construction. We will place a major emphasis on planning alternative travel routes, encouraging teleworking with local businesses, sharing information on the times that construction may most impact travel, and being good stewards of safety to those who are less protected in the construction zones.

Our efforts to reach these users and the information we need to share are more related to being good neighbors to the local community and having patience as we move to improve the corridor. Sharing this message will require a marketing component that is different than for other SHA projects. Our team will develop a comprehensive notification package that includes: roadway signs with safety messages to protect roadway workers, variable message boards notifying of expected travel delays, detour routes to common destinations, and other similar notification tools.

Public Outreach Elements

1. Identify Key Stakeholders and develop list of contact information
    a. Develop comprehensive list of communities/stakeholders that had prior communication with various projects along the corridor
        i. Roadway users
        ii. Community associations/leaders
        iii. Property owners/renters
        iv. Business owners/Developers
        v. Elected Officials
    b. Solicit and record stakeholder contact information
        i. Email addresses
        ii. Mailing addresses
        iii. Twitter/Facebook handles
    c. Create and disseminate a QR Code to direct the public to web page and social media
    d. Create and maintain a database of project stakeholders
2. Coordinate with SHA to develop and implement a Public Outreach Plan
    a. Create Public Outreach Plan to guide outreach for project duration
        i. Develop appropriate strategy for interactions with each stakeholder type/group
        ii. Determine preferred mechanism for sharing information with public/stakeholders
3. Develop public outreach materials
    a. PowerPoint Presentations should include:
        i. Background information
        ii. Description of all improvements that are proposed along the corridor

            1. Australian Managed Motorways and Coordinated-Adaptive Ramp Metering
            2. ATM/ITS strategies and Devices
            3. Hard Shoulder Running
        iii. Voiceover, so that it can be viewed outside of formal meetings
        iv. Video clips illustrating the use of improvements
        v. Benefits achieved by implementing strategies on other projects
    b. Meeting Boards should include:
        i. Project Corridor
        ii. Information on each strategy and improvement
        iii. Description of how strategies combat congestion and improve safety
        iv. Illustration of traffic data and benefits expected
    c. Create fact sheets for stakeholder groups and subject matter concepts
        i. Each strategy and explanation of how it works to combat congestion and improve safety
        ii. Young drivers
        iii. Experienced drivers
    d. Frequently Asked Questions document
    e. Video clips with YouTube links from the Project Website
        i. Illustrating how to use transportation improvements
        ii. How new concepts have functioned elsewhere (Australian Managed Motorways)
4. Coordinate with SHA to respond to inquiries and comments regarding the project during planning, design and construction
5. Create a project website with relevant project background and construction information
    a. Post relevant project background information
    b. Advertise public meetings and webinars
    c. Share fact sheets, FAQs, informational video clips, YouTube Links and webinars
    d. Describe and post video clips of performance of project components implemented elsewhere
        i. Australian Managed Motorways corridor performance
    e. Share construction, maintenance of traffic, and other project information
6. Create project email address and disseminate to the public to solicit feedback

7. Host informational meeting(s) and live webinars
    a. Secure meeting locations and book meeting facilities
    b. Strategize on information to be covered/shared at meetings
    c. Schedule informational/community meetings as required
    d. Identify webinar software and advertise dates and times to public using website and social media
8. Create and implement a robust social media strategy
    a. Solicit email addresses and social media followers
    b. Share information on upcoming live meetings and webinars
    c. Push updates on project activities
    d. Advertise availability of meeting materials
    e. Share construction information

B) Location: *The locations where, and an explanation of how, the PTC will be used on the Project.*

This PTC would be applied along the entire corridor.

C) Analysis: *Justify the use of the PTC including how it advances the project goals.*

This PTC would advance the project goals in multiple ways. It would advance the mobility goal by:

a. Educating the public on how to effectively use the new lane configurations and how the new devices are expected to be used or followed is very important so that the proposed improvements function as expected from day one.
b. User will be informed on the best/worst times of day to use the corridor during construction which could reduce congestion during those timeframes.

Implementing this PTC will advance the Safety goal of this project by:

c. Reminding the community to avoid distracted driving and speeding in construction zones thereby protecting workers.
d. By educating the public on the new lane configurations and the new devices, it is more likely that they will use the corridor with the improvements as intended and in a safe manner.

The inclusion of Public Outreach would advance the well-managed project goal by:

e. Preventing the community from having strong opposition to the project, elevating it beyond the Administration and ultimately lead to intermittent or permanent halting of the project.

f. Maintaining good communication with the public, communities, users of the facility, and elected officials is key to managing a project well and will reduce the possibility of issues cropping up as the project progresses.

D) Potential Impacts: A *preliminary analysis of potential impacts (both during and after construction) including but not limited to user impacts, right of way, geotechnical, utilities, environmental permitting, local community, safety, and life-cycle project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation.*

i. User Impacts: This PTC would only have positive impacts on the users of the corridor. The users would be well educated and informed on current happenings on the project and would better understand how to use the project improvements after construction.

ii. Right-of-Way Impacts: There are no Right-of-Way impacts associated with this PTC.

iii. Geotechnical Impacts: There are no geotechnical impacts associated with this PTC.

iv. Utility Impacts: There are no utility impacts associated with this PTC.

v. Environmental Impacts/Permitting: This PTC would assist in getting NEPA approval by completing the required public outreach and keeping all parties including permitting agencies updated on the project. No other environmental or permitting impacts are expected.

vi. Impacts to Local Communities: This PTC would only have positive impacts on the local communities. Community members would be well educated and informed on current happenings on the project and would better understand how to use the project improvements after construction.

vii. Safety Impacts: This PTC would have positive impacts on safety along the corridor by reminding the community to avoid distracted driving and speeding in construction zones thereby protecting workers. Additionally, by educating the public on the new lane configurations and devices proposed, it is more likely that they will use the corridor with the improvements as intended and in a safe manner.

viii. Life-cycle Project Costs: No change in life-cycle project costs are anticipated by implementing this PTC.

ix. Infrastructure Costs: There are no infrastructure costs associated with implementation of this PTC.

E) Other Projects: *A description of other projects on which the PTC has been used, the degree of success or failure of such usage, and the names and contact information (including telephone numbers and email addresses) of project owner representatives who can confirm such statements.*

The public outreach methodology identified here has been used successfully on several SHA Design-Build Projects by members of this team including the construction of MD 200 (Intercounty Connector) and is currently being used on the MD 210 Kerby Hill/Livingston Road project.

F) Administration Risk: *A description of risk to the Administration or third parties associated with implementing the PTC.*

The inclusion of a comprehensive public outreach program is essential in minimizing the Administration's risk of opposition from the adjacent communities and users of the corridor.

- The Administration has worked hard to develop strong relationships with the communities in Montgomery and Frederick Counties. SHA has provided the public with multiple opportunities to share thoughts and make comments on improvements that are planned on SHA facilities prior to implementation. The loss of this access to coordinate with SHA could jeopardize some of this hard-earned public trust.
- If the Administration and its agents do not educate the public on how best to use the traffic control devices that have been identified for use on the corridor, some of the mechanisms may not work as effectively as predicted. This could lead to overall dissatisfaction from the traveling public about the success of the unique program being implemented to improve congestion on the corridor.

G) Design-Builder Risk: *A description of risk to the Design-Builder associated with implementing the PTC.*

By implementing this PTC, the Design-Builders risks are the same as the Administrations. Implementing this PTC will only minimize risk.

H) Cost/Schedule Benefits: *Discussion of any cost or schedule benefits to this contract from usage of this PTC.*

Implementing this PTC will help to deliver this project on schedule and within budget by minimizing the risk of public opposition to the project and reducing the likelihood of delays associated with complaints and negative feedback during the NEPA phase.

I) Miscellaneous: *Any additional information that would assist the Administration in the review of this PTC*

N/A

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

November 28, 2016

Louis Robbins, P.E., DBIA
Corman Construction
12001 Guilford Road
Annapolis Junction MD 20701

Dear Mr. Robbins:

The Maryland Department of Transportation's State Highway Administration's (SHA) is in receipt of Proposed Technical Concept (PTC) No. 19 for the I-270 Innovative Congestion Management Progressive Design-Build contract (Contract No. MO0695172), submitted by your Design-Build Team on November 14, 2016. The SHA has completed our review of the PTC and offers the following comments for your consideration in the further development of your technical concepts and proposal:

1. The I-270 concepts presented by your team will introduce entirely new traffic control patterns and devices for many local travelers in Maryland. The impacts on driver expectation, outreach and education should be and are considered by this PTC, which generally appears to be a reasonable solution to address the goals of this contract.
2. As noted in the PTC, the Administration will take the lead on public outreach, and the plan will need to be further developed and finalized after Notice to Proceed.

Any questions or communications regarding the response to this PTC should be directed to Mr. Jason A. Ridgway, Director, Office of Highway Development at the project specific email address, MO069_IS_270@sha.state.md.us.

Sincerely,

Jason A. Ridgway, P.E.
Director, Office of Highway Development

cc: Jo Ellen Sines, DBIA, Corman Construction

Microsurfacing Memo

MEMORANDUM

To: Mr. Lou Robbins, P.E.

From: Parsons Brinckerhoff

Date: January 5, 2017

Project Name: I-270 Congestion Management

Subject: Microsurfacing Longevity Assessment

Introduction

As part of the IS 270 Innovative Congestion Management Project, the Corman team proposes to use microsurfacing paving as the final surfacing for the completed roadway where lane restriping is required and complete eradication of any temporary or permanent line striping is required without leaving scarred pavement or "ghost markings." Microsurfacing provides a cost effective, durable wearing surface and will completely cover any remnants of temporary or permanent striping that has been eradicated.

Upon review of the Proposed Technical Concept to utilize microsurfacing in this capacity, SHA responded with a single comment:

1. *"Generally, the concept appears to be a reasonable solution to address the goals of this contract; however, after NTP the Design-Builder will be required to perform pavement structural and functional analysis in accordance with the MDSHA pavement and geotechnical design guide and demonstrate that Microsurfacing provides at least a 7-year life extension (mid-point of the design range of 4-10 years shown in the design guide)."*

The following information has been prepared to assist in addressing this one comment received.

Comment Follow-Up

Concerns were raised by the Corman team that SHA's comment requested "structural" analysis to determine if Microsurfacing provides at least a 7 year life extension. Microsurfacing is a surface treatment that provides the following benefits:

- Seals the pavement surface, reducing water infiltration;
- Improves skid resistance versus the existing, worn pavement surface;
- Corrects minor surface irregularities including rutting and minor cracking; and
- Extends the pavement life by 5 to 7 years on average.

What microsurfacing does not provide is additional pavement structural strength. As a surface treatment, it should *not* be rated based on the criteria to improve a section of pavement structure. With this knowledge, the Corman team responded to SHA via email on December 27, 2016:

"We are in receipt of the comment in your reply to our PTC# 11 dated November 17th (attached) in which you state "*demonstrate that Microsurfacing provides at least a 7-year life extension*". We wish to point out the purpose of the Microsurfacing is not to improve the structural life of the existing pavement system – it is being utilized in this case to solely cover the eradiated traffic lines that will no longer be required and to prevent ghost markings. Structurally upgrading the existing roadway for an additional 7 years is not within the intent of this PTC or part of the overall project scope which is to reduce congestion and improve safety and mobility. We believe your intended comment was that the Microsurfacing must last approx. 7-years as that is the approx. duration between typical overlays of Interstate Highways in Maryland. The existing pavement on IS-270 does not currently exhibit any distress or appear to be in need of strengthening. Should the project scope be expanded to include strengthening the existing roadway structure for a 7 year life extension please provide the desired limits of strengthening and notify all proposers of this change in scope."

Longevity

Parsons Brinckerhoff performed research to identify what the expected life extension should be. Most documentation refers to a 5 to 7 year life expectancy. To verify this information, we interviewed multiple nearby state Department of Transportations to verify their experience with using Microsurfacing.

The Virginia Department of Transportation has implemented microsurfacing on I-66 and I-81 to great success. They have found that a typical life expectancy is about 3 to 8 years. The Tennessee Department of Transportation supported the same findings. A typical life expectancy for Tennessee's projects depended on the thickness of the lift. It was found that 7 years was the average for 3/8" thickness, while 8 years was the average for ½" thickness. SHA's own Pavement Preservation Guide refers to a 4-10 year typical life extension and is successful on both low-and high-volume roadways.

Conclusion

All DOT's who have applied the microsurfacing treatment confirm that it is a low cost alternative to upgrading the surface of a roadway. It does not upgrade the structural integrity of the pavement base though, and its longevity is heavily dependent on the condition of the existing pavement surface. SHA's guidelines suggest crack sealing and patching be included when proposing microsurfacing.

Without the necessary Pavement Condition information, the Corman team made assumptions and anticipates the need to perform minor crack sealing and patching where necessary; however, as indicated in the email response, the intent of this contract is not to correct pavement structure deficiencies. Should major deficiencies be found it would exceed our budget allotted for this item.

The location and extent of pavement surface pre-treatment will be determined after award of this contract via existing SHA data, additional corings/borings, and a pavement analysis of the existing surface.

Pavement Memo

1 East Pratt Street, Suite 300
Baltimore, MD 21202
Phone: 410-727-5050
www.wsp-pb.com/usa

MEMORANDUM

To: Mr. Matthew T. Harrell, P.E.

From: Hosam Salman, P.E., Ravi Vedantham, P.E., Robert O'Connor, P.E.

Date: January 15, 2017

Project Name: IS 270 Innovative Congestion Management Contract

Project Number: DB201510144B

Subject: Running Shoulder Pavement Assessment

Pursuant to your request, we reviewed the available geotechnical investigation and geometric improvement plans to assess the existing shoulder on I-270 in Montgomery and Frederick Counties, between I-495 and I-70.

Based on the provided documentation regarding the existing base and asphaltic concrete layers, either through plans for the original design or subsequent overlays, we divided the shoulder alignment into the following two sections, as shown below;

- Section 1; HMA 8.5" and Base 5" (from MD 109 to Father Hurley Blvd)
- Section 2; HMA 8.5" and Base 12" (from Father Hurley Blvd to the I-270/Spur Split)

The above thicknesses are approximate. The base drainage layer may be classified as crusher run or granular aggregate base (GAB). For section 1, the thickness of the base was identified based on the as-built plans while the thickness of the hot mix asphaltic concrete (HMA) was identified from the pavement core information provided. For section 2, the pavement boring information was compared to as-built information to determine appropriate assumptions for the HMA and base thicknesses.

Based on the information provided, Parsons Brinckerhoff understands that the expected average daily traffic (ADT) to be utilized on the proposed running shoulder consists of personal vehicle (light duty traffic only) of about 3,900 vehicles per day (VPD). This is about 1,300 vehicles per hour (VPH) for three (3) hours a day. For section 1, a design year of 10 years was used, while a design year of 20 years was used for section 2. Using an assumed traffic mix per AASHTO Guide for Design of Pavement Structures (1993), a design Equivalent Single Axle Load (ESAL) of 117,000 was obtained for section 1, and 204,000 was obtained for section 2 (Appendix A).

We evaluated the subgrade soil support based on the available soil information, SHA's Pavement Design Guide, and published soil survey data prepared by the University of Arizona for the National Cooperative Highway Research Program report NCHRP 9-23B (http://nchrp923b.lab.asu.edu). Based upon this data, we propose using a reasonable design Resilient Modulus (Mr) of 4,000 psi for the subgrade soil. This design value should be re-evaluated per the anticipated non-destructive pavement testing such as Falling Weight Deflectometer (FWD) or Dynamic Cone Penetrometer (DCP). The reviewed information regarding subsurface conditions is included in Appendix B.

As the existing shoulder pavement section thickness is less than the maximum frost depth penetration in this area, the design has taken into account a serviceability loss in accordance with Appendix G of AASHTO (1993) pavement design guide as explained below.

We calculated the serviceability loss due to frost impact as follows;

- Chart G-5; Seasonal Frost and Permafrost in North America, Part II, project has 30” frost depth.
- Chart G-6; Chart for Estimating Frost Heave Rate for a Roadbed Soil, Part II. Frost rate is 3 mm/day
- Chart G-7; Graph for Estimating Maximum Serviceability Loss Due to Frost Heave. Due to the existence of drainage GAB layer, drainage is considered “Fair”. With 30” frost depth, maximum serviceability loss is 0.75.
- Chart G-7; Chart for Estimating Serviceability Loss Due to Frost Heave, considering 20 years design life, 3 mm/day frost rate, 50% probability of area subject to frost heave, 0.75 maximum serviceability loss, the obtained serviceability loss due to frost if 0.3.
- From SHA pavement design input Item 9.12.03.02, the terminal serviceability = 3+0.3= 3.3.

Appendix D of this memorandum includes the calculations for serviceability loss due to frost heave in the design of the pavement structure.

The following pavement design assumptions are based upon the foregoing and the recommended parameters and minimum criteria outlined by the Pavement Design Guide (January 2015) prepared by the Maryland State Highway Administration Office of Materials & Technology. However, the design of section 1 is based on an exception to the recommended design life of 20 years. In an effort to reserve additional budget within the $100M max-price for other elements that add to the mobility and safety benefits of the corridor, we reduced the design life to 10 years for evaluating section 1, with the assumption that SHA will perform regular pavement preservation activities within the next 5 to 7 years as is typical for maintenance of interstate highways in Maryland. An additional HMA overlay layer could be included in the future, to extend the design life back to 20 years. Section 2 was evaluated based on a 20 year design life and met the structural requirements without any additional overlay or strengthening.

Pavement Design Assumptions – Section 1	
Description	AASHTO Input
Initial Serviceability	4.2
Terminal Serviceability	3.0
Serviceability Loss due to Frost Heave	0.30
Reliability	95%
Standard Deviation	0.39
HMA Structural Number (NEW)	0.44
HMA Structural Number (Existing)	0.38
Granular Base Structural Number (Existing)	0.11
Drainage Coefficient	1.0
Design ESALs	117,000
Average Daily Traffic (ADT)- light duty vehicles only	3,900 vpd
Design Life	10 years
Subgrade Resilient Modulus (Mr)	4,000 psi

Pavement Design Assumptions – Section 2	
Description	AASHTO Input
Initial Serviceability	4.2
Terminal Serviceability	3.0
Serviceability Loss due to Frost Heave	0.30
Reliability	95%
Standard Deviation	0.39
HMA Structural Number (NEW)	0.44
HMA Structural Number (Existing)	0.38
Granular Base Structural Number (Existing)	0.11
Drainage Coefficient	1.0
Designed ESAL	204,000
Average Daily Traffic (ADT) - light duty vehicles only	3,900 vpd
Design Life (years)	20 years
Subgrade Resilient Modulus (Mr)	4,000 psi

Based on the performed design and analysis, we need to achieve a structural number (SN) equal or exceeding 3.63 for Section 1, and an SN equal or exceeding 4.09 for Section 2.

Section 1 obtained an SN of 3.78 while Section 2 obtained a SN of 4.55. Both Sections are achieving the minimum required SN.

While both sections meet the required SN, a surface treatment may be considered due to other circumstances such as pavement marking or striping related purposes. Additional improvement benefits will be realized for quality ride and International Roughness Index (IRI) ratings. Appendix C includes the AASHTO (1993) design analysis for Sections 1 and 2.

The design is based on specific assumptions regarding the proposed average daily traffic of 3,900 vpd, design life of 10 or 20 years, the existing subgrade resilient modulus of 4,000 psi, base course drainage and existing HMA thicknesses. These assumptions were derived upon discussion with the design team and the

Contractor. Any change to these assumptions will be requiring pavement design re-evaluation and assessment.

We recommend an adequate field and laboratory investigation be performed to verify the subgrade design information and existing pavement and base course thicknesses. Falling Weight Deflectometer (FWD) and/or Dynamic Cone Penetrometer (DCP) should be performed as well so back-calculations analysis should be done on the pavement layers to better assess the actual subgrade resilient modulus and pavement layers.

We further understand that static signs and dynamic message systems (DMS) will be utilized to restrict traffic to light duty use only as classified per Federal Highway Administration FHWA –Traffic Monitoring Guide Class 2 and 3, Figure C-1 FHWA 13 VEHICLE CATEGORY CLASSIFICATION), and only during peak hours (3 hours per day), which is the basis of the foregoing design.

APPENDICES

Appendix A; ESAL Calculations
Appendix B; University of Arizona Soil Survey Data
Appendix C; Pavement Design Calculations
Appendix D; Supporting Data- SHA Design Tables

Appendix A

AASHTO 1993 ESAL Calculator for Flexible Pavements (A)

Vehicle Description	Traffic Volume: Quantity in the Design Lane	Traffic Volume: Days per Week	Traffic Volume: Weeks per Year	Analysis Period (years)	Axle 1 (kips)		Axle 2 (kips)		Axle 3 (kips)		Gross Weight (pounds)	Equivalency Factors: Axle 1	Equivalency Factors: Axle 2	Equivalency Factors: Axle 3	ESAL's
Class 1					2	S	2	S			4,000	0.0002	0.0002	0	0
Class 2	**1,800**	**5**	**52**	**10**	2	S	4	S			6,000	0.0002	0.002	0	10,296
Class 3	**2,100**	**5**	**52**	**10**	4	S	6	S			10,000	0.002	0.012	0	76,440
Class 4					10	S	30	T			40,000	0.101	0.702	0	0
Class 5					8	S	10	S			18,000	0.04	0.101	0	0
Class 6					10	S	30	T			40,000	0.101	0.702	0	0
Class 7					10	S	40	R			50,000	0.101	0.536	0	0
Class 8					8	S	30	T	12	S	50,000	0.04	0.702	0.212	0
Class 9					10	S	30	T	30	T	70,000	0.101	0.702	0.702	0
Class 10					12	S	36	R			48,000	0.212	0.352	0	0
Class 11					12	T	30	T	14	S	56,000	0.017	0.702	0.391	0
Class 12					10	S	40	R	16	S	66,000	0.101	0.536	0.651	0
Class 13					12	T	37	R	28	T	77,000	0.017	0.3945	0.538	0
Semi-tractor trailer					12	S	34	T	34	T	80,000	0.212	1.12	1.12	0
Fire Truck	**2**	**5**	**52**	**20**	20	S	30	T	30	T	80,000	1.44	0.702	0.702	29,578
User Defined					12	S	20	S	34	T	66,000	0.212	1.44	1.12	0
Vehicle type H10					4	S	16	S			20,000	0.002	0.651	0	0
Vehicle type H15					6	S	24	S			30,000	0.012	2.6	0	0
Vehicle type H20					8	S	32	S			40,000	0.04	6.3	0	0
Vehicle type 3					16	S	34	T			50,000	0.651	1.12	0	0
Vehicle type HS15					6	S	24	S	24	S	54,000	0.012	2.6	2.6	0
Vehicle type HS20					8	S	32	S	32	S	72,000	0.04	6.3	6.3	0
Vehicle type 3S2					10	S	31	T	31	T	72,000	0.101	0.799	0.799	0

Check for Total ADT 3,902

Terminal Serviceability, r_t	**3.0**
Assumed Structural Number, SN	**5**
Traffic Growth Rate, %/yr	**0**

Rigid ESAL = 163,800

Summary:		
Total AASHTO ESAL's		**116,314**
	Superpave	**ESAL Class 1**
Traffic Category		**20 Years**

Flexible ESAL = 117,000

116,314

Project:	Running Shoulder - I 270	Location:	Baltimore, Maryland
Job No.:	Shoulder	Date:	1/7/2017

AASHTO 1993 ESAL Calculator for Flexible Pavements (A)

Vehicle Description	Traffic Volume: Quantity in the Design Lane	Days per Week	Weeks per Year	Analysis Period (years)	Axle Load and Type: Axle 1 (kips)		Axle 2 (kips)		Axle 3 (kips)		Gross Weight (pounds)	Equivalency Factors: Axle 1	Axle 2	Axle 3	ESAL's
Class 1					2	S	2	S			4,000	0.0002	0.0002	0	0
Class 2	**1,800**	**5**	**52**	**20**	2	S	4	S			6,000	0.0002	0.002	0	20,592
Class 3	**2,100**	**5**	**52**	**20**	4	S	6	S			10,000	0.002	0.012	0	152,880
Class 4					10	S	30	T			40,000	0.101	0.702	0	0
Class 5					8	S	10	S			18,000	0.04	0.101	0	0
Class 6					10	S	30	T			40,000	0.101	0.702	0	0
Class 7					10	S	40	R			50,000	0.101	0.536	0	0
Class 8					8	S	30	T	12	S	50,000	0.04	0.702	0.212	0
Class 9					10	S	30	T	30	T	70,000	0.101	0.702	0.702	0
Class 10					12	S	36	R			48,000	0.212	0.352	0	0
Class 11					12	T	30	T	14	S	56,000	0.017	0.702	0.391	0
Class 12					10	S	40	R	16	S	66,000	0.101	0.536	0.651	0
Class 13					12	T	37	R	28	T	77,000	0.017	0.3945	0.538	0
Semi-tractor trailer					12	S	34	T	34	T	80,000	0.212	1.12	1.12	0
Fire Truck	**2**	**5**	**52**	**20**	20	S	30	T	30	T	80,000	1.44	0.702	0.702	29,578
User Defined					12	S	20	S	34	T	66,000	0.212	1.44	1.12	0
Vehicle type H10					4	S	16	S			20,000	0.002	0.651	0	0
Vehicle type H15					6	S	24	S			30,000	0.012	2.6	0	0
Vehicle type H20					8	S	32	S			40,000	0.04	6.3	0	0
Vehicle type 3					16	S	34	T			50,000	0.651	1.12	0	0
Vehicle type HS15					6	S	24	S	24	S	54,000	0.012	2.6	2.6	0
Vehicle type HS20					8	S	32	S	32	S	72,000	0.04	6.3	6.3	0
Vehicle type 3S2					10	S	31	T	31	T	72,000	0.101	0.799	0.799	0

Check for Total ADT 3,902

Terminal Serviceability, r_t	**3.0**
Assumed Structural Number, SN	**5**
Traffic Growth Rate, %/yr	**0**

Rigid ESAL = 285,600

Summary:

Total AASHTO ESAL's	**203,050**
Superpave	**ESAL Class 1**
Traffic Category	**20 Years**

Flexible ESAL = 204,000

203,050

Project: Running Shoulder - I 270 Location: Baltimore, Maryland

Job No.: Shoulder Date: 1/7/2017

Appendix B

Welcome to the Arizona State University Soil Unit Map Application!

Step 1

Select State

Maryland ▼

Click below to search for milepost coordinates or enter latitude/longitude below if known.

Search for Milepost Coordinates

Latitude:
39.

Longitude:
-77.284997

Use decimal degrees. Ex: Lat 33.45, Long -111.88.

Get Map | Reset

Step 2

Wait a minute for the layer to load

Click on the map to see each soil unit's
Map Character (MapChar). Use the slider bar
to zoom in or out, or grab the map to pan.

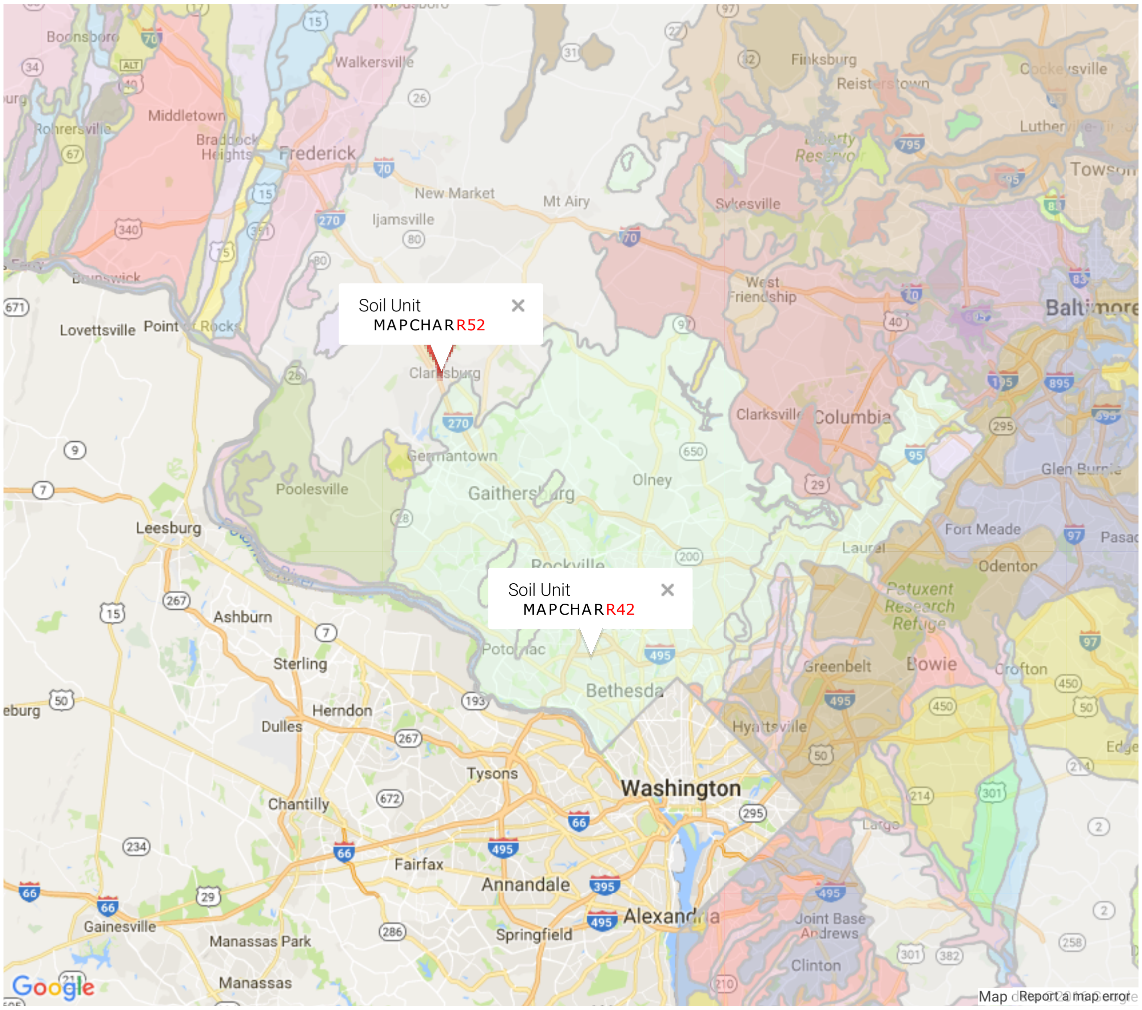
Step 3

Generate Soil Unit Report

MapChar:
MY4

Get Report

Enter a Map Character (MapChar) into the box
to generate the soil unit report.



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Properties of Soil Unit R42

Map Character	Map Unit Key	Map Unit Name	Component Name
R42	662964	Manor-Glenelg (s3166)	Manor

AASHTO Classification	AASHTO Group Index	Top Depth (in)	Bottom Depth (in)	Thickness (in)	% Component	Water Table Depth **Annual Min (ft)**	**Depth to** Bedrock (ft)
A-4	6	0	9.8	9.8	16	N/A	N/A
A-4	3	9.8	20.1	10.2	16	N/A	N/A
A-4	1	20.1	72	52	16	N/A	N/A

CBR from Index Properties	**Resilient Modulus** from **Index Properties** (psi)	Passing #4 (%)	Passing #10 (%)	Passing #40 (%)	Passing #200 (%)	Passing 0.002 **mm (%)**	Liquid Limit (%)
13.4	13467	92.5	90	85	70	17.5	36
16.7	15478	82.5	75	70	60	17.5	33
22.8	18887	82.5	75	62.5	45	12.5	30

Plasticity Index (%)	Saturated Volumetric **Water Content** (%)	Saturated Hydraulic Conductivity (ft/hr)	Parameter af (psi)	Parameter bf	Parameter cf	Parameter hr (psi)
9	47	0.10836	5.3456	0.7347	0.9701	3000.01
8	39	0.10836	6.8925	0.9404	0.8996	2999.89
7	38	0.27506	8.1421	0.8741	1.1395	3000

Properties of Soil Unit R52

Map Character	Map Unit Key	Map Unit Name	Component Name
R52	662974	Mt. Airy (s3176)	Mt. Airy

AASHTO Classification	AASHTO Group Index	Top Depth (in)	Bottom Depth (in)	Thickness (in)	% Component	Water Table Depth **Annual Min (ft)**	**Depth to** Bedrock (ft)
A-4	0	0	5.9	5.9	25	N/A	N/A
A-2-4	0	5.9	33.1	27.2	25	N/A	N/A

CBR from Index Properties	**Resilient Modulus** from **Index Properties** (psi)	Passing #4 (%)	Passing #10 (%)	Passing #40 (%)	Passing #200 (%)	Passing 0.002 **mm (%)**	Liquid Limit (%)
21.7	18309	50	50	42.5	37.5	20.5	36
37.1	25829	42.5	40	32.5	17.5	22.5	33

Plasticity Index (%)	Saturated Volumetric **Water Content** (%)	Saturated Hydraulic Conductivity (ft/hr)	Parameter af (psi)	Parameter bf	Parameter cf	Parameter hr (psi)
9	31	0.10836	5.8162	0.9445	0.7133	2999.76
8	N/A	0.27506	N/A	N/A	N/A	N/A

1 record found matching your criteria

Print Report Close

Properties of Soil Unit MY7

Map Character	Map Unit Key	Map Unit Name	Component Name
MY7	670984	Manor-Glenelg-Chester (s6595)	Chester

AASHTO Classification	AASHTO Group Index	Top Depth (in)	Bottom Depth (in)	Thickness (in)	% Component	Water Table Depth **Annual Min (ft)**	**Depth to** Bedrock (ft)
A-4	3	0	7.9	7.9	24	N/A	N/A
A-6	10	7.9	42.1	34.3	24	N/A	N/A
A-4	3	42.1	61.8	19.7	24	N/A	N/A

CBR from Index Properties	**Resilient Modulus** from **Index Properties** (psi)	Passing #4 (%)	Passing #10 (%)	Passing #40 (%)	Passing #200 (%)	Passing 0.002 **mm (%)**	Liquid Limit (%)
15.6	14797	92.5	90	85	70	16.5	24.5
9.6	10854	92.5	90	85	75	26.5	40
16.7	15478	90	90	80	60	17	31

Plasticity Index (%)	Saturated Volumetric **Water Content** (%)	Saturated Hydraulic Conductivity (ft/hr)	Parameter af (psi)	Parameter bf	Parameter cf	Parameter hr (psi)
7.5	48	0.10836	6.061	1.1975	0.8056	3000.01
12.5	43	0.10836	5.6846	0.7518	0.732	3000.01
8	38	0.10836	10.0821	0.973	0.7953	3000

Properties of Soil Unit MY4

Map Character	Map Unit Key	Map Unit Name	Component Name
MY4	670981	Hagerstown-Duffield-Clarksburg (s6592)	Hagerstown

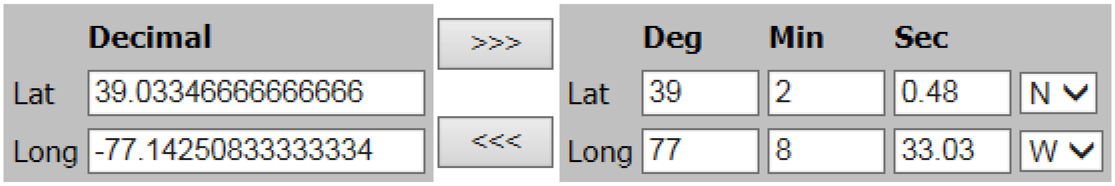
AASHTO Classification	AASHTO Group Index	Top Depth (in)	Bottom Depth (in)	Thickness (in)	% Component	Water Table Depth Annual Min (ft)	Depth to Bedrock (ft)
A-6	12	0	7.9	7.9	26	N/A	5.84
A-7-6	23	7.9	20.1	12.2	26	N/A	5.84
A-7-6	25	20.1	72	52	26	N/A	5.84

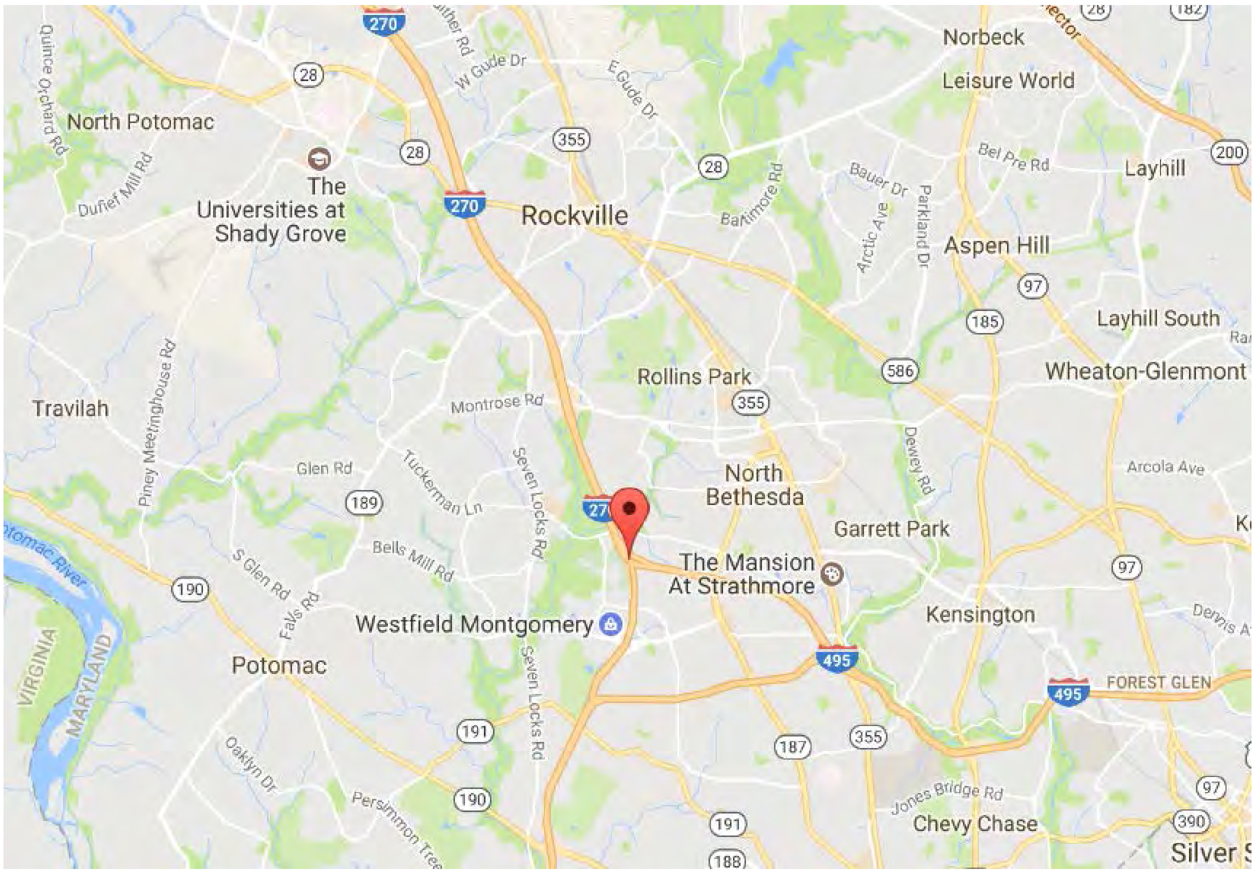
CBR from Index Properties	Resilient Modulus from Index Properties (psi)	Passing #4 (%)	Passing #10 (%)	Passing #40 (%)	Passing #200 (%)	Passing 0.002 mm (%)	Liquid Limit (%)
7.5	9272	92.5	90	90	82.5	25	37.5
4.3	6513	95	90	87.5	75	42.5	56.5
4.2	6365	92.5	90	87.5	85	47.5	50

Plasticity Index (%)	Saturated Volumetric Water Content (%)	Saturated Hydraulic Conductivity (ft/hr)	Parameter af (psi)	Parameter bf	Parameter cf	Parameter hr (psi)
15	43	0.27506	4.667	0.6999	0.6696	3000.01
30	42	0.10836	14.0113	0.7599	0.4309	2999.96
27.5	41	0.10836	13.1421	0.9034	0.2939	2999.95

Convert Latitude/Longitude to Decimal

http://andrew.hedges.name/experiments/convert_lat_long/





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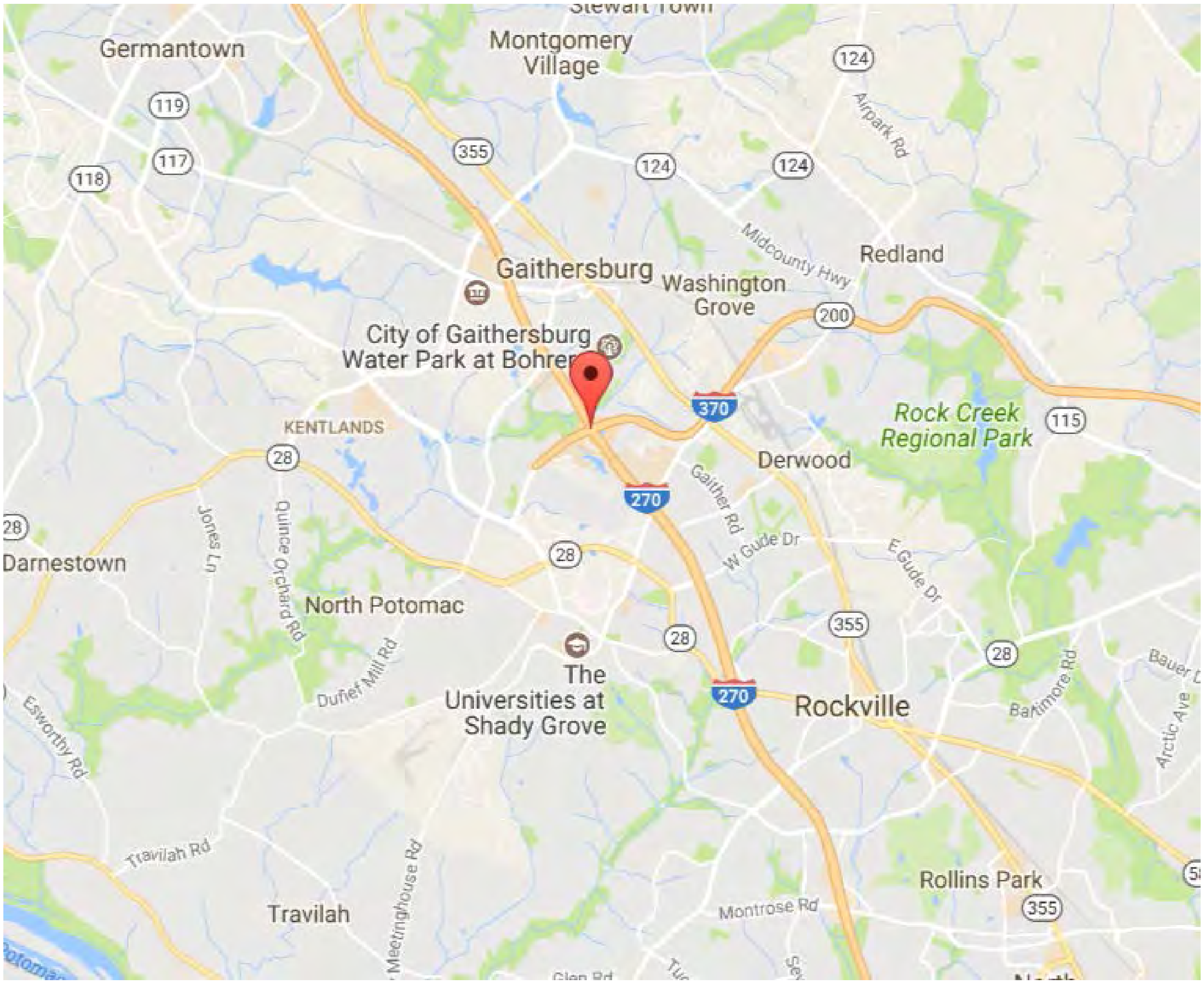
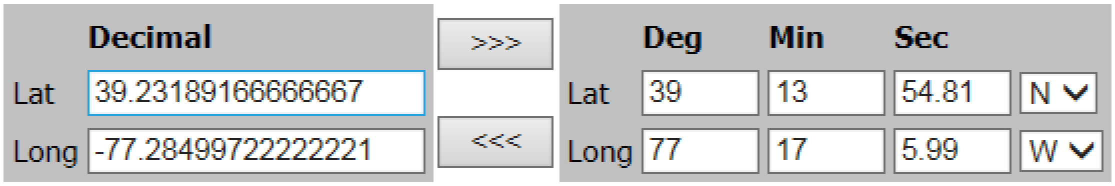
Long	-77.19839166666666	<<<	Long	77	11	54.21	W

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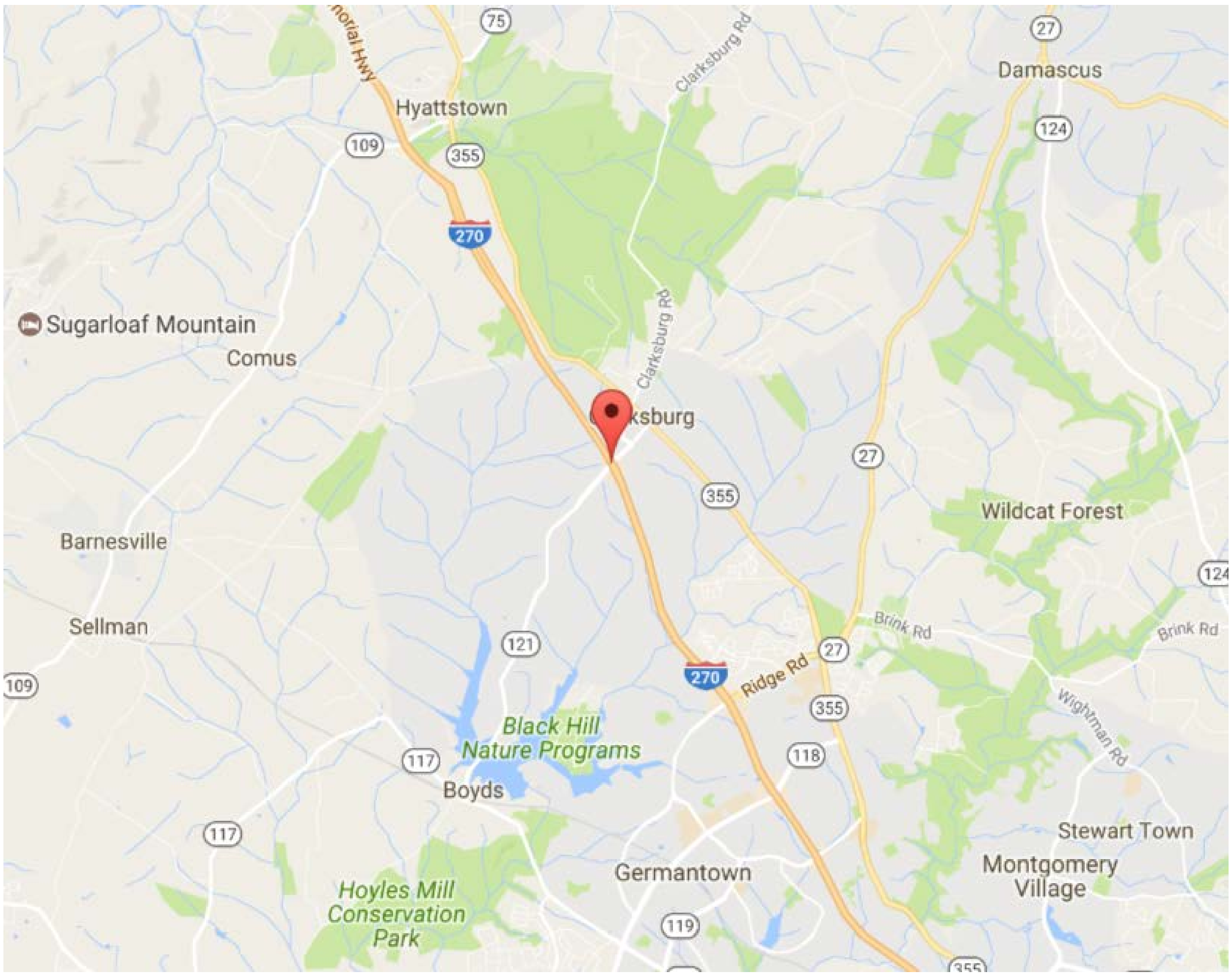
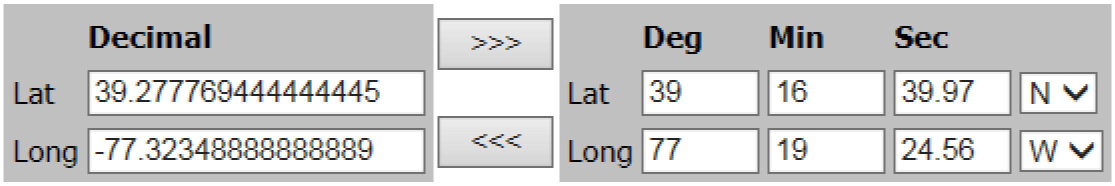
Long -77.28499722222221
>>>
<<<
Deg
Min
Sec
Lat 39 13 54.81 N
Long 77 17 5.99 W


Hyattstown
Damascus
Clarksburg Rd
Sugarloaf Mountain
Comus
ksburg
Wildcat Forest
Barnesville
Sellman
Brink Rd
Ridge Rd
Wightman Rd
Black Hill
Nature Programs
Boyds
Stewart Town
Montgomery
Village
Germantown
Hoyles Mill
Conservation
Park
270
355
109
117
121
118
119
124
27
75

```
Decimal Degrees = Degrees + minutes/60 + seconds/3600
```



	Decimal			Deg	Min	Sec	
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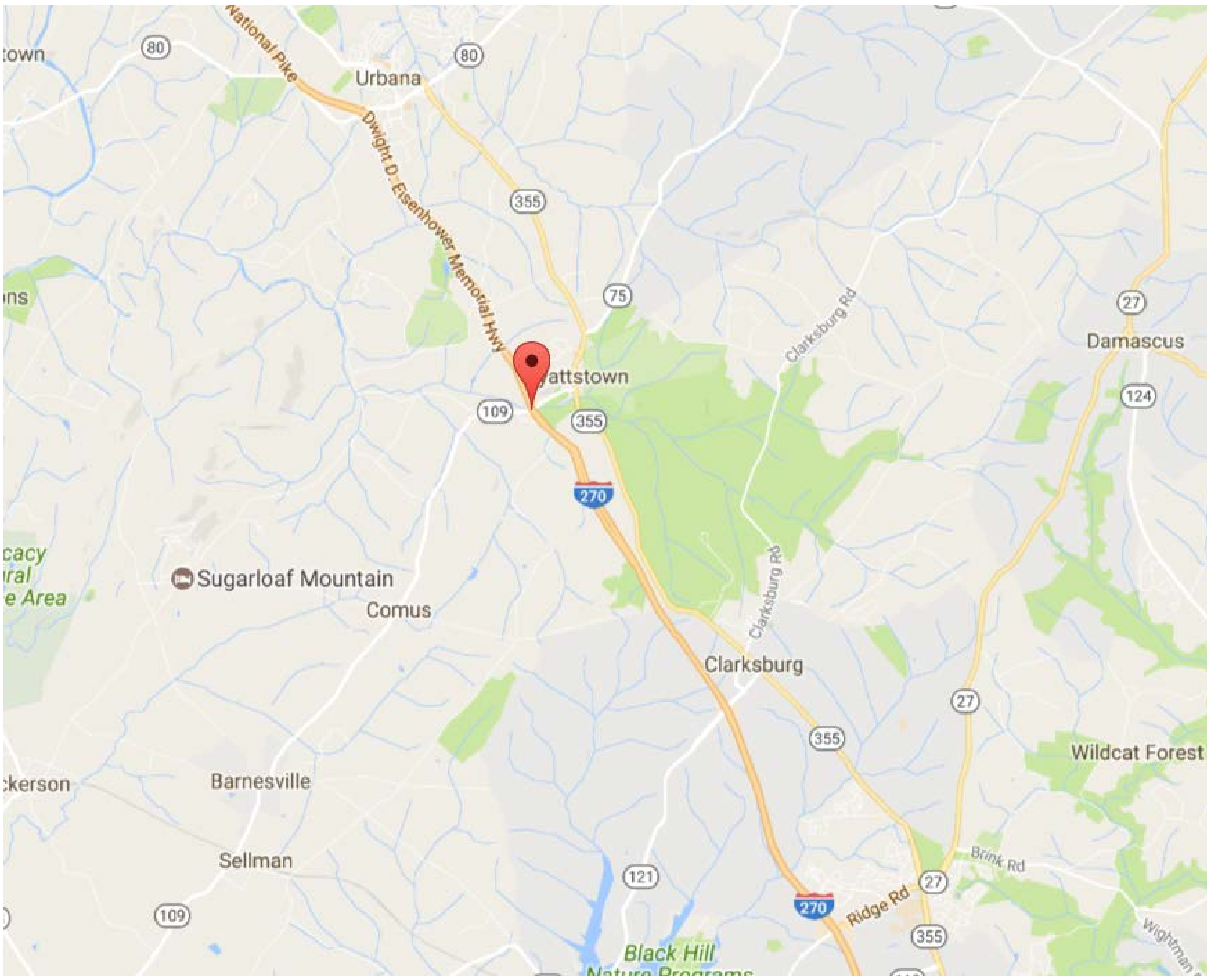
Long	-77.32348888888889	<<<	Long	77	19	24.56	W



Arizona State University Soil Unit Map

http://nchrp923b.lab.asu.edu

Appendix C

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: Running Shoulder
Route: I 270
Location: Section 1 (Existing 8.5" HMA) - Base 5"
Owner/Agency:
Design Engineer:

Flexible Pavement Design/Evaluation

Structural Number	3.63		**Subgrade Resilient Modulus**	4,000.00	**psi**
Total Flexible ESALs	117,000		**Initial Serviceability**	4.20	
Reliability	95.00	**percent**	**Terminal Serviceability**	3.30	
Overall Standard Deviation	0.39				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.38	1.00	8.50	3.23
Graded Stone Base	0.11	1.00	5.00	0.55
			ΣSN	3.78

Saturday, January 7, 2017 2:57:51PM

Engineer: Hosam Salman, P.E.

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: Running Shoulder
Route: I 270
Location: Section 2 (Existing 8.5" HMA) - Base 12"
Owner/Agency:
Design Engineer:

Flexible Pavement Design/Evaluation

Structural Number	3.63		**Subgrade Resilient Modulus**	4,000.00	**psi**
Total Flexible ESALs	204,000		**Initial Serviceability**	4.20	
Reliability	95.00	**percent**	**Terminal Serviceability**	3.30	
Overall Standard Deviation	0.39				

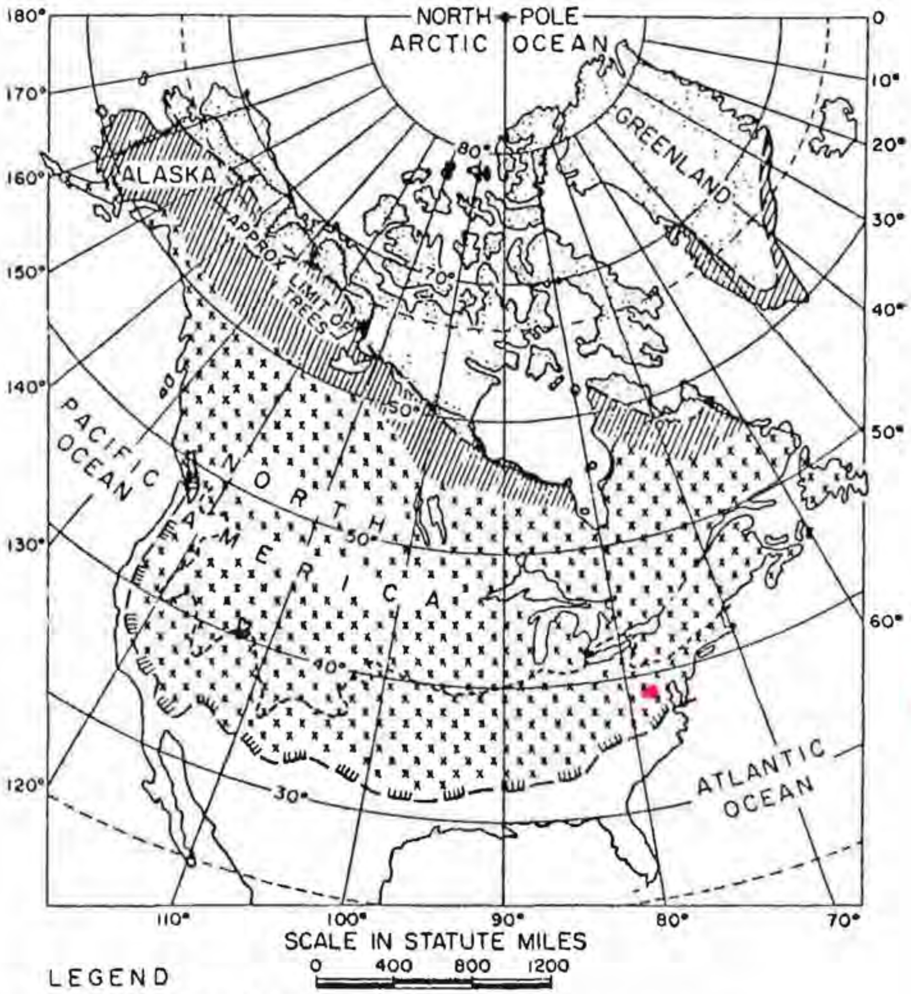
Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.38	1.00	8.50	3.23
Graded Stone Base	0.11	1.00	12.00	1.32
			ΣSN	4.55

Saturday, January 7, 2017 3:00:48PM

Engineer: Hosam Salman, P.E.

Appendix D



30'' ±
MAX FROST
DEPTH

LEGEND

AREA OF CONTINUOUS PERMAFROST

AREA OF DISCONTINUOUS AND SPORADIC PERMAFROST

AREA OF SEASONAL FROST ONLY

APPROXIMATE SOUTHERLY LIMIT OF AREA WHERE SEASONAL FROST MAY BE EXPECTED TO PENETRATE PAVEMENT AND BASE TO A DEPTH OF AT LEAST 12 INCHES 1 YEAR IN 10

3 FEET COMBINED THICKNESS OF PAVEMENT AND GRANULAR, WELL-DRAINED BASE REQUIRED TO PREVENT SUBSTANTIAL SUBGRADE FREEZING COLDEST WINTER IN 10

NOTE: Patches and islands of permafrost may be found in areas south of crosshatched zone, particularly in elevated mountain locations

Figure G.5. Seasonal Frost and Permafrost in North America, Part II (*43*)

Frost Rate = 3 mm/day

REF. SUMMARY OF SOIL TYPES (ATTH E. OF 9/26/1 MEMO)

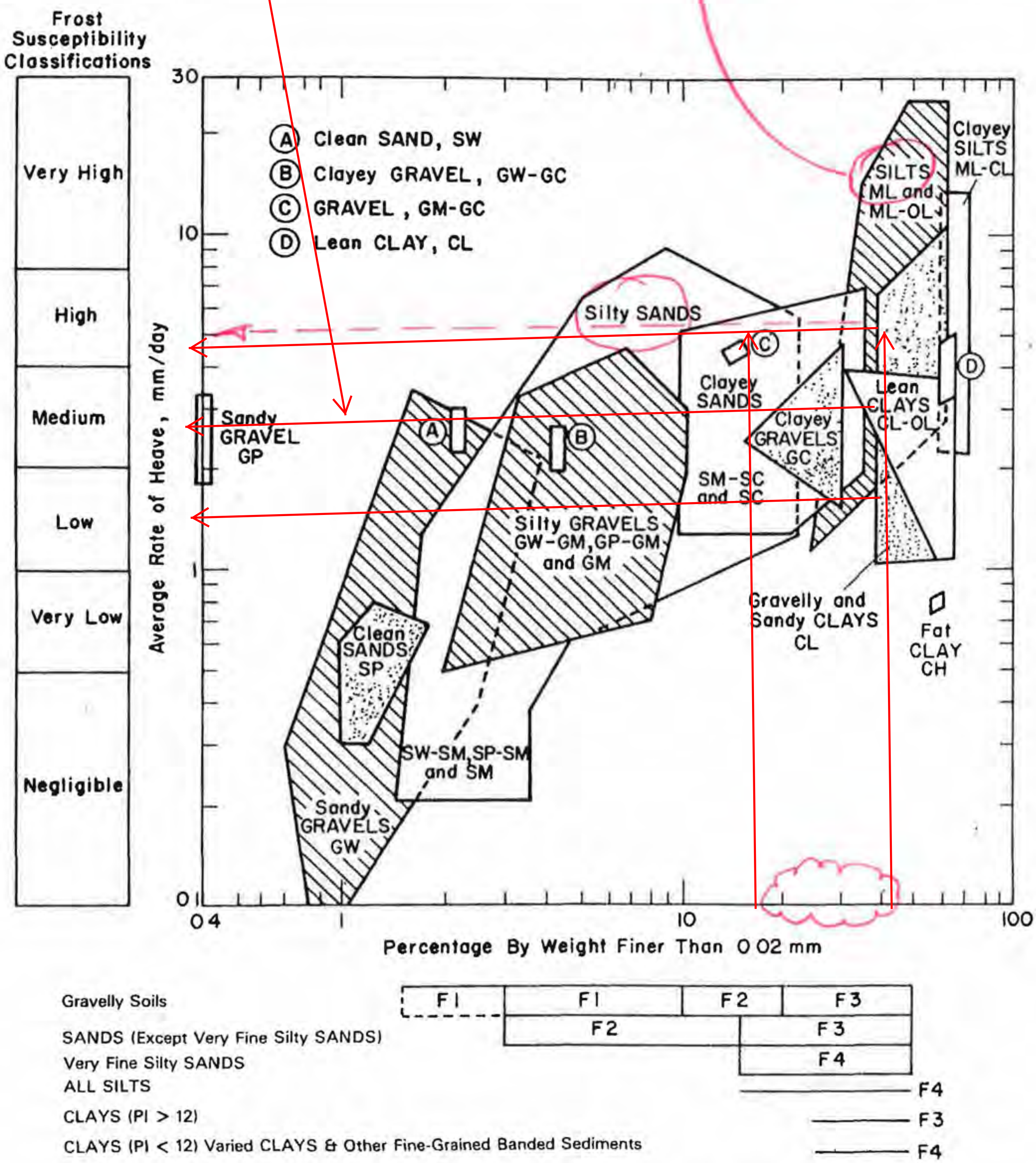


Figure G.6. Chart for Estimating Frost Heave Rate for a Roadbed Soil, Part II (*11*)

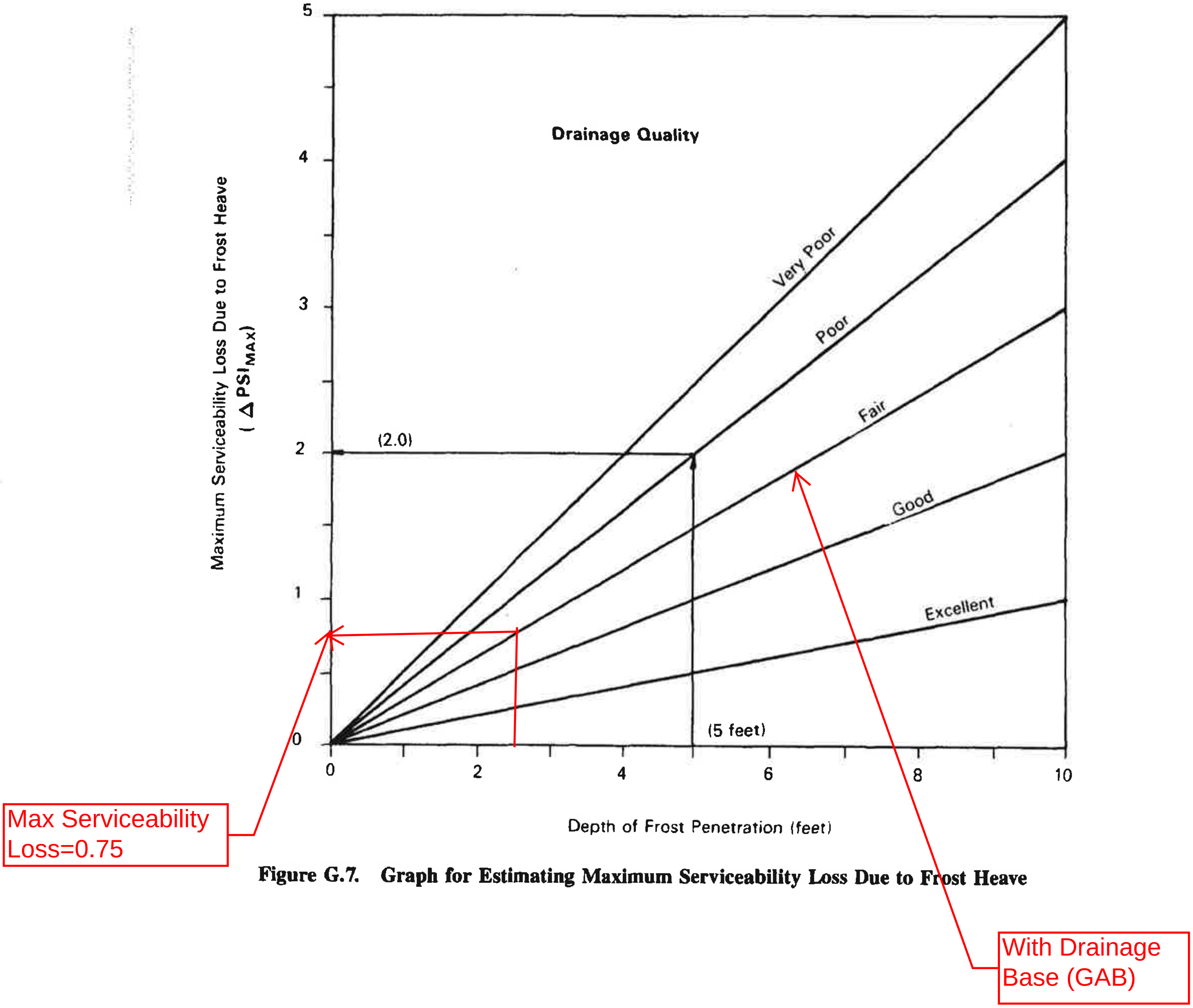


Figure G.7. Graph for Estimating Maximum Serviceability Loss Due to Frost Heave

swelling probability, there is no clear-cut method for approximating frost heave probability

Once values for the three frost heave factors are defined, the equation for serviceability loss (presented in Figure G 8) should be used to generate a frost heave serviceability loss curve similar to that presented in Figure 2 2 (Part II) The time, t, used with Figure G 8 should be equal to the analysis period For stage construction and rehabilitation strategies, the performance period is used The frost heave serviceability loss curve should then be combined with the swelling serviceability loss curve (if applicable) to produce a total serviceability loss versus time curve This curve will then be used as a component of the design procedure discussed in Chapter 3, Part II

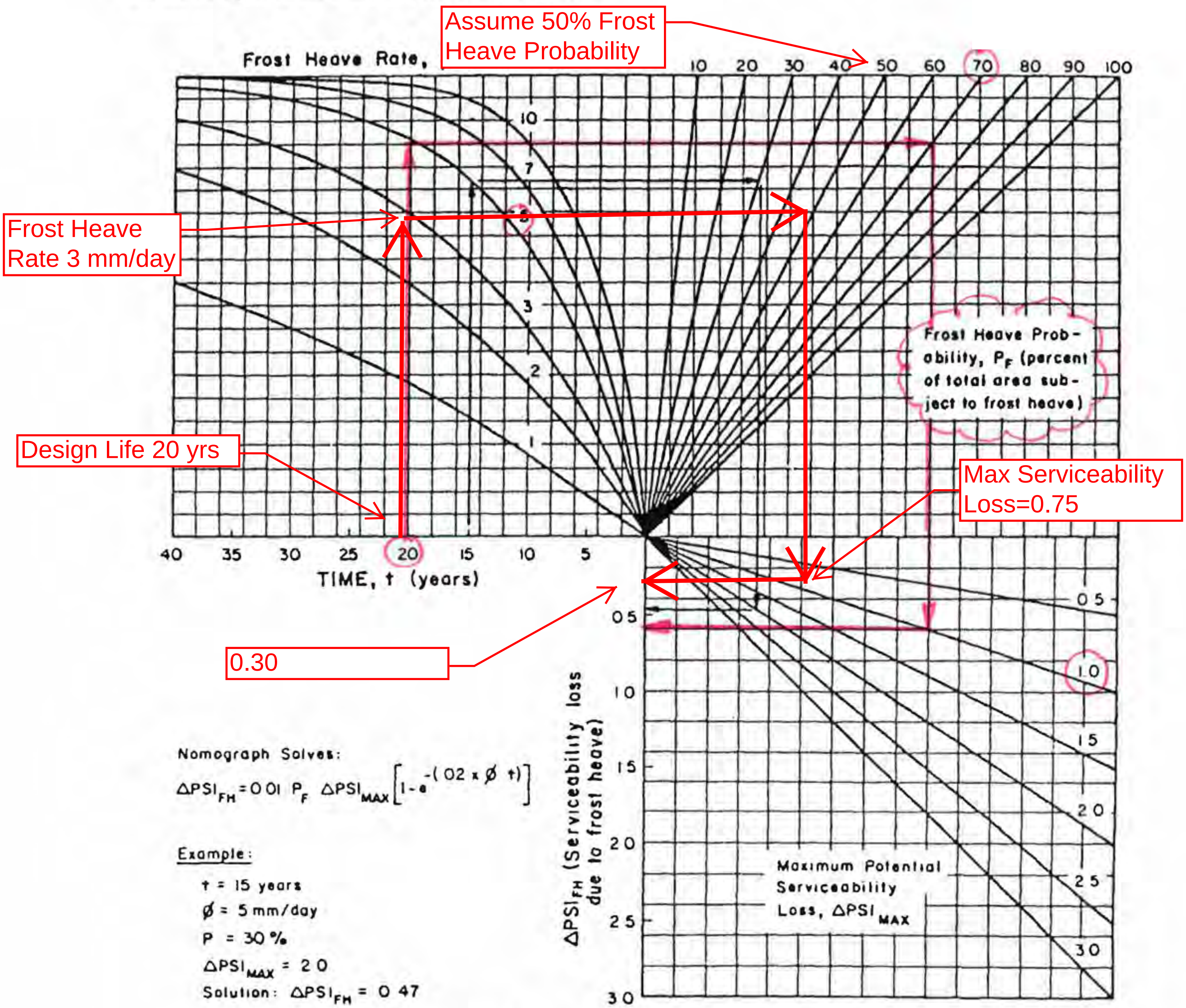


Figure G.8. Chart for Estimating Serviceability Loss Due to Frost Heave

Terminal Serviceability = 3+0.30= 3.30

New pavement design does not take into account any of the existing conditions of the pavement other than geotechnical and drainage conditions because it is a new design.

It is the design engineer's responsibility to use both design processes concurrently where needed and take care to monitor that both designs are agreeable with one another for design and for construction related reasons.

9.12.03.01 *Preliminary Steps*

Step 1. Conduct the steps as detailed in Preliminary Procedures.

Step 2. Conduct the steps as detailed in Testing & Data Collection.

Step 3. Conduct the steps as detailed in Analysis Procedures.

9.12.03.02 *Design Inputs*

Click to go to Unbonded Concrete Overlay Procedure

Calculate the required structural capacity (SC_f) for future traffic for each new pavement section. SC_f is obtained from Figures 3.1 and 3.7 and the nomograph equations on page II-32 and II-45 in the "AASHTO Guide for Design of Pavement Structures", for flexible and rigid pavement sections respectively. The following design inputs are required in order to use the nomograph or equation on pages II-32 and II-45:

- Initial Serviceability: 4.2
- Terminal Serviceability:

Interstates	3.0
Other Expressways and Principal Arterials	2.9
Minor Arterials	2.8
Collectors and Locals	2.6

- Reliability:

Interstates	95
Other Expressways and Principal Arterials	90
Minor Arterials	85
Collectors and Locals	80

- Standard Deviation: 0.49 for Flexible, 0.39 for Rigid
- Design ESALs: Refer to Traffic Analysis.
- Design Subgrade Resilient Modulus (M_r) – Obtained from geotechnical soils investigation for new pavement designs. Materials and Typical Design Properties includes default values for various types of subgrade materials.
- Modulus of Subgrade Reaction (k) – Obtained from geotechnical soils investigation for new pavement designs. Materials and Typical Design Properties includes default values for various types of subgrade materials. The modulus of subgrade reaction can also be calculated following the procedures identified in Section 3.2.1 of Chapter II of the "AASHTO Guide for Design of Pavement Structures."

4.07 DESIGN PROPERTIES FOR PAVEMENT MATERIALS – AASHTO 1993

Click to go to Flexible Pavement for New Design – AASHTO 1993.
Click to go to Overlay Design – Existing Flexible Pavement – AASHTO 1993

The following table presents numerous design parameters for materials commonly used by MDSHA.

Material	Design Use	Structural Coefficient Range for New Material	Desired Structural Coefficient	Min. Lift Thickness	Desired Lift Thickness	Max. Lift Thickness	Structural Coefficient Range After Deterioration	Structural Coefficient for Deteriorated Material	Drainage Coefficient
PCC	Surface	N/A	N/A	6.0"	N/A	14.0"	N/A	N/A	N/A
Break/Crack and Seat PCC	Base	0.20 – 0.35	0.25	6.0"	N/A	14.0"	N/A	N/A	1.0
Rubbilized PCC	Base	0.15 – 0.30	0.20	6.0"	N/A	14.0"	N/A	N/A	1.0
HMA Superpave 4.75 mm	Surface	0.44	0.44	0.5"	0.75"	1.0"	0.3 – 0.44	0.38	1.0
HMA Superpave 9.5 mm Gap Graded	Surface	0.44	0.44	1.0"	1.5"	1.5"	0.3 – 0.44	0.38	1.0
New HMA Superpave 9.5 mm	Surface, W/L	0.44	0.44	1.0"	1.5"	2.0"	0.3 – 0.44	0.38	1.0
HMA Superpave 12.5 mm Gap Graded	Surface	0.44	0.44	1.5"	2.0"	2.0"	0.3 – 0.44	0.38	1.0
Existing HMA Superpave 12.5 mm	Surface	0.44	0.44	1.5"	2.0"	3.0"	0.3 – 0.44	0.38	1.0
HMA Superpave 19.0 mm Gap Graded	Surface	0.44	0.44	2.0"	2.5"	2.5"	0.3 – 0.44	0.38	1.0
HMA Superpave 19.0 mm	Base, Surface	0.40	0.40	2.0"	3.0"	4.0"	0.3 – 0.40	0.36	1.0
HMA Superpave 25.0 mm	Base	0.40	0.40	3.0"	4.0"	5.0"	0.3 – 0.40	0.36	1.0
HMA Superpave 37.5 mm	Base	0.38	0.38	4.0"	5.0"	6.0"	0.3 – 0.38	0.34	1.0
Asphalt Treated Aggregate Base	Base	0.10 – 0.25	0.20	4.0"	6.0"	6.0"	0.10 – 0.25	0.20	1.0
Penetration Macadam	Base	0.10 – 0.25	0.20	3.0"	6.0"	8.0"	0.10 – 0.25	0.20	1.0
Macadam	Base	0.10 – 0.20	0.15	3.0"	6.0"	8.0"	0.10 – 0.20	0.15	*
Soil Cement Base Course	Base	0.15 – 0.25	0.20	4.0"	6.0"	6.0"	0.15 – 0.25	0.20	1.0

Material	Design Use	Structural Coefficient Range for New Material	Desired Structural Coefficient	Min. Lift Thickness	Desired Lift Thickness	Max. Lift Thickness	Structural Coefficient Range After Deterioration	Structural Coefficient for Deteriorated Material	Drainage Coefficient
Cement Modified Subgrade*	Subbase	0.05 – 0.07	0.06	4.0"	6.0"	8.0"	0.05 – 0.07	0.06	1.0
Existing Graded Aggregate Base, GAB	Base	0.08 – 0.14	0.12	3.0"	6.0"	6.0"	0.08 – 0.14	0.11	*
Bank Run Gravel	Base	0.06 – 0.12	0.10	3.0"	6.0"	6.0"	0.06 – 0.12	0.10	*
GSS w/ GAB	Base	0.05 – 0.10	0.08	3.0"	6.0"	12.0"	0.05 – 0.10	0.08	*
Soil Contaminated Aggregate Base	Base	0.05 – 0.10	0.08	3.0"	6.0"	6.0"	0.05 – 0.10	0.08	*
Common Borrow	Subbase	0.03 – 0.06	0.04	3.0"	6.0"	8.0"	0.03 – 0.06	0.04	*
Select Borrow	Subbase	0.04 – 0.08	0.05	3.0"	6.0"	8.0"	0.04 – 0.08	0.05	*
Capping Borrow	Subbase	0.04 – 0.08	0.06	3.0"	6.0"	8.0"	0.04 – 0.08	0.06	*
Modified Borrow	Subbase	0.05 – 0.09	0.07	3.0"	6.0"	8.0"	0.05 – 0.09	0.07	*

* MDSHA has adopted an approach to adjust the structural coefficient of unbound base rather than introduce a drainage coefficient. The structural coefficient of the unbound layer is affected by the thickness of the overlying material and degree of saturation of the base layer. This section further describes this relationship between degree of saturation and the effect on structural coefficient.

U.S. Department of Transportation
Federal Highway Administration
1200 New Jersey Avenue, SE
Washington, DC 20590
202-366-4000

Policy and Governmental Affairs
Office of Highway Policy Information

Traffic Monitoring Guide

Appendix C. VEHICLE TYPES

Motorcycles – All two or three-wheeled motorized vehicles. Typical vehicles in this category have saddle type seats and are steered by handlebars rather than steering wheels. This category includes motorcycles, motor scooters, mopeds, motor-powered bicycles, and three-wheel motorcycles.

Passenger Cars – All sedans, coupes, and station wagons manufactured primarily for the purpose of carrying passengers and including those passenger cars pulling recreational or other light trailers.

Other Two-Axle, Four-Tire Single Unit Vehicles – All two-axle, four-tire, vehicles, other than passenger cars. Included in this classification are pickups, panels, vans, and other vehicles such as campers, motor homes, ambulances, hearses, carryalls, and minibuses. Other two-axle, four-tire single-unit vehicles pulling recreational or other light trailers are included in this classification. Because automatic vehicle classifiers have difficulty distinguishing class 3 from class 2, these two classes may be combined into class 2.

Buses – All vehicles manufactured as traditional passenger-carrying buses with two axles and six tires or three or more axles. This category includes only traditional buses (including school buses) functioning as passenger-carrying vehicles. Modified buses should be considered to be a truck and should be appropriately classified.

In reporting information on trucks, the following criteria should be used:

- Truck tractor units traveling without a trailer will be considered single-unit trucks;
- A truck tractor unit pulling other such units in a saddle mount configuration will be considered one single-unit truck and will be defined only by the axles on the pulling unit;
- Vehicles are defined by the number of axles in contact with the road. Therefore, floating axles are counted only when in the down position; and
- The term "trailer" includes both semi- and full trailers.

Two-Axle, Six-Tire, Single-Unit Trucks – All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., with two axles and dual rear wheels.

Three-Axle Single-Unit Trucks – All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., with three axles.

Four or More Axle Single-Unit Trucks – All trucks on a single frame with four or more axles

Four or Fewer Axle Single-Trailer Trucks – All vehicles with four or fewer axles consisting of two units, one of which is a tractor or straight truck power unit.

Five-Axle Single-Trailer Trucks – All five-axle vehicles consisting of two units, one of which is a tractor or straight truck power unit.

Six or More Axle Single-Trailer Trucks – All vehicles with six or more axles consisting of two units, one of which is a tractor or straight truck power unit.

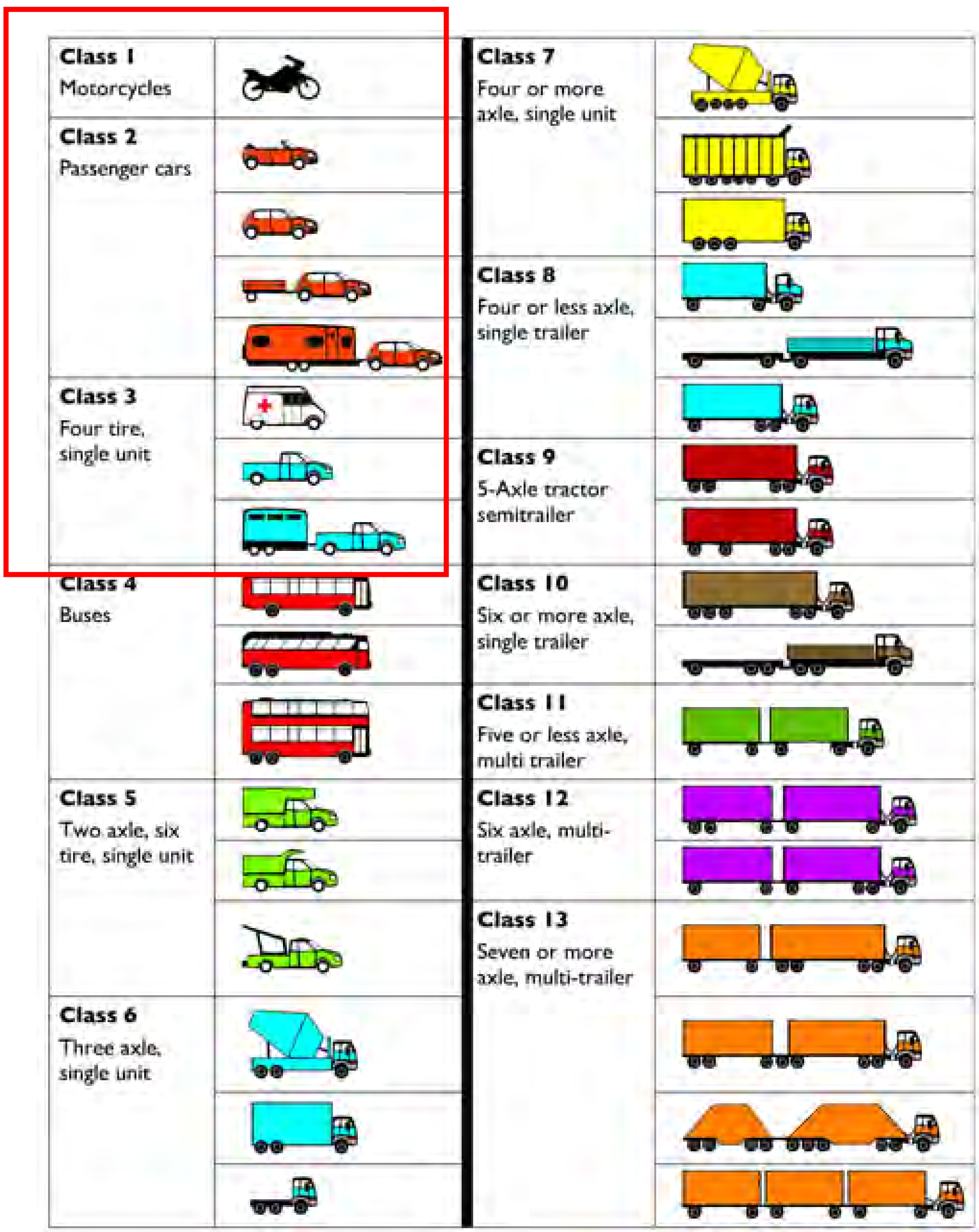
Five or Fewer Axle Multi-Trailer Trucks – All vehicles with five or fewer axles consisting of three or more units, one of which is a tractor or straight truck power unit.

Six-Axle Multi-Trailer Trucks – All six-axle vehicles consisting of three or more units, one of which is a tractor or straight truck power unit

Seven or More Axle Multi-Trailer Trucks – All vehicles with seven or more axles consisting of three or more units, one of which is a tractor or straight truck power unit.

Figure C-1 lists the 13 vehicle category classifications used by FHWA.

FIGURE C-1 FHWA 13 VEHICLE CATEGORY CLASSIFICATION



Source: Federal Highway Administration

Certain truck configurations utilize axles that can be lifted when the vehicle is empty or lightly loaded. The position of these axles — sometimes called lift axles, drop axles, or tag axles — affects the classification category into which the vehicle falls. To maintain consistency between visual and axle-based counts, the TMG recommends that only axles that are in the dropped position be considered when classifying the vehicle. While this promotes consistency, it may induce difficulty when interpreting summary classification statistics at certain locations. For example, a site may exhibit directional differences in vehicle classification even though the same trucks may be travelling one direction loaded (with axles down) and the other direction empty (with axles lifted).

Page last modified on November 7, 2014.

Evaluation Criteria Matrix

IS 270 Innovative Congestion Management Contract

Concept Evaluation Criteria Matrix

Date: 1/19/17

Evaluation Criteria / Concepts Evaluated	PTC 02: CHART Integration/ Communication/Networking	PTC 03B: Father Hurley Option 2 NB Exit Ramp Restriping*	PTC 05: MD 124: Extend SB Accel Lane**	PTC 06: MD 117 Restripe Ramp to two Lanes**	PTC 07: Father Hurley Option 1 NB CD Ramp*	PTC 08: Father Hurley Option 3 SB CD Ramp*	PTC 09: MD 118: Option 1 Eliminate NW Loop	PTC 10: Montrose Road Option 1 Partial Clover Leaf	PTC 14: Father Hurley Option 4 DDI*	Hard Shoulder Running Southbound	Hard Shoulder Running Northbound	Ramp Metering/Managed Motorways Southbound	Ramp Metering/Managed Motorways Northbound
SHA Cost Group Letter Class	F	D	C	C	D	D	C	D	F	G	H	G	G
I-270 NB Mobility Improvement	High	Moderate	N/A	N/A	Moderate	N/A	Moderate	Moderate	High	N/A	High	N/A	High
I-270 SB Mobility Improvement	High	N/A	Moderate	Moderate	N/A	Moderate	N/A	Moderate	Moderate	High	N/A	High	N/A
Arterial Mobility Impacts	Positive	Positive	Positive	Slightly Negative	Positive	Positive	Slightly Negative	Negative	Positive	Positive	Positive	Neutral	Neutral
Safety	Positive	Slightly Negative	Positive	Slightly Negative	Positive	Positive	Neutral	Positive	Positive	Neutral	Neutral	Positive	Positive
Maintainability/Operability	Moderate	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Moderate	Moderate	Active	Active
R/W Impacts	None	None	None	None	None	None	None	None	None	Minor	Minor	None	None
Utility Impacts	None Anticipated	None	Potential	Potential	None Anticipated	None Anticipated	None Anticipated	Minor	Potential	Minor	Minor	None	None
Environmental Impacts	None Anticipated	None	None	None	Minor	Minor	None	Minor	Minor	Minor	Minor	None	None
Permitting/NEPA Concerns	None	None	None	None	None	None	None	Avg.	Avg.	Avg.	Avg.	Avg.	Avg.
IAPA Needed	None	Potential	None	Potential	Potential	Potential	Yes	Yes	Yes	Potential	Potential	Yes	Yes
Noise	None	Potential	None	Potential	None	None	Potential	Potential	None	Yes	Yes	Potential	Potential
Construction Duration***	Medium	Short	Short	Short	Medium	Medium	Short	Medium	Long	Medium	Medium	Long	Long
Design Exceptions	No	Yes	No	Yes	No	No	Yes	Potential	No	Yes	Yes	Yes	Yes
Public Acceptance	Positive	Avg.	Avg.	Avg.	High	High	Avg.	Slightly Negative	Initial Low, Long term Positive	Positive	Positive	Initial Low, Long term Neutral	Initial Low, Long term Neutral
SHA Feedback to PTC Submission	Positive	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Positive	Neutral	Neutral	Neutral	Neutral

*Father Hurley Blvd. Interchange Improvements: PTCs 03B, 07, and 08 jointly offer similar mobility benefits to PTC 14, at a lesser construction cost.

**PCTs 05 and 06: These alternatives were eliminated because the introduction of multiple lanes with with the Ramp Metering Improvements offered similar benefits

*** Construction Durations:
Short = 0 to 9 Months
Medium = 9 to 18 Months
Long = 18 and Over

Legend

Concept included in Proposed Alternative	Concept not included in Proposed Alternative

Cost Group Estimate	Cost Group Letter Class	Cost Group Estimate	Cost Group Letter Class	Cost Group Estimate	Cost Group Letter Class	Cost Group Estimate	Cost Group Letter Class
Up to $100,000	A	$1,000,001 to $2,500,000	D	$10,000,001 to $15,000,000	G	$50,000,001 to $75,000,000	J
$100,001 to $500,000	B	$2,500,001 to $5,000,000	E	$15,000,001 to $30,000,000	H	$75,000,001 to $100,000,000	K
$500,001 to $1,000,000	C	$5,000,001 to $10,000,000	F	$30,000,001 to $50,000,000	I	Over $100,000,000	L

Utility Conflict Matrix

IS 270 Innovative Congestion Management Utility Conflict Matrix

Project Owner: State Highway Administration
Project No. : MO0695172
Project Description: IS 270 Innovative Congestion Management
Highway or Route: IS 270 from IS 70 to IS 495

Note: refer to subsheet for utility conflict cost analysis.

Utility Conflict Matrix Developed/Revised By: Parsons Brinckerhoff
Date: 19-Jan-17
Reviewed By:
Date:

Utility Owner and/or Contact Name	Conflict ID	Drawing or Sheet No.	Utility Type	Size and/or Material	Utility Conflict Description	Location	Utility Investigation Level Needed	Test Hole	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status
UNKNOWN	HSR-101	HSR 23	Communications	Duct	Fiber Optic under full-depth	NB C/D Lane	QLB	Maybe	No conflict anticipated		
WSSC	HSR-102	HSR 24	Water	66" PCCP	Water Line under full-depth	NB C/D Lane	QLB	No	No conflict anticipated		
SHA	HSR-103	HSR 27	Electric		SHA Electric Line (lighting) under full-depth and Proposed Barrier	NB C/D Lane	QLB	No	Probable Conflict		
SHA	HSR-104	HSR 27	Electric		Electric Under Full-Depth/Crosses Barrier	SB	QLB	No	No conflict anticipated - Avoid		
Level 3	HSR-105	HSR 27	Communications	Duct	Fiber Optic Under Full-Depth/Crosses Barrier	SB	QLA	Yes	No conflict anticipated - Avoid		
SHA	HSR-106	HSR 28	Electric		Electric Under Full-Depth/Crosses Barrier	SB	QLB	No	No conflict anticipated - Avoid		
Level 3	HSR-107	HSR 28	Communications	Duct	Fiber Optic Under Full-Depth/Crosses Barrier	SB	QLA	Yes	No conflict anticipated - Avoid		
SHA	HSR-108	HSR 28	Electric		SHA Electric Line (lighting) under full-depth and Concrete Barrier	NB C/D Lane	QLB	No	Probable Conflict		
WSSC	HSR-109	HSR 29	Water	72" Tunnel	Multiple Water Lines in Tunnel under Full-Depth and Concrete Barrier	NB C/D Lane	QLB	Maybe	No conflict anticipated		
SHA	HSR-110	HSR 29	Electric		Electric Under Full-Depth and Concrete Barrier	NB C/D Lane	QLB	No	Probable Conflict		
WSSC	HSR-111	HSR 29	Sanitary Sewer		Sanitary Sewer Under Full-Depth and Concrete Barrier	NB C/D Lane	QLB	Maybe	No conflict anticipated		
SHA	HSR-112	HSR 33	Electric		SHA Electric crossing full-depth and Concrete Barrier	NB C/D Lane	QLB	No	No conflict anticipated		
WSSC	HSR-113	HSR 33	Water		Water Line crossing Full-Depth and Concrete Barrier	NB C/D Lane	QLB	No	No conflict anticipated		
WSSC	HSR-114	HSR 33	Water		Water Line crossing Full-Depth and Concrete Barrier	NB C/D Lane	QLB	No	No conflict anticipated		
SHA	HSR-115	HSR 33	Electric		SHA Electric crossing full-depth and Concrete Barrier	NB C/D Lane	QLB	No	No conflict anticipated		
SHA	HSR-116	HSR 33	Electric		SHA Electric crossing full-depth and Concrete Barrier	SB C/D Lane	QLB	No	No conflict anticipated		

Utility Owner and/or Contact Name	Conflict ID	Drawing or Sheet No.	Utility Type	Size and/or Material	Utility Conflict Description	Location	Utility Investigation Level Needed	Test Hole	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status
UNKNOWN	HSR-117	HSR 34	Communications	Duct	Fiber Optic under Full-Depth (same as HSR-117 & 119)	NB C/D Lane	QLB	Yes (multiple)	Probable Conflict		
SHA	HSR-118	HSR 34	Electric		SHA Electric Crossing Full-Depth	SB C/D Lane	QLB	No	No conflict anticipated		
SHA	HSR-119	HSR 34	Electric		SHA Electric Crossing Full-Depth	NB C/D Lane	QLB	No	No conflict anticipated		
Level 3	HSR-120	HSR 35	Communications	Duct	Fiber Optic under Full-Depth and Dry Swale	SB C/D Lane	QLB	No	Probable Conflict		
UNKNOWN	HSR-121	HSR 35	Electric		Multiple Electric Lines under Full-Depth and Dry Swale	SB C/D Lane	QLB	No	Probable Conflict		
UNKNOWN	HSR-122	HSR 35	Electric		Multiple Electric Lines Crossing Full-Depth and W-Beam	NB C/D Lane	QLB	No	No conflict anticipated		
UNKNOWN	HSR-123	HSR 35	Communications		Multiple Telephone Lines Crossing Full-Depth and W-Beam	NB C/D Lane	QLB	No	No conflict anticipated		
MTA	HSR-124	HSR 35	Communications	Duct	Fiber Optic under Full-Depth, w-beam, and or Grass Swale	NB C/D Lane	QLB	No	Probable Conflict		
UNKNOWN	HSR-125	HSR 35	Electric		Electric under Full-Depth, w-beam, and or Grass Swale	NB C/D Lane	QLB	No	Probable Conflict		
Level 3	HSR-126	HSR 38	Communications	Duct	Fiber Optic Crossing Full-Depth	NB C/D Lane	QLB	No	Possible Conflict		
SHA	HSR-127	HSR 38	Electric		Electric crossing Full-Depth	NB C/D Lane	QLB	No	Probable Conflict		
Transco	HSR-128	HSR 38	Gas	Transmission Line	Gas Crossing Full-Depth	NB C/D Lane	QLB	No	No conflict anticipated		
SHA	HSR-129	HSR 38	Electric		Electric crossing Full-Depth	NB C/D Lane	QLB	No	Probable Conflict		
Level 3	HSR-130	HSR 39	Communications	Duct	Fiber Optic under Full-Depth Widening	SB C/D Lane	QLA	Yes	Probable Conflict		
SHA	HSR-131	HSR 53	Electric		Electric crossing Full-Depth and Concrete Barrier	NB C/D Lane	QLA	Yes	Possible Conflict		
SHA	HSR-132	HSR 53	Communications	Duct	Fiber Optic crossing Full-Depth and Concrete Barrier	NB C/D Lane	QLA	Yes	Possible Conflict		
WSSC	HSR-133	HSR 53	Sanitary Sewer	8" Sewer	Sewer line crossing full-depth and concrete barrier	NB C/D Lane	QLB	No	No conflict anticipated		
SHA	HSR-134	HSR 54	Electric		Multiple Electric lines under Full-Depth,Concrete Barrier, and or Grass Swale	NB C/D Lane	QLB	No	Probable Conflict		
SHA	HSR-135	HSR 54	Communications	Duct	Fiber Optic under Full-Depth,Concrete Barrier, and or Grass Swale	NB C/D Lane	QLA	Yes	Probable Conflict		
SHA	HSR-136	HSR 54	Electric		Electric Crossing Full-Depth and Concrete Barrier	NB C/D Lane	QLB	No	Probable Conflict		

Utility Owner and/or Contact Name	Conflict ID	Drawing or Sheet No.	Utility Type	Size and/or Material	Utility Conflict Description	Location	Utility Investigation Level Needed	Test Hole	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status
WSSC	HSR-137	HSR 55	Water	96" Water	Water Crossing Full-Depth and Concrete Barrier	NB C/D Lane	QLB	No	No conflict anticipated		
WSSC	HSR-138	HSR 55	Sanitary Sewer	18" Sewer	Sewer line crossing full-depth and concrete barrier	NB C/D Lane	QLB	No	No conflict anticipated		
SHA	HSR-139	HSR 55	Electric		Electric Adjacent to Full-depth and Concrete Barrier	NB C/D Lane	QLB	No	No conflict anticipated		
SHA	GI-201	GI 15	Electric	Light Pole	Light Pole adjacent to Full-depth widening	Loop Ramp		No	Possible Conflict		
SHA	GI-202	GI 16	Electric		Electric crossing Full-depth widening	Directional Ramp		No	No conflict anticipated		
Level 3	GI-203	GI 16	Communications	Duct	Fiber Optic crossing Full-depth widening	Directional Ramp	QLB	No	No conflict anticipated		
Level 3	GI-204	GI 21	Communications	Duct	Fiber Optic crossing Full-depth widening and W-beam	Directional Ramp	QLA	Yes	Possible Conflict		
SHA	GI-207	GI 22	Electric	Duct	SHA Electric Duct under full-depth widening and W-beam	Directional Ramp	QLB	No	Probable Conflict		
Level 3	GI-208	GI 22	Communications	Duct	Fiber Optic crossing Full-depth widening and W-beam	Directional Ramp	QLA	Yes	Possible Conflict		
SHA	GI-209	GI 23	Electric	Duct	Multiple SHA Electric lines including a Duct under full-depth widening and W-beam	Loop Ramp	QLB	No	Probable Conflict		
Level 3	GI-210	GI 23	Communications	Duct	Fiber Optic crossing Full-depth widening and W-beam	Loop Ramp	QLA	Yes	Possible Conflict		
SHA	GI-211	GI 23	Electric	Light Pole	SHA Light Pole Impacted by full-depth widening	Loop Ramp	QLB	No	Possible Conflict		
SHA	GI-212	GI 23	Communications	Duct	Fiber Optic crossing Full-depth widening and W-beam	Loop Ramp	QLB	Maybe	Possible Conflict		
SHA	GI-213	GI 23	Communications	Duct	Fiber Optic crossing Full-depth widening and W-beam	Loop Ramp	QLB	Maybe	Possible Conflict		
Level 3	GI-214	GI 25	Communications	Duct	Fiber Optic crossing Full-depth widening	Loop Ramp	QLA	Maybe	No Conflict Anticipated		
Level 3	GI-215	GI 26	Communications	Duct	Fiber Optic crossing Full-depth widening	Directional Ramp	QLA	Maybe	No Conflict Anticipated		
SHA	GI-217	GI 30	Electric	Light Pole	Light Pole impacted by Widening	Directional Ramp		No	Probable Conflict		
SHA	GI-218	GI 30	Electric		Electric impacted by Widening	Directional Ramp		No	Probable Conflict		
SHA	GI-219	GI 32	Electric	Light Pole	Light Pole impacted by Widening	Directional Ramp		No	Probable Conflict		
SHA	GI-220	GI 32	Electric		Electric impacted by Widening	Directional Ramp		No	Probable Conflict		
WSSC	GI-221	GI 37	Sanitary Sewer	10" TC	Sanitary Sewer Under Full-Depth Widening	Directional Ramp		No	No conflict anticipated		

Utility Owner and/or Contact Name	Conflict ID	Drawing or Sheet No.	Utility Type	Size and/or Material	Utility Conflict Description	Location	Utility Investigation Level Needed	Test Hole	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status
SHA	GI-222	GI 41	Electric	Light Pole	Light Pole adjacent to Full-depth widening	Directional Ramp		No	Possible Conflict		

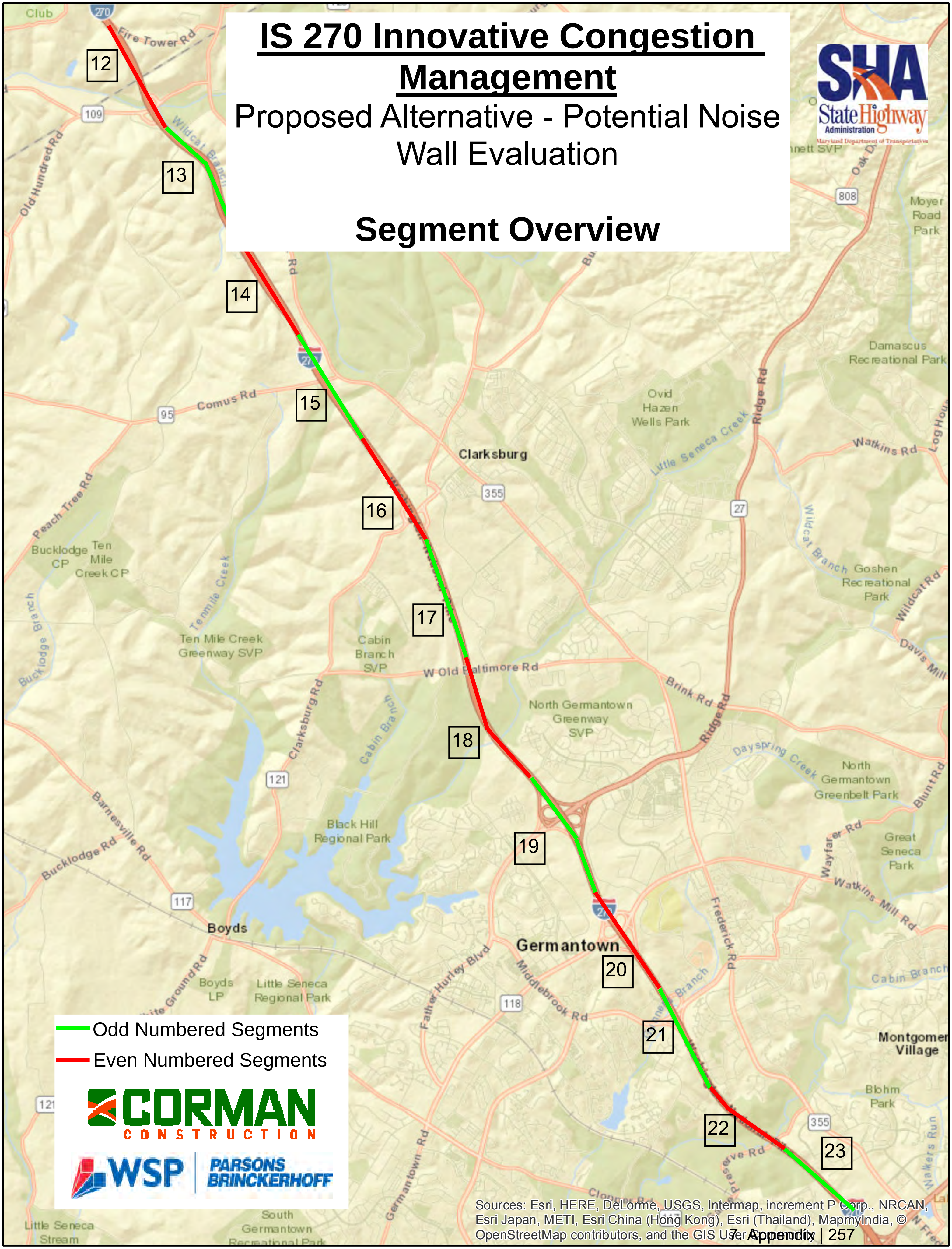
Key:
[List of acronyms used in the utility conflict matrix]

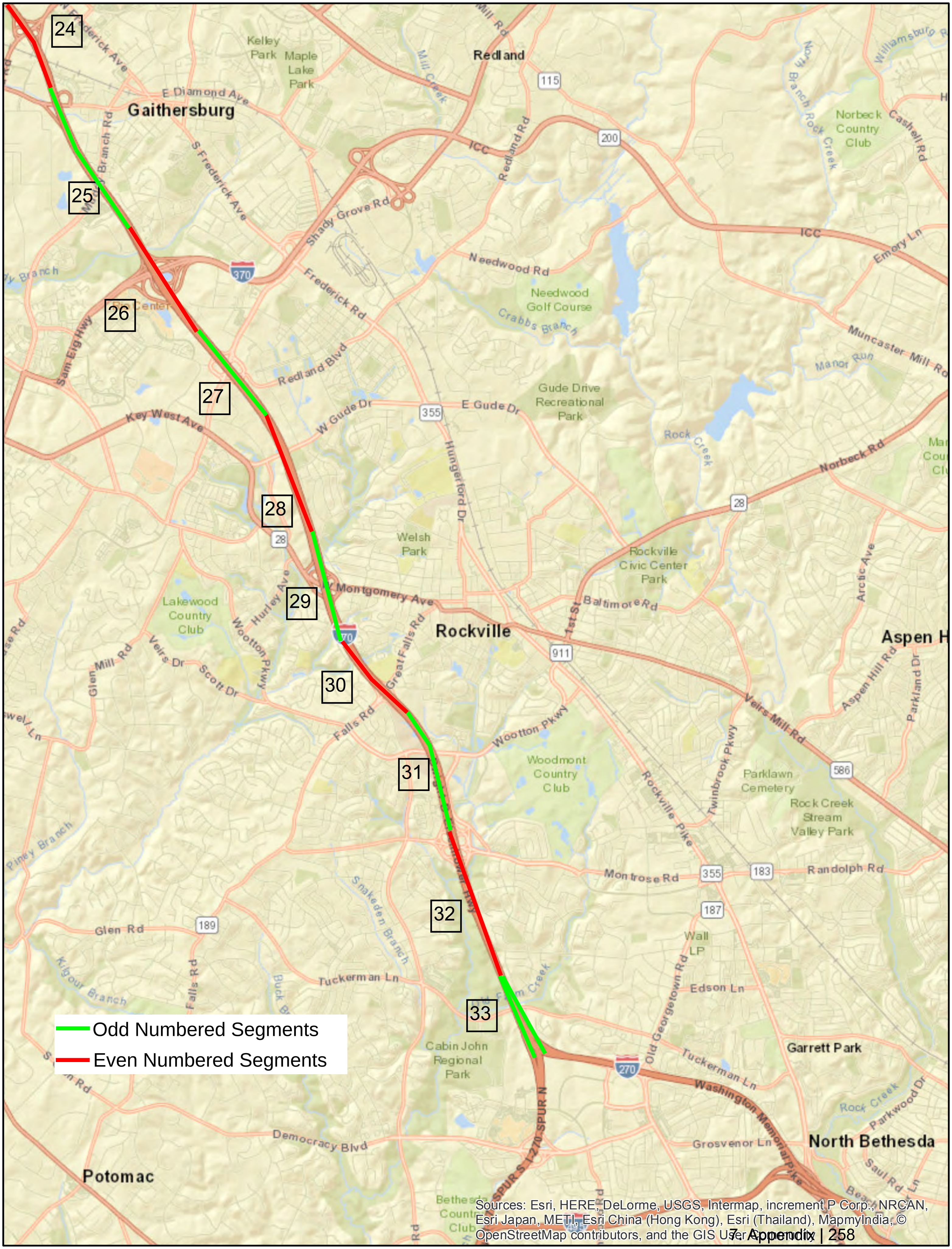
Assessment of
Potential Noise Walls

IS 270 Innovative Congestion Management

Proposed Alternative - Potential Noise Wall Evaluation

Segment Overview




24
25
26
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30
31
32
33
Gaithersburg
Redland
Rockville
Aspen H
North Bethesda
Potomac
Garrett Park
Odd Numbered Segments
Even Numbered Segments
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

IS 270 Innovative Congestion Management

Proposed Alternative - Potential Noise Wall Evaluation

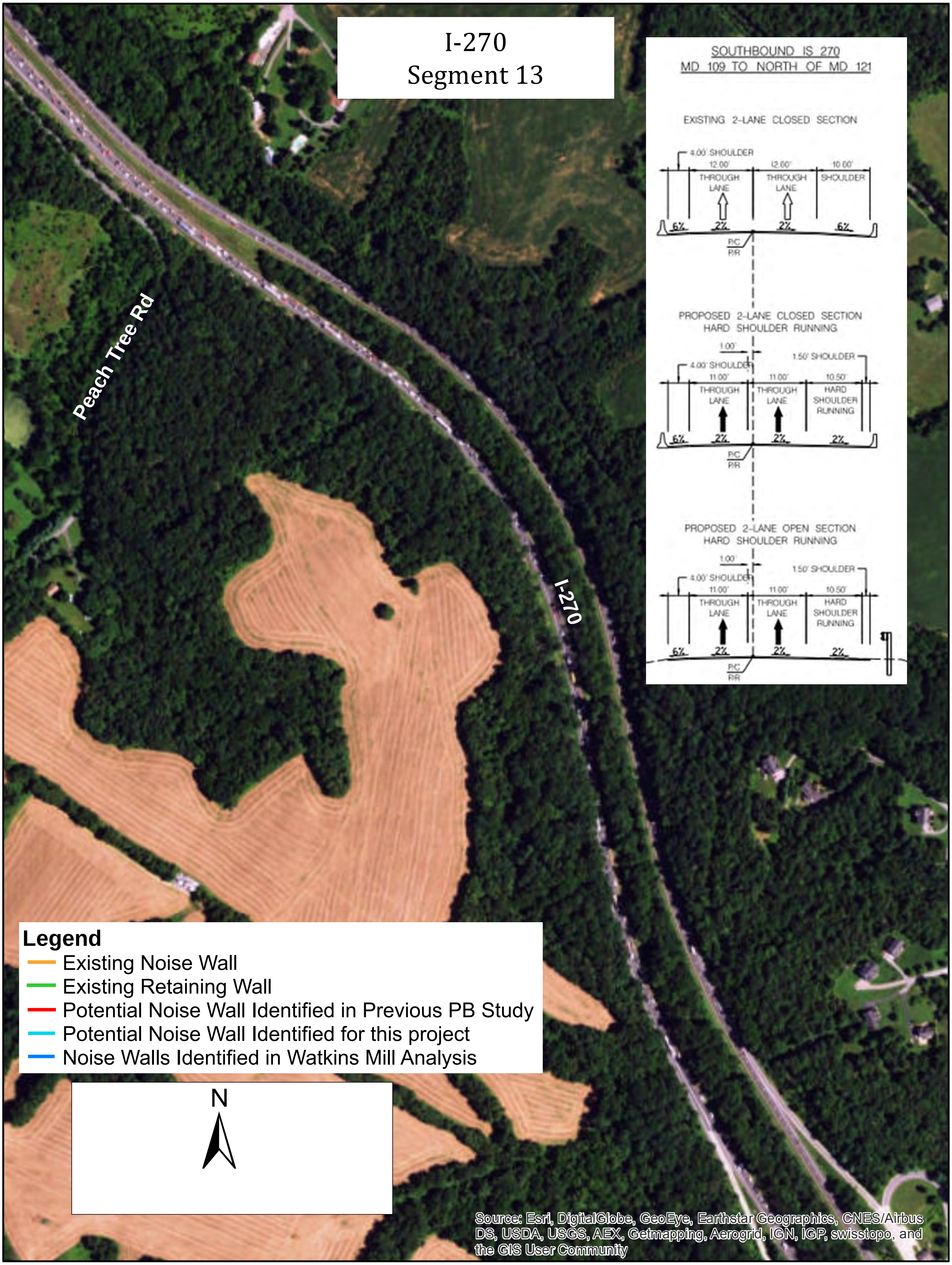
Potential Noise Wall Analysis Segment #	Potential Noise Wall Identifier	Estimated Length (ft)	Comments
15	X4	565	
15	X5	388	
21	B2	2136	
21	B3	2432	
22	X3	1029	
23	Watkins Mill - B1	1512	Not Reasonable finding on previous study
23	Watkins Mill - B2	400	Not Reasonable finding on previous study
25	B1	4198	
26	X1	1738	Potential Mod. To existing wall
26	SB2	1037	Potential Mod. To existing wall
27	SB3	900	
29	SB4	2327	
30	SB5	2116	
30	SB6	2621	Existing retaining wall, additional abatement may be necessary
30	SB7	779	
32	SB8	1466	

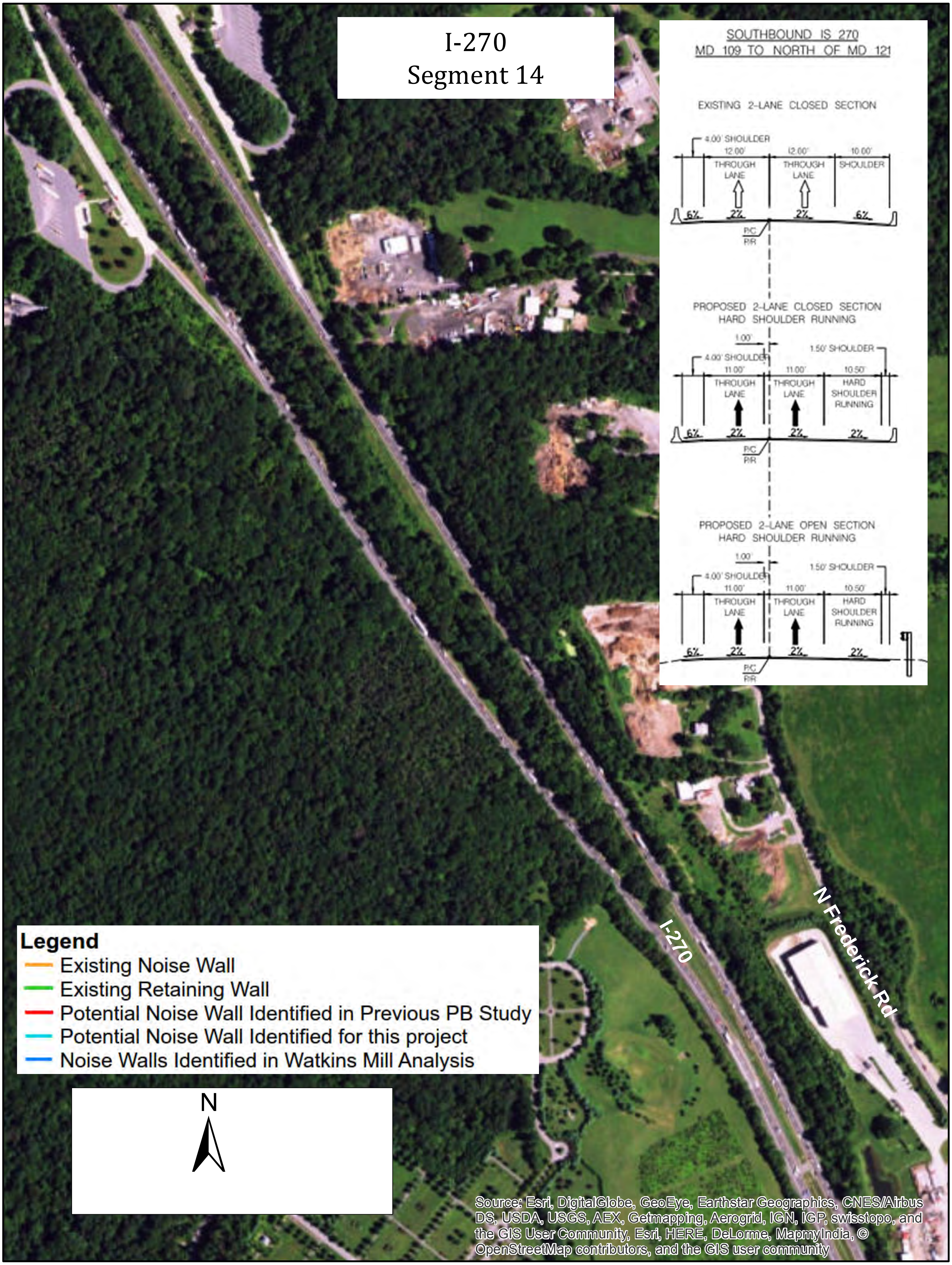
Notes:

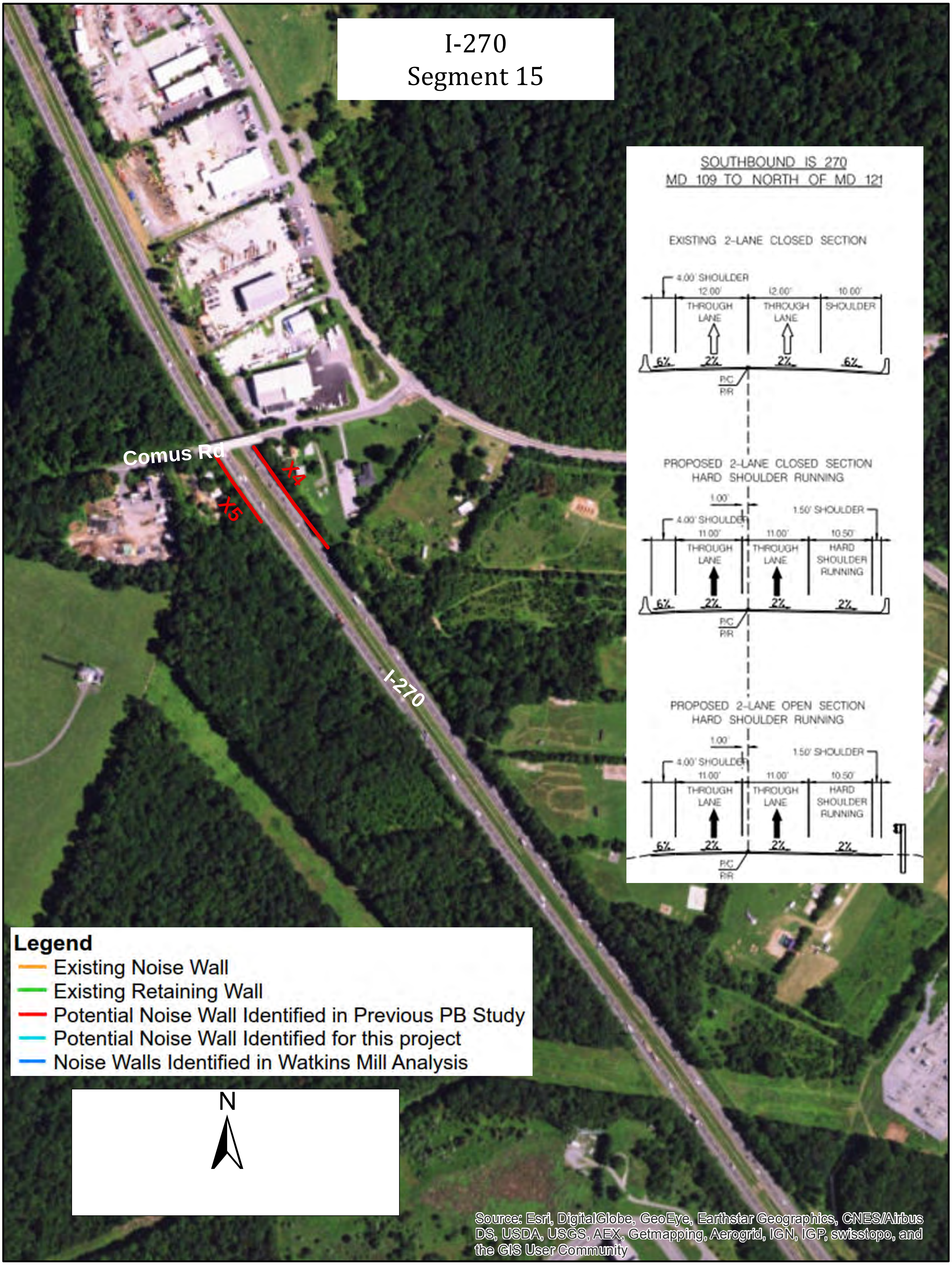
1) Potential Noise Wall Evaluation segments identified on attached "Segment Overview."

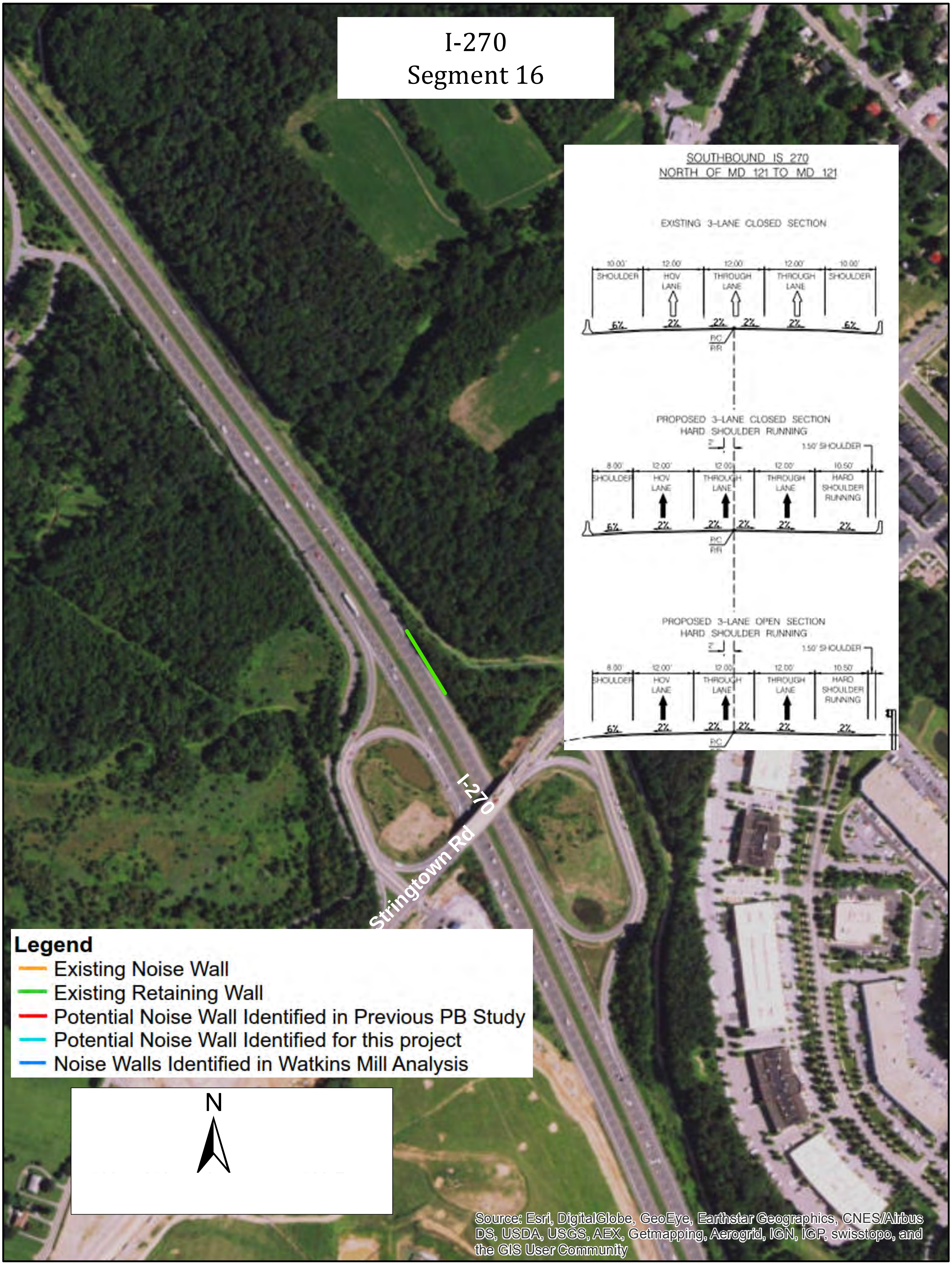
2) Potential Noise Walls, as well as existing retaining and noise walls, identified on individual segment sheets.


I-270
Segment 12
I-270
Old Hundred Rd
Legend
Existing Noise Wall
Existing Retaining Wall
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


I-270
Segment 13
SOUTHBOUND IS 270
MD 109 TO NORTH OF MD 121
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00' THROUGH LANE
12.00' THROUGH LANE
10.00' SHOULDER
6% 2% 2% 6%
P/C
P/R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2%
P/C
P/R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2%
P/C
P/R
Peach Tree Rd
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

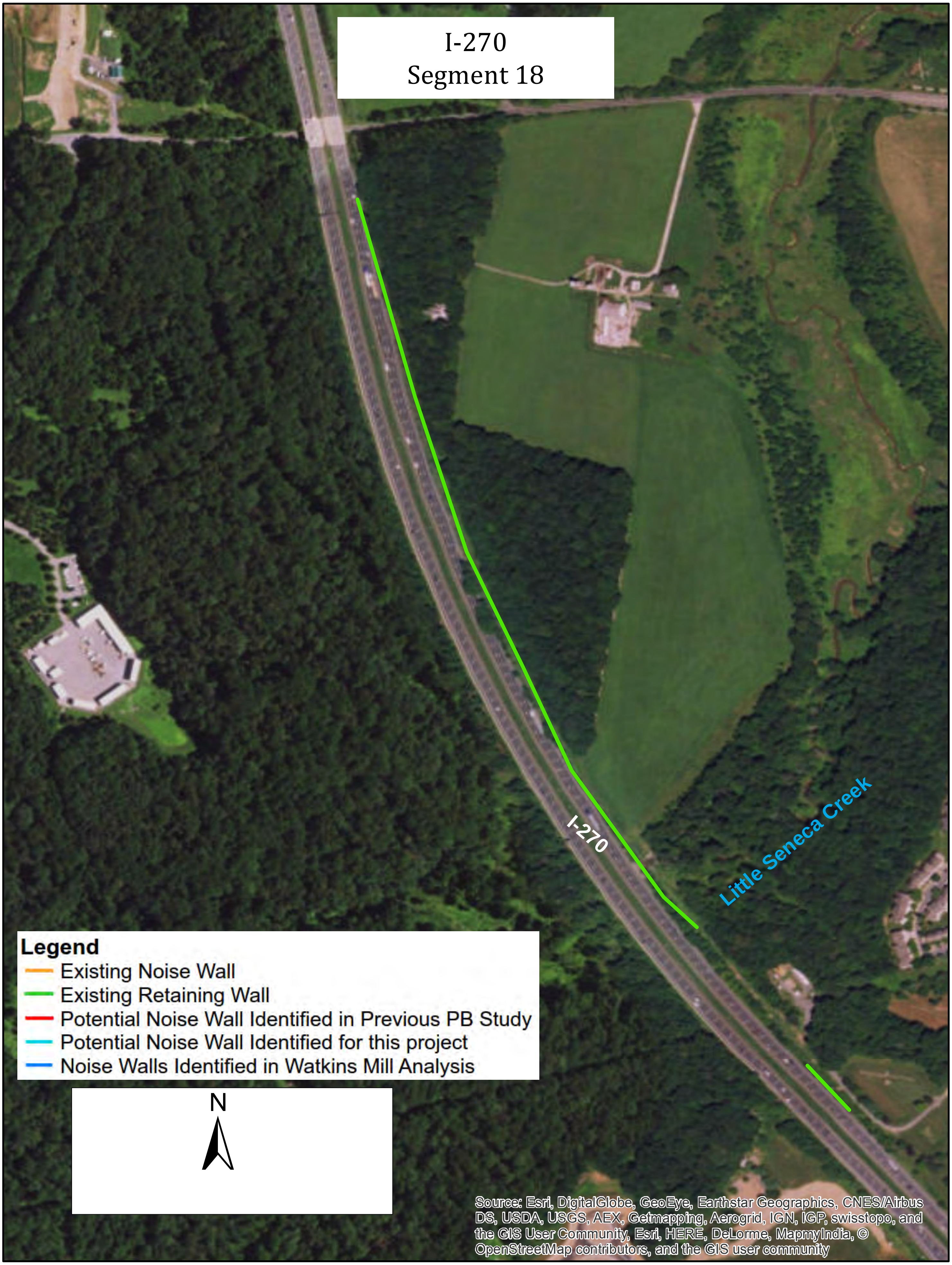

I-270
Segment 14
SOUTHBOUND IS 270
MD 109 TO NORTH OF MD 121
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00'
THROUGH LANE
12.00'
THROUGH LANE
10.00'
SHOULDER
6%
2%
2%
6%
P/C
P/R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00'
THROUGH LANE
11.00'
THROUGH LANE
10.50'
HARD SHOULDER RUNNING
6%
2%
2%
2%
P/C
P/R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00'
THROUGH LANE
11.00'
THROUGH LANE
10.50'
HARD SHOULDER RUNNING
6%
2%
2%
2%
P/C
P/R
I-270
N Frederick Rd
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community


I-270
Segment 15
SOUTHBOUND IS 270
MD 109 TO NORTH OF MD 121
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00'
THROUGH LANE
12.00'
THROUGH LANE
10.00'
SHOULDER
6%
2%
2%
6%
P.C
P.R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00'
THROUGH LANE
11.00'
THROUGH LANE
10.50'
HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C
P.R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00'
THROUGH LANE
11.00'
THROUGH LANE
10.50'
HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C
P.R
Comus Rd
X4
X5
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



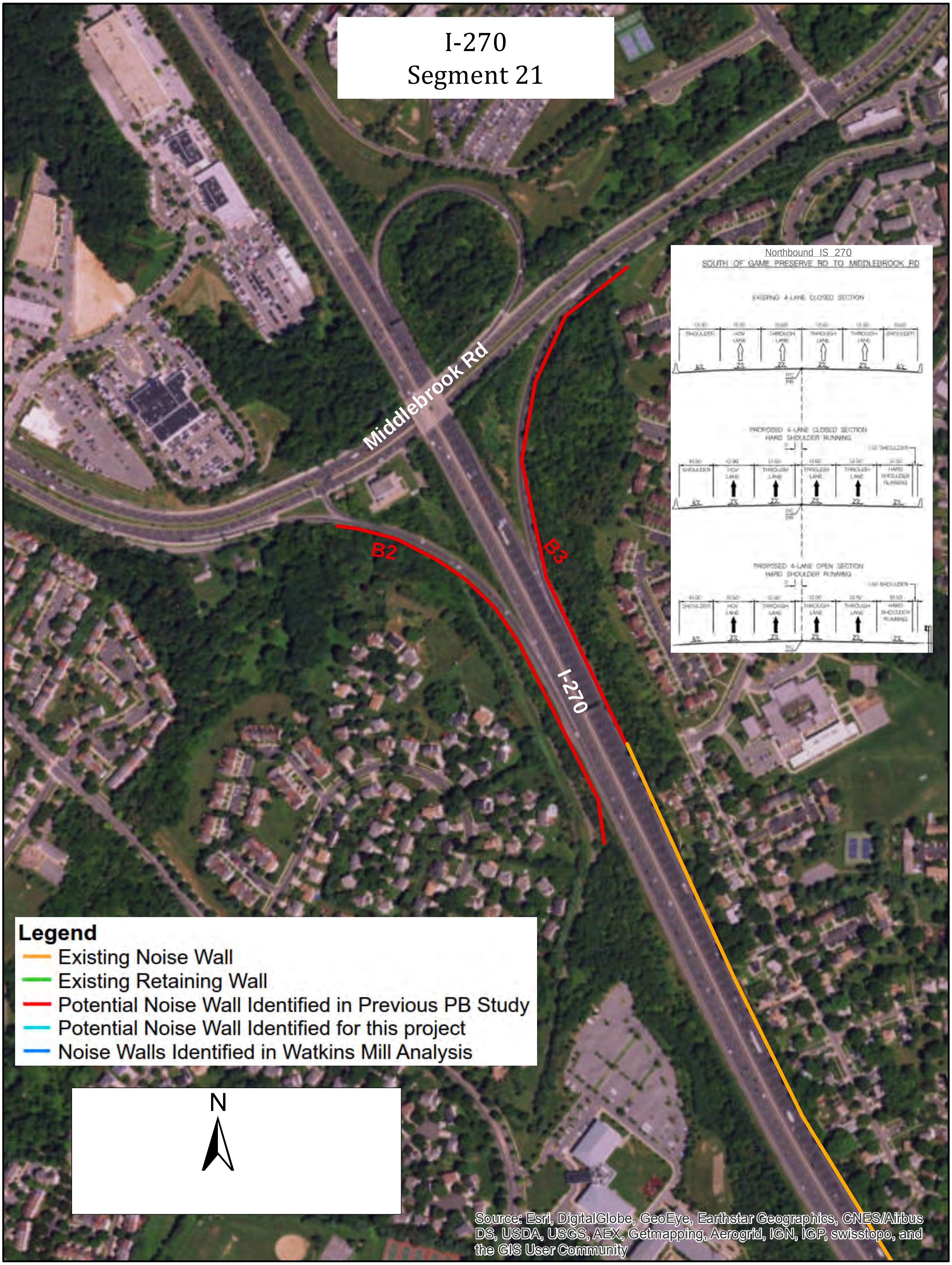
I-270
Segment 16
SOUTHBOUND IS 270
NORTH OF MD 121 TO MD 121
EXISTING 3-LANE CLOSED SECTION
10.00' SHOULDER
12.00' HOV LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
10.00' SHOULDER
6% 2% 2% 2% 2% 6%
P/C
P/R
PROPOSED 3-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.50' SHOULDER
8.00' SHOULDER
12.00' HOV LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2% 2% 2%
P/C
P/R
PROPOSED 3-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.50' SHOULDER
8.00' SHOULDER
12.00' HOV LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2% 2% 2%
P/C
I-270
Stringtown Rd
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

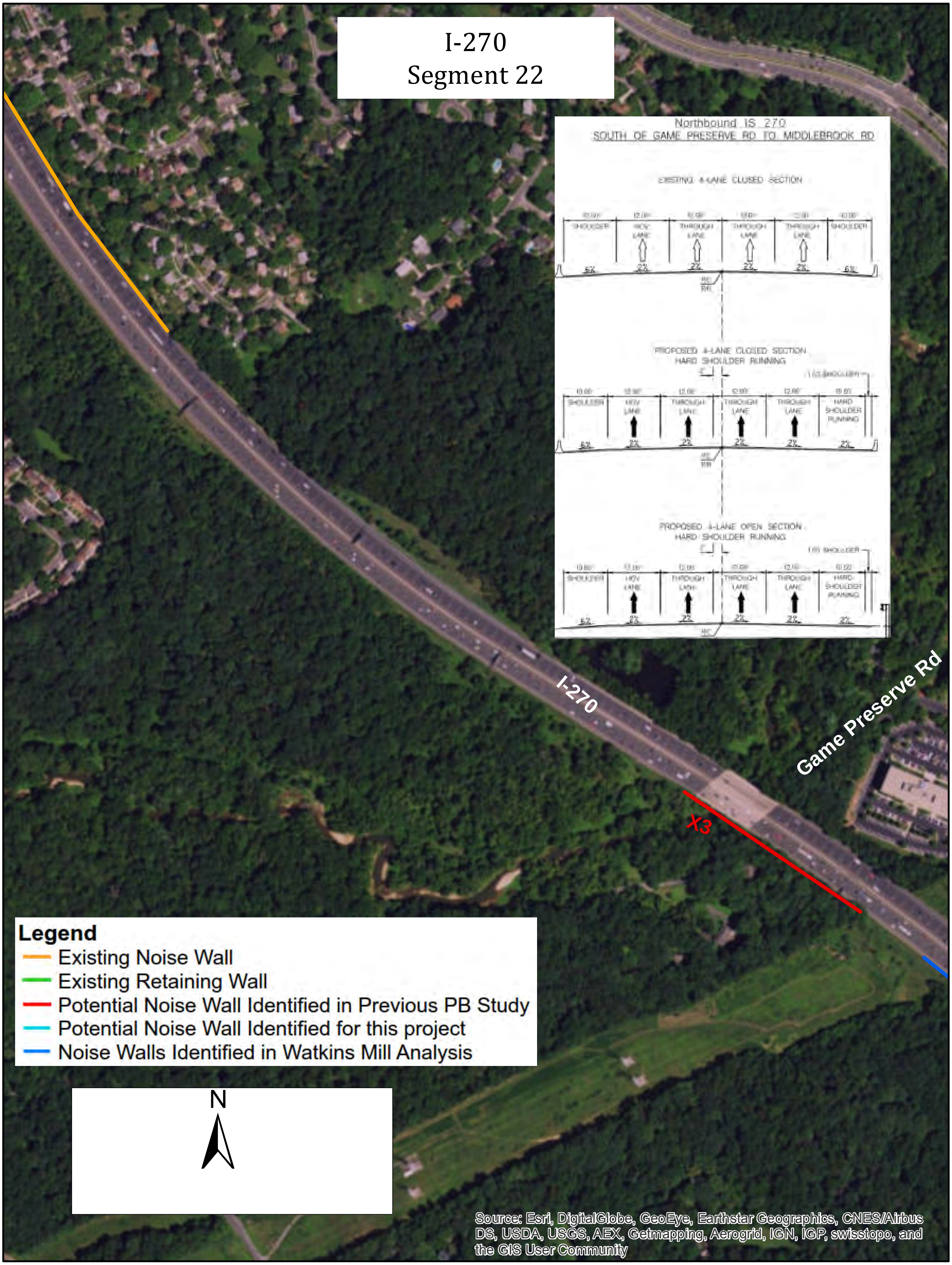

I-270
Segment 17
Shawnee Ln
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

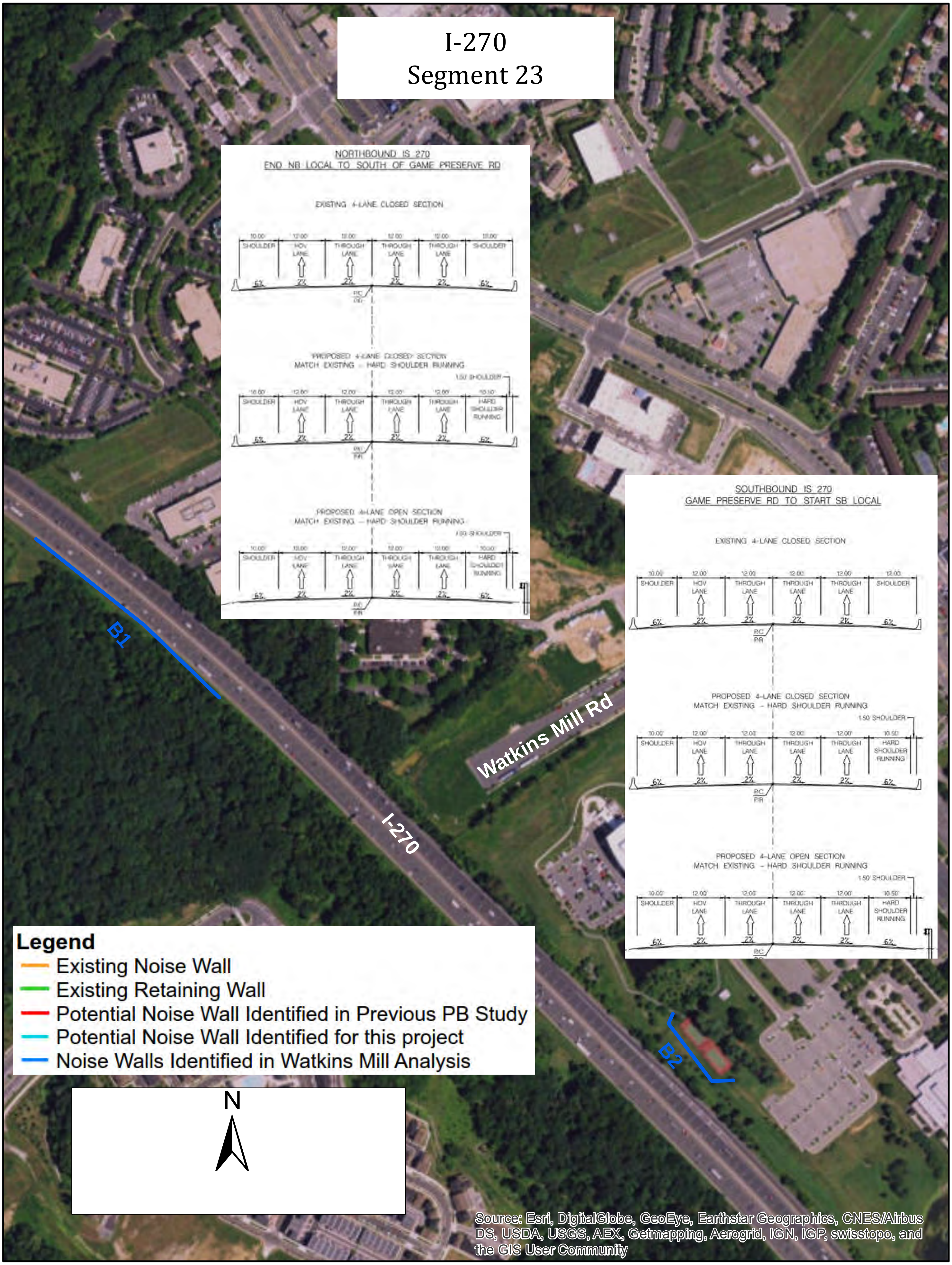

I-270
Segment 18
I-270
Little Seneca Creek
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

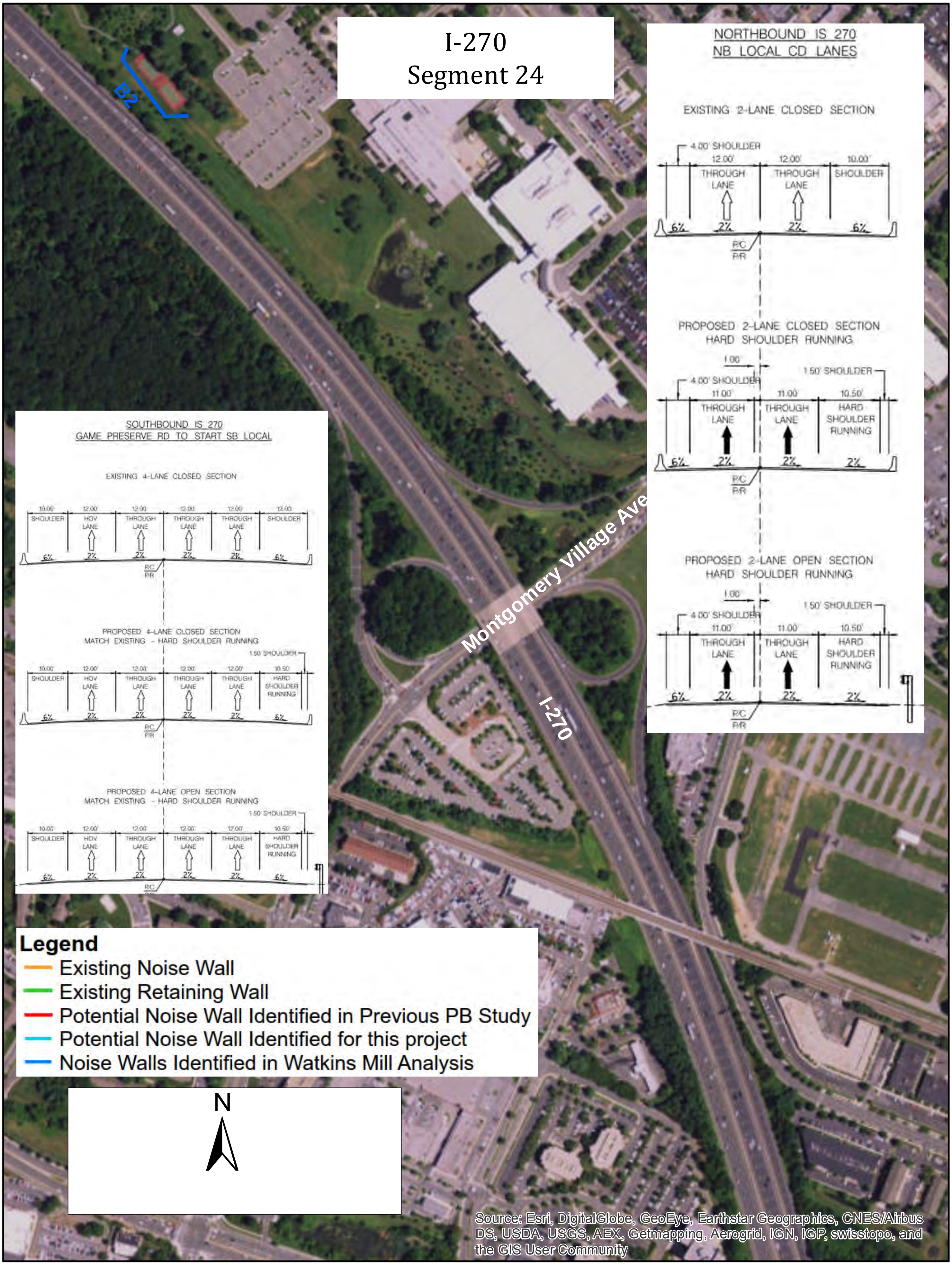
I-270
Segment 19
On- and Off-ramp Improvements proposed
Ridge Rd
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


I-270
Segment 20
Meadowbrook Estates
NB Off-Ramp Improvements at MD 118
Col
Germantown Rd
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

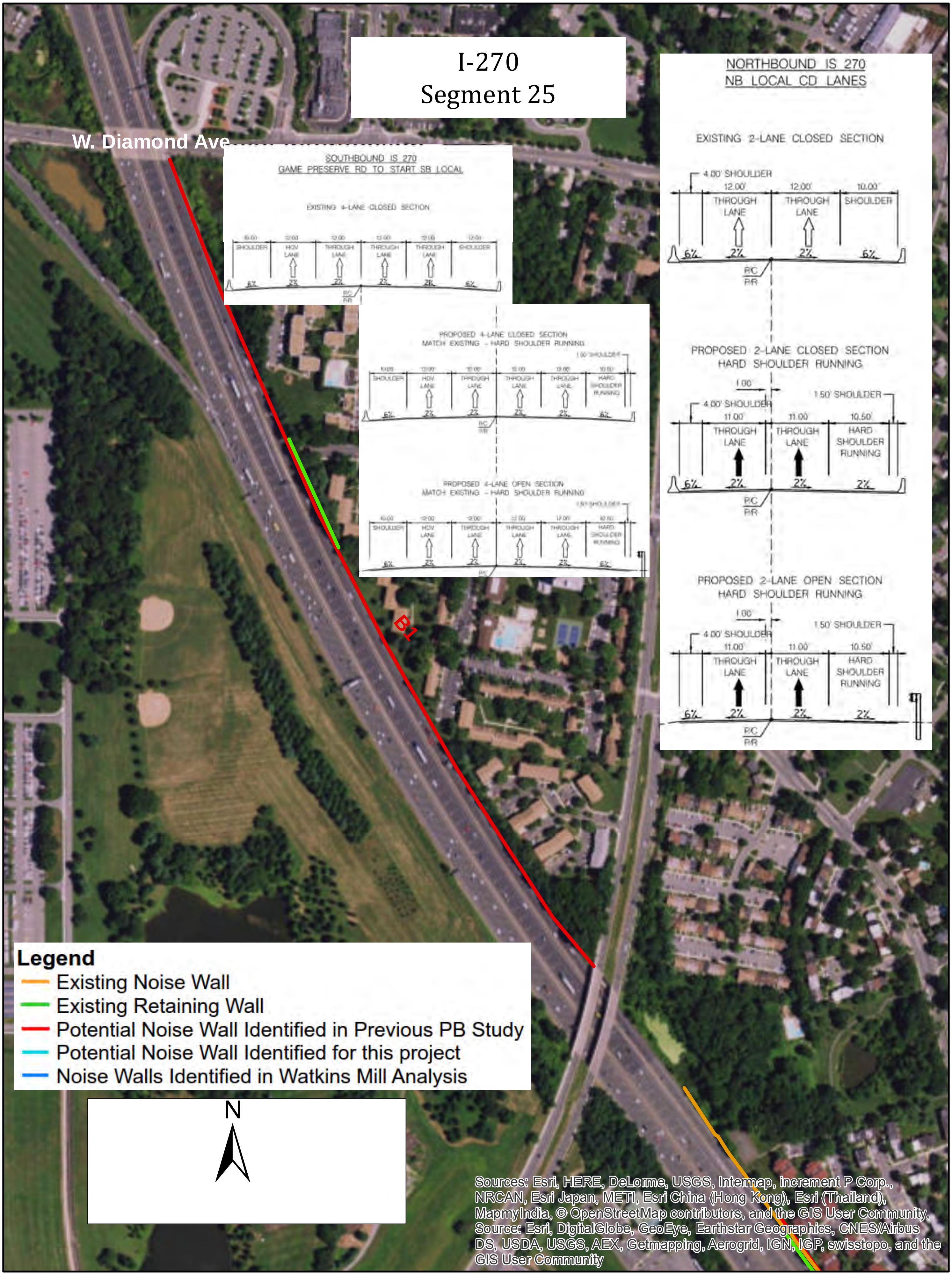

I-270
Segment 21
Northbound IS 270
SOUTH OF GAME PRESERVE RD TO MIDDLEBROOK RD
EXISTING 4-LANE CLOSED SECTION
PROPOSED 4-LANE CLOSED SECTION
HARD SHOULDER RUNNING
PROPOSED 4-LANE OPEN SECTION
HARD SHOULDER RUNNING
Middlebrook Rd
B2
B3
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

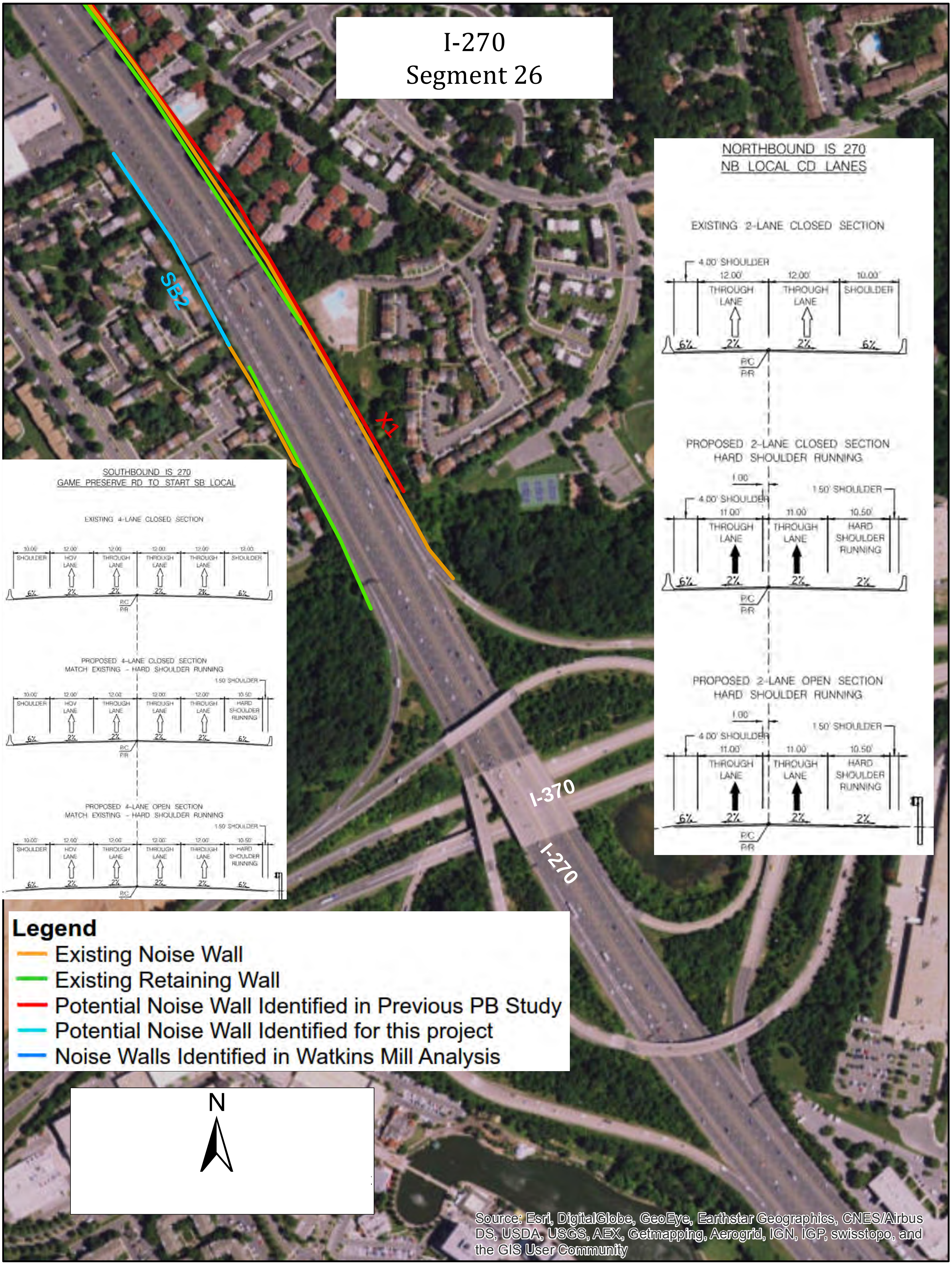

I-270
Segment 22
Northbound IS 270
SOUTH OF GAME PRESERVE RD TO MIDDLEBROOK RD
EXISTING 4-LANE CLOSED SECTION
PROPOSED 4-LANE CLOSED SECTION
HARD SHOULDER RUNNING
PROPOSED 4-LANE OPEN SECTION
HARD SHOULDER RUNNING
I-270
Game Preserve Rd
X3
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

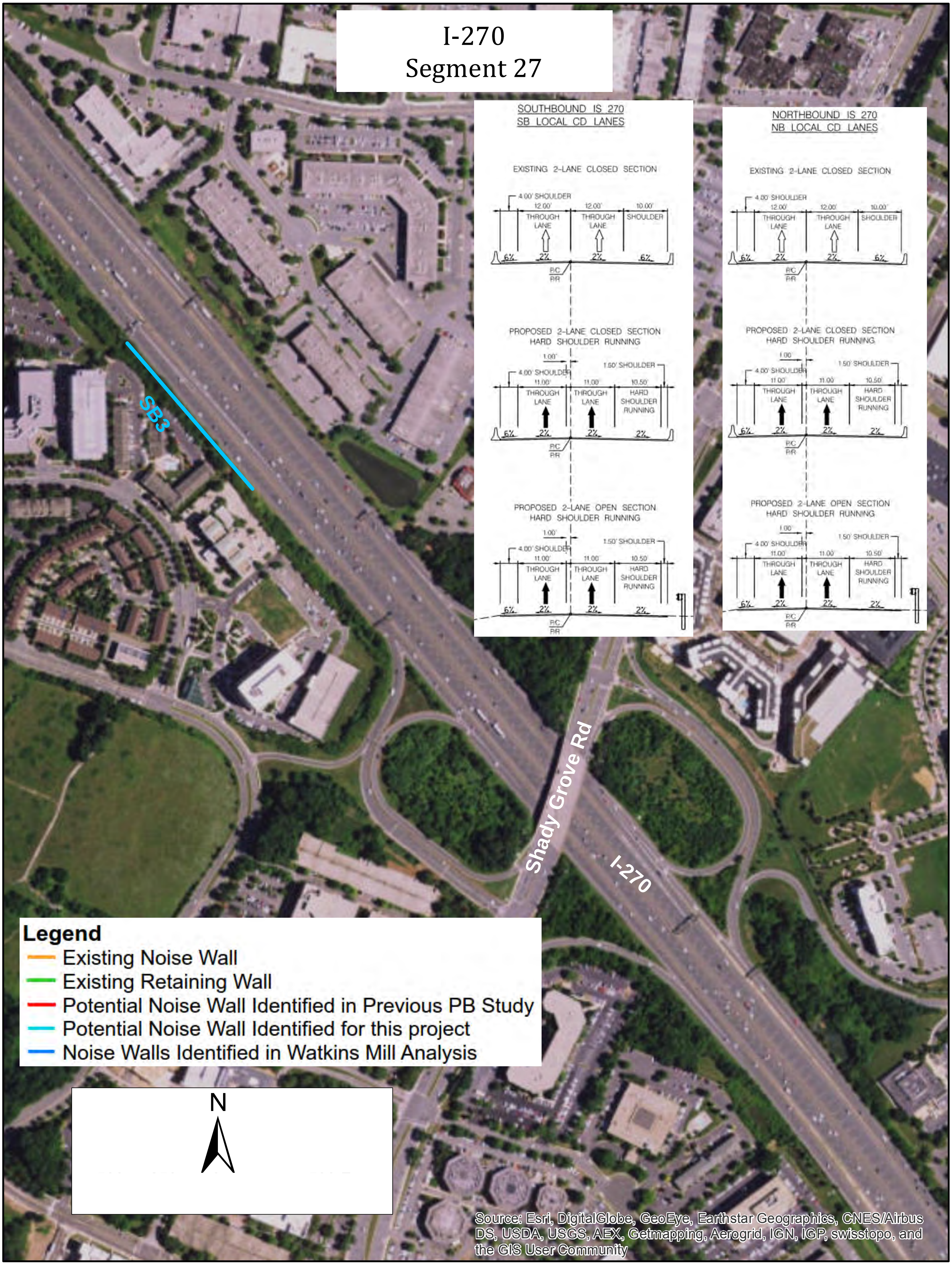

I-270
Segment 23
NORTHBOUND IS 270
END NB LOCAL TO SOUTH OF GAME PRESERVE RD
EXISTING 4-LANE CLOSED SECTION
SHOULDER
HOV LANE
THROUGH LANE
THROUGH LANE
THROUGH LANE
SHOULDER
PROPOSED 4-LANE CLOSED SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
PROPOSED 4-LANE OPEN SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
SOUTHBOUND IS 270
GAME PRESERVE RD TO START SB LOCAL
EXISTING 4-LANE CLOSED SECTION
PROPOSED 4-LANE CLOSED SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
1.50' SHOULDER
HARD SHOULDER RUNNING
PROPOSED 4-LANE OPEN SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
B1
B2
Watkins Mill Rd
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

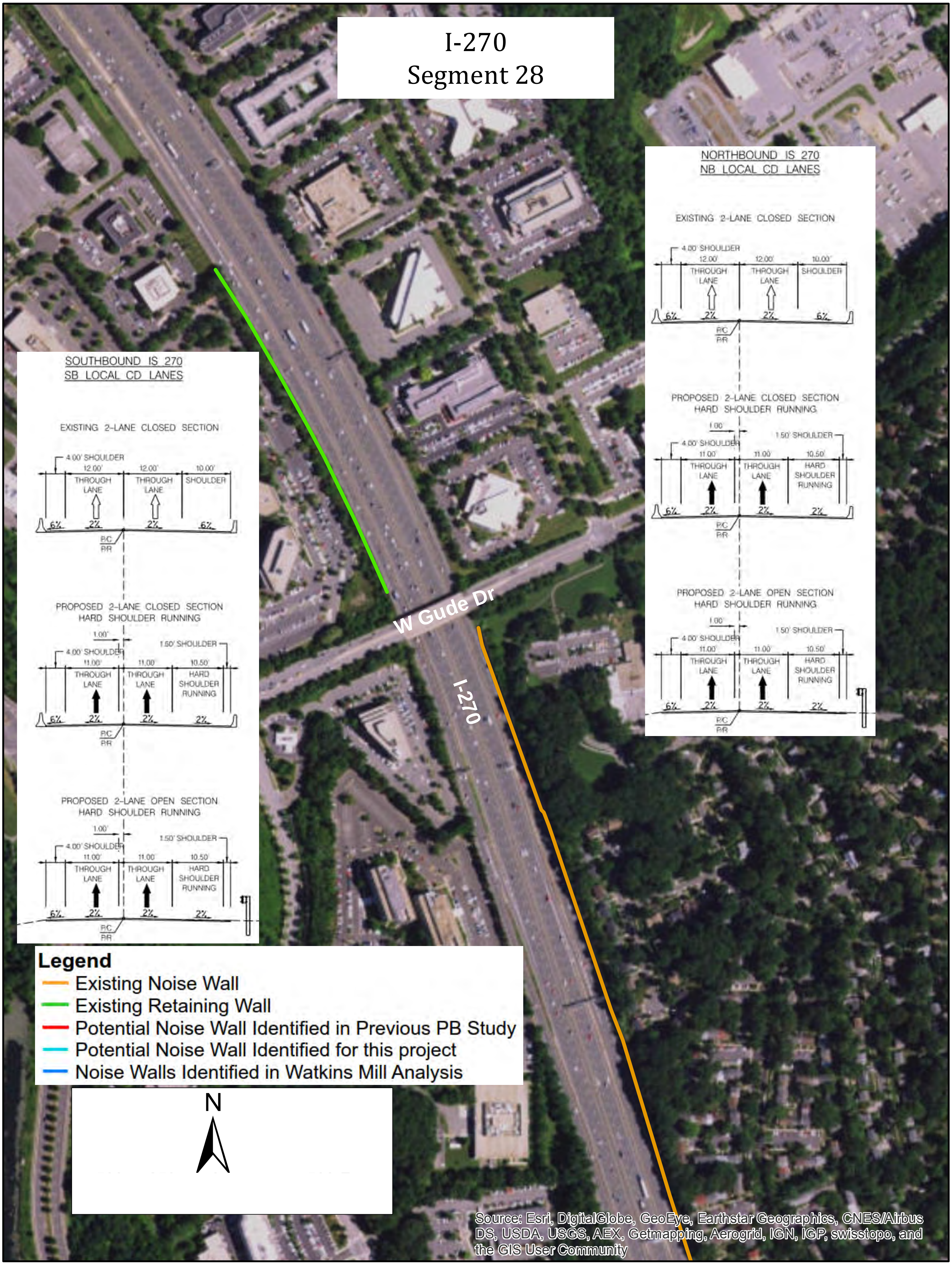


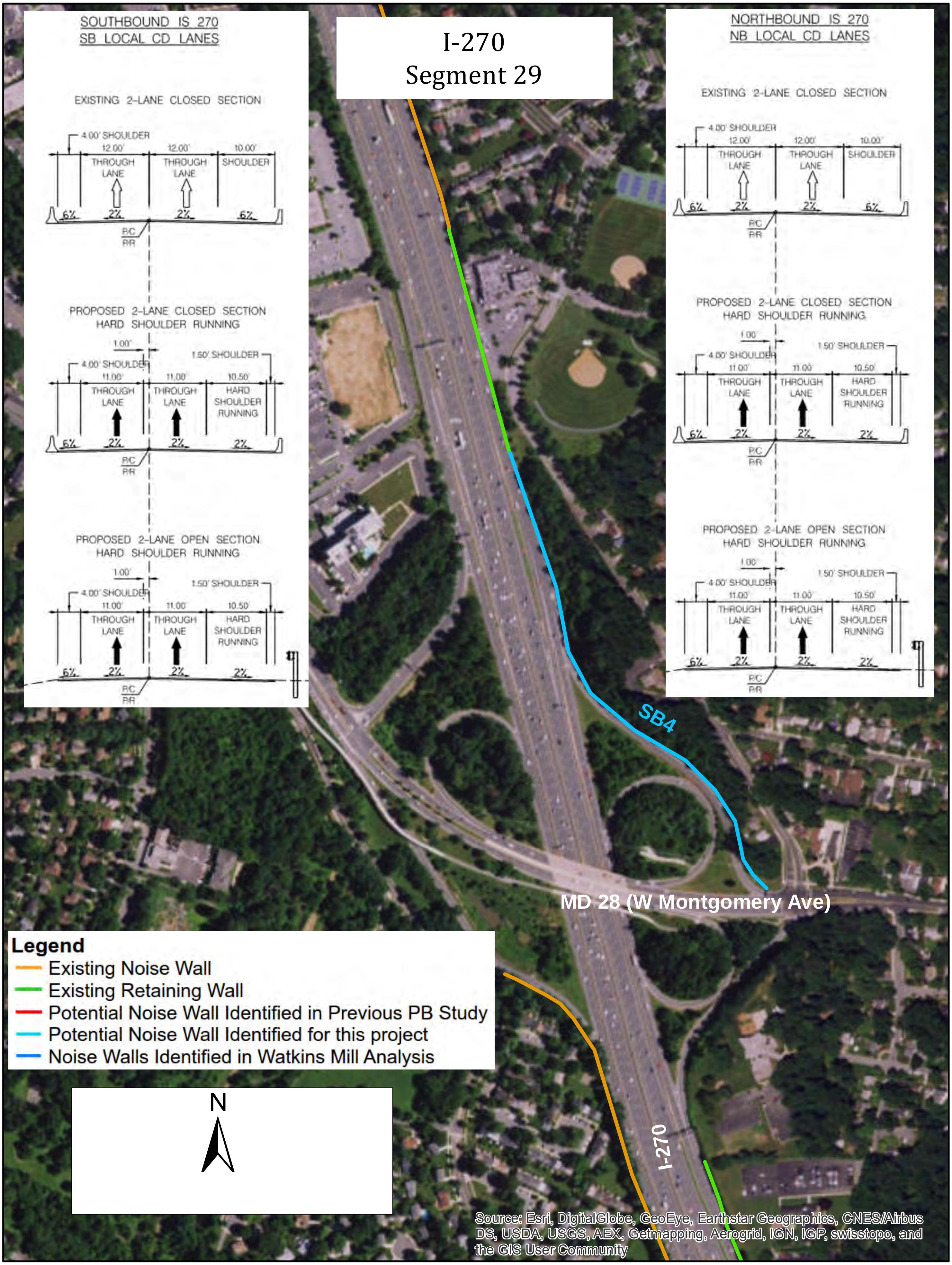
I-270
Segment 24
NORTHBOUND IS 270
NB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00' THROUGH LANE
12.00' THROUGH LANE
10.00' SHOULDER
6% 2% 2% 6%
P.C P.R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2%
P.C P.R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2%
P.C P.R
SOUTHBOUND IS 270
GAME PRESERVE RD TO START SB LOCAL
EXISTING 4-LANE CLOSED SECTION
10.00' SHOULDER
12.00' HOV LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
12.00' SHOULDER
6% 2% 2% 2% 2% 6%
P.C P.R
PROPOSED 4-LANE CLOSED SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
1.50' SHOULDER
10.00' SHOULDER
12.00' HOV LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2% 2% 6%
P.C P.R
PROPOSED 4-LANE OPEN SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
1.50' SHOULDER
10.00' SHOULDER
12.00' HOV LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
12.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2% 2% 6%
P.C
B2
Montgomery Village Ave
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

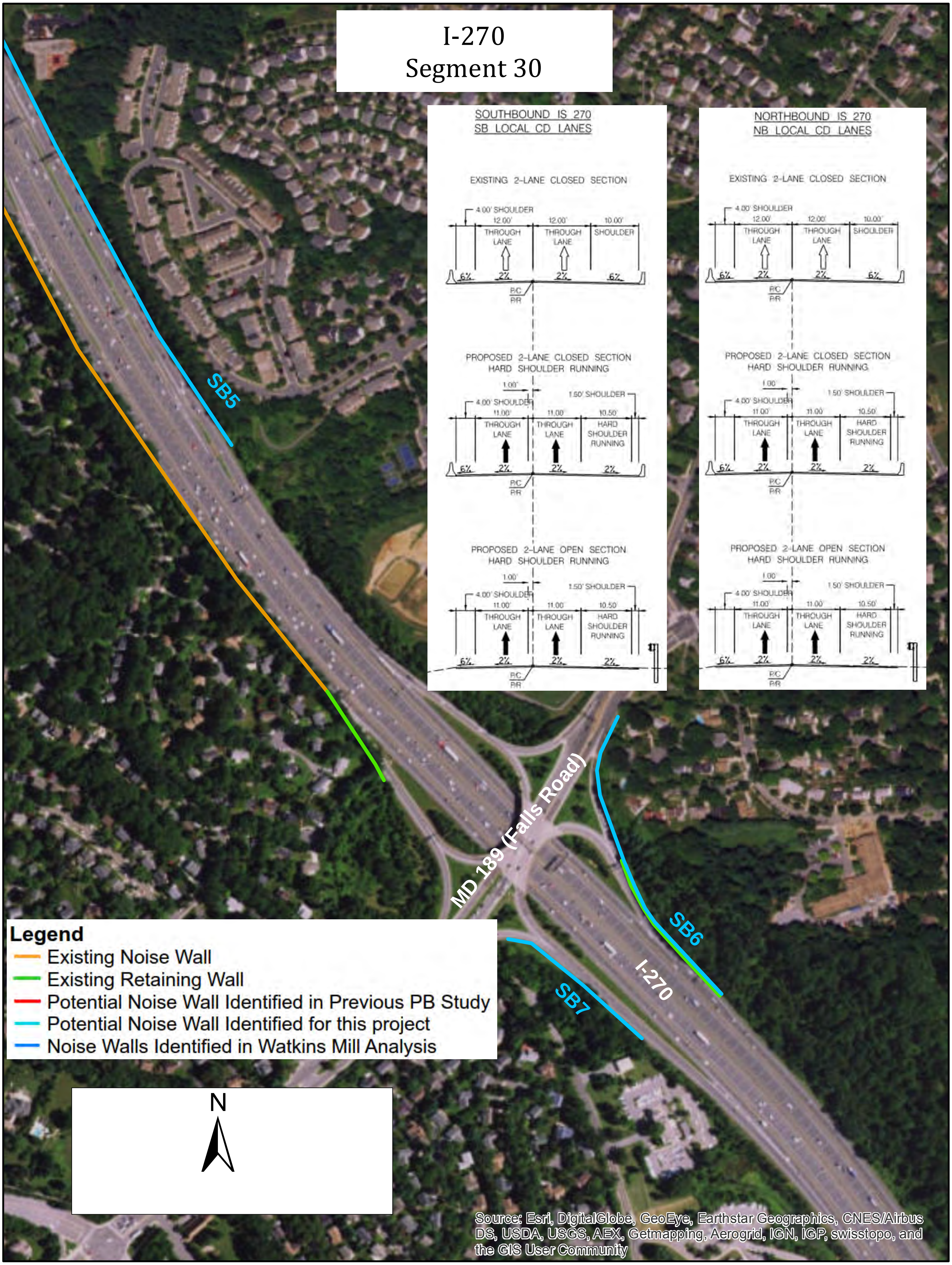

I-270
Segment 25
W. Diamond Ave
B1
SOUTHBOUND IS 270
GAME PRESERVE RD TO START SB LOCAL
EXISTING 4-LANE CLOSED SECTION
PROPOSED 4-LANE CLOSED SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
PROPOSED 4-LANE OPEN SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
NORTHBOUND IS 270
NB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00'
THROUGH LANE
10.00'
SHOULDER
6%
2%
PC
PR
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
11.00'
10.50'
HARD SHOULDER RUNNING
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


I-270
Segment 26
NORTHBOUND IS 270
NB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00'
12.00'
10.00'
THROUGH LANE
THROUGH LANE
SHOULDER
6%
2%
2%
6%
P/C
P/R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00'
11.00'
10.50'
THROUGH LANE
THROUGH LANE
HARD SHOULDER RUNNING
6%
2%
2%
2%
P/C
P/R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00'
11.00'
10.50'
THROUGH LANE
THROUGH LANE
HARD SHOULDER RUNNING
6%
2%
2%
2%
P/C
P/R
SOUTHBOUND IS 270
GAME PRESERVE RD TO START SB LOCAL
EXISTING 4-LANE CLOSED SECTION
PROPOSED 4-LANE CLOSED SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
PROPOSED 4-LANE OPEN SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
SHOULDER
HOV LANE
THROUGH LANE
HARD SHOULDER RUNNING
1.50' SHOULDER
SB2
X1
I-370
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

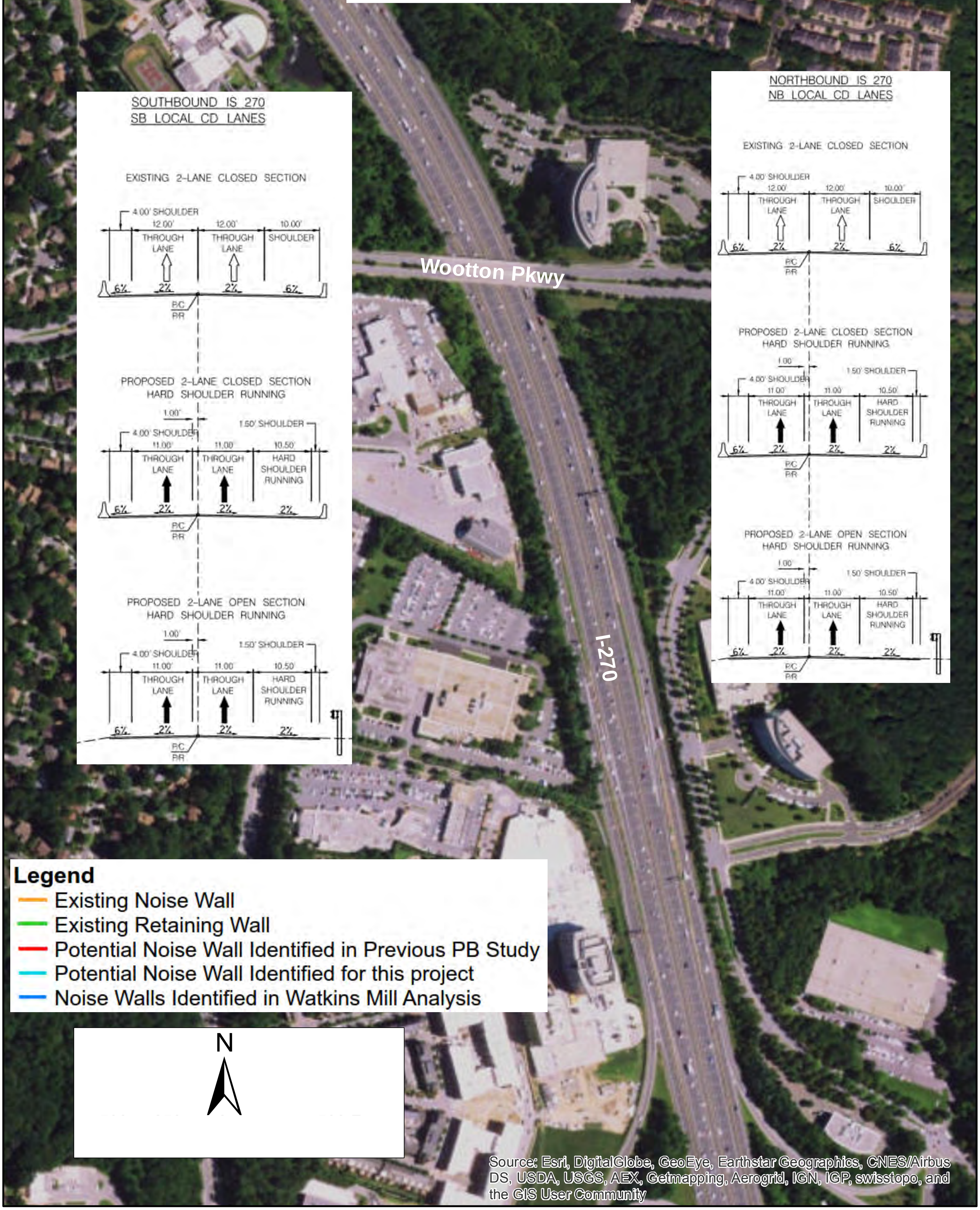

I-270
Segment 27
SOUTHBOUND IS 270
SB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00'
12.00'
10.00'
THROUGH LANE
THROUGH LANE
SHOULDER
6%
2%
2%
6%
P.C.
P.R.
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00'
11.00'
10.50'
THROUGH LANE
THROUGH LANE
HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C.
P.R.
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00'
11.00'
10.50'
THROUGH LANE
THROUGH LANE
HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C.
P.R.
NORTHBOUND IS 270
NB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00'
12.00'
10.00'
THROUGH LANE
THROUGH LANE
SHOULDER
6%
2%
2%
6%
P.C.
P.R.
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00'
11.00'
10.50'
THROUGH LANE
THROUGH LANE
HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C.
P.R.
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00'
11.00'
10.50'
THROUGH LANE
THROUGH LANE
HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C.
P.R.
SB3
Shady Grove Rd
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

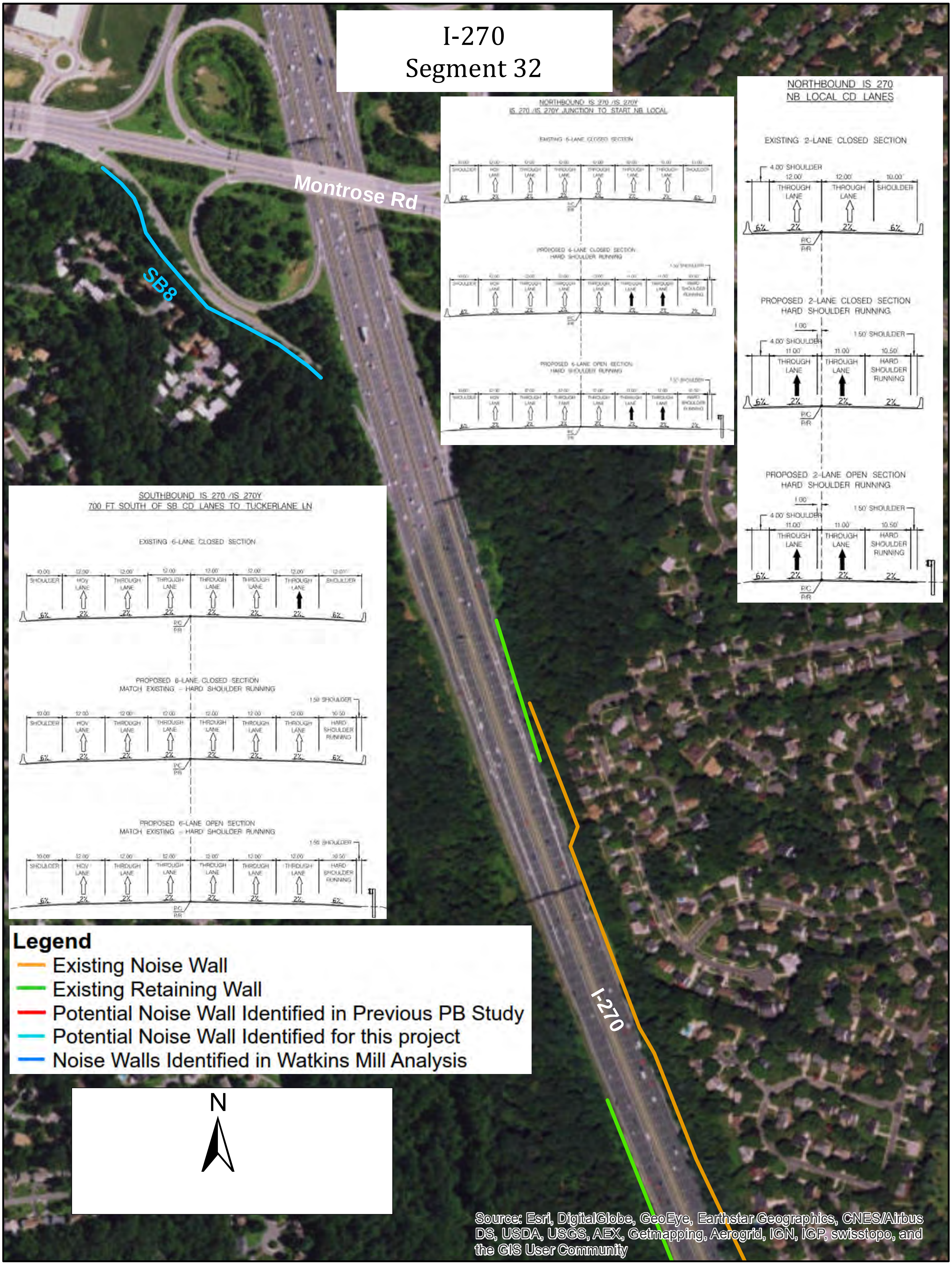

I-270
Segment 28
NORTHBOUND IS 270
NB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00' THROUGH LANE
12.00' THROUGH LANE
10.00' SHOULDER
6% 2% 2% 6%
P.C P.R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2%
P.C P.R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2%
P.C P.R
SOUTHBOUND IS 270
SB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00' THROUGH LANE
12.00' THROUGH LANE
10.00' SHOULDER
6% 2% 2% 6%
P.C P.R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2%
P.C P.R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
1.50' SHOULDER
4.00' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6% 2% 2% 2%
P.C P.R
W Gude Dr
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

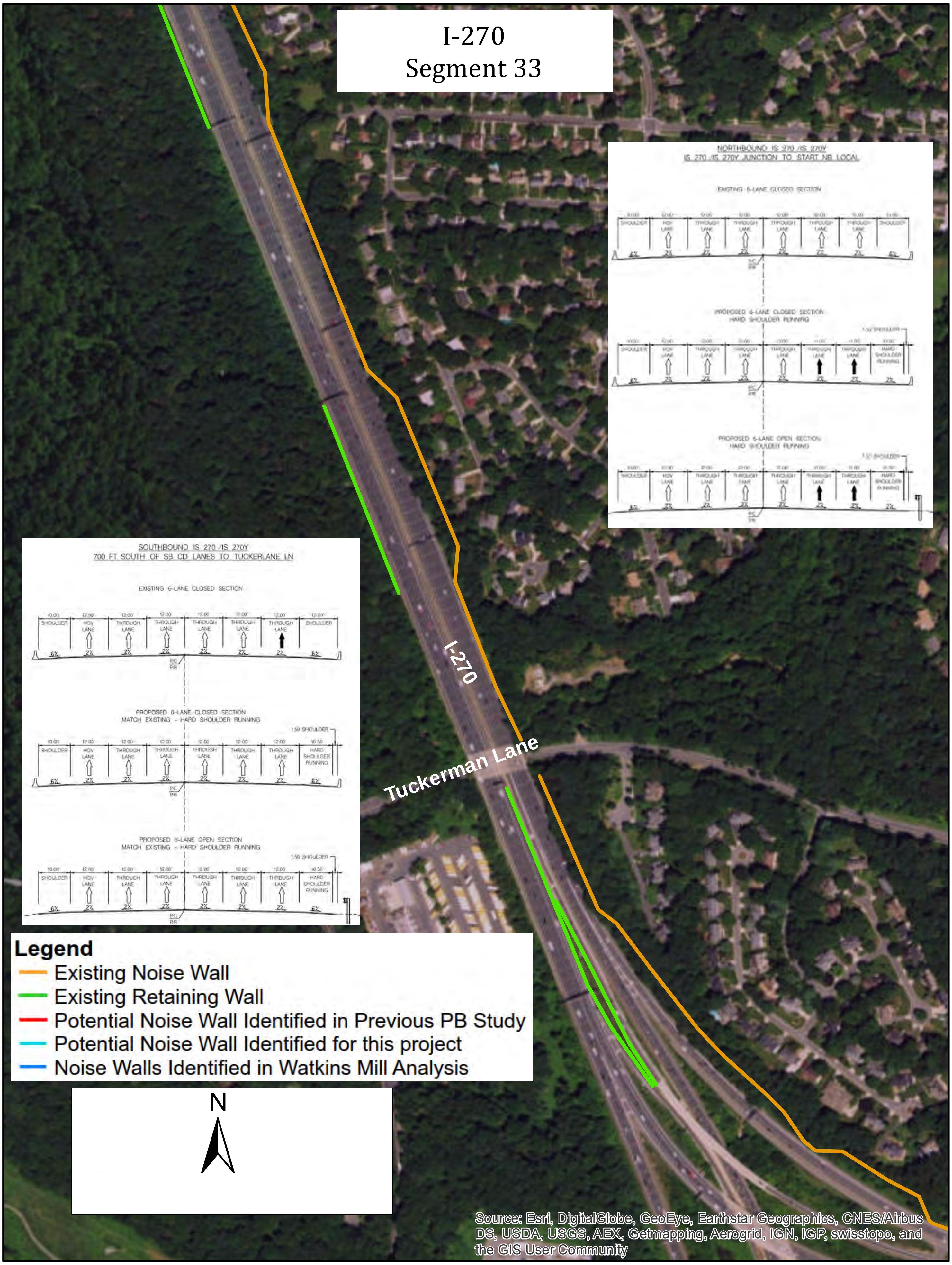

I-270
Segment 29
SOUTHBOUND IS 270
SB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00' THROUGH LANE
12.00' THROUGH LANE
10.00' SHOULDER
6%
2%
2%
6%
P.C
P.R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C
P.R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C
P.R
NORTHBOUND IS 270
NB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00' THROUGH LANE
12.00' THROUGH LANE
10.00' SHOULDER
6%
2%
2%
6%
P.C
P.R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C
P.R
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
1.50' SHOULDER
11.00' THROUGH LANE
11.00' THROUGH LANE
10.50' HARD SHOULDER RUNNING
6%
2%
2%
2%
P.C
P.R
SB4
MD 28 (W Montgomery Ave)
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


I-270
Segment 30
SOUTHBOUND IS 270
SB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
4.00' SHOULDER
12.00'
THROUGH LANE
12.00'
THROUGH LANE
10.00'
SHOULDER
6%
2%
2%
6%
P/C
P/R
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
1.00'
4.00' SHOULDER
11.00'
THROUGH LANE
11.00'
THROUGH LANE
1.50' SHOULDER
10.50'
HARD SHOULDER RUNNING
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
NORTHBOUND IS 270
NB LOCAL CD LANES
SB5
SB6
SB7
MD 189 (Falls Road)
I-270
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

I-270
Segment 31




I-270
Segment 32
NORTHBOUND IS 270 /IS 270Y
IS 270 /IS 270Y JUNCTION TO START NB LOCAL
NORTHBOUND IS 270
NB LOCAL CD LANES
EXISTING 2-LANE CLOSED SECTION
PROPOSED 2-LANE CLOSED SECTION
HARD SHOULDER RUNNING
PROPOSED 2-LANE OPEN SECTION
HARD SHOULDER RUNNING
Montrose Rd
SB8
SOUTHBOUND IS 270 /IS 270Y
700 FT SOUTH OF SB CD LANES TO TUCKERLANE LN
EXISTING 6-LANE CLOSED SECTION
PROPOSED 6-LANE CLOSED SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
PROPOSED 6-LANE OPEN SECTION
MATCH EXISTING - HARD SHOULDER RUNNING
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
I-270
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

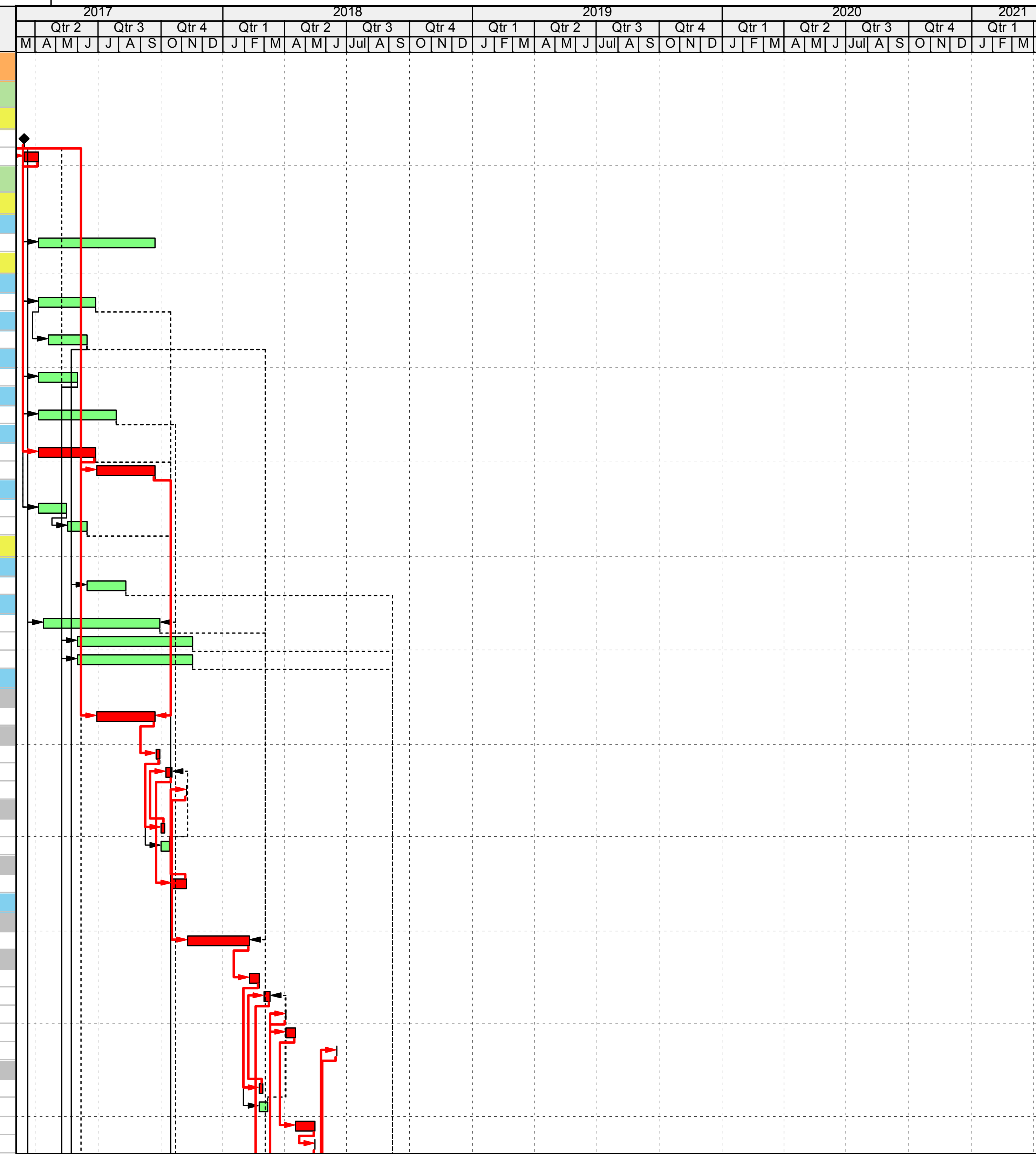

I-270
Segment 33
NORTHBOUND IS 270 /IS 270Y
IS 270 /IS 270Y JUNCTION TO START NB LOCAL
EXISTING 6-LANE CLOSED SECTION
PROPOSED 6-LANE CLOSED SECTION
HARD SHOULDER RUNNING
PROPOSED 6-LANE OPEN SECTION
HARD SHOULDER RUNNING
SOUTHBOUND IS 270 /IS 270Y
700 FT SOUTH OF SB CD LANES TO TUCKERLANE LN
EXISTING 6-LANE CLOSED SECTION
10.00' 12.00' 12.00' 12.00' 12.00' 12.00' 12.00' 12.00'
SHOULDER HOV LANE THROUGH LANE THROUGH LANE THROUGH LANE THROUGH LANE THROUGH LANE SHOULDER
6% 2% 2% 2% 2% 2% 2% 6%
PROPOSED 6-LANE CLOSED SECTION
MATCH EXISTING – HARD SHOULDER RUNNING
1.50 SHOULDER
10.00' 12.00' 12.00' 12.00' 12.00' 12.00' 12.00' 10.50'
SHOULDER HOV LANE THROUGH LANE THROUGH LANE THROUGH LANE THROUGH LANE THROUGH LANE HARD SHOULDER RUNNING
PROPOSED 6-LANE OPEN SECTION
MATCH EXISTING – HARD SHOULDER RUNNING
I-270
Tuckerman Lane
Legend
Existing Noise Wall
Existing Retaining Wall
Potential Noise Wall Identified in Previous PB Study
Potential Noise Wall Identified for this project
Noise Walls Identified in Watkins Mill Analysis
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Schedule

TECHNICAL PROPOSAL DRAFT PROJECT SCHEDULE

Proposal Date: January 19, 2017

Activity ID	Activity Name	Orig Dur	Start	Finish
IS-270 Innovative Congestion Management				
IS-270 Project Milestones				
Project-Wide Milestones				
A1060	Project NTP	0	15-Mar-17*	
A1090	Scope Confirmation	15	15-Mar-17*	04-Apr-17
Design/Construction				
Early Works				
Scope Validation				
A1050	Scope Validation	120	05-Apr-17	22-Sep-17
General Project Wide Design Elements				
Surveying				
A1000	Project Surveys	60	05-Apr-17	28-Jun-17
Utility Designation				
A1010	Utility Designations	40	19-Apr-17	14-Jun-17
Environmental Delineation Plan				
A1020	Natural Resource Inventory	40	05-Apr-17	31-May-17
NEPA (Project Wide Activities)				
A1030	Noise Analysis	80	05-Apr-17	27-Jul-17
Geotechnical Investigation (Borings)				
A1040	Geotechnical Borings	60	05-Apr-17	28-Jun-17
A1100	Geotechnical Boring Analysis & Report	60	29-Jun-17	22-Sep-17
Traffic Analysis				
A1070	Traffic Counts	30	05-Apr-17	16-May-17
A1080	Traffic Modeling Update	20	17-May-17	14-Jun-17
CAP Pkg 1 - Ramp Metering/Detection w/No ROW/Util/Enviro Impacts				
CAP Pkg 1 - Utility Coordination				
CP1.DGN.115	CAP Pkg 1 Utility Coordination	40	15-Jun-17	10-Aug-17
CAP Pkg 1 - Environmental				
CP1.DGN.365	CAP Pkg 1 MEPA/NEPA (CE)	120	12-Apr-17	29-Sep-17
CP1.DGN.355	CAP Pkg 1 Agency Coordination	120	01-Jun-17	17-Nov-17
CP1.DGN.375	CAP Pkg 1 Permit Acquisition	120	01-Jun-17	17-Nov-17
CAP Pkg 1 Design (30%)				
30% Design Production				
CP1.DGN.305	Produce Preliminary (30%) Dgn - CAP Pkg 1	60	29-Jun-17	22-Sep-17
30% Design QA Review				
CP1.DGN.PBREV.305	PB Internal Review Preliminary QA (30%) Dgn - CAP Pkg 1	5	25-Sep-17	29-Sep-17
CP1.DGN.PBREV.320	PB Revise Preliminary (30%) Dgn per CC/MCD Cmnts - CAP Pkg 1	7	09-Oct-17	17-Oct-17
CP1.DGN.IDC.305	DB Team/SHA Preliminary Investigation Mtg (30%) Dgn - CAP Pkg 1	1	08-Nov-17	08-Nov-17
30% Corman/MC Dean Review				
CP1.DGN.CREV.305	CC/MCD Internal Review Preliminary (30%) Dgn - CAP Pkg 1	5	02-Oct-17	06-Oct-17
CP1.DGN.CREV.315	CC/MCD Develop Preliminary Schedule & CAP Cost Estimate - CAP Pkg 1	10	02-Oct-17	13-Oct-17
30% SHA Review				
CP1.DGN.SREV.325	SHA Review Preliminary (30%) Dgn - CAP Pkg 1	15	18-Oct-17	07-Nov-17
CAP 1 Design (60-65%)				
60-65% Design Production				
CP1.DGN..605	Produce Semi-Final (60-65%) Dgn - CAP Pkg 1	60	09-Nov-17	07-Feb-18
60-65% Design QA Review				
CP1.DGN.PBREV.605	PB Internal Review Semi-Final QA (60-65%) Dgn - CAP Pkg 1	10	08-Feb-18	21-Feb-18
CP1.DGN.PBREV.610	PB Revise Semi-Final (60-65%) Dgn per CC/MCD Cmnts - CAP Pkg 1	7	01-Mar-18	09-Mar-18
CP1.DGN.IDC.915	DB Team/SHA Semi-Final Reveiw Meeting - CAP Pkg 1	1	02-Apr-18	02-Apr-18
CP1.DGN.PBREV.630	PB Revise Semi-Final (60-65%) Dgn per SHA Cmnts - CAP Pkg 1	10	03-Apr-18	16-Apr-18
CP1.DGN.IDC.905	PB Interdisciplinary Coordination Mtg Semi-Final (60-65%) Dgn - CAP Pkg	1	15-Jun-18	15-Jun-18
60-65% Corman/MC Dean Review				
CP1.DGN.CREV.605	CC/MCD Internal Review Semi-Final (60-65%) Dgn - CAP Pkg 1	5	22-Feb-18	28-Feb-18
CP1.DGN.CREV.635	CC/MCD Develop Semi-Final Schedule & CAP Cost Estimate - CAP Pkg 1	10	22-Feb-18	07-Mar-18
CP1.DGN.CREV.615	CC/MCD Estimate CAP Semi-Final (60-65%) Dgn - CAP Pkg 1	20	17-Apr-18	14-May-18
CP1.DGN.CREV.625	CC/MCD Submit CAP to Estimate to SHA (60-65%) Dgn - CAP Pkg 1	1	15-May-18	15-May-18



Actual Level of Effort · Remaining Work · ◆ ◆ Milestone
Actual Work · Critical Remaining Work

IS-270 Innovative Congestion Management
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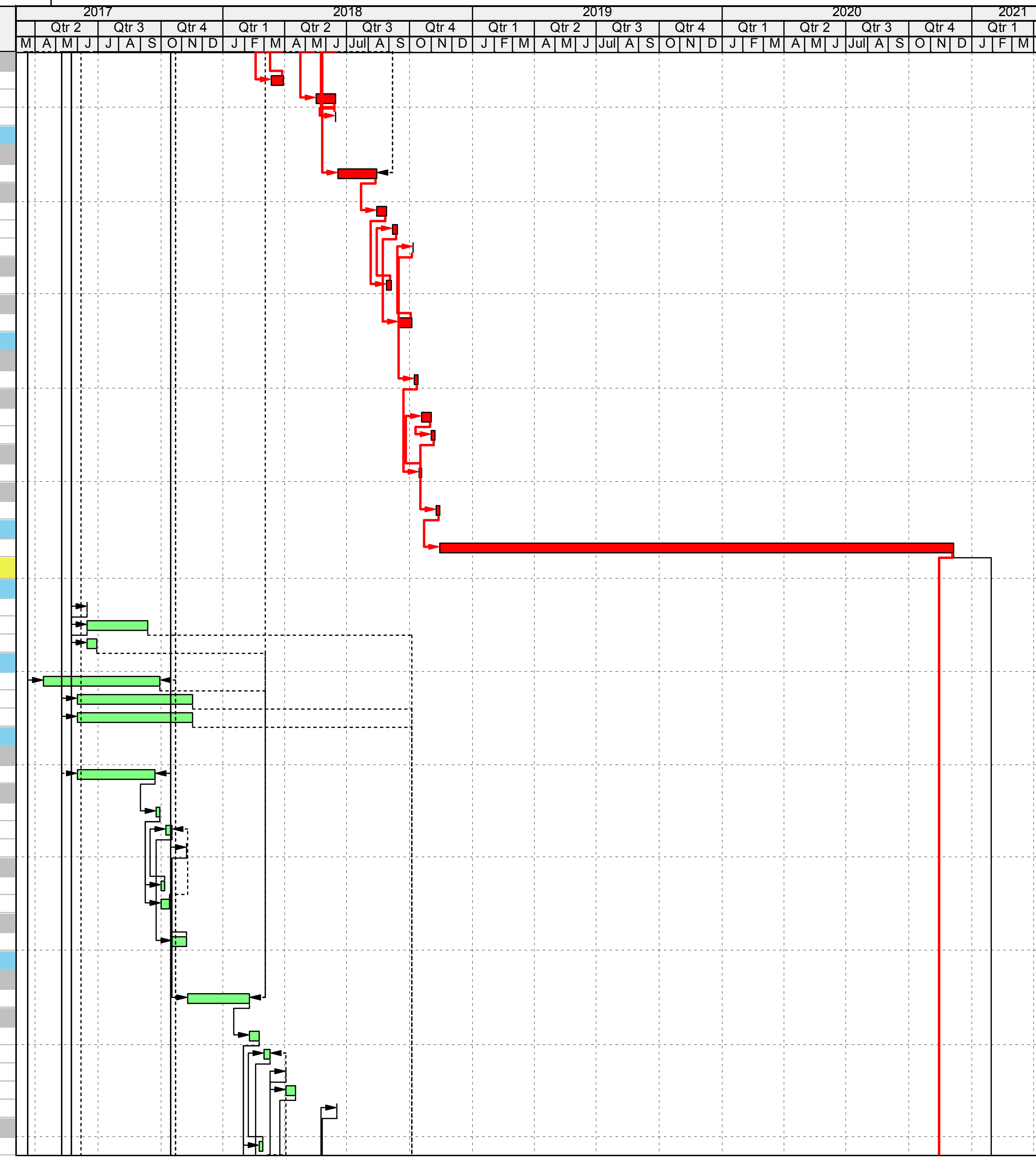
CORMAN CONSTRUCTION · WSP · PARSONS BRINCKERHOFF

TECHNICAL PROPOSAL DRAFT PROJECT SCHEDULE

Proposal Date: January 19, 2017

Activity ID	Activity Name	Orig Dur	Start	Finish
60-65% SHA Review				
CP1.DGN.SREV.615	SHA Review Semi-Final (60-65%) Dgn - CAP Pkg 1	15	12-Mar-18	30-Mar-18
CP1.DGN.SREV.635	CC/MCD & SHA Negotiate CAP (60-65%) Dgn - CAP Pkg 1	20	16-May-18	13-Jun-18
CP1.DGN.SREV.935	SHA Authorize CAP (60-65%) Dgn - CAP Pkg 1	1	14-Jun-18	14-Jun-18
CAP 1 Design (90%)				
90% Design Production				
CP1.DGN.905	Produce Final (90%) Dgn - CAP Pkg 1	40	18-Jun-18	13-Aug-18
90% Design QA Review				
CP1.DGN.PBREV.905	PB Internal Review Final QA (90%) Dgn - CAP Pkg 1	10	14-Aug-18	27-Aug-18
CP1.DGN.PBREV.920	PB Revise Final (90%) Dgn per CC/MCD Cmnts - CAP Pkg 1	7	05-Sep-18	13-Sep-18
CP1.DGN.IDC.925	DB Team/SHA Final Reveiw Meeting - CAP Pkg 1	1	05-Oct-18	05-Oct-18
90% Corman/MC Dean Review				
CP1.DGN.CREV.905	CC/MCD Internal Review Final (90%) Dgn - CAP Pkg 1	5	28-Aug-18	04-Sep-18
90% SHA Review				
CP1.DGN.SREV.925	SHA Review Final (90%) Dgn - CAP Pkg 1	15	14-Sep-18	04-Oct-18
CAP Pkg 1 Design (RFC)				
RFC Production				
CP1.DGN.PBREV.915	PB Prepare Final Response to Final (90%) Dsn - CAP Pkg 1	5	08-Oct-18	12-Oct-18
RFC QA Review				
CP1.DGN.PBREV.R05	PB Revise/Post Final per Cmnts - CAP Pkg 1	10	18-Oct-18	31-Oct-18
CP1.DGN.PBREV.R10	PB Produce/Issu RFC Dgn Pkg - Sign/Seal/Submit - CAP Pkg 1	5	01-Nov-18	07-Nov-18
RFC Corman/MC Dean Review				
CP1.DGN.CREV.R05	CC/MCD Formal Review Revised Fnl Dgn - CAP Pkg 1	3	15-Oct-18	17-Oct-18
RFC SHA Review & Authorize Construction				
CP1.DGN.SREV.105	SHA Review & Authorize Construction - CAP Pkg 1	5	08-Nov-18	14-Nov-18
CAP Pkg 1 Construction				
CP1.CON.C105	CC/MCD Construct - CAP Pkg 1	520	14-Nov-18	04-Dec-20
CAP Pkg 2 - Ramp Metering/Detection w/ ROW/Util/Enviro Impacts				
CAP Pkg 2 - Utility Coordination				
CP2.DGN.105	CAP Pkg 3 Potential Utility Conflicts Identified	1	15-Jun-17	15-Jun-17
CP2.DGN.115	CAP Pkg 2 Utility Coordination	60	16-Jun-17	11-Sep-17
CP2.DGN.125	CAP Pkg 3 Utility Test Holes	10	16-Jun-17	29-Jun-17
CAP Pkg 2 - Environmental				
CP2.DGN.365	CAP Pkg 2 MEPA/NEPA (CE)	120	12-Apr-17	29-Sep-17
CP2.DGN.355	CAP Pkg 2 Agency Coordination	120	01-Jun-17	17-Nov-17
CP2.DGN.375	CAP Pkg 2 Permit Acquisition	120	01-Jun-17	17-Nov-17
CAP Pkg 2 Design (30%)				
30% Design Production				
CP2.DGN.305	Produce Preliminary (30%) Dgn - CAP Pkg 2	80	01-Jun-17	22-Sep-17
30% Design QA Review				
CP2.DGN.PBREV.345	PB Internal Review Preliminary QA (30%) Dgn - CAP Pkg 2	5	25-Sep-17	29-Sep-17
CP2.DGN.PBREV.375	PB Revise Preliminary (30%) Dgn per CC/MCD Cmnts - CAP Pkg 2	7	09-Oct-17	17-Oct-17
CP2.DGN.IDC.615	DB Team/SHA Preliminary Investigation Mtg (30%) Dgn - CAP Pkg 2	1	08-Nov-17	08-Nov-17
30% Corman/MC Dean Review				
CP2.DGN.CREV.325	CC/MCD Internal Review Preliminary (30%) Dgn - CAP Pkg 2	5	02-Oct-17	06-Oct-17
CP2.DGN.CREV.315	CC/MCD Develop Preliminary Schedule & CAP Cost Estimate - CAP Pkg 2	10	02-Oct-17	13-Oct-17
30% SHA Review				
CP2.DGN.SREV.335	SHA Review Preliminary (30%) Dgn - CAP Pkg 2	15	18-Oct-17	07-Nov-17
CAP 2 Design (60-65%)				
60-65% Design Production				
CP2.DGN..605	Produce Semi-Final (60-65%) Dgn - CAP Pkg 2	60	09-Nov-17	07-Feb-18
60-65% Design QA Review				
CP2.DGN.PBREV.655	PB Internal Review Semi-Final QA (60-65%) Dgn - CAP Pkg 2	10	08-Feb-18	21-Feb-18
CP2.DGN.PBREV.665	PB Revise Semi-Final (60-65%) Dgn per CC/MCD Cmnts - CAP Pkg 2	7	01-Mar-18	09-Mar-18
CP2.DGN.IDC.925	DB Team/SHA Semi-Final Reveiw Meeting - CAP Pkg 2	1	02-Apr-18	02-Apr-18
CP2.DGN.PBREV.930	PB Revise Semi-Final (60-65%) Dgn per SHA Cmnts - CAP Pkg 2	10	03-Apr-18	16-Apr-18
CP2.DGN.IDC.935	PB Interdisciplinary Coordination Mtg Semi-Final (60-65%) Dgn - CAP Pkg	1	15-Jun-18	15-Jun-18
60-65% Corman/MC Dean Review				
CP2.DGN.CREV.605	CC/MCD Internal Review Semi-Final (60-65%) Dgn - CAP Pkg 2	5	22-Feb-18	28-Feb-18



Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
◆ ◆ Milestone

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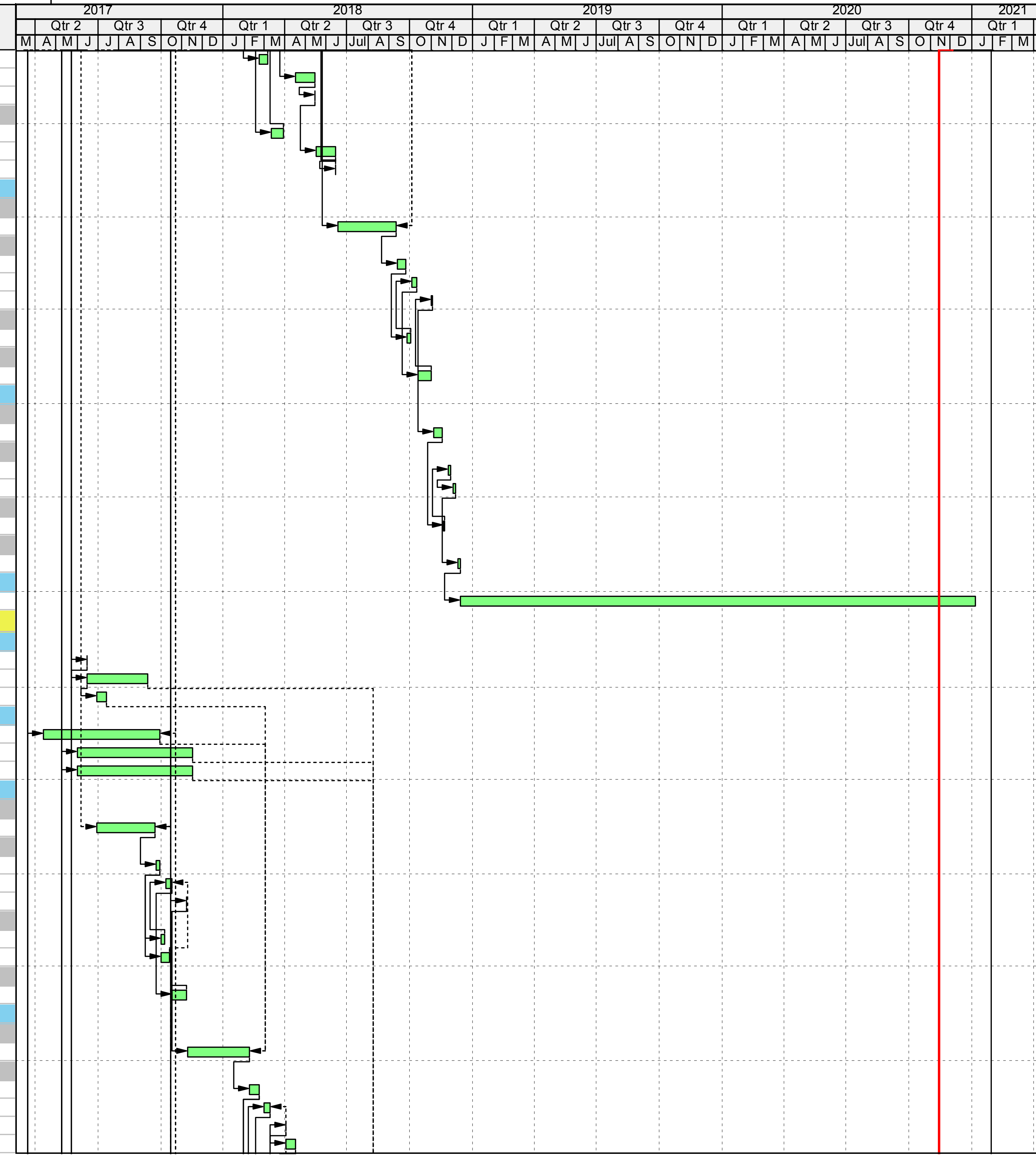
CORMAN CONSTRUCTION WSP PARSONS BRINCKERHOFF

TECHNICAL PROPOSAL DRAFT PROJECT SCHEDULE

Proposal Date: January 19, 2017

Activity ID	Activity Name	Orig Dur	Start	Finish
CP2.DGN.CREV.635	CC/MCD Develop Semi-Final Schedule & CAP Cost Estimate - CAP Pkg 2	10	22-Feb-18	07-Mar-18
CP2.DGN.CREV.615	CC/MCD Estimate CAP Semi-Final (60-65%) Dgn - CAP Pkg 2	20	17-Apr-18	14-May-18
CP2.DGN.CREV.625	CC/MCD Submit CAP to Estimate to SHA (60-65%) Dgn - CAP Pkg 2	1	15-May-18	15-May-18
60-65% SHA Review				
CP2.DGN.SREV.625	SHA Review Semi-Final (60-65%) Dgn - CAP Pkg 2	15	12-Mar-18	30-Mar-18
CP2.DGN.SREV.635	CC/MCD & SHA Negotiate CAP (60-65%) Dgn - CAP Pkg 2	20	16-May-18	13-Jun-18
CP2.DGN.SREV.645	SHA Authorize CAP (60-65%) Dgn - CAP Pkg 2	1	14-Jun-18	14-Jun-18
CAP 2 Design (90%)				
90% Design Production				
CP2.DGN.915	Produce Final (90%) Dgn - CAP Pkg 2	60	18-Jun-18	11-Sep-18
90% Design QA Review				
CP2.DGN.PBREV.925	PB Internal Review Final QA (90%) Dgn - CAP Pkg 2	10	12-Sep-18	25-Sep-18
CP2.DGN.PBREV.985	PB Revise Final (90%) Dgn per CC/MCD Cmnts - CAP Pkg 2	7	03-Oct-18	11-Oct-18
CP2.DGN.IDC.995	DB Team/SHA Final Reveiw Meeting - CAP Pkg 2	1	02-Nov-18	02-Nov-18
90% Corman/MC Dean Review				
CP2.DGN.CREV.915	CC/MCD Internal Review Final (90%) Dgn - CAP Pkg 2	5	26-Sep-18	02-Oct-18
90% SHA Review				
CP2.DGN.SREV.945	SHA Review Final (90%) Dgn - CAP Pkg 2	15	12-Oct-18	01-Nov-18
Cap Pkg 2 Design (RFC)				
RFC Production				
CP2.DGN.PBREV.935	PB Prepare Final Response to Final (90%) Dsn - CAP Pkg 2	10	05-Nov-18	16-Nov-18
RFC QA Review				
CP2.DGN.PBREV.R20	PB Revise/Post Final per Cmnts - CAP Pkg 2	5	26-Nov-18	30-Nov-18
CP2.DGN.PBREV.R30	PB Produce/Issu RFC Dgn Pkg - Sign/Seal/Submit - CAP Pkg 2	5	03-Dec-18	07-Dec-18
RFC Corman/MC Dean Review				
CP2.DGN.CREV.R5	CC/MCD Formal Review Revised Fnl Dgn - CAP Pkg 2	3	19-Nov-18	21-Nov-18
RFC SHA Review & Authorize Construction				
CP2.DGN.SREV.105	SHA Review & Authorize Construction - CAP Pkg 2	5	10-Dec-18	14-Dec-18
CAP Pkg 2 Construction				
CP2.CON.C205	CC/MCD Construct - CAP Pkg 2	520	14-Dec-18	06-Jan-21
CAP Pkg 3 - Geometric Improvements w/No ROW/Util/Enviro Impacts				
CAP Pkg 3 - Utility Coordination				
CP3.DGN.105	CAP Pkg 3 Potential Utility Conflicts Identified	1	15-Jun-17	15-Jun-17
CP3.DGN.115	CAP Pkg 3 Utility Coordination	60	16-Jun-17	11-Sep-17
CP3.DGN.125	CAP Pkg 3 Utility Test Holes	10	30-Jun-17	14-Jul-17
CAP Pkg 3 - Environmental				
CP3.DGN.365	CAP Pkg 3 MEPA/NEPA (CE)	120	12-Apr-17	29-Sep-17
CP3.DGN.355	CAP Pkg 3 Agency Coordination	120	01-Jun-17	17-Nov-17
CP3.DGN.375	CAP Pkg 3 Permit Acquisition	120	01-Jun-17	17-Nov-17
CAP Pkg 3 Design (30%)				
30% Design Production				
CP3.DGN.305	Produce Preliminary (30%) Dgn - CAP Pkg 3	60	29-Jun-17	22-Sep-17
30% Design QA Review				
CP3.DGN.PBREV.395	PB Internal Review Preliminary QA (30%) Dgn - CAP Pkg 3	5	25-Sep-17	29-Sep-17
CP3.DGN.PBREV.325	PB Revise Preliminary (30%) Dgn per CC/MCD Cmnts - CAP Pkg 3	7	09-Oct-17	17-Oct-17
CP3.DGN.IDC.635	DB Team/SHA Preliminary Investigation Mtg (30%) Dgn - CAP Pkg 3	1	08-Nov-17	08-Nov-17
30% Corman/MC Dean Review				
CP3.DGN.CREV.355	CC/MCD Internal Review Preliminary (30%) Dgn - CAP Pkg 3	5	02-Oct-17	06-Oct-17
CP3.DGN.CREV.315	CC/MCD Develop Preliminary Schedule & CAP Cost Estimate - CAP Pkg 3	10	02-Oct-17	13-Oct-17
30% SHA Review				
CP3.DGN.SREV.345	SHA Review Preliminary (30%) Dgn - CAP Pkg 3	15	18-Oct-17	07-Nov-17
CAP 3 Design (60-65%)				
60-65% Design Production				
CP3.DGN..625	Produce Semi-Final (60-65%) Dgn - CAP Pkg 3	60	09-Nov-17	07-Feb-18
60-65% Design QA Review				
CP3.DGN.PBREV.605	PB Internal Review Semi-Final QA (60-65%) Dgn - CAP Pkg 3	10	08-Feb-18	21-Feb-18
CP3.DGN.PBREV.615	PB Revise Semi-Final (60-65%) Dgn per CC/MCD Cmnts - CAP Pkg 3	7	01-Mar-18	09-Mar-18
CP3.DGN.IDC.645	DB Team/SHA Semi-Final Reveiw Meeting - CAP Pkg 3	1	02-Apr-18	02-Apr-18
CP3.DGN.PBREV.625	PB Revise Semi-Final (60-65%) Dgn per SHA Cmnts - CAP Pkg 3	10	03-Apr-18	16-Apr-18



Actual Level of Effort | Remaining Work | ◆ ◆ Milestone
Actual Work | Critical Remaining Work

IS-270 Innovative Congestion Management

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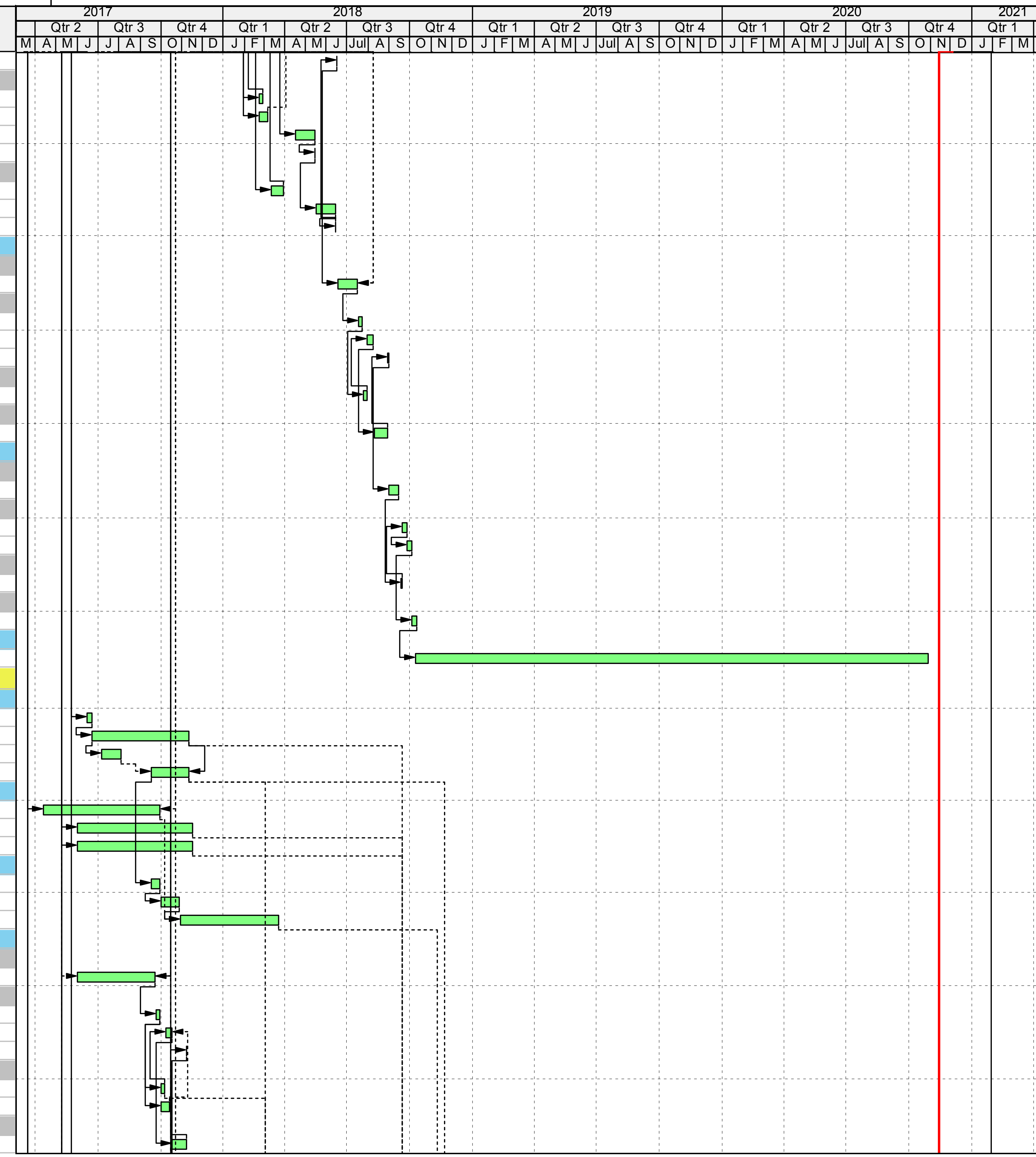
CORMAN CONSTRUCTION | WSP | PARSONS BRINCKERHOFF

TECHNICAL PROPOSAL DRAFT PROJECT SCHEDULE

Proposal Date: January 19, 2017

Activity ID	Activity Name	Orig Dur	Start	Finish
CP3.DGN.IDC.655	PB Interdisciplinary Coordination Mtg Semi-Final (60-65%) Dgn - CAP Pkg	1	15-Jun-18	15-Jun-18
60-65% Corman/MC Dean Review				
CP3.DGN.CREV.665	CC/MCD Internal Review Semi-Final (60-65%) Dgn - CAP Pkg 3	5	22-Feb-18	28-Feb-18
CP3.DGN.CREV.645	CC/MCD Develop Semi-Final Schedule & CAP Cost Estimate - CAP Pkg 2	10	22-Feb-18	07-Mar-18
CP3.DGN.CREV.625	CC/MCD Estimate CAP Semi-Final (60-65%) Dgn - CAP Pkg 3	20	17-Apr-18	14-May-18
CP3.DGN.CREV.635	CC/MCD Submit CAP to Estimate to SHA (60-65%) Dgn - CAP Pkg 3	1	15-May-18	15-May-18
60-65% SHA Review				
CP3.DGN.SREV.635	SHA Review Semi-Final (60-65%) Dgn - CAP Pkg 3	15	12-Mar-18	30-Mar-18
CP3.DGN.SREV.655	CC/MCD & SHA Negotiate CAP (60-65%) Dgn - CAP Pkg 3	20	16-May-18	13-Jun-18
CP3.DGN.SREV.665	SHA Authorize CAP (60-65%) Dgn - CAP Pkg 3	1	14-Jun-18	14-Jun-18
CAP 3 Design (90%)				
90% Design Production				
CP3.DGN.935	Produce Final (90%) Dgn - CAP Pkg 3	20	18-Jun-18	16-Jul-18
90% Design QA Review				
CP3.DGN.PBREV.975	PB Internal Review Final QA (90%) Dgn - CAP Pkg 3	5	17-Jul-18	23-Jul-18
CP3.DGN.PBREV.935	PB Revise Final (90%) Dgn per CC/MCD Cmnts - CAP Pkg 3	7	31-Jul-18	08-Aug-18
CP3.DGN.IDC.945	DB Team/SHA Final Reveiw Meeting - CAP Pkg 3	1	30-Aug-18	30-Aug-18
90% Corman Review				
CP3.DGN.CREV.945	CC/MCD Internal Review Final (90%) Dgn - CAP Pkg 3	5	24-Jul-18	30-Jul-18
90% SHA Review				
CP3.DGN.SREV.955	SHA Review Final (90%) Dgn - CAP Pkg 3	15	09-Aug-18	29-Aug-18
Cap Pkg 3 Design (RFC)				
RFC Production				
CP3.DGN.PBREV.985	PB Prepare Final Response to Final (90%) Dsn - CAP Pkg 3	10	31-Aug-18	14-Sep-18
RFC QA Review				
CP3.DGN.PBREV.R40	PB Revise/Post Final per Cmnts - CAP Pkg 3	5	20-Sep-18	26-Sep-18
CP3.DGN.PBREV.R50	PB Produce/Issu RFC Dgn Pkg - Sign/Seal/Submit - CAP Pkg 3	5	27-Sep-18	03-Oct-18
RFC Corman/MC Dean Review				
CP3.DGN.CREV.R15	CC/MCD Formal Review Revised Fnl Dgn - CAP Pkg 3	3	17-Sep-18	19-Sep-18
RFC SHA Review & Authorize Construction				
CP3.DGN.SREV.105	SHA Review & Authorize Construction - CAP Pkg 3	5	04-Oct-18	10-Oct-18
CAP Pkg 3 Construction				
CP3.CON.C305	CC/MCD Construct - CAP Pkg 3	520	10-Oct-18	28-Oct-20
CAP Pkg 4 - Geometric Improvements w/ ROW/Util/Enviro Impacts				
CAP Pkg 4 - Utility Coordination				
CP4.DGN.105	CAP Pkg 4 Potential Utility Conflicts Identified	5	15-Jun-17	21-Jun-17
CP4.DGN.115	CAP Pkg 4 Utility Coordination	100	22-Jun-17	10-Nov-17
CP4.DGN.125	CAP Pkg 4 Utility Test Holes	20	07-Jul-17	03-Aug-17
CP4.DGN.135	CAP Pkg 4 Utility Relocation Design	40	18-Sep-17	10-Nov-17
CAP Pkg 4 - Environmental				
CP4.DGN.365	CAP Pkg 4 MEPA/NEPA	120	12-Apr-17	29-Sep-17
CP4.DGN.355	CAP Pkg 4 Agency Coordination	120	01-Jun-17	17-Nov-17
CP4.DGN.375	CAP Pkg 4 Permit Acquisition	120	01-Jun-17	17-Nov-17
CAP Pkg 4 - Right of Way				
CP4.DGN.325	CAP Pkg 4 ROW Needs Identified	10	18-Sep-17	29-Sep-17
CP4.DGN.335	CAP Pkg 4 ROW Plats Developed/Reviewed/Approved	20	02-Oct-17	27-Oct-17
CP4.DGN.345	CAP Pkg 4 ROW Acquisition (by SHA)	100	30-Oct-17	23-Mar-18
CAP Pkg 4 Design (30%)				
30% Design Production				
CP4.DGN.305	Produce Preliminary (30%) Dgn - CAP Pkg 4	80	01-Jun-17	22-Sep-17
30% Design QA Review				
CP4.DGN.PBREV.305	PB Internal Review Preliminary QA (30%) Dgn - CAP Pkg 4	5	25-Sep-17	29-Sep-17
CP4.DGN.PBREV.310	PB Revise Preliminary (30%) Dgn per CC/MCD Cmnts - CAP Pkg 4	7	09-Oct-17	17-Oct-17
CP4.DGN.IDC.315	DB Team/SHA Preliminary Investigation Mtg (30%) Dgn - CAP Pkg 4	1	08-Nov-17	08-Nov-17
30% Corman Review				
CP4.DGN.CREV.305	CC/MCD Internal Review Preliminary (30%) Dgn - CAP Pkg 4	5	02-Oct-17	06-Oct-17
CP4.DGN.CREV.315	CC/MCD Develop Preliminary Schedule & CAP Cost Estimate - CAP Pkg 4	10	02-Oct-17	13-Oct-17
30% SHA Review				
CP4.DGN.SREV.305	SHA Review Preliminary (30%) Dgn - CAP Pkg 4	15	18-Oct-17	07-Nov-17



Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
◆ ◆ Milestone

IS-270 Innovative Congestion Management

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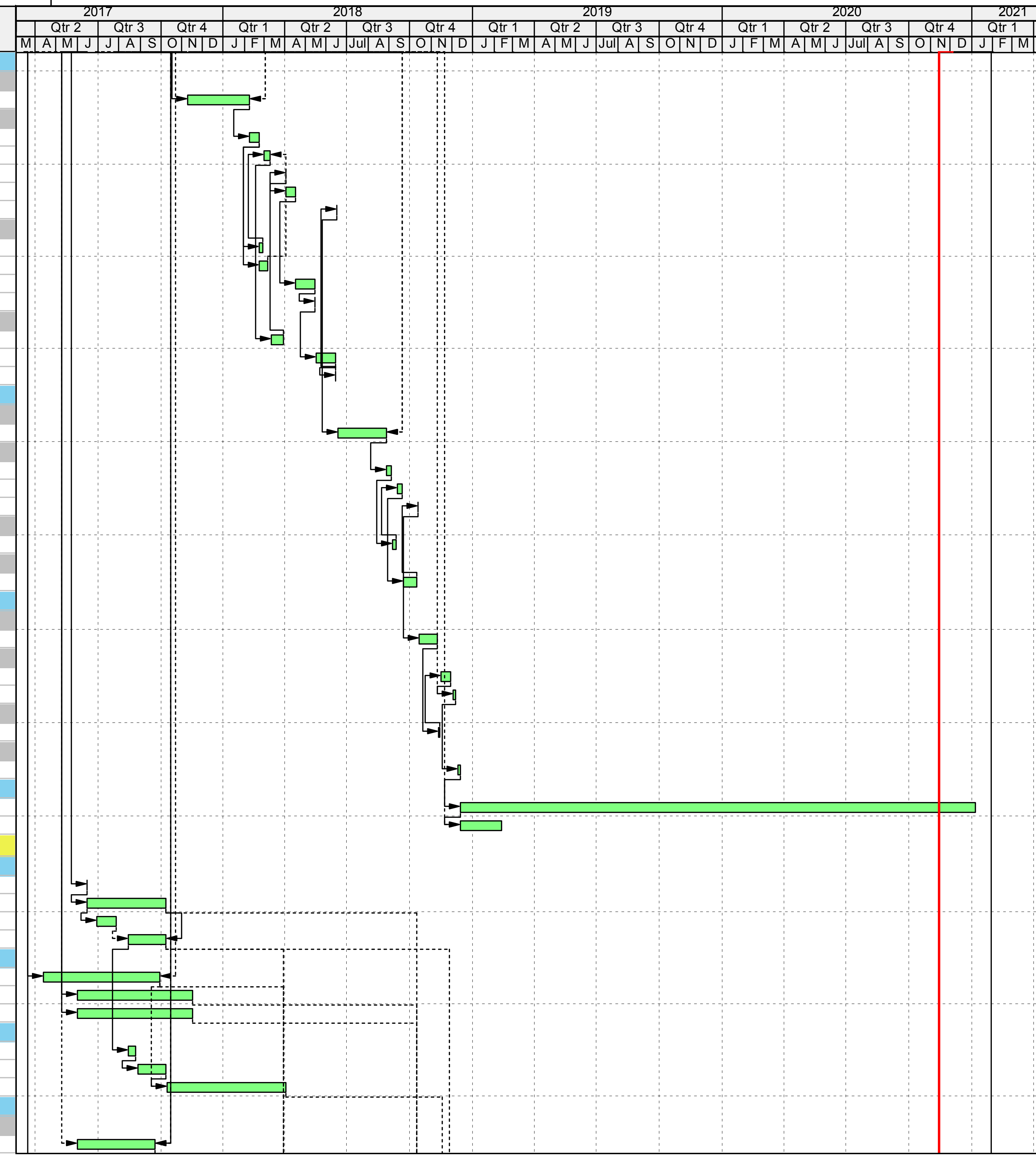
CORMAN CONSTRUCTION · WSP · PARSONS BRINCKERHOFF

TECHNICAL PROPOSAL DRAFT PROJECT SCHEDULE

Proposal Date: January 19, 2017

Activity ID	Activity Name	Orig Dur	Start	Finish
CAP 4 Design (60-65%)				
60-65% Design Production				
CP4.DGN..645	Produce Semi-Final (60%) Dgn - CAP Pkg 4	60	09-Nov-17	07-Feb-18
60-65% Design QA Review				
CP4.DGN.PBREV.605	PB Internal Review Semi-Final QA (60%) Dgn - CAP Pkg 4	10	08-Feb-18	21-Feb-18
CP4.DGN.PBREV.615	PB Revise Semi-Final (60%) Dgn per CC/MCD Cmnts - CAP Pkg 4	7	01-Mar-18	09-Mar-18
CP4.DGN.IDC.625	DB Team/SHA Semi-Final Reveiw Meeting - CAP Pkg 4	1	02-Apr-18	02-Apr-18
CP4.DGN.PBREV.635	PB Revise Semi-Final (60%) Dgn per SHA Cmnts - CAP Pkg 4	10	03-Apr-18	16-Apr-18
CP4.DGN.IDC.645	PB Interdisciplinary Coordination Mtg Semi-Final (60%) Dgn - CAP Pkg 4	1	15-Jun-18	15-Jun-18
60-65% Corman Review				
CP4.DGN.CREV.605	CC/MCD Internal Review Semi-Final (60%) Dgn - CAP Pkg 4	5	22-Feb-18	28-Feb-18
CP4.DGN.CREV.635	CC/MCD Develop Semi-Final Schedule & CAP Cost Estimate - CAP Pkg 4	10	22-Feb-18	07-Mar-18
CP4.DGN.CREV.615	CC/MCD Estimate CAP Semi-Final (60%) Dgn - CAP Pkg 4	20	17-Apr-18	14-May-18
CP4.DGN.CREV.625	CC/MCD Submit CAP to Estimate to SHA (60%) Dgn - CAP Pkg 4	1	15-May-18	15-May-18
60-65% SHA Review				
CP4.DGN.SREV.655	SHA Review Semi-Final (60%) Dgn - CAP Pkg 4	15	12-Mar-18	30-Mar-18
CP4.DGN.SREV.665	CC/MCD & SHA Negotiate CAP (60%) Dgn - CAP Pkg 4	20	16-May-18	13-Jun-18
CP4.DGN.SREV.645	SHA Authorize CAP (60%) Dgn - CAP Pkg 4	1	14-Jun-18	14-Jun-18
CAP 4 Design (90%)				
90% Design Production				
CP4.DGN.975	Produce Final (90%) Dgn - CAP Pkg 4	50	18-Jun-18	27-Aug-18
90% Design QA Review				
CP4.DGN.PBREV.905	PB Internal Review Final QA (90%) Dgn - CAP Pkg 4	5	28-Aug-18	04-Sep-18
CP4.DGN.PBREV.915	PB Revise Final (90%) Dgn per CC/MCD Cmnts - CAP Pkg 4	7	12-Sep-18	20-Sep-18
CP4.DGN.IDC.925	DB Team/SHA Final Reveiw Meeting - CAP Pkg 4	1	12-Oct-18	12-Oct-18
90% Corman Review				
CP4.DGN.CREV.1005	CC/MCD Internal Review Final (90%) Dgn - CAP Pkg 4	5	05-Sep-18	11-Sep-18
90% SHA Review				
CP4.DGN.SREV.675	SHA Review Semi-Final (60%) Dgn - CAP Pkg 4	15	21-Sep-18	11-Oct-18
Cap Pkg 4 Design (RFC)				
RFC Production				
CP4.DGN.PBREV.1085	PB Prepare Final Response to Final (90%) Dsn - CAP Pkg 4	20	15-Oct-18	09-Nov-18
RFC QA Review				
CP4.DGN.PBREV.R80	PB Revise/Post Final per Cmnts - CAP Pkg 4	10	15-Nov-18	30-Nov-18
CP4.DGN.PBREV.R90	PB Produce/Issu RFC Dgn Pkg - Sign/Seal/Submit - CAP Pkg 4	5	03-Dec-18	07-Dec-18
RFC Corman/MC Dean Review				
CP5.DGN.CREV.R35	CC/MCD Formal Review Revised Fnl Dgn - CAP Pkg 4	3	12-Nov-18	14-Nov-18
RFC SHA Review & Authorize Construction				
CP4.DGN.SREV.105	SHA Review & Authorize Construction - CAP Pkg 4	5	10-Dec-18	14-Dec-18
CAP Pkg 4 Construction				
CP4.CON.C505	CC/MCD Construct - CAP Pkg 4	520	14-Dec-18	06-Jan-21
CP4.CON.C515	CC/MCD Utility Relocation - CAP Pkg 4	40	14-Dec-18	12-Feb-19
CAP Pkg 5 - Significant Geometric Improvements w/ ROW/Util/Enviro Impacts				
CAP Pkg 5 - Utility Coordination				
CP5.DGN.105	CAP Pkg 5 Potential Utility Conflicts Identified	1	15-Jun-17	15-Jun-17
CP5.DGN.115	CAP Pkg 5 Utility Coordination	80	16-Jun-17	09-Oct-17
CP5.DGN.125	CAP Pkg 5 Utility Test Holes	20	30-Jun-17	28-Jul-17
CP5.DGN.135	CAP Pkg 5 Utility Relocation Design	40	14-Aug-17	09-Oct-17
CAP Pkg 5 - Environmental				
CP5.DGN.365	CAP Pkg 5 MEPA/NEPA	120	12-Apr-17	29-Sep-17
CP5.DGN.355	CAP Pkg 5 Agency Coordination	120	01-Jun-17	17-Nov-17
CP5.DGN.375	CAP Pkg 5 Permit Acquisition	120	01-Jun-17	17-Nov-17
CAP Pkg 5 - Right of Way				
CP5.DGN.325	CAP Pkg 5 ROW Needs Identified	10	14-Aug-17	25-Aug-17
CP5.DGN.335	CAP Pkg 5 ROW Plats Developed/Reviewed/Approved	30	28-Aug-17	09-Oct-17
CP5.DGN.345	CAP Pkg 5 ROW Acquisition (by SHA)	120	10-Oct-17	02-Apr-18
CAP Pkg 5 Design (30%)				
30% Design Production				
CP5.DGN.305	Produce Preliminary (30%) Dgn - CAP Pkg 5	80	01-Jun-17	22-Sep-17



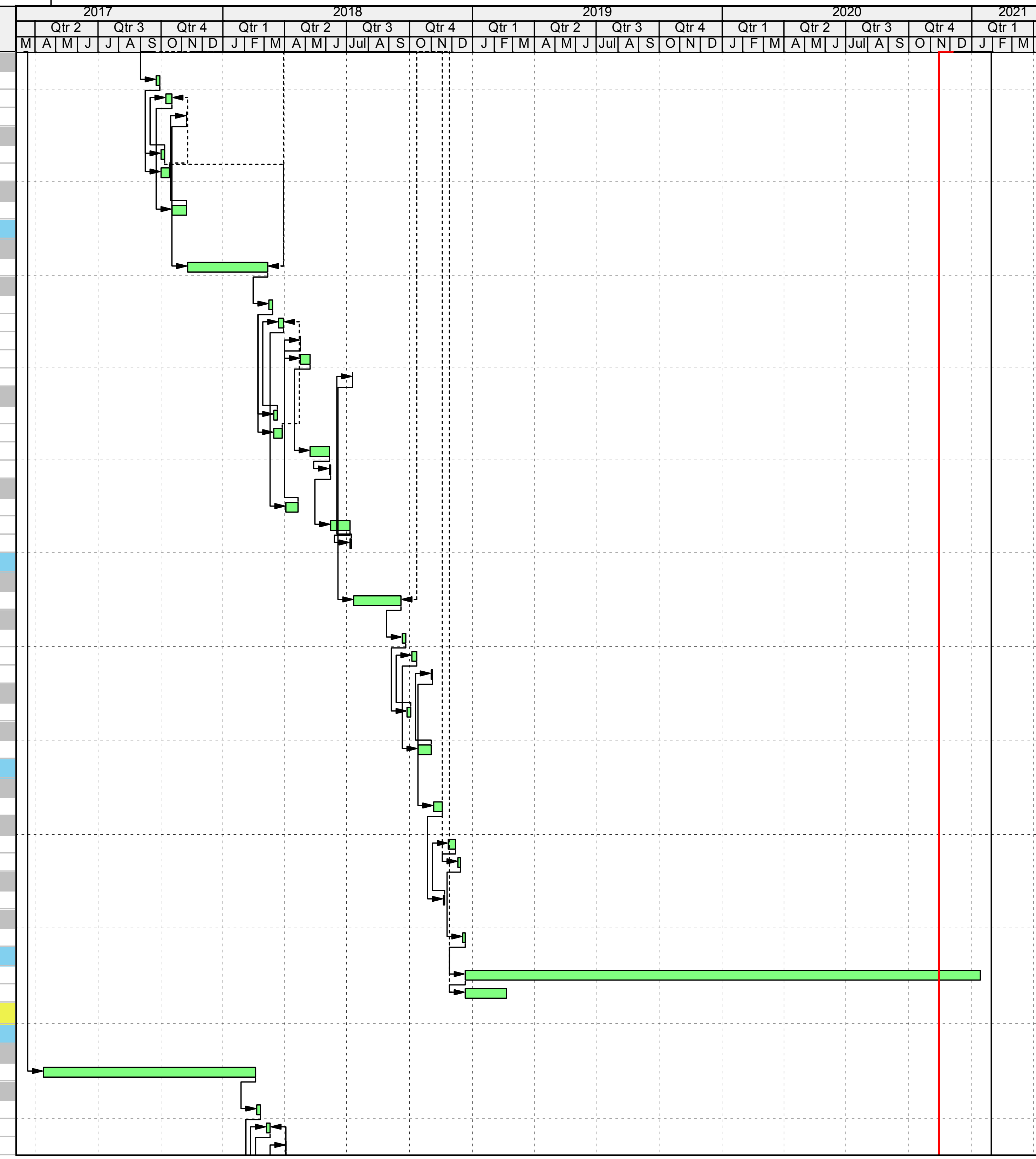
Actual Level of Effort — Remaining Work — ◆ ◆ Milestone
Actual Work — Critical Remaining Work

IS-270 Innovative Congestion Management

TECHNICAL PROPOSAL DRAFT PROJECT SCHEDULE

Proposal Date: January 19, 2017

Activity ID	Activity Name	Orig Dur	Start	Finish
30% Design QA Review				
CP5.DGN.PBREV.305	PB Internal Review Preliminary QA (30%) Dgn - CAP Pkg 5	5	25-Sep-17	29-Sep-17
CP5.DGN.PBREV.315	PB Revise Preliminary (30%) Dgn per CC/MCD Cmnts - CAP Pkg 5	7	09-Oct-17	17-Oct-17
CP5.DGN.IDC.335	DB Team/SHA Preliminary Investigation Mtg (30%) Dgn - CAP Pkg 5	1	08-Nov-17	08-Nov-17
30% Corman Review				
CP5.DGN.CREV.345	CC/MCD Internal Review Preliminary (30%) Dgn - CAP Pkg 5	5	02-Oct-17	06-Oct-17
CP5.DGN.CREV.315	CC/MCD Develop Preliminary Schedule & CAP Cost Estimate - CAP Pkg 5	10	02-Oct-17	13-Oct-17
30% SHA Review				
CP56.DGN.SREV.305	SHA Review Preliminary (30%) Dgn - CAP Pkg 5	15	18-Oct-17	07-Nov-17
CAP 5 Design (60-65%)				
60-65% Design Production				
CP5.DGN..655	Produce Semi-Final (60-65%) Dgn - CAP Pkg 5	80	09-Nov-17	07-Mar-18
60-65% Design QA Review				
CP5.DGN.PBREV.605	PB Internal Review Semi-Final QA (60-65%) Dgn - CAP Pkg 5	5	08-Mar-18	14-Mar-18
CP5.DGN.PBREV.615	PB Revise Semi-Final (60-65%) Dgn per CC/MCD Cmnts - CAP Pkg 5	7	22-Mar-18	30-Mar-18
CP5.DGN.IDC.655	DB Team/SHA Semi-Final Reveiw Meeting - CAP Pkg 5	1	23-Apr-18	23-Apr-18
CP5.DGN.PBREV.625	PB Revise Semi-Final (60-65%) Dgn per SHA Cmnts - CAP Pkg 5	10	24-Apr-18	07-May-18
CP5.DGN.IDC.635	PB Interdisciplinary Coordination Mtg Final (60-65%) Dgn - CAP Pkg 5	1	09-Jul-18	09-Jul-18
60-65% Corman Review				
CP5.DGN.CREV.605	CC/MCD Internal Review Semi-Final (60-65%) Dgn - CAP Pkg 5	5	15-Mar-18	21-Mar-18
CP5.DGN.CREV.635	CC/MCD Develop Semi-Final Schedule & CAP Cost Estimate - CAP Pkg 5	10	15-Mar-18	28-Mar-18
CP5.DGN.CREV.615	CC/MCD Estimate CAP Semi-Final (60-65%) Dgn - CAP Pkg 5	20	08-May-18	05-Jun-18
CP5.DGN.CREV.625	CC/MCD Submit CAP to Estimate to SHA (60-65%) Dgn - CAP Pkg 5	1	06-Jun-18	06-Jun-18
60-65% SHA Review				
CP5.DGN.SREV.665	SHA Review Semi-Final (60-65%) Dgn - CAP Pkg 5	15	02-Apr-18	20-Apr-18
CP5.DGN.SREV.695	CC/MCD & SHA Negotiate CAP (60-65%) Dgn - CAP Pkg 5	20	07-Jun-18	05-Jul-18
CP5.DGN.SREV.645	SHA Authorize CAP (60-65%) Dgn - CAP Pkg 5	1	06-Jul-18	06-Jul-18
CAP 5 Design (90%)				
90% Design Production				
CP5.DGN.905	Produce Final (90%) Dgn - CAP Pkg 5	50	10-Jul-18	18-Sep-18
90% Design QA Review				
CP5.DGN.PBREV.905	PB Internal Review Final QA (90%) Dgn - CAP Pkg 5	5	19-Sep-18	25-Sep-18
CP5.DGN.PBREV.915	PB Revise Final (90%) Dgn per CC/MCD Cmnts - CAP Pkg 5	7	03-Oct-18	11-Oct-18
CP5.DGN.IDC.975	DB Team/SHA Final Reveiw Meeting - CAP Pkg 5	1	02-Nov-18	02-Nov-18
90% Corman Review				
CP5.DGN.CREV.905	CC/MCD Internal Review Final (90%) Dgn - CAP Pkg 5	5	26-Sep-18	02-Oct-18
90% SHA Review				
CP5.DGN.SREV.605	SHA Review Semi-Final (60%) Dgn - CAP Pkg 5	15	12-Oct-18	01-Nov-18
Cap Pkg 5 Design (RFC)				
RFC Production				
CP5.DGN.PBREV.935	PB Prepare Final Response to Final (90%) Dsn - CAP Pkg 5	10	05-Nov-18	16-Nov-18
RFC QA Review				
CP5.DGN.PBREV.R100	PB Revise/Post Final per Cmnts - CAP Pkg 5	10	26-Nov-18	07-Dec-18
CP5.DGN.PBREV.R110	PB Produce/Issu RFC Dgn Pkg - Sign/Seal/Submit - CAP Pkg 5	5	10-Dec-18	14-Dec-18
RFC Corman/MC Dean Review				
CP5.DGN.CREV.R45	CC/MCD Formal Review Revised Fnl Dgn - CAP Pkg 5	3	19-Nov-18	21-Nov-18
RFC SHA Review & Authorize Construction				
CP5.DGN.SREV.105	SHA Review & Authorize Construction - CAP Pkg 5	5	17-Dec-18	21-Dec-18
CAP Pkg 5 Construction				
CP5.CON.C605	CC/MCD Construct - CAP Pkg 5	520	21-Dec-18	13-Jan-21
CP5.CON.C615	CC/MCD Utility Relocation - CAP Pkg 5	40	21-Dec-18	19-Feb-19
CAP 6 - Managed Motorways Software Development, Installation, Integration and Sid-by-Side Training				
CAP 6 Detailed Requirement Development (60-65%)				
60-65% Design Production				
CP6.DGN..605	Produce System Archetecture (60-65%) - CAP Pkg 6	215	12-Apr-17	16-Feb-18
60-65% Design QA Review				
CP6.DGN.PBREV.605	PB Internal Review Semi-Final QA (60-65%) Dgn - CAP Pkg 6	5	19-Feb-18	23-Feb-18
CP6.DGN.PBREV.615	PB Revise Semi-Final (60-65%) Dgn per CC/MCD Cmnts - CAP Pkg 6	5	05-Mar-18	09-Mar-18
CP6.DGN.IDC.625	DB Team/SHA Semi-Final Reveiw Meeting - CAP Pkg 6	1	02-Apr-18	02-Apr-18



Actual Level of Effort | Remaining Work | ◆ ◆ Milestone
Actual Work | Critical Remaining Work

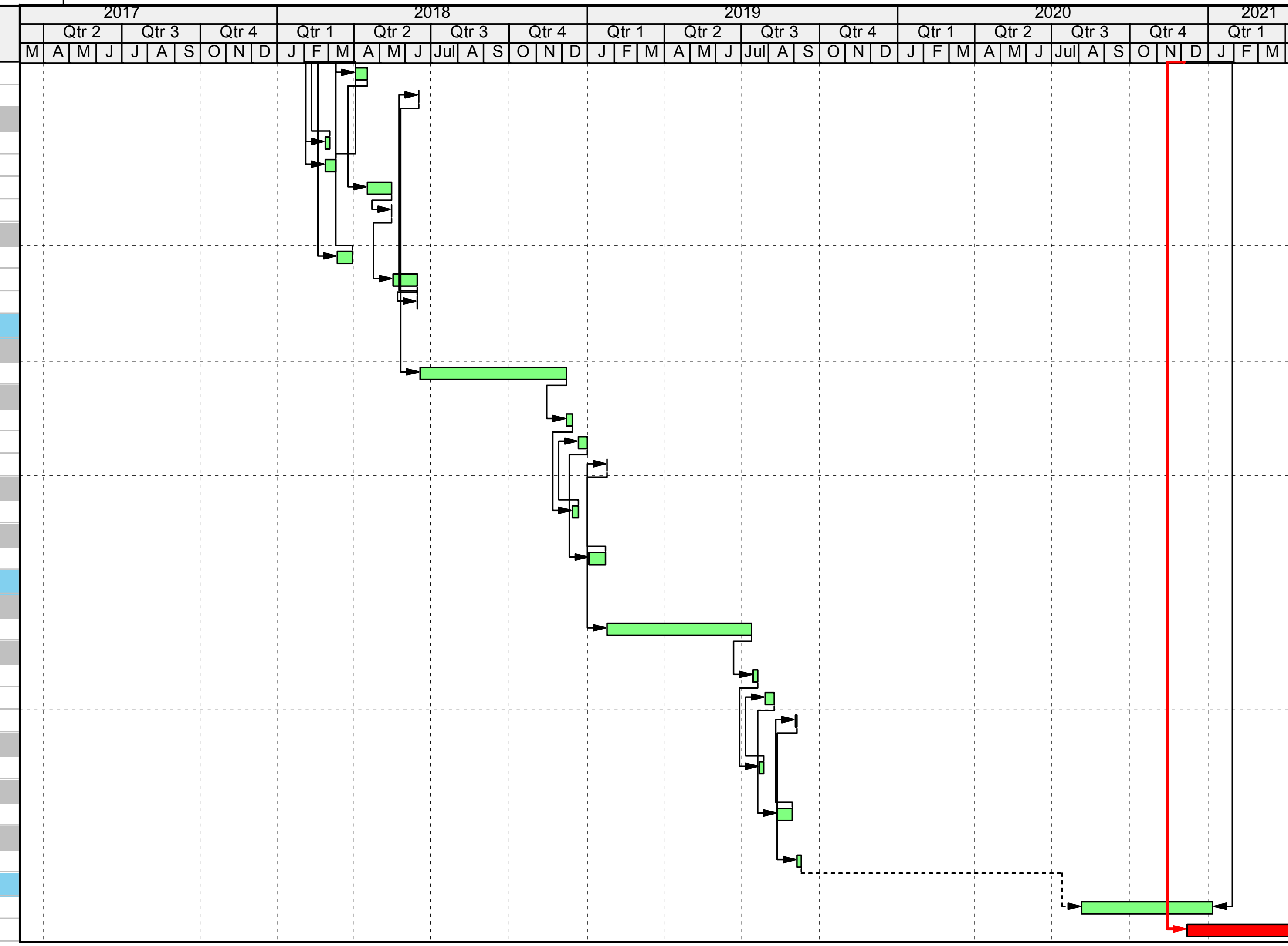
IS-270 Innovative Congestion Management

CORMAN CONSTRUCTION | WSP | PARSONS BRINCKERHOFF

TECHNICAL PROPOSAL DRAFT PROJECT SCHEDULE

Proposal Date: January 19, 2017

Activity ID	Activity Name	Orig Dur	Start	Finish
CP6.DGN.PBREV.635	PB Revise Semi-Final (60-65%) Dgn per SHA Cmnts - CAP Pkg 6	10	03-Apr-18	16-Apr-18
CP6.DGN.IDC.645	Reveiw Meeting (60-65%) Dgn - CAP Pkg 6	1	15-Jun-18	15-Jun-18
60-65% Corman Review				
CP6.DGN.CREV.605	CC/MCD Internal Review Semi-Final (60-65%) Dgn - CAP Pkg 6	5	26-Feb-18	02-Mar-18
CP6.DGN.CREV.635	CC/MCD Develop Semi-Final Schedule & CAP Cost Estimate - CAP Pkg 6	10	26-Feb-18	09-Mar-18
CP6.DGN.CREV.615	CC/MCD Estimate CAP Semi-Final (60-65%) Dgn - CAP Pkg 6	20	17-Apr-18	14-May-18
CP6.DGN.CREV.625	CC/MCD Submit CAP to Estimate to SHA (60-65%) Dgn - CAP Pkg 6	1	15-May-18	15-May-18
60-65% SHA Review				
CP6.DGN.SREV.615	SHA Review Semi-Final (60-65%) Dgn - CAP Pkg 6	15	12-Mar-18	30-Mar-18
CP6.DGN.SREV.625	CC/MCD & SHA Negotiate CAP (60-65%) Dgn - CAP Pkg 6	20	16-May-18	13-Jun-18
CP6.DGN.SREV.635	SHA Authorize CAP (60-65%) Dgn - CAP Pkg 6	1	14-Jun-18	14-Jun-18
CAP 6 Final Requirements and System Design (90%)				
90% Design Production				
CP6.DGN.905	Produce Final System Design (90%) - CAP Pkg 6	120	18-Jun-18	06-Dec-18
90% Design QA Review				
CP6.DGN.PBREV.915	PB Internal Review Final QA (90%) Dgn - CAP Pkg 6	5	07-Dec-18	13-Dec-18
CP6.DGN.PBREV.925	PB Revise Final (90%) Dgn per CC/MCD Cmnts - CAP Pkg 6	5	21-Dec-18	31-Dec-18
CP6.DGN.IDC.935	Reveiw Meeting (90%) Dgn - CAP Pkg 6	1	23-Jan-19	23-Jan-19
90% Corman Review				
CP6.DGN.CREV.935	CC/MCD Internal Review Final (90%) Dgn - CAP Pkg 6	5	14-Dec-18	20-Dec-18
90% SHA Review				
CP6.DGN.SREV.975	SHA Review Final (90%) Dgn - CAP Pkg 6	15	02-Jan-19	22-Jan-19
Cap Pkg 6 Software Development (100%)				
RFC Production				
CP6.DGN.PBREV.1135	PB Software Production (100%) - CAP Pkg 6	120	24-Jan-19	12-Jul-19
RFC QA Review				
CP6.DGN.PBREV.1185	PB Internal Review Final QA (100%) - CAP Pkg 6	5	15-Jul-19	19-Jul-19
CP6.DGN.PBREV.R100	PB Revise/Post Final per Cmnts - CAP Pkg 6	10	29-Jul-19	09-Aug-19
CP6.DGN.PBREV.R110	Final Review Mtg	1	03-Sep-19	03-Sep-19
RFC Corman/MC Dean Review				
CP6.DGN.CREV.R45	CC/MCD Formal Review Revised Fnl Dgn - CAP Pkg 6	5	22-Jul-19	26-Jul-19
90% SHA Review				
CP6.DGN.SREV.695	SHA Review Final (100%) Dgn - CAP Pkg 6	15	12-Aug-19	30-Aug-19
RFC SHA Review & Authorize Construction				
CP6.DGN.SREV.105	SHA Review & Authorize Construction - CAP Pkg 6	5	04-Sep-19	10-Sep-19
CAP Pkg 6 Construction				
CP6.CON.C705	CHART Commissioning/Testing/Integration	105	05-Aug-20	06-Jan-21
CP6.CON.C715	Training & Side by Side	84	07-Dec-20	06-Apr-21



Actual Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work

IS-270 Innovative Congestion Management

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Anticipated Right-of-Way Needs

List of Anticipated Right of Way Needs	Date: January 19, 2017
Related Disciplines: Right of Way	Corman Construction

A) Hard Shoulder Running

Right of way needs are anticipated for two of the six proposed safety refuges required for Hard Shoulder Running (PTC 16; PTC 17):

SB Safety Refuge No. 2 (Segment 2 – HSR Sheets 11 & 12)

- Temporary Construction Easement – 5,250 SF
- Revertible Slope Easement – 12,300 SF

NB Safety Refuge No. 1 (Segment 4 – HSR Sheet 28)

- Temporary Construction Easement – 2,400 SF
- Revertible Slope Easement – 5,200 SF
- Fee Simple (Through Highway) – 10,300 SF

No right of way needs are anticipated for:

- *SB Safety Refuge No. 1 (Segment 2 – HSR Sheets 9 & 10)*
- *SB Safety Refuge No. 3 (Segment 4 – HSR Sheets 27-28)*
- *SB Safety Refuge No. 4 (Segment 5 – HSR Sheet 39)*

B) Geometric Improvements

There are no right of way needs anticipated for the proposed Geometric Improvements including PTC 03B – Father Hurley NB Exit Ramp Restriping, PTC 07 – Father Hurley NB Poor Man CD, PTC 08 – Father Hurley SB Poor Man CD, PTC 09 – MD 118 Option 1 Eliminated NW Loop, and all the Ramp Improvements associated with PTC 12 – Managed Motorways.

C) Managed Motorways

There are no right of way needs anticipated for the proposed ITS/Ramp Metering/ATM Improvements as shown on the Managed Motorways Plan Set.

D) Watkins Mill Interchange Modifications

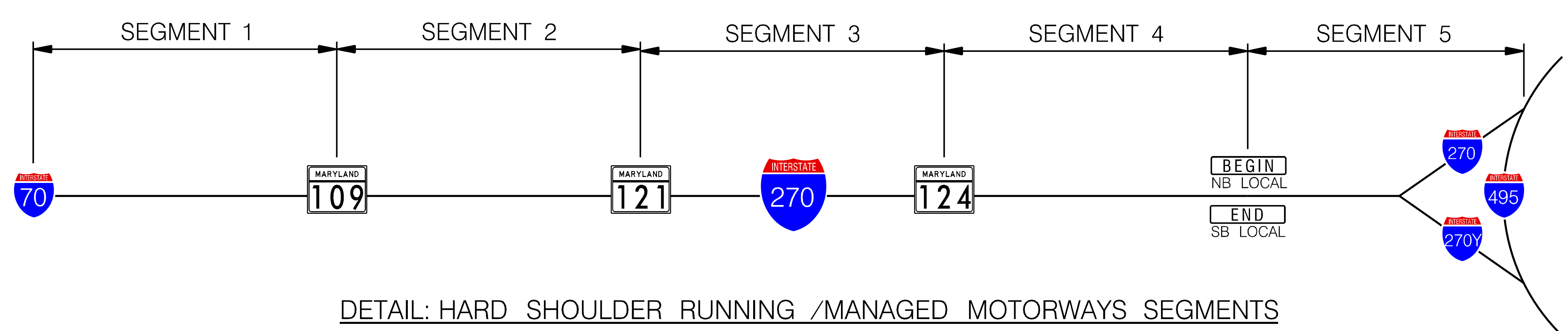
There are no right of way needs anticipated for the proposed modifications to the Watkins Mill Interchange Project as shown on the Watkins Mill Plan Set.

Plans

- Hard Running Shoulder
- Geometric Improvements
- Managed Motorways
- Watkins Mill Breakout

INDEX OF SHEETS

SHEET NO.	PLAN SET
	HARD SHOULDER RUNNING
HSR 1	DETAIL SHEET – RAMP FREEWAY JUNCTIONS
HSR 2–13	HARD SHOULDER RUNNING PLAN SHEETS – SEGMENT 2 (PTC 16)
HSR 14–21	HARD SHOULDER RUNNING PLAN SHEETS – SEGMENT 3 (PTC 17)
HSR 22–53	HARD SHOULDER RUNNING PLAN SHEETS – SEGMENT 4 (PTC 17)
HSR 54–57	HARD SHOULDER RUNNING PLAN SHEETS – SEGMENT 5 (PTC 17)
	GEOMETRIC IMPROVEMENTS
GI 1	RIDGE RD – NB EXIT RAMP TO RIDGE RD PLAN SHEETS (PTC 3)
GI 2–4	FATHER HURLEY BLVD COMBINED NB ENTRANCE RAMP MERGE AREA PLAN SHEETS (PTC 7)
GI 5–7	FATHER HURLEY BLVD COMBINED SB ENTRANCE RAMP MERGE AREA PLAN SHEETS (PTC 8)
GI 8–10	MD 118 (GERMANTOWN RD) ELIMINATE LOOP RAMP PLAN SHEETS (PTC 9)
GI 11–27	SOUTHBOUND I–270 RAMP IMPROVEMENT PLAN SHEETS (PTC 12)
GI 28–41	NORTHBOUND I–270 RAMP IMPROVEMENT PLAN SHEETS (PTC 12)
	MANAGED MOTORWAYS
MM 1–17	MANAGED MOTORWAYS PLAN SHEETS – SEGMENT 1 (PTC 12 /PTC 15)
MM 18–31	MANAGED MOTORWAYS PLAN SHEETS – SEGMENT 2 (PTC 12 /PTC 15)
MM 32–53	MANAGED MOTORWAYS PLAN SHEETS – SEGMENT 3 (PTC 12 /PTC 15)
MM 54–85	MANAGED MOTORWAYS PLAN SHEETS – SEGMENT 4 (PTC 12 /PTC 15)
MM 86–89	MANAGED MOTORWAYS PLAN SHEETS – SEGMENT 5 (PTC 12 /PTC 15)
MM 90–92	MANAGED MOTORWAYS PLAN SHEETS – SEGMENT 1 CROSS ROADS (PTC 12 /PTC 15)
MM 93–97	MANAGED MOTORWAYS PLAN SHEETS – SEGMENT 3 CROSS ROADS (PTC 12 /PTC 15)
MM 98–108	MANAGED MOTORWAYS PLAN SHEETS – SEGMENT 4 CROSS ROADS (PTC 12 /PTC 15)
	WATKINS MILL INTERCHANGE
WM 1–4	WATKINS MILL INTERCHANGE PLAN SHEETS (PTC 18)



DETAIL: HARD SHOULDER RUNNING /MANAGED MOTORWAYS SEGMENTS

NOT TO SCALE

CORMAN CONSTRUCTION

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DRAFT PLANS

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

I-270 INNOVATIVE CONGESTION MANAGEMENT

INDEX OF SHEETS

INDEX OF SHEETS & SEGMENT MAP DETAIL

DATE: JANUARY 19, 2017 | INDX 01 OF 01

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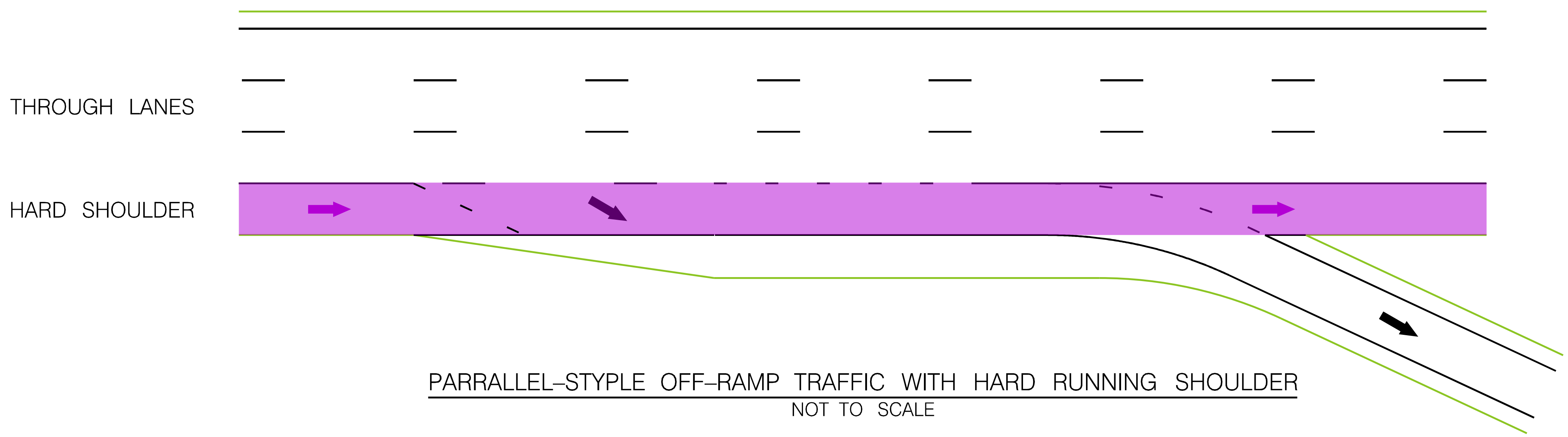
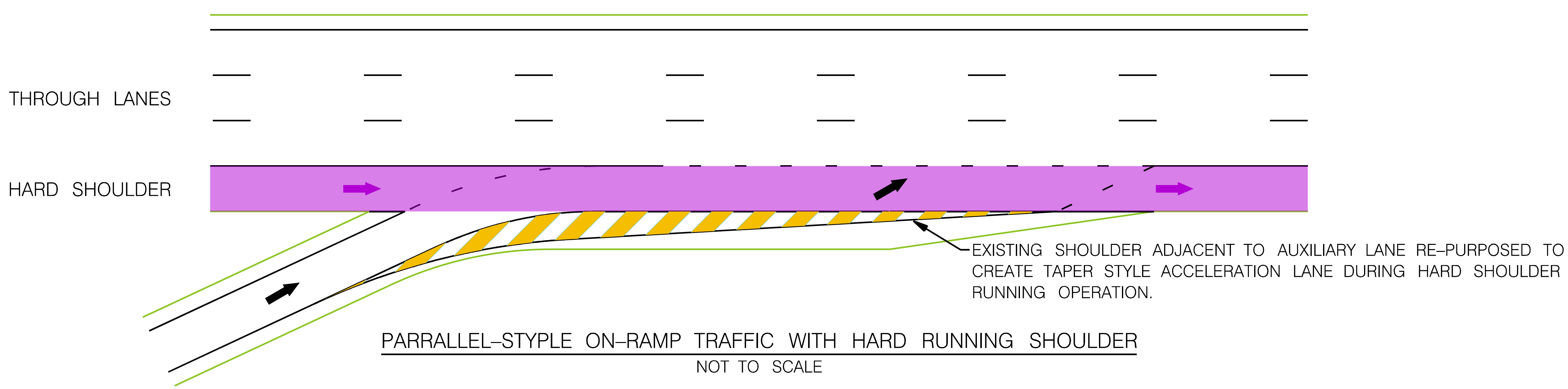


PARRALLEL-STYPLE OFF-RAMP TRAFFIC WITH HARD RUNNING SHOULDER
NOT TO SCALE



PARRALLEL-STYPLE ON-RAMP TRAFFIC WITH HARD RUNNING SHOULDER
NOT TO SCALE

BY: stypulam

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

DETAIL SHEET
RAMP FREEWAY JUNCTIONS

DATE: JANUARY 19, 2017

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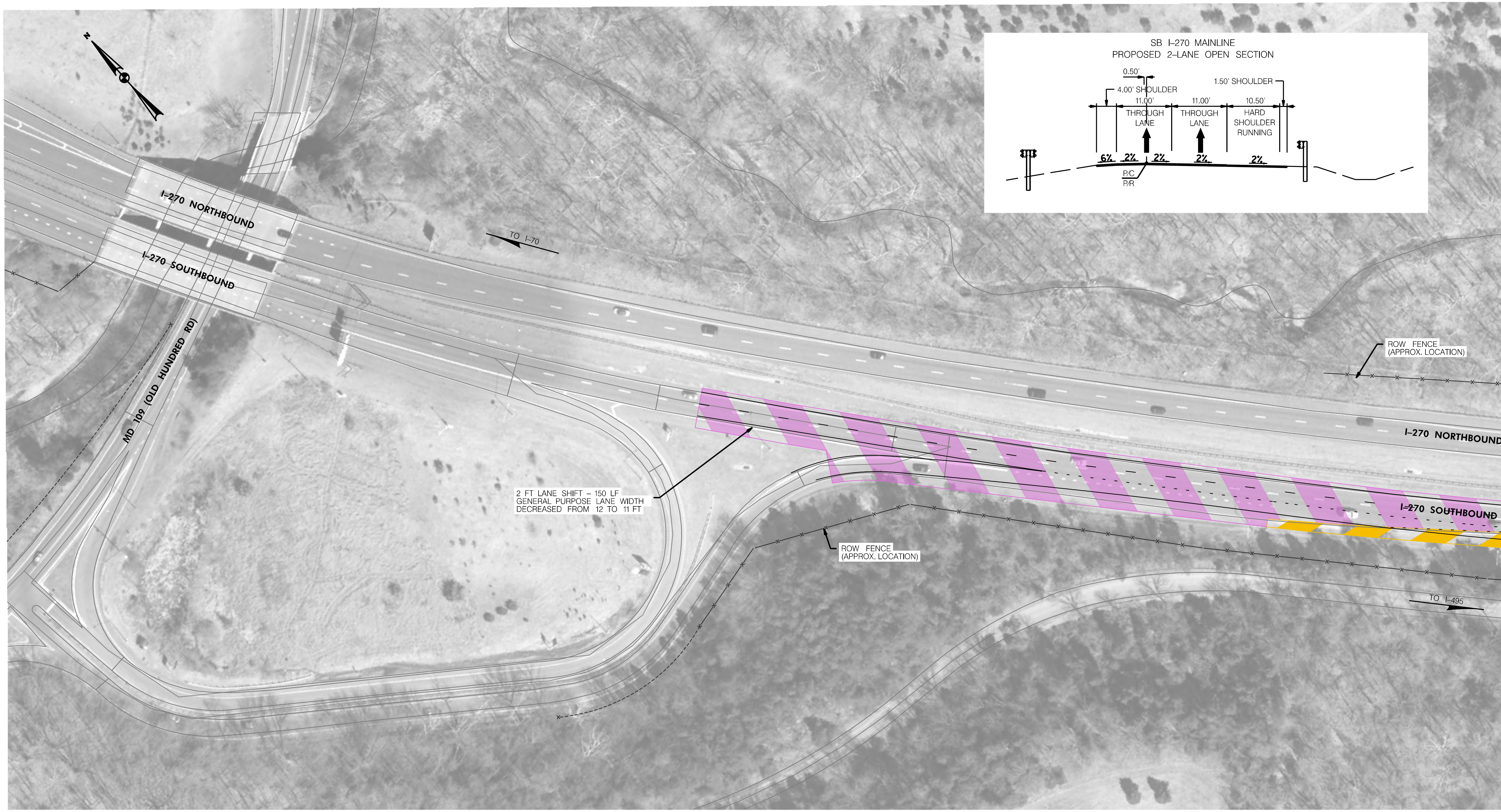

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDERS ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
	W–BEAM TRAFFIC BARRIER
WEDGE/LEVEL & RESURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
MICROSURFACING	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
I–270 – MD 109 (OLD HUNDRED RD)

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PAVEMENT CORE DATA

NO.	ROAD /LANE	MILEPOINT	LOCATION	HMA DEPTH (IN.)
CORE 4	NB I-270 MAINLINE RIGHT SHOULDER	18.66	5' FROM WHITE LINE	20.0

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDERS ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – SOUTH OF MD 109 (OLD HUNDRED RD)

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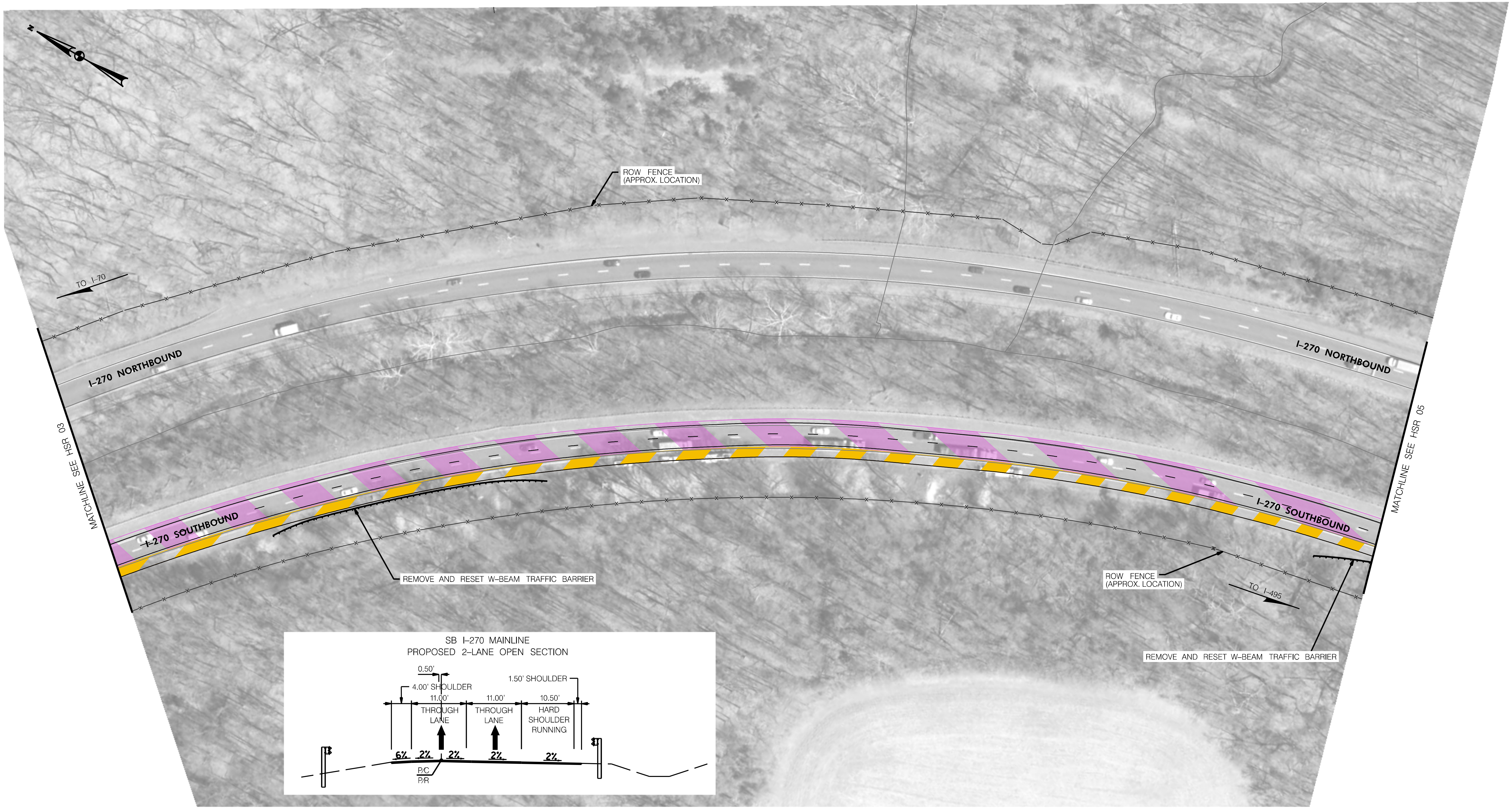


NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDER ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

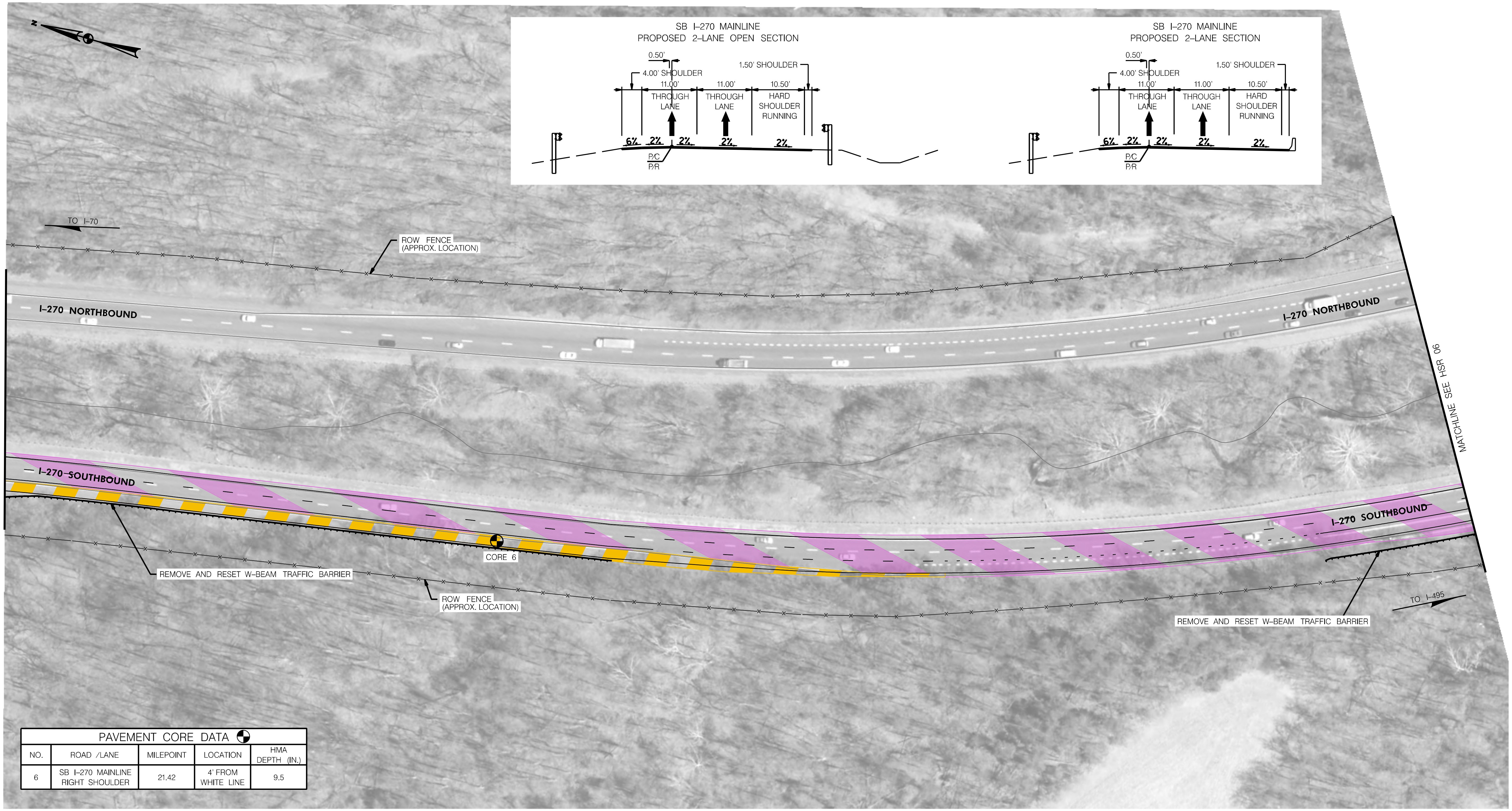
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – SOUTH OF MD 109 (OLD HUNDRED RD)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:05 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P004_IS270.dgn



PAVEMENT CORE DATA

NO.	ROAD /LANE	MILEPOINT	LOCATION	HMA DEPTH (IN.)
6	SB I-270 MAINLINE RIGHT SHOULDER	21.42	4' FROM WHITE LINE	9.5

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDER ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
WEDGE/LEVEL & RESURFACING	W-BEAM TRAFFIC BARRIER
MICROSURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

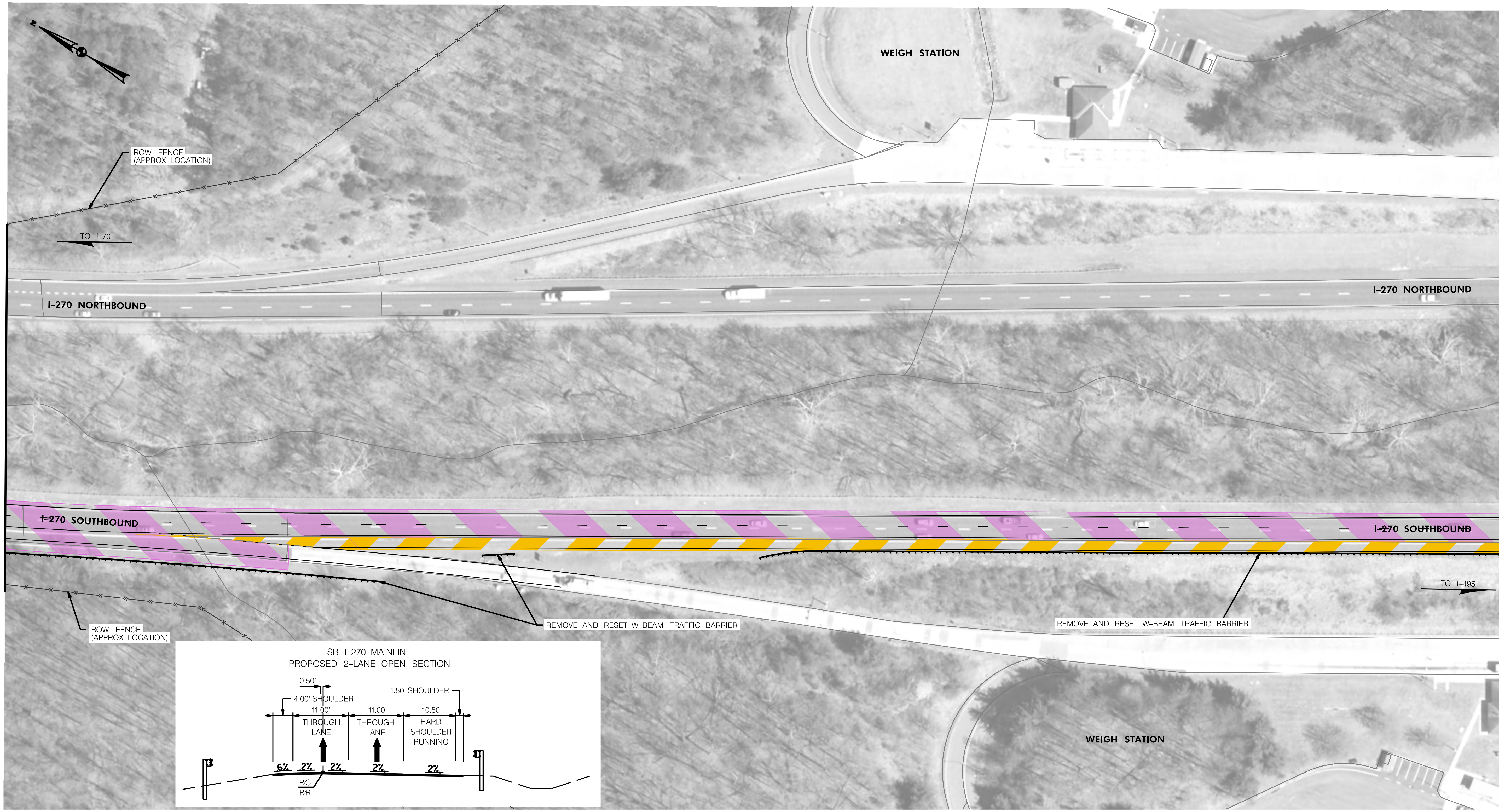
HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – SOUTH OF MD 109 (OLD HUNDRED RD)

DATE: JANUARY 19, 2017

HSR 05 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 08:06 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P005_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDER ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – WEIGH STATION

DATE: JANUARY 19, 2017

HSR 06 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 08:08 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P006_IS270.dgn

MATCHLINE SEE HSR 06

MATCHLINE SEE HSR 08

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDERS ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – WEIGH STATION

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:09 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P007_IS270.dgn

PAVEMENT CORE DATA

NO.	ROAD /LANE	MILEPOINT	LOCATION	HMA DEPTH (IN.)
CORE 3	NB I-270 MAINLINE RIGHT SHOULDER	20.57	5' FROM WHITE LINE	9.5

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDERS ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
WEDGE/LEVEL & RESURFACING	W-BEAM TRAFFIC BARRIER
MICROSURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

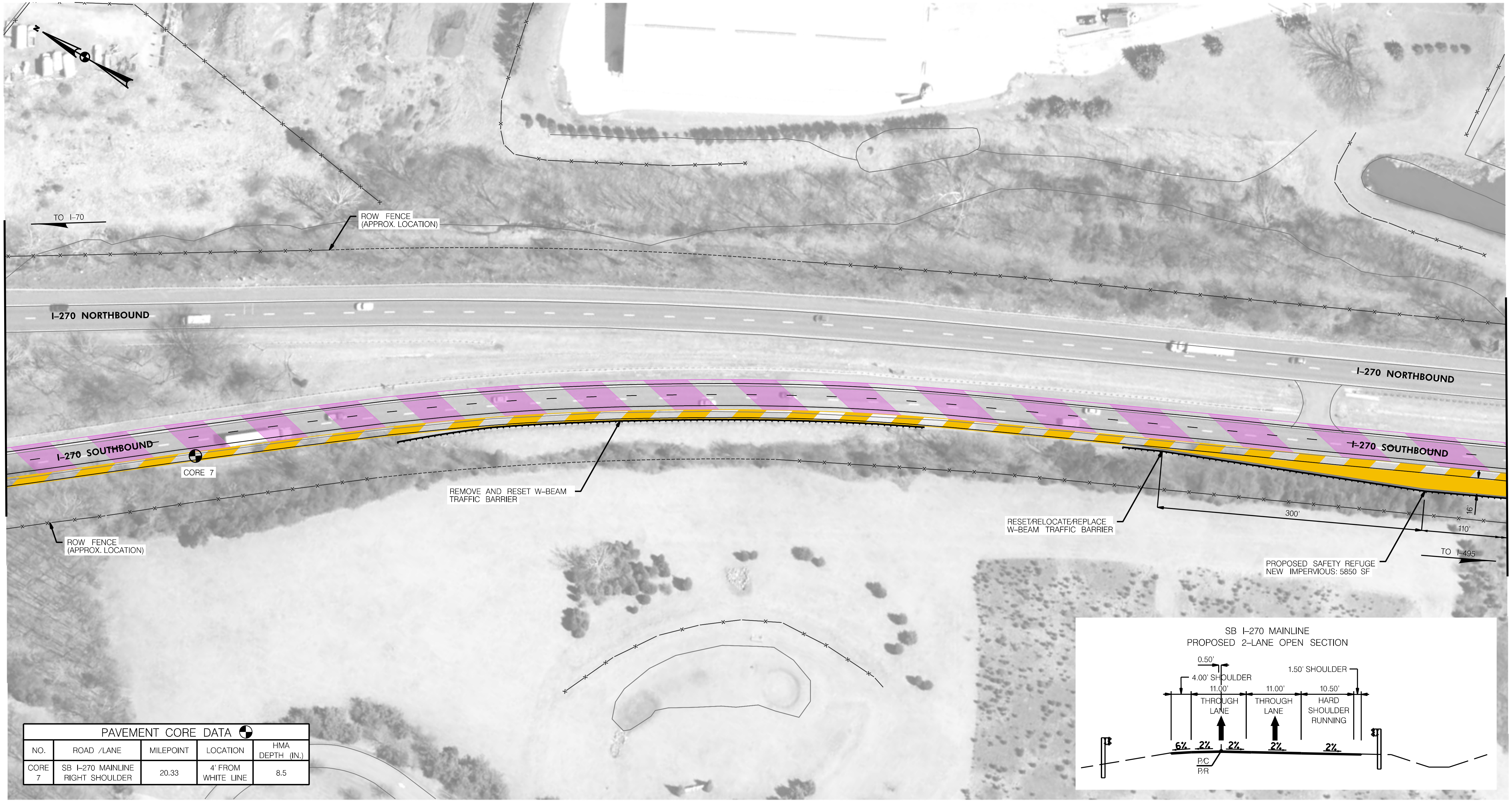
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – NORTH OF COMUS RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:10 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P008_IS270.dgn



PAVEMENT CORE DATA

NO.	ROAD /LANE	MILEPOINT	LOCATION	HMA DEPTH (IN.)
CORE 7	SB I-270 MAINLINE RIGHT SHOULDER	20.33	4' FROM WHITE LINE	8.5

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDER ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – NORTH OF COMUS RD

DATE: JANUARY 19, 2017

HSR 09 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 08:52 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P009_IS270.dgn

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDERS ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	
WEDGE/LEVEL & RESURFACING	
MICROSURFACING	
PAVEMENT MARKINGS	
W-BEAM TRAFFIC BARRIER	
CONCRETE BARRIER	
EXISTING GRATE INLET (ADJUST OR REPLACE)	
EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

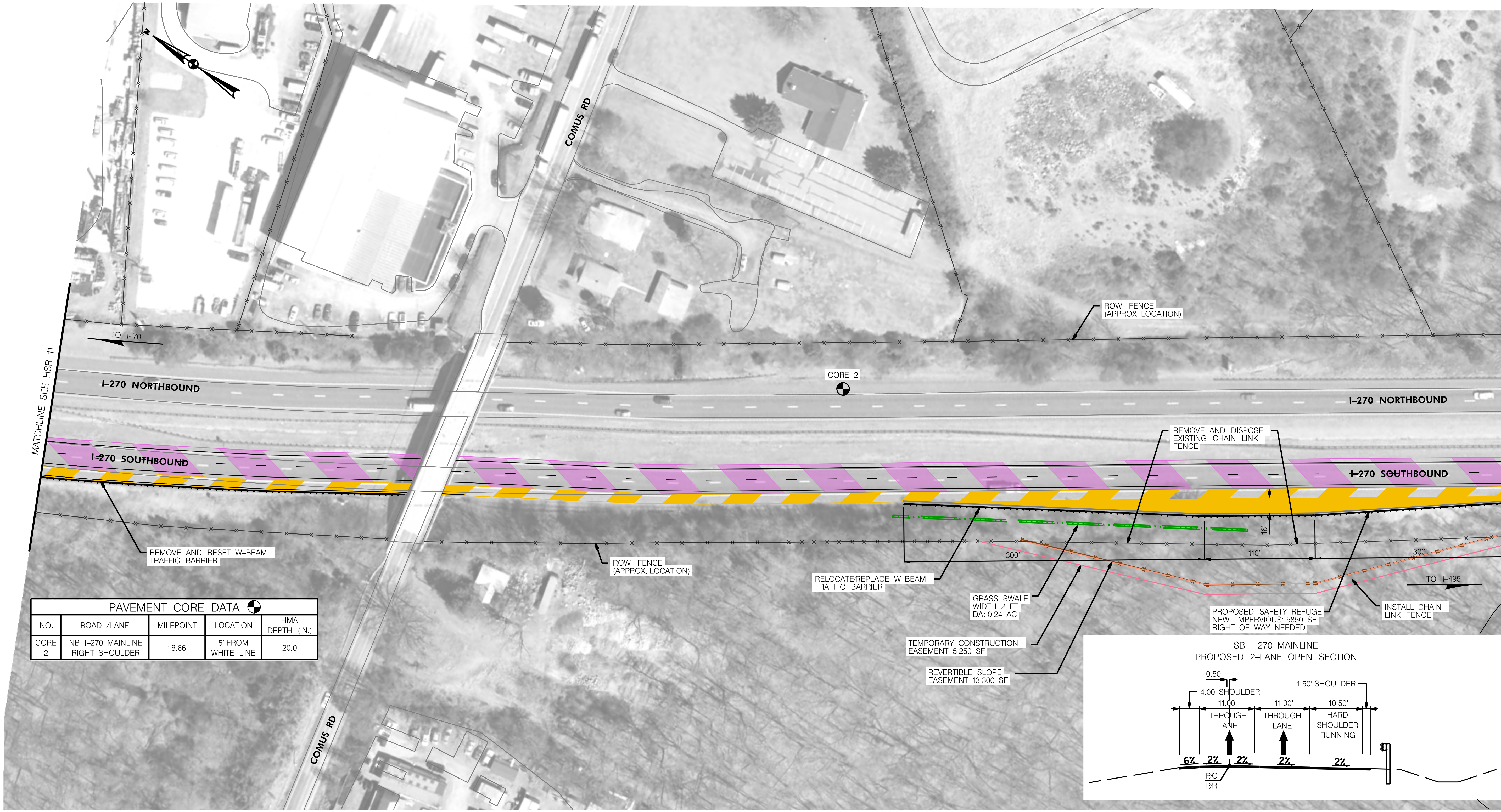
HARD SHOULDER RUNNING

SEGMENT 2
IS 270 - NORTH OF COMUS RD

DATE: JANUARY 19, 2017

HSR 10 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 08:32 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P010_IS270.dgn



PAVEMENT CORE DATA

NO.	ROAD /LANE	MILEPOINT	LOCATION	HMA DEPTH (IN.)
CORE 2	NB I-270 MAINLINE RIGHT SHOULDER	18.66	5' FROM WHITE LINE	20.0

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDER ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
WEDGE/LEVEL & RESURFACING	W-BEAM TRAFFIC BARRIER
MICROSURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – COMUS RD

DATE: JANUARY 19, 2017

HSR 11 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 08:16 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P011_IS270.dgn

MATCHLINE SEE HSR 11

MATCHLINE SEE HSR 13

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDER ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN
CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

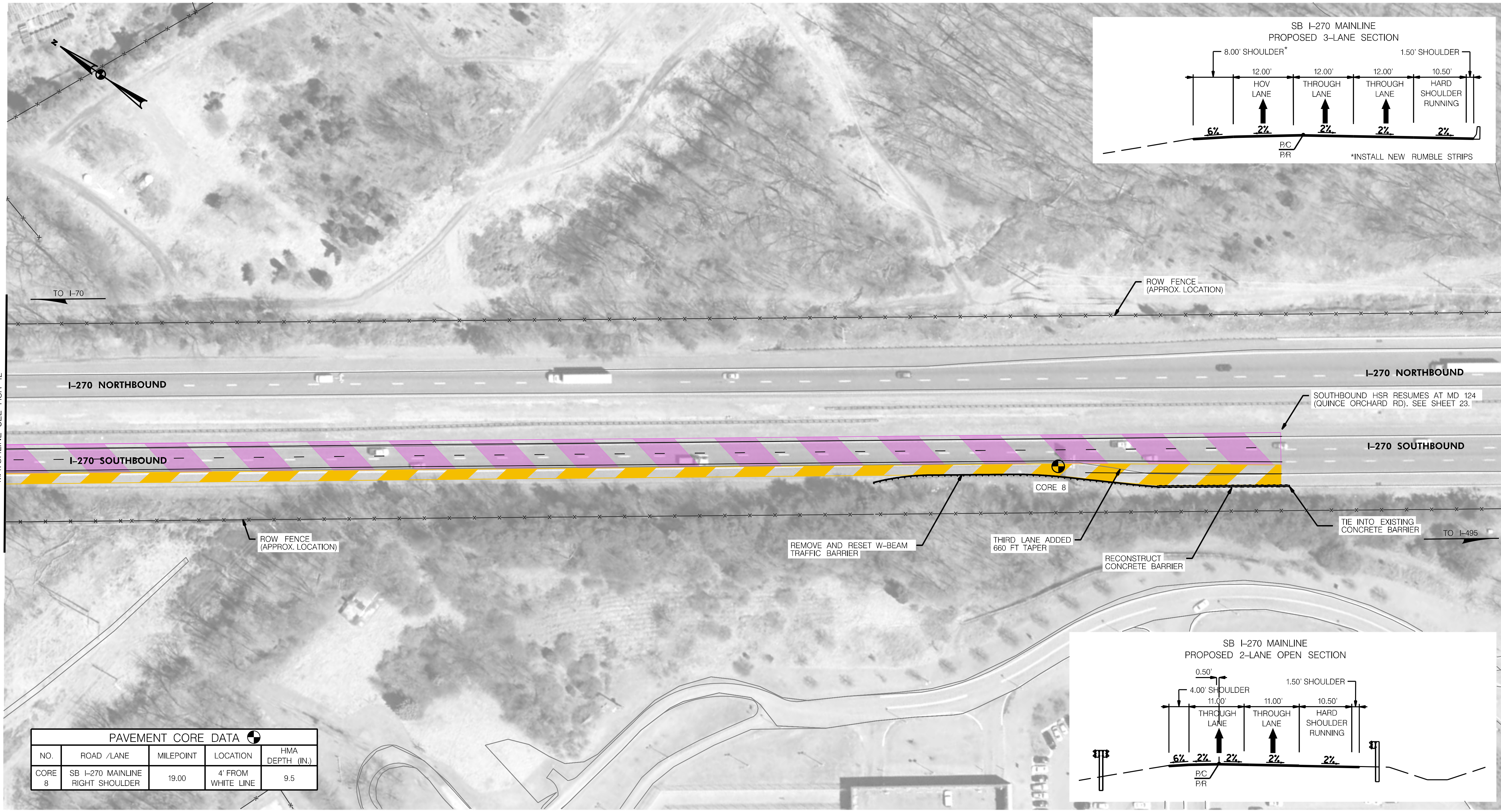
SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:17 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P012_IS270.dgn



PAVEMENT CORE DATA

NO.	ROAD /LANE	MILEPOINT	LOCATION	HMA DEPTH (IN.)
CORE 8	SB I-270 MAINLINE RIGHT SHOULDER	19.00	4' FROM WHITE LINE	9.5

NOTES:
1. GPR DATA AVAILABLE FOR RIGHT SHOULDER ONLY.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.5 INCHES OF HMA/BITUMINOUS CONCRETE & 5 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

- FULL DEPTH RECONSTRUCTION
- WEDGE/LEVEL & RESURFACING
- MICROSURFACING
- PAVEMENT MARKINGS
- W-BEAM TRAFFIC BARRIER
- CONCRETE BARRIER
- EXISTING GRATE INLET (ADJUST OR REPLACE)
- EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

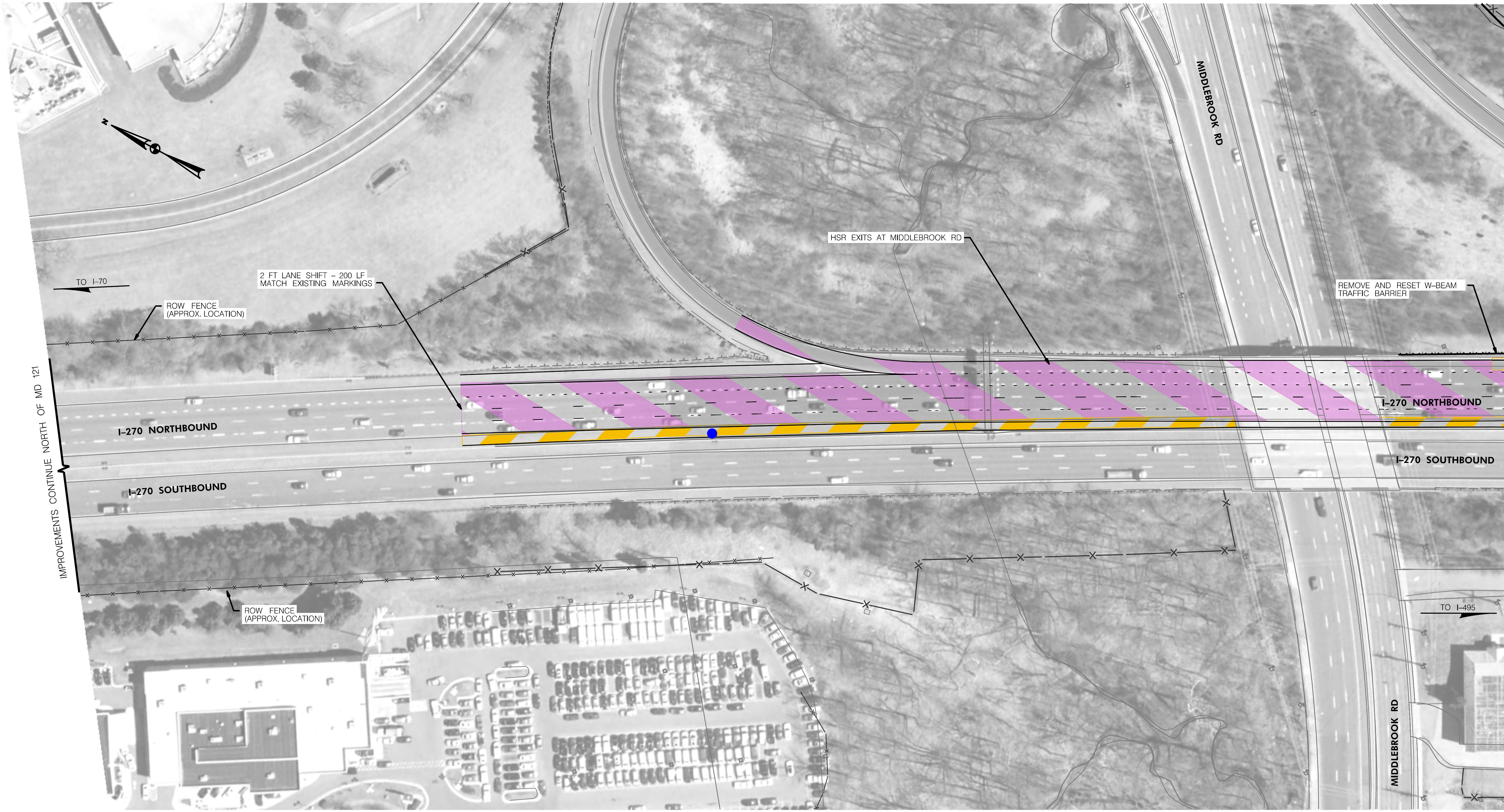
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 2
IS 270 – NORTH OF MD 121 (CLARKSBURG RD)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:19 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P013_IS270.dgn



NOTES:
1. NO GPR DATA AVAILABLE (LIMITS BEGIN SOUTH OF MIDDLEBROOK RD).
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 13.5 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

- FULL DEPTH RECONSTRUCTION
- WEDGE/LEVEL & RESURFACING
- MICROSURFACING
- PAVEMENT MARKINGS
- W-BEAM TRAFFIC BARRIER
- CONCRETE BARRIER
- EXISTING GRATE INLET (ADJUST OR REPLACE)
- EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'

SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 3
IS 270 – MIDDLEBROOK RD

DATE: JANUARY 19, 2017

HSR 14 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 08:21 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P014_IS270.dgn

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 6.5 INCHES OF HMA/BITUMINOUS CONCRETE & 14 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
WEDGE/LEVEL & RESURFACING	W-BEAM TRAFFIC BARRIER
MICROSURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 3
IS 270 - SOUTH OF MIDDLEBROOK RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:23 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P015_IS270.dgn

BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-33	NB I-270 MAINLINE RIGHT SHOULDER	547,701.26	1,243,297.84	12.0	15.6
SB-37	SB I-270 MAINLINE LEFT SHOULDER	547,045.05	1,243,530.42	6.0	13.2

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 6.5 INCHES OF HMA/BITUMINOUS CONCRETE & 14 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 3
IS 270 – SOUTH OF MIDDLEBROOK RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:24 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P016_IS270.dgn

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 6.5 INCHES OF HMA/BITUMINOUS CONCRETE & 14 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

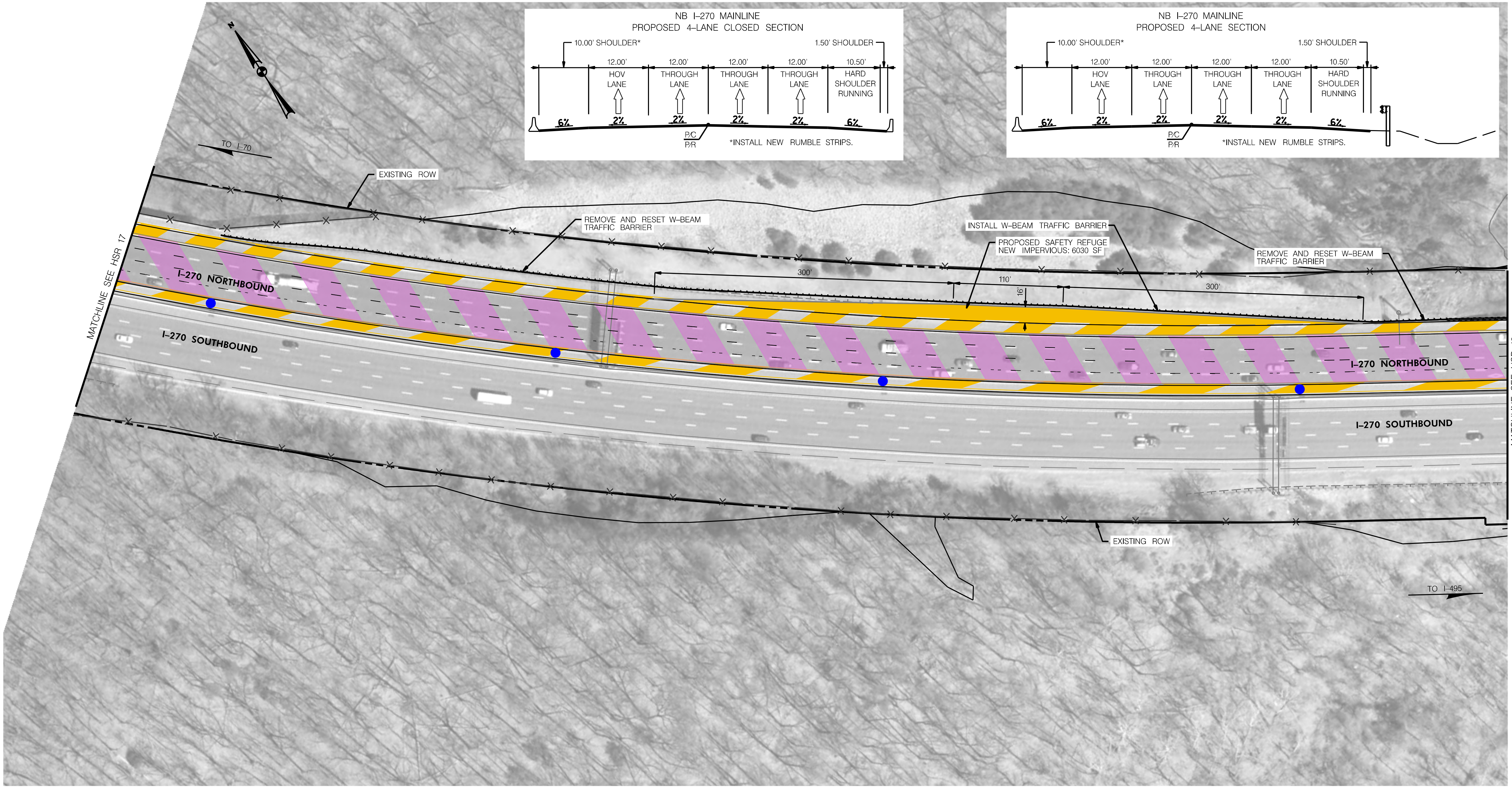
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 3
IS 270 – SOUTH OF MIDDLEBROOK RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:26 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P017_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 6.5 INCHES OF HMA/BITUMINOUS CONCRETE & 14 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

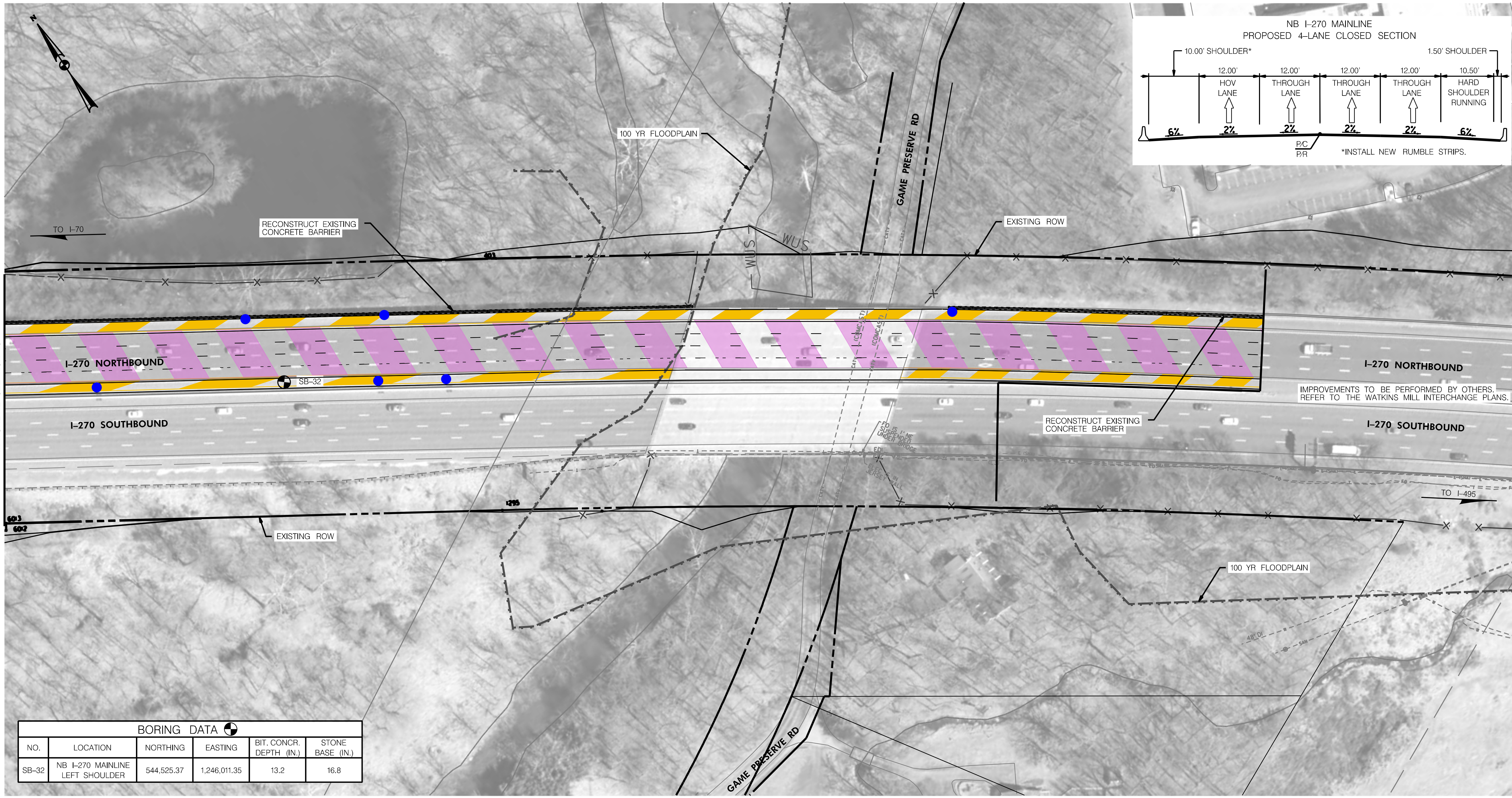
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 3
IS 270 - NORTH OF GAME PRESERVE RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:28 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P018_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-32	NB I-270 MAINLINE LEFT SHOULDER	544,525.37	1,246,011.35	13.2	16.8

NOTES:
1. NO GPR DATA AVAILABLE (LIMITS OF GPR BEGIN AT MIDDLEBROOK RD).
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 6.5 INCHES OF HMA/BITUMINOUS CONCRETE & 14 INCHES OF GAB (NORTH OF GAME PRESERVE RD).
3. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB (SOUTH OF GAME PRESERVE RD).

CORMAN CONSTRUCTION
WSP PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT
HARD SHOULDER RUNNING
SEGMENT 3
IS 270 - GAME PRESERVE RD

DATE: JANUARY 19, 2017
HSR 19 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 08:30 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P019_IS270.dgn

BORING DATA					
NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-35	SB I-270 MAINLINE RIGHT SHOULDER	543,189.58	1,247,709.47	14.4	20.4

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 3
IS 270 - SOUTH OF GAME PRESERVE RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:32 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P020_IS270.dgn

NOTES:
1. GPR DATA AVAILABIE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA BITUMINOUS CONCRETE & 15 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'

SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

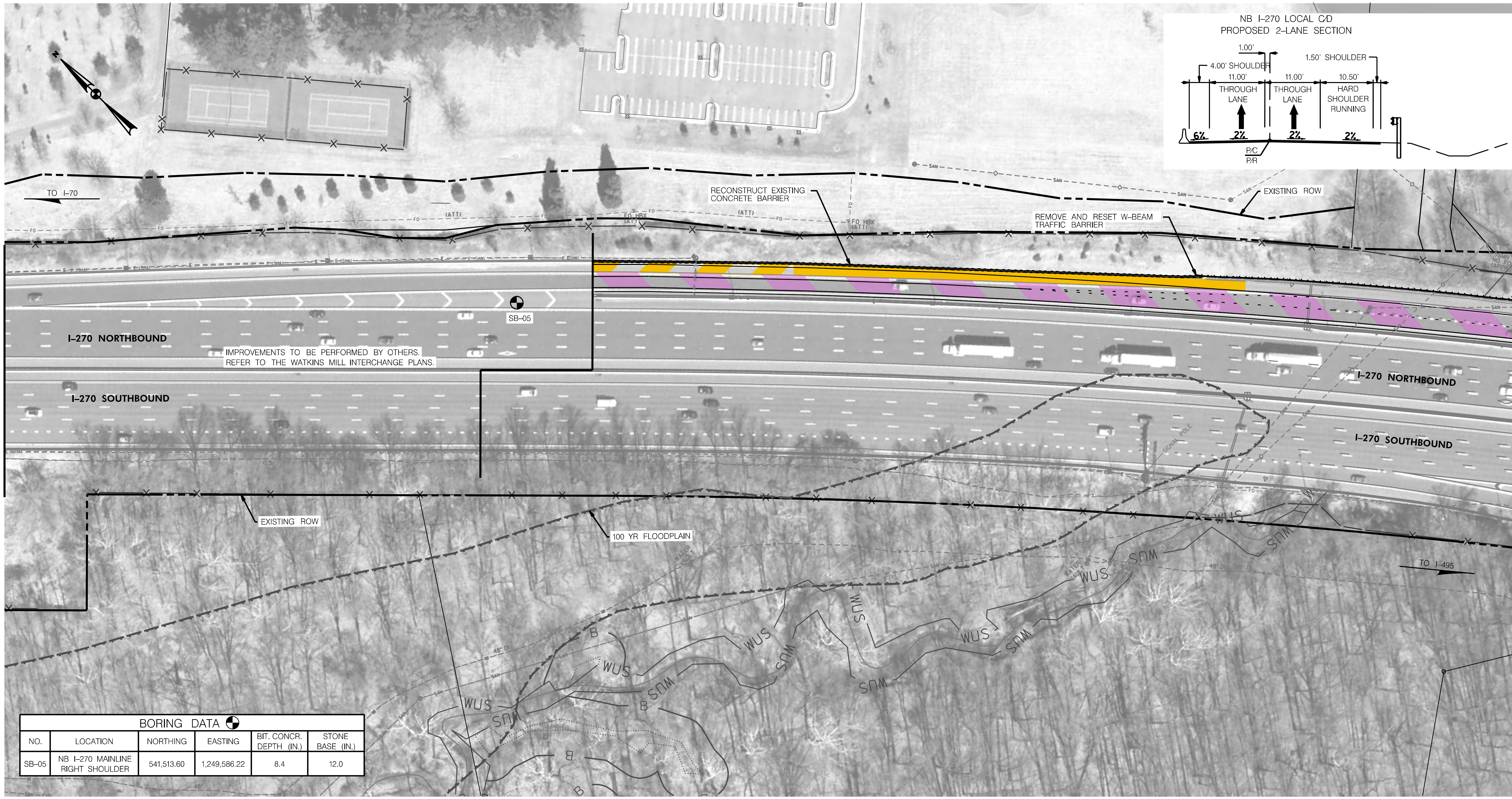
HARD SHOULDER RUNNING

SEGMENT 3
IS 270 - WATKINS MILL RD

DATE: JANUARY 19, 2017

HSR 21 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 08:33 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P021_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-05	NB I-270 MAINLINE RIGHT SHOULDER	541,513.60	1,249,586.22	8.4	12.0

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 15 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

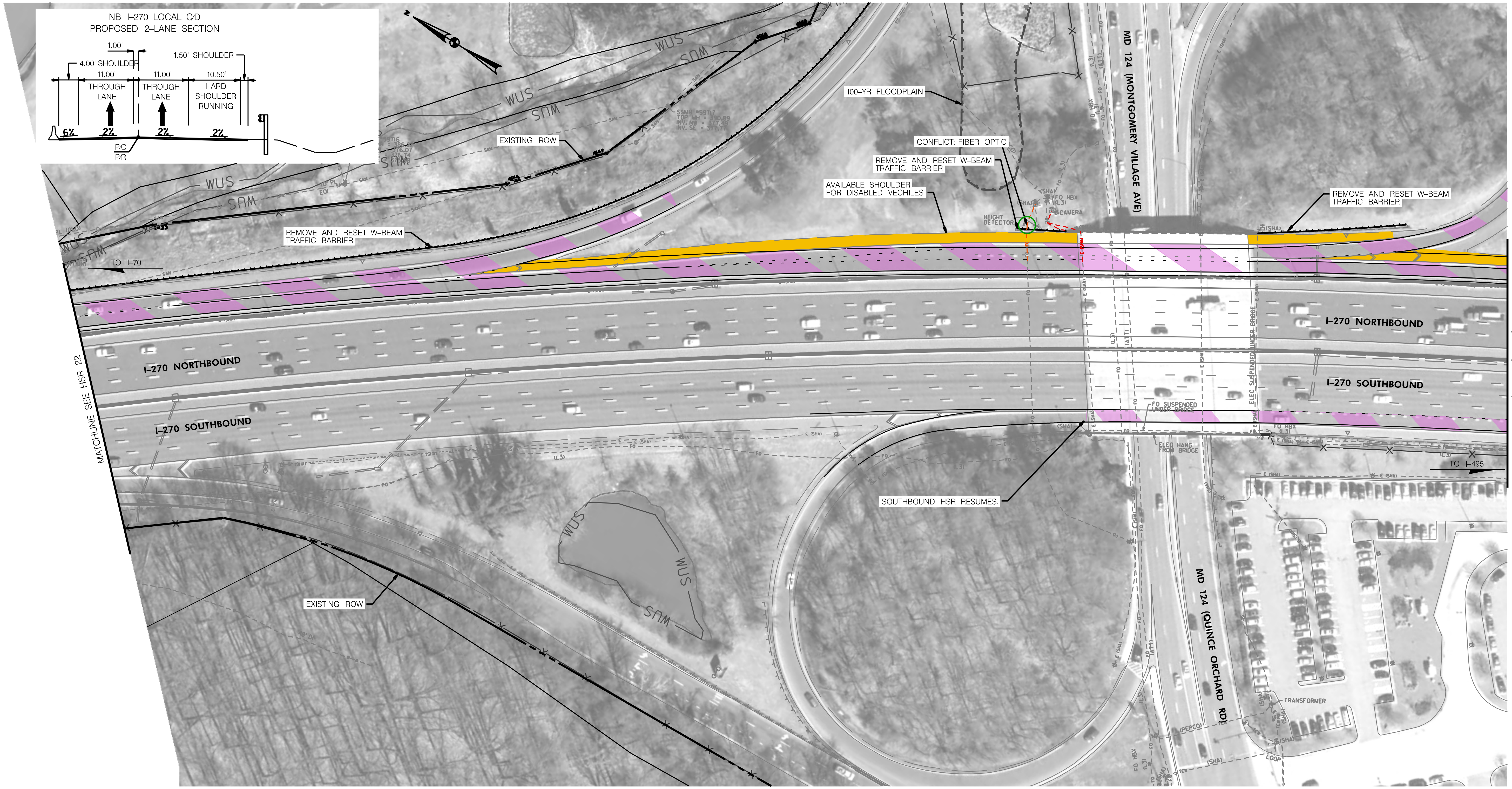
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – MD 124 (QUINCE ORCHARD RD)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:35 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P022_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 15 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'

SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

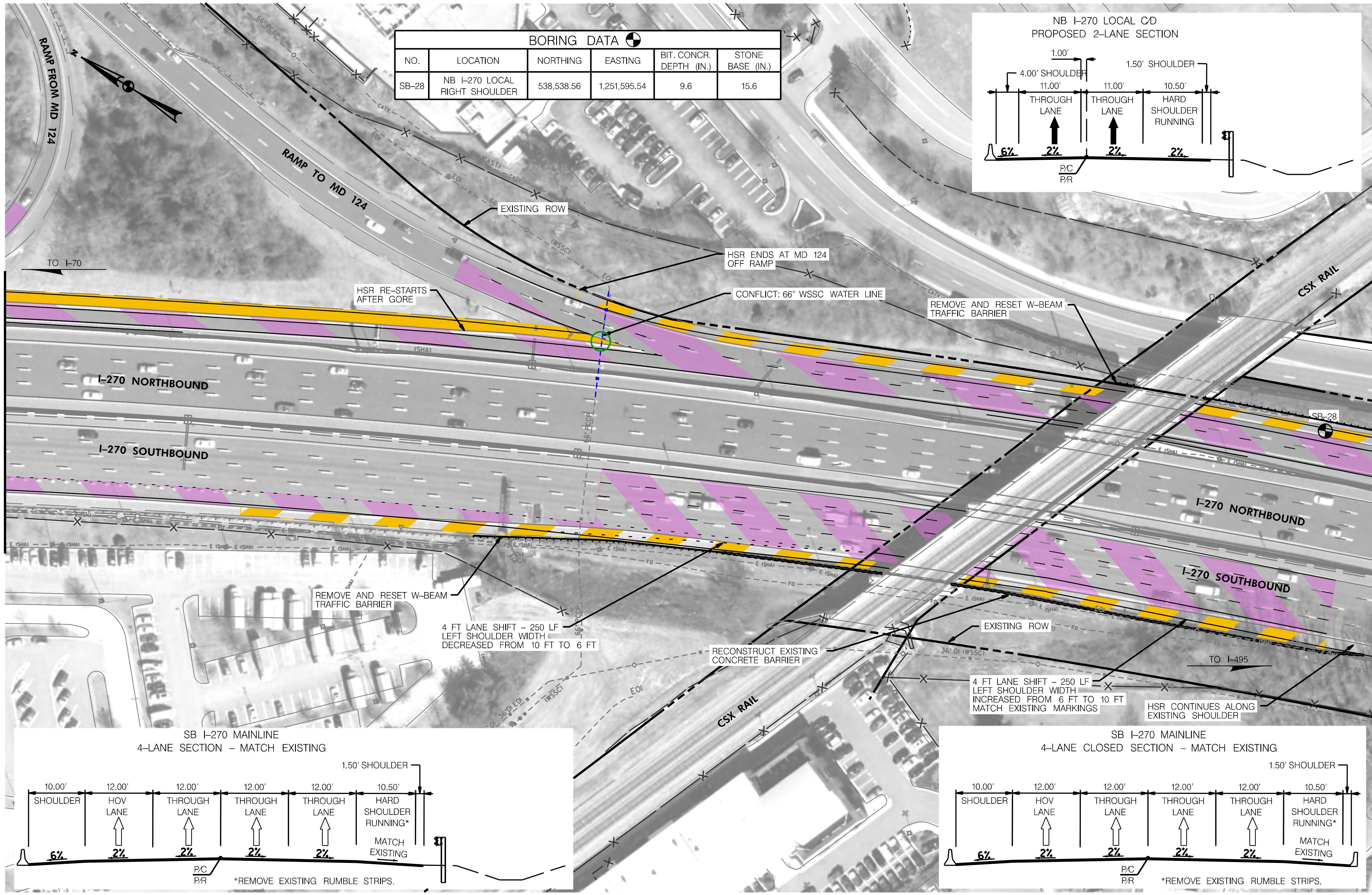
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – MD 124 (QUINCE ORCHARD RD)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:37 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P023_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-28	NB I-270 LOCAL RIGHT SHOULDER	538,538.56	1,251,595.54	9.6	15.6

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 15 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

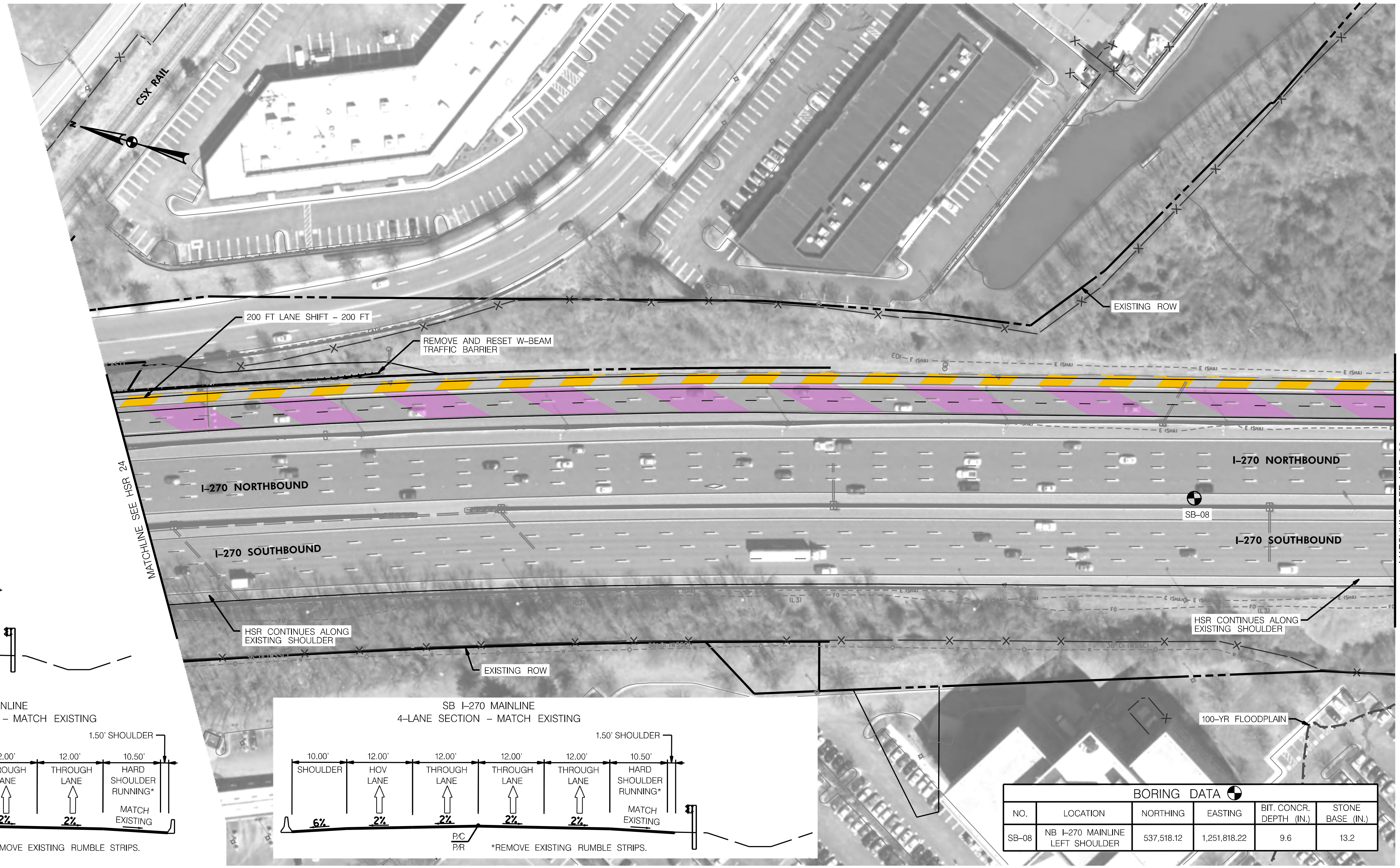
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - SOUTH OF MD 124

DATE: JANUARY 19, 2017

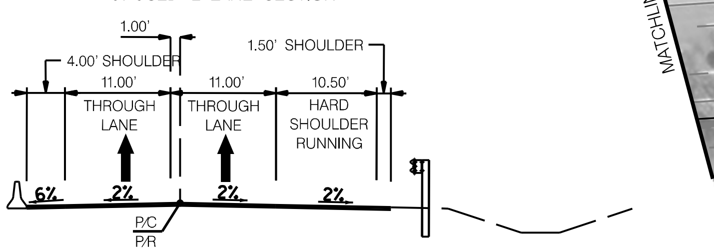
PLOTTED: Wednesday, January 18, 2017 AT 07:08 AM
FILE: J:\201310144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P024_IS270.dgn



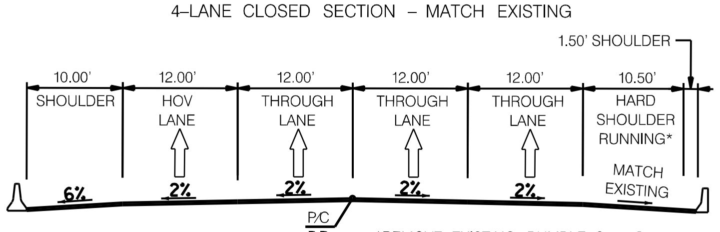
BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-08	NB I-270 MAINLINE LEFT SHOULDER	537,518.12	1,251,818.22	9.6	13.2

NB I-270 LOCAL C/D
PROPOSED 2-LANE SECTION



SB I-270 MAINLINE
4-LANE CLOSED SECTION - MATCH EXISTING



*REMOVE EXISTING RUMBLE STRIPS.

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 8.0 INCHES OF HMA/BITUMINOUS CONCRETE & 15 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

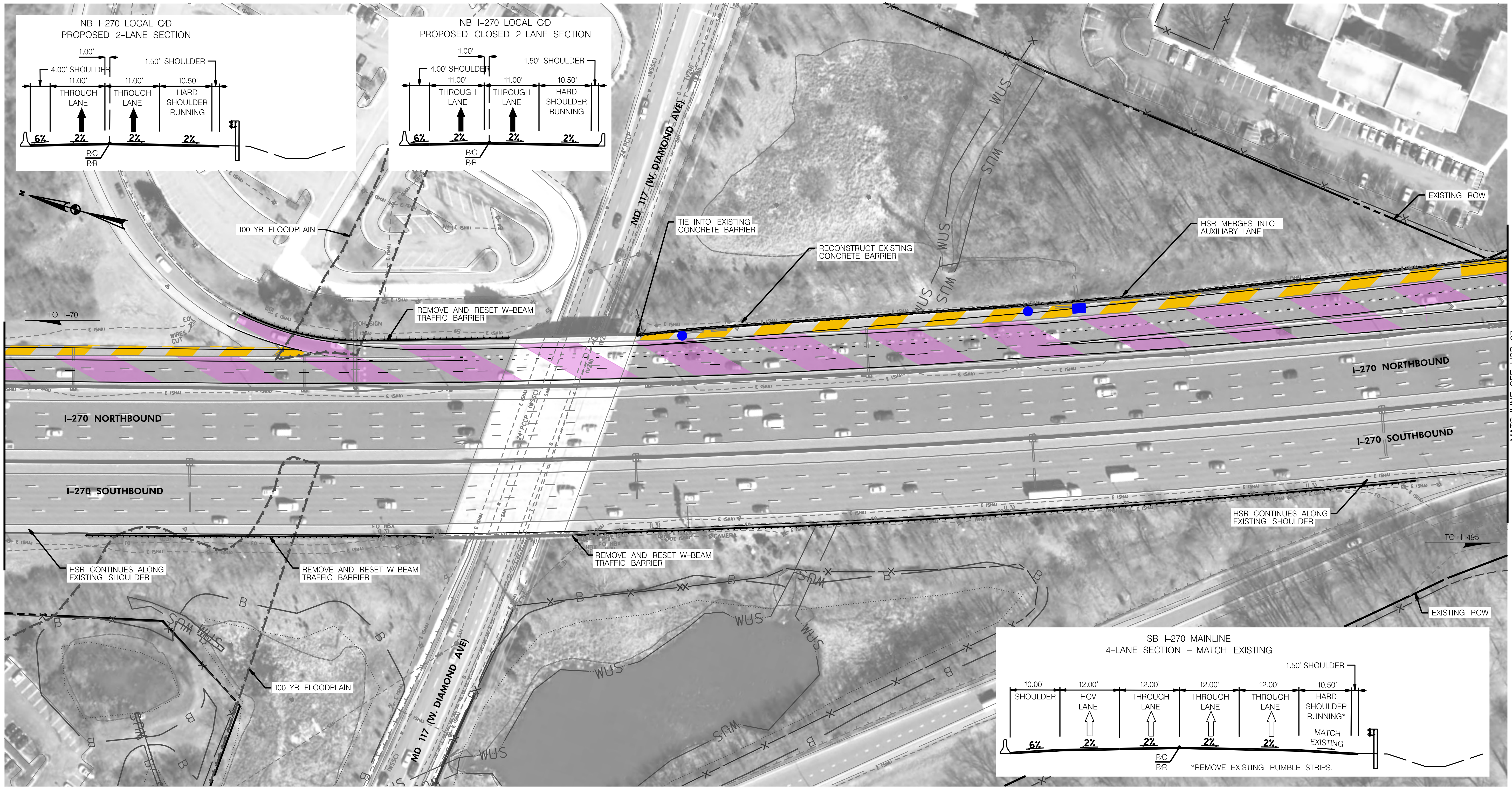
REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT
HARD SHOULDER RUNNING
SEGMENT 4
IS 270 - NORTH OF MD 117 (W. DIAMOND AVE)

DATE: JANUARY 19, 2017

PLOTTED: Wednesday, January 18, 2017 AT 07:13 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P025_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 8.0 INCHES OF HMA/BITUMINOUS CONCRETE & 15 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

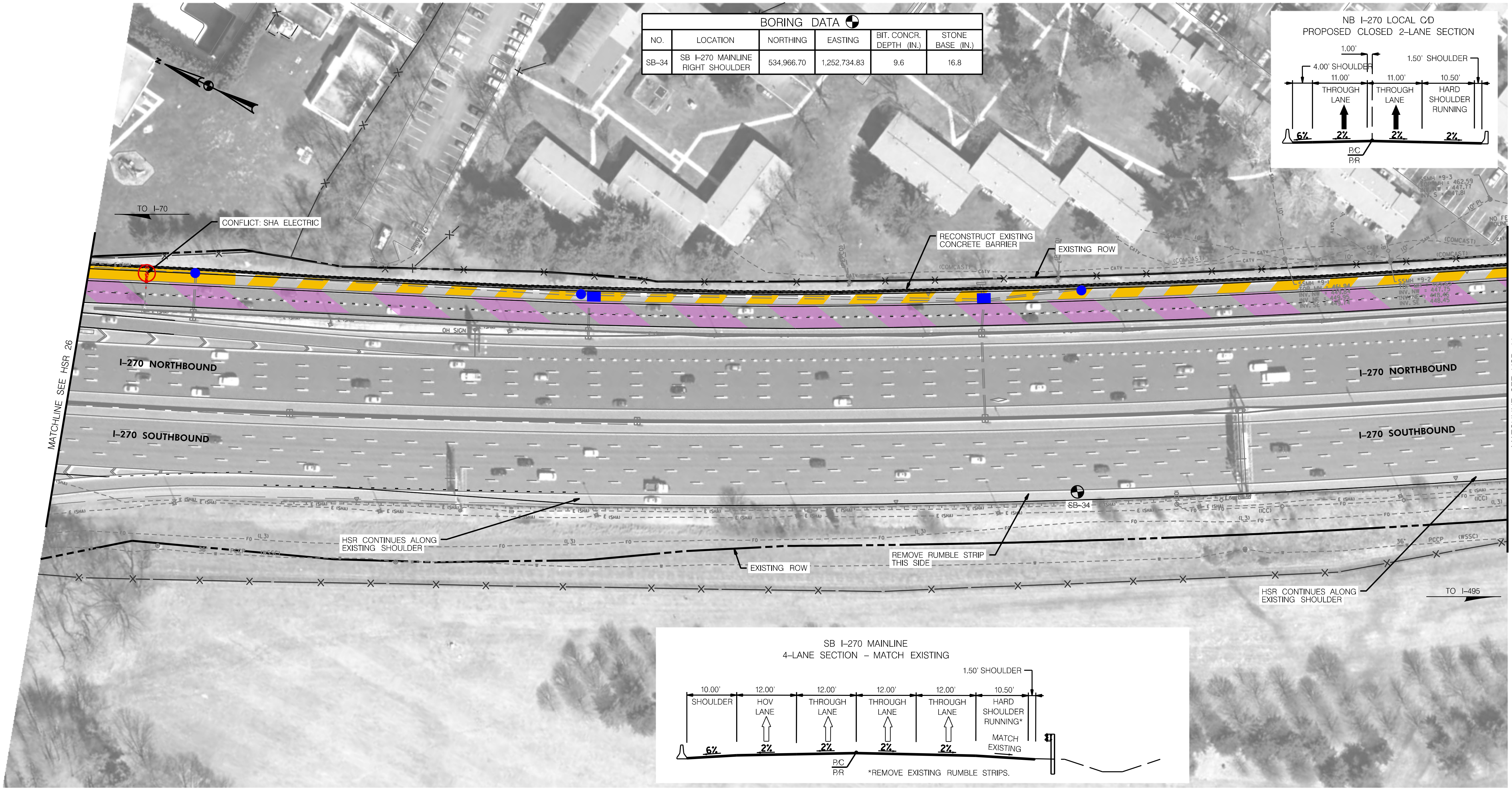
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - MD 117 (W. DIAMOND AVE)

DATE: JANUARY 19, 2017
HSR 26 OF 57



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-34	SB I-270 MAINLINE RIGHT SHOULDER	534,966.70	1,252,734.83	9.6	16.8

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 15 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
WEDGE/LEVEL & RESURFACING	W-BEAM TRAFFIC BARRIER
MICROSURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

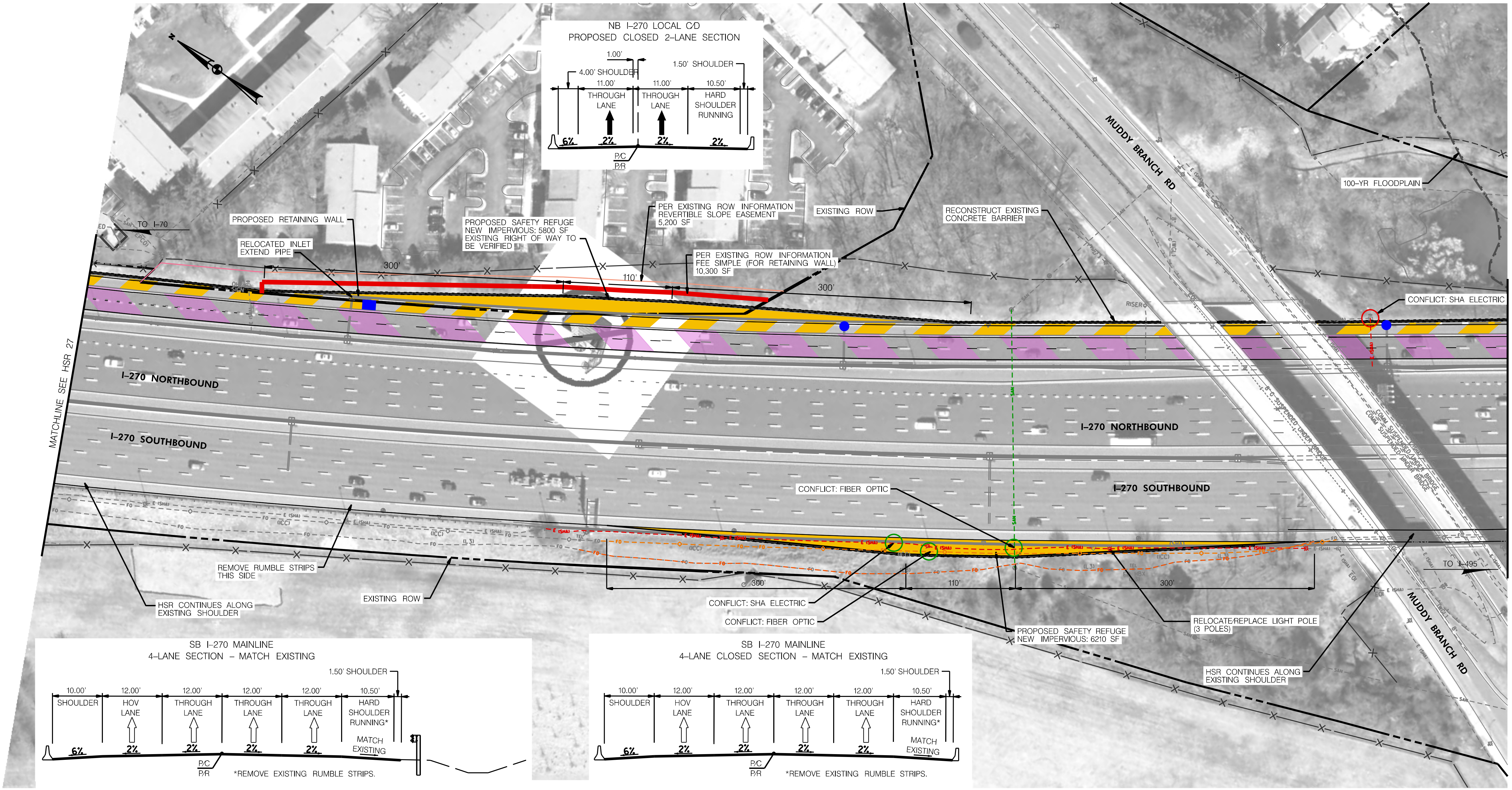
REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT
HARD SHOULDER RUNNING
SEGMENT 4
IS 270 - SOUTH OF MD 117

DATE: JANUARY 19, 2017
HSR 27 OF 57

PLOTTED: Wednesday, January 18, 2017 AT 07:18 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P027_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 15 INCHES OF GAB (NO RECORDS SOUTH OF MUDDY BRANCH).

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

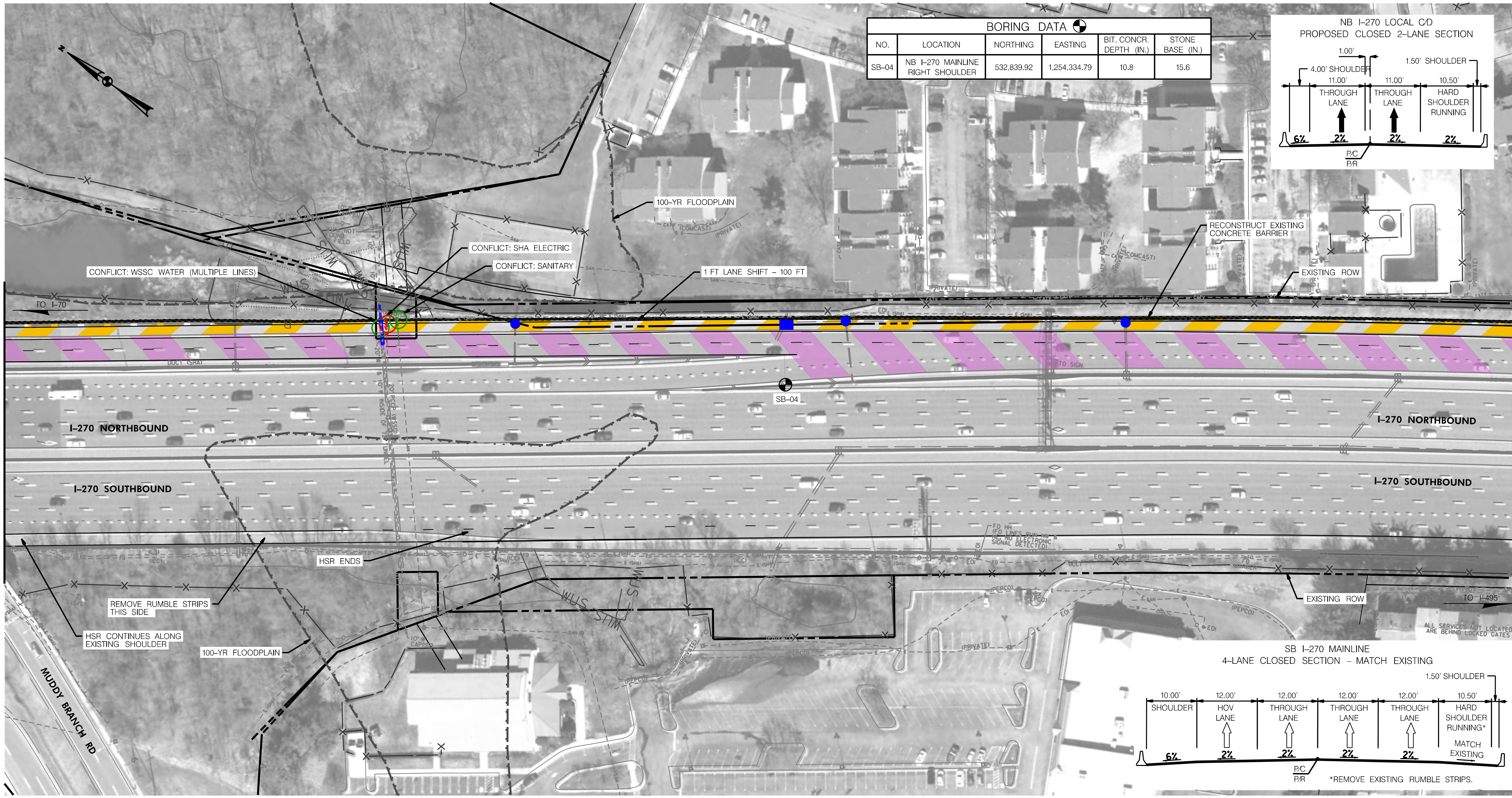
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - MUDDY BRANCH RD

DATE: JANUARY 19, 2017

PLOTTED: Wednesday, January 18, 2017 AT 07:25 AM
FILE: J:\201310144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P028_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-04	NB I-270 MAINLINE RIGHT SHOULDER	532,839.92	1,254,334.79	10.8	15.6

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

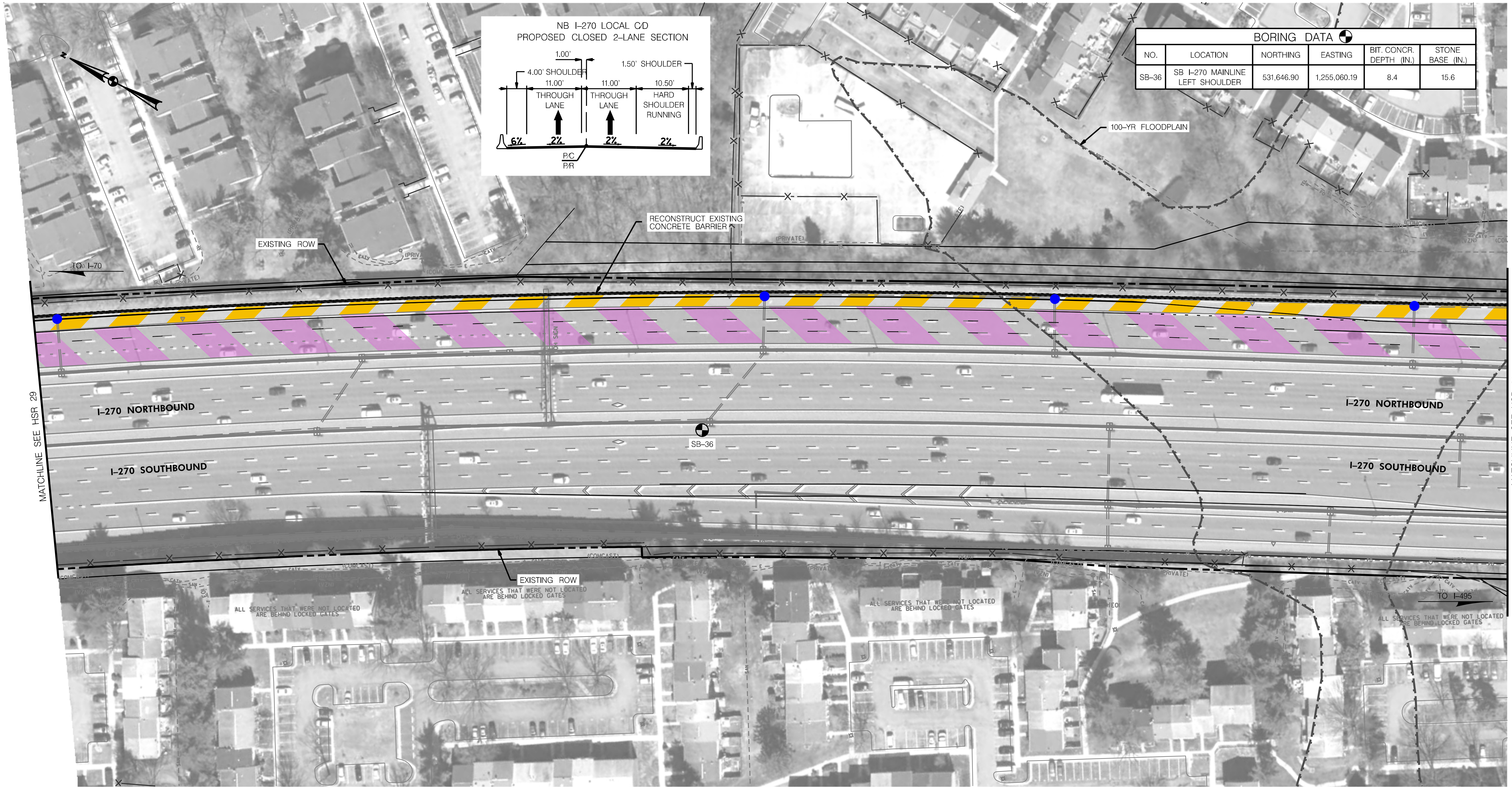
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – SOUTH OF MUDDY BRANCH RD

DATE: JANUARY 19, 2017

PLOTTED: Wednesday, January 18, 2017 AT 07:28 AM
FILE: J:\201310144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P029_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-36	SB I-270 MAINLINE LEFT SHOULDER	531,646.90	1,255,060.19	8.4	15.6

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

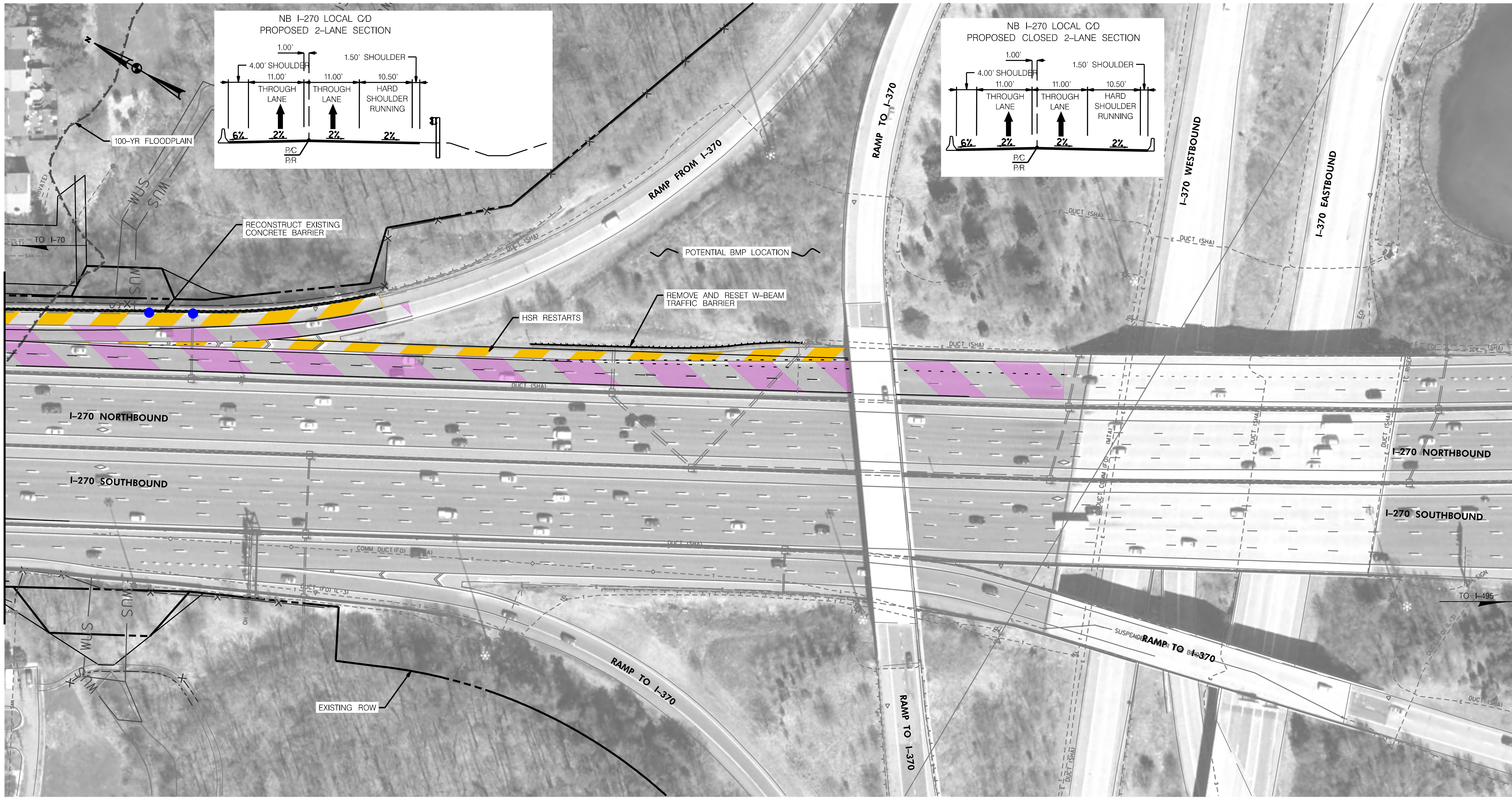
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – NORTH OF I-370

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:50 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P030_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE MAINLINE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 10.0 INCHES OF HMA/BITUMINOUS CONCRETE & 16 INCHES OF GAB.
3. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
WEDGE/LEVEL & RESURFACING	W–BEAM TRAFFIC BARRIER
MICROSURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – I–370

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:52 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P031_IS270.dgn

BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-25	SB I-270 LOCAL LEFT SHOULDER	528,447.82	1,256,928.52	8.4	15.6

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

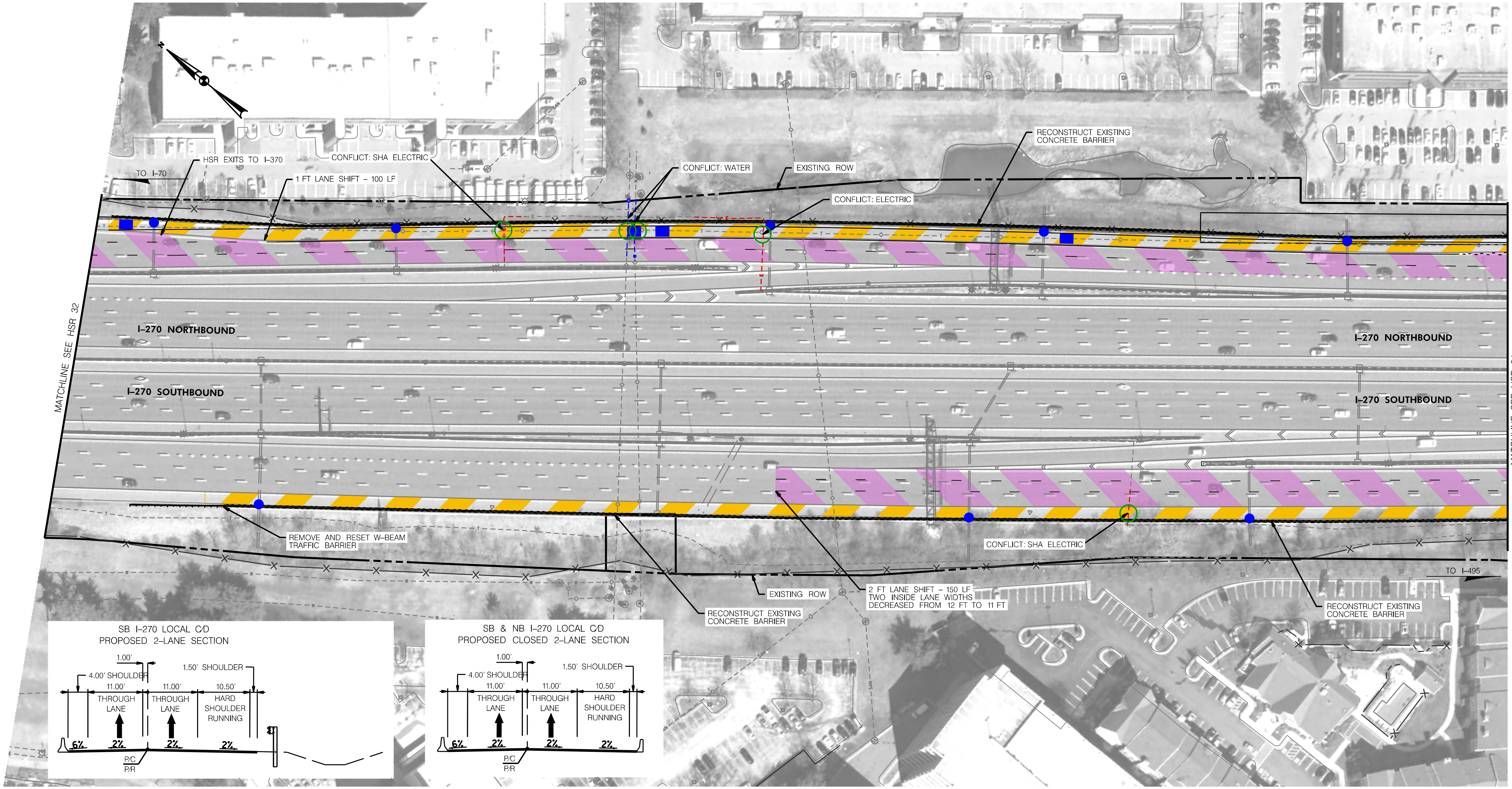
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – I-370

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:53 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P032_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

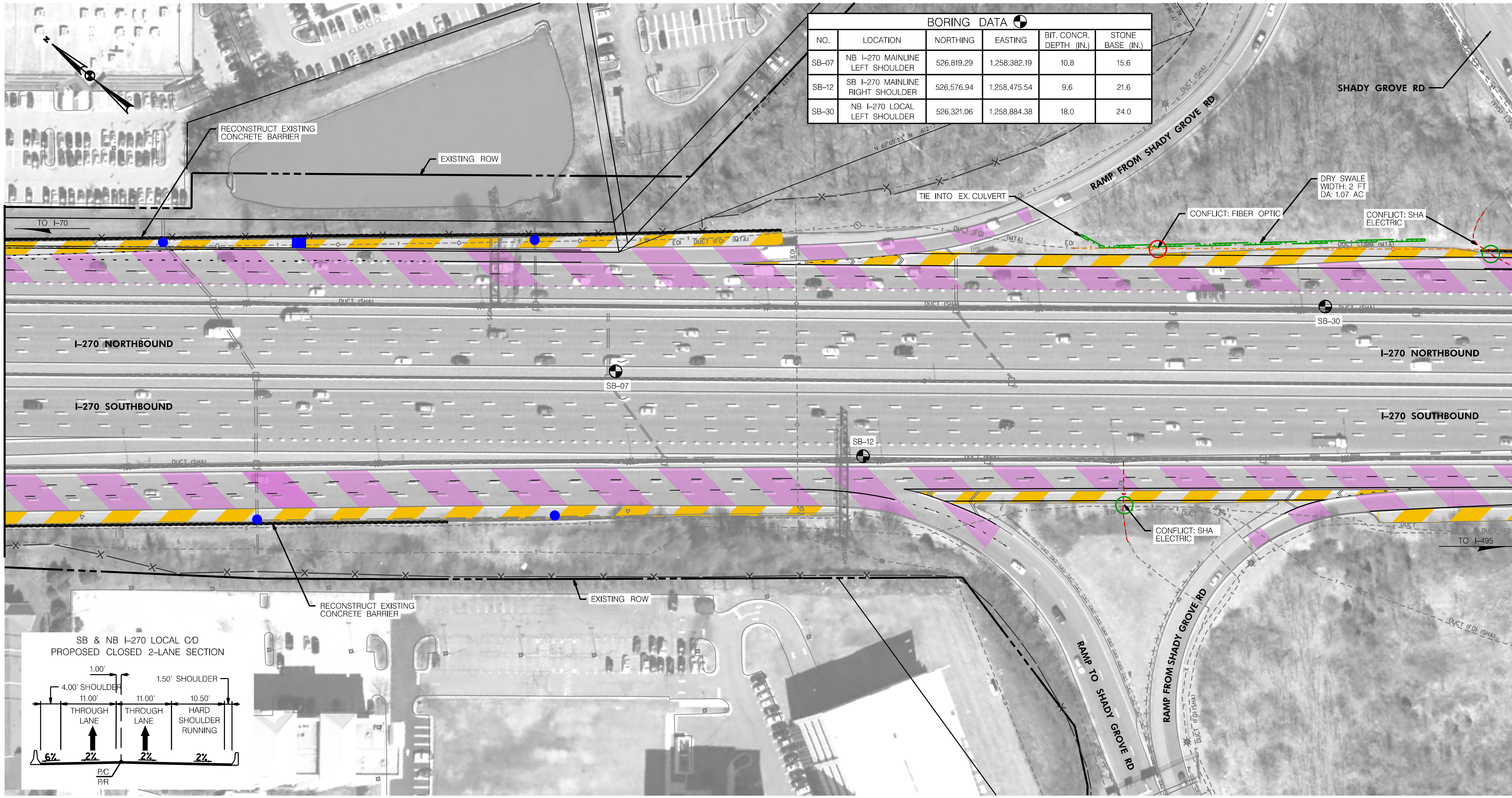
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - SOUTH OF I-370

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:56 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P033_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-07	NB I-270 MAINLINE LEFT SHOULDER	526,819.29	1,258,382.19	10.8	15.6
SB-12	SB I-270 MAINLINE RIGHT SHOULDER	526,576.94	1,258,475.54	9.6	21.6
SB-30	NB I-270 LOCAL LEFT SHOULDER	526,321.06	1,258,884.38	18.0	24.0

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

- FULL DEPTH RECONSTRUCTION
- WEDGE/LEVEL & RESURFACING
- MICROSURFACING
- PAVEMENT MARKINGS
- W-BEAM TRAFFIC BARRIER
- CONCRETE BARRIER
- EXISTING GRATE INLET (ADJUST OR REPLACE)
- EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

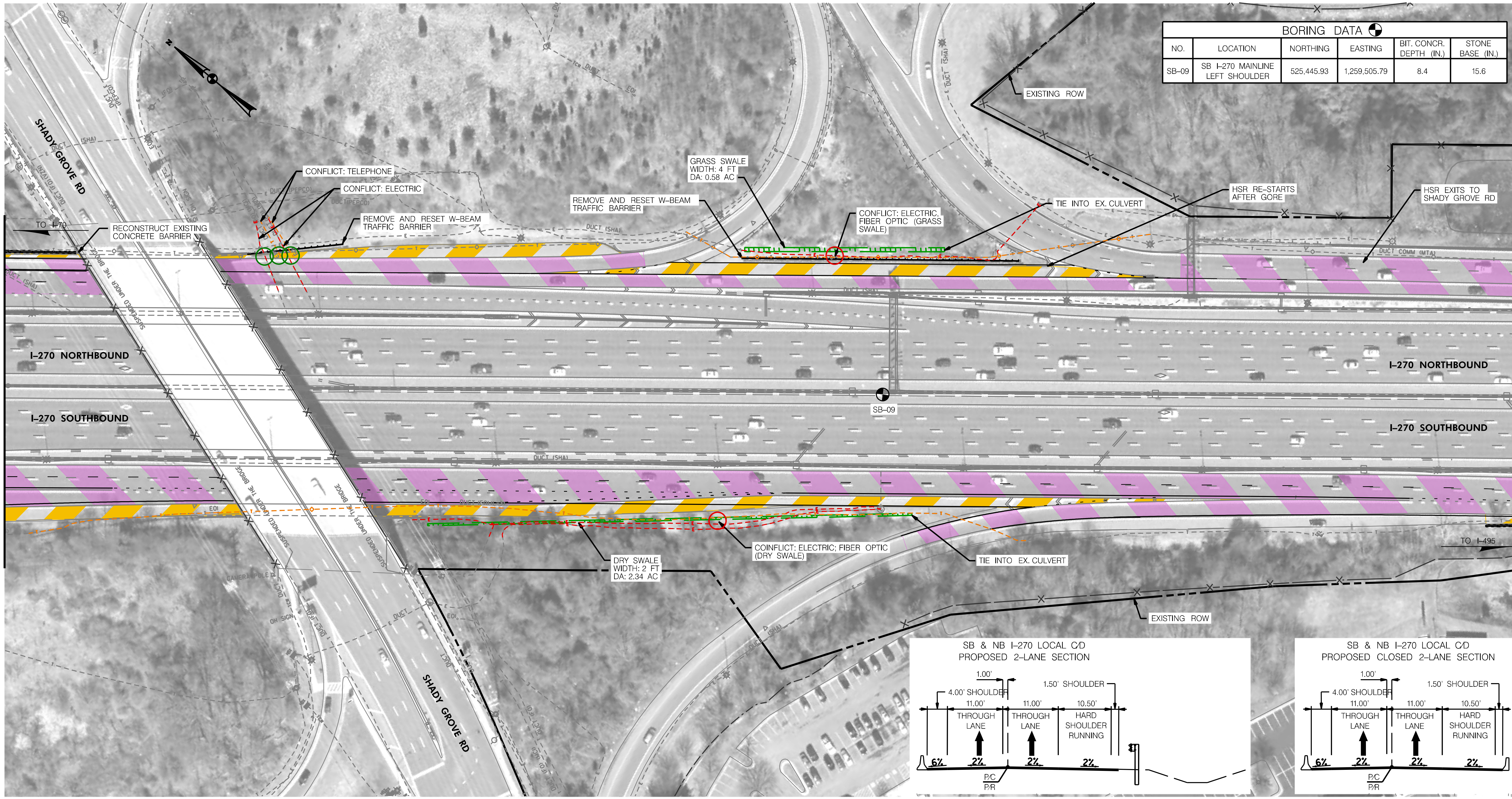
SEGMENT 4
IS 270 - NORTH OF SHADY GROVE RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 08:59 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P034_IS270.dgn

BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-09	SB I-270 MAINLINE LEFT SHOULDER	525,445.93	1,259,505.79	8.4	15.6



NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

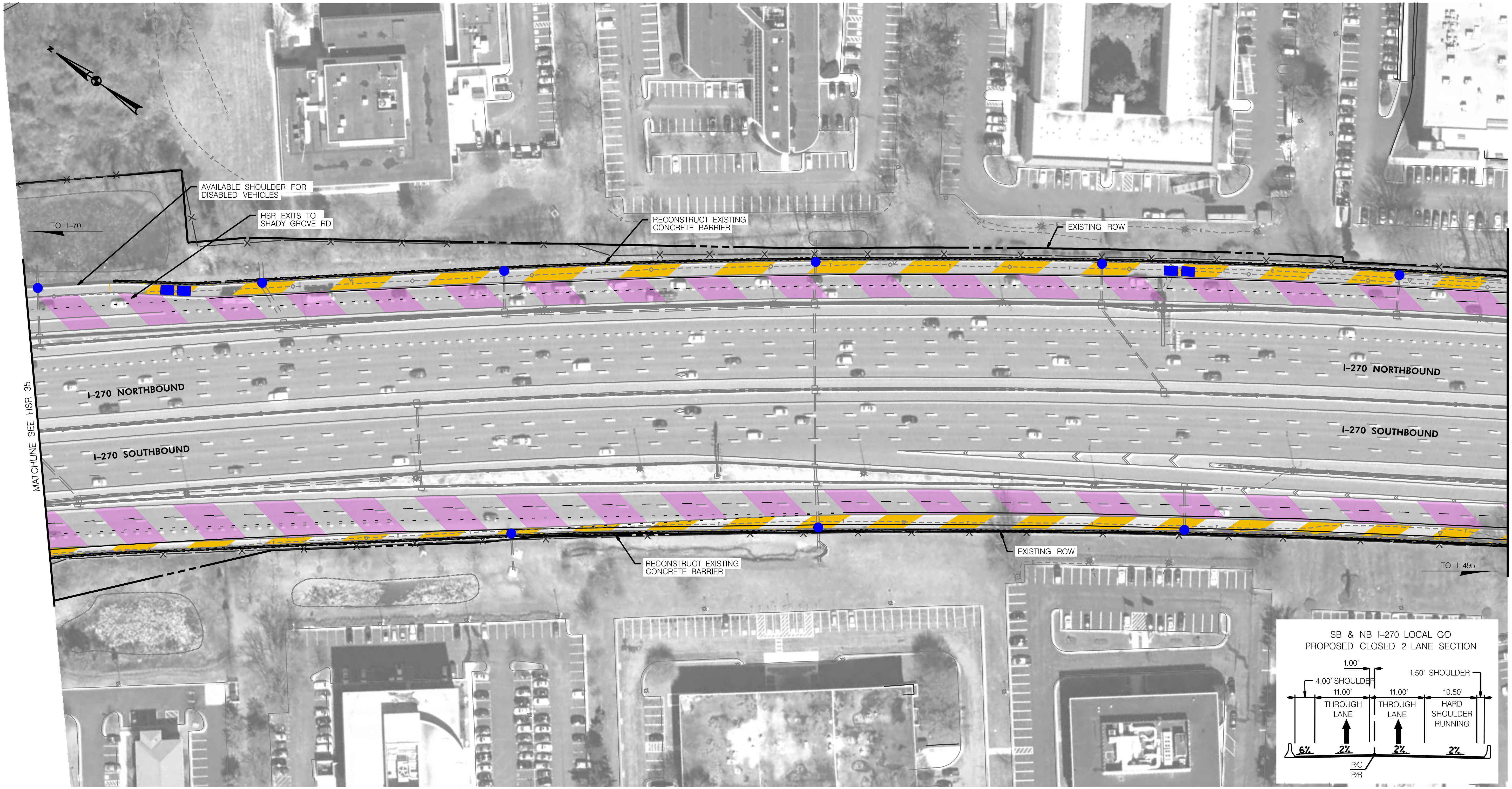
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – SHADY GROVE RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:03 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P035_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

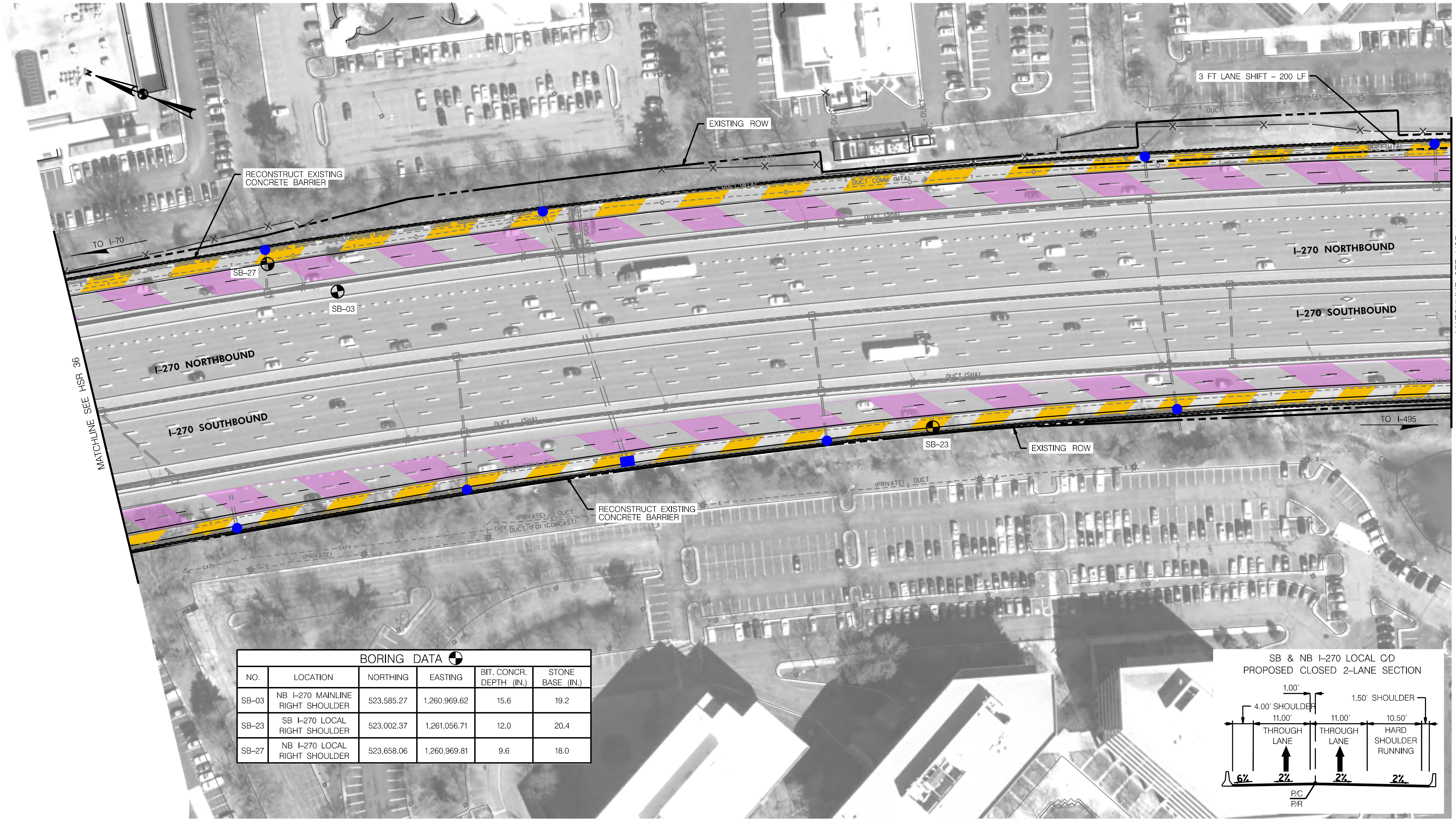
HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – SOUTH OF SHADY GROVE RD

DATE: JANUARY 19, 2017

HSR 36 OF 57

PLOTTED: Tuesday, January 17, 2017 AT 09:07 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P036_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-03	NB I-270 MAINLINE RIGHT SHOULDER	523,585.27	1,260,969.62	15.6	19.2
SB-23	SB I-270 LOCAL RIGHT SHOULDER	523,002.37	1,261,056.71	12.0	20.4
SB-27	NB I-270 LOCAL RIGHT SHOULDER	523,658.06	1,260,969.81	9.6	18.0

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. NO RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION

WEDGE/LEVEL & RESURFACING

MICROSURFACING

PAVEMENT MARKINGS

W-BEAM TRAFFIC BARRIER

CONCRETE BARRIER

EXISTING GRATE INLET (ADJUST OR REPLACE)

EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

– NONE ANTICIPATED

– POSSIBLE

– PROBABLE

DRAFT PLANS

50' 0 50' 100'

SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA

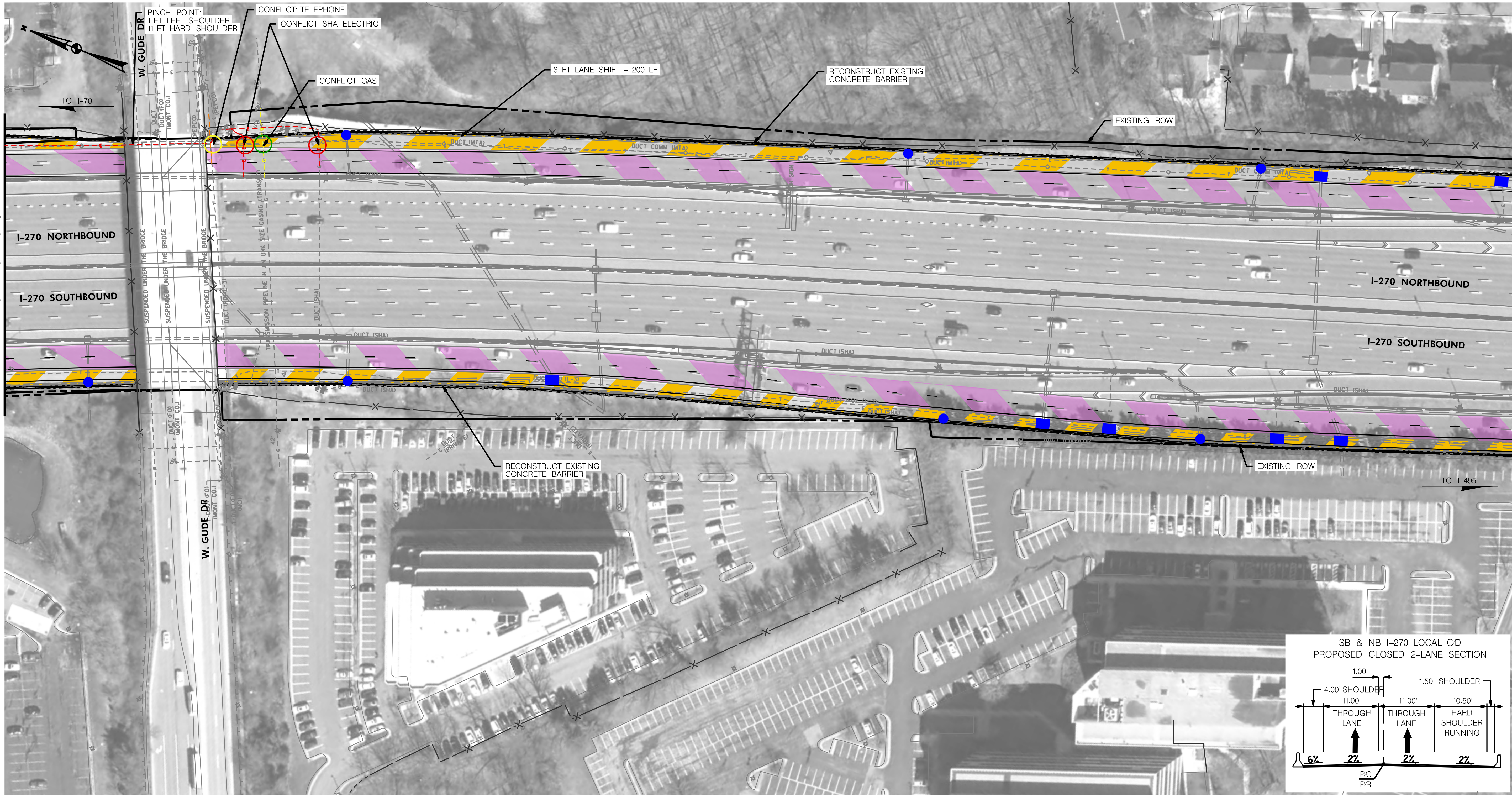
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – SOUTH OF SHADY GROVE RD

DATE: JANUARY 19, 2017



NOTES:

1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES OF GAB (NO RECORDS NORTH OF W. GUDE DR.).

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

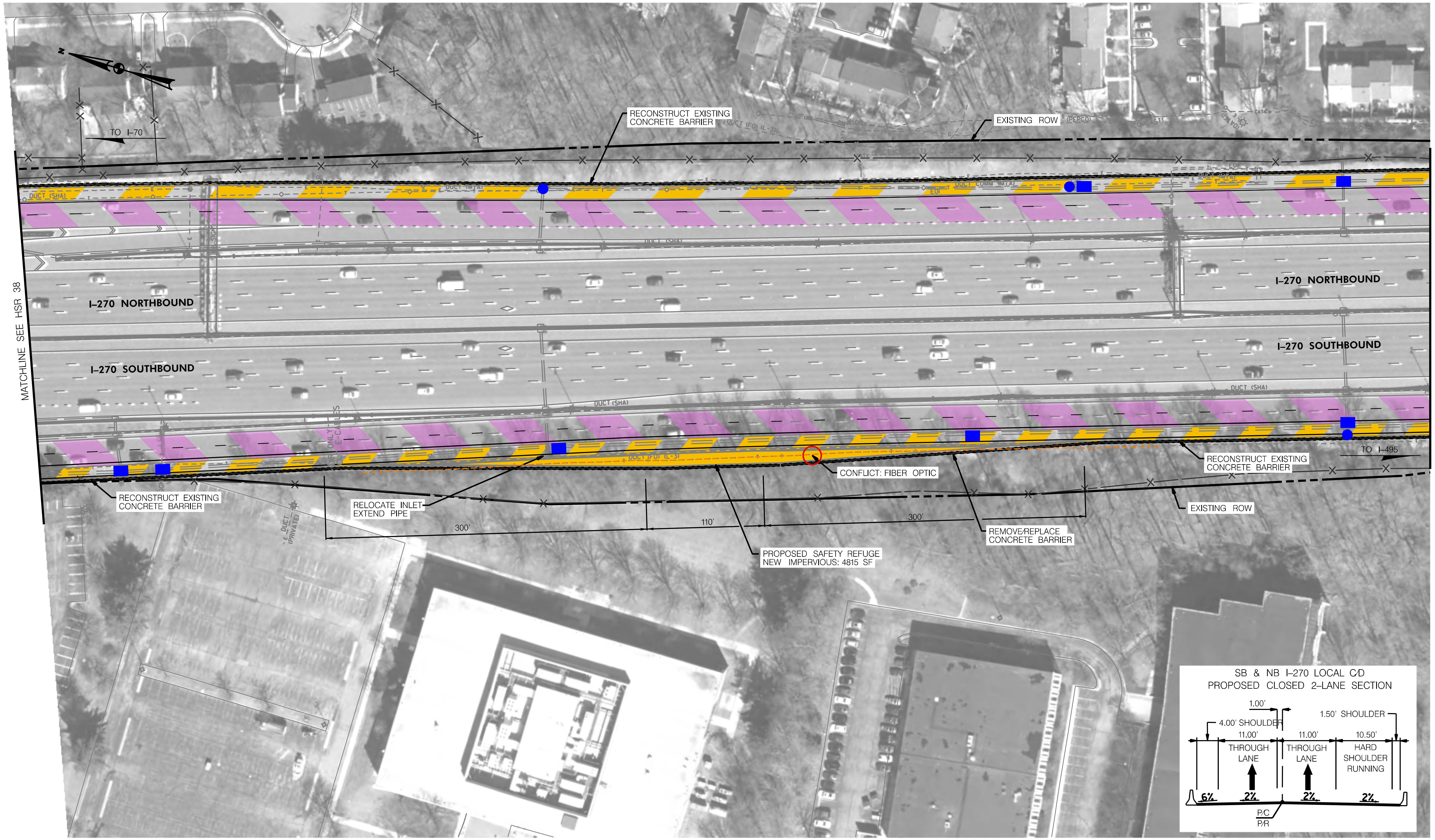
SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - W. GUDE AVE

DATE: JANUARY 19, 2017



NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	
WEDGE/LEVEL & RESURFACING	
MICROSURFACING	
PAVEMENT MARKINGS	
W-BEAM TRAFFIC BARRIER	
CONCRETE BARRIER	
EXISTING GRATE INLET (ADJUST OR REPLACE)	
EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

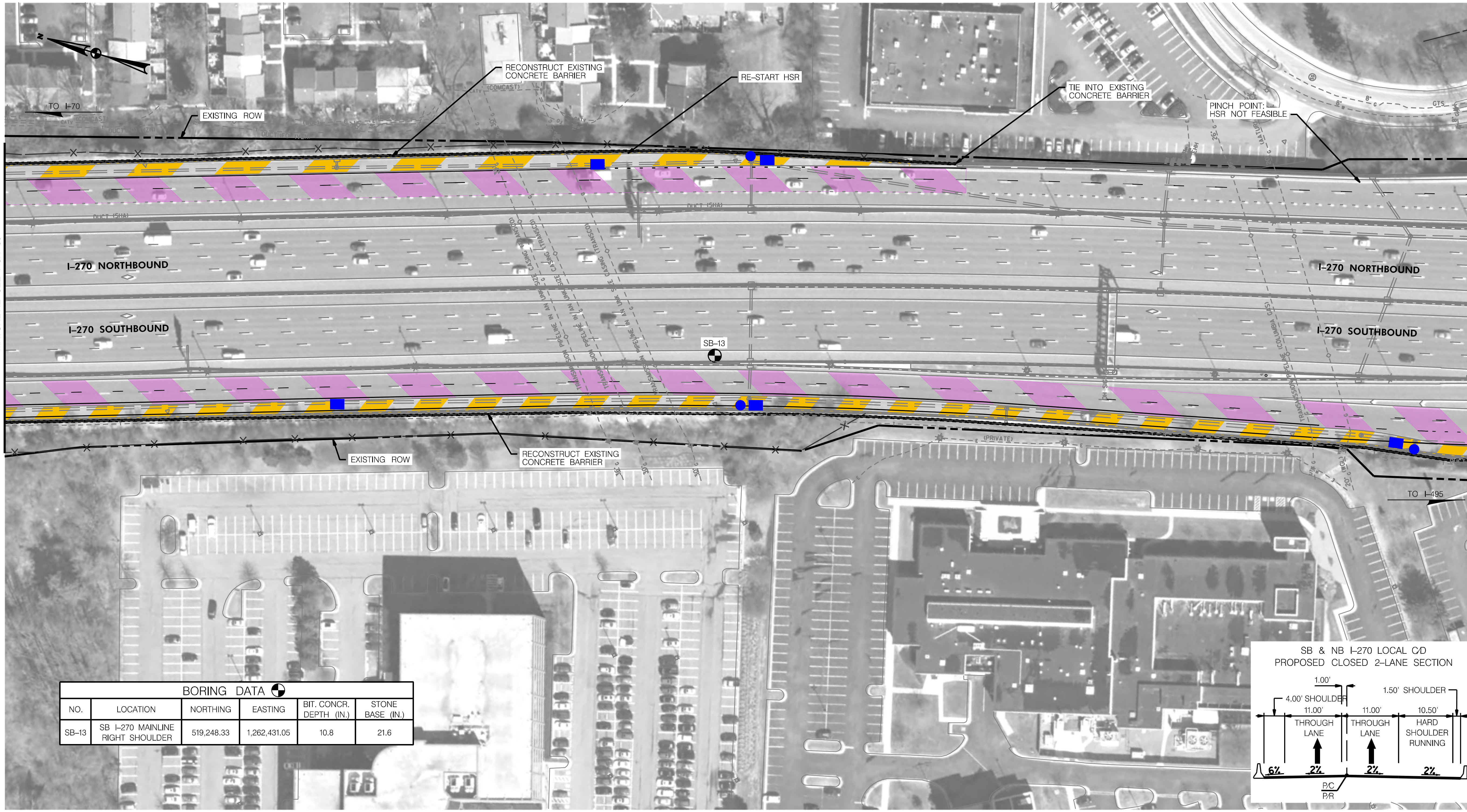
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – SOUTH OF W. GUDE AVE

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:34 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P039_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-13	SB I-270 MAINLINE RIGHT SHOULDER	519,248.33	1,262,431.05	10.8	21.6

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

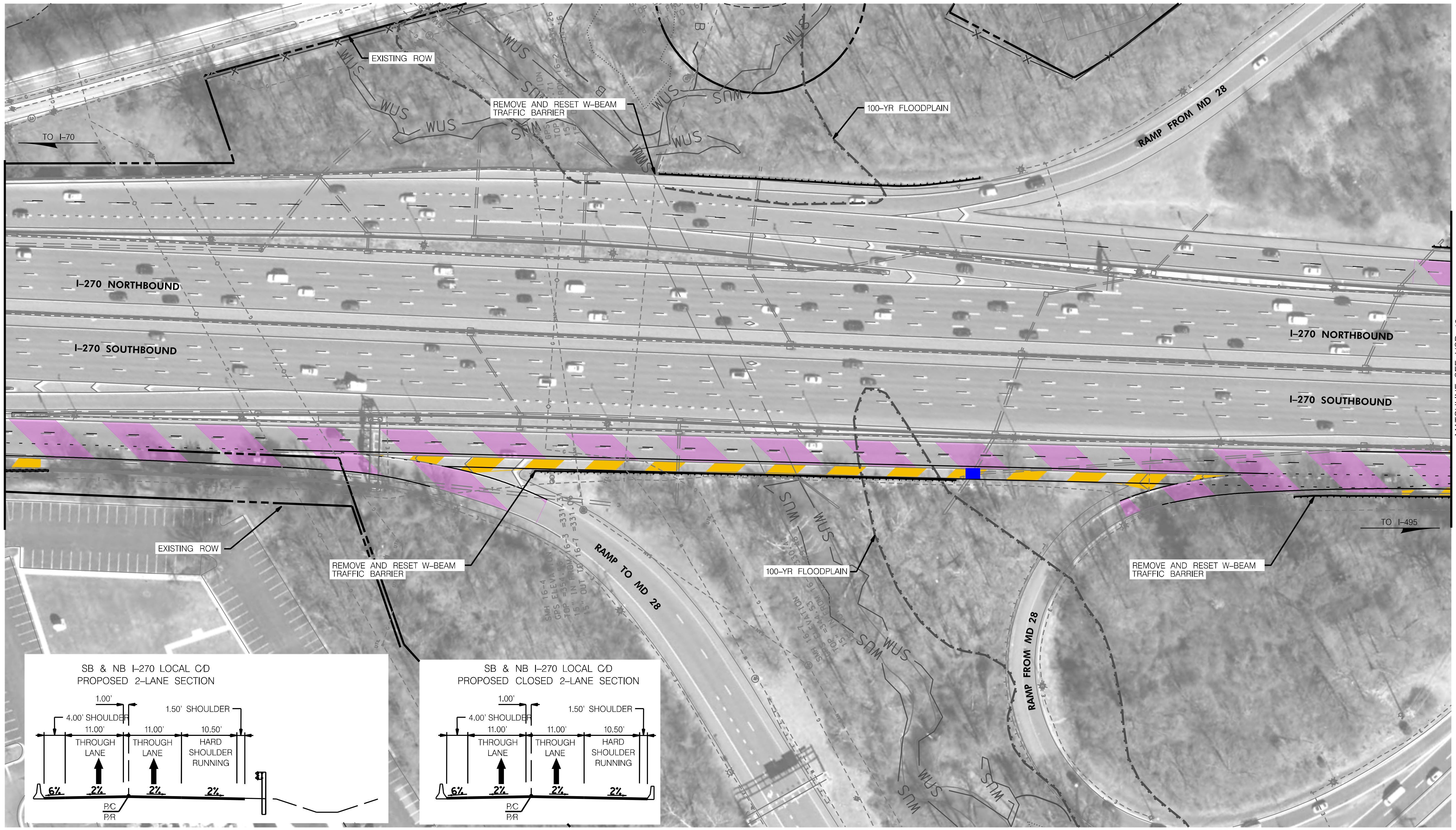
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - NORTH OF MD 28 (W. MONTGOMERY AVE)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:19 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P040_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES OF GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
WEDGE/LEVEL & RESURFACING	W-BEAM TRAFFIC BARRIER
MICROSURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

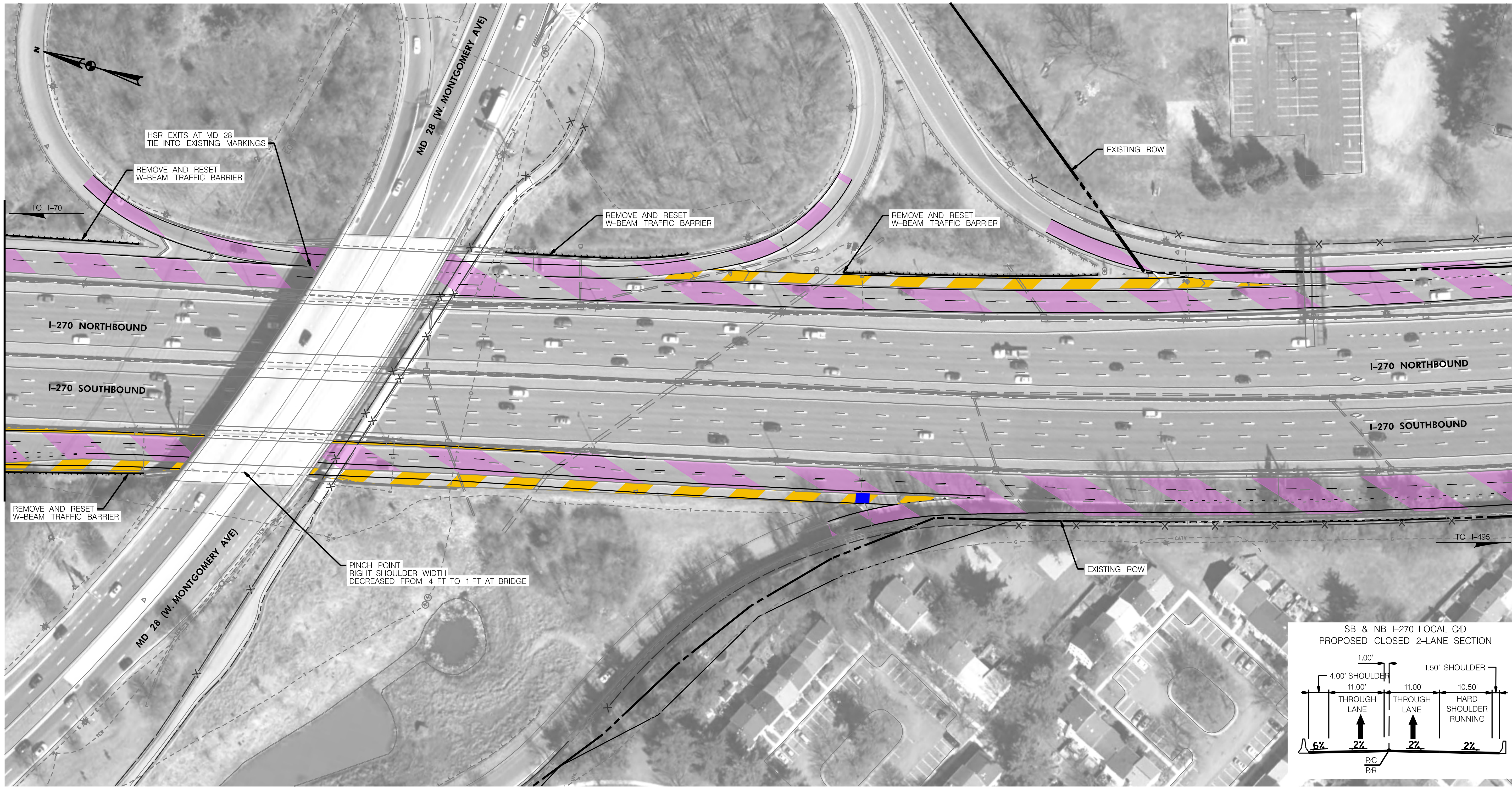
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - NORTH OF MD 28 (W. MONTGOMERY AVE)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:24 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P041_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - MD 28 (W. MONTGOMERY AVE)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:27 AM
FILE: J:\20151044 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P042_IS270.dgn

BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-10	SB I-270 MAINLINE LEFT SHOULDER	514,467.61	1,264,074.21	10.8	24.0

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

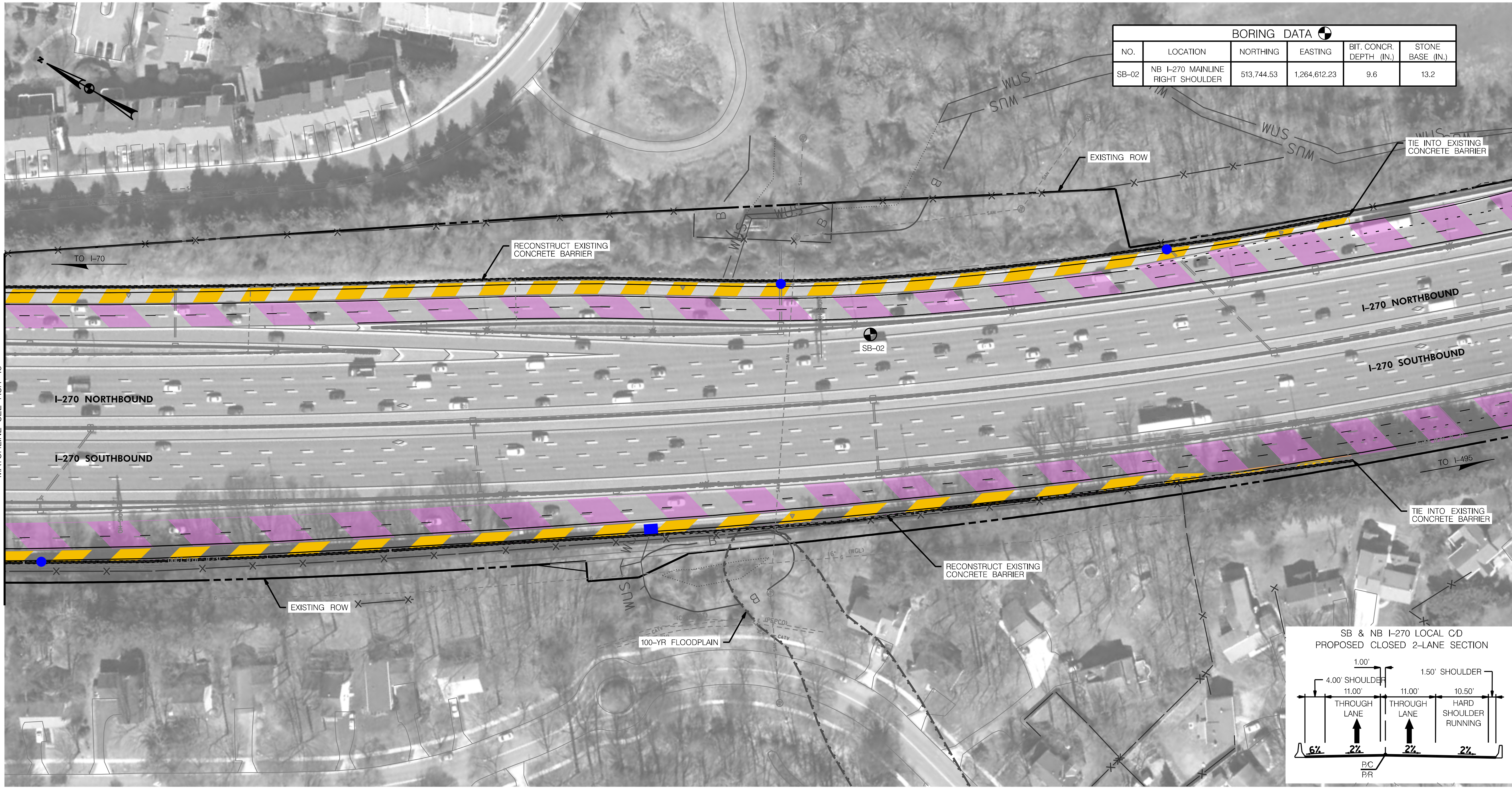
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – NORTH OF MD 189 (FALLS RD)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:29 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P043_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-02	NB I-270 MAINLINE RIGHT SHOULDER	513,744.53	1,264,612.23	9.6	13.2

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES OF GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

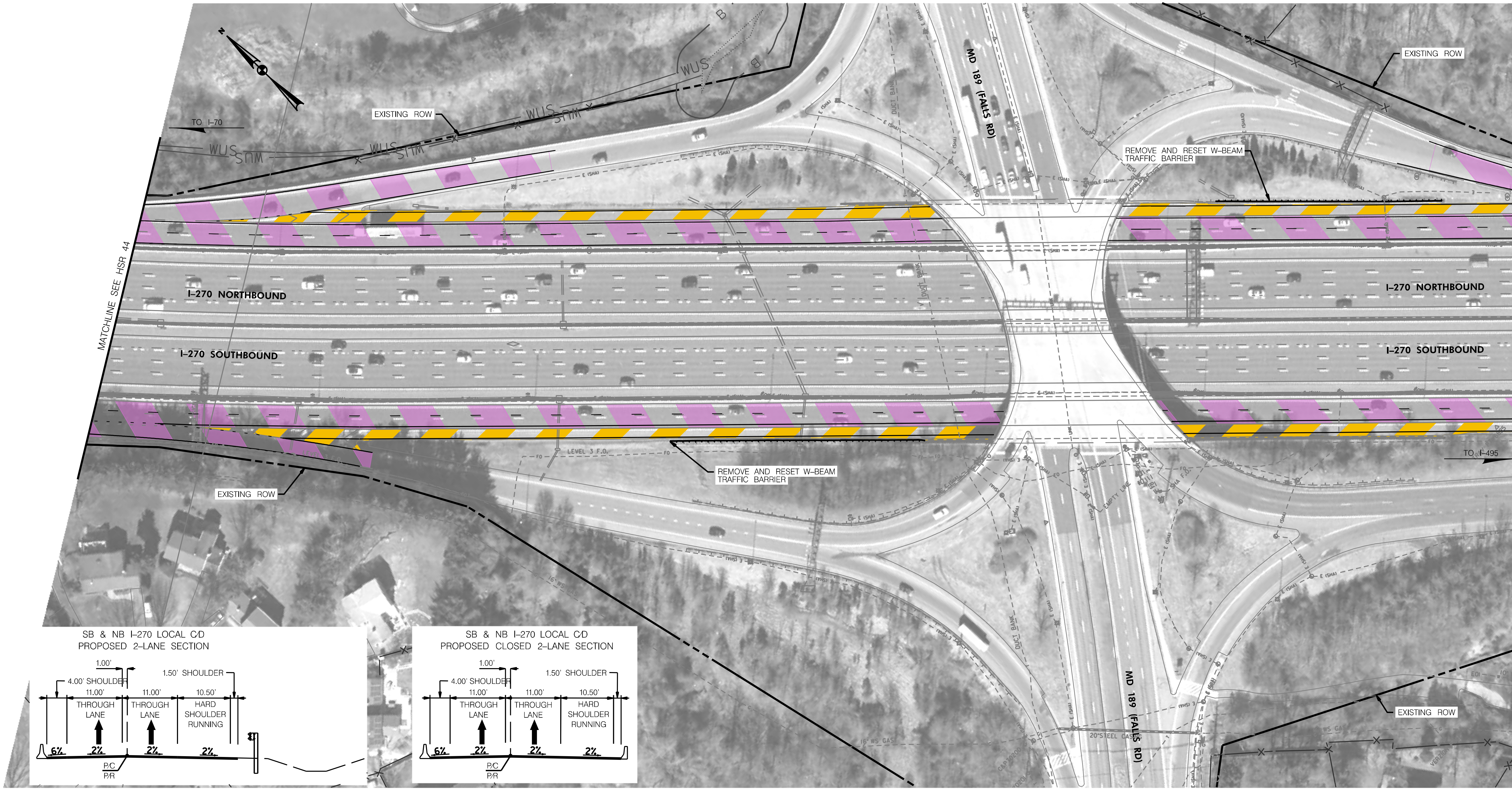
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - NORTH OF MD 189 (FALLS RD)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:33 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P044_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION

WEDGE/LEVEL & RESURFACING

MICROSURFACING

PAVEMENT MARKINGS

W-BEAM TRAFFIC BARRIER

CONCRETE BARRIER

EXISTING GRATE INLET (ADJUST OR REPLACE)

EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

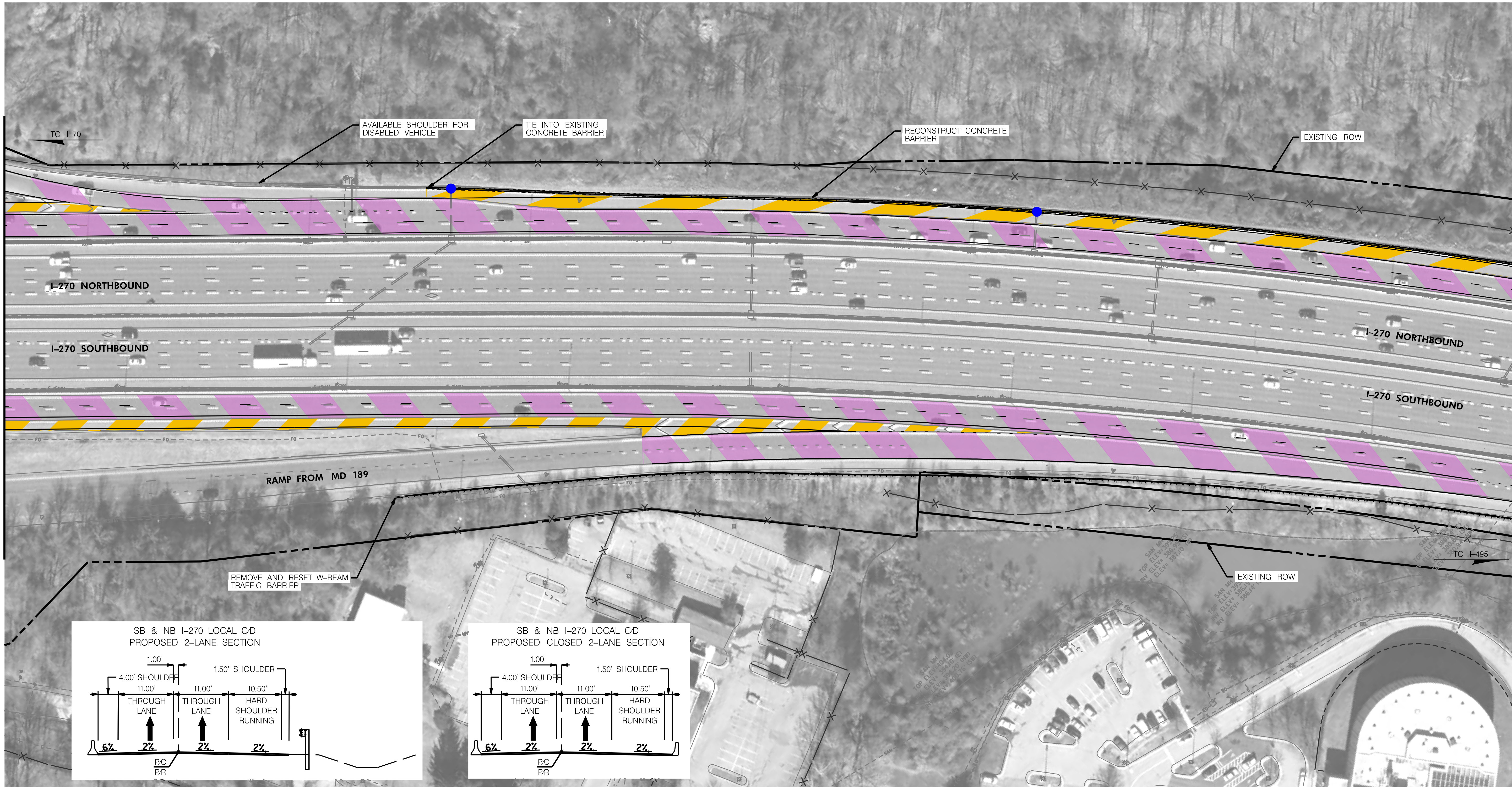
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – MD 189 (FALLS RD)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:33 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P045_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	
WEDGE/LEVEL & RESURFACING	
MICROSURFACING	
PAVEMENT MARKINGS	
W-BEAM TRAFFIC BARRIER	
CONCRETE BARRIER	
EXISTING GRATE INLET (ADJUST OR REPLACE)	
EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

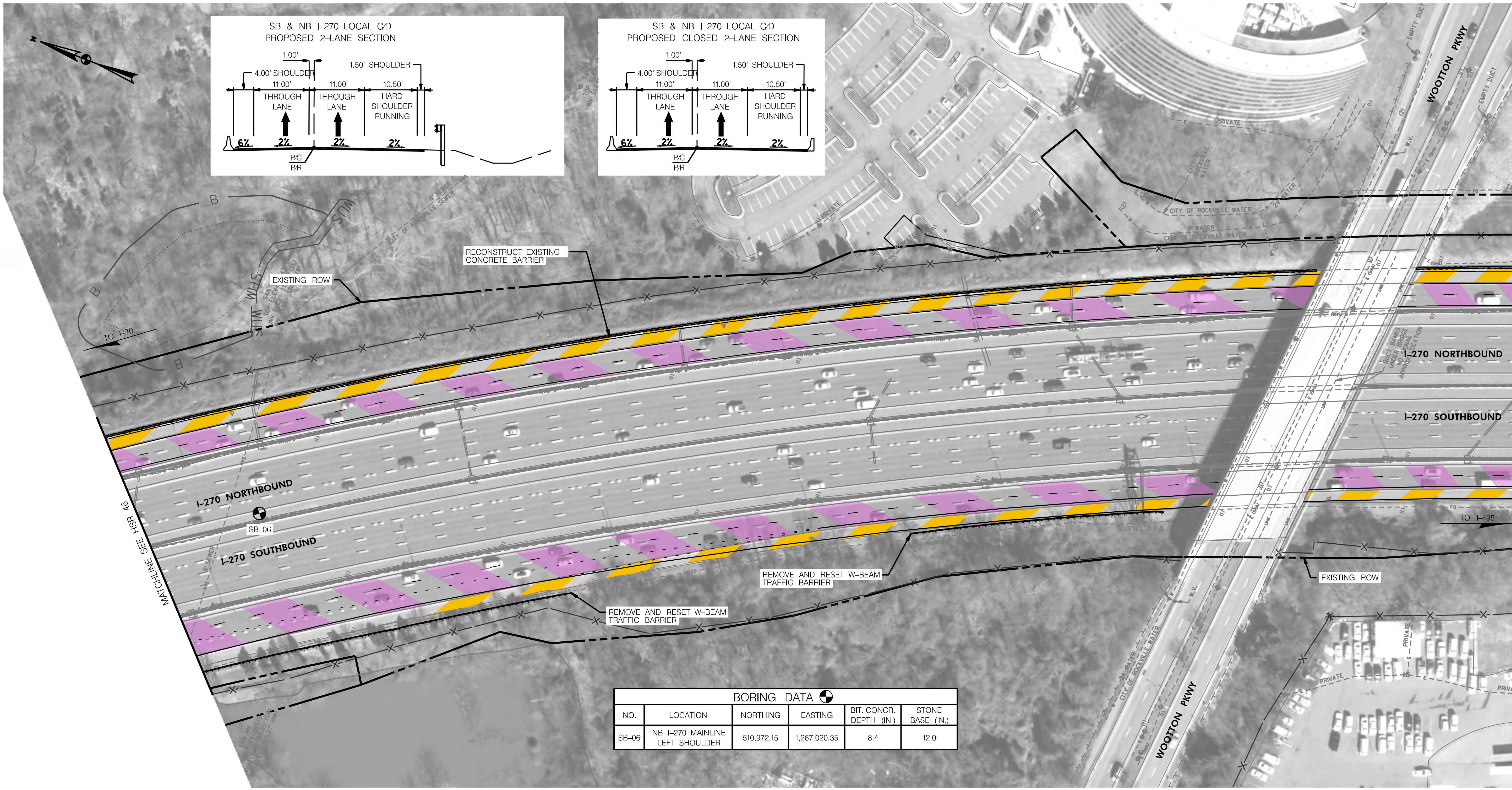
IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – SOUTH OF MD 189 (FALLS RD)

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:38 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P046_IS270.dgn



BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-06	NB I-270 MAINLINE LEFT SHOULDER	510,972.15	1,267,020.35	8.4	12.0

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION	PAVEMENT MARKINGS
WEDGE/LEVEL & RESURFACING	W-BEAM TRAFFIC BARRIER
MICROSURFACING	CONCRETE BARRIER
	EXISTING GRATE INLET (ADJUST OR REPLACE)
	EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – WOOTTON PKWY

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:38 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P047_IS270.dgn

BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-14	SB I-270 MAINLINE RIGHT SHOULDER	508,639.84	1,267,868.15	9.6	16.8
SB-24	SB I-270 LOCAL LEFT SHOULDER	508,971.29	1,267,772.36	9.6	15.6
SB-29	NB I-270 LOCAL LEFT SHOULDER	509,404.69	1,267,841.11	13.2	15.6

NOTES:
1. GPR DATA AVAILABLE - SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 - SOUTH OF WOOTTON PKWY

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:40 AM
FILE: J:\201510144 - I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P048_IS270.dgn

BORING DATA

NO.	LOCATION	NORTHING	EASTING	BIT. CONCR. DEPTH (IN.)	STONE BASE (IN.)
SB-01	NB I-270 MAINLINE RIGHT SHOULDER	507,837.90	1,268,183.17	9.6	14.4

NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES GAB.

CORMAN CONSTRUCTION
WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION
WEDGE/LEVEL & RESURFACING
MICROSURFACING
PAVEMENT MARKINGS
W-BEAM TRAFFIC BARRIER
CONCRETE BARRIER
EXISTING GRATE INLET (ADJUST OR REPLACE)
EXISTING MANHOLE COVER (ADJUST OR REPLACE)

UTILITY CONFLICTS
- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

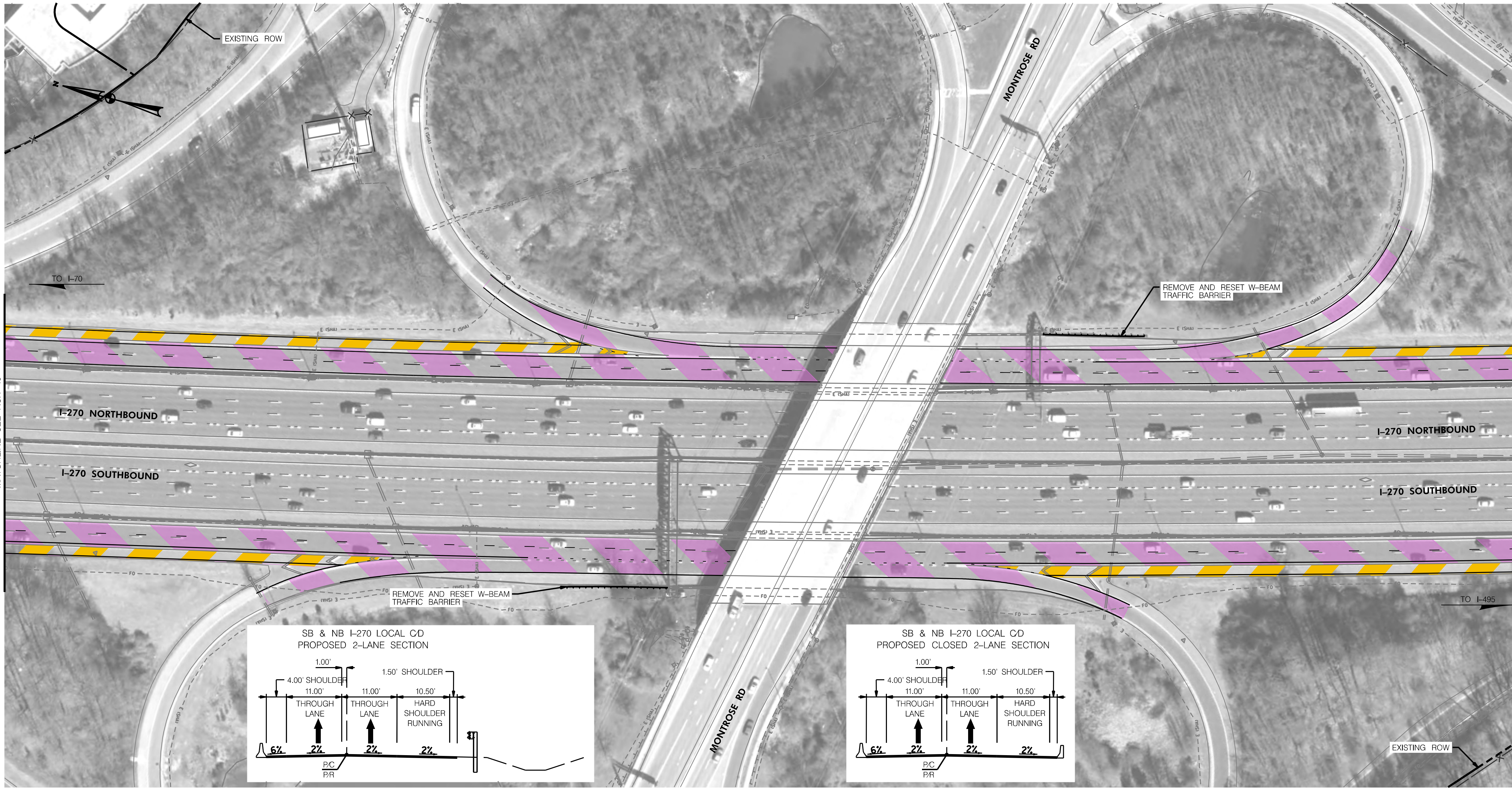
HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – NORTH OF MONTROSE RD

DATE: JANUARY 19, 2017

BY: hendersonst –

PLOTTED: Tuesday, January 17, 2017 AT 09:42 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P049_IS270.dgn



NOTES:
1. GPR DATA AVAILABLE – SEE SHADING FOR LIMITS OF FULL DEPTH RESURFACING.
2. RECORDS OF THE C/D LANE RIGHT SHOULDER PAVEMENT SECTION INDICATE AT LEAST 5.0 INCHES OF HMA/BITUMINOUS CONCRETE & 9 INCHES GAB.

CORMAN CONSTRUCTION

WSP | PARSONS BRINCKERHOFF

LEGEND

FULL DEPTH RECONSTRUCTION		PAVEMENT MARKINGS	
WEDGE/LEVEL & RESURFACING		W-BEAM TRAFFIC BARRIER	
MICROSURFACING		CONCRETE BARRIER	
		EXISTING GRATE INLET (ADJUST OR REPLACE)	
		EXISTING MANHOLE COVER (ADJUST OR REPLACE)	

UTILITY CONFLICTS

- NONE ANTICIPATED
- POSSIBLE
- PROBABLE

DRAFT PLANS

50' 0 50' 100'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

REVISIONS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
INNOVATIVE CONTRACTING DIVISION

IS 270 INNOVATIVE CONGESTION MANAGEMENT

HARD SHOULDER RUNNING

SEGMENT 4
IS 270 – MONTROSE RD

DATE: JANUARY 19, 2017

PLOTTED: Tuesday, January 17, 2017 AT 09:50 AM
FILE: J:\201510144 – I-270 ATM\Tech Proposal\Concepts\Hard Shoulder Running\Plan Sheets\pHD-P050_IS270.dgn