



OFFICE OF STRUCTURES
STRUCTURAL DETAIL MANUAL

Chapter 01

FOUNDATIONS
(FND)

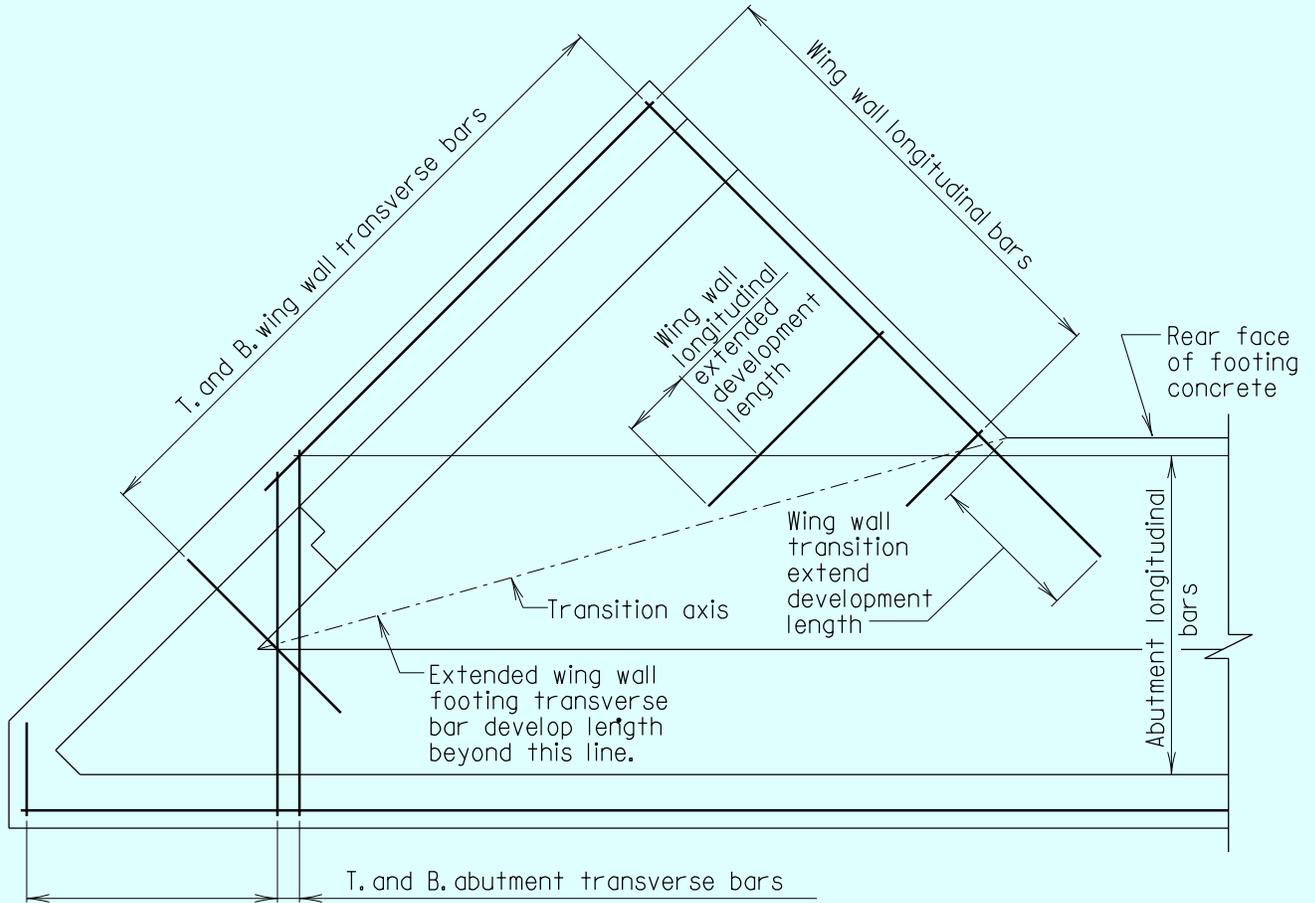


OFFICE OF STRUCTURES
STRUCTURAL DETAIL MANUAL

Chapter 01 - Foundations

SECTION 01

**GENERAL
(FND-GN)**



ACUTE CORNER

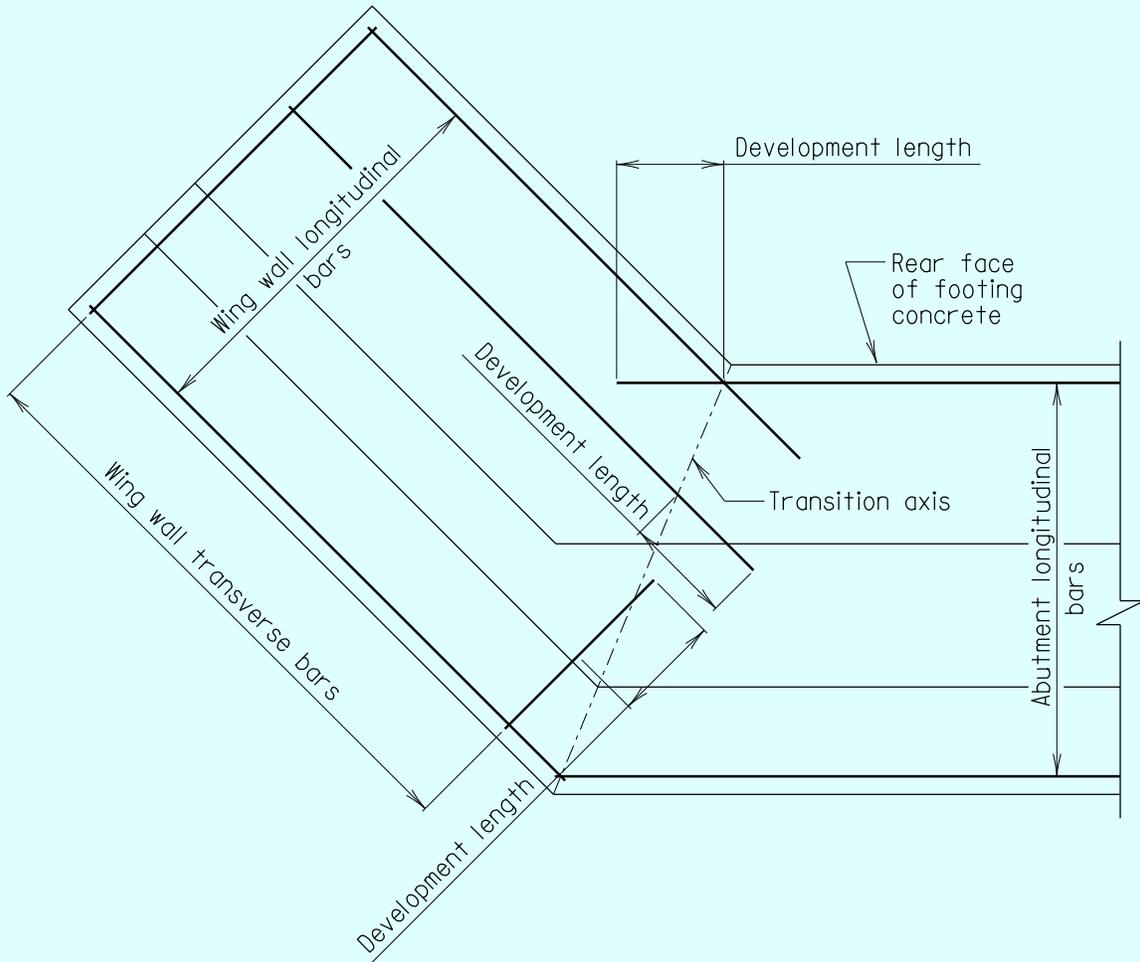
Scale: $\frac{3}{8}'' = 1'-0''$

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APPROVAL
<i>L.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 11/17/97
VERSION
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
SKEWED ABUTMENT AND WINGWALL FOOTING INTERSECTION
DETAIL NO. FND-GN-101
SHEET 1 OF 2

FOUNDATION - GENERAL



OBTUSE CORNER

Scale: $\frac{3}{8}'' = 1'-0''$

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<i>L.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 11/17/97
VERSION
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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
SKEWED ABUTMENT AND WING WALL FOOTING INTERSECTION
DETAIL NO. FND-GN-101
SHEET 2 OF 2

FOUNDATION - GENERAL

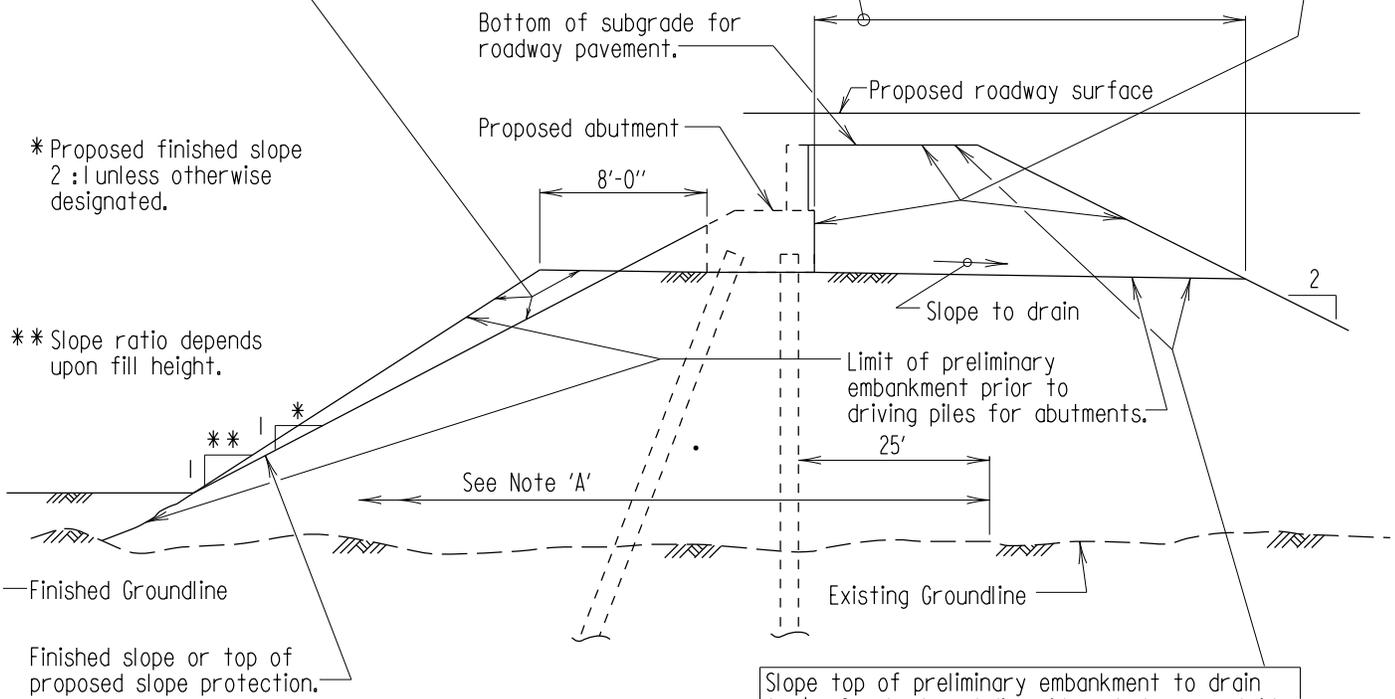
Chapter 01 - Foundations

SECTION 02

PILE FOUNDATION (FND-PF)

Limits of temporary fill during compaction of preliminary embankment. Temporary fill within these limits to be removed to finished slope line and used in completing preliminary embankment after abutment is completed. Removal of this overburden and placing of same behind abutments will be measured and paid for as Class 2 Excavation.

Limits of completed preliminary embankment



* Proposed finished slope 2:1 unless otherwise designated.

** Slope ratio depends upon fill height.

See Note 'A'

Slope top of preliminary embankment to drain to ϕ of embankment (i.e. midway between outside shoulders) and from abutment to rear of fill along ϕ , to carry drainage down rear embankment slope to sediment trap or other erosion control device. Temporarily seed and mulch front and back slopes to original groundline. Permanent seed and mulch on side slopes. Install 4'-0" wide soil stabilization matting in top swale to original groundline.

ELEVATION

Scale: None

Note A:
No boulders, rocks, or stumps in this area of fill and all stumps, surface boulders and rocks to be removed from existing ground within these limits.

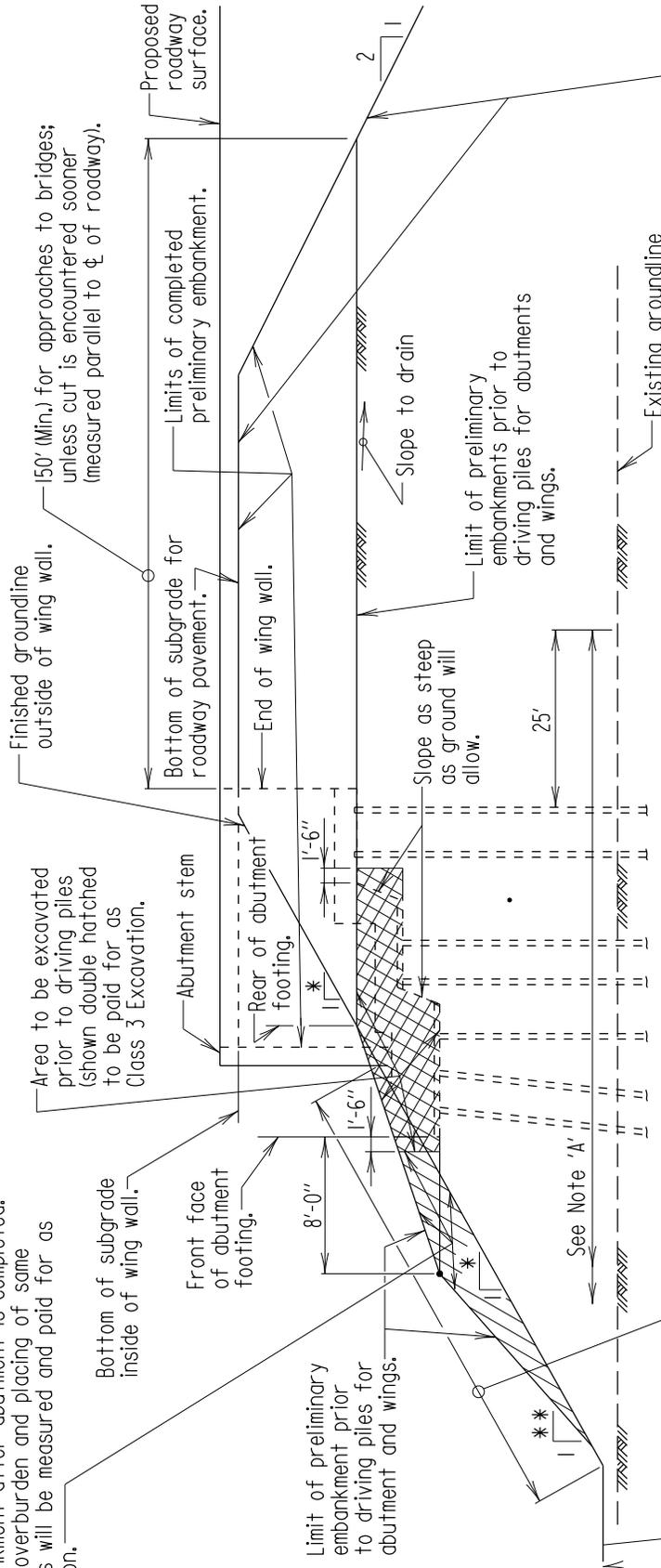
APPROVAL
<i>E.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 7/24/2001
VERSION
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
PRELIMINARY EMBANKMENT FOR PEDESTAL TYPE BRIDGE ABUTMENTS ON PILES	
DETAIL NO. FND-PF-101	SHEET <u>1</u> OF <u>1</u>

FOUNDATION - PILES

Limits of temporary fill during compaction of preliminary embankment. Temporary fill within these limits to be removed to finished slope line and used in completing preliminary embankment after abutment is completed. Removal of this overburden and placing of same behind abutments will be measured and paid for as Class 2 Excavation.

Area to be excavated prior to driving piles (shown double hatched) to be paid for as Class 3 Excavation.



Slope top of preliminary embankment to drain to ϕ of embankment (i.e. midway between outside shoulders) and from abutment to rear of fill along ϕ , to carry drainage down rear embankment slope to sediment trap or other erosion control device.
Temporarily seed and mulch front and back slopes to original groundline. Permanent seed and mulch on side slopes. Install 4'-0" wide soil stabilization matting in top swale to original groundline.

ELEVATION

Scale: None

* Proposed finished slope
2:1 unless otherwise designated.

** Slope ratio depends upon fill height.

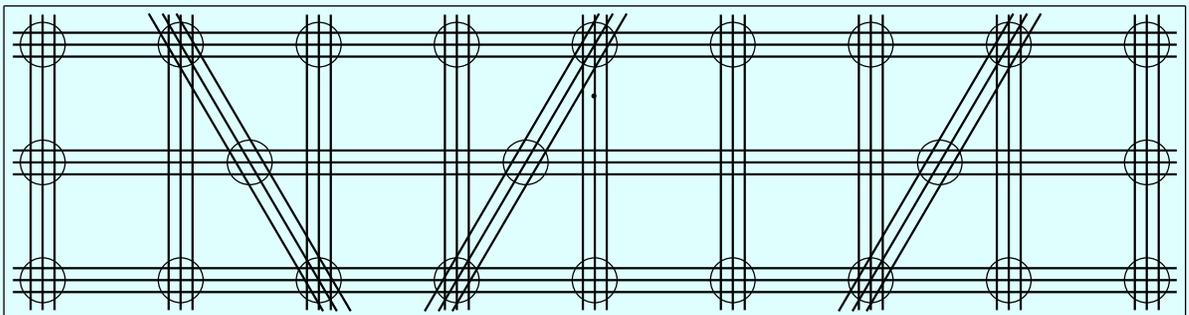
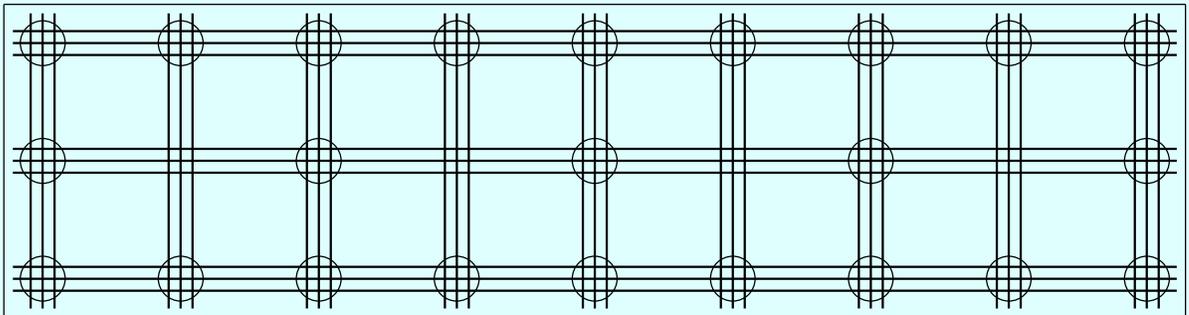
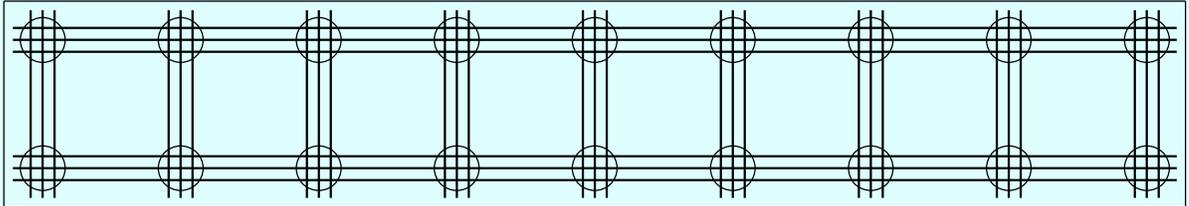
Note A:
No boulders, rocks, or stumps in this area of fill and all stumps, surface boulders and rocks to be removed from existing ground within these limits.

APPROVAL	
<i>E.S. Friedman</i>	DIRECTOR
OFFICE OF STRUCTURES	
DATE: 7/24/2001	
VERSION	
1.0	

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

**PRELIMINARY EMBANKMENT FOR SEMI-CANTILEVER TYPE
ABUTMENTS ON PILES WITH STEPPED WING WALL FOOTERS**

DETAIL NO. FND-PF-102 SHEET 1 OF 1



TYPICAL PIER FOOTING PLANS

Scale: $\frac{3}{16}''=1'-0''$

Notes:

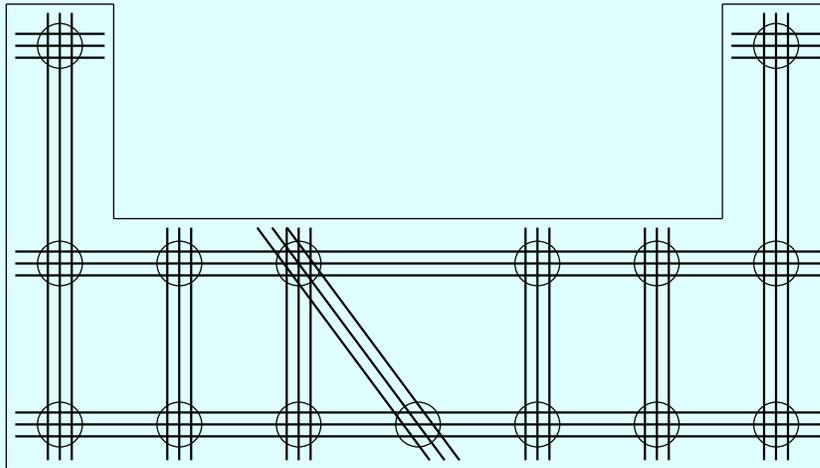
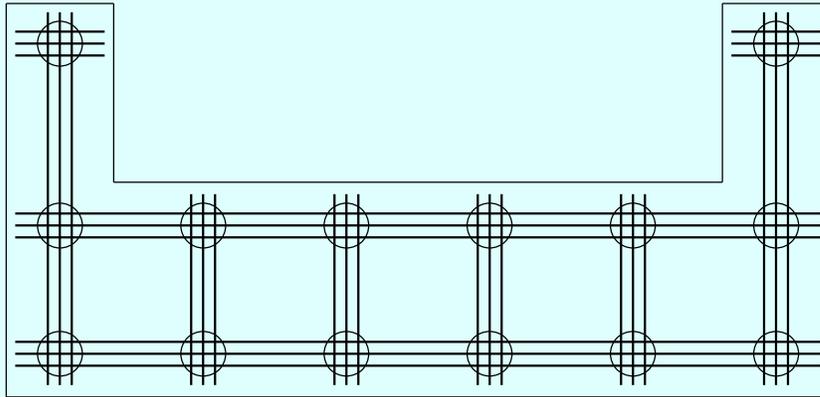
1. All rebars shall be 3-#6 @ 4" c/c centered over piles as shown.
2. Lower mat of bars shall be 3" (vertical) above top of center line of pile.
3. All piles shall be crossed at least twice with no more than 3 crossings per pile.
4. The direction taken by bars shall wherever possible be, the shortest distance between piles.
5. In all cases the total pattern shall be shown on Contract Documents with Pile Layout Plan.
6. \bigcirc denotes all piling, cast-in-place, steel H piles, etc. When showing on Contract Documents H piles shall be shown with the normal "H" symbol.
7. In laying out pile plan, if possible, piles shall be positioned to minimize need for diagonal bars.
8. A note in area of rebar pattern shall appear on Contract Documents as follows "Shop plans shall show how rebars are to be tied as well as how they will be held in place above piling while pour is being made."

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<i>L.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 1/21/2001
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1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
REBAR MAT PATTERN OVER PILING
DETAIL NO. FND-PF-201
SHEET <u>1</u> OF <u>3</u>

FOUNDATION - PILES



TYPICAL ABUTMENT FOOTING PLANS

Scale: $\frac{3}{16}$ "=1'-0"

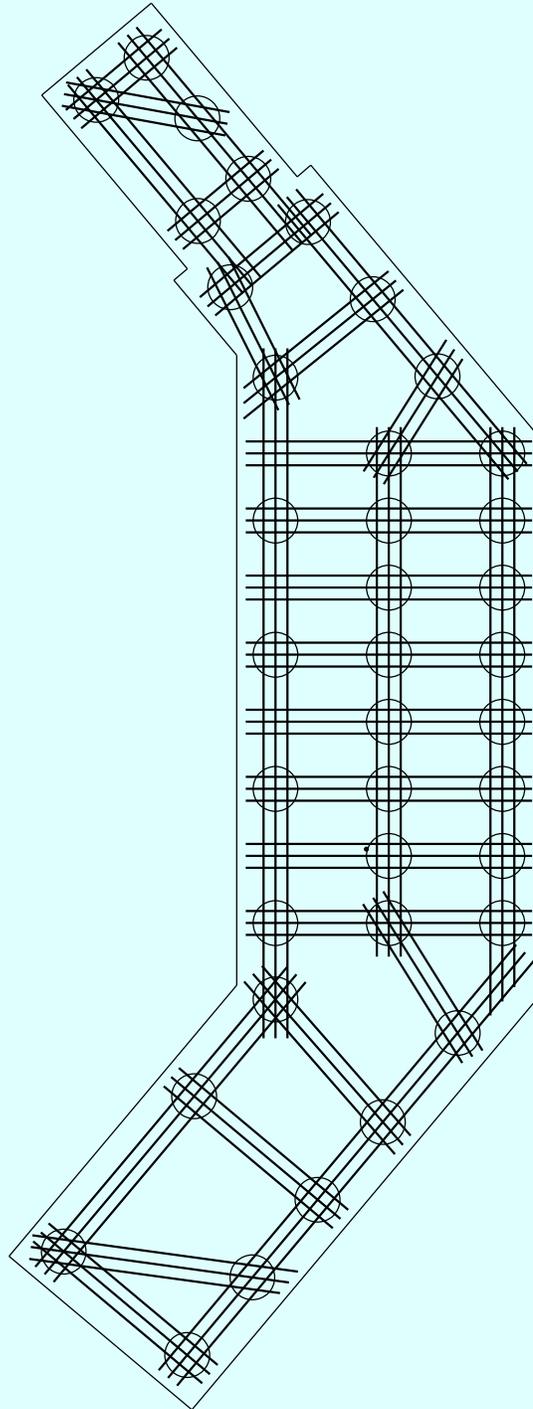
See notes on Sheet 1 of 3.

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<i>L.S. Freedom</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 1/22/2001
VERSION
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
REBAR MAT PATTERN OVER PILING
DETAIL NO. FND-PF-201
SHEET 2 OF 3

FOUNDATION - PILES



TYPICAL ABUTMENT FOOTING PLAN

Scale: $\frac{3}{16}'' = 1'-0''$

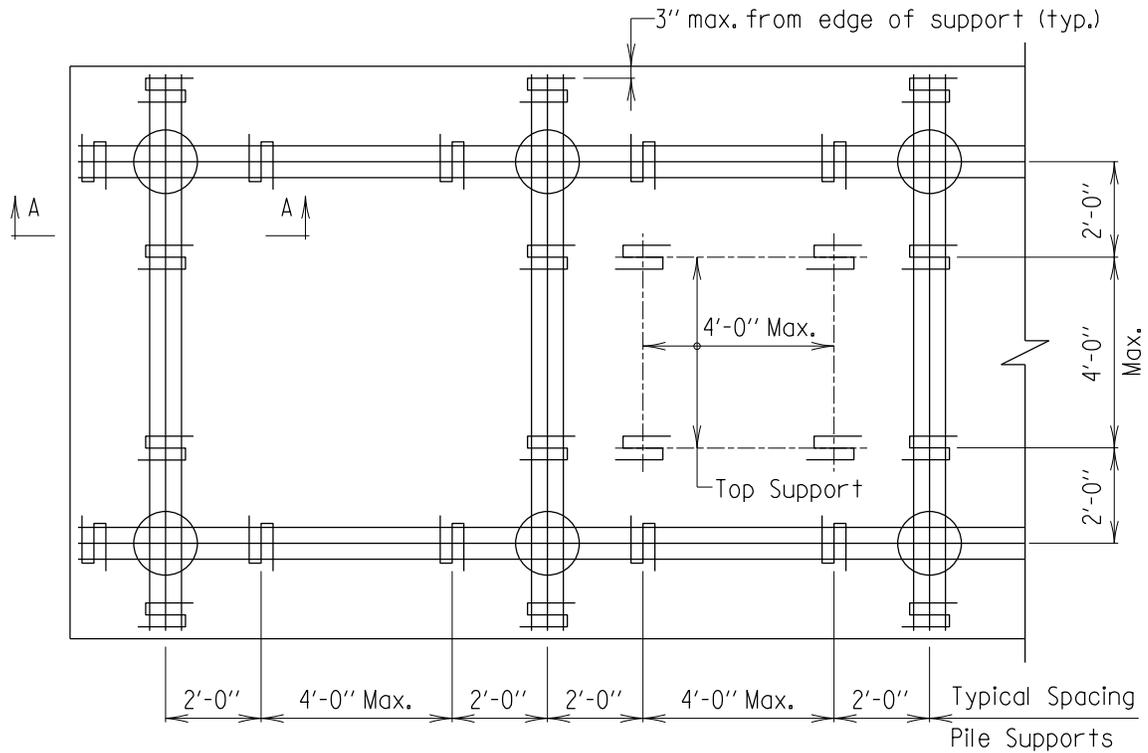
See notes on Sheet 1 of 3.

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<i>E.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 1/22/2001
VERSION
1.0

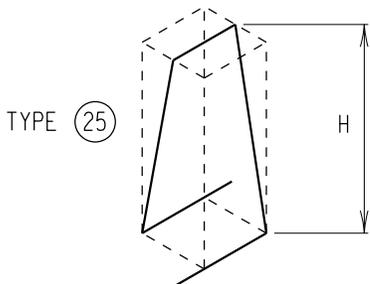
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
REBAR MAT PATTERN OVER PILING
DETAIL NO. FND-PF-201
SHEET <u>3</u> OF <u>3</u>

FOUNDATION - PILES



PLAN - PILES (SHOWING MAXIMUM SPACING OF BAR SUPPORTS)

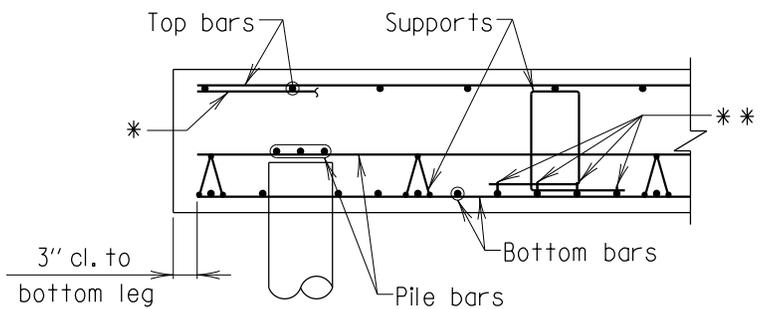
Scale: 1/4" = 1'-0"



ISOMETRIC VIEW

SEE TYPICAL BAR SHEET FOR DIMENSIONS

SIZE	HEIGHT
#4	0'-7" ≤ H ≤ 1'-6"
#5	1'-6" ≤ H ≤ 3'-6"



** Tie each base leg at two intersections to bottom footing bars for stability.

SECTION A-A

Scale: None

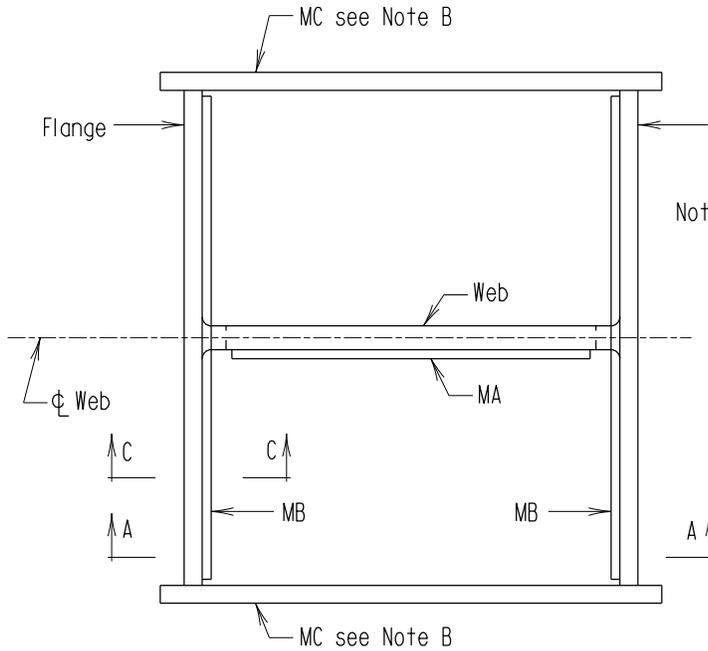
DIMENSIONS AND QUANTITIES TO BE SUPPLIED BY CONTRACTOR

* Top bar cannot be dropped to act as a support bar. If support bar is required, separate #5 bars are to be used.

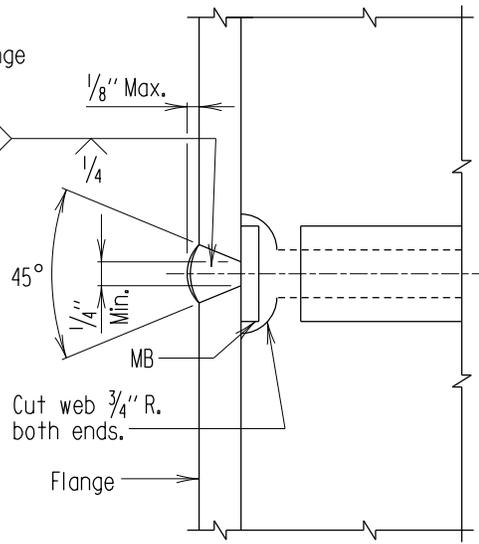
APPROVAL <i>L.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES DATE: 03/07/1991
VERSION 1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
REINFORCING BAR STANDARD FOOTING SUPPORT SYSTEM
DETAIL NO. FND-PF-202
SHEET <u>1</u> OF <u>1</u>

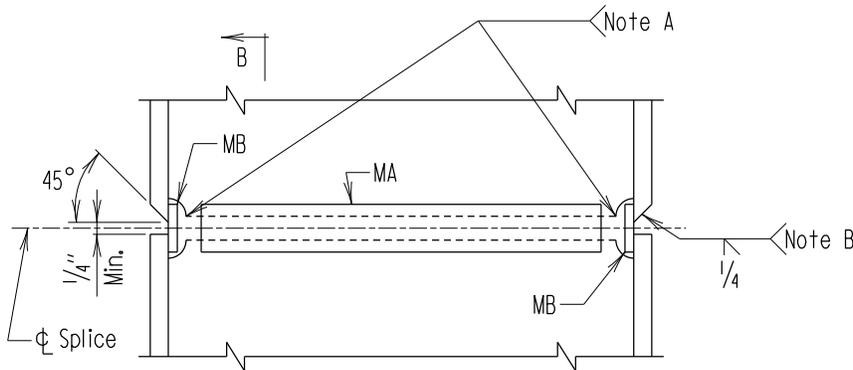
FOUNDATION - PILES



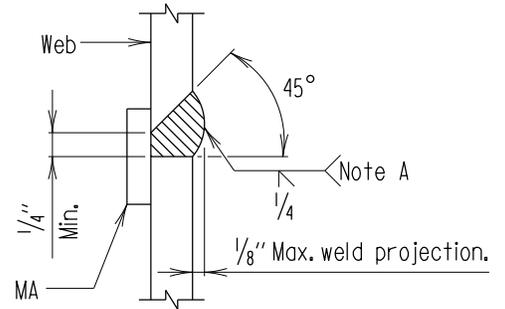
PLAN
Scale: None



SECTION C-C
ALTERNATE FLANGE WELD
Scale: 6" = 1'-0"



SECTION A-A
Scale: None



SECTION B-B
Scale: 6" = 1'-0"

All Material to ASTM A-36.

Material Required:

- | | | |
|--|--|---|
| 1 Bar MA 1" x 3/16" x 7 1/4" | 1 Bar MA 1" x 3/16" x 9 3/8" | 1 Bar MA 1" x 3/16" x 1'-0" |
| For HP 10 Piles 2 Bars MB 1" x 3/16" x 10" | For HP 12 Piles 2 Bars MB 1" x 3/16" x 1'-0" | For HP 14 Piles 2 Bars MB 1" x 3/16" x 1-2 1/2" |
| 2 Bars MC 3" x 3/8" x 11" | 2 Bars MC 3" x 3/8" x 1'-1" | 2 Bars MC 3" x 3/8" x 1'-3" |

Note A:
End of weld to be smooth and flush with web cut, 1/4" min. effective throat.

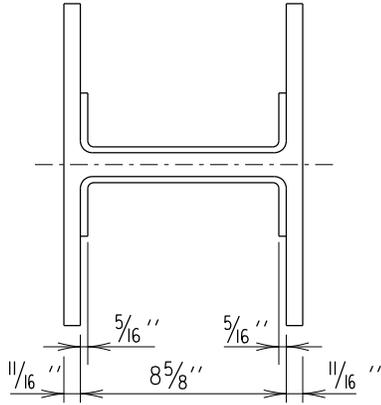
Note B:
Bar MC to be tack welded to flange at splice to back up end of flange weld, remove MC after weld is completed. End of weld must be smooth and flush with edge of flange. Grind weld smooth with edge of flange if pile is unsupported in weld area such as: in air, water, or soft mud, 1/4" min. effective throat.

Note C:
Let welds cool to air temperature before driving piles.

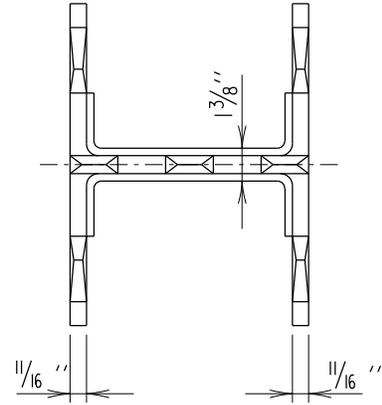
Note D:
No pile splicing to be allowed on any portion of pile that is to remain exposed or to be above finished groundline in completed structure.

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<i>E.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 01/22/2001
VERSION
1.0

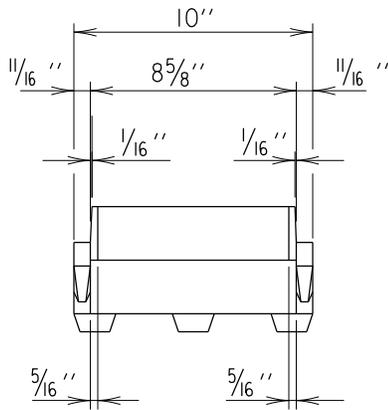
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
STEEL H PILE SPLICE DETAILS
DETAIL NO. FND-PF-301
SHEET <u>1</u> OF <u>1</u>



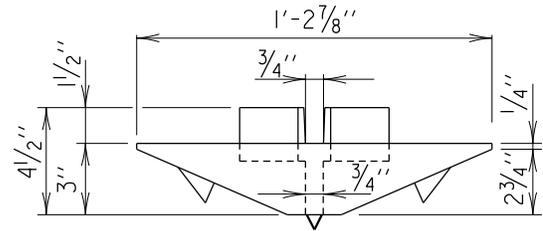
PLAN
Scale: 1 1/2" = 1'-0"



PLAN
Scale: 1 1/2" = 1'-0"



ELEVATION
Scale: 1 1/2" = 1'-0"



SIDE VIEW
Scale: 1 1/2" = 1'-0"

Size of Pile	*Size of 45 Bevel	Size of Groove Weld
10 x 42	1/4	5/16
10 x 57	1/4	5/16

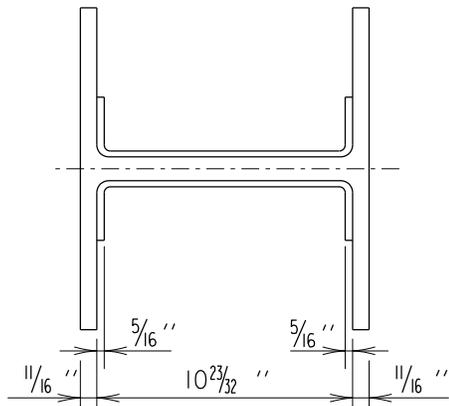
* See Note 2.

Notes:

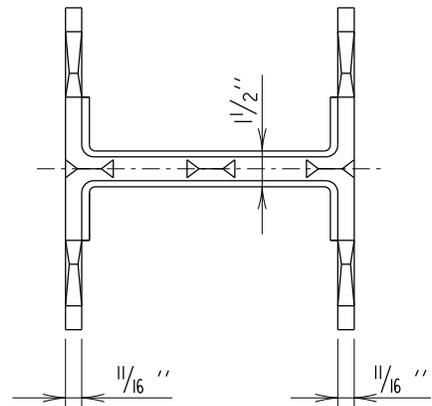
1. Material: Cast Steel A.S.T.M. A27 65/35. All fillets shall be 3/8".
2. Point to be welded to pile with a continuous single bevel groove weld along outside face of flange. Either the exterior face of the flange or the prefabricated pile tip shall contain a 45° bevel to allow for placement of the weld.
3. For each shipment of points a foundry certificate verifying material meets the Specifications is required.

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DATE: 04/03/2018
VERSION
1.01

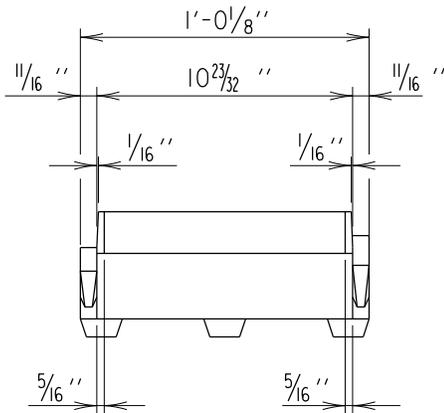
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
TOOTHED PILE POINT FOR 10" H PILE	
DETAIL NO. FND-PF-302	SHEET <u>1</u> OF <u>1</u>



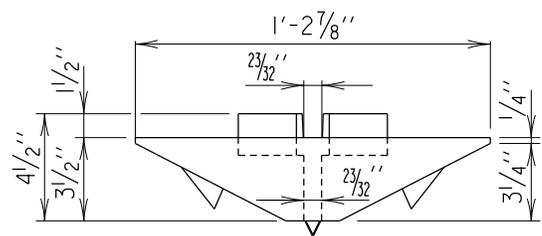
PLAN
Scale: $1\frac{1}{2}'' = 1'-0''$



PLAN
Scale: $1\frac{1}{2}'' = 1'-0''$



ELEVATION
Scale: $1\frac{1}{2}'' = 1'-0''$



SIDE VIEW
Scale: $1\frac{1}{2}'' = 1'-0''$

Notes:

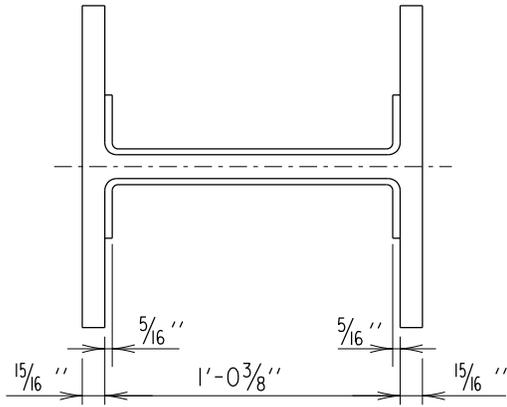
1. Material: Cast Steel A.S.T.M. A27 65/35. All fillets shall be $\frac{3}{8}''$.
2. Point to be welded to pile with a continuous single bevel groove weld along outside face of flange. Either the exterior face of the flange or the prefabricated pile tip shall contain a 45° bevel to allow for placement of the weld.
3. For each shipment of points a foundry certificate verifying material meets the Specifications is required.

Size of Pile	*Size of 45 Bevel	Size of Groove Weld
12 x 53	$\frac{1}{4}$	$\frac{5}{16}$
12 x 74	$\frac{5}{16}$	$\frac{5}{16}$

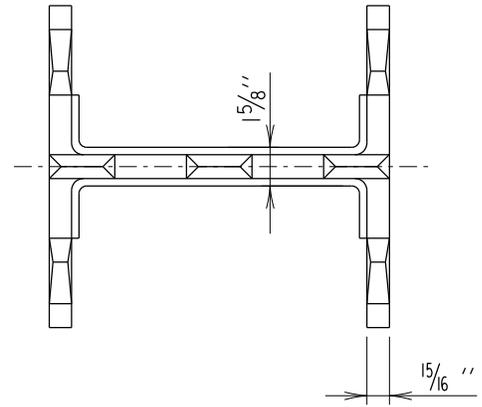
* See Note 2.

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<i>[Signature]</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 04/03/2018
VERSION
1.01

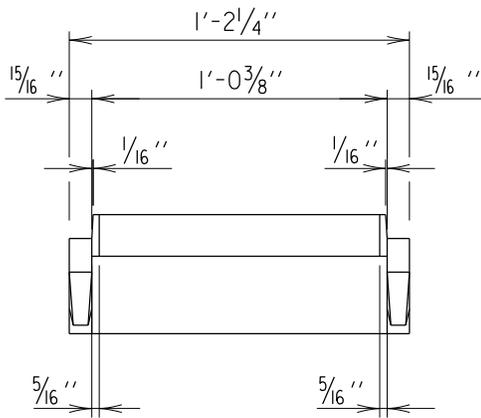
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
TOOTHED PILE POINT FOR 12" H PILE	
DETAIL NO. FND-PF-303	SHEET <u>1</u> OF <u>1</u>



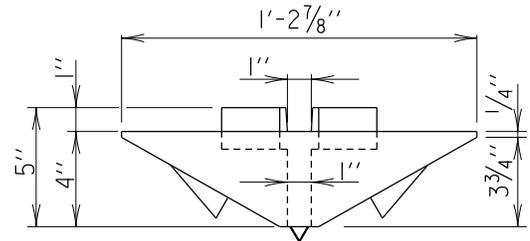
PLAN
Scale: $1\frac{1}{2}'' = 1'-0''$



PLAN
Scale: $1\frac{1}{2}'' = 1'-0''$



ELEVATION
Scale: $1\frac{1}{2}'' = 1'-0''$



SIDE VIEW
Scale: $1\frac{1}{2}'' = 1'-0''$

Size of Pile	*Size of 45 Bevel	Size of Groove Weld
14 x 73	1/4	5/16
14 x 89	5/16	5/16
14 x 102	3/8	3/8
14 x 117	3/8	7/16

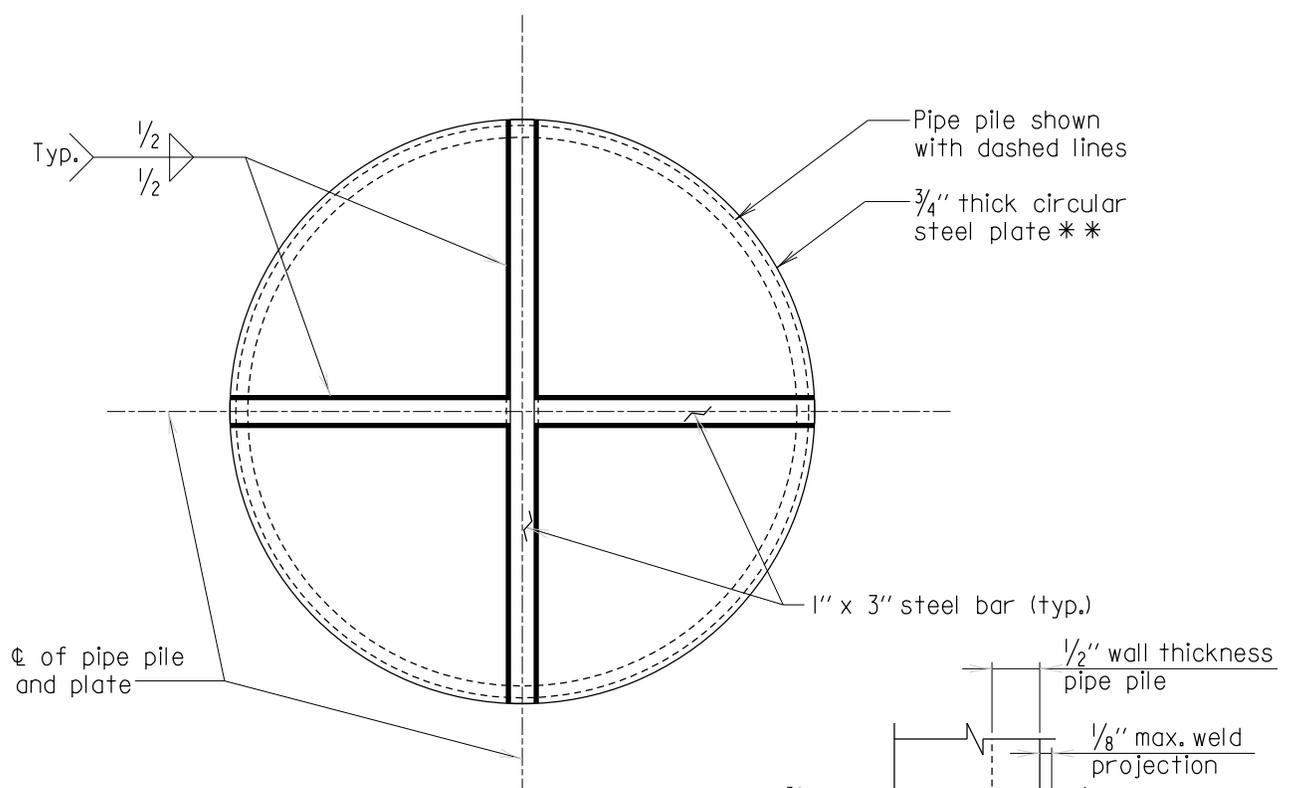
* See Note 2.

Notes:

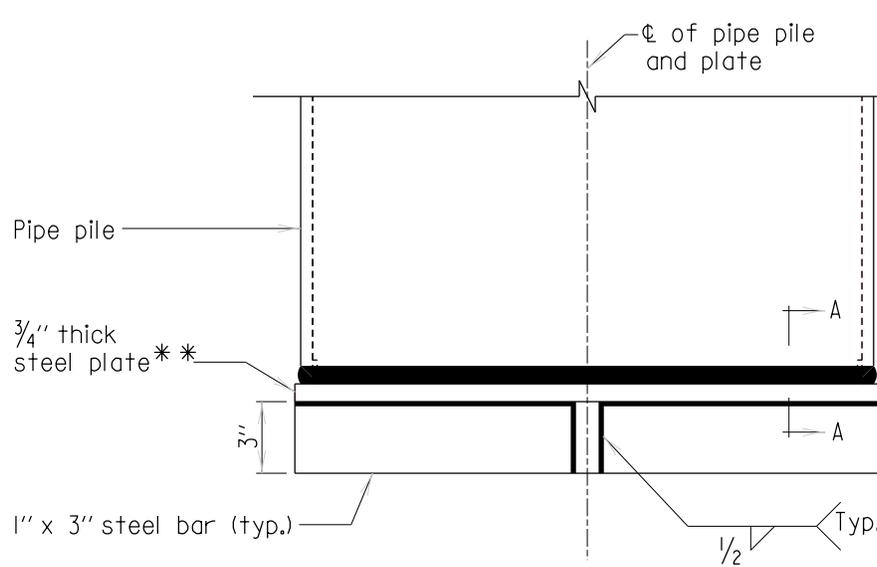
1. Material: Cast Steel A.S.T.M. A27 65/35. All fillets shall be $\frac{3}{8}''$.
2. Point to be welded to pile with a continuous single bevel groove weld along outside face of flange. Either the exterior face of the flange or the prefabricated pile tip shall contain a 45° bevel to allow for placement of the weld.
3. For each shipment of points a foundry certificate verifying material meets the Specifications is required.

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<i>[Signature]</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 04/03/2018
VERSION
1.01

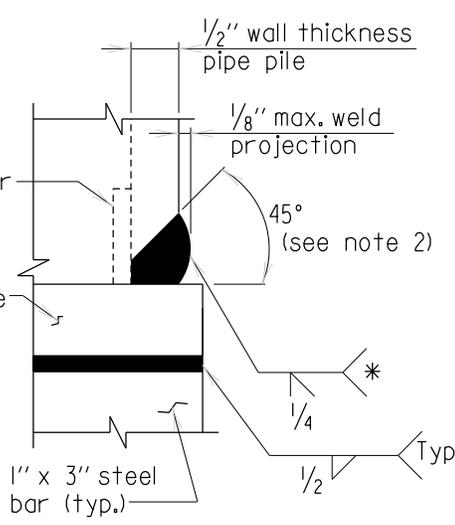
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
TOOTHED PILE POINT FOR 14" H PILE	
DETAIL NO. FND-PF-304	SHEET <u>1</u> OF <u>1</u>



PLAN (BOTTOM VIEW)
Scale: 1/2" = 1'-0"



ELEVATION
Scale: 1/2" = 1'-0"



SECTION A-A
Scale: 1/2" = 1'-0"

* End of weld to be smooth and flush with pipe pile wall cut, 1/4" min. effective throat.

Notes:

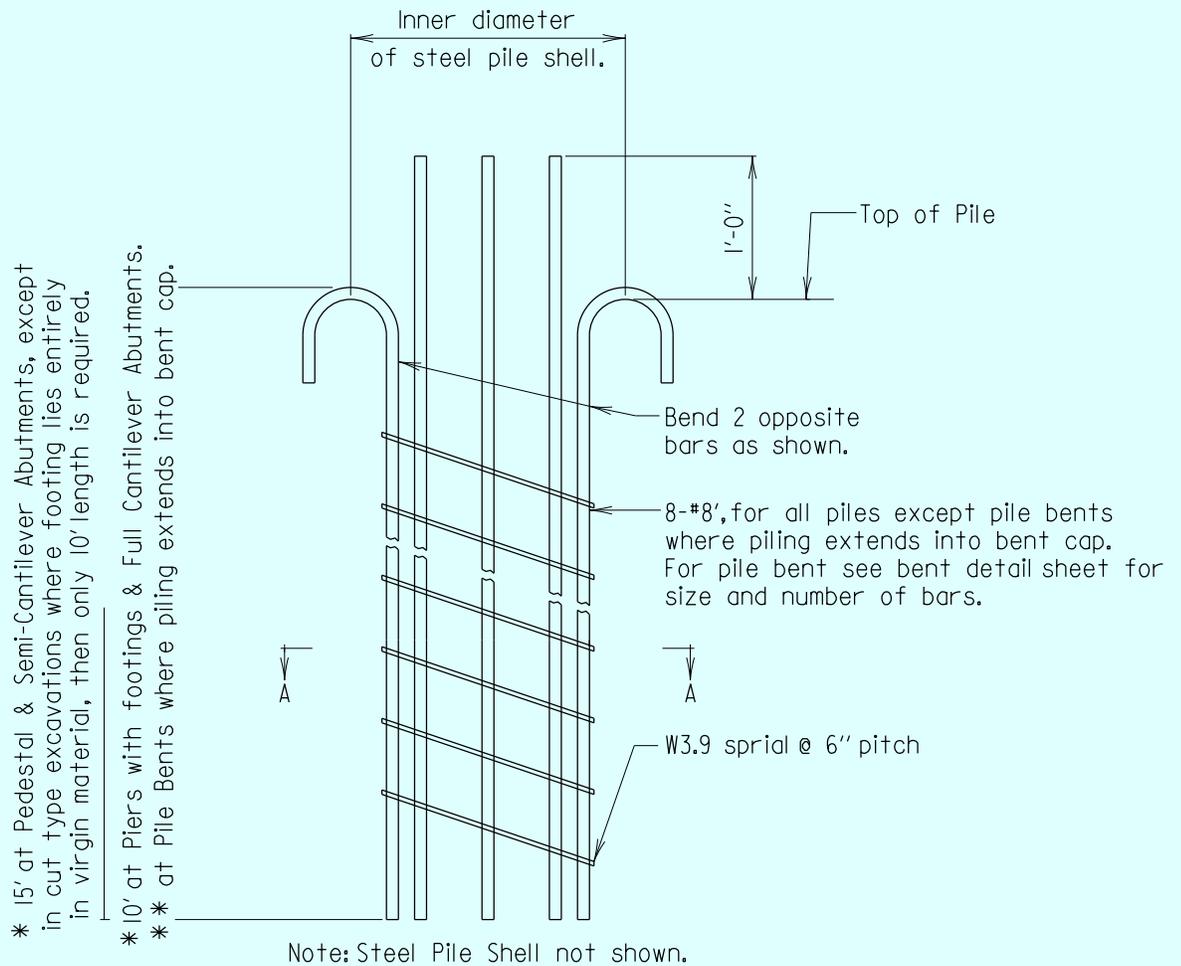
1. Plate to be welded to pile with a continuous single bevel groove weld along outside face of pile.
2. Either the exterior face of pile or the pile tip be beveled at 45°, to allow for placement of the weld.

** 3. Circular steel plate shall have a diameter that is 1/2" larger than outside diameter of steel pipe pile.

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<i>Ben C. ...</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 04/03/2018
VERSION
1.0

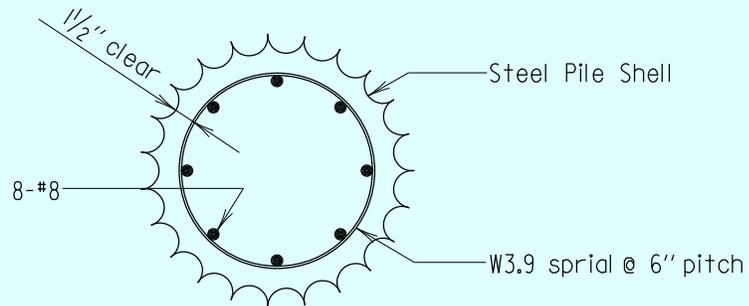
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
PILE POINT FOR PIPE PILES	
DETAIL NO. FND-PF-401	SHEET <u>1</u> OF <u>1</u>

FOUNDATION - PILES



ELEVATION

Scale:None



SECTION A-A

Scale:None

Note:

- 1.* Unless otherwise indicated on substructure contract drawing.
- 2.** Full height of pile above finished groundline plus 10' unless otherwise indicated on substructure contract drawings.
3. Unless otherwise indicated on other Contract Plans or in the Special Provisions the Steel Pile Shell shall be a minimum #5 gauge. This will apply to pile shells with or without deformations.
4. Cage required for all pile shells with or without deformations.
5. All materials and dimensions shown are minimums. Engineer shall design.

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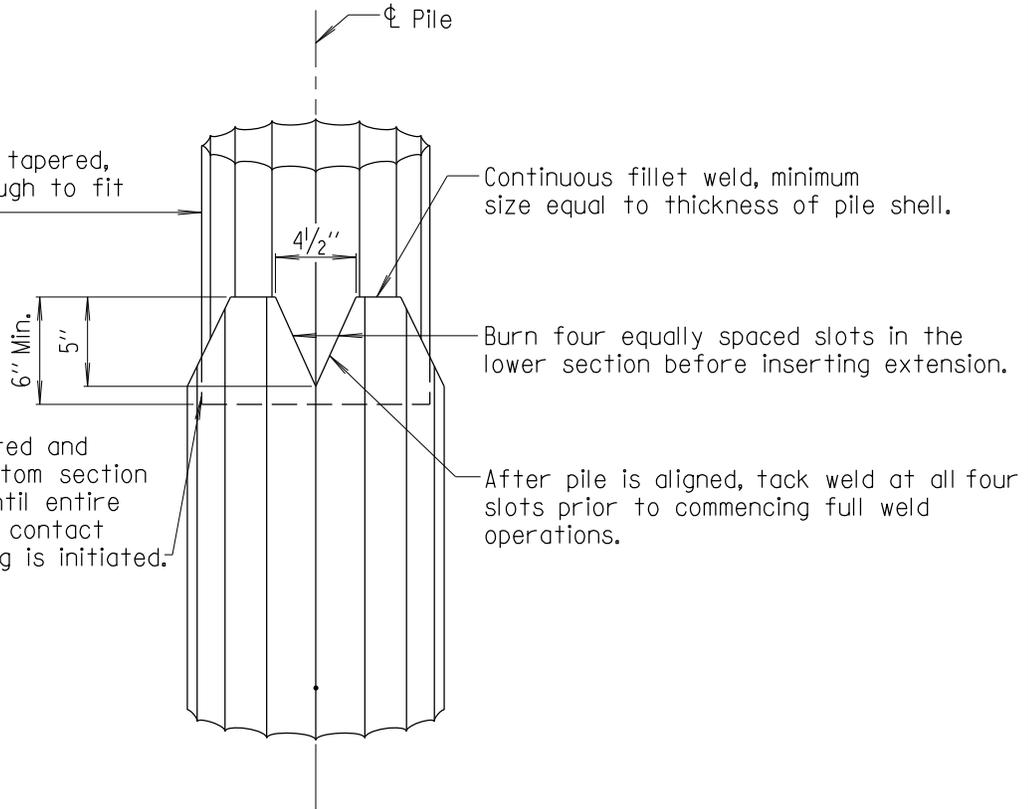
APPROVAL
<i>L.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 10/09/2007
VERSION
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
DETAILS FOR CAST-IN-PLACE CONCRETE PILES	
DETAIL NO. FND-PF-501	SHEET <u>1</u> OF <u>1</u>

FOUNDATION - PILES

If "male end" is not factory tapered, it shall be tapered just enough to fit into lower section.

Top extension shall be inserted and driven if necessary into bottom section (after "V" cutting is done) until entire area of weldment is in tight contact before alignment tack welding is initiated.



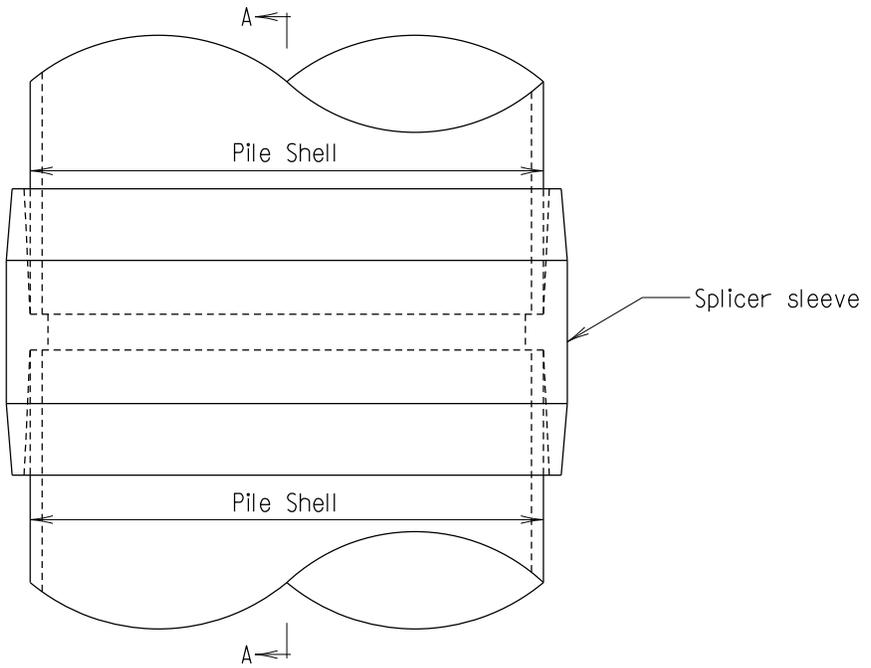
ELEVATION
Scale: None

Note:
No pile splicing to be allowed on any portion of pile that is to remain exposed in completed structure.

APPROVAL
<i>L.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 06/20/1975
VERSION
1.0

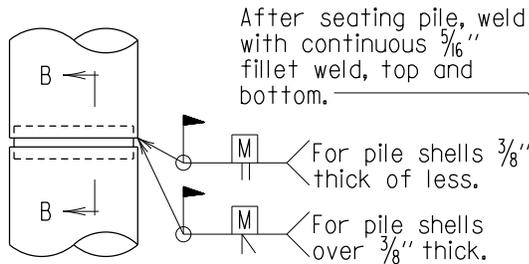
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
SPLICE FOR CAST-IN-PLACE CONCRETE PILE SHELL	
DETAIL NO. FND-PF-502	SHEET <u>1</u> OF <u>1</u>

FOUNDATION - PILES



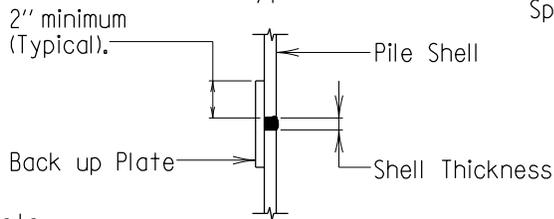
**ELEVATION OF SPLICE
(USING SPLICER SLEEVE)**

Scale: 3" = 1'-0"



**ELEVATION OF SPLICE
(USING ALL WELDED ALTERNATE)**

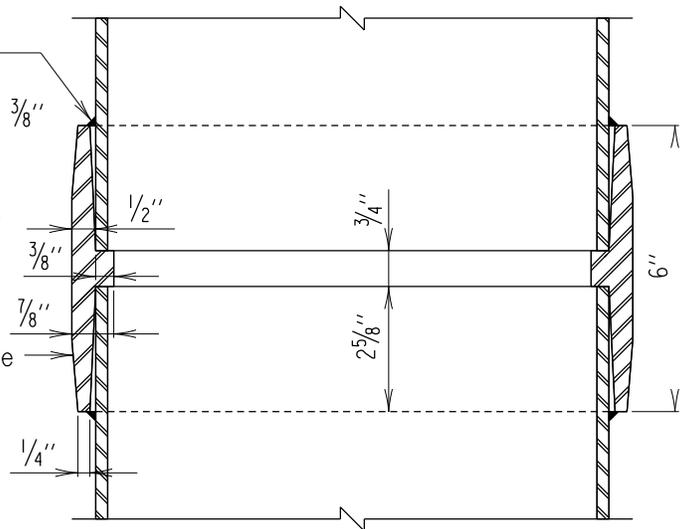
Scale: 3/4" = 1'-0"



Note:
Back-up plate to be cut from same pile size as is being spliced. Cut and bend to fit inside diameter of pile.

SECTION B-B

Scale: None



SECTION A-A

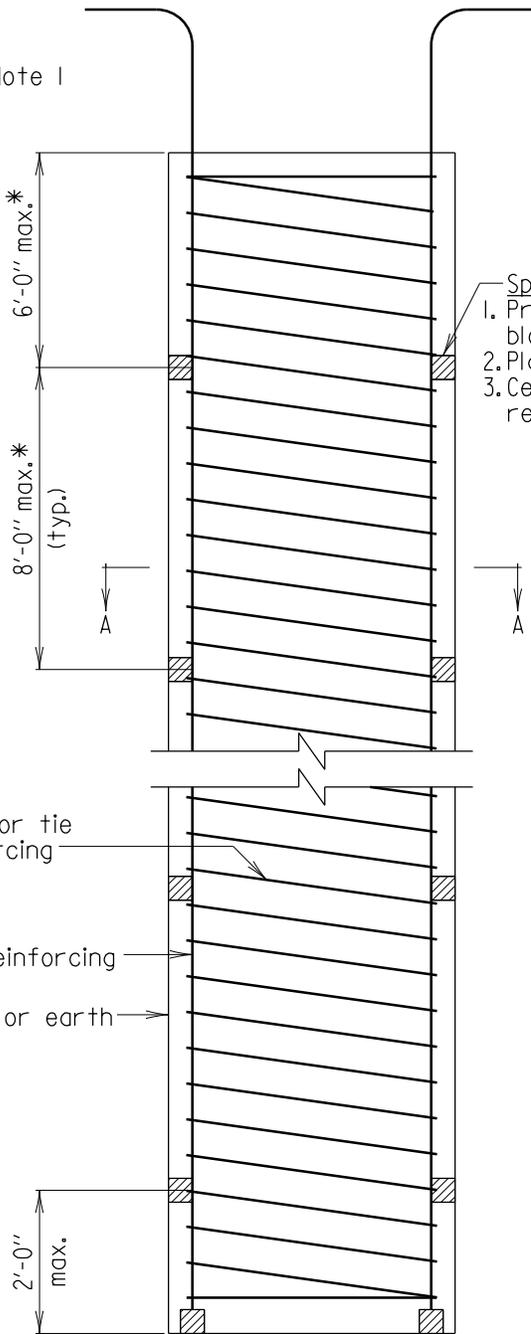
Scale: 3" = 1'-0"

- Notes:
1. No pile splicing to be allowed on any portion of pile that is to remain exposed in completed structure.
 2. Splicer sleeve material shall be steel conforming to ASTM A-36.
 3. Contractor has the option of using either the "Splicer Sleeve" or "All Welded" alternates.

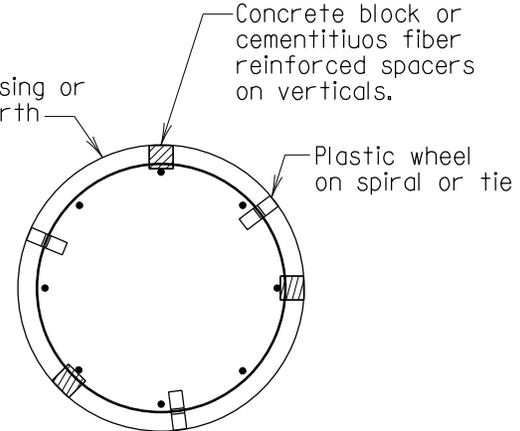
APPROVAL
<i>E.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 01/22/2001
VERSION
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
SPLICE FOR CAST-IN-PLACE CONCRETE PIPE PILE SHELL	
DETAIL NO. FND-PF-503	SHEET <u>1</u> OF <u>1</u>

* See Note 1



- Spacer types:
1. Precast concrete block
 2. Plastic wheel
 3. Cementitious fiber reinforced spacers.



SECTION A-A
Scale: $\frac{3}{8}'' = 1'-0''$

Spiral or tie reinforcing
Main reinforcing
Casing or earth

PILE OR CAISSON
Scale: $\frac{3}{8}'' = 1'-0''$

Notes:

1. The Contractor has the option of using any of the spacers shown for the reinforcement cage. The spacing of the spacers for proprietary items shall be as recommended by the manufacturer.
2. The pitch of spiral reinforcement must be considered for some wheel type spacers.
3. Concrete spacer blocks to be tied to main reinforcing with a double tie of #16 tie wire or equivalent.
4. For size and number of main reinforcing steel and size of spiral or tie reinforcing steel see other details elsewhere.
5. Use 3 spacers per horizontal plane for caissons less than 36" in diameter. Use 4 spacers per horizontal plane for caissons 36" in diameter and greater or as recommended by the manufacturer of the proprietary items.

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<i>L.S. Freedom</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 08/07/1998
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1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
CAISSON/PILE REBAR CAGE CLEARANCE SPACING DEVICES
DETAIL NO. FND-PF-504
SHEET <u> 1 </u> OF <u> 1 </u>

FOUNDATION - PILES

Chapter 01 - Foundations

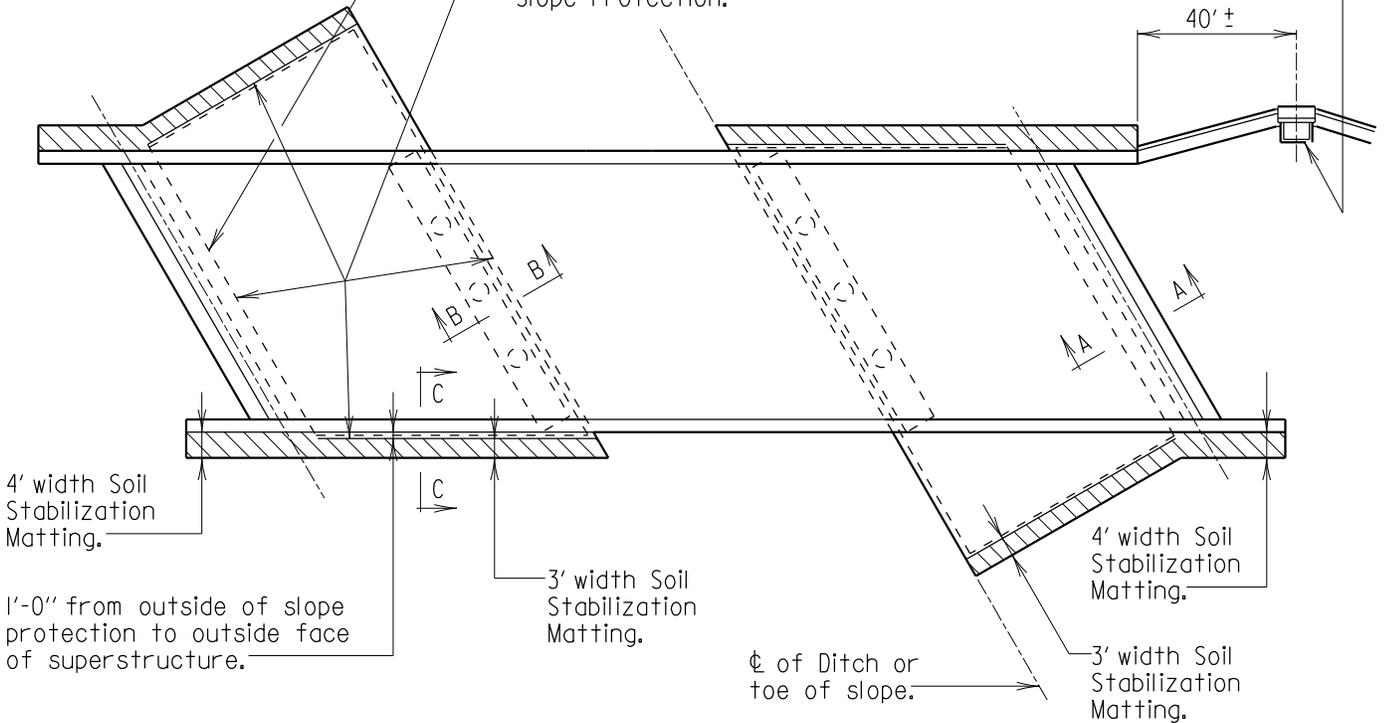
SECTION 03

SLOPE PROTECTION (FND-SP)

Front face of Abutment.

Limits of measurement for basis of Payment for Slope Protection.

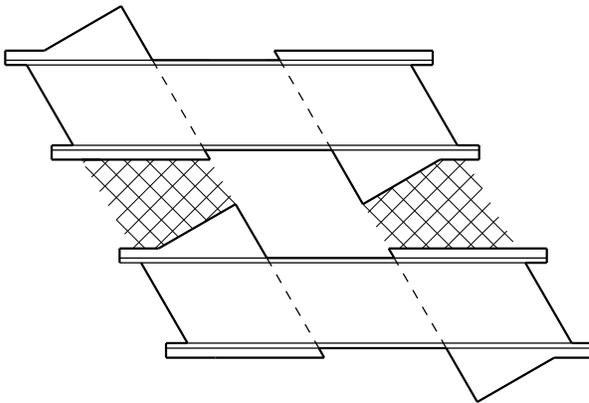
Place inlet on all downhill end(s) where crown is forcing water to that location.



Soil Stabilization Matting shown hatched.

PLAN

Scale: None



SKETCH-PLAN

Note:
On dual bridges where perpendicular distance between bridge faces is less than 30' or on skewed dual bridges if where the unprotected area for both ends of the bridges (hatched areas  in sketch-Plan) were added is less than 200 sq., then slope protection is to be continuous thru median area.

Notes:

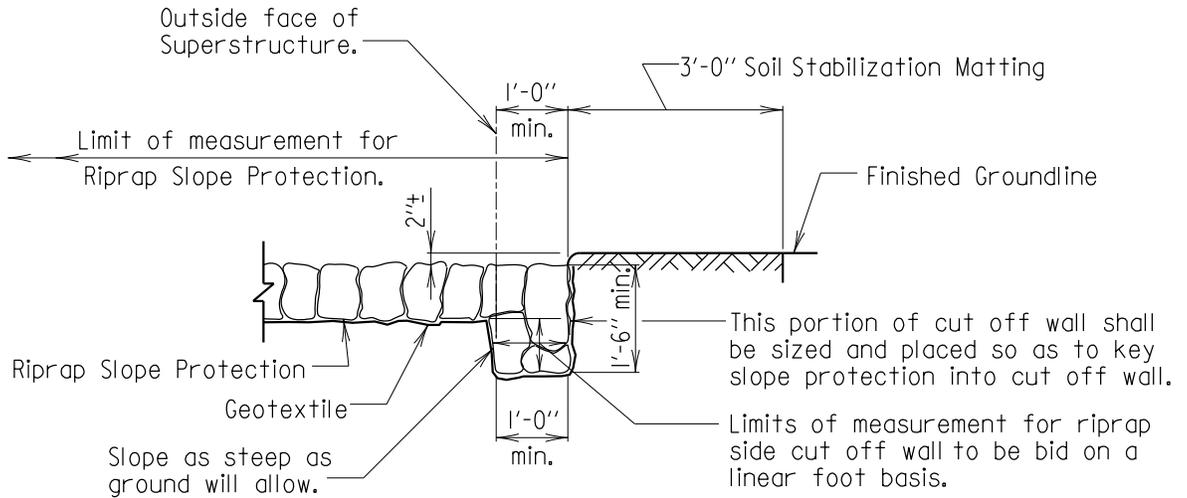
1. For Sections A-A, B-B, and C-C see sheets 2 thru 6 of 6.
2. If limits for slope protection are shown on Contract Drawings, then those limits take precedent over what is shown on this sheet.

Slanted lettering indicate notes "For Office Use Only".

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<i>E.S. Friedman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 09/16/2011
VERSION
1.0

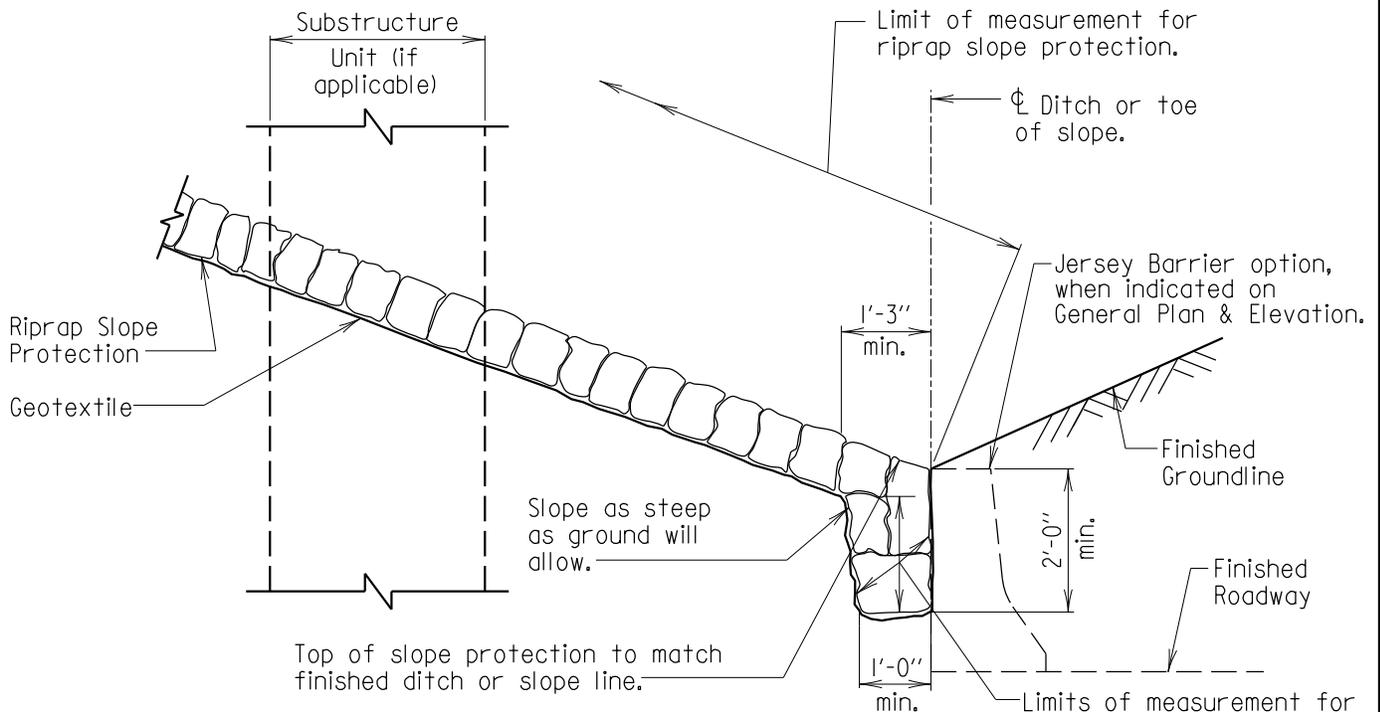
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
SLOPE PROTECTION FOR BRIDGES CARRYING ROAD OVER ROAD OR RAILROADS
DETAIL NO. FND-SP-101
SHEET <u>1</u> OF <u>6</u>

FOUNDATION - SLOPE



SECTION C-C THRU SIDE OF CUTOFF WALL

Scale: $\frac{3}{8}''=1'-0''$



SECTION B-B THRU BOTTOM CUTOFF WALL

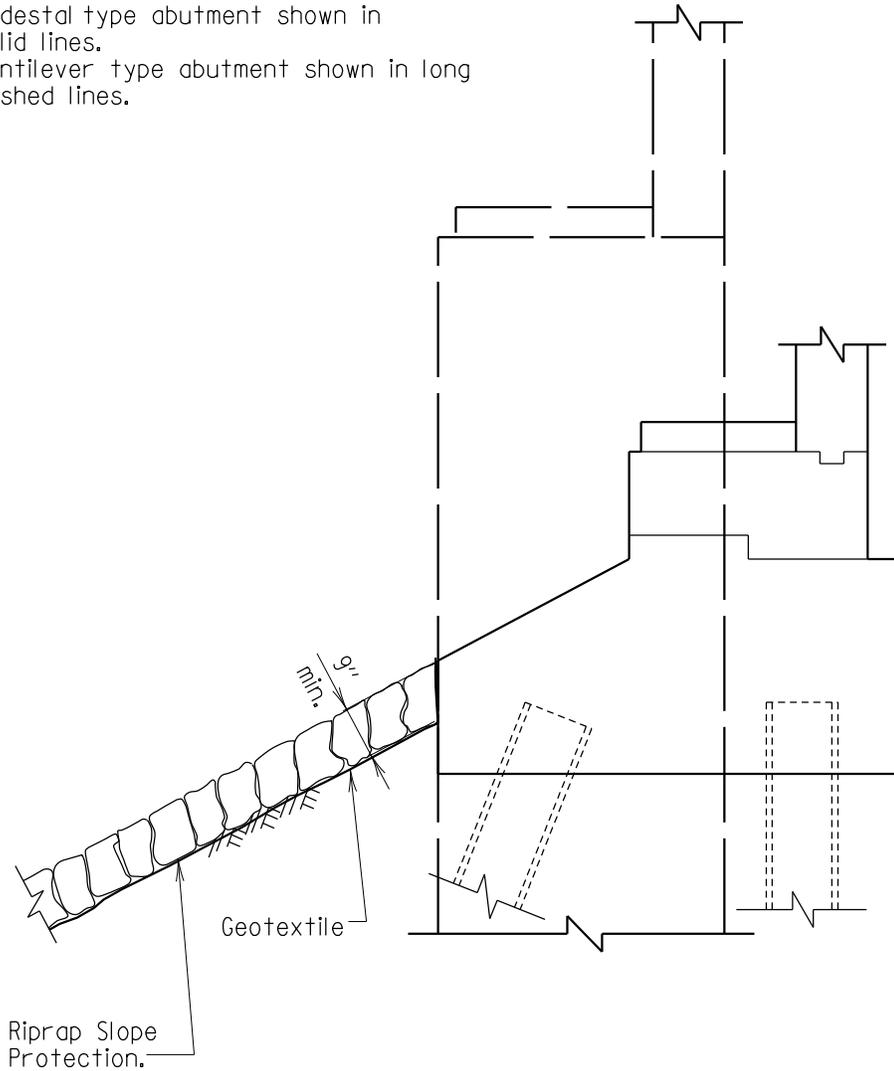
Scale: $\frac{3}{8}''=1'-0''$

Note:
If a barrier configuration is used at bottom of slope, the bottom cut off wall shall be eliminated.

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DATE: 09/16/2011
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1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
RIPRAP SLOPE PROTECTION FOR BRIDGES CARRYING ROAD OVER ROAD OR RAILROAD	
DETAIL NO. FND-SP-101	SHEET <u>2</u> OF <u>6</u>

Note:
 Pedestal type abutment shown in solid lines.
 Cantilever type abutment shown in long dashed lines.



SECTION A-A THRU ABUTMENT

Scale: $\frac{3}{8}'' = 1'-0''$

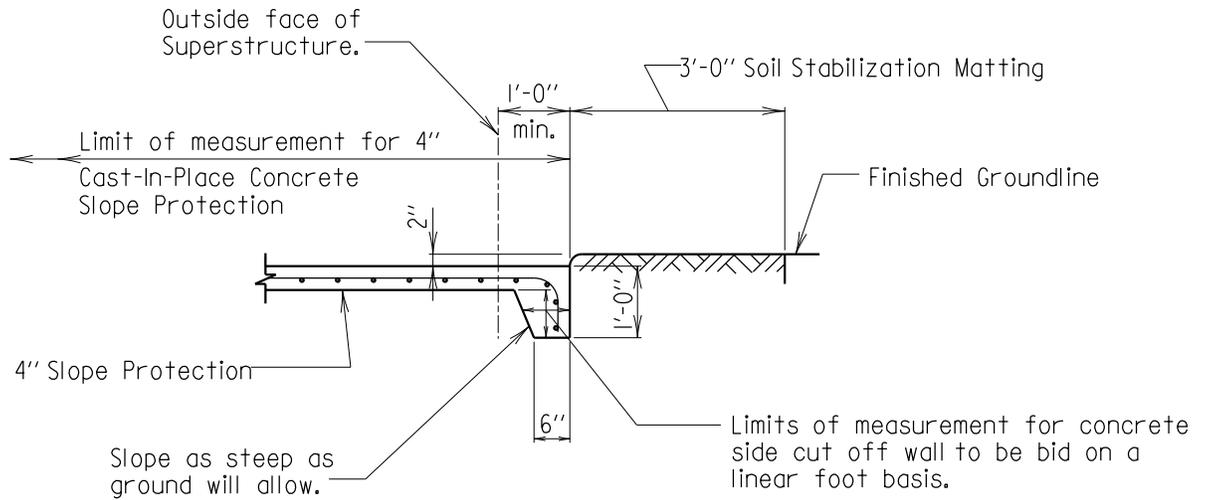
Notes:

1. Bottom cut off wall may be eliminated if slope protection can be founded in rock.
2. All material for riprap slope protection shall be Class I conforming to 901.02.
3. Refer to Section 312 for other requirements.

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DATE: 09/16/2011
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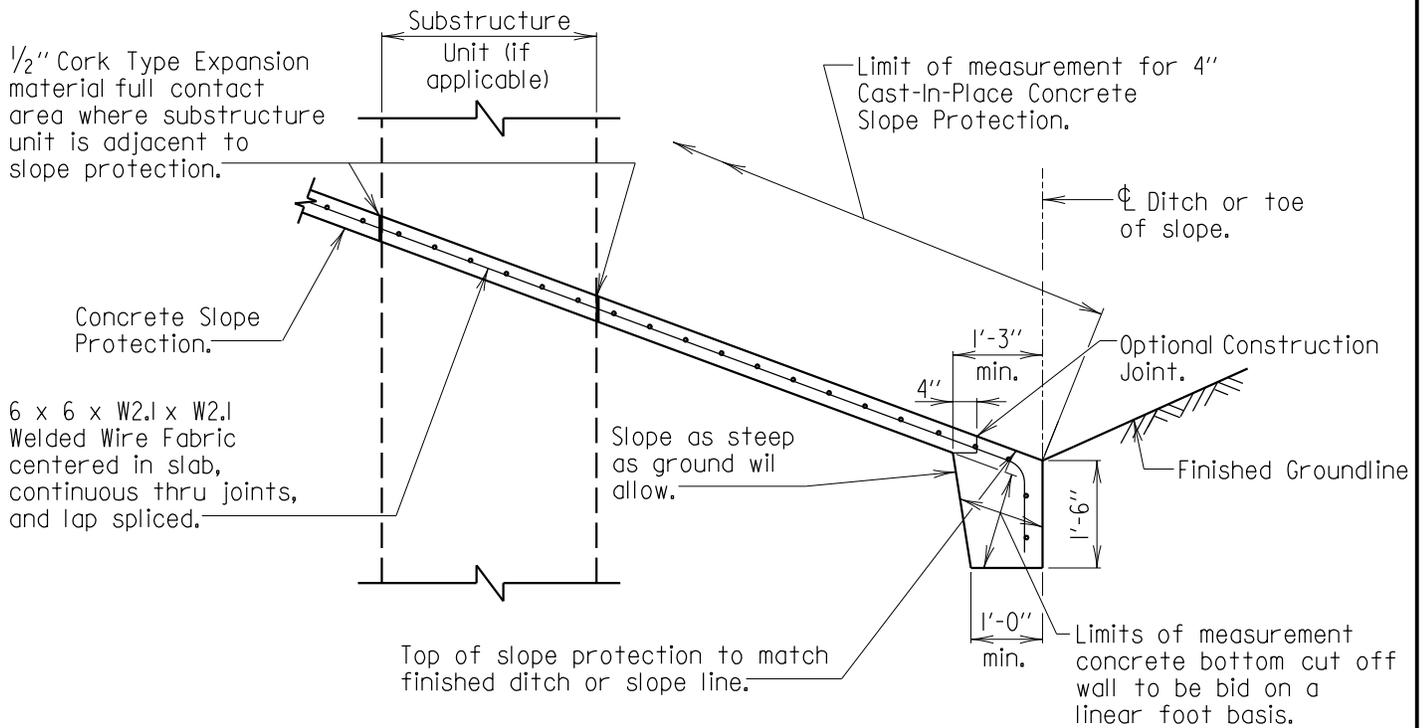
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
RIPRAP SLOPE PROTECTION FOR BRIDGES CARRYING ROAD OVER ROAD OR RAILROAD
DETAIL NO. FND-SP-101
SHEET <u>3</u> OF <u>6</u>

FOUNDATION - SLOPE



SECTION C-C THRU SIDE OF CUTOFF WALL

Scale: $\frac{3}{8}''=1'-0''$



SECTION B-B BOTTOM OF CUTOFF WALL

Scale: $\frac{3}{8}''=1'-0''$

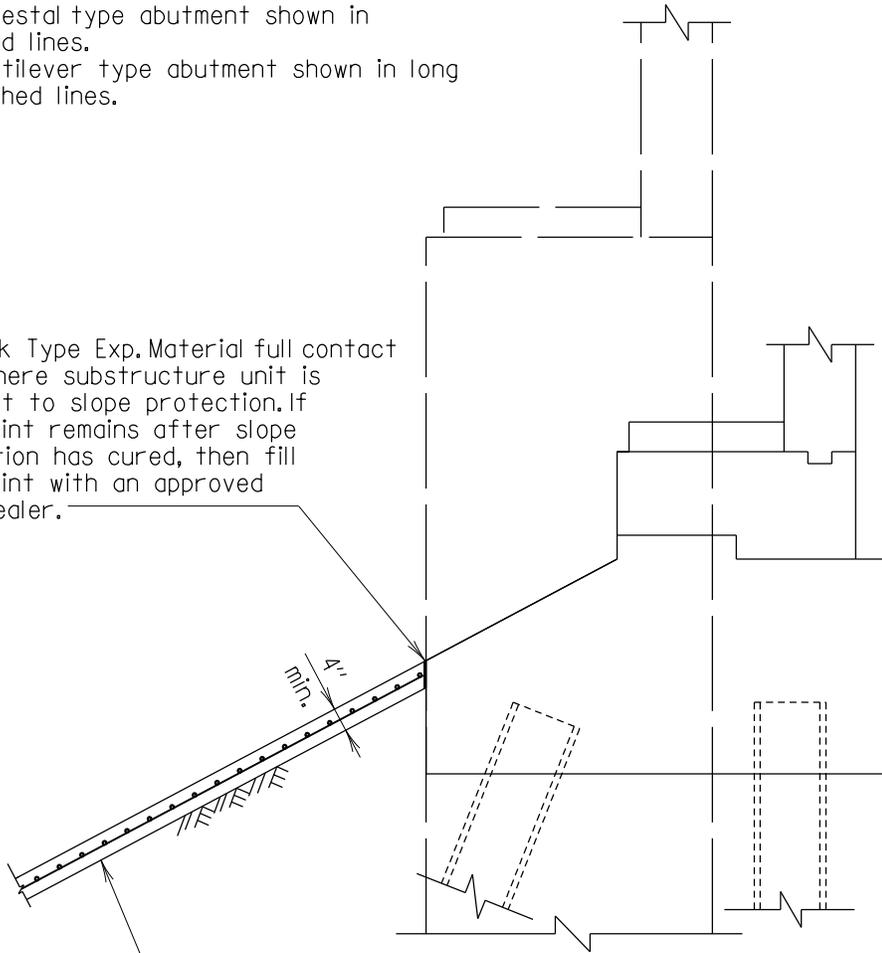
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<i>L.S. Freeman</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 09/16/2011
VERSION
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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
CONCRETE SLOPE PROTECTION FOR BRIDGES CARRYING ROAD OVER ROAD OR RAILROAD	
DETAIL NO. FND-SP-101	SHEET <u>4</u> OF <u>6</u>

Note:
 Pedestal type abutment shown in solid lines.
 Cantilever type abutment shown in long dashed lines.

1/2" Cork Type Exp. Material full contact area where substructure unit is adjacent to slope protection. If open joint remains after slope protection has cured, then fill open joint with an approved joint sealer.

Concrete Slope Protection



SECTION A-A THRU ABUTMENT

Scale: 3/8" = 1'-0"

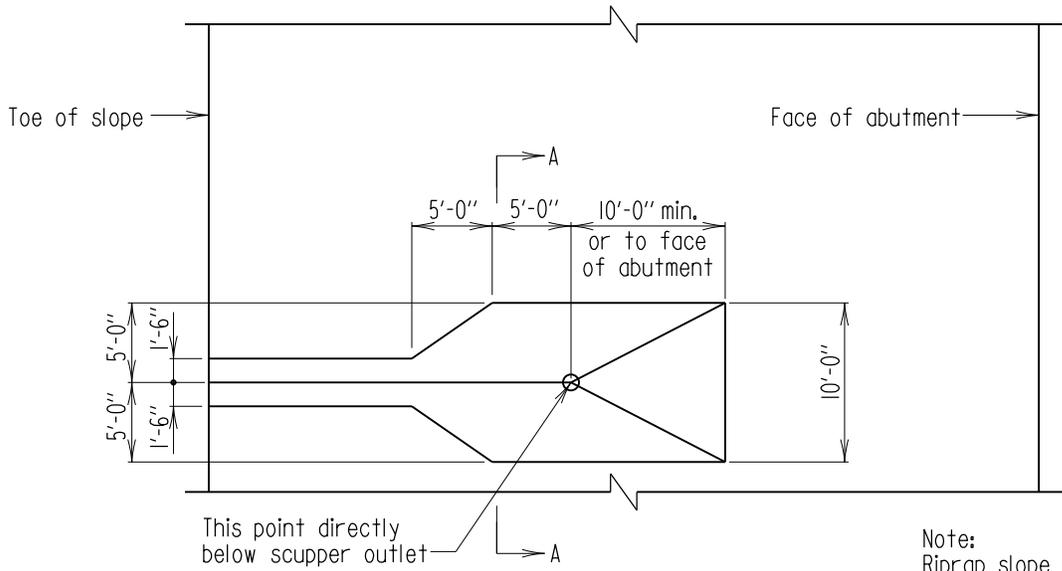
Notes:

1. Bottom cut off wall may be eliminated if slope protection can be founded in rock.
2. Refer to Section 310 for other requirements.

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CONCRETE SLOPE PROTECTION FOR BRIDGES CARRYING ROAD OVER ROAD OR RAILROAD	
DETAIL NO. FND-SP-101	SHEET <u>5</u> OF <u>6</u>

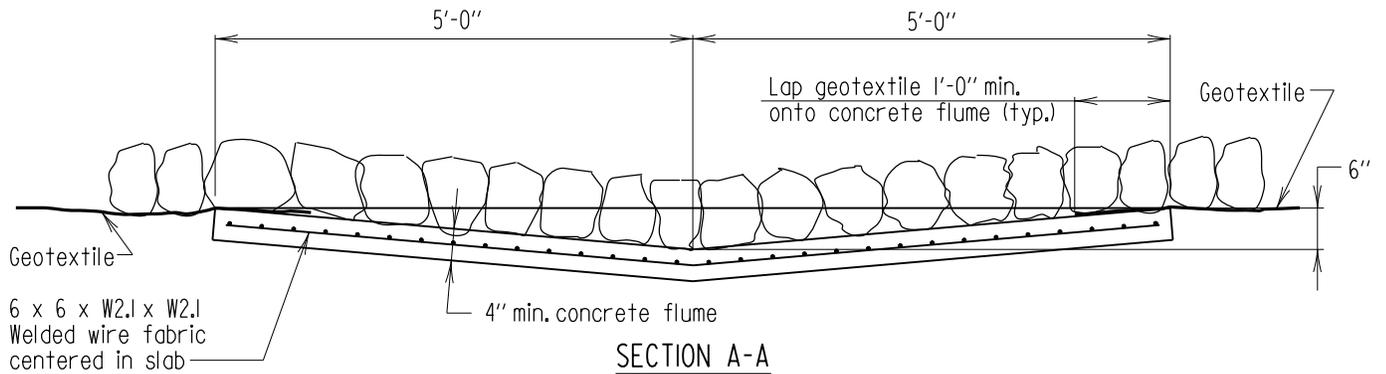
FOUNDATION - SLOPE



PLAN

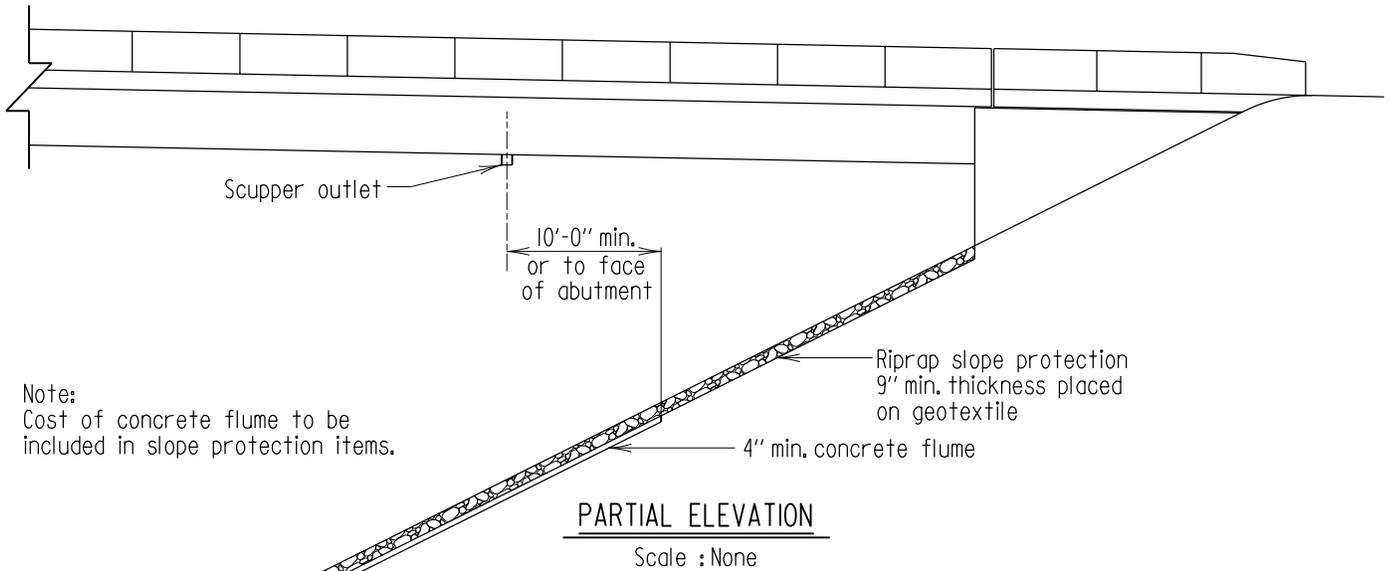
Scale : None

Note:
Riprap slope protection
not shown.



SECTION A-A

Scale : $1/2'' = 1'-0''$



PARTIAL ELEVATION

Scale : None

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DATE: 09/16/2011
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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
CONCRETE SPLASH BLOCK ON END SLOPE WITH RIPRAP SLOPE PROTECTION
DETAIL NO. FND-SP-101
SHEET <u>6</u> OF <u>6</u>

FOUNDATION - SLOPE

GENERAL NOTES

SELECTION OF THE RIPRAP D50 SIZE AND BLANKET THICKNESS:

The FHWA equations from HEC-23, Bridge Scour and Stream Instability Countermeasures (Design Guideline 8, Rock Riprap at Abutments and Piers) should be used to compute the minimum required D50 size of riprap. This value is to be compared with the D50 size of riprap in the table below to select the appropriate riprap Class and blanket thickness. As noted previously, use of Class I riprap is not recommended except for certain conditions, see sheet 5 of this detail.

RIPRAP CLASS	D50 MINIMUM SIZE (INCHES)	APPROXIMATE D50 WEIGHT (POUNDS)	MINIMUM BLANKET THICKNESS (INCHES)*
I	9.5	40	19
II	16	200	32
III	23	600	46

*These dimensions apply to the upper blanket section only, not the toe section.

DESIGN OF THE TOE SECTION:

A stable riprap toe is the most important feature in the design of riprap abutment protection installations. Guidance on the design of the toe section is provided on sheet 2 of this detail. The following criteria serve to establish the design for the riprap toe:

1. Design the riprap toe extend below the depth of contraction scour in the scour cross-section (see sheet 2 of this detail).
2. The riprap toe should be at least 6 feet thick. (A lesser toe thickness may be appropriate under certain field conditions as depicted on sheets 4 and 5 of this detail).
3. The top width of the riprap toe is typically 12 feet or more in order to fit the riprap geometry to the ground conditions.
4. An aggregate or geotextile filter cloth is normally used with the riprap installation.

RIPRAP SPECIFICATIONS:

The following riprap specification are set forth in the MDOT SHA Standard Specifications for Construction and Materials:

Construction: Section 312, Riprap Slope and Channel Protection.

Materials: Section 901.01, Aggregate ; 901.02 Stone for Riprap; 921.09 Geotextile.

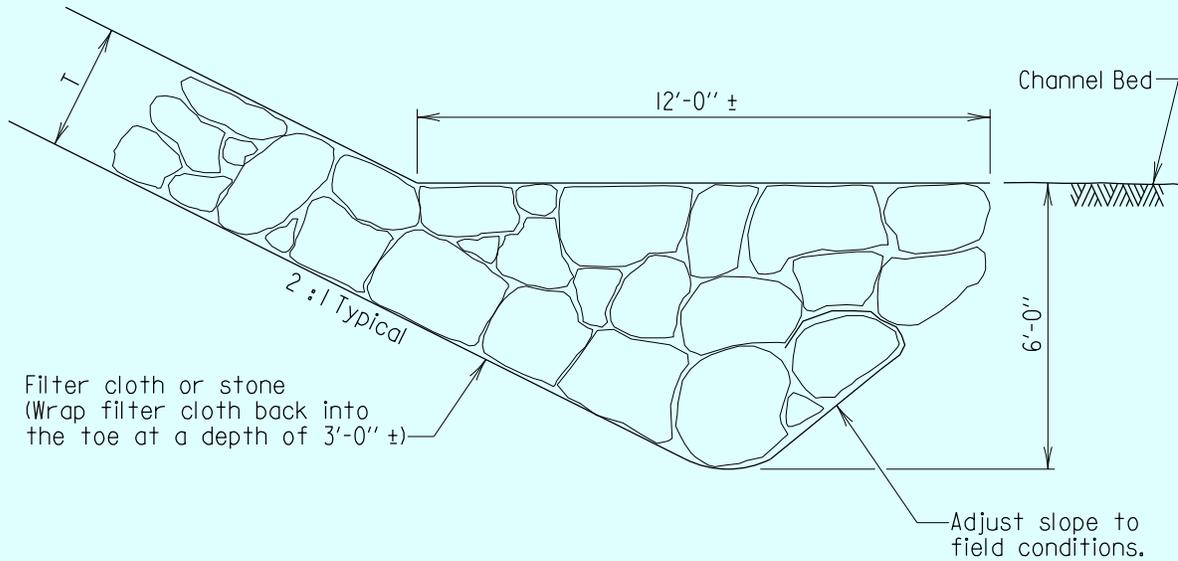
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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES TYPICAL RIPRAP INSTALLATIONS AT PIERS AND ABUTMENTS GENERAL NOTES
DETAIL NO. FND-SP-201
SHEET <u>1</u> OF <u>6</u>

FOUNDATION - SOLPE

T = 32" (min.) Class 2
 T = 46" (min.) Class 3



TYPICAL RIPRAP BLANKET AND TOE DETAIL

Scale: 1/4" = 1'-0"

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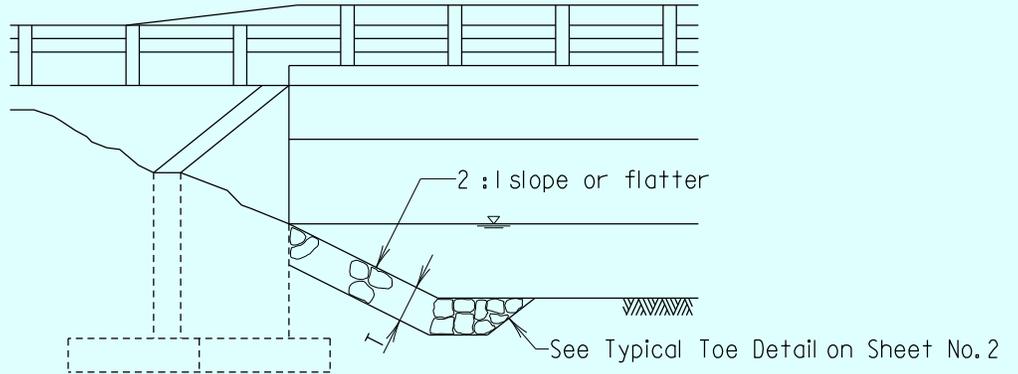
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TYPICAL RIPRAP INSTALLATIONS
 AT PIERS AND ABUTMENTS
 DETAILS

DETAIL NO. FND-SP-201

SHEET 2 OF 6

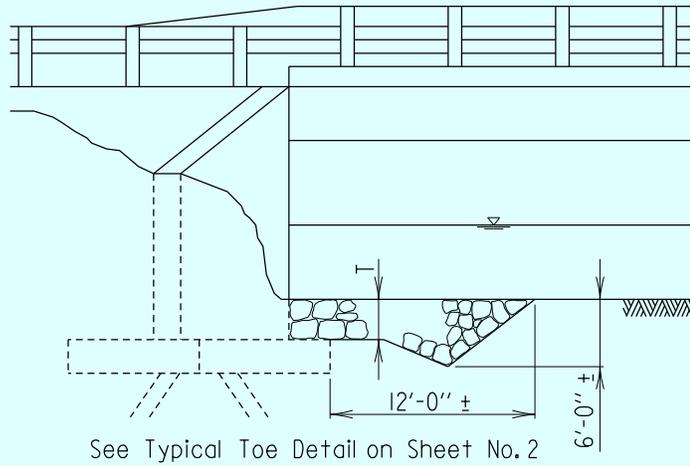
FOUNDATION - SOLPPE



SECTION A-A

Scale: None

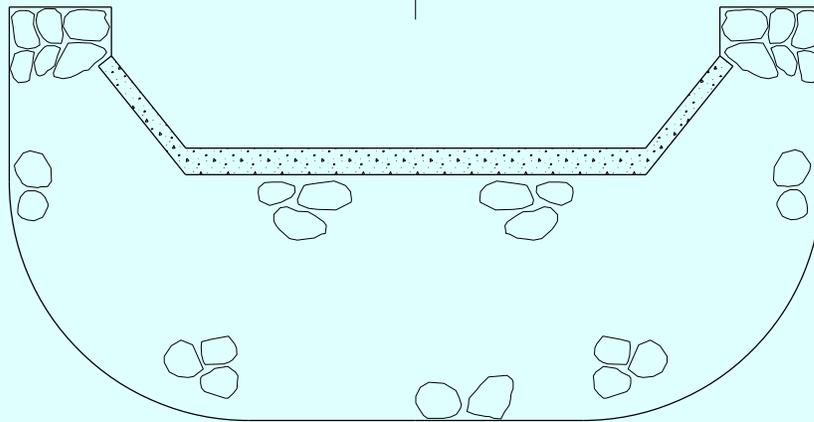
T = 32" (min.) Class 2
T = 46" (min.) Class 3



SECTION A-A

Scale: None

→ A



PLAN VIEW

Scale: None

→ A

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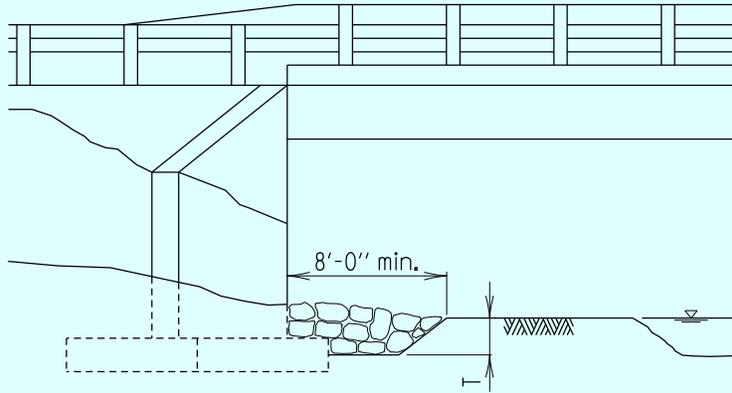
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TYPICAL RIPRAP INSTALLATIONS
AT PIERS AND ABUTMENTS
ABUTMENT NEAR CHANNEL BANK

DETAIL NO. FND-SP-201

SHEET 3 OF 6

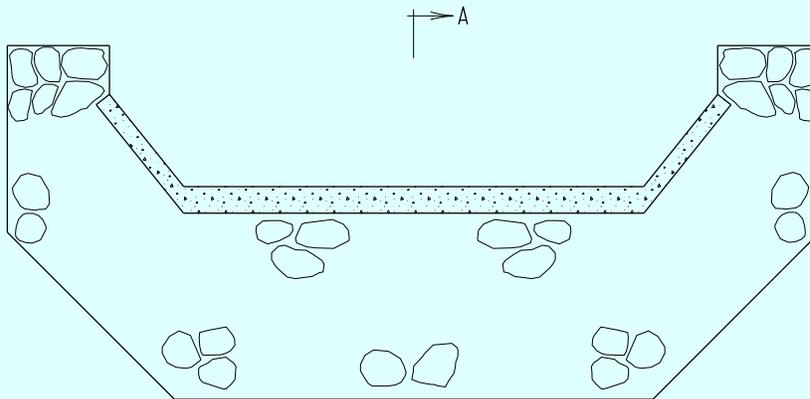
FOUNDATION - SOLP



SECTION A-A

Scale: None

T = 32'' (min.) Class 2
 T = 46'' (min.) Class 3
 (Evaluate need for filter cloth)



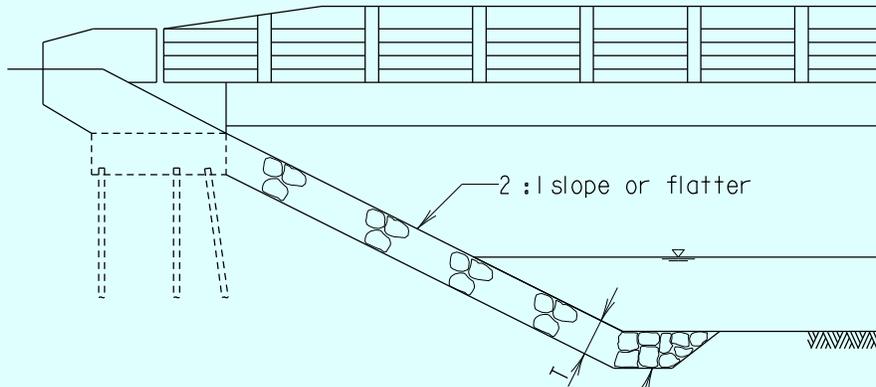
PLAN VIEW

Scale: None

Note:
 This detail is for use when the abutment is set well back from the channel bank with low flow depths and velocities for worst case scour conditions. The Engineer may consider use of Class 1 riprap for this condition.

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TYPICAL RIPRAP INSTALLATIONS AT PIERS AND ABUTMENTS ABUTMENT ON FLOOD PLAIN	
DETAIL NO. FND-SP-201	SHEET <u>4</u> OF <u>6</u>

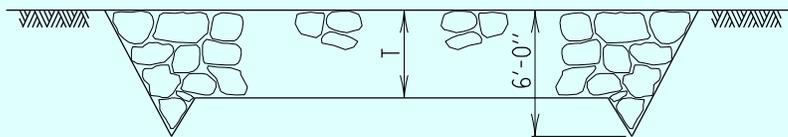
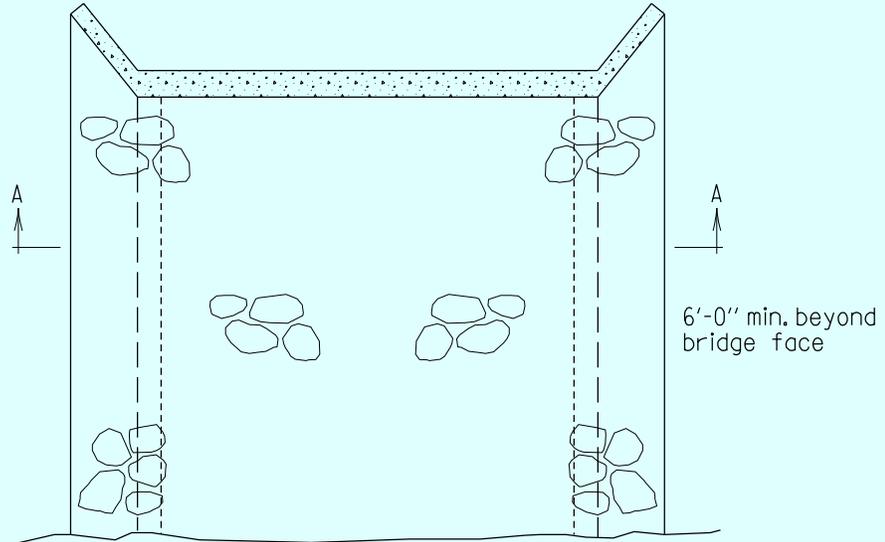


See Typical Toe Detail on Sheet No. 2

T = 32" (min.) Class 2
T = 46" (min.) Class 3

ELEVATION VIEW

Scale: None



SECTION A-A

Scale: None

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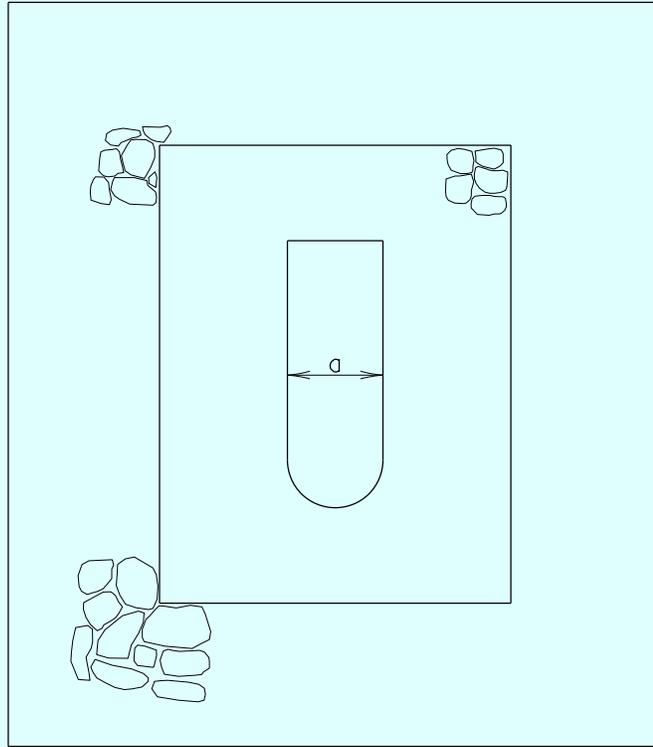
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**TYPICAL RIPRAP INSTALLATIONS
AT PIERS AND ABUTMENTS
ABUTMENT NEAR TOP OF HIGH CHANNEL BANK**

DETAIL NO. FND-SP-201

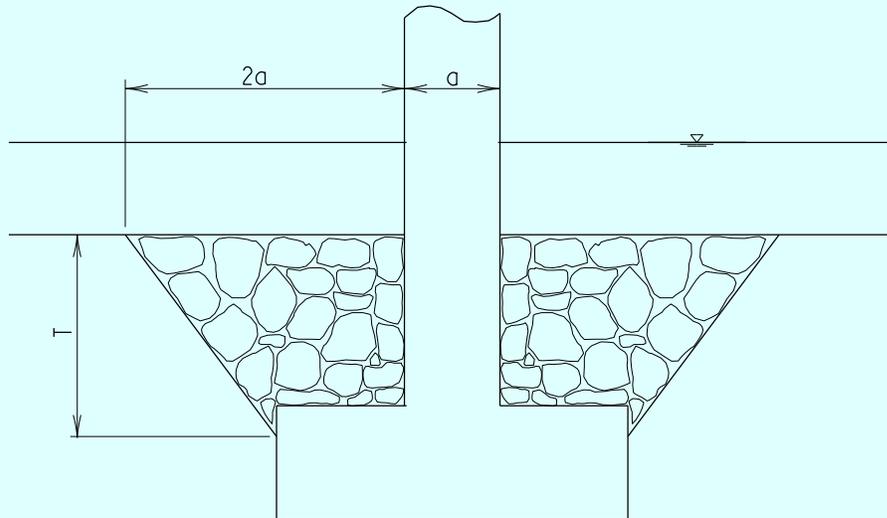
SHEET 5 OF 6

FOUNDATION - SOLPPE



PLAN VIEW

Scale: None



ELEVATION VIEW

Scale: None

Note:
 Piers should be designed to be stable for expected worst-case scour conditions without reliance on scour countermeasures. Where additional scour protection is desired, such protection should be related to the site conditions, but would normally be expected to fall within the limits depicted above.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
TYPICAL RIPRAP INSTALLATIONS AT PIERS AND ABUTMENTS SCOUR COUNTERMEASURE AT PIER	
DETAIL NO. FND-SP-201	SHEET <u>6</u> OF <u>6</u>

FOUNDATION - SOLPPE