Chapter 01

FOUNDATIONS (FND)
Chapter 01 - Foundations

SECTION 01

GENERAL
(FND-GN)
Wing wall longitudinal bars

Wing wall longitudinal extended development length

Transition axis

Extended wing wall footing transverse bar develop length beyond this line.

T. and B. wing wall transverse bars

T. and B. abutment transverse bars

Rear face of footing concrete

ACUTE CORNER

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

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

Wing wall longitudinal bars

Wing wall transverse bars

Development length

Transition axis

Rear face of footing concrete

Development length

Abutment longitudinal bars
Chapter 01 - Foundations

SECTION 02

PILE FOUNDATION
(FND-PF)
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.

** Proposed finished slope 2:1 unless otherwise designated.

* * Slope ratio depends upon fill height.

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 150' (Min.) for approaches to bridges; unless cut is encountered sooner (measured parallel to 1/4 of roadway).

Proposed roadway surface

Slope to drain

Bottom of subgrade for roadway pavement

Proposed abutment

8'-0"

150' (Min.) for approaches to bridges

Limit of preliminary embankment prior to driving piles for abutments.

25'

Limit of completed preliminary embankment

Finished Groundline

Existing Groundline

Finished slope or top of proposed slope protection.

Slope top of preliminary embankment to drain to 1/4 of embankment (i.e., midway between outside shoulders) and from abutment to rear of fill along 1/4, 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.

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.
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.
TYPICAL PIER FOOTING PLANS.

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. ○ 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.”

Scale: 3/16"=1'-0"
TYPICAL ABUTMENT FOOTING PLANS

Scale: 3/16" = 1'-0"

See notes on Sheet 1 of 3.
See notes on Sheet 1 of 3.
**PLAN - PILES (SHOWING MAXIMUM SPACING OF BAR SUPPORTS)**

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

**ISOMETRIC VIEW**

SEE TYPICAL BAR SHEET FOR DIMENSIONS

<table>
<thead>
<tr>
<th>SIZE</th>
<th>HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>0'-7&quot; ≤ H ≤ 1'-6&quot;</td>
</tr>
<tr>
<td>#5</td>
<td>1'-6&quot; ≤ H ≤ 3'-6&quot;</td>
</tr>
</tbody>
</table>

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

**SECTION A-A**

Scale: None

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

DIMENSIONS AND QUANTITIES TO BE SUPPLIED BY CONTRACTOR

**STATE OF MARYLAND**

DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

OFFICE OF STRUCTURES

REINFORCING BAR STANDARD FOOTING SUPPORT SYSTEM

APPROVAL

OFFICE OF STRUCTURES

DATE: 03/07/99

VERSION

1.0

DETAIL NO. FND-PF-202

SHEET 1 OF 1
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.

Material Required:

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

All Material to ASTM A-36.
Notes:

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
---|---|---
10 x 42 | $1/4$ | $5/16$
10 x 57 | $1/4$ | $5/16$

* See Note 2.
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.

<table>
<thead>
<tr>
<th>Size of Pile</th>
<th>Size of 45 Bevel</th>
<th>Size of Groove Weld</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 x 53</td>
<td>1/4</td>
<td>5/16</td>
</tr>
<tr>
<td>12 x 74</td>
<td>3/16</td>
<td>5/16</td>
</tr>
</tbody>
</table>

* See Note 2.
Point to be welded to pile with a continuous single bevel groove weld along outside face of flange.

For each shipment of points a foundry certificate verifying material meets the Specifications is required.

<table>
<thead>
<tr>
<th>Size of Pile</th>
<th>Size of 45 Bevel</th>
<th>Size of Groove Weld</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 x 73</td>
<td>1/4</td>
<td>3/8</td>
</tr>
<tr>
<td>14 x 89</td>
<td>3/16</td>
<td>3/8</td>
</tr>
<tr>
<td>14 x 102</td>
<td>3/8</td>
<td>3/8</td>
</tr>
<tr>
<td>14 x 117</td>
<td>3/8</td>
<td>3/8</td>
</tr>
</tbody>
</table>

* See Note 2.
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.

* End of weld to be smooth and flush with pipe pile wall cut, 1/4" min. effective throat.
**DETAILS FOR CAST-IN-PLACE CONCRETE PILES**

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.

---

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

Continuous fillet weld, minimum size equal to thickness of pile shell.

Burn four equally spaced slots in the lower section before inserting extension.

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.

After pile is aligned, tack weld at all four slots prior to commencing full weld operations.

If "male end" is not factory tapered, it shall be tapered just enough to fit into lower section.
SPLICE FOR CAST-IN-PLACE CONCRETE PIPE PILE SHELL

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

Splicer sleeve material shall be steel.

Contractor has the option of using either the "Splicer Sleeve" or "All Welded" alternates.

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.

ELEVATION OF SPLICE
(USING SPICER SLEEVE)
Scale: 3/4" = 1'-0"

ELEVATION OF SPLICE
(USING ALL WELDED ALTERNATE)
Scale: 3/4" = 1'-0"

After seating pile, weld with continuous 5/16" fillet weld, top and bottom.

For pile shells 3/8" thick or less.

For pile shells over 3/8" thick.

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"

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

SPlice FOR CAST-IN-PLACE CONCRETE PIPE PILE SHELL

APPROVAL
DATE: 01/22/2001
VERSION

DETAIL NO. FND-PF-503 SHEET OF 1
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.
Chapter 01 - Foundations

SECTION 03

SLOPE PROTECTION (FND-SP)
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 precedence over what is shown on this sheet.
Limit of measurement for Riprap Slope Protection.

Slope as steep as ground will allow.

Outside face of Superstructure.

Limit of measurement for Riprap Slope Protection.

Riprap Slope Protection
Geotextile

Finished Groundline

3'-0'' Soil Stabilization Matting

Top of slope protection to match finished ditch or slope line.

Limits of measurement for riprap bottom cut off wall to be bid on a linear foot basis.

Note:
If a barrier configuration is used at bottom of slope, the bottom cut off wall shall be eliminated.
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 1 conforming to 901.02.
3. Refer to Section 312 for other requirements.
SECTION C-C THRU SIDE OF CUTOFF WALL

Limit of measurement for 4"
Cast-In-Place Concrete Slope Protection

1'-0"
min.

3'-0" Soil Stabilization Matting

Finished Groundline

Outside face of Superstructure.

Limit of measurement for 4"
Concrete Slope Protection

Slope as steep as ground will allow.

6 x 6 x W2.1 x W2.1 Welded Wire Fabric centered in slab, continuous thru joints, and lap spliced.

Top of slope protection to match finished ditch or slope line.

SECTION B-B BOTTOM OF CUTOFF WALL

Limit of measurement for 4"
Cast-In-Place Concrete Slope Protection.

1'-3"
min.

Ditch or toe of slope.

Optional Construction Joint.

Finishing Groundline

1'-0"
min.

Limits of measurement concrete bottom cut off wall to be bid on a linear foot basis.

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 4 OF 6
**SECTION A-A THRU ABUTMENT**

**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.

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

Scale: 3/8” = 1’-0”

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
OFFICE OF STRUCTURES

DETAIL NO. FND-SP-101 SHEET 5 OF 6
CONCRETE SPLASH BLOCK
ON END SLOPE WITH RIPRAPH SLOPE PROTECTION

Note:
Riprap slope protection not shown.

Geotextile

4'' min. concrete flume

Lap geotextile 1'-0'' min. onto concrete flume (typ.)

6 x 6 x W2.1 x W2.1 Welded wire fabric centered in slab

4'' min. concrete flume

Note:
Cost of concrete flume to be included in slope protection items.

Scupper outlet

10'-0'' min. or to face of abutment

Riprap slope protection
9'' min. thickness placed on geotextile

4'' min. concrete flume
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 standard.

<table>
<thead>
<tr>
<th>RIPRAP CLASS</th>
<th>D50 MINIMUM SIZE (INCHES)</th>
<th>APPROXIMATE D50 WEIGHT (POUNDS)</th>
<th>MINIMUM BLANKET THICKNESS (INCHES)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>9.5</td>
<td>40</td>
<td>19</td>
</tr>
<tr>
<td>II</td>
<td>16</td>
<td>200</td>
<td>32</td>
</tr>
<tr>
<td>III</td>
<td>23</td>
<td>600</td>
<td>46</td>
</tr>
</tbody>
</table>

*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 standard. 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 standard).
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 sheet 45 of this standard.
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 July 2008 Edition of the 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.
TYPICAL RIPRAP BLANKET AND TOE DETAIL

Scale: $1\frac{1}{4}'' = 1'-0''$

Filter cloth or stone
(Wrap filter cloth back into the toe at a depth of 3'-0''+)

Adjust slope to field conditions.

$T = 32''$ (min.) Class 2
$T = 46''$ (min.) Class 3

Adjust slope to field conditions.

DETAIL NO. FND-SP-201

SHEET 2 OF 6

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

TYPICAL RIPRAP INSTALLATIONS
AT PIERS AND ABUTMENTS
DETAILS

FOR OFFICE USE ONLY

DRAFT

VERSION

OFFICE OF STRUCTURES
DIRECTOR

APPROVAL
TYPICAL RIPRAP INSTALLATIONS AT PIERS AND ABUTMENTS

ABUTMENT NEAR CHANNEL BANK

12'-0'' +

PLAN VIEW
Scale: None

SECTION A-A
Scale: None

See Typical Toe Detail on Sheet No. 2

T = 32'' (min.) Class 2
T = 46'' (min.) Class 3

2:1 slope or flatter

2:1:3

See Typical Toe Detail on Sheet No. 2

SECTION A-A
Scale: None

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

FOR OFFICE USE ONLY

VERSION
DRAFT

APPROVAL
DIRECTOR
OFFICE OF STRUCTURES
DATE

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

TYPICAL RIPRAP INSTALLATIONS
AT PIERS AND ABUTMENTS
ABUTMENT NEAR CHANNEL BANK

DETAIL NO. FND-SP-201
SHEET 3 OF 6
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 I riprap for this condition.

SECTION A-A
Scale: None

T = 32" (min.) Class 2
T = 46" (min.) Class 3
(Evaluate need for filter cloth)

PLAN VIEW
Scale: None
TYPICAL RIPRAP INSTALLATIONS
AT PIERS AND ABUTMENTS
ABUTMENT NEAR TOP OF HIGH CHANNEL BANK

DATE: STATE HIGHWAY ADMINISTRATION
DEPARTMENT OF TRANSPORTATION
STATE OF MARYLAND

SHEET OF APPROVAL
* GUIDE SHEET FOR PLAN DEVELOPMENT ONLY - DO NOT INCLUDE THIS SHEET IN CONTRACT PLANS *

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

2:1 slope or flatter

See Typical Toe Detail on Sheet No. 2

SECTION A-A
Scale: None

6'-0" min. beyond bridge face

FOR OFFICE USE ONLY

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

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

DETAIL NO. FND-SP-201

SHEET 5 OF 6
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.