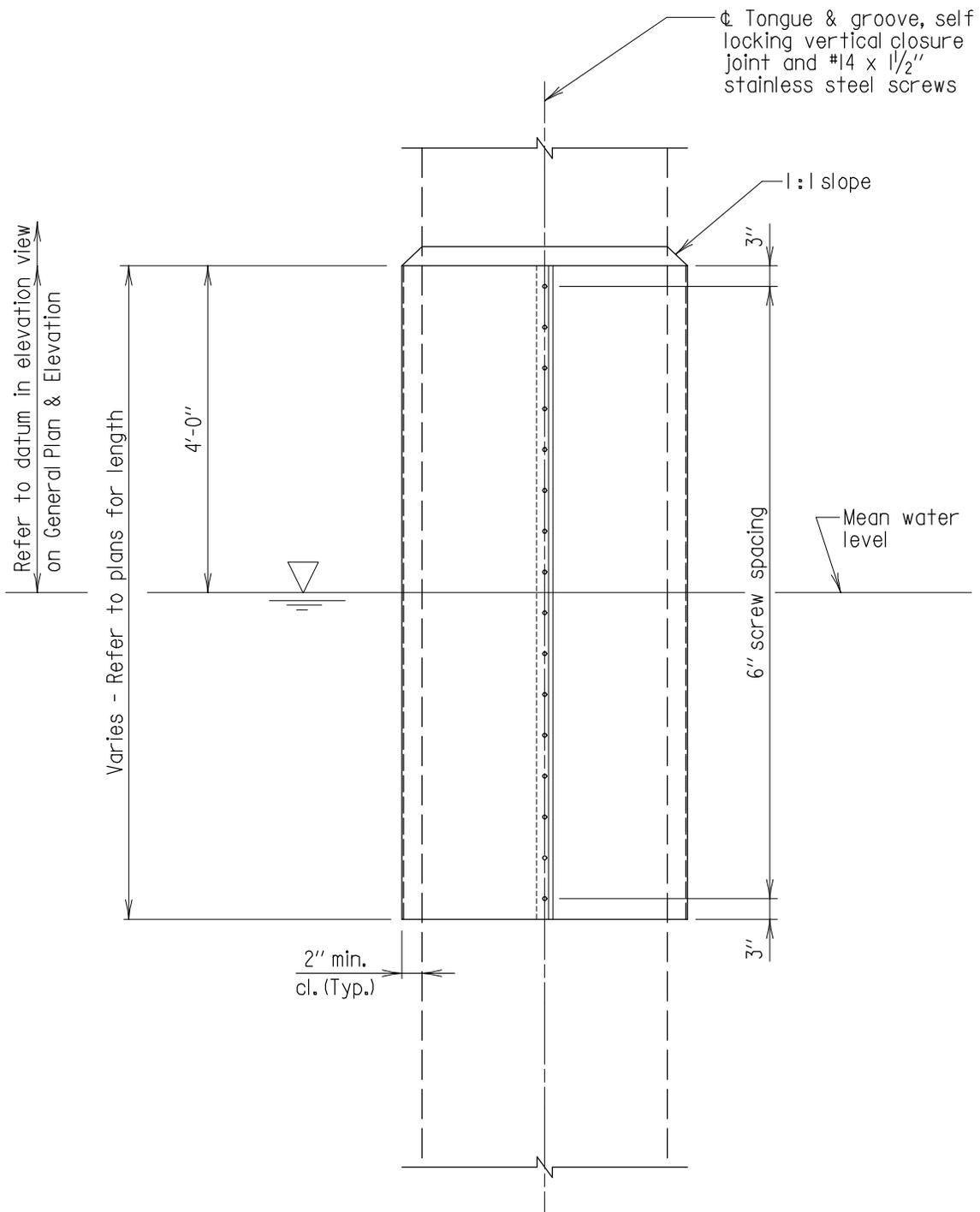


Chapter 11 - Structural Repairs

SECTION 04

**SUBSTRUCTURE  
REPAIRS  
(SR-SUB)**



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

<b>APPROVAL</b>
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DATE: 06/28/2017
<b>VERSION</b>
1.0

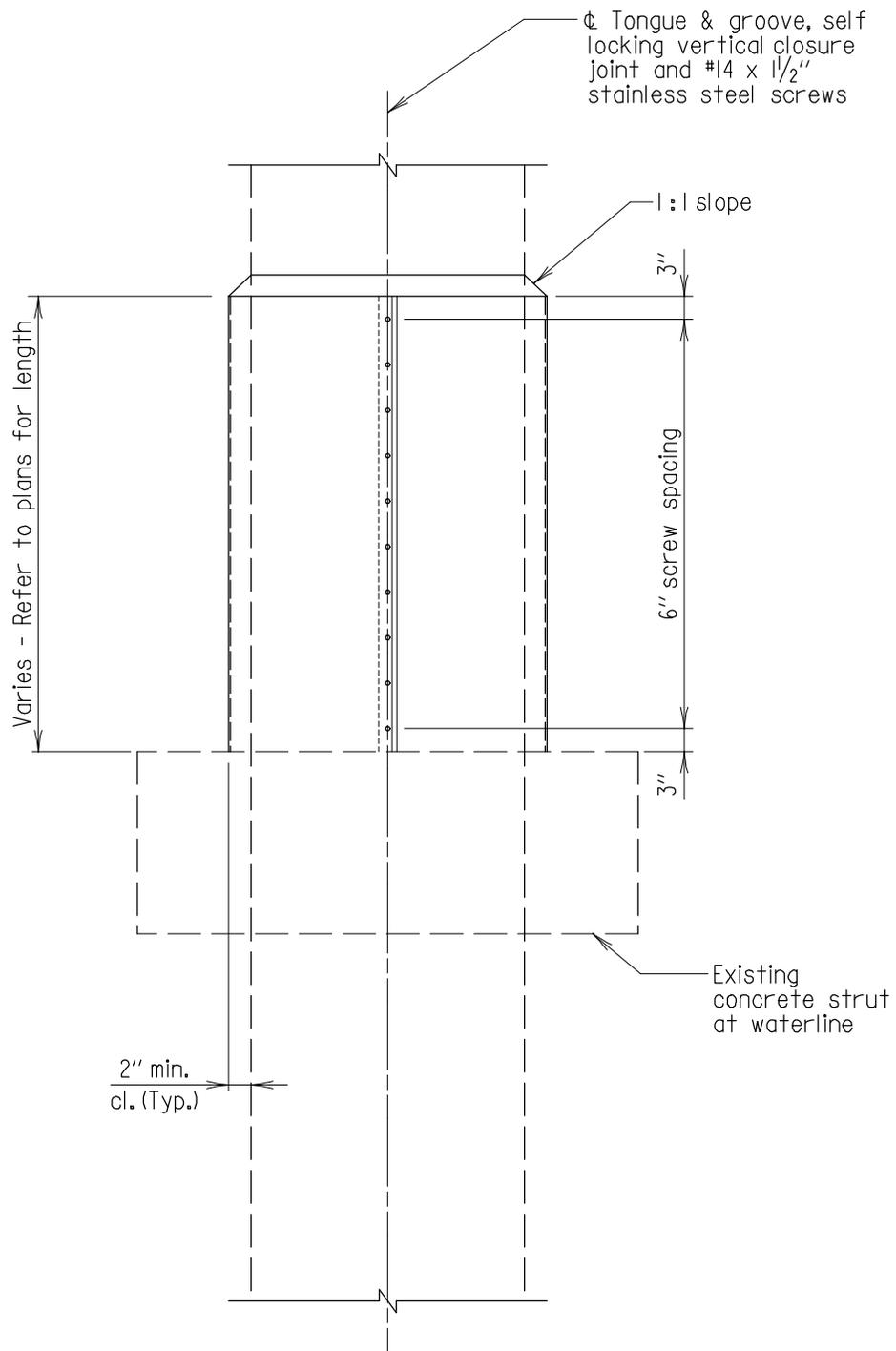
STATE OF MARYLAND  
DEPARTMENT OF TRANSPORTATION  
STATE HIGHWAY ADMINISTRATION  
OFFICE OF STRUCTURES

FIBERGLASS PROTECTIVE PILE JACKET  
FOR EXISTING PILES

DETAIL NO. SR-SUB-101

SHEET 1 OF 4

STRUCTURAL REPAIRS

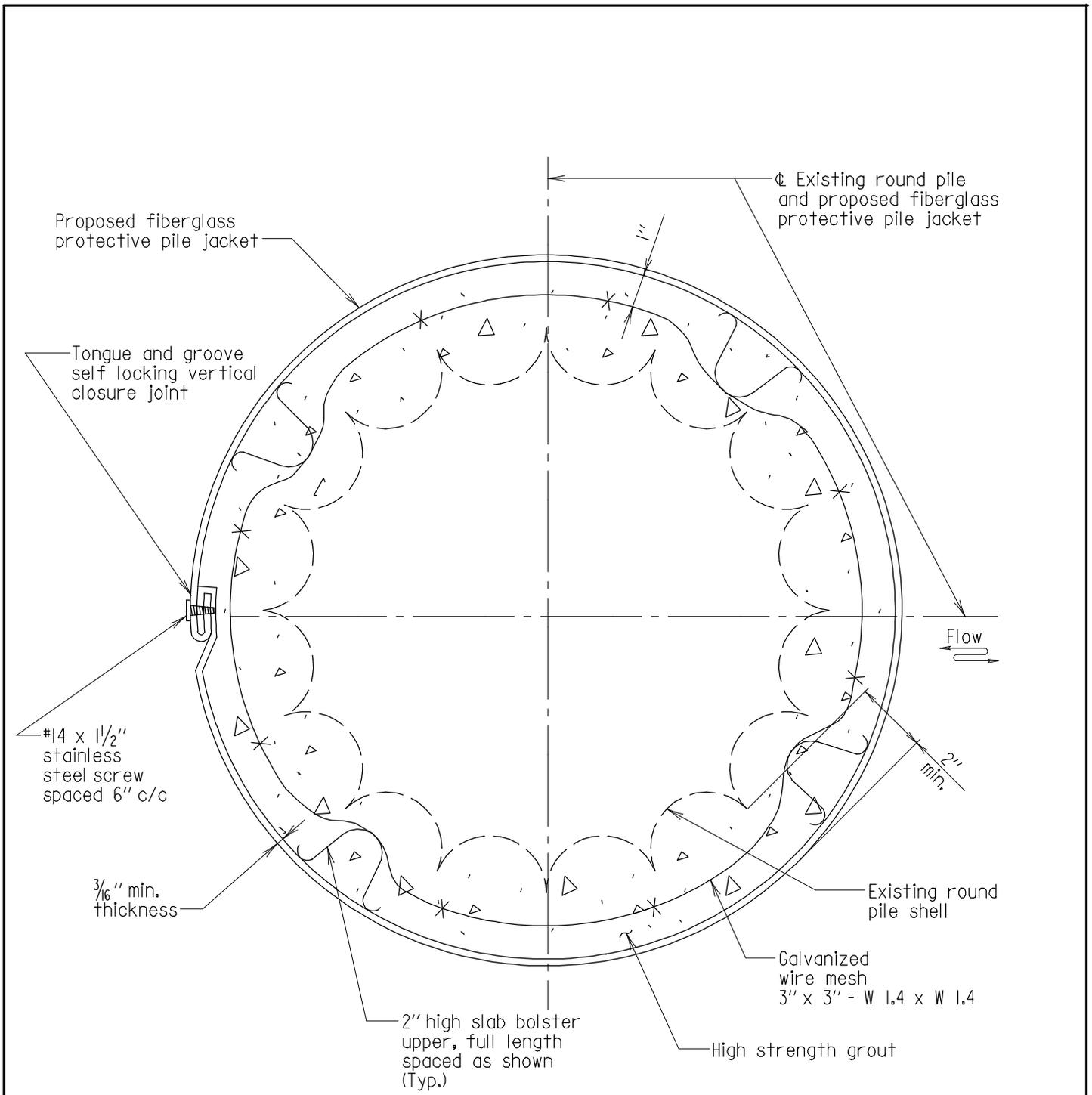


ELEVATION  
Scale: 1/2" = 1'-0"

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
FIBERGLASS PROTECTIVE PILE JACKET FOR EXISTING PILES WITH CONCRETE STRUT
DETAIL NO. SR-SUB-101
SHEET <u>2</u> OF <u>4</u>

STRUCTURAL REPAIRS



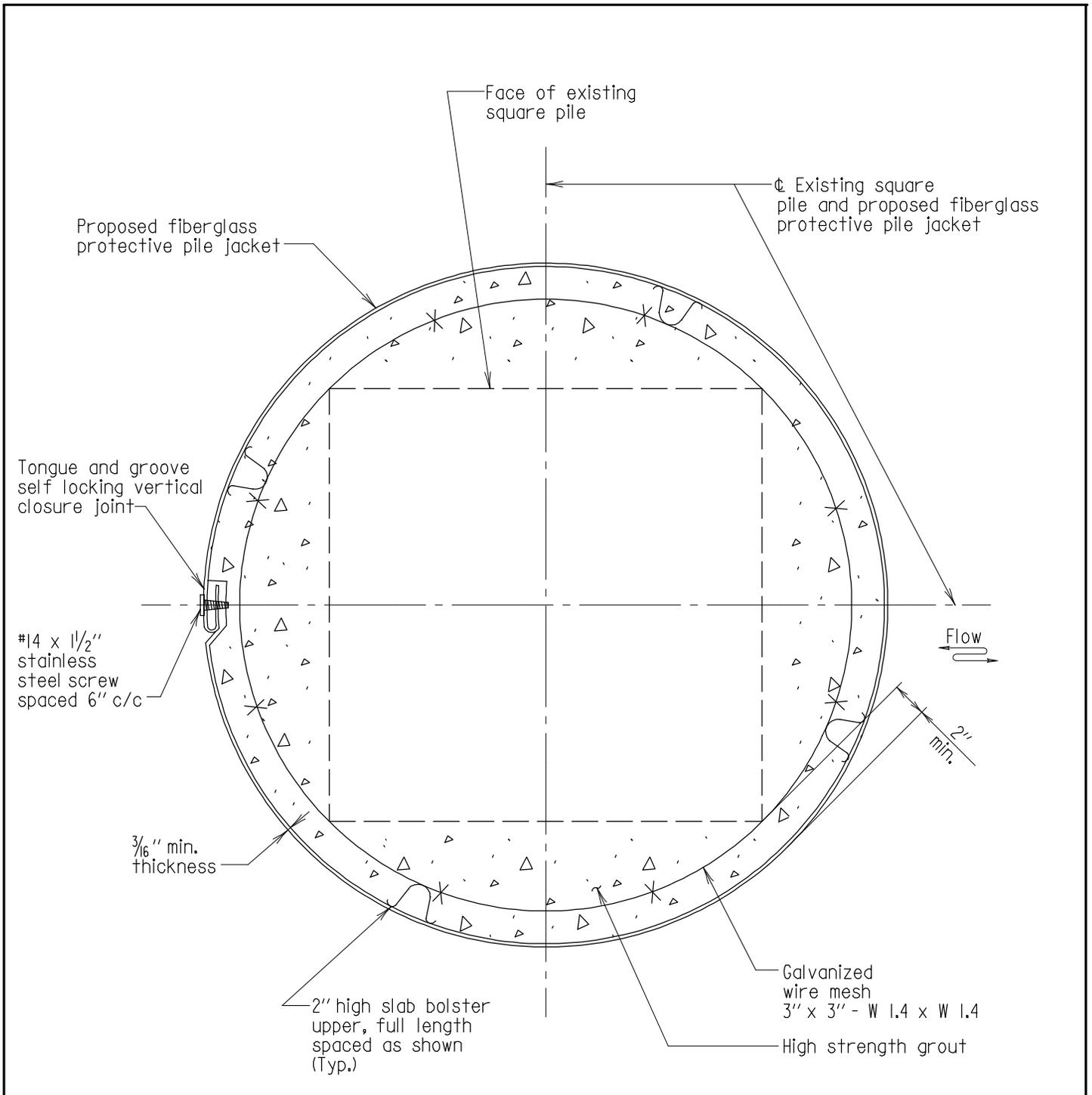
SECTION  
Scale: None

- Notes:
- Existing pile reinforcing steel not shown.
  - Existing piles shall be cleaned a maximum of 24 hours prior to placement of jacket and high-strength grout.
  - The closure joint shall not protrude more than 1" from either inside or outside face of the jacket.
  - Fluted pile shown.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
FIBERGLASS PROTECTIVE PILE JACKET FOR EXISTING ROUND PILES	
DETAIL NO. SR-SUB-101	SHEET <u>3</u> OF <u>4</u>

STRUCTURAL REPAIRS



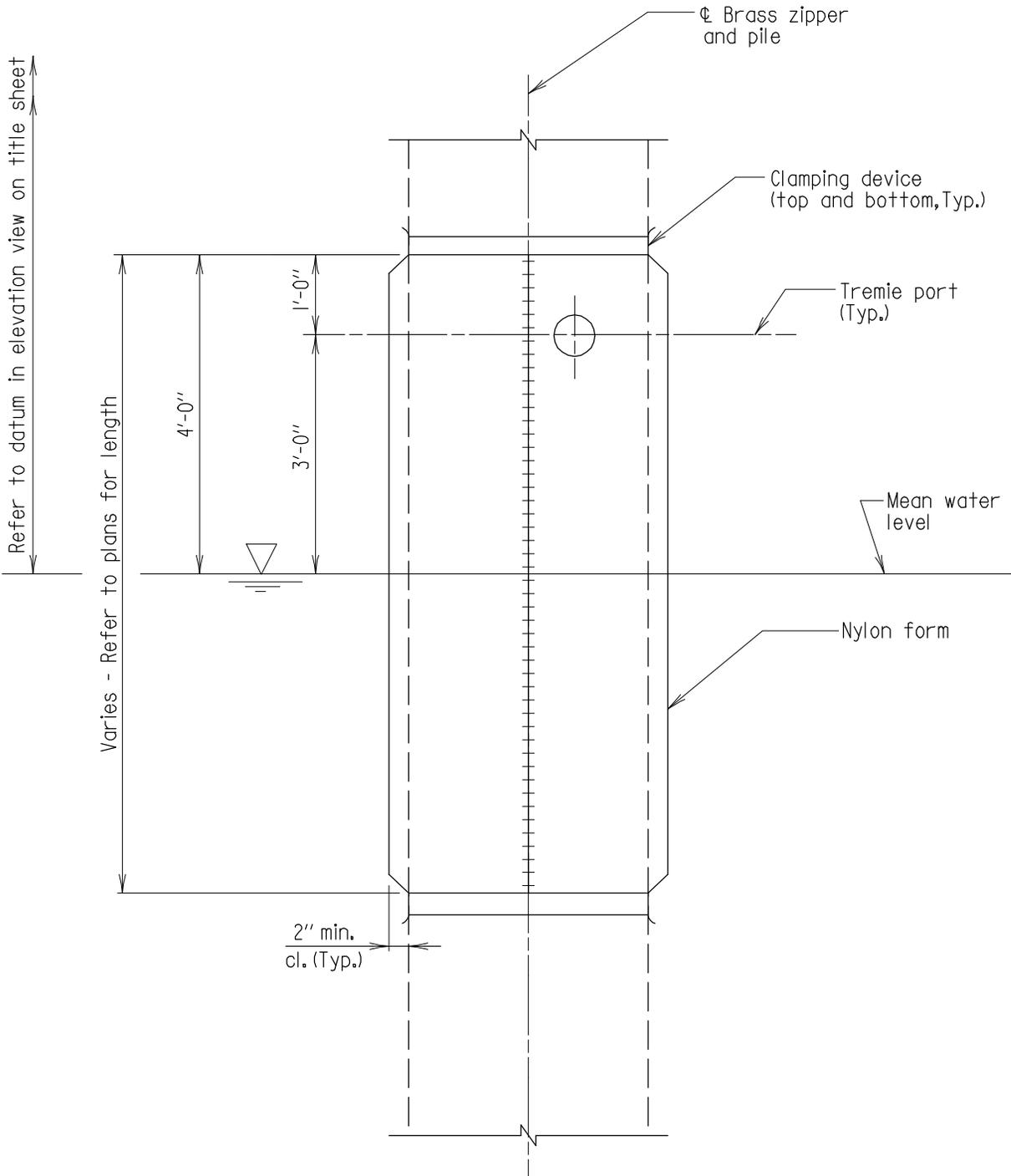
SECTION  
Scale: None

- Notes:
- Existing pile reinforcing steel not shown.
  - Existing piles shall be cleaned a maximum of 24 hours prior to placement of jacket and high-strength grout.
  - The closure joint shall not protrude more than 1" from either inside or outside face of the jacket.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
FIBERGLASS PROTECTIVE PILE JACKET FOR EXISTING SQUARE PILES
DETAIL NO. SR-SUB-101
SHEET 4 OF 4

STRUCTURAL REPAIRS



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

Note:  
External bands to minimize bulging of form note shown.

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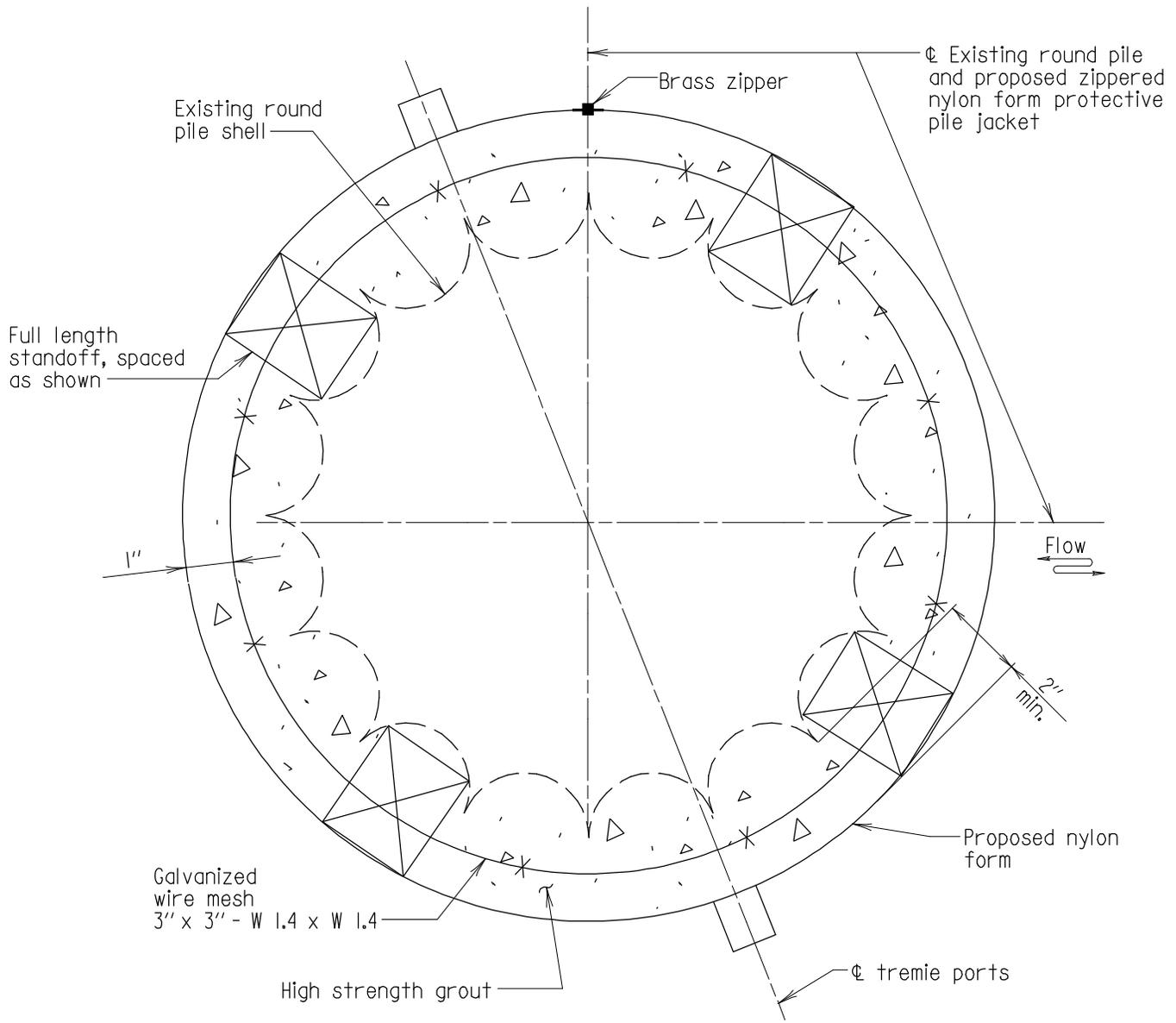
STATE OF MARYLAND  
DEPARTMENT OF TRANSPORTATION  
STATE HIGHWAY ADMINISTRATION  
OFFICE OF STRUCTURES

NYLON FORM PROTECTIVE PILE JACKET  
AT EXISTING PILES

DETAIL NO. SR-SUB-102

SHEET 1 OF 3

STRUCTURAL REPAIRS



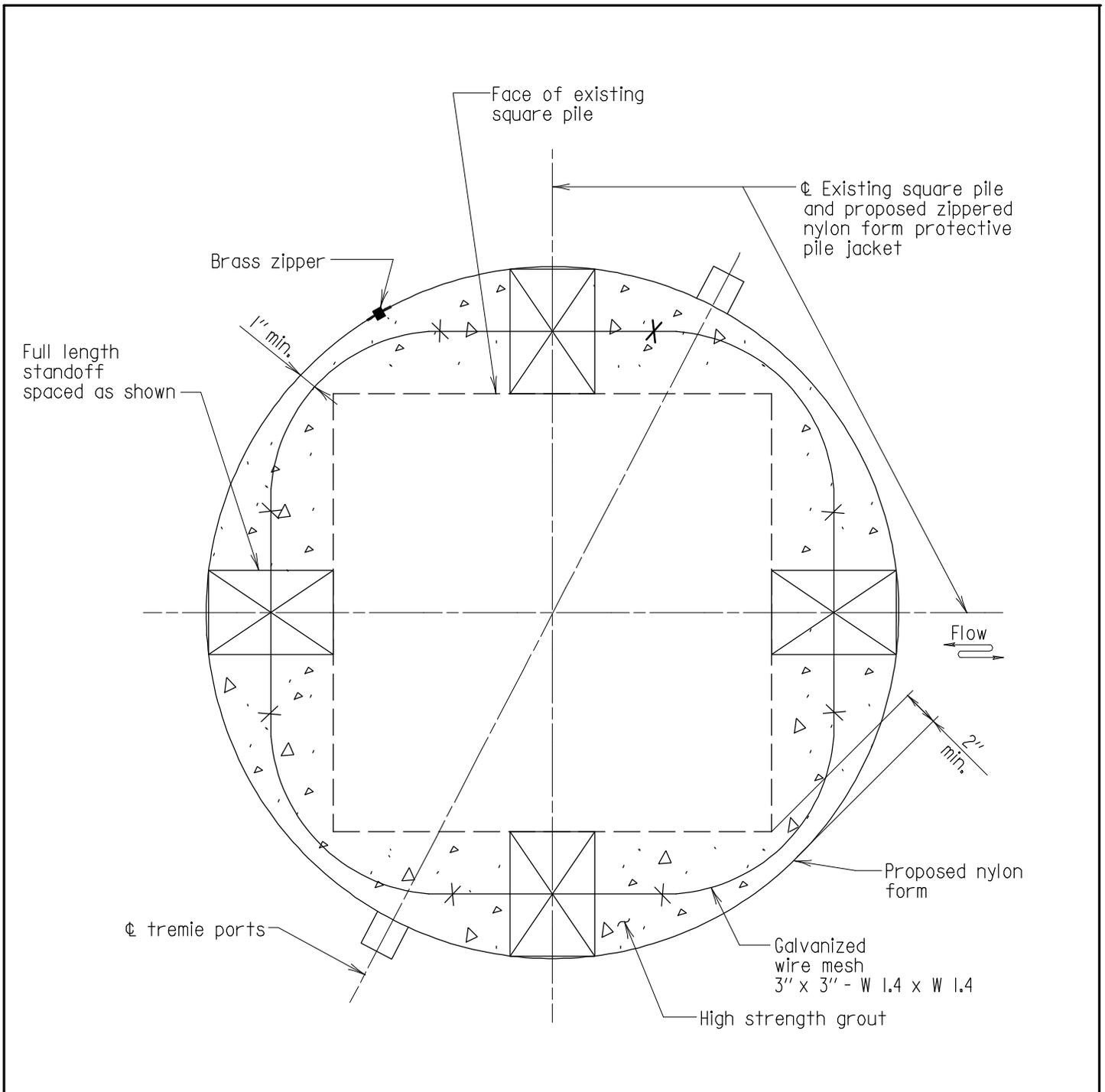
SECTION  
Scale: None

- Notes:
- Existing pile reinforcing steel not shown.
  - Existing piles shall be cleaned a maximum of 24 hours prior to placement of jacket and high-strength grout.
  - Fluted pile shown.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
NYLON FORM PROTECTIVE PILE JACKET FOR EXISTING ROUND PILES
DETAIL NO. SR-SUB-102
SHEET 2 OF 3

STRUCTURAL REPAIRS



SECTION  
Scale: None

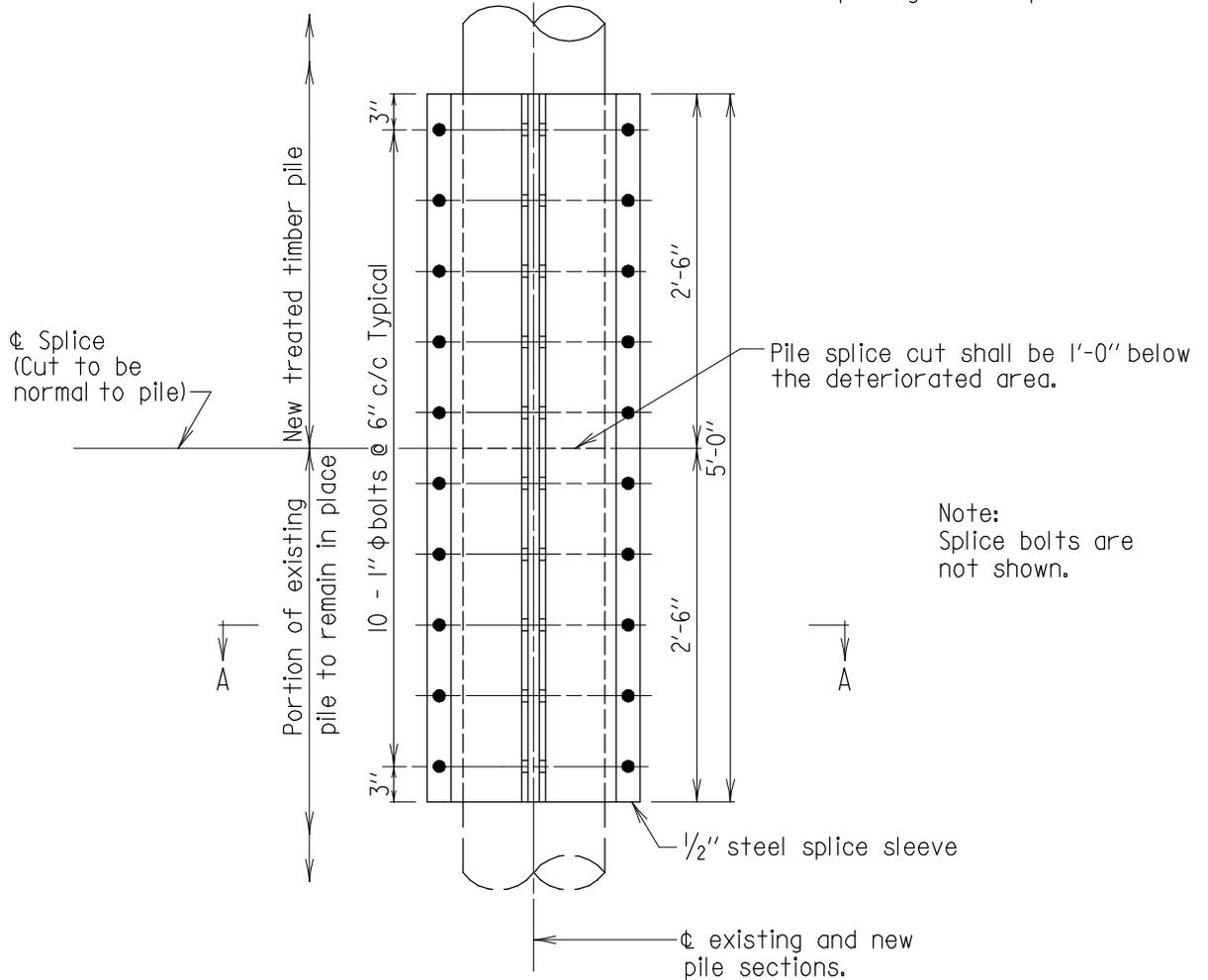
- Notes:
- Existing pile reinforcing steel not shown.
  - Existing piles shall be cleaned a maximum of 24 hours prior to placement of jacket and high-strength grout.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
NYLON FORM PROTECTIVE PILE JACKET FOR EXISTING REINFORCED CONCRETE PILES	
DETAIL NO. SR-SUB-102	SHEET <u>3</u> OF <u>3</u>

STRUCTURAL REPAIRS

Note:  
 Butt ends of new treated timber pile and existing pile shall have the same diameter. All voids between the existing pile and the new pile section or the sleeve shall be filled with an epoxy. The epoxy shall be placed on the existing pile end before installing new section and on inside of the sleeve before placing on the pile.



Note:  
 Splice bolts are not shown.

ELEVATION  
PILE SPLICE SLEEVE  
 Scale: 3/4" = 1'-0"

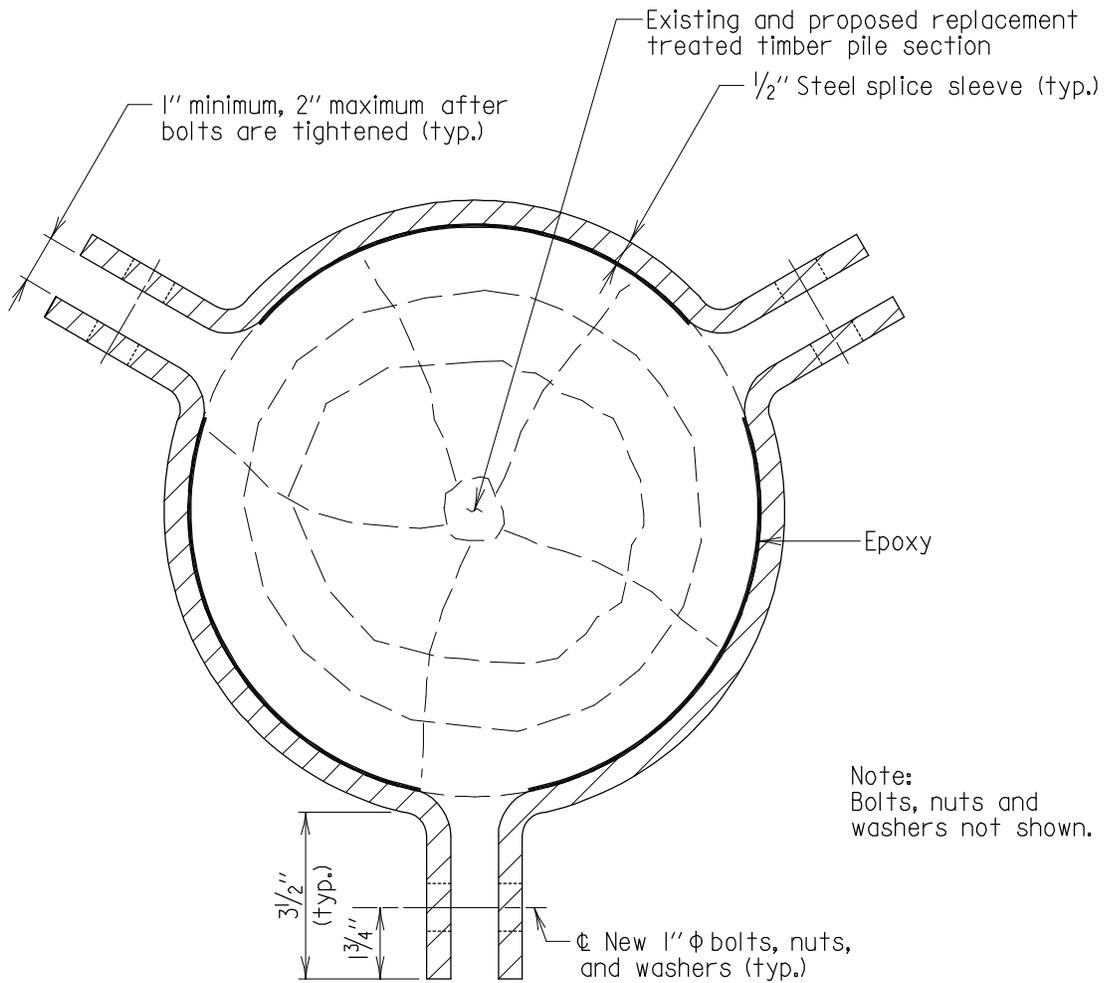
Notes:

1. Epoxy shall be water insensitive with a consistency of putty.
2. All structural steel shall be ASTM A 709 Grade 50 and be hot-dipped galvanized after fabrication in conformance with ASTM A 153. All galvanized material shall be off-vented a minimum of 24 days before installation.
3. Hardware shall be ASTM A 325 and be mechanically galvanized in conformance with ASTM A 153.
4. All timber for cross bracing and piling shall conform to Section 462. All timber for new cross bracing shall be No. 1 Southern Pine. All timber for piles shall be Southern Pine. All timber shall be treated with creosote with 20 lb/ft<sup>3</sup> retention in conformance with AASHTO M 133.
5. For "Section A-A" see sheet nos. 2 and 3 of 8.

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DATE: 06/28/2017
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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
SPLICE FOR CONNECTING EXISTING TIMBER PILING TO NEW TIMBER PILING
DETAIL NO. SR-SUB-201
SHEET <u>1</u> OF <u>8</u>

STRUCTURAL REPAIRS



SECTION A-A (3 SECTION SPLICE ALTERNATE)

Scale: 3" = 1'-0"

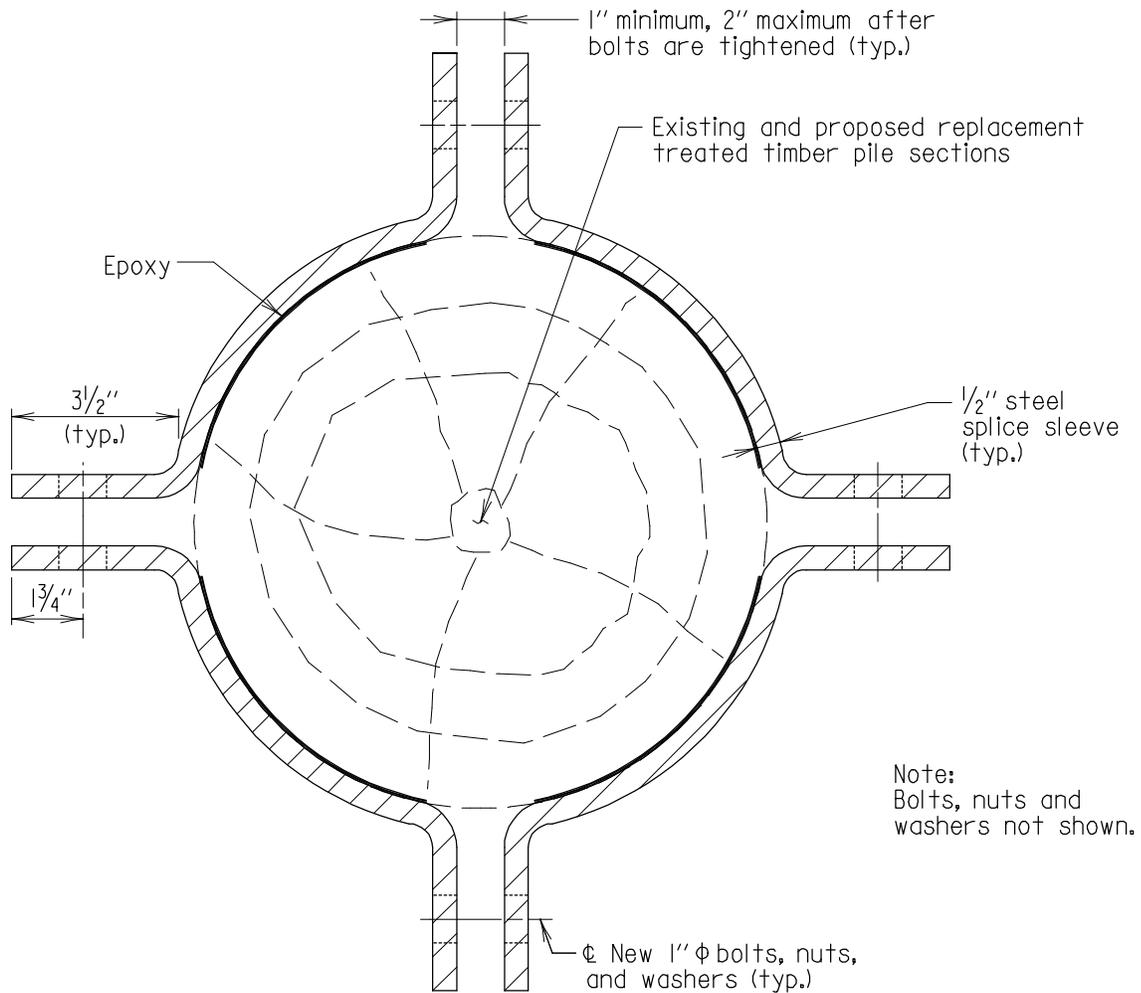
Note:  
The three section splice can only be used when there is no bracing being attached in splice area.

Note:  
The 5'-0" steel pile splice sleeve shall be tightened enough to force out excess epoxy from around the circumference of the pile.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
SPLICE FOR CONNECTING EXISTING TIMBER PILING TO NEW TIMBER PILING
DETAIL NO. SR-SUB-201
SHEET 2 OF 8

STRUCTURAL REPAIRS



Note:  
Bolts, nuts and washers not shown.

SECTION A-A (4 SECTION SPLICE ALTERNATE)

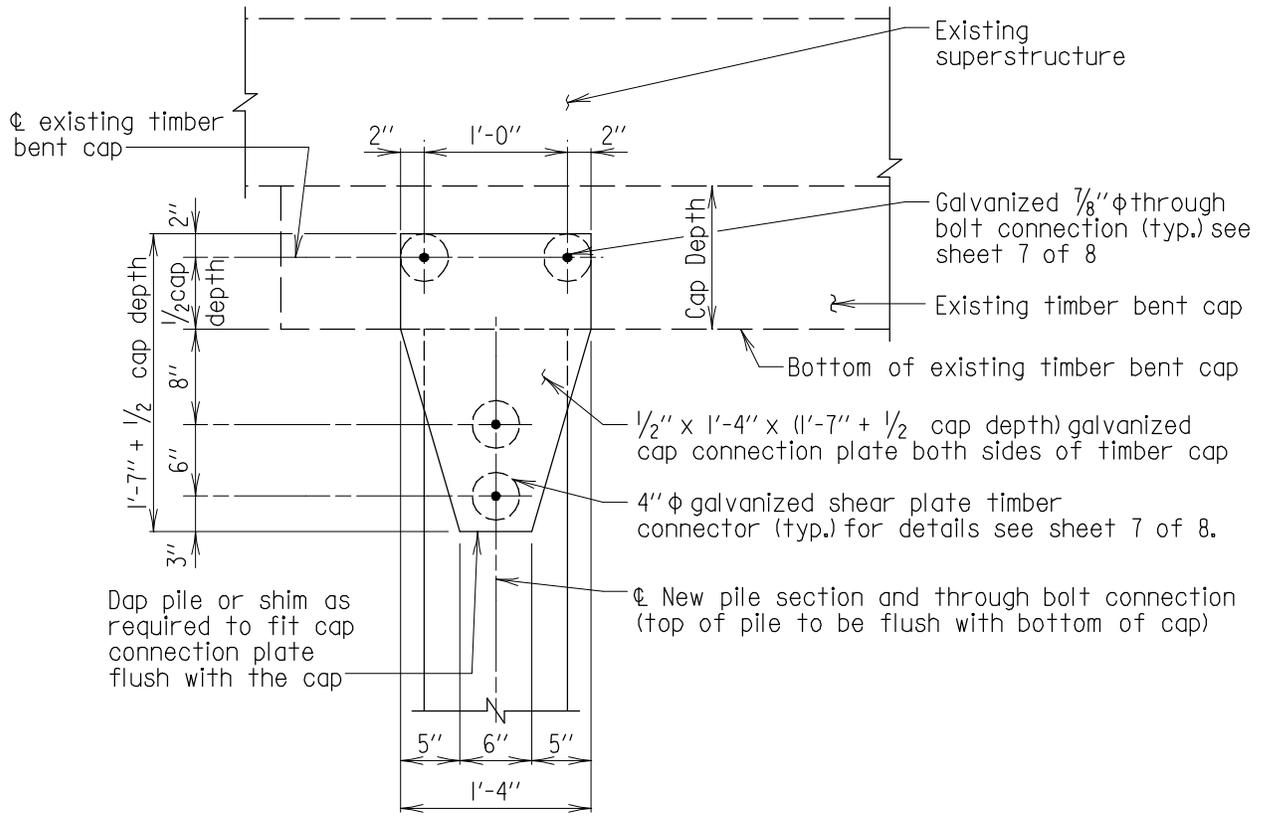
Scale: 3" = 1'-0"

Note:  
The four section splice can be used at any location.

Note:  
The 5'-0" steel pile splice sleeve shall be tightened enough to force out excess epoxy from around the circumference of the pile.

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DATE: 06/28/2017
<b>VERSION</b>
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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
SPLICE FOR CONNECTING EXISTING TIMBER PILING TO NEW TIMBER PILING
DETAIL NO. SR-SUB-201
SHEET <u>3</u> OF <u>8</u>



PILE CONNECTION FOR NONSTRENGTHENED TIMBER CAPS

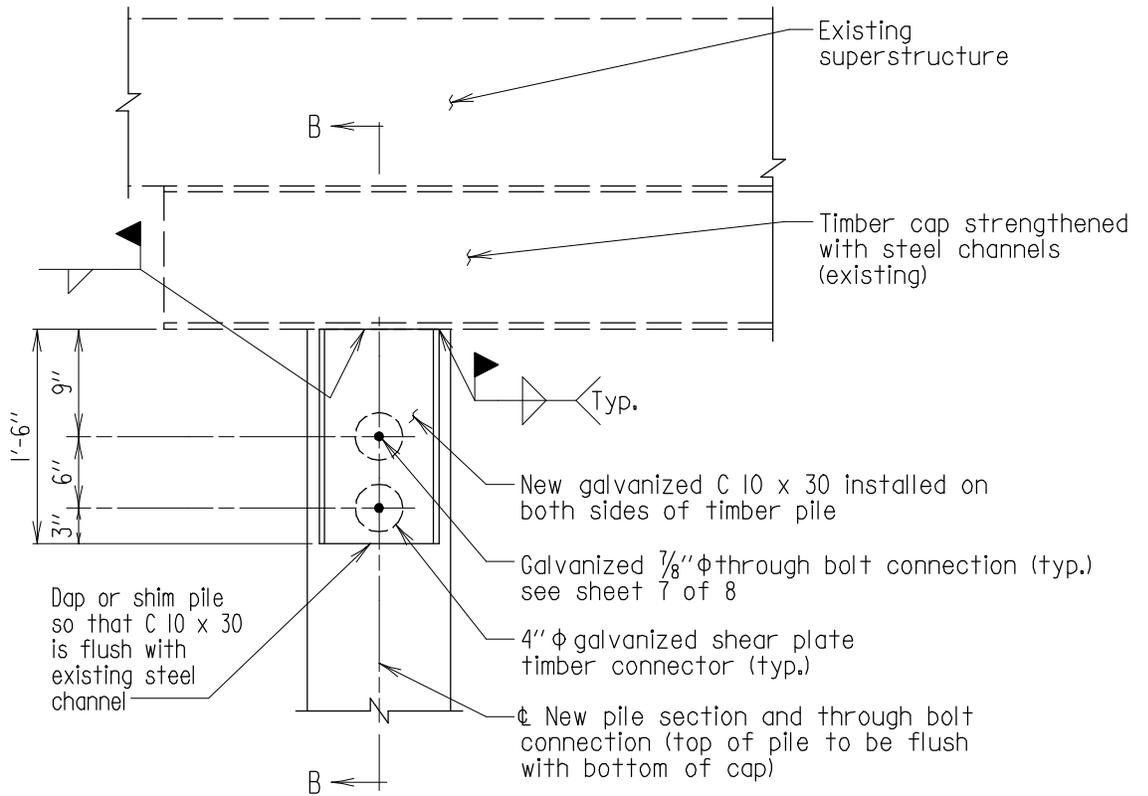
Scale:  $\frac{3}{4}'' = 1'-0''$

Notes:

1. All field drilled holes in the piles shall have a compatible preservative treatment applied to them before bolting.
2. All steel plates, bolts, nuts, etc. shall be mechanically or hot dipped galvanized to conform with ASTM A 153.
3. Shims shall be galvanized ASTM A 709 Grade 50 steel.
4. All galvanized material shall be off-vented a minimum of 24 days before installation.
5. All field drilled holes in the steel plates shall have a compatible galvanized touch up conforming to ASTM A 780 applied.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
CONNECTION OF NEW TIMBER PILE SECTION TO EXISTING TIMBER CAP
DETAIL NO. SR-SUB-201
SHEET <u>4</u> OF <u>8</u>



PILE CONNECTION FOR STEEL CHANNEL STRENGTHENED TIMBER CAPS

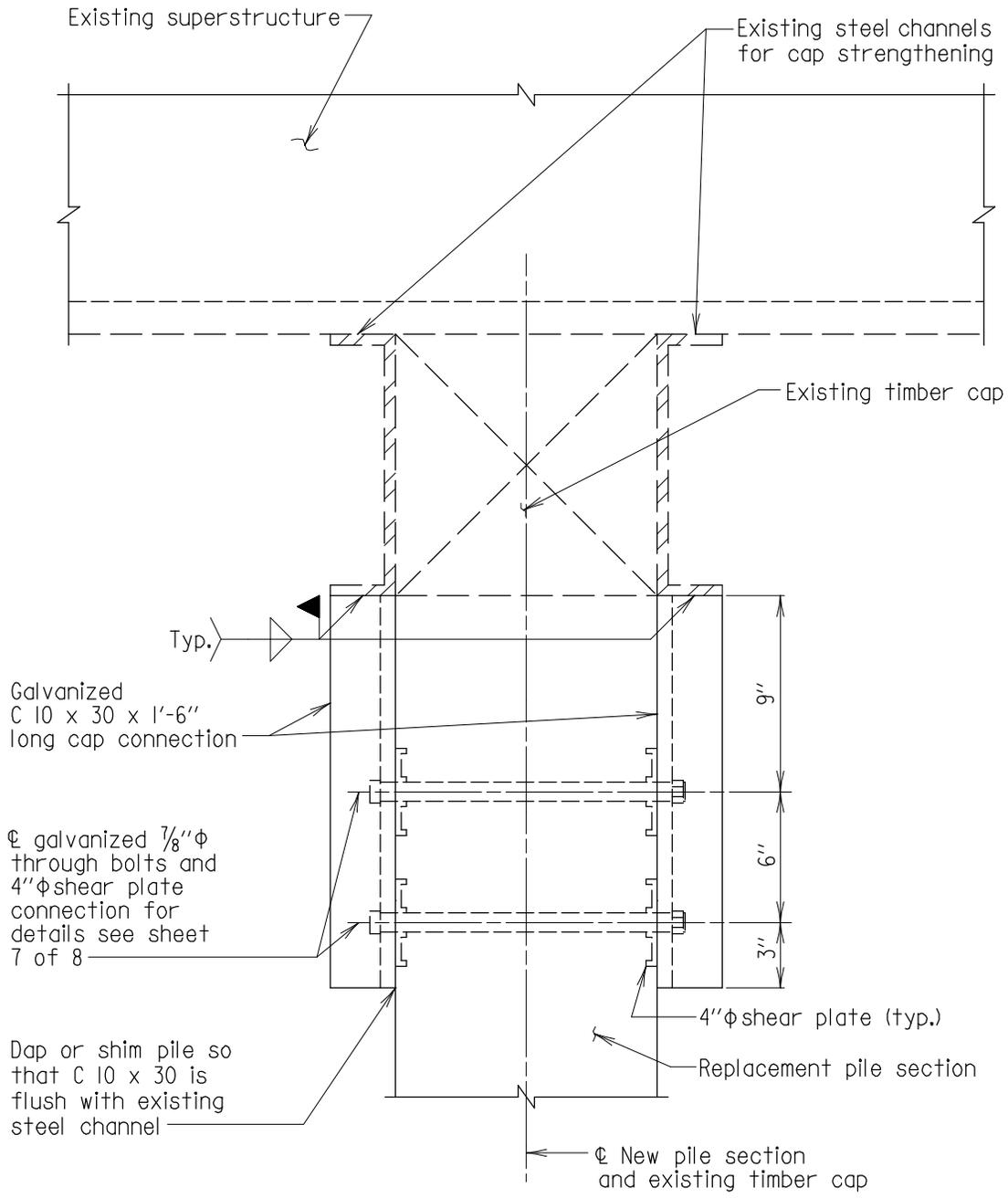
Scale:  $\frac{3}{4}'' = 1'-0''$

Notes:

1. All steel plates, bolts, nuts, etc. shall be mechanically or hot dipped galvanized to conform to ASTM A 153.
2. Shims shall be galvanized ASTM A 709 Grade 50 steel.
3. All galvanized material shall be off-vented a minimum of 24 days before installation.
4. This detail is not designed to transfer cap loads to the pile.
5. Areas of field welding and drilling shall be repaired with a galvanized touch up kit conforming to ASTM A 780.
6. All field drilled holes in the piles shall have a compatible preservative treatment applied to them before bolting.
7. For Section B-B see sheet 6 of 8.

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1.0

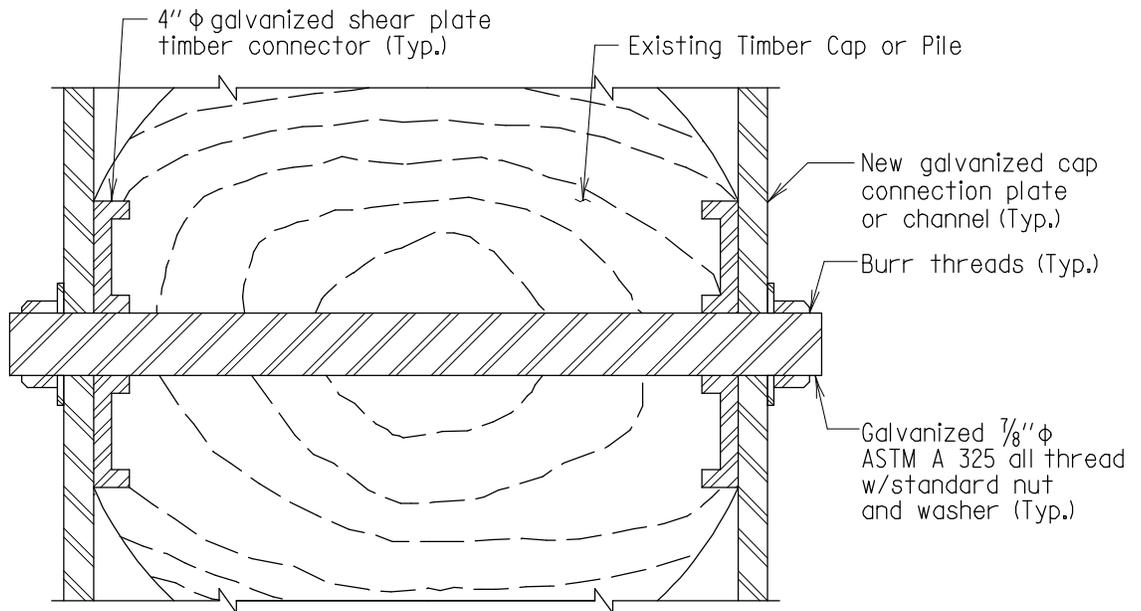
STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
CONNECTION OF NEW TIMBER PILE SECTION TO EXISTING STEEL CHANNEL STRENGTHENED TIMBER CAP
DETAIL NO. SR-SUB-201
SHEET <u>5</u> OF <u>8</u>



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

<p style="text-align: center;"><b>APPROVAL</b></p> <p><i>Gene C. Washburn</i> - DIRECTOR          OFFICE OF STRUCTURES</p> <p>DATE: 06/28/2017</p> <hr/> <p style="text-align: center;"><b>VERSION</b></p> <p style="text-align: center;">1.0</p>	<p>STATE OF MARYLAND          DEPARTMENT OF TRANSPORTATION          STATE HIGHWAY ADMINISTRATION          OFFICE OF STRUCTURES</p> <p>CONNECTION OF NEW TIMBER PILE SECTION          TO EXISTING STEEL CHANNEL STRENGTHENED          TIMBER CAP</p> <p>DETAIL NO. SR-SUB-201</p>
<p>SHEET <u>6</u> OF <u>8</u></p>	

STRUCTURAL REPAIRS



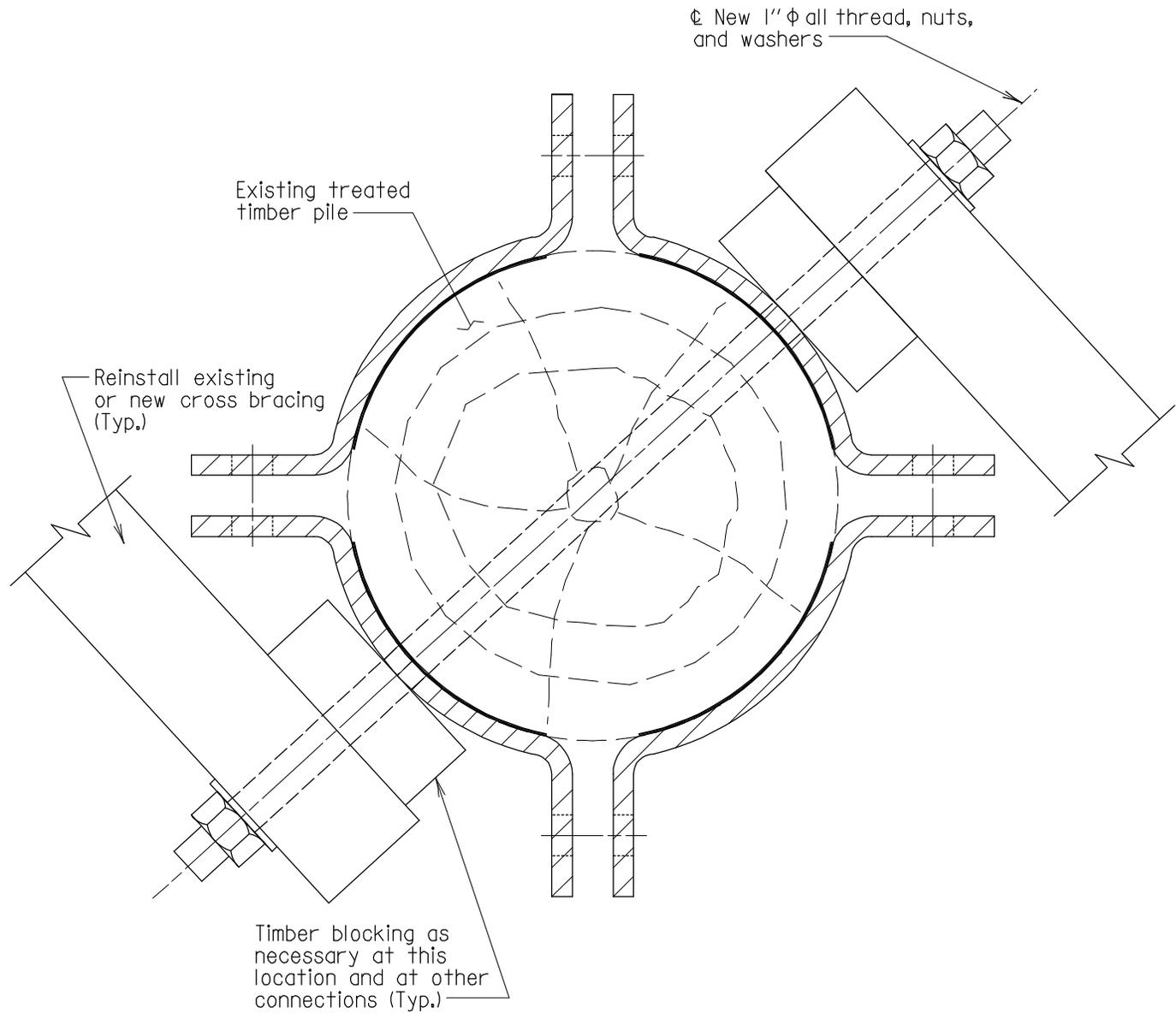
TYPICAL THROUGH BOLT CONNECTION

Scale:  $\frac{3}{8}$ " = 1"

APPROVAL
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DATE: 06/28/2017
VERSION
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
CONNECTION OF NEW TIMBER PILE SECTION TO EXISTING STEEL CHANNEL STRENGTHENED TIMBER CAP
DETAIL NO. SR-SUB-201
SHEET <u>7</u> OF <u>8</u>

STRUCTURAL REPAIRS



4 SECTION SPLICE CROSS BRACING DETAIL

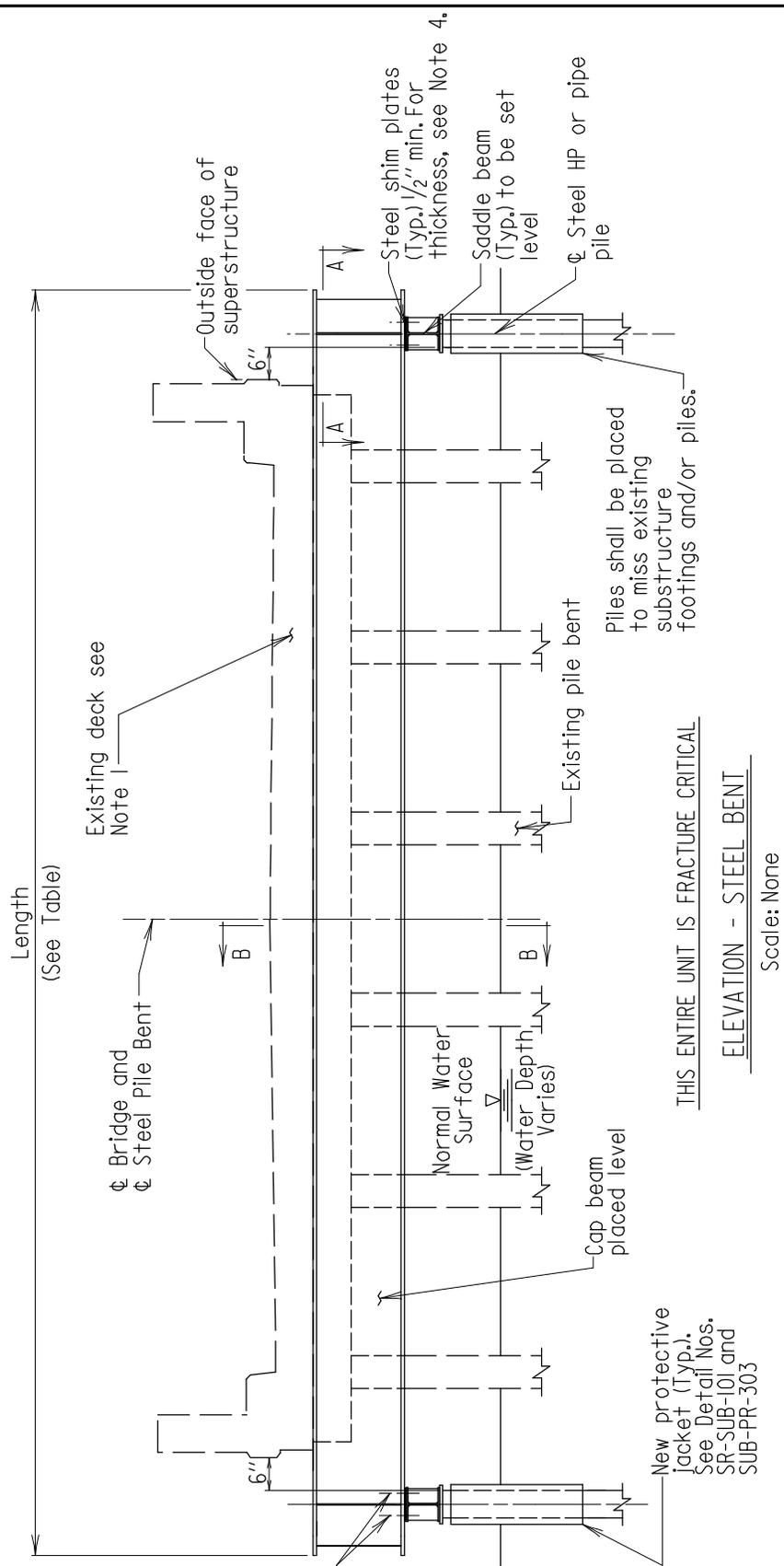
Scale: 1/2" = 1'-0"

Note:  
Refer to the General Plan and Elevation to see whether new cross bracing is required and at which locations.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
SPLICE FOR CONNECTING EXISTING TIMBER PILING TO NEW TIMBER PILING CROSS BRACING DETAILS
DETAIL NO. SR-SUB-201
SHEET <u>8</u> OF <u>8</u>

STRUCTURAL REPAIRS



THIS ENTIRE UNIT IS FRACTURE CRITICAL

ELEVATION - STEEL BENT

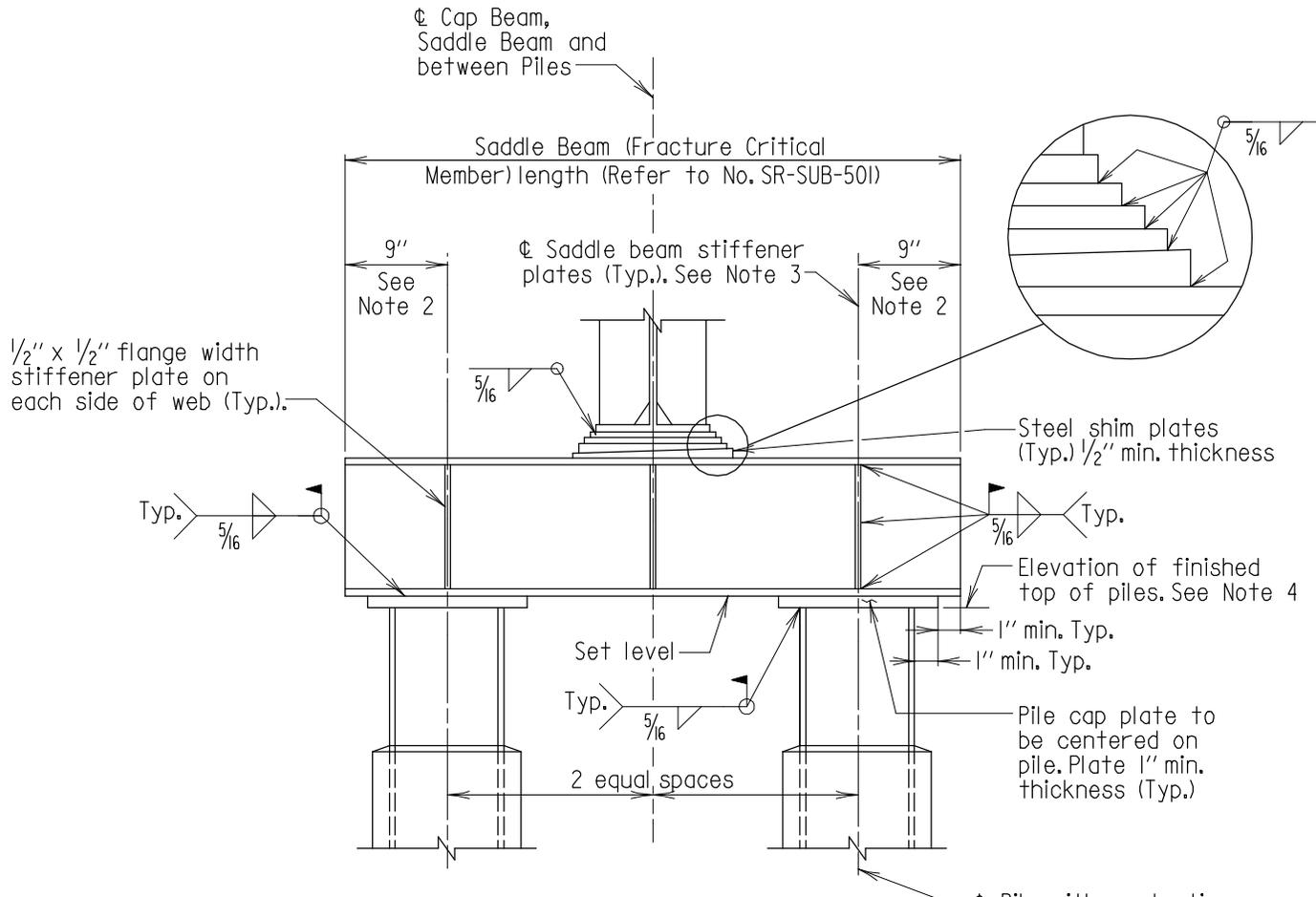
Scale: None

Notes:

1. Provide 1"φ bolts through existing concrete slab or timber/concrete deck. For details of installation, see sht. 4. For location of bolts, see "Typical Cap Beam Top Flange Plan" on sht. 5.
2. For details of cap, see "Typical Cap Beam Elevation" on sht. 5.
3. For details of HP section, see "Typical Saddle Beam Elevation" on sht. 2.
4. The Contractor is responsible for achieving a solid bearing of the existing superstructure onto the new steel cap beam. This shall be accomplished by insertion of the steel shim wedge plates between the flanges of the cap beam and the superstructure. The steel shim wedge plates shall be placed at 3'-0" maximum c/c along the cap beam and shall be in full contact with the cap beam flange.
5. If piles are placed in water, a new protective jacket shall be installed.
6. For materials list see Detail No. SR-SUB-501.
7. For "Section A-A" see sheet 3, for "Section B-B" see sheet 4.

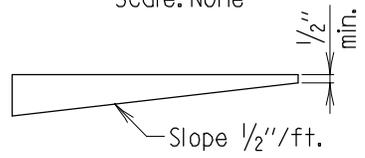
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DIRECTOR OFFICE OF STRUCTURES	
DATE: 06/28/2017	
VERSION	
1.0	

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
STEEL REPLACEMENT/TEMPORARY BENT FOR TIMBER/CONCRETE COMPOSITE OR CONCRETE SLAB BRIDGES	
DETAIL NO. SR-SUB-301	SHEET <u>1</u> OF <u>6</u>



TYPICAL SADDLE BEAM ELEVATION

Scale: None



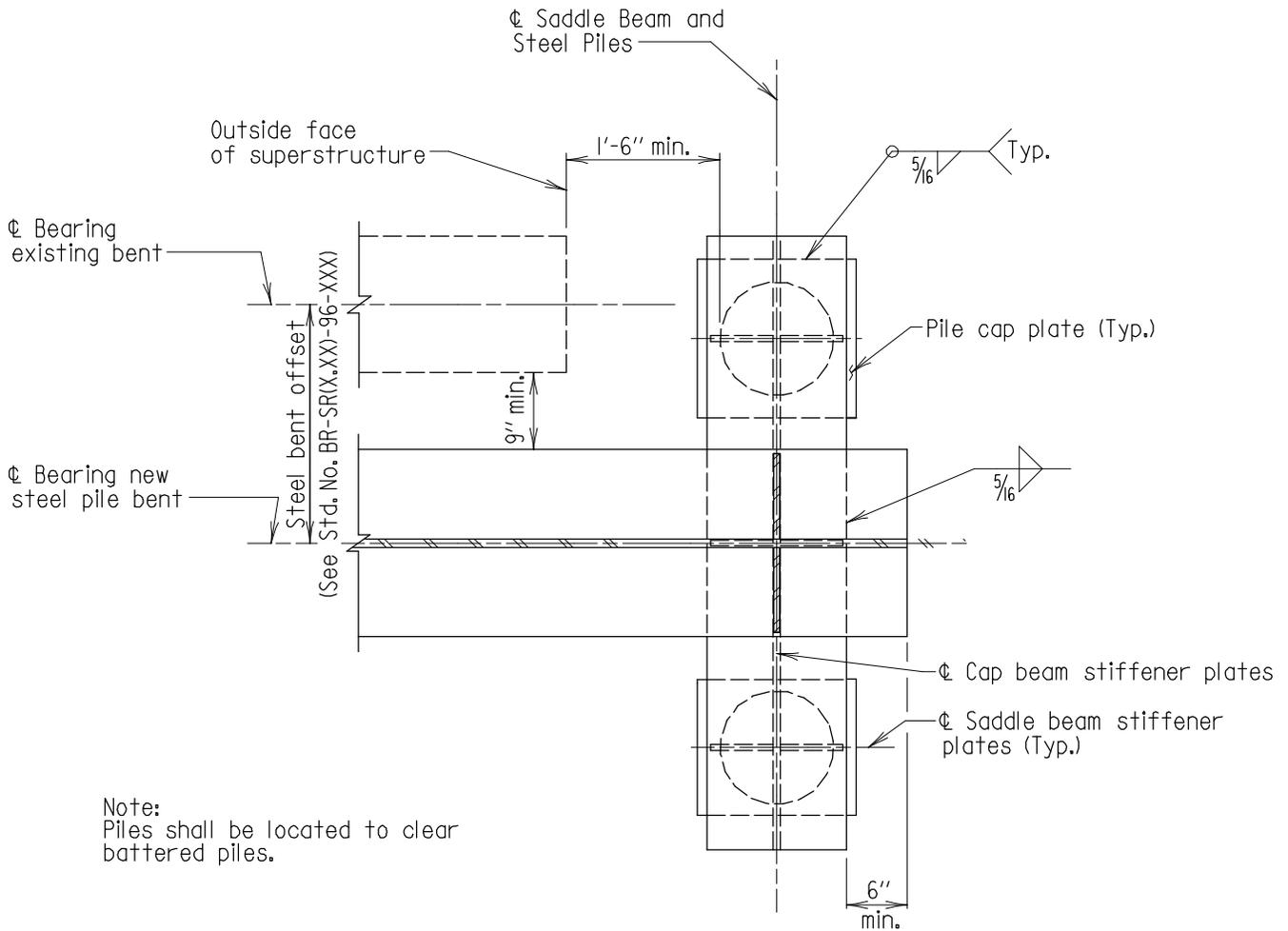
WEDGE DETAIL

Scale: None

- Notes:
- Existing bent and bolts not shown for clarity.
  - Contractor shall verify in the field, prior to welding, the positions of the stiffener plates and adjust, as necessary, so that the plates are located at the centerline of the piles and centerline of cap beam.
  - The top shim plate shall be 1" longer on each side than the flange.
  - Each consecutive descending plate shall be 1" wider and longer than the previous plate all around.
  - The wedges shall be 3" longer and 1" wider than the bottom plate.
  - For weld termination on stiffeners, see SUP-SS(GEN)-203. Clip corners of stiffeners 1" horizontal and 1/2" vertical.
  - Elevation of finished top of piles shall be determined in the field. Piles shall be cut off level and ground to a smooth, flat surface. The elevation shall be set to keep the height of stacked plates to a minimum.

<p style="text-align: center;"><b>APPROVAL</b></p> <p><i>Gene C. [Signature]</i> DIRECTOR OFFICE OF STRUCTURES</p> <p>DATE: 06/28/2017</p>	<p><b>STATE OF MARYLAND</b> <b>DEPARTMENT OF TRANSPORTATION</b> <b>STATE HIGHWAY ADMINISTRATION</b> <b>OFFICE OF STRUCTURES</b></p> <p>STEEL REPLACEMENT/TEMPORARY BENT FOR TIMBER/CONCRETE COMPOSITE OR CONCRETE SLAB BRIDGES</p>
<p style="text-align: center;"><b>VERSION</b></p> <p style="text-align: center;">1.0</p>	<p>DETAIL NO. SR-SUB-301</p> <p style="text-align: right;">SHEET <u>2</u> OF <u>6</u></p>

STRUCTURAL REPAIRS



Note:  
Piles shall be located to clear battered piles.

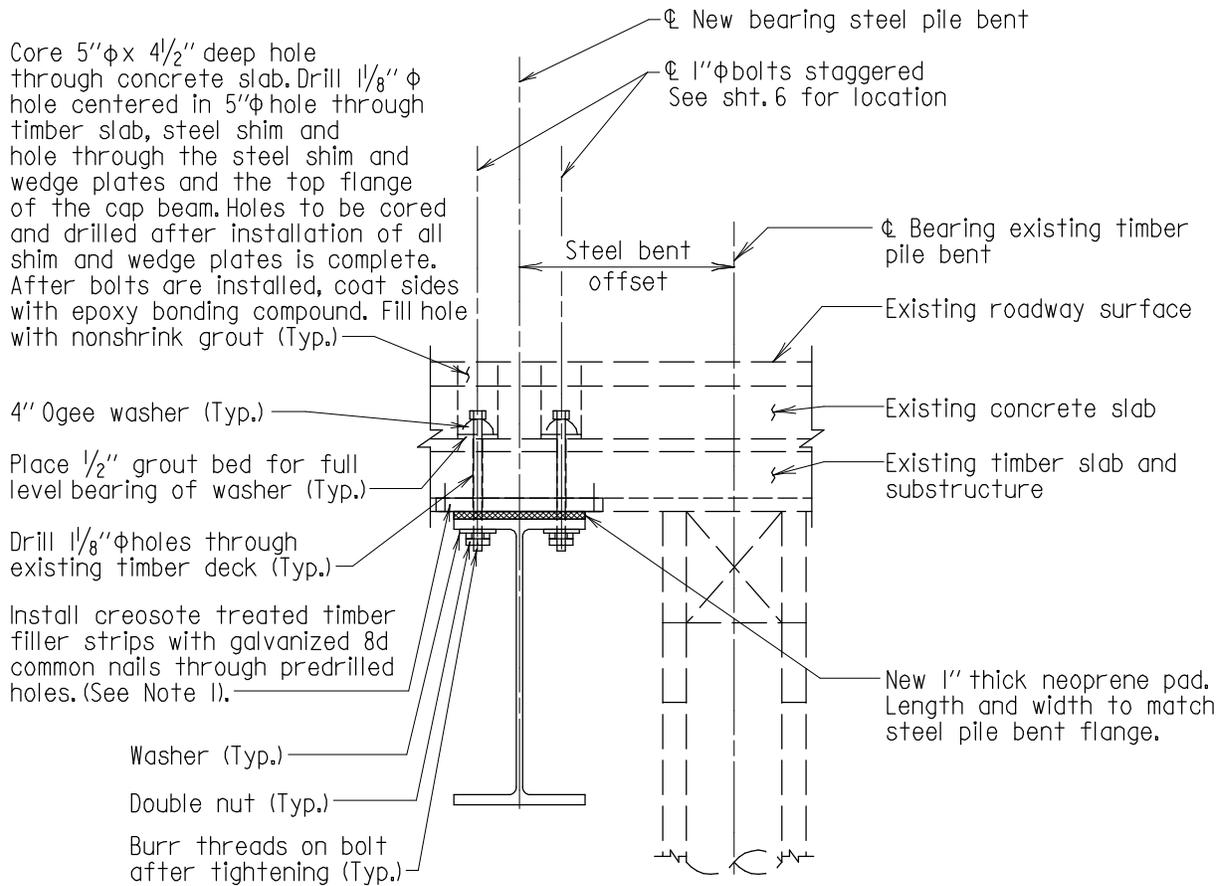
SECTION A-A

Scale: None

Note:  
 Ⓞ of new steel pile bent to be parallel to Ⓞ of existing bent (if applicable).  
 Ⓞ of saddle beam to be parallel to L of existing bridge.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES	
STEEL REPLACEMENT/TEMPORARY BENT FOR TIMBER/CONCRETE COMPOSITE OR CONCRETE SLAB BRIDGES	
DETAIL NO. SR-SUB-301	SHEET <u>3</u> OF <u>6</u>



SECTION B-B (TIMBER CONCRETE COMPOSITE)

Scale: None

Notes:

1. Creosote treated timber filler strips shall be sized to fit the gap between the staggered timbers. The length shall be measured along the centerline of the road, and shall be the cap beam flange width +4" minimum on each side.
2. Saddle beam not shown for clarity.

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1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
ATTACHMENTS OF STEEL REPLACEMENT/TEMPORARY BENT CAP FOR TIMBER/CONCRETE COMPOSITE BRIDGES
DETAIL NO. SR-SUB-301
SHEET 4 OF 6

Core 5"  $\phi$  x 4 1/2" deep hole through concrete slab. Core 1/2"  $\phi$  hole centered in 5"  $\phi$  hole through the remaining concrete slab. Drill a 1/8"  $\phi$  hole, centered in the 1/2"  $\phi$  hole through the steel shim and wedge plates and the top flange of the cap beam. Holes to be cored and drilled after installation of all shim and wedge plates is complete. After bolts are installed, coat sides with epoxy bonding compound. Fill hole with nonshrink grout (Typ.)

4" Ogee washer (Typ.)

Place 1/2" grout bed for full level bearing of washer (Typ.)

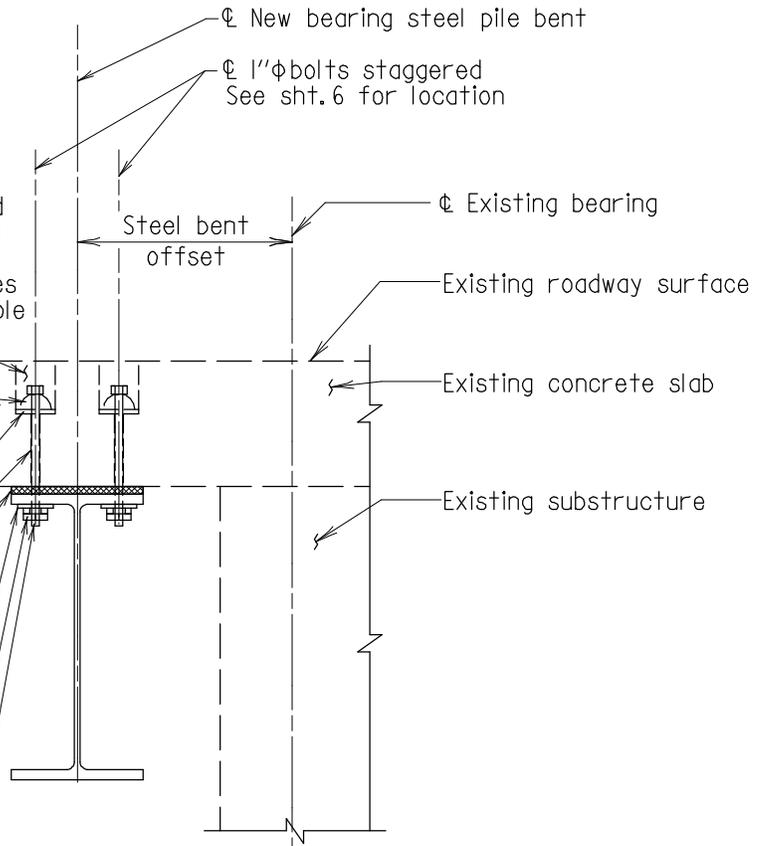
Drill 1/8"  $\phi$  holes through existing concrete deck (Typ.)

New 1" thick neoprene pad. Length and width to match steel pile bent flange.

Washer (Typ.)

Double nut (Typ.)

Burr threads on bolt after tightening (Typ.)



SECTION B-B (CONCRETE SLAB)

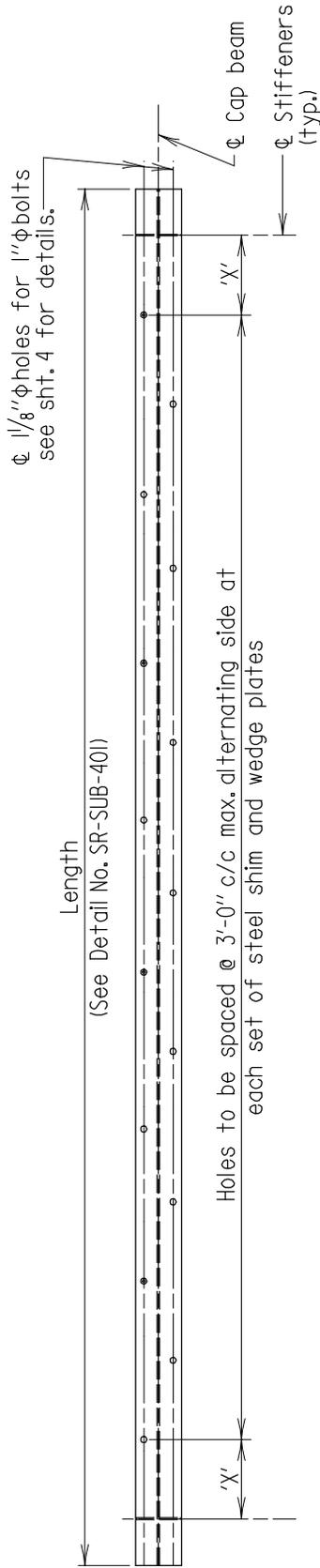
Scale: None

Notes:

1. Cresote treated timber filler strips shall be sized to fit the gap between the staggered timbers. The length shall be measured along the centerline of the road, and shall be the cap beam flange width +4" minimum on each side.
2. Saddle beam not shown for clarity.

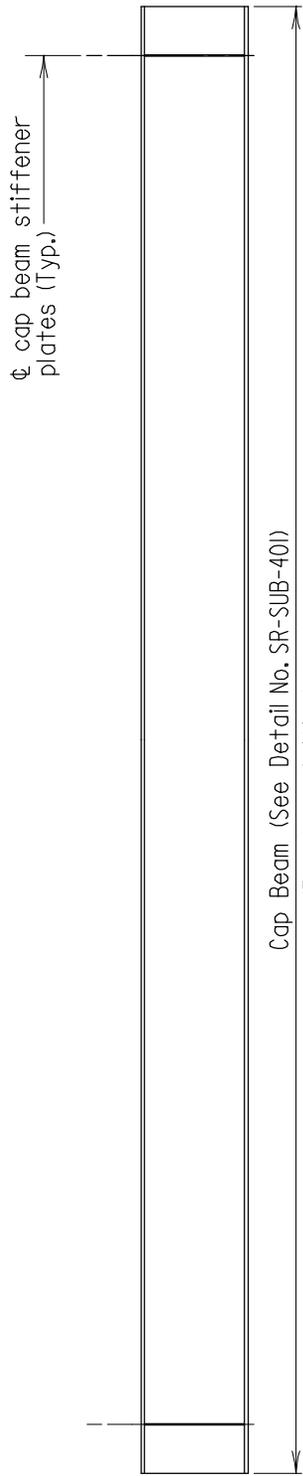
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<i>Ben C. [Signature]</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 06/28/2017
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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
ATTACHMENTS OF STEEL REPLACEMENT/TEMPORARY BENT FOR CONCRETE SLAB BRIDGES
DETAIL NO. SR-SUB-301
SHEET <u>5</u> OF <u>6</u>



TYPICAL CAP BEAM TOP FLANGE PLAN

Scale: None



TYPICAL CAP BEAM ELEVATION

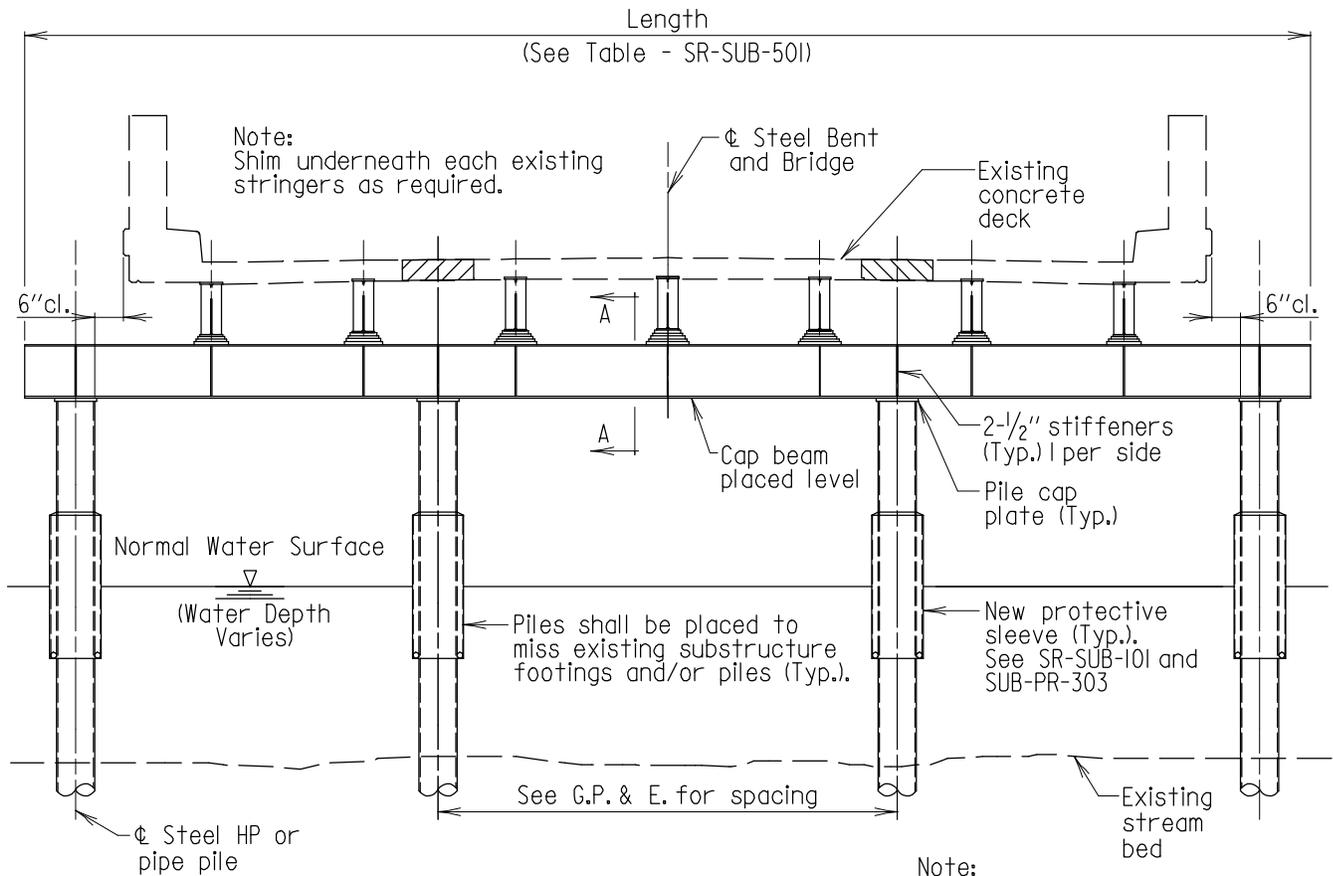
Scale: None

Notes:

1. The cap beam shall be installed with the natural mill camber up.
2. Contractor shall verify in the field, prior to welding, the positions of the stiffener plates and adjust, as necessary, such that the plates are located at the centerline of the saddle beam.
3. For weld termination on stiffeners, see SUP-SS(GEN)-203. All welds shall be 5/16 fillets. Clip corners of stiffeners at fillets 1" horizontal and 1/2" vertically.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
STEEL REPLACEMENT/TEMPORARY BENT FOR TIMBER/CONCRETE COMPOSITE OR SLAB BRIDGES
DETAIL NO. SR-SUB-301
SHEET <u>6</u> OF <u>6</u>



ELEVATION - STEEL BENT

Scale: None

Note:  
Existing superstructure  
shown dashed.

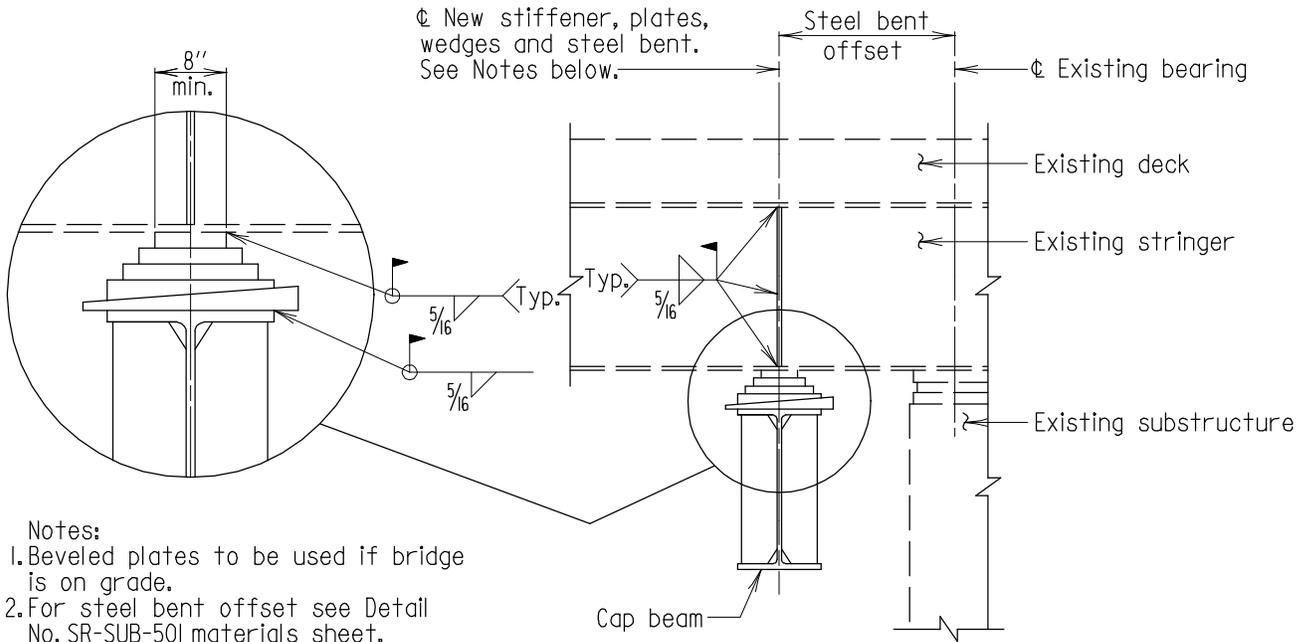
Notes:

1. The Contractor shall saw cut the top 1" depth of concrete for holes through the concrete deck for pile driving.
2. The holes in the deck shall be 2'-0" x 2'-0" maximum.
3. Cut and bend existing reinforcement to allow driving of piles. After piles are driven, bend the bars back to original location and splice according to REBAR-ER-101.
4. Any deck reinforcement damaged during the pile driving operation shall be repaired or replaced using REBAR-ER-101.
5. New pile bent cap beam shall be placed so that the lowest stringer is 1/2" above the top flange of the cap.
6. If piles are placed in water, a new protective jacket shall be installed.
7. For materials list, see Detail No. SR-SUB-501.

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STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
STEEL REPLACEMENT/TEMPORARY BENT FOR STEEL STRINGER BRIDGES
DETAIL NO. SR-SUB-401
SHEET <u>1</u> OF <u>3</u>

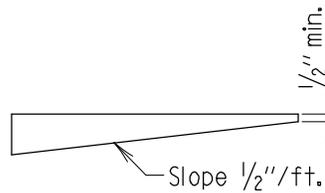
STRUCTURAL REPAIRS



- Notes:
1. Beveled plates to be used if bridge is on grade.
  2. For steel bent offset see Detail No. SR-SUB-50I materials sheet.

SECTION A-A

Scale: None



WEDGE DETAIL

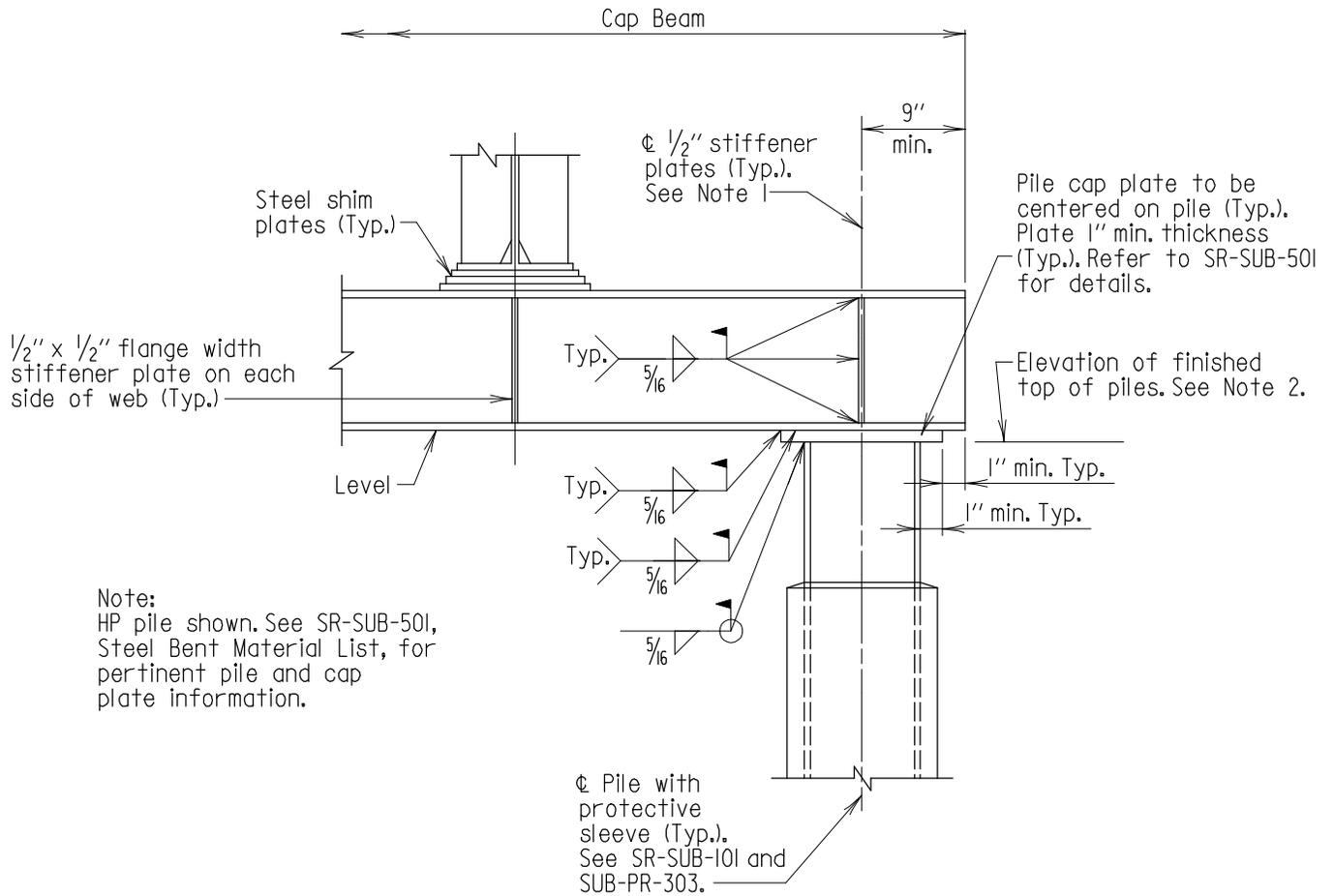
Scale: None

Notes:

1. The top plate shall be 1" longer on each side than the existing flange is wide and a minimum 8" wide.
2. Each consecutive descending plate shall be 1" wider and longer than the previous plate all around.
3. All wedges shall be at least 3" longer and 1" wider than the bottom plate.
4. Wedges shall be used in pairs.
5. Tack weld all plates together until the last wedge is driven.
6. One plate in each stack shall have a 1/2" minimum thickness. All other plates shall have a 1" minimum thickness.
7. The height of the stacked plates shall be a maximum of 6".
8. For weld termination on stiffeners, see Detail No. SUP-SS(GEN)-203. Clip corners of stiffeners 1" horizontal and 1/2" vertical.

APPROVAL
<i>Ben C. [Signature]</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 06/28/2017
VERSION
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
STEEL REPLACEMENT/TEMPORARY BENT DETAILS STEEL STRINGER BRIDGES
DETAIL NO. SR-SUB-40I
SHEET <u>2</u> OF <u>3</u>



Note:  
 HP pile shown. See SR-SUB-501, Steel Bent Material List, for pertinent pile and cap plate information.

PILE ELEVATION

Scale: None

Notes:

- For weld termination on stiffeners, see SUP-SS(GEN)-203. Clip corners of stiffeners 1" horizontal 2" vertical.
- Elevation of finished top of piles shall be determined in the field. Piles shall be cut off level and ground to a smooth, flat finish.

APPROVAL
 DIRECTOR OFFICE OF STRUCTURES DATE: 06/28/2017
VERSION
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
STEEL REPLACEMENT/TEMPORARY BENT DETAILS STEEL STRINGER BRIDGES
DETAIL NO. SR-SUB-401
SHEET <u>3</u> OF <u>3</u>

STEEL PILE BENT TABLE

STEEL BENT CAP BEAM	
Beam Size	
Girder Web	
Girder Flanges	
Weld Size (Flange to Web)	
Stiffener Size	
Steel Grade	
Length	
'X'	
Steel Bent Offset	

SADDLE BEAM	
Beam Size	
Stiffener Size	
Beam Length	

PILE	
Size and Type	
Pile Cap Plate	

EXISTING STRINGER	
Stiffener Size	

For Steel Stringers Only

<b>APPROVAL</b>
<i>Gene C. [Signature]</i> DIRECTOR OFFICE OF STRUCTURES
DATE: 06/28/2017
<b>VERSION</b>
1.0

STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
STEEL REPLACEMENT/TEMPORARY BENT MATERIAL LIST
DETAIL NO. SR-SUB-501 <span style="float: right;">SHEET <u>  </u> OF <u>  </u></span>

STRUCTURAL REPAIRS