Chapter 11 - Structural Repairs

SECTION 04

SUBSTRUCTURE REPAIRS (SR-SUB)
Tongue & groove, self locking vertical closure joint and "14 x 11/2" stainless steel screws

1:1 slope

Existing concrete strut at waterline

2" min. cl. (Typ.)

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

FIBERGLASS PROTECTIVE PILE JACKET
FOR EXISTING PILES WITH CONCRETE STRUT
Proposed fiberglass protective pile jacket

Existing round pile shell

Calvanized wire mesh
3" x 3" - W 1.4 x W 1.4

High strength grout

2" high slab bolster upper, full length spaced as shown (Typ.)

Tongue and groove self locking vertical closure joint

Existing round pile and proposed fiberglass protective pile jacket

Flow

14 x 1 1/2"
stainless steel screw
spaced 6" c/c

3/16" min.
thickness

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

**FIBERGLASS PROTECTIVE PILE JACKET FOR EXISTING SQUARE PILES**

**1.** Existing pile reinforcing steel not shown.

**2.** Existing piles shall be cleaned a maximum of 24 hours prior to placement of jacket and high-strength grout.

**3.** The closure joint shall not protrude more than 1" from either inside or outside face of the jacket.

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**Notes:**

1. Existing pile reinforcing steel not shown.
2. Existing piles shall be cleaned a maximum of 24 hours prior to placement of jacket and high-strength grout.
3. The closure joint shall not protrude more than 1" from either inside or outside face of the jacket.
NYLON FORM PROTECTIVE PILE JACKET
AT EXISTING PILES

Clamping device (top and bottom, Typ.)
Tremie port (Typ.)
Nylon form
Mean water level

Refer to datum in elevation view on title sheet

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

Note:
External bands to minimize bulging of form not shown.
NYLON FORM PROTECTIVE PILE JACKET FOR EXISTING ROUND PILES

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

Galvanized wire mesh
3" x 3" - W 1.4 x W 1.4

High strength grout

Brass zipper

Existing round pile shell

Full length standoff, spaced as shown

Proposed nylon form

Tremie ports

Existing round pile and proposed zippered nylon form protective pile jacket

Flow

STATE HIGHWAY ADMINISTRATION
DEPARTMENT OF TRANSPORTATION
STATE OF MARYLAND
OFFICE OF STRUCTURES
DETAIL NO. SR-SUB-102
SHEET 2 OF 3
VERSION 1.0

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

VERSION

STATE HIGHWAY ADMINISTRATION
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NYLON FORM PROTECTIVE PILE JACKET FOR EXISTING ROUND PILES

NOTES:
1. Existing pile reinforcing steel not shown.
2. Existing piles shall be cleaned a maximum of 24 hours prior to placement of jacket and high-strength grout.
3. Fluted pile shown.
NYLON FORM PROTECTIVE PILE JACKET FOR EXISTING REINFORCED CONCRETE PILES

**SECTION**

Scale: None

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

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/ft² retention in conformance with AASHTO M 133.
5. For "Section A-A" see sheet nos. 2 and 3 of 8.
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.
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.
**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
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CONNECTION OF NEW TIMBER PILE SECTION TO EXISTING TIMBER CAP

DETAIL NO. SR-SUB-201

SHEET 4 OF 8
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.

For Section B-B see sheet 6 of 8.
SECTION B-B

Scale: $\frac{5}{2}'' = 1'-0''$

Existing superstructure

Existing steel channels for cap strengthening

Existing timber cap

Typ.

Existing timber cap

Galvanized C 10 x 30 x 1'-6'' long cap connection

6'' galvanized $\frac{3}{4}''$ through bolts and 4'' shear plate connection for details see sheet 7 of 8

Dap or shim pile so that C 10 x 30 is flush with existing steel channel

4'' shear plate (typ.)

Replacement pile section

4'' shear plate (typ.)

& New pile section and existing timber cap

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DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

CONNECTION OF NEW TIMBER PILE SECTION TO EXISTING STEEL CHANNEL STRENGTHENED TIMBER CAP

DATE: 06/29/2017

VERSION

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DETAIL NO. SR-SUB-201 SHEET 6 OF 8
TYPICAL THROUGH BOLT CONNECTION

Scale: 3/8" = 1"

4" galvanized shear plate timber connector (Typ.)

Existing Timber Cap or Pile

New galvanized cap connection plate or channel (Typ.)

Burr threads (Typ.)

Galvanized 7/8" ASTM A 325 all thread w/standard nut and washer (Typ.)

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CONNECTION OF NEW TIMBER PILE SECTION TO EXISTING STEEL CHANNEL STRENGTHENED TIMBER CAP

DATE: 06/28/2017

VERSION 1.0
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.

New 1" all thread, nuts, and washers

Reinstall existing or new cross bracing (Typ.)

Existing treated timber pile

Timber blocking as necessary at this location and at other connections (Typ.)

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OFFICE OF STRUCTURES

DATE: 06/28/2017
VERSION 1.0

SPLICE FOR CONNECTING EXISTING TIMBER PILING TO NEW TIMBER PILING CROSS BRACING DETAILS

DETAIL NO. SR-SUB-201 SHEET 8 OF 8
ELEVATION - STEEL BENT

THIS ENTIRE UNIT IS FRACTURE CRITICAL

Notes:
1. Provide 1/2" 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" 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.
1. 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.

2. The top shim plate shall be 1" longer on each side than the flange.

3. Each consecutive descending plate shall be 1" wider and longer than the previous plate all around.

4. The wedges shall be 3" longer and 1" wider than the bottom plate.

5. For weld termination on stiffeners, see SUP-SS(GEN)-203. Clip corners of stiffeners 1" horizontal and 1/2" vertical.

6. 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.
Note:
Piles shall be located to clear battered piles.

Note:
$\frac{1}{2}$ of new steel pile bent to be parallel to $\frac{1}{2}$ of existing bent (if applicable),
$\frac{1}{2}$ of saddle beam to be parallel to $L$ of existing bridge.

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

STEEL REPLACEMENT/TEMPORARY BENT FOR TIMBER/CONCRETE COMPOSITE OR CONCRETE SLAB BRIDGES

APPROVAL

DATE: 06/28/2017
VERSION
1.0

DETAIL NO. SR-SUB-301

SHEET 3 OF 6
Core 5" x 4 1/2" deep hole through concrete slab. Drill 1/4" hole centered in 5" hole through timber slab, steel shim and 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.)

New bearing steel pile bent

1" bolts staggered

See sh. 6 for location

4" Ogee washer (Typ.)

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

Drill 1/4" holes through existing timber deck (Typ.)

Install creosote treated timber filler strips with galvanized 8d common nails through predrilled holes.(See Note 1).

Washer (Typ.)

Double nut (Typ.)

Burr threads on bolt after tightening (Typ.)

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.
SECTION B-B (CONCRETE SLAB)

Scale: None

Core 5"x 4 1/2" deep hole through concrete slab. Core 1/2" Ø hole centered in 5" Ø hole through the remaining concrete slab. Drill a 1/2" Ø hole, centered in the 1/2" Ø 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" Ø 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.)

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.
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 tip 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 1/2" vertically.

Holes to be spaced @ 3'-0" c/c max, alternating side at each set of steel shim and wedge plates.
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 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.
States:  
1. Beveled plates to be used if bridge is on grade. 
2. For steel bent offset see Detail No. SR-SUB-501 materials sheet.

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 ½'' 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-SSIGEN-203. Clip corners of stiffeners 1'' horizontal and ½'' vertical.
Notes:
1. For weld termination on stiffeners, see SUP-SS(GEN)-203. Clip corners of stiffeners 1" horizontal 2" vertical.
2. 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.

State Highway Administration
Department of Transportation
State of Maryland
Office of Structures

Steel Replacement/Temporary Bent Details
Steel Stringer Bridges

Detail No. SR-SUB-401
Sheet 3 of 3

Date: 06/28/2017
Version 1.0

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

## Steel Bent Cap Beam

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<tr>
<th>Item</th>
<th>Detail</th>
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<tbody>
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<td>Beam Size</td>
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<tr>
<td>Girder Web</td>
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<tr>
<td>Girder Flanges</td>
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<td>Weld Size (Flange to Web)</td>
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<tr>
<td>Stiffener Size</td>
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<tr>
<td>Steel Grade</td>
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<tr>
<td>Length</td>
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<td>'X'</td>
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<td>Steel Bent Offset</td>
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## Saddle Beam

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<tbody>
<tr>
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<td>Stiffener Size</td>
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<td>Beam Length</td>
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## Pile

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<tbody>
<tr>
<td>Size and Type</td>
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<td>Pile Cap Plate</td>
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## Existing Stringer

For Steel Stringers Only

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<th>Detail</th>
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<tbody>
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