**PRESTRESSED CONCRETE PILE NOTES:**

1. Work this Index with the Square Prestressed Concrete Pile Splices (Index 22601), the Prestressed Concrete Pile Standards (Index 22612, 22614, 22618, 22624, 22630, and the Pile Data Table in the Structures Plans.

2. Concrete:
   A. Piles: Class V (Special)
   B. Silica Fume: See "GENERAL NOTES" in the Structures Plans for locations where the use of silica fume, metakaolin or ultra-fine flyash is required for options using stainless steel strand and reinforcing.

3. Concrete strength at time of prestress transfer:
   A. Piles: 4,000 psi minimum.

4. Reinforcing:
   A. Bars:
      a. Stainless Steel: Meet the requirements of Specification Section 931 for Type 304, Grade 75.
      b. Carbon FRP: Meet the requirements of Specification Section 932.
   B. Prestressing Strands:
      a. Stainless Steel: Seven-wire HSSS, UNS S32205 (Type 2205) or UNS S31803 strand, meeting the requirements of specification Section 933.
      b. Carbon FRP: Meet the requirements of Specification Section 933.

5. Spiral Ties:
   A. Tie each wrap of the spiral strand to a minimum of two corner strands.
   B. One full turn required for spiral splices.

6. Pile Splices: Fill dowel holes and form the joint between pile sections with a Type AB Epoxy Compound in accordance with Specification Section 962. Use an Epoxy Bonding Compound or an Epoxy Mortar as recommended by the Manufacturer.

---

### TABLE OF MAXIMUM PILE PICK-UP AND SUPPORT LENGTHS

<table>
<thead>
<tr>
<th>D = Square Pile Size (inches)</th>
<th>Required Storage and Transportation Detail</th>
<th>Pick-Up Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>2, 3, or 4 point</td>
<td>1 Point</td>
</tr>
<tr>
<td>14</td>
<td>2, 3, or 4 point</td>
<td>2 Point</td>
</tr>
<tr>
<td>18</td>
<td>2, 3, or 4 point</td>
<td>3 Point</td>
</tr>
<tr>
<td>24</td>
<td>2, 3, or 4 point</td>
<td>3 Point</td>
</tr>
<tr>
<td>30</td>
<td>2, 3, or 4 point</td>
<td>3 Point</td>
</tr>
</tbody>
</table>

---

**NOTES AND DETAILS FOR SQUARE CFRP & SS PRESTRESSED CONCRETE PILES**

---

**TYPICAL PILE SHAPE FOR MOLD FORMS**

**DETAILED SHOWING TYPICAL COVER**
NOTES:
1. For Sections D-D, & E-E, see Index Nos. 22612, 22614, 22618, 22624 or 22630 for applicable concrete pile size and Pile Splice Reinforcement Details.
2. Prestressing strands, spiral ties and/or reinforcement are not shown for clarity.
3. In cases where pile splices are desired due to length limitations in shipping and/or handling, the "Drivable Preplanned Prestressed Precast Splice Detail" shall be used.
4. When preformed dowel holes are utilized, the 1" spiral tie pitch shall be continued to 4'-0" below the head of the pile, See Index Nos. 22618, 22624. Preformed holes shall be either removable preforming material or stay-in-place corrugated galvanized steel ducts. Stay-in-place ducts shall be fabricated from galvanized sheet steel meeting the requirements of ASTM A653, Coating Designation G90, 26 gauge. Ducts shall be 1/2" diameter for CFRP Bars, and 1" diameter for SS Bars with a minimum corrugation (rib) height of 0.12 in. Ducts shall be fabricated with either welded or interlocked seams. Galvanizing of welded seams will not be required.
5. For tension piles where top of Prestressed Pile is less than 3 feet below Pile Cut-off Elevation, extend No. 6 CFRP Bars or No. 10 SS into cap beyond Pile Cut-off Elevation to achieve development as approved by the Engineer.

DETAIL A

DRIVABLE UNFORESEEN REINFORCED PRECAST PILE SPICE DETAIL

DRIVABLE PREPLANNED PRESTRESSED PRECAST PILE SPICE DETAIL

NONDRIVABLE UNFORESEEN REINFORCED C-I-P PILE BUILD-UP DETAIL

TYPICAL SPLICE BEFORE BONDING

No chamfer, flat surface required

1⅜" Ø Drilled or preformed holes for CFRP Bars, or 1⅝" Ø Drilled or preformed holes for SS Bars (see Splice Details)

See Note No. 4

Full epoxy compound joint to fill hole with Bars in place

No. 6 CFRP Bars or No. 10 SS Bars

Extended into Cap/ Footing to Pile cut-off Elevation, See Note 5.

Bent Cap, Pile Cap or Footing

C-I-P Concrete

Top of Prestressed Pile

Pile Cut-off Elevation

5'-4" Max

4'-9" (Typ.)

No. 6 CFRP Bars or No. 10 SS Bars

Driven prestressed pile

Bar extension

Splice section

27'-9" Maximum Pile Build-up

No. 6 CFRP Bars or No. 10 SS Bars

Driven prestressed pile

Bar extension

Splice section

10'-6" (SS Bars Only)

10'-6" (SS Bars)

4'-6" (CFRP Bars)

Splice section

10'-6" (SS Bars)

4'-6" (CFRP Bars)

Full length of Build-up

Driven prestressed pile

Bar extension

See Detail A

See Detail A

Full epoxy compound joint

No. 6 CFRP Bars or No. 10 SS Bars

Preformed holes, 4'-2" (SS Option) or 4'-8" (CFRP Option) long, in driven pile (see Note No. 6)

No. 6 CFRP Bars or No. 10 SS Bars

Pile Cut-off Elevation

5'-0" Max.

C-I-P Pile Build-up

4'-6" (Typ.)

1" Cover at End

1" Cover at End

C-I-P Concrete

Auxiliary SS reinforcing Bars cast with pile. See Section F-F; Not Required for CFRP Prestressed Pile Option.
**ALTERNATE STRAND PATTERNS**

- **4 ~ 0.6" Ø, CFRP 7-Strand, at 42 kips**
- **4 ~ ½" Ø, CFRP Single-Strand, at 41 kips**

**SECTION A-A**

1. Work this Index with Index No. 22600 - Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index No. 22601 - Square CFRP & SS Prestressed Concrete Pile Splices.
2. Any of the given Alternate Strand Patterns may be utilized.

**NOTES:**
- See Alternate Strand Patterns
SS PRESTRESSED PILE DETAILS

NOTES:
1. Work this Index with Index No. 22600 - Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index No. 22601 - Square CFRP & SS Prestressed Concrete Pile Splices.
2. Any of the given Strand Patterns may be utilized.

The strands shall be located as follows:
- Place one strand at each corner and place the remaining strands equally spaced between the corner strands.
- The total strand pattern shall be concentric with the nominal concrete section of the pile.

SECTION D-D
(See Nondrivable unforeseen Reinforced Precast Pile Build-Up Detail)

SECTION E-E
(See Drivable unforeseen Prestressed Precast Pile Splice Detail)

SS PILE SPLICE REINFORCEMENT DETAILS

STRAND PATTERN
8 – ½" Ø, MSSS at 24 kips

ELEVATION

Spiral Tie Spacing
5 Turns @ 1" Pitch
16 Turns @ 3" Pitch
6" Pitch
16 Turns @ 3" Pitch
1"

3" Cover (Typ.)
W4.0 Spiral Ties
W4.0 Spiral Ties @ 6" pitch, full length

SECTION A-A

See Strand Pattern
Spiral Ties @ 6" pitch, full length

SECTION D-D
(See Nondrivable Unforeseen Reinforced Precast Pile Build-Up Detail)

SECTION E-E
(See Drivable Unforeseen Prestressed Precast Pile Splice Detail)

CFRP PILE SPLICE REINFORCEMENT DETAILS

NOTES:
1. Work this Index with Index 22600 - Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index 22601 - Square CFRP & SS Prestressed Concrete Pile Splices.
2. Any of the given Alternate Strand Patterns may be utilized. The strands shall be located as follows:
   Place one strand at each corner and equally space the remaining strands between the corner strands. The total strand pattern shall be concentric with the nominal concrete section of the pile.

CFRP PRESTRESSED PILE DETAILS
SS PRESTRESSED PILE DETAILS

NOTES:
1. Work this Index with Index No. 22600 – Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index No. 22601 – Square CFRP & SS Prestressed Concrete Pile Splices.
2. Any of the given Alternate Strand Patterns may be utilized.
   The strands shall be located as follows:
   Place one strand at each corner and place the remaining strands equally spaced between the corner strands.
   The total strand pattern shall be concentric with the nominal concrete section of the pile.
**ALTERNATE STRAND PATTERNS**

12 ~ 0.6" Ø, CFRP 7-Strand, at 34 kips
12 ~ 0.6" Ø, CFRP Single-Strand, at 33 kips

See Alternate Strand Patterns

NOTES:
1. Work this Index with Index 22600 - Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index 22601 - Square CFRP & SS Prestressed Concrete Pile Splices.
2. Any of the given Strand Patterns may be utilized.
3. The strands shall be located as follows:
   - Place one strand at each corner and place the remaining strands equally spaced between the corner strands.
   - The total strand pattern shall be concentric with the nominal concrete section of the pile.

SEE NOTE NO. 4 ON INDEX NO. 22601

SEE NONDRIVABLE UNFORESEEN REINFORCED PRECAST PILE BUILD-UP DETAIL

SEE NODRIVABLE PREPROMPTED PRESTRESSED PRECAST SPlice DETAIL

SEE DRIVABLE PREPROMPTED PRESTRESSED PRECAST SPlice DETAIL

SEE DRIVABLE PREPROMPTED PRESTRESSED PRECAST SPlice DETAIL
**REVISION NO.**

**SHEET NO.**

**INDEX NO.**

**DESCRIPTION:**

REVISION

18" SQUARE CFRP & SS PRESTRESSED CONCRETE PILE

NOTES:

1. Work this Index with Index No. 22600 - Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index No. 22601 - Square CFRP & SS Prestressed Concrete Pile Splices.

2. Any of the given Strand Patterns may be utilized. The strands shall be located as follows:
   - Place one strand at each corner and place the remaining strands equally spaced between the corner strands.
   - The total strand pattern shall be concentric with the nominal concrete section of the pile.

**ELEVATION**

**STRAND PATTERN**

16 – ½" Ø, HSSS, at 26 kips

**SECTION A-A**

**SECTION D-D**

(See Nondrivable Unforeseen Reinforced Precast Pile Build-Up Detail)

**SECTION E-E**

(See Drivable Preplanned Prestressed Precast Splice Detail)

**SECTION F-F**

(See Drivable Prestressed Precast Splice Detail)

**SS PRESTRESSED PILE DETAILS**

**INDEX NO.**

**SHEET NO.**

18" SQUARE CFRP & SS PRESTRESSED CONCRETE PILE

**FY 2017-18 DESIGN STANDARDS**

01/01/16

10/26/16
ALTERNATE STRAND PATTERNS

16 – 0.6" Ø, CFRP 7-Strand, at 42 kips
16 – ½" Ø, CFRP Single-Strand, at 41 kips

NOTES:
1. Work this Index with Index 22600 - Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index 22601 - Square CFRP & SS Prestressed Concrete Pile Splices.
2. Any of the given Strand Patterns may be utilized.
   The strands shall be located as follows:
   Place one strand at each corner and place the remaining strands equally spaced between the corner strands.
   The total strand pattern shall be concentric with the nominal concrete section of the pile.
** See Note No. 4 on Index No. 22601
**ALTERNATE STRAND PATTERNS**

**SECTION B-B**
(See Pile Splice Reinforcement Details)

**SECTION C-C**
(See Pile Splice Reinforcement Details)

**SECTION D-D**
(See Nondrivable Unforeseen Reinforced Precast Pile Build-Up Detail)

**SECTION E-E**
(See Drivable Preplanned Prestressed Precast Pile Splice Detail)

**SECTION F-F**
(See Drivable Preplanned Prestressed Precast Pile Splice Detail)

**NOTES:**

1. Any of the given Strand Patterns may be utilized. The strands shall be located as follows:
   - Place one strand at each corner and place the remaining strands equally spaced between the corner strands. The local strand pattern shall be concentric with the nominal concrete section of the pile.

2. CONTRACTOR OPTION: The 30" pile may be cast SOLID by omitting the 18" Ø void. In this event, the Contractor shall submit calculations for approval and a proposed strand configuration that provide net prestressing after losses equal to 1000 psi. Alternate configurations for the Diagonal Ties, to maintain the position of the 4 ~ No. 6 Bars, may be approved by the Engineer.

3. Work this Index with Index No. 22600 - Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index No. 22601 - Square CFRP & SS Prestressed Concrete Pile Splices.

- 20 ~ 6" Ø, CFRP 7-Strand at 38 kips
- 20 ~ 1/2 Ø, CFRP Single-Strand at 37 kips
- 20 ~ 4½ Ø, CFRP 3-Strand at 38 kips

**CFRP PILE SPICE DETAILS**
NOTES:
1. Any of the given Strand Patterns may be utilized. The strands shall be located as follows:
   Place one strand at each corner and place the remaining strands equally spaced between the corner strands. The total strand pattern shall be concentric with the nominal concrete section of the pile.
2. CONTRACTOR OPTION: The 30" pile may be cast SOLID by omitting the 18" Ø void. In this event, the Contractor shall submit calculations for approval and a proposed strand configuration that provides net prestressing after losses equal to 1000 psi. Alternate configurations for the Diagonal Ties, to maintain the position of the 4 ~ No. 8 Bars, may be approved by the Engineer.
3. Work this Index with Index No. 22600 - Notes and Details for Square CFRP & SS Prestressed Concrete Piles and Index No. 22601 - Square CFRP & SS Prestressed Concrete Pile Splices.
1. Work this Index with the Pile Data Table in the Structures Plans.
2. Concrete:
   A. Piles: Class V (Special)
   B. Splice: Class IV
   C. Silica Fume: See "GENERAL NOTES" in Structures Plans for locations where the use of silica fume, metakaolin or ultra-fine flyash is required for options using stainless steel strand and reinforcing.
3. Concrete Strength at time of prestress transfer:
   A. Piles: 6,000 psi minimum.
4. Reinforcing:
   A. Bars:
      a. Stainless Steel: Meet the requirements of Specification Section 931 for Type 304, Grade 75.
      b. Carbon FRP: Meet the requirements of Specification Section 932.
   B. Prestressing Strands:
      a. Stainless Steel: Seven-wire HSSS, UNS S32205 (Type 2205) or UNS S31803 strand, meeting the requirements of Specification Section 933.
      b. Carbon FRP: Meet the requirements of Specification Section 933.
   C. Spiral Ties:
      a. One half turn is required for carbon steel spiral splice.
      b. One full turn is required at the pile head and tip.
5. Pile Splices:
   A. Epoxy: Type AB Epoxy Compound or Mortar must meet the requirements of Specification Section 926.
      a. Use a Type AB Epoxy Bonding Compound or Epoxy Mortar, as recommended by the Manufacturer, to form the joint between pile sections.
   B. Driving: Resume pile driving after splice concrete reaches a minimum strength of 5,500 psi.
6. Mark piles at the pick-up points to indicate the proper points for attaching handling lines.
**54° PRECAST/POST-TENSIONED CFRP & SS CONCRETE CYLINDER PILE**

**ALTERNATE STRAND PATTERNS**
- 48 ~ 0.5" Ø, Single-Strand, at 28 kips
- 48 ~ 0.6" Ø, 7-Strand, at 29 kips

**Inside Pile Wall**
- Full Epoxy Compound Joint
- Temporary Blocking Form to retain epoxy compound
- Cast in Place Plugs

**Outside Pile Wall**
- Form to retain epoxy compound
- Gasket

*For Spun Cast Cylinder Piles, the following requirements for concrete cover apply:*
1. Slightly or Moderately Aggressive Environments: The concrete cover may be reduced to 2 inches.
2. Extremely Aggressive Environments: The concrete cover may be reduced to 2 inches as long as the concrete has a documented chloride ion penetration apparent diffusion coefficient with a mean value of 0.005 in/year or less; otherwise, a 3-inch concrete cover is required.
**Outside Pile Wall**
- Form to retain epoxy compound

**Inside Pile Wall**
- Temporary Blocking
- Form to retain epoxy compound
- Cover (Typ.)

**Gasket**
- Cover (Typ.)

**W20 Wire Ties**
- No. 4 Bars or 1'-0" Min. Lap Splice

**W11 Spiral Wire Ties**
- 4 ~ Longitudinal Spacers (No. 3 Bars or W11 wire) for Spiral Ties @ Equal Spaces
- 24 ~ No. 10 Bars @ Equal Spaces

**Cast in Place Plug**
- Cover (Typ.)
- 1'/0" Ø Formed Holes for Tendons @ Equal Spaces

**Drivable Unforeseen Field Splice Detail**
- (Cast-In-Place Plug)

**Alternate Strand Patterns**
- 72 ~ 3/4" Ø, HSSS Strands, at 21 kips (30-3 strand tendons)
- 58 ~ 3/8" Ø, HSSS Strands, at 24 kips (29-2 strand tendons)
- 48 ~ 5/8" Ø, HSSS Strands, at 32 kips (24-2 strand tendons)

**Concrete Seal**

*For Spun Cast Cylinder Piles, the following requirements for concrete cover apply:
1. Slightly or Moderately Aggressive Environments: The concrete cover may be reduced to 2 inches.
2. Extremely Aggressive Environments: The concrete cover may be reduced to 2 inches as long as the concrete has a documented chloride ion penetration apparent diffusion coefficient with a mean value of 0.005 in/year or less; otherwise, a 3-inch concrete cover is required.
The 4½” Ø void in the pile shall be positively vented to water or air after the final pile installation. If the 3½” Ø vents are included in the pile cut-off section, then venting shall be provided by the use of a 1” Ø PVC conduit through the substructure cap or column.

**NOTES**

1. Work this Index with the Pile Data Table in the Structures Plans.
2. Concrete:
   A. Piles: Class V (Special)
   B. Splice Collar: Class IV
   C. Silica Fume: See “GENERAL NOTES” in the Structures Plans for locations where the use of silica fume, metakaolin or ultra-fine flyash is required.
3. Concrete Strength at time of prestress transfer:
   A. Piles: 4,000 psi minimum.
4. Reinforcing:
   A. Bars:
      a. Stainless Steel: Meet the requirements of Specification Section 931 for Type 304, Grade 75.
      b. Carbon FRP: Meet the requirements of Specification Section 932.
   B. Prestressing Strands:
      a. Stainless Steel: Seven-wire HSSS, UNS S32205 (Type 2205) or UNS S31803 strand, meeting the requirements of Specification Section 933.
      b. Carbon FRP: Meet the requirements of Specification Section 933.
   C. Spiral Ties:
      a. One half turn is required for carbon steel spiral splice.
      b. One full turn is required at the pile head and tip.
5. Pile Splices:
   A. Epoxy: Type AB Epoxy Compound or Epoxy Mortar must meet the requirements of Specification Section 928.
      a. Use a Type AB Epoxy Bonding Compound or Epoxy Mortar, as recommended by the Manufacturer, to form the joint between pile sections.
      b. Use a Type AB Epoxy Bonding Compound as a bonding agent on internal pile surfaces.
   B. Splices: Resume pile driving after the splice concrete reaches a minimum strength of 5,500 psi.
6. Mark piles at the pick-up points to indicate the proper points for attaching handling lines.

**TABLE OF MAXIMUM PILE PICK-UP AND SUPPORT LENGTHS**

<table>
<thead>
<tr>
<th>Maximum Pile Length (Feet)</th>
<th>Required Storage and Transportation Detail</th>
<th>Pick-Up Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>122</td>
<td>2, 3, or 4 point</td>
<td>1 Point</td>
</tr>
<tr>
<td>174</td>
<td>2, 3, or 4 point</td>
<td>2 Point</td>
</tr>
</tbody>
</table>
**DESCRIPTION:**

**REVISION:**

**INDEX NO.:**

**SHEET NO.:**

**REV No.:**

---

**ALTERNATE STRAND PATTERNS**

- 0.3" Ø, CFRP Single-Strand, at 39 kips
- 0.8" Ø, CFRP 7-Strand, at 40 kips

---

**SECTION A-A**

- 24 – No. 6 CFRP Bars
- 36 – CFRP Strands @ Equal Spaces
- 2" Min. Cover (Typ.)

**SECTION B-B**

- 60' Ø
- No. 3 Bars or 0.3" Ø CFRP Strand Spiral Ties
- 45' Ø Void
- 3' Min. Cover (Typ.)
- 24 – No. 6 CFRP Bars @ Equal Spaces

---

**DETAIL “A”**

- Inside Pile Wall
- Full epoxy compound joint
- Temporary Blocking
- Form to retain epoxy compound
- Gasket
- Form to retain epoxy compound
- Outside Pile Wall

---

**DRIVABLE UNFORESEEN FIELD SPLICE DETAIL**

(Cast in Place Plug)

- Concrete Seal
- 1'-0" Ø Void, open top and bottom to allow through venting of sections
- Roughen inside surface of 60" Ø Pile to 1/4" amplitude for Spliced Pile Section
- Closed No. 4 CFRP Bars or 0.3" Ø CFRP Strand Ties @ 1'-0" ± (Typ.)
- Full Epoxy Compound Joint around cylinder pile wall only (See Detail “A”)
- Clean inside surface of 60" Ø Pile with a high pressure water blast (3000 psi Min.) and apply bonding agent for Driven Prestressed Pile

---

**60" PRESTRESSED CFRP & SS CONCRETE CYLINDER PILE**

**FY 2017-18 DESIGN STANDARDS**

**INDEX NO.:**

**SHEET NO.:**

---

**Footnote:**

10/26/2016

9:24:13 AM

22660
**Concrete Seal**

- 2'-0" to 3" min. Cover (Typ.)
- Clean inside surface of 60" Ø Pile with a high pressure water blast (3000 psi Min.) and apply bonding agent for Driven Prestressed Pile

**Driven Prestressed Pile**

- Roughen inside surface of 60" Ø Pile to ⅜" amplitude for Spliced Pile Section
- Closed No. 4 SS Bars or W20 SS Wire Ties @ 1'-0" ± (Typ.)

**Spliced Pile Section**

- Full Epoxy Compound Joint around cylinder pile wall only (See Detail "A")

**SECTION A-A**

- 44 - 0.6" Ø HSSS Strand, at 36 kips
- 36 - 0.6" Ø HSSS Strand, at 36 kips

**alternate Strand Patterns**

- 0.6" Ø HSSS Strands @ Equal Spaces
- 2" Min. Cover (Typ.)
- 3" Min. Cover (Typ.)

**SECTION B-B**

- Full epoxy compound joint
- Temporary Blocking Form to retain epoxy compound

**DETAIL "A"**

- Inside Pile Wall
- Outside Pile Wall
- Form to retain epoxy compound
- Gasket

**60" Prestressed CFRP & SS Concrete Cylinder Pile**

**FY 2017-18 Design Standards**

**Revision No. 22660**