Index 22600 Series Square CFRP & SS Prestressed Concrete Piles (Rev. 11/16)

Design Criteria

AASHTO LRFD Bridge Design Specifications; Structures Design Guidelines (SDG); Structures Detailing Manual (SDM); Fiber Reinforced Polymer Guidelines (FRPG)

Design Assumptions and Limitations

Index 22600 is the lead standard for the Square CFRP & SS Prestressed Concrete Pile standard series which includes Indexes 22600 through 22630. Use this standard with Indexes 22601, 20602, 22612, 22614, 22618, 22624 and 22630.

Standard piles are designed to have 1000 psi uniform compression after prestress losses without any applied loads to offset tensile stresses that occur during typical driving.

The piles are designed to have 0.0 psi tension using a load factor of 1.5 times the pile self weight during pick-up, storage and transportation as shown in the "Table of Maximum Pile Pick-Up and Support Lengths" on the standard.

Plan Content Requirements

In the Structures Plans:

Show and label the piles on the Foundation Layout, End Bent, Intermediate Bent, Pier, Footing, Typical Section and other sheets as required.

Complete the following "Data Table" in accordance with SDG 3.5 and SDM 11.4 and include it in the contract plans with the "Foundation Layout" sheets. Modify table and notes as required to accommodate the required number of piles, piers and/or bents, use of Test Piles and instrumentation. When not enough space is available on one plan sheet, continuations of the Data Table and/or separate pile cut-off elevation tables are acceptable. See Introduction I.3 for more information regarding use of Data Tables.

For projects without Test Piles change data table column heading "TEST PILE LENGTH (ft.)" to "PILE ORDER LENGTH (ft.)".
## PILE DATA TABLE

<table>
<thead>
<tr>
<th>PILE NUMBER</th>
<th>PILE SIZE (in.)</th>
<th>NOMINAL BEARING RESISTANCE (tons)</th>
<th>NOMINAL UPLIFT RESISTANCE (tons)</th>
<th>MINIMUM TIP ELEVATION (ft.)</th>
<th>TEST PILE LENGTH (ft.)</th>
<th>REQUIRED NET ELEVATION (ft.)</th>
<th>REQUIRED PRE-COMBINATION ELEVATION (ft.)</th>
<th>FACTORED DESIGN UPLIFT LOAD (tons)</th>
<th>FACTORED DESIGN COMPRESSION (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PILE 1</td>
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<td>PILE 2</td>
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<td>PILE 3</td>
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<td>PILE 4</td>
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<td>PILE 5</td>
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<td>PILE 6</td>
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<td>PILE 7</td>
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</tbody>
</table>

### PILE INSTALLATION NOTES [Notes Code: 7-D031]

Contractor to verify location of all utilities prior to any pile installation activities.

Minimum Tip Elevation is required for lateral stability.

When a required jacking elevation is shown, the jet shall be lowered to the elevation and continue to operate at this elevation until the jacking is completed. If jacking in pre-trenching elevations differ from those shown on the table, the Engineer shall be responsible for determination of the required driving resistance.

No jacking will be allowed without the approval of the Engineer.

The Contractor should not anticipate being placed to jet piles below the 100-year scour elevation or required jet elevation, whichever is deeper.

At each Bent, pile styling is to commence at the center of the Bent and proceed outward.
Payment

<table>
<thead>
<tr>
<th>Item number</th>
<th>Item description</th>
<th>Unit Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>455-34-ABB</td>
<td>Prestressed Concrete Piling (CFRP or SS)</td>
<td>LF</td>
</tr>
</tbody>
</table>

Design Aids

![12" SQUARE PRESTRESSED CONCRETE PILE INTERACTION DIAGRAM](image)

**Design Assumptions:**
- Concrete compressive strength $f'_c = 6$ ksi.
- Modulus of elasticity of prestressing strands, $E_p = 18,000$ ksi (1/2" CFRP), 22,480 ksi (0.6" CFRP), 23,500 ksi (HSSS) & 28,500 ksi (Carbon-Steel).
- Resistance factors $\phi$ based on ACI 440.4R for CFRP strands (0.65 compression-controlled, 0.85 tension-controlled); and AASHTO LRFD 5.5.4.2.1 for HSSS & Carbon-Steel strands (0.75 compression-controlled, 1.0 tension-controlled).
- All piles assumed to have spiral ties.
- Strand sizes and strand patterns used to create interaction curves correspond with those indicated in Index 22612 for CFRP & HSSS and Index 20612 for Carbon-Steel.
**Design Assumptions:**

- Concrete compressive strength $f'_c = 6$ ksi.
- Modulus of elasticity of prestressing strands, $E_p$: 18,000 ksi (1/2" CFRP), 22,480 ksi (0.6" CFRP), 23,500 ksi (HSSS) & 28,500 ksi (Carbon-Steel).
- Resistance factors $\phi$ based on ACI 440.4R for CFRP strands (0.65 compression-controlled, 0.85 tension-controlled); and AASHTO LRFD 5.5.4.2.1 for HSSS & Carbon-Steel strands (0.75 compression-controlled, 1.0 tension-controlled).
- All piles assumed to have spiral ties.
- Strand sizes and strand patterns used to create interaction curves correspond with those indicated in Index 22614 for CFRP & HSSS and Index 20614 for Carbon-Steel.
Design Assumptions:
- Concrete compressive strength $f'_c = 6$ ksi.
- Modulus of elasticity of prestressing strands, $E_p = 18,000$ ksi (1/2" CFRP), 22,480 ksi (0.6" CFRP), 23,500 ksi (HSSS), & 28,500 ksi (Carbon-Steel).
- Resistance factors $\phi$ based on ACI 440.4R for CFRP strands (0.65 compression-controlled, 0.85 tension-controlled); and AASHTO LRFD 5.5.4.2.1 for HSSS & Carbon-Steel strands (0.75 compression-controlled, 1.0 tension-controlled).
- All piles assumed to have spiral ties.
- Strand sizes and strand patterns used to create interaction curves correspond with those indicated in Index 22618 for CFRP & HSSS and Index 20618 for Carbon-Steel.
Design Assumptions:
- Concrete compressive strength $f'_c = 6$ ksi.
- Modulus of elasticity of prestressing strands, $E_p = 18,000$ ksi (1/2" CFRP), 22,480 ksi (0.6" CFRP), 23,500 ksi (HSSS), & 28,500 ksi (Carbon-Steel).
- Resistance factors $\phi$ based on ACI 440.4R for CFRP strands (0.65 compression-controlled, 0.85 tension-controlled); and AASHTO LRFD 5.5.4.2.1 for HSSS & Carbon-Steel strands (0.75 compression-controlled, 1.0 tension-controlled).
- All piles assumed to have spiral ties.
- Strand sizes and strand patterns used to create interaction curves correspond with those indicated in Index 22624 for CFRP & HSSS and Index 20624 for Carbon-Steel.
Design Assumptions:
- Concrete compressive strength $f'_c = 6$ ksi.
- Modulus of elasticity of prestressing strands, $E_p = 18,000$ ksi (1/2" CFRP), 22,480 ksi (0.6" CFRP), 23,500 ksi (HSSS), & 28,500 ksi (Carbon-Steel).
- Resistance factors $\phi$ based on ACI 440.4R for CFRP strands (0.65 compression-controlled, 0.85 tension-controlled); and AASHTO LRFD 5.5.4.2.1 for HSSS & Carbon-Steel strands (0.75 compression-controlled, 1.0 tension-controlled).
- All piles assumed to have spiral ties.
- Strand sizes and strand patterns used to create interaction curves correspond with those indicated in Index 22630 for CFRP & HSSS and Index 20630 for Carbon-Steel.