***Designer note: See standardized special provisions for bid item Grouted Bar Couplers, Item 505.1000.S***

Precast Pier Columns, Item SPV.0090.xx; Precast Pier Caps, Item SPV.0090.xx.

**A Description**

This special provision describes the manufacture, transportation, storage, installation and bracing as required for precast pier columns and precast pier caps.

Precast materials shall meet the specifications of the PCI Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products, MNL-116.

The work governed by this specification shall also include the furnishing and installation of any appurtenant items necessary for transportation, handling, storage and erection.

Conform to standard spec 501, 502 and 503 as further modified in this special provision.

If the substructure elements are to be cast in a commercial precast plant, the plant shall be on the WisDOT approved list of Precast Concrete Certified Producers for Category C, Special Structures.

Alternately, the bridge contractor may elect to precast the substructure elements in their yard or at the project site.  If this option is used, inspection by the project staff shall be required as the engineer directs. Provide concrete conforming to standard spec 502 as modified in standard spec 715. Provide QMP for precast concrete as specified in standard spec 715.

**B Materials**

The contractor shall make all arrangements to fabricate, supply, and install the precast pier columns and precast pier caps including all necessary incidentals for construction of the proposed superstructure.

**B.1 Concrete**

The contractor/supplier shall submit a concrete mix design, developed conforming to standard spec 503.2.2, to the engineer for approval. Obtain approval from the engineer for the mix design prior to starting production of the elements. The contractor/supplier shall allow for a 14-day review period by the engineer after the submittal of the concrete mix design.

Concrete for the precast pier columns and precast pier caps shall conform to standard spec 501, in addition to the following requirements for the concrete:

* 3,500 psi, minimum final design strength at 28 days, and before shipping.
* 3/4-inch maximum aggregate size.
* 6%-8% air entrainment.
* 0.40 maximum w/c ratio.

Ensure concrete attains the required strengths above per standard spec 503.2.2.

**B.2 Mild Reinforcing Steel**

Furnish mild bar reinforcing steel conforming to standard spec 505.

**B.3 Non-Shrink Grout**

Use structural, gray, non-shrink grout for joints between pier footing and pier column, pier column and pier cap and for joints between pier cap units (if applicable), as shown on the plans. Non-shrink grout shall be quick-setting, rapid strength gain, high-bond strength grout. Grout shall not contain calcium chloride or admixture containing calcium chloride or other ingredient in sufficient quantity to cause corrosion to steel reinforcement. Grout shall be nonmetallic. Mix grout just prior to use according to the manufacturer’s instructions. Use grout supplied by the coupler manufacturer or a product from WisDOT’s approved product list.

Follow manufacturer’s recommendation for dosage of corrosion inhibitor admixture.

Use structural non-shrink grout that meets a minimum compressive strength of 4,000 psi within 24 hours when tested as specified in AASHTO T 106. Meet all the requirements of AASHTO T160 with the exception that the Contractor-supplied cube molds shall remain intact with a top firmly attached throughout the curing period. Use structural non-shrink grout with no expansion after seven days. Refer to Table 1 for structural non-shrink grout requirements.

**Table 1 - Structural Non-Shrink Grout Requirements**

**\*Property: Requirement (ASTM / AASHTO)**

Accelerated Weathering: As Specified in ASTM or AASHTO (C666 / T260)

Compressive Strength: >5,000 psi @ 28 days (T106)

Accepted Bond Strengths: >1,000 psi @ 24 Hours (C882)

Test Medium: <3% Sodium Chloride (T161)

Accepted Weight Loss: <15% @ 300 Cycles (T161)

Length Change: No expansion after 7 days (T160)

**B.4 Pier Column and Pier Cap Manufacturing**

Fabricate precast pier columns and pier caps to the following tolerances:

Length = ±1/2 inch

Width = ±1/4 inch

Depth = ±1/4 inch

Cover = +1/4, -0 inch

Sweep = ±1/4 inch

Variation from specified plan end squareness or skew = ± 1/4 inch

**B.5 Grouted Bar Couplers**

Provide grouted bar couplers used to provide a moment connection to the cast-in-place concrete footings and at the interface of the precast concrete pier columns to the precast concrete pier caps according to the bid item “Grouted Bar Couplers”.

**C Construction**

**C.1 Sequence of Work**

Develop the detailed sequence of work tasks to be performed and submit them with the shop drawings. The engineer shall obtain the work plan and all project-related approvals before the existing bridge can be removed (if applicable).

**C.2 Lifting Anchors**

The precast fabricator shall submit lifting locations and lifting anchor details for approval by the engineer prior to use. The top of the lifting anchors shall be recessed 1/2-inch minimum from the surface of the precast element. The lifting anchors shall be hot-dipped galvanized. Lifting anchors cast into the precast elements shall be used for lifting and moving the precast elements at the fabrication plant and in the field. The angle between the top surface of the precast elements and the lifting line shall not be less than 60 degrees, when measured from the top surface of the precast elements to the lifting line. Damage caused to any precast elements shall be repaired at the expense of the contractor to the satisfaction of the engineer.

**C.3 Handling, Storage, and Shipping**

The contractor may provide additional reinforcement to ensure crack-free pier column and pier cap installation, which is incidental to the cost of the precast pier columns and precast pier caps. It is the responsibility of the contractor to handle, store, ship, and erect the pier columns and pier caps in a crack-free manner. “Crack-free” is defined as not having more than one crack every 25 square feet, the width of which does not exceed 0.008”.

All precast elements shall be removed from the forms in such a manner that no damage occurs to the element. Any materials forming blockouts in the precast elements shall be removed such that damage does not occur to the precast elements or the blockout.

All storage of precast pier columns and precast pier caps, either before shipment to the bridge site or at the bridge site, shall be such that they are supported in a manner that will minimize deflection but also in a manner that will not induce forces that cause cracking. During storage for long periods of time (longer than one month), all precast elements shall be checked at least once per month to ensure creep-induced deformation does not occur.

The engineer will inspect the finished columns and cap for cracking and evaluate the severity of the cracks prior to on-site placement. Repair cracks as directed by the engineer. Crack repair is at the expense of the contractor. This inspection is independent of the inspections required by standard spec 502 and 503.

**C.4 Shop Drawings**

Submit detailed shop drawings, which include, but are not limited to:

1. Complete description of the details covering each of the precast pier columns and precast pier caps units. This shall include:

* Complete geometric layouts for each precast segment, including mild reinforcement layout.
* Step by step erection procedure of precast pier columns and precast pier caps, including method and timing of column and cap bracing and temporary support.
* Detailed methods for column and cap handling and transporting to/at the site.
* Detailed locations and methods of installation of the grouted bar couplers used to provide a moment connection to the cast-in-place concrete footings and at the interface of the precast concrete pier columns to the precast concrete pier caps.
* Detailed methods of forming for grout filling on site.
* Safety procedures to be followed.

2. Calculations for supplemental reinforcement for handling, erection, and operation. The contractor may request to modify the precast section or unit size, pier cap grouted bar coupler details, or joint details from that listed in the plans. However, the contractor must submit shop drawings accurately portraying these revisions for approval, complying with the below requirements:

* All modifications must take into account revisions to handling, storage, shipping, and erection stresses, and consequently possible revisions in the mild steel reinforcement.
* The materials, devices, systems, and operations shall comply with all conditions in this special provision and the design criteria as indicated on the plans.
* If the design does not comply with the above requirements, calculations and correspondence prepared by a registered Professional Engineer in the State of Wisconsin shall be submitted to the engineer for approval justifying the areas of non-compliance.
* The modification shall result in no net increase in cost to the Owner, or result in an extension of the construction schedule.

Submit all information sufficiently in advance of the start of construction to allow the engineer an average 45-calendar day review period, but not less than a 30-calendar day review period. The review period shall begin on the day of receipt of the submittal in the office of the engineer. All submittals not approved and requiring resubmittal shall be subject to the above review time periods, with the review time beginning anew for each such submittal. Coordinate all submittals between various subordinates (contractors, suppliers, and engineers) to allow for a reasonable distribution of the review effort required by the engineer at any given time. Receive final approval before any fabrication begins. Furnish all shop drawings as per all applicable requirements of standard spec 506.3.2. Supply manufacturer’s literature where applicable. All shop drawings are to accurately detail the actual methods, materials, equipment, etc., that the contractor will be using in the field on the project. Do not deviate unless approved by the engineer.

**C.5 Grouted Bar Couplers**

**Filling**

Complete the installation of the grouted bar couplers conforming to the bid item “Grouted Bar Couplers”.

Create matching templates for precisely locating/orientating the bar couplers and provide them to the contractor for aligning/orientating reinforcing bars in the cast-in-place concrete footings.

**C.6 Erection**

Erect the precast pier columns and pier caps to the following tolerances:

Erection tolerance on elevation = ±1/4 inch

Erection tolerance on beam seat elevation = ±1/8 inch (May be set high and ground to specified elevation)

**D Measurement**

The department will not measure Precast Pier Columns and Precast Pier Caps. The department will use pay plan quantity per standard spec 109.1.1.2.

**E Payment**

The department will pay for measured quantities at the contract unit price under the following bid items:

|  |  |  |
| --- | --- | --- |
| ITEM NUMBER | DESCRIPTION | UNIT |
| SPV.0090.xx | Precast Pier Columns | LF |
| SPV.0090.xx | Precast Pier Caps | LF |

Payment for Precast Pier Columns and Precast Pier Caps is full compensation for all labor, materials, and equipment required to detail, fabricate, construct and erect the proposed precast pier columns and precast pier caps. Payment also includes shop drawings and any supplemental or alternate calculations, handling, shipping and placing; and reinforcing steel.