SP00588 (2018 Specifications: 0~~7~~9-01-20)

(This Section requires SP00530, SP00540, ~~SP02001~~ and SP02510. Requires Sections 00960, 00970, and 00990 when electrical components are encased in concrete.)

SECTION 00588 - PRECAST HISTORIC ORNAMENTAL BRIDGE RAILS

(Follow all instructions. If there are no instructions above a subsection, paragraph, sentence, or bullet, then include it in the project. The specifications may be modified to include project specific specifications, but all additions, deletions, or modifications must be sent to the ODOT Technical Resource and State Specifications Engineer for review and approval.)

Section 00588, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00588.00 Scope - This work consists of constructing precast historic ornamental Bridge rails ("stealth rails") of the Material or combination of Materials shown and specified.

Precast Work includes:

- Field measurement of all existing rail segment lengths, curves, miter angles, superelevations, and Slopes
- Providing forms for cast-in-place posts
- Providing templates to locate concrete anchors to fasten precast rails to the Bridge

Cast-in-place Work includes:

- Providing and placing concrete according to Section 00530 and Section 00540 for the cast-in-place rail components
- Installing bolted connections according to Section 00560
- Installing anchor bolts and associated nuts and washers
- Applying water repellent concrete sealer

00588.02 Definitions:

Stealth Rail - Structural steel frame encased in a precast ornamental concrete rail section.

00588.03 Working Drawings - Essential elements of design and section dimensions for rail are as shown.

Submit unstamped Working Drawings for approval according to 00150.35. Include details of lifting, storage, transporting, erecting, and bracing.

Materials

00588.10 Materials - Furnish Materials meeting the following requirements:

Concrete	02001
Keyway Grout	02080.30
Reinforcement	02510
Structural Steel	02530
Structural Steel Tubing	02810.20
Pipe	02810.30

Furnish concrete containing synthetic micro fiber reinforcing at a rate of 0.75 lb/cu yd or as recommended by the fiber manufacturer.

Select one of the following fibers or an approved equal:

- Fibercast 500 by PROPEX, 1-800-621-1273, http://www.fibermesh.com
- Fibermesh 150 by PROPEX, 1-800-621-1273, http://www.fibermesh.com
- MasterFiber M100 by BASF MasterBuilders, 1-800-628-9990, http://www.masterbuilders.com
- CAST-MASTER by FORTA Corporation, 1-800-245-0306 or 1-724-458-5221, http://www.forta-ferro.com
- Grace Microfiber by W.R. GRACE, 1-877-423-6491, http://www.grace.com
- PSI Fiberstrand Mult-Mix 80 by Euclid Chemical Company, 1-800-321-7628, http://www.euclidchemical.com

00588.12 Acceptance of Concrete - Acceptance of concrete will be according to Section 00165 and the following:

(a) Aggregate - Acceptance of Aggregate will be based on the Contractor's quality control testing, if verified, according to Section 00165.

(b) Plastic Concrete - Acceptance of plastic concrete will be based on tests performed by the QCT, according to Section 02001.

(c) Hardened Concrete:

(1) General - Acceptance of hardened concrete will be based on analysis of compressive strength test results of cylinders cast and cured by the Contractor and tested according to AASHTO T 22 by a CSTT at an ODOT-certified laboratory and verified according to Section 00165.

(2) Sampling and Testing - Obtain a sample from a delivery vehicle, selected at random, during each Day's production for each mix design used. Test the sample for temperature, slump, density, and air content and cast at least three cylinders for testing at 28 Days. Cure the cylinders in a manner similar to the members they represent. Alternately, the cylinders may be cured in a curing chamber correlated in temperature with the concrete in the forms. Leave the cylinders in the form with the member or in

the curing chamber until the member is stripped. After the member is stripped, place the acceptance cylinders in storage in a moist condition according to AASHTO T 23.

(3) Acceptance - Concrete members with an Actual Strength Test Value (ASTV) meeting or exceeding the specified design strength, $f'c$, will be acceptable for strength. If the compressive strength of a single test specimen varies by more than 10 percent from the average of the other specimens, that compressive strength value will be discarded. The average compressive strength test of the remaining specimens will be the ASTV.

If the ASTV is less than $f'c$ but at least 85 percent of $f'c$, the Engineer may review the results to determine if the member is suitable for the intended purpose. If suitable, the concrete represented by an ASTV less than $f'c$ may be accepted subject to a price adjustment according to 00150.25.

Concrete that has an ASTV less than 85 percent of $f'c$ will not be accepted. All costs of removal, replacement, and all related work are the Contractor's responsibility.

Equipment

00588.25 Vibrators - Provide either internal or external vibrators in working condition meeting the manufacturer's rating.

When epoxy coated reinforcement is used, use internal vibrators fitted with a manufactured rubber head to minimize damage to the epoxy coating.

Construction

00588.40 General - Construct Bridge rails:

- True to line, grade and dimensions shown or established, with a smooth and even top rail that does not follow any unevenness in the Superstructure.
- Vertical, rather than normal to the deck, whether the deck is superelevated or not, unless shown otherwise. Constructing rail or baluster normal to the deck requires the Engineer's approval.
- After falsework has been removed, so that the span is self-supporting.

00588.41 Forms:

(a) General - Construct forms for precast and cast-in-place components from metal or polymer Material. Provide forms that are smooth and tight fitting, rigidly held in line and grade, and removable without damage to the concrete. Make form joints in vertical planes. Construct all moldings, panel work, and bevel strips as shown. Make corners in the finished work true, sharp, and free of cracks, spalls, and other defects.

Forms for cast-in-place base may be constructed from high density overlay (HDO) plywood.

Allowable construction tolerance for forms is 1/16 inch.

Construct rail post or transitions with fixed forms as shown.

Remove and replace any unsatisfactory Work at no additional cost to the Agency.

(b) Test Section - Construct a test section of precast historic ornamental bridge rail at least 5 feet in length to demonstrate accuracy and quality of formwork and finish. With the Engineer's approval, a section of rail of similar design constructed for a previous project may be designated as the test section. Production casting will not be allowed until the test section has been approved by the Engineer.

A test section may be permanently installed in the Work if approved.

00588.42 Placing Reinforcement - Place reinforcement as shown and according to Section 00530.

00588.43 Placing Concrete:

(a) General - Place concrete so that the finished members are uniform and monolithic, free of cold joints.

Do not deposit concrete in the forms until the Engineer has inspected and approved the placement of reinforcement, conduit, and other embedded items.

Prepare forms according to 00588.41. Remove temporary struts, stays, and braces when the concrete has reached an elevation rendering them unnecessary. Remove these temporary members entirely from the forms and do not bury them in the concrete.

Place concrete close to its final position, without segregation of Materials or displacement of the reinforcement.

(b) Consolidation - Consolidate concrete, during and immediately after placing, by mechanical vibration as follows:

- Operate internal vibrators at frequencies that produce consolidated placements.
- Do not use vibration for shifting concrete to the extent of causing segregation.
- Vibrate at points uniformly spaced and not further than twice the radius over which vibration is visibly effective.
- Continue vibration until the concrete is thoroughly consolidated, but not until segregation occurs or localized areas of grout form.
- Use external vibration through a mechanical means other than internal vibrator to consolidate locations not accessible to internal vibrators.

00588.44 Curing - Cure precast members with low-pressure steam or radiant heat inside a suitable enclosure to contain the steam or heat, and minimize moisture and heat loss.

(a) Curing Temperature - Measure cure temperature by one of the following methods:

(1) Measuring Enclosure Temperature - Equip the enclosure with 24-hour recording thermometers at each end of each casting bed. Record the temperature for each thermometer on a single chart for each 24-hour period.

Do not allow the curing temperature within the enclosure to exceed 160 °F. During the initial application of live steam or radiant heat, do not allow the temperature within the enclosure to increase at a rate exceeding 40 °F per hour.

(2) Measuring Concrete Temperature - Embed a thermocouple 6 to 8 inches from the top or bottom of the member on its centerline and near its midpoint.

Record the concrete temperature with a calibrated recorder that provides a continuous record of time and temperature throughout the curing cycle.

Do not allow the concrete temperature to exceed 190 °F. During the initial application of steam or radiant heat, do not allow the concrete temperature to increase at a rate exceeding 80 °F per hour.

(b) Curing with Low-Pressure Steam - Make the initial application of steam after initial set of concrete as determined by AASHTO T 197 (ASTM C403).

Provide a steam supply line to the enclosure equipped with a motor-operated modulating steam control valve operated by a temperature-sensing element located in the enclosure.

Provide steam at 100 percent relative humidity.

Do not apply steam directly on the concrete, form surfaces, or test cylinders.

Distribute the steam within the enclosure through suitable ports located on each side of the units within the enclosure at not more than 30-foot centers, to keep the units being cured completely and uniformly surrounded with steam.

(c) Curing with Radiant Heat - Radiant heat may be applied to beds by means of pipes circulating steam, hot oil, or hot water; by electric blankets or heating elements adjacent to forms; or by circulating warm air under and around forms. Do not allow pipes, blankets, or heating elements to be in contact with concrete, form surfaces, or test cylinders.

(d) General Wet Cure Requirements - Cure precast or cast-in-place Work with water. Begin curing as soon after placement as possible without damaging the freshly placed concrete. Continue curing for 7 Calendar Days after placement.

Keep surfaces not covered by waterproof forms damp by applying water with a fog nozzle until the surface has set sufficiently to allow sprinkling with water or covering with wet burlap and plastic or an approved wet or dry material.

Do not interrupt curing for more than one hour during the cure period.

If, during the cure time, the surrounding temperature falls below 45 °F, extend the cure for the number of hours the temperature is below 45 °F.

(In the first sentence below, use "coated" for projects including a concrete sealer. Otherwise, use "uncoated." Delete the unused word and all parentheses.)

00588.45 Surface Finish - Provide all exposed concrete surfaces with a Class 2 surface finish (ground, floated, and ***(***coated***) (***uncoated***)***) according to 00540.53(c). Completely fill holes and depressions at least 1/8 inch or more in depth or diameter by sacking with an approved patching Material. Hand-scrape the patched surface with a carbide blade to the original plane surface. Color the patching Material to match the Bridge rail. For concrete surfaces that are not exposed, provide a Class 1 surface finish according to 00540.53(c).

00588.46 Lifting, Storing, Transporting, Erecting, and Bracing - Be responsible for the safety of precast members during all stages of construction. Lifting, storage, transporting, erecting, and bracing details will not be reviewed by the Engineer. Lifting, storage, transporting, erecting, and bracing of members are the sole responsibility of the Contractor.

Lift members at the support points specified by the manufacturer and in a manner that does not cause damage, bending, or torsional forces. Members will be rejected if not handled as specified.

00588.47 Anchor Location Templates - Use fabricator-supplied templates to accurately mark anchor bolt locations for drilling on the Bridge.

(Use the following subsection .48 when a concrete sealer is required.)

00588.48 Water-Repellent Concrete Sealer - Apply a clear water-repellent concrete sealer from Section 02060.30 of the QPL, containing 100 percent silane, to all exposed exterior surfaces. Prepare and coat concrete according to the sealer manufacturer's recommendations. Apply two coats of sealer at the manufacturer's minimum yield.

Apply each coat in a uniform layer, completely covering the preceding coat. Correct runs, sags, skips, and other deficiencies before applying succeeding coats. Such corrective work may require recleaning, application of additional coating Materials, or other measures as directed, at no additional cost to the Agency.

Apply coating Materials by air or airless sprayer, brush, roller, any combination of these methods, or as recommended by the coating Material manufacturer, unless otherwise specified. If air is used for application, ensure that it is free of water, oil, and any other material detrimental to the coating system. Provide adequate separators and traps and test air cleanliness daily according to ASTM D4285, or as directed. Regardless of the method used to apply the coating, use brushes to push the coating Material into complex details, crevices, gaps, difficult-to-access areas, and where spraying does not adequately cover or penetrate. All application techniques shall conform to Section 7 in SSPC-PA 1 and the applicable sections of SSPC Paint Application Guide No. 11.

(Use the following subsection .49 when electrical components are encased in concrete.)

00588.49 Electrical Systems - Install electrical system components permanently encased within the precast or cast-in-place ornamental concrete rail according to Sections 00960, 00970, and 00990.

Measurement

00588.80 Measurement - No measurement of quantities will be made for work performed under this Section.

The estimated quantity of precast historic ornamental concrete bridge rail is:

Structure No.	Quantity (Feet)

Payment

00588.90 Payment - The accepted quantities of precast historic ornamental concrete rails will be paid for at the Contract lump sum amount for the Pay Item “Precast Historic Ornamental Concrete Rail”.

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

Payment includes payment for electrical system components permanently encased within the Bridge rail.

No separate or additional payment will be made for anchor bolts and anchorage devices, except those cast in precast concrete members.

Payment for anchor bolt and anchorage devices in cast-in-place concrete members, and for reinforcement extending from a precast unit, cast-in-place deck, wall, or Bridge end panel into the rail will be included in payment made for the precast unit, cast-in-place deck, wall, or Bridge end panel, as appropriate.

Payment for guardrail terminal connectors, connection plates, spacer blocks, and other connection hardware will be included in payment for the guardrail transition item according to 00810.90.