

PRECAST BRIDGE ELEMENTS

Description

This work shall consist of furnishing, erecting and installing all precast concrete bridge elements including all necessary materials and equipment to complete the work in accordance with 105.03

Alternate Approach

The Contractor may substitute cast-in-place concrete for the precast elements, however, no additional contract time or closure time shall be granted for utilizing cast-in-place concrete.

Submittals

Working Drawings shall be in accordance with 105.02. The working drawings shall include the following:

Locations and details of all lifting inserts, hardware or devices
Type and amount of any additional reinforcing required for lifting

Minimum compressive strength attained before handling the precast elements

Details of vertical adjusting hardware.

The working drawings shall be stamped and signed by an Engineer registered in the State of Indiana. The submittal shall include supporting engineering calculations regarding transport and erection loads and stresses.

The working drawings shall also include an erection plan. The erection plan shall include the following:

1. A work area plan depicting items such as utilities overhead and below the work area, drainage inlet structures, and protective measures.
2. Equipment to be used to lift substructure elements including cranes, excavators, lifting slings, sling hooks, and jacks. Include crane locations and operation radii.
3. Detailed sequence of construction and schedule for all operations. Account for setting and cure time for grouts, grouted splice couplers and closure pours.
4. All equipment that will be used for the assembly of the substructure.
5. Methods of providing temporary support of the elements. Include methods of adjusting and securing the element after placement.
6. Procedures for controlling both horizontal and vertical tolerance limits. Include details of any alignment jigs including bi-level templates for reinforcing anchor dowels.
7. Method, sequence, and equipment for forming grout voids and installing the structural non-shrink grout.
8. Methods of forming closure pours including the use of backer rods. Do not assume that the backer rods will restrain the pressure from the grout in vertical grout joints. Provide additional forming to retain the backer rod.
9. Methods for curing grout and closure pour concrete.
10. The working drawings shall also include a casting schedule.

Materials

(a) Concrete

Concrete shall be in accordance with 702.

(b) Reinforcing bars

Reinforcing bars shall be in accordance with 703.

(c) Reinforced Concrete Bridge Approaches

Reinforced Concrete Bridge Approaches shall be in accordance with 609 unless modified herein.

(d) Grouted Splice Couplers

Grouted Splice Couplers shall be comprised of a combination of a structural sleeve and high strength cementitious grout. The grout shall be in accordance with the Grouted Splice Coupler's manufacturer's recommendations. The following reinforcing splice couplers are acceptable for use provided that the requirements of this specification are met.

NMB Splice Sleeve
Splice Sleeve North America, Inc.
192 Technology Drive, Suite J
Irvine, CA 92618-2409

Sleeve-Lock Grout Sleeve System
Dayton Superior
Corporate Headquarters
7777 Washington Village Drive, Suite 130
Dayton, OH 45459

Erico Lenton Interlok
ERICO United States
34600 Solon Road
Solon, OH 44139

(e) Structural Non-Shrink Grout

Use structural non-shrink grout for joints between precast elements in accordance with 105.03. Use gray, non-shrink grout concrete, containing no calcium chloride or admixture containing calcium chloride or other ingredient in sufficient quantity to cause corrosion to steel reinforcement. Use quick-setting, rapid strength gain, non-shrink, and high-bond strength grout. Meet all the requirements of AASHTO T 160 with the exception that the Contractor supplied cube molds will remain intact with a top firmly attached throughout the curing period.

Structural Non-Shrink Grout shall meet the following requirements:

Structural Non-Shrink Grout			
*Properties	Requirements	ASTM	AASHTO
Accelerated Weathering Tested Medium Accepted Weight Loss	<3% White Utah Road Salt <15% @ 300 Cycles		T 161
Compressive Strength	≥3,000 psi @ 24 hours >5,000 psi @ 7 days		T 106
Accepted Bond Strengths	>1,000 psi @ 24 Hours	C 882 as modified by C 928 8.5	
Length Change	No expansion after 7 days		T 160

* Certified test results from an AASHTO accredited testing laboratory will suffice for acceptance.

(f) Corrugated Steel Pipe

Shall conform to AASHTO M 36 or AASHTO M 245.

(g) Leveling Devices

Refer to the plans or working drawings for fabricated steel leveling devices. Alternate devices may be used provided the devices can support the anticipated loads.

(h) Lifting Devices

Use lifting devices that can support the required vertical and horizontal forces with the applicable safety factors according to the Component Handling and Erection Bracing requirements in the PCI Design Handbook. In the approach slabs, use a device that will have 2¾ inch top cover and 1 inch bottom cover after installation. This may require partial removal of the device after installation.

(i) Miscellaneous Steel Items

Galvanize all miscellaneous steel items permanently cast into structural concrete elements in accordance with AASHTO M 111.

(j) Flowable Backfill

Flowable Backfill shall be in accordance with 213.

Fabrication

Fabrication shall be in accordance with 707. In lieu of using a precast plant, the elements may be fabricated on site and shall be constructed in accordance with 702 unless modified within this provision. If the elements are not cast on site, the elements shall be fabricated at:

1. Department Approved Certified Precast Concrete Producer
2. Within 100 miles of the project site, unless approved by the Engineer

Do not place concrete in the forms until the Engineer has inspected the form and has approved all materials in the precast elements and the placement of the materials in the form.

Provide the Engineer a tentative casting schedule at least two weeks in advance to make inspection and testing arrangements. A similar notification is required for the shipment of precast elements to the job site.

Removal of forms shall conform to 702.13 and concrete curing shall be in accordance with 609.10 or 702.22.

Supply test data such as slump, air voids, or unit weight for the fresh concrete and compressive strengths for the hardened concrete after 7, 14, and 28 days, if applicable.

Finish the precast elements in accordance with 609.09 or 702.21.

Quality Assurance

(a) Precast Substructure Elements

Prevent cracking or damage of precast elements during handling and storage.

Replace defects and breakage of precast elements.

1. Members that sustain damage or surface defects during fabrication, handling, storage, hauling, or erection are subject to review or rejection.
2. Obtain approval before performing repairs.
3. Repair work shall reestablish the elements' structural integrity, durability, and aesthetics to the satisfaction of the Engineer.
4. Determine the cause when damage occurs and take corrective action.
5. Failure to take corrective action leading to similar repetitive damage can be cause for rejection of the damaged element.
6. Cracks that extend to the nearest reinforcement plane and fine surface cracks that do not extend to the nearest reinforcement plane but are numerous or extensive are subject to review and rejection.
7. Full depth cracking and breakage greater than 1 ft are cause for rejection.

Document all test results. The quality control file will contain at least the following information:

1. Element identification
2. Date and time of cast
3. Concrete cylinder test results
4. Quantity of used concrete and the batch printout
5. Form stripping date and repairs if applicable
6. Location/number of blockouts and lifting inserts
7. Temperature and moisture of curing period
8. Lifting device details, requirements, and inserts

(b) Structural Non-Shrink Grout

Warranty the in-place structural non-shrink grout performance and workmanship for two years. Repair, at the Department's option, any bonding failures that occur during the warranty period.

Handling, Storing and Transportation

Handling and Shipping shall be in accordance with 707.08 where applicable, except that the minimum strength of the member prior to shipping shall be 3,500 psi unless the shipping design requires otherwise.

General Procedure for All Installation of Elements

If required in the Contract Plans, the Contractor shall dry fit adjacent elements prior to the final installation. The Contractor shall establish working points, working lines and benchmark elevations prior to placement of all elements. In addition, the Contractor shall check the condition of the receiving bonding surface prior to connecting the elements. The Contractor shall take any necessary measures to remove items such as dust, rust and debris to provide the satisfactory bonding required between the protruding reinforcing bar elements and the grouted couplers. The elements shall be placed in the sequence and according to the methods outlined in the working drawings. Any precast elements placed against other concrete surfaces shall be set at the correct elevation using leveling devices or shims. The structural non-shrink grout shall be mixed just before its use and according to the manufacturer's recommendations.

Installation of Bent Caps and Wingwalls

Prior to lifting the precast element, the top of the lower element shall be surveyed. Shims shall be added to ensure the connection is made at the correct elevation. The elevation of the top of the shims shall be surveyed as well as any projecting dowels (if applicable). The elevations shall be verified to ensure they are within the proper tolerances.

A dry fit of the element is recommended until work crews are familiar with the process. During the dry fit, set the element in the proper horizontal location and check that the horizontal and vertical alignment are within the specified tolerances. If required, remove the elements and adjust the shims if the element is not within tolerances. Check the dowel spacing or grouted splice couplers by using bi-level templates and jigs. Slight tilting of the element is allowed if it is within tolerances.

Lift the element and use lifting devices as shown in the working drawings. Set the element and install the couplers, or fill the pipe blockouts, once the connection geometry is established and checked. Install temporary bracing if specified in the working drawings.

Allow the grout in the coupler to cure until the coupler can resist 100 percent of the specified minimum yield strength of the bar before removing the bracing and proceeding with installation of components above the element. Backfilling behind the element may be allowed if engineering calculations are provided that show the temporary bracing will resist the loading. The required grout strength is based on the certified test report utilizing the testing cube samples.

Bridge seats may be ground to achieve the specified seat elevation tolerance to a maximum depth of 3/8".

Installation of Approach Slabs

Prior to the installation process, pre-test the grout material installation under field conditions in a similar void mock-up before installation of the approach slab to determine grout flowability. Include in the mock-up at least two fill ports that are of the same configuration as the actual bridge.

Working points, working lines, and benchmark elevations shall be established before placing of all elements. The approach slabs shall be lifted using lifting devices as shown in the working drawings. The approach slabs shall be set in the proper horizontal location and checked for proper

alignment and grade within specified tolerances. Prior to releasing the approach slabs, survey the top elevation of the approach slab to verify its elevation. The Contractor shall prevent shifting of the precast approach slab panels during installation.

Just prior to use, mix structural non-shrink grout in accordance with the manufacturer's instruction and Saturate Surface Dry (SSD) all surfaces receiving structural non-shrink grout. The grout shall be placed following manufacturer's recommendations for preparation and installation. If the heat of hydration is excessive, contact the manufacturer's representative for advice on how to reduce heat such as wet curing or adding retarding admixture.

Superimposed dead loads or live loads shall not be applied to the precast approach slabs until the structural non-shrink grout has reached a strength of 500 psi based on manufacturer's published data. The structural non-shrink grout shall be cured in accordance with the manufacturer's recommendations.

Flowable backfill shall be pumped under the end of the approach slabs by starting from the center of the approach slab and proceed toward the outside edges or start from one end and proceed continuously to the other end.

The closure pours shall be cast as shown on the plans or working drawings and the surface shall be tined.

Profile grind the deck and approaches in accordance with 501.25 after all panels are in place, grouting is complete, and design strength is achieved.

Method of Measurement

Concrete will be measured in accordance with 702. Reinforcing bars shall be measured in accordance with 703. Flowable backfill shall be measured in accordance with 213.

Basis of Payment

The accepted quantities of concrete will be paid for in accordance with 702. The accepted quantities of reinforcing bars shall be paid for in accordance with 703. Flowable backfill will be paid for in accordance with 213.

The cost of all materials, labor and equipment, including additional reinforcement for lifting and transport, lifting hardware, testing, transportation and installation, grinding, corrugated steel pipe, leveling devices, shims, grouted splice couplers and grout for bedding material or closure pours shall be included in the pay items of this provision.