

PRECAST CONCRETE/STEEL COMPOSITE SUPERSTRUCTURE

****From Roxbury BHF 0187(8)/ER 0187(9)**

- xx. DESCRIPTION. This work shall consist of manufacturing, transporting, and erecting prefabricated concrete/steel composite superstructure units as shown on the Plans. The work shall also include connecting the units together by installing diaphragms and placing grout between units.

The work under this Section shall be performed in accordance with these provisions, the Plans, and Sections 506 and 540 of the Standard Specifications.

- xx. MATERIALS. Materials shall meet the requirements of Subsections 506.02, 540.02, and the following:

Concrete Repair Material.....780.01-780.04

- xx. GENERAL FABRICATION REQUIREMENTS. The structural steel furnished under this Section shall be fabricated in a plant meeting the requirements of Subsection 506.03. After fabrication, the structural steel shall be transported to a plant meeting the requirements of Subsection 540.03(a), where the remainder of the composite superstructure unit shall be fabricated.

The Fabricator of the final unit shall have demonstrated experience in the production of steel beam composite precast units or it shall have a satisfactory addendum to its Quality Control plan and erection/lifting plans specific to the member detailed.

- xx. DESIGN AND DRAWINGS. The Fabricator(s) shall submit Fabrication Drawings for the precast concrete/steel composite superstructure units, including but not limited to precast concrete, reinforcing steel, structural steel, shear connectors, and all lift points and their reinforcement in accordance with Subsection 105.03, to include the information requirements specified in Subsection 540.04.

- xx. INSPECTION. In addition to the requirements of Subsection 540.06, the structural steel shall also be inspected by the Agency in accordance with Subsection 106.04 and Section 506.

- xx. FABRICATION.

(a) Forming Members. Forms shall be well constructed, carefully aligned, clean, substantial, and firm, and securely placed and fastened together to provide a level, true riding surface. The adjustable supports and deflection control shall be checked by the Fabricator's engineer prior to pouring and monitored throughout the pouring process. Any defects or damage due to form work, stripping, or handling may be cause for rejection. Holes, cutouts, anchorage, reinforcement, and any other related details shown on the Plans shall be provided for in the members.

The form finish shall be in accordance with the approved Fabrication Drawings.

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- (b) Structural Steel. Structural steel shall be fabricated in conformance with Section 506.
- (c) Welding. All welding shall conform to the requirements of Subsection 506.10.
- (d) Reinforcing Steel. Bar reinforcement shall be furnished and installed in conformance with Section 507.
- (e) Concrete. Concrete mix and proportioning shall meet the requirements of Subsection 501.03 for Concrete, High Performance Class A.
- (f) Placing Concrete. Concrete shall not be deposited in the forms until the Agency representative has approved placement of the reinforcement and inserts. The concrete shall be vibrated internally, externally, or a combination thereof to the required consolidation. The vibrating shall be done with care and in such a manner that:
 - (1) Concrete is uniformly consolidated.
 - (2) Displacement of reinforcement and inserts is avoided.
 - (3) Acceptable finish surfaces are produced.
- (g) Curing. Curing shall meet the requirements of Subsection 501.17.
- (h) Removal From Forms. Forms shall not be removed until the curing period has ended.
- (i) Concrete Finishing. Finishing shall conform to the requirements of Subsection 501.16.
- (j) Dimensional Tolerances.
 - (1) Geometry of Concrete Deck.
 - a. Length (Each Unit). ± 20 mm (3/4") (Adjacent unit lengths shall not vary by more than 20 mm (3/4"))
 - b. Width. ± 10 mm (3/8")
 - c. Deck Thickness. $+ 10$ mm (3/8"), $- 6$ mm (1/4")
 - d. Deviation from Diagonals. ± 20 mm (3/4") (horizontal)
 - e. Deviation from End Squareness or Skew. ± 20 mm (3/4") (horizontal)
 - f. Stringer Spacing. ± 13 mm (1/2") (within a unit)
 - g. Horizontal Alignment. ± 10 mm (3/8") (Deviation from straight line parallel to the centerline of the unit)
 - h. Insert Location. ± 10 mm (3/8")

- (2) Reinforcing.
 - a. Spacing. ± 50 mm (2") (non-cumulative)
 - b. Cover (Top and Bottom Mat). ± 10 mm (3/8")
- (3) Field Installation.
 - a. Vertical deviation between units prior to grouting shall not exceed 10 mm (3/8") (after finishing operations are complete).
 - b. Joint width between units shall be 20 mm (3/4") \pm 13 mm (1/2").
- (k) Rejection of Units. Individual precast units will be rejected for any of the following reasons:
 - (1) Fractures or cracks passing through the deck.
 - (2) Camber that does not meet the requirements in the approved Fabrication Drawings.
 - (3) Honeycombed open texture.
 - (4) Dimensions not within the allowable tolerances as specified.
 - (5) Separation of the concrete deck from the steel girders.
 - (6) Defects that indicate proportioning, mixing, and molding not in compliance with the specifications.
 - (7) Damaged ends where such damage would prevent making a satisfactory joint.
 - (8) Units with crack(s) within any part of the concrete that is greater than 0.8 mm (0.03") in width.
 - (9) Significant damage to the units during transportation, erection, or construction as determined by the Engineer.
 - (10) Units not fabricated in accordance with the Contract Documents.
- (l) Repair of Units. Units that contain minor defects caused by manufacture or handling may be repaired at the manufacturing site. Repair procedures shall be in accordance with the approved quality control plan and require approval by the Engineer. Minor defects are defined as holes, honeycombing, or spalls which are 150 mm (6 inches) or less in diameter and do not penetrate deeper than 25 mm (1 inch) into the concrete. Surface voids or "bugholes" that are less than 16 mm (5/8 inch) in diameter and less than 6 mm (1/4 inch) deep need not be repaired. Repairs shall be made using an overhead and vertical concrete repair material satisfactory to the Engineer. The repair material shall

be cured as specified by the manufacturer. The Engineer shall approve final repairs.

- (m) Cracking. Crack widths less than 0.3 mm (0.01") shall be sealed with a penetrating sealer using Agency approved materials and procedures. Crack widths measuring 0.3 mm to 0.8 mm (0.01" to 0.03") shall be epoxy injected using Agency approved materials and procedures. At the Engineer's discretion, cracked members shall be repaired or replaced at the Contractor's expense.
- (n) Labeling. Each unit shall be clearly and permanently labeled on the underside of the deck (in the vicinity of the end diaphragm) with the following information:
 - (1) Trade Name
 - (2) Manufacturer
 - (3) Date of Manufacture
 - (4) Load Rating
 - (5) Mark Number
- (o) Pre-Assembly. The units shall be pre-assembled at the Fabricator's plant to assure proper match between units before shipping to the project site, to the satisfaction of the Agency. Dimensions shall be provided to the Contractor for setting abutment dimensions and elevations.
- (p) Shipping. Units shall not be shipped until the minimum 28-day strength is attained and they have been stamped by the Agency. A 48-hour advance notice of the loading and shipping schedule shall be provided. The units shall be secured on the vehicle in order that no fatigue cracking will occur during transport. The Contractor shall secure the necessary hauling permits.

xx. CONCRETE TESTING.

- (a) General. Precast concrete/steel composite superstructure units shall be manufactured in a plant which maintains a quality control laboratory complete with equipment for measuring the properties of fresh and hardened concrete. As a minimum, the laboratory shall be equipped with a compression testing machine, curing room or chamber, apparatus for measuring slump and air entrainment, and a complete set of aggregate sieves. The compression testing machine shall be calibrated yearly by an independent laboratory using equipment that is certified by the National Institute of Standards and Technology. The testing machine shall be power operated and capable of applying the load continuously rather than intermittently, and without shock.
- (b) Testing of Compressive Strength. Specimens shall be standard cylinders made by the Fabricator in accordance with AASHTO T 23. An Agency representative shall witness fabrication of test specimens. Molds for forming test specimens shall conform to AASHTO M 205 and shall be supplied by the Fabricator. The

specimens shall be cured under the same conditions as the member from the time of casting until the member is removed from the form. At that time, the specimens shall be moved to storage where curing shall continue under standard conditions in accordance with AASHTO T 23. These specimens shall be retained by the Fabricator for testing by the Agency. Specimens shall be tested either at the Agency's Materials and Research Section laboratory, or at the manufacturer's plant laboratory. An Agency representative will witness all tests. If the average strength of specimens from a member does not reach the 28-day design strength within 28 days, the member shall be rejected.

xx. HANDLING. Handling shall be performed in accordance with Subsection 540.09.

xx. INSTALLATION.

(a) General. The precast concrete/steel composite superstructure units shall be fabricated in accordance with the applicable sections of the specifications and/or the Special Provisions for each respective item. Construction procedures and permissible variations other than those contained herein shall be submitted for approval.

(b) Erection Plan. Cranes, lifting devices, and other equipment for erecting precast concrete/steel composite superstructure units shall be of adequate design and capacity to safely erect, align, and secure all members and components in their final positions without damage. The Contractor is solely responsible for the methods and equipment employed for the erection of the precast concrete/steel composite superstructure units.

The Contractor shall submit Construction Drawings in accordance with Section 105 for the methods and sequence of precast concrete/steel composite superstructure unit erection, the temporary bracing, and the equipment to be used for the erection. The erection plan shall include the necessary computations to indicate the magnitude of stress in the segments during erection and to demonstrate that all of the erection equipment has adequate capacity for the work to be performed. The erection plan shall contain provisions for all stages of construction, including temporary stoppages.

The precast concrete/steel composite superstructure units may be used to support equipment prior to placement of the pavement only with written permission of the Engineer. The proposed use of the precast concrete/steel composite superstructure units for support of equipment shall be detailed in the erection plan.

Submittal of the erection plan is for the Agency's information only, and shall in no way be construed as approval of the proposed method of erection. Unless otherwise directed by the Engineer, the Contractor shall follow the erection plan as submitted.

(c) Erection of Units. Erection of units shall not proceed until substructure concrete has been cured for the minimum length of

time specified in Subsection 501.17. Units shall be installed to the correct line and grade as shown on the approved drawings and as indicated in the approved erection procedure. After all the units are erected, they shall be inspected to ensure the correctness of their location. Approved steel shims shall be used between the bearing and the beam to compensate for minor differences in elevation between units and to comply with approach and adjacent deck elevations.

- (d) Structural Steel. All diaphragms and other structural steel work shall be installed as shown on the approved Working Drawings after the units are in their final locations.
 - (e) Matching Elevation of Units. Adjacent units shall match elevation within 6 mm (1/4 inch) vertically (along longitudinal edges) and 6 mm (1/4 inch) vertically at the end of units, provided all diaphragms can be tightened without permanent deformation or damage to any structural component. If the tolerance is not met, the units shall be adjusted as indicated in the procedures shown on the approved Working Drawings.
 - (f) Filling and Sealing Longitudinal Joints. Prior to placement of non-shrink grout material, the surface of the joint shall be free of any material, such as oil, grease, or dirt, which may prevent bonding of the sealing materials.
 - (g) Sealing of Lifting Holes. After the units are in their final locations, a bonding agent shall be applied and the lifting holes filled with cementitious grout. A removable form shall be provided at the bottom surface of the deck to retain the grout.
 - (h) Loading. Units may be loaded upon erection and before the joints are sealed in accordance with the approved erection procedure. Once the joints are sealed, no further loading of the units will be allowed until joint material has properly and finally cured and as approved by the Engineer. The grout shall be cured in accordance with the manufacturer's instructions until design strength has been met.
 - (i) Final Repairs. After the installation work is complete, remaining concrete defects, holes for inserts, and lifting holes shall be repaired as indicated and approved by the Engineer.
 - (j) Grout. Grout shall be placed in accordance with the requirements of Subsection 540.11.
 - (k) Technical Assistance. The Contractor shall have a representative from the Fabricator of the final unit present at the project site, full time, during the erection of the precast concrete/steel composite superstructure units to provide technical assistance to the Contractor in the event unusual problems or special circumstances arise.
- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Precast Concrete/Steel Composite Superstructure) to be measured for payment will be the number of square meters (square **feet**) installed in the complete and accepted work.

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xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Precast Concrete/Steel Composite Superstructure) will be paid for at the Contract unit price per square meter (square **foot**). Payment will be full compensation for detailing, fabricating, repairing, quality control testing, transporting, handling, and installing the materials specified, including concrete, reinforcing steel, structural steel, shear studs, connectors, and shims; for designing and installing lift brackets and any other material contained within or attached to the members; for any grouting work required; for furnishing and implementing the erection plan; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Elastomeric bearing pads will be paid for separately under Contract item 531.11.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.675 Special Provision (Precast Concrete/Steel Composite Superstructure)	Square Meter (Square Yard)