**DESIGNER NOTES**

*All notes to the designer are highlighted. Please read the notes carefully. This special provision has been developed by MassDOT and shall be used for all Prefabricated Bridge Units. Please only modify content highlighted in yellow. Un-highlighted content shall not be modified.*

*Special provisions content highlighted in yellow that may need to be modified includes the following:*

* *Include applicable special provision (galvanizing or Metalizing) for steel beam coating (Page 3).*
* *Indicate requirements for closure pour concrete on the plans (Page 5).*
* *Delete the entire* COMPENSATION *section when used as part of Item 995. (Page 6 – COMPENSATION). However, the Unit of Measurement for the Item 995. Schedule of Basis for Partial Payment shall be each (EA) and the quantity shall be the number of individual prefabricated bridge units to be supplied and assembled to into the bridge structure. DO NOT break the prefabricated bridge units into their constitutive components (e.g. CY of concrete, LB of structural steel) and lump these quantities with the field installed materials as this creates needless work for the resident engineer to separate them when paying contractors. See Bridge Manual, Part I, Chapter 5 for more information.*

*This Special Provision was revised to be consistent with Materials Specification M4 of Division III of the  2025 Standard Specifications.*

*DELETE ALL DESIGNER NOTES, AND REMOVE HIGHLIGHTING PRIOR TO SUBMITTAL*

# PREFABRICATED BRIDGE UNITS (PBUs)

### General.

The work under this Heading consists of fabricating, transporting, and erecting Prefabricated Bridge Units (PBUs) and includes all labor, materials, equipment and incidentals necessary to complete the work as shown on the Plans. PBUs consist of shop assembled pairs of structural steel beams and associated diaphragms with shop cast reinforced concrete deck slabs that are fabricated off site and shipped as units. The concrete to be used in the fabrication of the Prefabricated Bridge Units (PBUs) shall meet the requirements of Section M4: Cement Concrete and Related Materials.

## QUALITY ASSURANCE FOR STRUCTURAL STEEL

### General.

Quality Assurance requirements for the fabrication of structural steel shall be as specified in Section 960 and shall be performed at the structural steel plant during fabrication, at the precast concrete plant during PBU assembly, and in the field for final erection and assembly. Quality Assurance requirements for the assembly of the structural steel elements and fabrication of precast concrete deck slabs shall be as specified below.

### Quality Control for Structural Steel.

The work under this subheading shall conform to the relevant provisions of Section 960 and shall include the supply, fabrication, and assembly of beams and diaphragms into PBUs. Structural steel Fabricators shall be approved by MassDOT in accordance with Standard Specifications, Division I, Section 6.01. The steel Fabricator shall provide qualified work crew(s) and QC inspectors to the precast concrete plant as needed to perform all steel fabrication and assembly work that is required to be performed for the fabrication of the PBUs.

### Acceptance for Structural Steel.

Structural steel elements shall conform to the requirements of the specifications and shall be accepted by MassDOT prior to being released from the steel Fabricator for shipment to the precast plant. The structural steel for the PBUs shall be assembled at the precast concrete plant and the assembly shall be accepted by MassDOT at the precast concrete plant prior to casting the deck.

## MATERIALS

### Materials.

Materials shall conform to M4.09.1 and the following:

Mechanical Reinforcing Bar Splicer M8.01.9

Lifting Devices PCI MNL-116

Stud Shear Connectors M8.04.1

High Strength Bolts M8.04.3

Structural Steel M8.05.0

#### Cement Concrete Mix Design.

Cement concrete for PBUs shall be 5000 psi, 3/4 inch HP Concrete and meet the requirements of M4.06.2 High Performance Concrete.

#### Stud Shear Connectors.

Stud shear connectors applied to flanges of the beams may be installed at either the steel fabrication shop or the precast plant. If the installation is performed at the precast plans, the work shall be done by steel fabrication shop personnel.

#### Threaded Inserts

Threaded inserts are permissible on the underside of the PBU decks to facilitate the forming of the closure pours. Threaded inserts shall be hot dip galvanized or made of stainless steel. The number of threaded inserts shall be minimized and the inserts shall not come in contact with the reinforcing steel.

## CONSTRUCTION METHODS – PLANT FABRICATION OF STRUCTURAL STEEL

### Shop Drawings.

Shop drawings shall conform to the following requirements:

1. General Requirements of Section 5.02
2. Subsection 960.60 and M4.09.2B
3. The drawings shall account for the geometry of the complete bridge structure and individual PBU components.

### Fabrication.

All structural steel components shall be fabricated in accordance with Subsection 960.61.

### Coatings.

The corrosion protection for the fabricted steel members shall be as specified on the Plans. *Provide Special Provison for the type of coating to be used: Thermal Sprayed Coating (aka Metalizing) or Galvanized.*

### Tolerances.

Tolerances for the fabrication of the steel beams shall be in accordance with 960.61.

# CONSTRUCTION METHODS – PLANT FABRICATION OF PRECAST CONCRETE

### PBU Assembly Plan Drawings.

PBU Assembly Plan Drawings shall identify the Fabricator’s proposed plan for supporting the steel beams of a PBU unit in a manner that will provide for the proper fit and relative elevations of PBUs consistent with the final relative bridge geometry (elevations, horizontal locations and skew) and that will ensure the beams deflect as assumed in the calculation of the beam camber and Top-of-Form elevations. Alternative methods of support during casting of the deck require approval by the engineer and revised Top-of-Form elevations. The PBU Assembly Plan shall also show the design and plan of the foundation that shall support the PBU units during assembly, the method for forming the deck, and the procedure for the placement and finishing of the deck concrete. The PBU Assembly Plan Drawings shall be submitted by the Contractor to the Engineer of Record for approval.

To ensure proper fit in the field and conformance with the roadway profile and deck cross slope, the Fabricator shall cast the deck with the beams set to the relative proposed bridge seat geometry (elevations, horizontal locations, and skew) and the deck forms to the relative blocking distances as defined by the Top-of-Form elevations. The temporary supports shall be installed in accordance with the approved PBU Assembly Plan Drawings. The Contractor shall independently verify the Fabricator’s temporary support geometry and the foundation and temporary supports during all operations for settlement. The Contractor shall submit the following documentation to the Engineer of Record for review and approval:

1. The method the Contractor shall employ to independently verify the Fabricator’s temporary support geometry as installed to ensure that it is consistent with the final relative bridge geometry
2. The method the Contractor shall employ to independently monitor the foundation and temporary support during all assembly and casting operations for settlement
3. Method of forming deck slabs

### Pre-Production Meeting.

The Contractor shall notify the MassDOT Research and Materials Section to determine if a pre-production meeting will be required to review the specification, shop drawings, curing plan, schedule, and discuss any specific requirements. The meeting shall be held prior to scheduling a MassDOT Inspector (refer to M4.09.4 *Department Acceptance*), and at least seven (7) days prior to the scheduled casting of any PBU or control section. The Contractor shall schedule the meeting, which shall include representatives of the Fabricator and MassDOT.

### Reinforcement.

The reinforcing bars shall be installed in accordance with Subsection 901.35, including tolerances for cover and horizontal spacing of bars. Components of mechanical reinforcing bar splicers shall be set with the tolerances shown on the plans. The reinforcing bars and mechanical reinforcing bar splicers shall be assembled into a rigid cage that will maintain its shape in the form and which will not allow individual reinforcing bars to move during the placement of concrete. This cage shall be secured in the form so that the clearances to all faces of the concrete, as shown on the plans, shall be maintained.

### Tolerances.

Fabrication shall comply with tolerances specified on the plans. Tolerances for steel reinforcement placement shall be in accordance with Subsection 901.35. Tolerances for the deck finish shall be in accordance with Subsection 901.37E.4.

### Forms.

Concrete shall be cast in rigidly constructed forms, which will maintain the PBUs within specified tolerances to the shapes, lines and dimensions shown on the approved fabrication drawings. Forms shall be constructed from flat, smooth, non-absorbent material and shall be sufficiently tight to prevent the leakage of the plastic concrete. When wood forms are used, all faces in contact with the concrete shall be laminated or coated with a non-absorbent material. All worn or damaged forms, which cause irregularities on the concrete surface or damage to the concrete during form removal, shall be repaired or replaced before being reused. If threaded inserts are cast into the elements for support of formwork, the inserts shall be recessed a minimum of 1 inch and shall be plugged after use with a grout of the same color as that of the precast cement concrete.

## CONSTRUCTION METHODS – FIELD CONSTRUCTION

### General.

All of the Contractor’s field personnel involved in the erection and assembly of the Prefabricated Bridge Units shall have knowledge of and follow the approved Erection Procedure and Quality Control Plan for Prefabricated Bridge Unit Assembly.

Prior to installation, the following documentation shall be reviewed and confirmed by the MassDOT Resident Engineer or designee:

1. QC Compressive Strength Test Report Forms attaining Design Strength, f’c for the Prefabricated Bridge Unit’s representative sublot.
2. Certificate of Compliance generated by the Fabricator as described in M4.09.3.
3. QC Inspection Reports signed by the Quality Control Manager.

Field construction staff shall verify that the Resident Engineer has accepted all Prefabricated Bridge Units prior to installation.

### Erection Procedure and Quality Control Plan for Prefabricated Bridge Unit Assembly.

Prior to the erection, the Contractor shall submit an Erection Procedure and a Quality Control Plan for PBU Assembly for approval by the Engineer. This submittal shall include computations and drawings for the transport, hoisting, erection and handling of the PBUs. The Erection Procedure and Quality Control Plan for PBU Assembly shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts with working knowledge of the Contractor’s equipment, approved shop drawings, and materials to build the bridge. The Erection Procedure and Quality Control Plan for PBU Assembly shall, at a minimum, include the following:

#### Erection Procedure

The Erection Procedure shall be prepared to conform to the requirements of Subsection 960.61, Design, Fabrication and Erection and the applicable sections in Chapter 8 of the PCI Design Handbook (eighth edition) for handling, erection, and bracing requirements. At a minimum, the Erection Procedure shall provide:

1. Steel reinforcing details, concrete deck details, location, and details of lifting devices
2. Minimum concrete compressive strength for handling the PBUs.
3. Concrete stresses and steel member stresses during handling, transport, and erection.
4. Crane capacities, pick radii, sling geometry, and lifting hardware.
5. Verification that the equipment can handle all pick loads and weights with the required factor of safety.
6. Evaluation of construction sequence and evaluation of any geometric conflicts in the lifting of the PBUs and setting them on the abutments and piers.
7. Design of crane supports including verification of subgrade for support.
8. Location and design of all temporary bracing that will be required during erection.

#### Quality Control Plan for PBU Assembly

The Quality Control Plan for PBU Assembly is a document prepared and submitted by the Contractor prior to the start of work which requires the Contractor to identify and detail the sequence of construction in accordance with the project schedule and which clearly identifies all stages of field construction. The assembly procedures for the PBUs shall be submitted in PDF format on 24”x36” sheets. This document will be treated as a Construction Procedure and will be reviewed by both the Designer and the District Construction Office.

At a minimum, the Quality Control Plan for PBU Assembly shall include the following:

1. Listing of the equipment, materials, and personnel including their assigned responsibilities that will be used to erect and assemble the PBUs on site.
2. Documentation of all preparatory work necessary for moving personnel, equipment, supplies, and incidentals to the project site before beginning work.
3. Detailed schedule showing the sequence of operations that the Contractor will follow to complete the field construction from setting working points and working lines to the casting of closure pours and the curing of the closure pour concrete, as described below and as called for on the plans.
4. Contractor’s means for ensuring that the PBU shall align to the roadway profile and cross slope and means for adjusting the final deck slab elevation.
5. Timeline and descriptions of Quality Control activities to be followed throughout the field construction operations including methods and procedures for controlling tolerance limits both horizontally and vertically.

### Survey and Layout.

Working points, working lines, and benchmark elevations shall be established prior to placement of all elements. The Contractor is responsible for field survey as necessary to complete the work. MassDOT reserves the right to perform additional independent survey. If discrepancies are found, the Contractor may be required to verify previous survey data.

### Preparation of Closure Pours.

Immediately prior to erecting the PBUs, the surfaces of the closure pours shall be cleaned at the job site of all dust, dirt, carbonation, laitance, and other potentially detrimental materials which may interfere with the bonding of the closure pour concrete and precast concrete bridge deck using a high-pressure water blast. The exposed reinforcing steel in the precast concrete bridge deck shall be protected from damage during the cleaning of the closure pours. Damaged epoxy coating of steel reinforcement shall be repaired, and the reinforcing steel shall be cleaned as directed by the Engineer. The surfaces of the closure pours shall be wetted so that the surfaces shall have a Saturated Surface Dry (SSD) condition no more than 24 hours prior to the placement of the closure pour concrete. If UHPC is used as the closure pour concrete, the surfaces of the closure pours shall be prepared as called for in the UHPC Special Provision.

### Erection.

The PBUs shall be placed in the sequence and according to the methods outlined in the Erection Procedure and Quality Control Plan for Prefabricated Bridge Unit Assembly to the line and grade shown on the plans. The height of each PBU shall be adjusted to within acceptable tolerances by approved means as specified in the Assembly Plan. The Contractor shall ensure that the PBU is in the proper horizontal and vertical location prior to releasing it from the crane and setting the next unit.

As the PBUs are being erected, the Contractor shall monitor the width of the closure pours and the out-to-out width of the precast concrete bridge deck elements so that, after all PBUs are erected, the actual overall width of the bridge deck shall not deviate from the dimension shown on the plans beyond a tolerance of +0 inches and -1 inches. In order to achieve this, the Contractor may vary the width of the closure pours within the tolerances specified on the plans. If required, random oriented fiber shims of different thicknesses may be used to adjust the final elevation of the prefabricated bridge unit to meet the proper roadway grade.

After the layout of PBUs has been accepted by the Engineer, the Contractor shall cut all lifting devices off below the surface of the precast concrete bridge deck.

### Filling of Blockouts for Lifting Devices and Closure Pours.

Concrete for closure pours shall be as called for on the plans and shall be placed and cured in accordance with the Assembly Plan. If called for on the plans, the concrete end diaphragms, pier diaphragms, and link slabs shall be filled with the closure pour concrete in accordance with the Assembly Plan.

Blockouts in the precast concrete bridge deck that were provided for the lifting devices shall be filled with same concrete as that used for filling the closure pours or other approved material.

After the formwork has been removed, all threaded inserts that have been cast into the precast concrete bridge deck for support of the formwork shall be plugged with a grout of the same color as that of the precast concrete.

## COMPENSATION

### **Basis** of Payment.

The furnishing, fabricating, and erecting of all Prefabricated Bridge Units for the structure shall be paid for at the contract unit price EACH, complete in place.

### Payment Items.

Prefabricated Bridge Units EA