## 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 prestressed concrete bridge beams. Please only modify content highlighted in yellow. Unhighlighted content shall not be modified.*

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

* *Identify the type of prestressed concrete bridge beam(s) to be used on this project: (NEXT F, NEXT D, NEBT, NEDBT, adjacent or spread box beam, adjacent or spread deck beams) (page 2 – General).*
* *Delete the Materials - Transverse Ties section, if not applicable to your project. (page 2).*
* *Delete reference to void forms if not using box or deck beams (page 3)*
* *Modify the Construction Methods – Field Construction section as necessary. (pages 3-7)*
* *Insert specification for closure pour concrete and indicate requirements for closure pour concrete on the plans if applicable (see reference page 7).*
* *Delete the entire* COMPENSATION *section when used as part of Item 995. (page 7 - COMPENSATION). However, the Unit of Measurement for the Item 995. Schedule of Basis for Partial Payment shall be per foot (FT) for all prestressed concrete beams.*
* *Include steel reinforcement and prestressing strand size, grade, and coating on the plans.*
* *Show limits of raked surface finish for the prestressed concrete bridge beam on the plans.*
* *Prestressed concrete bridge beam Fabricators have concrete mix designs that are approved annually by the MassDOT Research and Materials Section.*

*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*

# *PRESTRESSED CONCRETE BEAMS* *(replace with item headings)*

### General.

The work under this Heading consists of fabricating, transporting and installing *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (fill in with item headings)*, and includes all necessary labor, materials, and equipment to complete the work as shown on the Plans. The Precast, Prestressed, and Prefabricated Concrete Elements shall meet the requirements of Section M4: Cement Concrete and Related Materials.

## MATERIALS

### Materials.

Materials shall conform to M4.09.1 and the following:

Non-Shrink Grout Products M4.04.5

Prestressing Strands AASHTO M 203

Welded Steel Wire Fabric M8.01.2

Mechanical Reinforcing Bar Splicer M8.01.9

Strand Chuck M8.15.0

Lifting Devices PCI MNL-116

#### Reinforcement and Prestressing Strands.

The size and grade of steel reinforcement and prestressing strands shall be as indicated on the plans. All reinforcing steel shall be epoxy coated, Grade 60. All prestressing strands shall be uncoated.

1. **Transverse Ties.** *(delete section if your project does not use adjacent deck or box beams)*

The transverse ties shall be low-relaxation strands meeting the requirements of AASHTO M 203. The size and grade shall be as indicated on the plans.The ties shall be supplied with a seamless polypropylene sheath which has corrosion inhibitor grease between the strand and sheath. The location of all transverse ties, shall be as shown on the plans.

#### Threaded Inserts

Threaded inserts are permissible in Prestressed Concrete Beams for installing formwork, utility supports, or deck drains. Threaded inserts shall be hot dip galvanized or made of stainless steel and shall not come in contact with the reinforcing steel. The number of threaded inserts installed for the Contractor’s convenience shall be kept to a minimum.

# CONSTRUCTION METHODS – PLANT FABRICATION

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### 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 Prestressed Concrete Beam 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 of the Standard Specifications, 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.

### Placing and Tensioning Strands.

Placing and tensioning strands shall be in accordance with PCI MNL-116. The location of all prestressing strands shall be as indicated on the plans.

### Tolerances.

Fabrication shall comply with tolerances specified on the plans. Tolerances for steel reinforcement placement shall be in accordance with Subsection 901.35. In the absence of specifications on the plans, tolerances shall comply with the latest version of the PCI MNL 135, Precast Tolerance Manual.

### Forms.

Concrete shall be cast in rigidly constructed forms, which will maintain the Prestressed Concrete Beams 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.

*(Delete the following paragraph if your project does not use deck or box beams)* Where applicable, the material used for forming voids in concrete deck beams and box beams shall be sufficiently strong and resistant to water to support the wet concrete, which is to be packed around the void forms, without collapsing. The void forms shall be securely anchored so that no movement will occur during placing and consolidation of the concrete. Void drains shall be installed at the locations shown on the plans and Fabricator shall ensure that the drains are in contact with the void form. After the beams have been cast and removed from the forms, the Fabricator shall check that the drains are still in contact with the void form by inserting a rigid probe into the drain for a distance greater than the thickness of the concrete at the void drain.

## CONSTRUCTION METHODS – FIELD CONSTRUCTION

### General.

All of the Contractor’s field personnel involved in the erection and assembly of the Prestressed Concrete Beams shall have knowledge of and follow the approved Erection Procedure and Quality Control Plan for Prestressed Concrete Beam 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 Prestressed Concrete Beam’s representative sublot.
2. Certificate of Compliance generated by the Fabricator as described under the Fabricator Quality Control section.
3. QC Inspection Reports signed by the Quality Control Manager.

Field construction staff shall verify that the Resident Engineer has accepted all Prestressed Concrete Beams prior to installation.

### Erection Procedure and Quality Control Plan for Prestressed Concrete Beam Assembly.

Prior to the erection, the Contractor shall submit an Erection Procedure and a Quality Control Plan for Prestressed Concrete Beam Assembly for approval by the Engineer. This submittal shall include computations and drawings for the transport, hoisting, erection and handling of the Prestressed Concrete Beams. The Erection Procedure and Quality Control Plan for Prestressed Concrete Beam 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 Prestressed Concrete Beam Assembly shall, at a minimum, include the following:

#### Erection Procedure

The Erection Procedure shall be prepared to conform to the requirements of 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, and location and details of lifting devices
2. Minimum concrete compressive strength for handling the Prestressed Concrete Beams.
3. Concrete 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 Prestressed Concrete Beams 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 Prestressed Concrete Beam Assembly

The Quality Control Plan for Prestressed Concrete Beam 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 Prestressed Concrete Beams 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 Prestressed Concrete Beam 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 Prestressed Concrete Beams 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 Prestressed Concrete Beam 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.

*(Designer Note: the following sections should be modified as appropriate or as noted for the specific requirements of the project, and all non-applicable sections should be deleted.)*

### Adjacent Prestressed Concrete Deck or Box Beams.

#### Beam Layout and Erection.

Prestressed concrete beams shall be installed to the line and grade shown on the plans in accordance with the Contractor's approved Erection Procedure and Assembly Plan. The location of the beams on the abutments and piers shall be laid out according to the nominal width of the beams as shown on the plans. Each beam shall be erected such that after erection, the beam shall lie entirely within the horizontal lines defined by its nominal width for its entire length and shall not infringe on the space allocated for any adjacent beam. The Contractor may adjust the width of the shear key between beams.

Immediately prior to erecting the beams, the keyway surfaces shall be cleaned at the job site of all dust, dirt, and carbonation using a high-pressure water blast.

After all beams are erected, the actual overall width of the beams as laid out shall not deviate from the nominal dimension shown on the framing plan beyond a tolerance of +0 inches and -1 inches.

After the beam layout has been accepted by the Engineer, the Contractor shall cut the lifting devices off below the top of the beam.

#### Bridges with Piers.

*(Delete this paragraph if the bridge does not have piers and re-adjust the paragraph numbering)* Prior to erecting the beams, the surfaces of the recessed keyway on top of the pier cap shall be lined by attaching closed cell foam with adhesive to the limits and thickness shown on the plans. Expanded polystyrene shall be placed outside of the recessed area on top of the pier as shown on the plans to prevent the concrete from coming in contact with the pier cap itself.

#### Transverse Tie Tensioning.

Unless shown otherwise on the plans, the transverse ties shall be tensioned to 5,000 pounds before the keyways are filled. After the keyways are filled with mortar (M4.04.5) and the mortar has cured, the ties shall be tensioned as specified on the plans. No traffic or heavy equipment shall be allowed on the bridge until all transverse ties have been properly tensioned and the deck has been cast and cured.

#### Mortaring of Keyways.

The precast concrete keyways that will receive mortar shall be free of materials such as paint, oil, curing compound, bond breaker, dirt etc. that will inhibit bonding. The precast concrete keyways shall be hydro-blasted with equipment that can remove asphaltic material, oils, dirt, rubber, curing compounds, paint carbonation, laitance, and other potentially detrimental materials, which may interfere with the bonding of the mortar and precast concrete.

Exposed reinforcing steel in the precast beam shall be protected from damage during the cleaning of the keyways. Damaged epoxy coating of steel reinforcement shall be repaired, and the reinforcing steel shall be cleaned as directed by the Engineer.

Mortar (M4.04.5) shall be placed in strict accordance with the manufacturer's recommendations and instructions.

The keyways shall be filled flush to the top of the beams and any vertical misalignment between beams shall be feathered out on a slope of 1 to 12. Curing shall be performed in strict accordance with the manufacturer's recommendations. The keyways shall not be filled in cold weather when either the ambient temperature or the prestressed concrete beam's temperature is below the mortar manufacturer's recommendation. No localized heating of either the prestressed concrete beams or of the air surrounding the keyway will be permitted in an attempt to reach application temperatures.

If the keyways are not filled within five days after the beams are erected, the Contractor shall cover and protect the keyways from weather and debris until they are filled.

#### Concrete Deck Slab Placement.

Prior to casting the concrete deck slab, the top of the beam shall be clean and free of all laitance or bond inhibiting agents. The concrete deck slab shall be placed after the transverse ties have been fully tensioned. Deck concrete shall be placed against the beam concrete without the use of any bonding agents.

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

#### Backwalls, Curtain Walls and Keeper Blocks.

The backwalls, the curtain walls at the abutment bridge seats, and the keeper blocks shall be cast only after the beam layout has been accepted. Closed cell foam shall be attached to the bridge beams to the limits and thickness as shown on the plans and the backwall / curtain wall / keeper block concrete shall be placed directly against it. The sidewalk and safety curb may be cast after the curtain walls and exterior pier keeper blocks have been cast.

### Prestressed NEBT, NEDBT, NEXT F, NEXT D and Spread Deck or Box Beams.

#### Beam Layout and Erection.

Prestressed concrete beams shall be installed to the line and grade shown on the plans in accordance with the Contractor's approved Erection Procedure and Assembly Plan. (*Add the following two sentences for NEBT or NEDBT beams)* As the beams are being erected, temporary blocking or bracing shall be installed to prevent the beams from tipping over. The detail and calculations for this bracing shall be included with the erection procedure submittal.

*(Add this paragraph for NEDBT and NEXTD beams only)* Immediately prior to erecting the beams, the surfaces of the closure pours shall be cleaned at the job site of all dust, dirt, and carbonation using a high-pressure water blast. In addition, the surfaces of closure pours shall be wetted so that the surfaces shall have a Saturated Surface Dry (SSD) condition for at least 24 hours prior to the placement of the closure pour concrete.

As the beams are being erected, the Contractor shall monitor the width of the closure pours and the out-to-out width of the beams top flanges so that, after all beams 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.

#### Diaphragms. *(for NEBT or NEDBTs only, if not used re-adjust the paragraph numbering)*

After the intermediate reinforced concrete diaphragms have been poured and allowed to reach a minimum of 70% of the required 28-day strength, the temporary bracing may be removed. The placement of the deck concrete will not be permitted until these concrete diaphragms have been installed and have reached this minimum strength.

The sequence for placing the abutment end diaphragm, integral abutment diaphragm and the pier diaphragm concrete shall be as shown on the plans.

#### Concrete Deck Slab Placement. *(This is for all beams except NEDBT and NEXT D beams)*

Prior to casting the deck, the abutments and piers shall be prepared for the placement of the deck concrete as called for on the plans and the Contractor shall cut the lifting devices off below the top of the beam.

The top of the beam shall be clean and free of all laitance. Deck concrete shall be placed against the beam concrete without the use of any bonding agents.

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

#### Closure Pour Concrete Placement. *(This is for NEDBT and NEXTD beams only)*

Prior to placing the closure pour concrete, the abutments and piers shall be prepared for the placement of the closure pour concrete as called for on the plans.

The surfaces of the closure pours shall be free of materials such as paint, oil, curing compound, bond breaker, dirt etc. that will inhibit bonding. The surfaces of the closure pours shall be hydro-blasted with equipment that can remove asphaltic material, oils, dirt, rubber, curing compounds, paint carbonation, laitance, and other potentially detrimental materials, which may interfere with the bonding of the closure pour concrete and precast concrete.

The exposed reinforcing steel shall be protected from damage during the cleaning of the surfaces 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 Contractor shall cut the lifting devices off below the top of the beam, and the recesses shall be filled with mortar (M4.04.5). The Contractor shall also remove projections and fill all depressions in the tops of the beams with mortar (M4.04.5).

 After the formwork has been removed, all threaded inserts that have been cast into the beams 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 Prestressed Concrete Deck Beams, Prestressed Concrete Beams (NEBT, NEBT D, NEXT F or NEXT D), and Prestressed Concrete Box Beams shall be paid for at the contract unit price per FT, complete in place.

### Payment Items.

Prestressed Concrete Deck Beams (S36 - ##) FT

Prestressed Concrete Deck Beams (S48 - ##) FT

Prestressed Concrete Box Beams (B36 - ##) FT

Prestressed Concrete Box Beams (B48 - ##) FT

Prestressed Concrete NEBT #### FT

Prestressed Concrete NEDBT ## X ## FT

Prestressed Concrete NEXT ##F ### FT

Prestressed Concrete NEXT ##D ### FT

# = per MassDOT Standard Nomenclature.