Index D20310 Series Inverted-T Beams

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; Structures Detailing Manual (SDM); Structures Design Guidelines (SDG)

Design Assumptions and Limitations

Index D20310 is the lead standard for the Inverted-T Beam Developmental Design Standard series which includes Indexes D20310 and D20320. Use this Developmental Design Standard with Index D20320.

These Developmental Design Standards must be supplemented with project specific information including a Table of Beam Variables, Strand Pattern Details and a Strand Debonding Legend which must be completed and included in the Structures Plans. These standards and the supplemental project specific information that is included in the plans provide sufficient information to permit beam fabrication without the submittal of shop drawings.

The pretensioned beams in these Developmental Design Standard Drawings act as simple spans under both Dead Load and Live Load even where the deck is detailed to be continuous across the intermediate supports.

When the total initial tensioning force of the fully bonded strands required by design exceeds 310 kips, shield additional strands at the end of the beam when possible. The end reinforcement may only be redesigned to accommodate an increased vertical splitting force when approved by the State Structures Design Office. If approval is granted, Indexes D20310 and D20320 must then be modified for inclusion in the contract documents and signed and sealed by the EOR.

The "Optional Deck Forming Notch" as shown on the beam End View on Index D20320 is intended to accommodate the use of stay-in-place ¾" thick plywood deck forms. Note that by the use of this detail, the plywood deck form follows the cambered geometry of the top of the beam. Thus the build-up due to beam camber and deck geometry extends over the entire width of the deck between the faces of the outside webs of the fascia beams. This build-up condition is different than what is seen with I-beam and U-beam superstructures where the build-up is only present directly over the top flanges of the beams. Stay-in-place metal deck forms are typically not required for Inverted-T Beam superstructures.

The cast-in-place bridge deck thickness is 6½" for Long Bridges and 6" for Short Bridges. See SDG 4.2 for definitions of Long Bridges and Short Bridges. A single mat of reinforcing steel is typically used with these Inverted-T Beams. Beneath and adjacent to traffic railings the deck must be thickened to 8½" for Long Bridges and 8" for Short Bridges. Supplemental reinforcing steel is required in these thickened portions of the deck. The increased deck thickness must extend to the first interior beam for edge railings, and at least one full bay each side of the traffic railing for interior railings.
A Framing Plan is required for all bridges. Show the locations of the two different Optional Deck Forming Notch dimensions required due to changes in deck thickness. See the SDM for additional Framing Plan requirements for skewed or horizontally curved bridges.

When the following conditions are met for inverted T-beams, use a Live Load Distribution factor equal to 0.2 for moment and 0.27 for shear:

1. Designed in accordance with Developmental Design Standards 20310 and 20320.
2. Span lengths are 30 feet to 75 feet.
3. Span to depth ratios are 22 to 38.
4. Design Deck thickness equals 6 inches.
5. No permanent intermediate diaphragms.
6. Distance $d_e = -9$ inches (align barrier directly above exterior beam).
7. Nominal girder spacing equals 2 feet. Actual girder spacing equals a minimum of 2 feet.1 inch to allow for casting, sweep and erection tolerances.

**Plan Content Requirements**

Insert the Developmental Design Standards Index, received from the Central Office monitor, into the appropriate component plan set in accordance with PPM, Volume 2, Section 3.8.

In the Structures Plans:

Complete the following "INVERTED-T BEAM - TABLE OF BEAM VARIABLES" and include it in the plans. Use additional sheets when the actual number of beams or strand patterns exceeds the capacity of a single plan sheet using the standard table. Supplemental details and modifications are permitted if special conditions require dimensions, details or notes. However, the "INVERTED-T BEAM - TABLE OF BEAM VARIABLES" itself should not be modified. See Introduction I.3 for more information regarding use of Data Tables.

Report elastic and time dependent shortening effects (Dim R) at the top of the beam @ 120 days. The average of the calculated values for the top and bottom of the beam may be used.

Round Angle $\Phi$ up to the nearest degree.

Specify shear stirrup spacings V1, V2 and V3 for Bars 4K to the nearest inch.
### INVERTED-T BEAM - TABLE OF BEAM VARIABLES

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>CONCRETE PROPERTIES</th>
<th>STN.</th>
<th>PLAN VIEW</th>
<th>END OF BEAM AND BEARING DIMENSIONS **</th>
<th>BEAM DIMENSIONS *</th>
<th>REINFORCING STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPAN NO.</td>
<td>BEAM NO.</td>
<td>CLASS</td>
<td>STRENGTHS (PSI)</td>
<td>TYPE</td>
<td>END 1</td>
<td>END 2</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

**NOTE:** Use Developmental Design Standard Index Nos. D20310 and D20320.

### STRAND DEBONDING LEGEND
- Fully bonded strands.
- Strands debonded: __"__ from end of beam.
- Strands debonded: __"__ from end of beam.
- Strands debonded: __"__ from end of beam.
- Strands debonded: __"__ from end of beam.

### DIMENSION NOTES
* All longitudinal beam dimensions shown on this sheet with a single asterisk (*) are measured along the top of beam at the centerline of beam.
** End of beam bearing dimensions "F" and "K" are measured along the bottom of the beam.

### STRAND DESCRIPTION
Use __"__ Diameter, Grade 770 Low-Relaxation Carbon Steel Strands stressed at __ ksi each. Area per strand equals __ sq in.
Payment

<table>
<thead>
<tr>
<th>Item number</th>
<th>Item description</th>
<th>Unit Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>450-1-250</td>
<td>Prestressed Beams, Inverted T, 20&quot;</td>
<td>LF</td>
</tr>
</tbody>
</table>

Design Aids

*These section properties are based on gross section properties and neglect the 3/4" chamfers on the bottom flanges.*