TEMPORARY DESIGN BULLETIN C09-03

DATE: June 2, 2009

TO: District Directors of Production, District Design Engineers, District Structures Design Engineers, District Construction Engineers

FROM: Robert Robertson, P. E., State Structures Design Engineer

COPIES: Lora Hollingsworth, Brian Blanchard, Ghulam Mujtaba, Tom Malerk, Jeffrey Ger (FHWA)

SUBJECT: Implementation of New Florida-I Beam Design Standards Including Related Data Tables and Structures Manual Revisions

REQUIREMENTS

1. Design Standards

The Florida-I Beam and related Design Standards Index Sheets will be released for implementation with the July 2009 Interim Design Standards. Copies of these sheets and their associated data tables are included with Attachments ‘A’ & ‘B’ as listed below.

Attachment ‘A’, Florida-I Beam and Related Design Standards:
- Index No. 20010 (2 Sheets): Typical Florida-I Beam Details and Notes
- Index No. 20036 (2 Sheets): Florida-I 36 Beam - Standard Details
- Index No. 20045 (2 Sheets): Florida-I 45 Beam - Standard Details
- Index No. 20054 (2 Sheets): Florida-I 54 Beam - Standard Details
- Index No. 20063 (2 Sheets): Florida-I 63 Beam - Standard Details
- Index No. 20072 (2 Sheets): Florida-I 72 Beam - Standard Details
- Index No. 20078 (2 Sheets): Florida-I 78 Beam - Standard Details
- Index No. 20199 (1 Sheet): Build-Up and Deflection Data
- Index No. 20510 (1 Sheet): Composite Elastomeric Bearing Pads for Florida-I Beams
- Index No. 20511 (2 Sheets): Bearing Plate Details for Florida-I Beams

Attachment ‘B’, Florida-I Beam Related Data Tables (CADD Cells):
- Cell No. 20010: Florida-I Beam Table of Beam Variables
- Cell No. 20199: Build-up & Deflection Data Table
- Cell No. 20510: Bearing Pad – Data Table (Florida-I Beam)
- Cell No. 20511: Bearing Plate – Data Table (Florida-I Beam)

a. Volume 1 – Structures Design Guidelines

i. Replace Section 2.3.1A with the following:

“The majority of Florida bridges will be exempt from seismic or restrainer design requirements. For exempted bridges, only the minimum bearing support dimensions need to be satisfied as required by LRFD [4.7.4.4]. Exempted bridges include those with superstructures comprising simple-span or continuous flat slabs, simple-span prestressed slabs or double-tees, and simple-span AASHTO, Florida Bulb-T, Florida-I, or steel girders.”

ii. In Section 2.5, insert the following into Table 2.1 under Prestressed Beams:

<table>
<thead>
<tr>
<th>Beam Description</th>
<th>Lb/ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida-I 36 Beam (Index No. 20036)</td>
<td>840</td>
</tr>
<tr>
<td>Florida-I 45 Beam (Index No. 20045)</td>
<td>906</td>
</tr>
<tr>
<td>Florida-I 54 Beam (Index No. 20054)</td>
<td>971</td>
</tr>
<tr>
<td>Florida-I 63 Beam (Index No. 20063)</td>
<td>1037</td>
</tr>
<tr>
<td>Florida-I 72 Beam (Index No. 20072)</td>
<td>1103</td>
</tr>
<tr>
<td>Florida-I 78 Beam (Index No. 20078)</td>
<td>1146</td>
</tr>
</tbody>
</table>

iii. Replace the text of Section 4.1.3 – Girder Transportation with the following:

“Coordinate the transportation of heavy and/or long girders with the Department’s Permit Office and the appropriate industry representatives during the design phase of the project.”

Commentary: Longer beams may require evaluation of delivery routes by the appropriate industry representative to ensure turns can be made safely, particularly in urban areas.”

iv. Renumber Sections 4.3.1A through 4.3.1F to Sections 4.3.1B through 4.3.1G respectively. Insert the following as the new Section 4.3.1A:

“The Florida-I Beams are the Department’s standard prestressed concrete beams and will be used in the design of all new bridges and bridge widenings as applicable. AASHTO Beams and Florida Bulb-T Beams will not be used in new designs.”

v. Replace item 1 of renumbered Section 4.3.1E with the following:

“Strand patterns utilizing an odd number of strands per row (a strand located on the centerline of beam) and a minimum side cover (centerline of strand to face of concrete) of 3-inches are required for all Florida-I, AASHTO, and Bulb-T beam sections except AASHTO Type V and VI beams for which a strand pattern with an even number of strands per row must be utilized.”
vi. Replace item 8 of renumbered Section 4.3.1E with the following:

“For wide-top beams such as Florida-I, Bulb-T, and AASHTO Types V & VI beams, evaluate the top flanges of those beams to safely and adequately support the self-weight of the forms, concrete, and construction load specified in Section 400 of the FDOT Standard Specifications for Road and Bridge Construction.

For the Florida-I Beam, the Standard top flange reinforcing allows for a beam spacing up to 14 feet with an 8½” deck.”

vii. Replace renumbered Section 4.3.1F with the following:

“The maximum prestressing force ($P_u$) from fully bonded strands at the ends of prestressed beams must be limited to the values shown on the Standard Drawings. For non-standard single web prestressed beam designs, modify the requirements of LRFD 5.10.10.1 to provide vertical reinforcement in the ends of pretensioned beams with the following splitting resistance:

- $3\% \ P_u$ from the end of the beam to $h/8$, but not less than 10”;
- $5\% \ P_u$ from the end of the beam to $h/4$, but not less than 10”;
- $6\% \ P_u$ from the end of the beam to $3h/8$, but not less than 10”.

Do not apply losses to the calculated prestressing force ($P_u$). The minimum length of debonding from the ends of the beams is half the depth of the beam ($h/2$). Do not modify the reinforcing in the ends of the beams shown in the Standard Drawings without the approval of the State Structures Design Office.

Commentary: To minimize horizontal and diagonal web cracks and compensate for the longer splitting force distribution length adopted by LRFD in 2002 ($h/4$), the maximum splitting force from bonded prestressing has been increased. An additional splitting zone from $h/4$ to $3h/8$ has been added to control the length of potential cracks, consistent with previous standard FDOT designs.”

viii. Replace renumbered Section 4.3.1.G with the following:

“Provide embedded bearing plates for all AASHTO & Florida Bulb-T beams with beam sections deeper than 60 inches. Provide embedded bearing plates for all Florida-I beams. For all beam designs where the beam grade exceeds 2%, include beveled bearing plates.”

ix. Replace the heading of Section 4.3.3 with the following:

“Florida Bulb-T Beams and Florida-I Beams [5.14.1.2.2]
The minimum web thicknesses for Florida-I and Florida Bulb-T beams are:”
x. Insert the following girder costs into Section 9.2.2.B.2
(Prestressed Concrete Girders; cost per linear foot):

- Florida-I; 36          $190
- Florida-I; 45          $205
- Florida-I; 54          $220
- Florida-I; 63          $235
- Florida-I; 72          $250
- Florida-I; 78          $260

xi. Insert the following debris quantity estimations into Section 9.4
(Component; CY/LF):

- 36” Florida-I          0.207
- 45” Florida-I          0.224
- 54” Florida-I          0.240
- 63” Florida-I          0.256
- 72” Florida-I          0.272
- 78” Florida-I          0.283


i. Replace item 2AA of Section 3.5A with the following:

“Bulb-T / Florida-I Beam Superstructure”

ii. Replace Section 13.11A with the following:

“See Design Standards Index Nos. 20500 (Bearing Pads - AASHTO & Florida Bulb-T Beams), 20510 (Bearing Pads – Florida-I Beams), 20501 (Bearing Plates - AASHTO & Florida Bulb-T Beams), 20502 (Bearing Plates - Florida U-Beams), and 20511 (Bearing Plates – Florida-I Beams). See Volume 3, Instructions for Design Standards for example drawings and general instructions.”

c. Volume 3 – Examples, Details & Instructions

Add the following Instructions for Design Standards shown in Attachment ‘C’:

- Index 20000 Series (1 Sheet): Prestressed Florida-I Beam Instructions
- Index 20510 (1 Sheet): Composite Elastomeric Bearing Pad Instructions for Florida-I Beams

d. Volume 7 – Design Aids

Add the following Design Aids as shown in Attachment ‘D’:

- ‘Florida-I Beam Section Properties’ (1 Sheet)
- ‘Florida-I Beam Estimated Maximum Span Lengths’ charts (2 Sheets)
COMMENTARY

This Temporary Design Bulletin (TDB) is a follow-up to TDB C09-01 released in January 2009. This TDB implements Florida-I Beam sizes 36” through 78” depth. Potential beams of deeper size will be addressed in the future.

HISTORY

See Temporary Design Bulletin C09-01.

IMPLEMENTATION

Florida I-Beams (FIB’s) will be used on all new Design-Bid-Build projects having both a design start date of February 1, 2009 or later and a letting date of July 1, 2010 or later. The FIB’s shall be used for preliminary design and estimates of projects with projected schedules falling on or after these dates.

AASHTO Beams and Florida Bulb-T Beams will no longer be used in Design-Bid-Build projects where the design start date is scheduled on or after February 1, 2009 with a letting date on or after July 1, 2010. Bridge Development Reports (BDR’s) for these projects shall not include AASHTO Beams and Florida Bulb-T Beams in cost comparisons.

No currently designed projects will require a redesign as a result of this TDB, but Districts may elect to introduce FIB’s into current designs at their discretion. For projects where the BDR already recommends an AASHTO or Florida Bulb-T beam design, FIB’s may be substituted into the final design without issuing a BDR addendum.

For all projects requiring the use of FIB’s as stated above, Value Engineering Change Proposals (VECP’s) to use AASHTO and Florida Bulb-T beams will not be accepted.

New BDR’s shall continue to consider the use of all viable structure types including the possibility of steel box and/or I-girders. Current policies stated in the Plans Preparation Manual Vol. 1 Section 26.9 still apply.

FIB’s may be used on Design-Build projects effective immediately.

Current policies regarding the shipping of large girders remain in effect for FIB’s. Allowable size limits for beams are limited to project-specific transportation considerations. As stated in Structures Design Guidelines Section 4.1.3, the transportation of heavy and/or long girders requires coordination with the Department’s Permit Office and the appropriate industry representative during the design phase of the project.

Since implementation is dependent on the design start date, there will be a period of time where lettings have some projects with the new FIB’s while others use the old AASHTO Beams and Florida Bulb-T Beams. For this transition period, the Design Standards will continue to include both the new FIB shapes and the old beam shapes.
Changes to specifications and procedures are summarized as follows:

1. **Structures Manual**

   SDG Vol. 7 Design Aids – ‘BDR Bridge Cost Estimate’: FIB Estimated Costs per Liner Foot have been added to the spreadsheet.

   All other updates are included in the Requirements of this Bulletin.

2. **Design Standards**

   All updates are included in the Requirements of this Bulletin.

3. **Standard Specifications**

   Section 450 – ‘Precast Prestressed Concrete Construction’: All references and updates regarding the FIB will be included in the FDOT January, 2010 Specifications Workbook.

4. **Basis of Estimates**


5. **Plans Preparations Manual**

   No changes are anticipated at this time.

6. **Misc. Design Tool Updates**

   a. **CADD**: New FIB cells and tables in MicroStation & PDF format will be released with the July 2009 Interims and posted on the Structures Design website. These Cells are shown in Attachment ‘B’, and they will be included in the MicroStation Structures Menu with the next Maintenance Release.

   b. **Design Software**: The new FIB’s are included in Version 3.0 of the FDOT LRFD Prestressed Beam Program already released. Proprietary software vendors have been contacted and given the new FIB section properties to be included for use in their design programs.

**CONTACT**

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RVR/rms
Attachments
Attachment A

Florida-I Beam & Related Design Standards

- Index No. 20010 (2 Sheets): Typical Florida-I Beam Details and Notes
- Index No. 20036 (2 Sheets): Florida-I 36 Beam - Standard Details
- Index No. 20045 (2 Sheets): Florida-I 45 Beam - Standard Details
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- Index No. 20078 (2 Sheets): Florida-I 78 Beam - Standard Details
- Index No. 20199 (1 Sheet): Build-Up and Deflection Data
- Index No. 20510 (1 Sheet): Composite Elastomeric Bearing Pads for Florida-I Beams
- Index No. 20511 (2 Sheets): Bearing Plate Details for Florida-I Beams
BEAM NOTES

1. All bars dimensions are cut-to-fit.
2. Place one (1) bar 5/8" or 5/2" at each location as detailed alternating the direction of the ends for each bar (see "ELEVATION AT END OF BEAM" Index Nos. 20036, 20045, 20054, 20063, 20072 and 20078).
3. Bars 4L shall be bent prior to the beam leaving the prestressing yard. Bars 4L shall be bent parallel to the ends of the beams.
4. Cauion should be used with bars 4L in the ends of exterior beams to assure the bent portion of the bar is properly oriented so that the bar will be embedded in the concrete to the correct length.
5. Strands N shall be either ASTM A416, Grade 250 or Grade 270, seven-wire strands 3/8" or larger, stressed to 10,000 lbs. each.

6. unless otherwise noted, the minimum concrete cover for reinforcing steel shall be 2".
7. All Concrete slabs, precast heavy reinforced reinforced concrete may be used in lieu of bars 303, 5K, 4M, and 52 as shown on the standard details for each beam size. Welded deformed wire reinforcement shall conform to A52472 SQP and 52, with minimum yield strength of 75 ksi.
8. Install Safety Sleeves approximately 2-3' from ends of beam and spaced on 8'-0" (max.) centers. Safety Sleeves shall be NSF x 4" Sch. 80 PVC Pipe with Cap. Holes shall be free of debris and dirt prior to casting beam.

9. For beams with sagged end conditions, the end reinforcement, defined as Bars 303, 302, 301, 302, 5K, 4M, 4S, 52 placed at the limits of the spacing for Bars 303 in "ELEVATION AT END OF BEAM" shall be placed parallel to the sagged end of the beam. Bars 303, 302, 5K and 4M located beyond the limits of bars 303 shall be placed perpendicular to the sagged end of the beam. Parallel bars as needed to avoid overlapping bars at the transverse to Bars 303 and 4M, and field cut to maintain minimum cover. Provide additional Bars 4M, 4S, 302, 301 as required. Additional Bars 303 are not included in the Number Replaced in the "ELEVATION AT END OF BEAM". For placement locations, see "BEAM ELEVATION" Index No. 20036. Select the dimensions of Bars 303, 302, 5K, 4M, and 52 as shown on the "BEAM ELEVATION" Index No. 20036 for placed end conditions.

10. Placebars of 303, 302, 5K, 4M, and 52 correspond to END 1 and Bars 302, 301, 302, 5K, 4M, and 52 placed at the end of the beam. Progressive restack resting bars within the limits of bars 52 until vertically locating the spacing of the bar up to a maximum of 1". For welded bars, cut top cross wire and rotate bars as required or reduce end cover at top of the beam to minimum 1".

11. For beams with sagged end conditions, welded deformed wire reinforcement shall not be used for end reinforcement (Bars 303, 302, 4M, and 4S).

12. Bars 5K and 52 shall be placed and tied to the fully bonded strands in the bottom or center space (see "ELEVATION AT END OF BEAM" Index Nos. 20036, 20045, 20054, 20063, 20072 and 20078) and placed parallel to the dimensional details for each beam size. For welded deformed wire reinforcement, supplemental transverse 4M bars are permitted to support Places X and Y. The bars are on the bottom row of strands.

13. At the Contractor's option, Bars 303, 302, 301, 302, 5K, 4M, and 52 may be fabricated as one bar with a 1'-0" minimum lap splice at the top legs.

14. For referenced Dimensions, Angles and Case Numbers, see the Table of Beam Variables in Structures Plans.

INSTRUCTIONS TO DESIGNER:

To limit vertical gripping forces in the webs of beams, the maximum Prestress Force at the beam ends from fully bonded strands must be limited to the following:

<table>
<thead>
<tr>
<th>Beam Type</th>
<th>Max. Bonded Prestress Force</th>
<th>Index No.</th>
<th>Last Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida-16</td>
<td>1450 Kips</td>
<td>20036</td>
<td>07/01/09</td>
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<tr>
<td>Florida-15</td>
<td>1770 Kips</td>
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<td>07/01/09</td>
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<td>Florida-13</td>
<td>1740 Kips</td>
<td>20063</td>
<td>07/01/09</td>
</tr>
<tr>
<td>Florida-12</td>
<td>1980 Kips</td>
<td>20072</td>
<td>07/01/09</td>
</tr>
<tr>
<td>Florida-11</td>
<td>2230 Kips</td>
<td>20078</td>
<td>07/01/09</td>
</tr>
</tbody>
</table>

No losses shall be applied when calculating the Bonded Prestress Force. The reinforcing in the ends of the beams must not be modified without the approval of the State Structures Design Engineer.
Insert for Diaphragm Reinforcing

**When Intermediate Diaphragms are Required by Design**

**INSERT DETAIL**

**INSERT NOTES**
1. Provide 1/8" zinc-electroplated, ferrule wing nut or col inserts, UNC threads, 1/2" minimum gage wire, not more than 4" in depth with a minimum ultimate tensile strength of 14,000 lbs. in 4,000 psi concrete.
2. All bars are to be provided on both sides (fronts) of beam webs, in an assembly as long as the thickness of the beam web, consisting of two (2) ferrule or col inserts attached by two (2) or more struts may be utilized. The connecting struts shall have a minimum ultimate tensile strength of 14,000 lbs.
3. Inserts for diaphragm reinforcing are required at each end of each intermediate diaphragm shown on the Beam Design Plan. See Superstructure and Beam Framing Plans for longitudinal location of inserts for each face of beam.
**ALTERNATE REINFORCING STEEL (WELDED WIRE REINFORCEMENT) DETAILS**

**PIECES M END VIEW**

- Piece M-1 ties to Piece K-2
- 6 ~ Ø25's (FF)
- Ø 5 - 2 - 5
- Ø 25's @ 2 - 5
- Ø 25's @ 2 - 5
- Piece S-1, S-2, S-3 or S-4
- Match spacing of adjacent pieces
- Piece S-2 shown
- Piece S-3 shown
- Piece S-4 shown

**PLAN VIEW**

- Piece M-1 (2 Required)
- Piece M-2 (2 Required)

**END OF BEAM**

**W24 Cover**

**SECTION A-A FOR WELDED WIRE REINFORCEMENT**

- Pieces K-1
- Pieces K-2
- Pieces S (Single Mat) Tied to Strands at Beam

**PARTIAL SECTION AT CENTER BEAM**

**PIECES K & S END VIEW**

- Piece D-1 ties to Piece K-1
- Ø 1 - 3 - 2
- Ø 1 - 3 - 2
- Ø 1 - 3 - 2
- Ø 1 - 3 - 2

**PIECES D END VIEW**

- Ø 1 - 3 - 2
- Ø 1 - 3 - 2
- Ø 1 - 3 - 2
- Ø 1 - 3 - 2

**NOTES:**

- For beams with swept end conditions, Pieces D-1, D-2 & M-4 shall be used. Conventional Reinforcement Bars C, D-1, D-2 & M-2 shall be used.
- See Index No 20031 for details. See Note A for placement details. Stiff Pieces K & Bars S-5 to accommodate swept end conditions and align with Bars C & D.

**LEGEND:**

- BF = Front Face
- BF = Back Face

**CONVENTIONAL REINFORCING BARS A, C, L, Y**

**PARTIAL BEAM END VIEW**

**2008 Interim Design Standard**

**Index No. 20036**

**FLORIDA-1 36 BEAM - STANDARD DETAILS**

**REVISIONS**

**Date 2009-07-01**

**Sheet No. 2 of 2**
ALTERNATE REINFORCING STEEL (WELDED WIRE REINFORCEMENT) DETAILS

PIECES M END VIEW

PLAN VIEW
PIECE M-1
(2 Required)

PLAN VIEW
PIECE M-3
(2 Required)

PIECES K & S END VIEW

PIECE K-1
(Arched EF)
(4 Required ~ 2 Pairs)

PIECE K-2
(FF Shown Solid)
(8 Required ~ 4 Pairs)

PIECE S-1, S-2, S-3 or S-4
(2 Required Each Piece)

PIECE D END VIEW

PIECE D-1
(4 Required ~ 2 Pairs)

PIECE D-2
(4 Required ~ 2 Pairs)

PIECE D-3
(4 Required ~ 2 Pairs)

NOTES:

a. See Sheet 1 for placement details & Table of Beam Variables in Structures Plans for variables S1, S2, S3, S4 & V1.
b. Placement Conventional Reinforcement Bars S4, S3, S2 & S1 as shown on Sheet 1. Place additional bars S1 as shown in Section A-A for Welded Wire Reinforcement. Bars S2 will not be used with the WWR Option.
c. Pieces may be fabricated in multiple length sections.
d. For beams with skewed end conditions, Pieces (D-1, D-2 & D-3) shall not be used. Conventional Reinforcement Bars (D), (D1), (D2), (D3), (D4) & (D5) shall be used. See Index No. 200205 Shew Details and Note 9 for placement details. Shift Pieces K & Bars S1 to accommodate skewed end conditions and align with Bars C & D.

2008 Interim Design Standard

Sheet No. 2 of 2
ALTERNATE REINFORCING STEEL (WELDED WIRE REINFORCEMENT) DETAILS

PIECES M
END VIEW

PIECE M-1 (2 Required)

Match spacing of adjacent Piece M-1:
- L3 = 0.25% @ 6" or 6'-0"
- L3 = 0.25% (BF) @ 36" or 3'-0"

PIECE M-3 (2 Required)

W12.4 (Piece K-1)
W10 (Pieces K-2 & S)
D12 (Piece K-1)
D25 (Pieces K-2 & S)
W12.4 (Piece K-1)
W10 (Pieces K-2 & S)

PIECES K & S
END VIEW

PIECE K-1 (Aligned EF)
(4 Required ~ 2 Pairs)

Notes:
1. See Sheet 1 for placement details & Table of Beam Variables
2. Place Conventional Reinforcement Bars A, C, L, Y & 4L as shown on Sheet 1. Place additional Bars S as shown in Section A-A for Welded Wire Reinforcement. Bars S may be used with the WWR option.
3. Pieces may be fabricated in multiple length sections.
4. For beams with skewed end conditions, Pieces D-1, D-2 & M-1 shall not be used; Conventional Reinforcement Bars D-1, D-2, C, L, Y & M shall be used. See Plate No. 2000054

2008 Interim Design Standard

Sheet No. 2 of 2

ARCHIVED
**BEAM CAMBER AND BUILD-UP NOTES:**

The build-up values given in the table are based on theoretical beam cambers. The Contractor shall monitor beam cambers for the purpose of predicting camber values at the time of the deck pour. If the predicted cambers exceed the limit given below, the Engineer shall be notified, and the Engineer will approve the build-up dimensions as required. When the measured beam cambers create a conflict with the bottom mat of deck steel, notify the Engineer a minimum of 21 days prior to casting.

DIN "A" includes the weight of the Stay-In-Place Formwork.

**DEAD LOAD DEFLECTION DIAGRAM**

**INSTRUCTIONS TO DESIGNER:**

Although not shown here in the Diagrams or Notes, the effect of horizontal curvature, when present, needs to be considered for the Build-up Calculations.

**NOTE:**

Work this Index with the Build-up and Deflection Data Table for AASHTO, Bull-T and Florida-1 Beams in Structures Plans.
NOTES:

1. Work this sheet with Index No. 2052D - Composite Elastomeric Bearing Pad, and WEARING PLATE DATA TABLE in the Structures Plans.

2. Embedded Bearing Plates A are required for all Florida+ beams. Beveled Bearing Plates B are required for beams as scheduled in the BEARING PLATE DATA TABLE in the Structures Plans.

3. Bearing plate materials shall conform to ASTM A662 or ASTM A709 Grade 36 or 50. Welded Concrete Anchor Studs shall conform to Specification Section 502. Hot-dip galvanize Bearing Plates A & B after fabrication except that Galvanized Caps may be welded in place after hot-dip galvanizing. Drilled Bearing Plates A and B as an assembled unit, thread Bearing Plate A only. Holes are not required in Plate B or when Plate B is not required. Drill and thread holes perpendicular to the bottom of Plate B and prior to plates being galvanized (ASTM A 123). 

4. Provide Electroplated Flat Countersunk Head Cap Screws in accordance with ASTM F 833 Electroplating shall have ASTM B633-82 Type 1. Provide screws long enough to maintain a 1-1/2" minimum embedment into Embedded Bearing Plate A and Galvanized Cap. Provide screws with 3/8" min. to 1-1/2" max. height and nominal 1/4" inside diameter.

5. Include the cost of Bearing Plates in the pay item for Prestressed Beams.

6. For Dimensions C and D, see WEARING PLATE DIMENSIONS on Index No. 2052D and the WEARING PLATE DATA TABLE in the Structures Plans. For Dimensions I, K1, and K2, see TABLE OF BEAM VARIABLES in the Structures Plans.

7. All dimensions and dimensions shown are shown along E Beam, except for dimensions to 3/8" dia. Screws and 7/8" dia x 2-1/2" Anchor Studs, which are along E Screws or & Anchor Studs. Positive Slope shown, Negative Slope similar.

8. When Skew = 0°, dimensions for Embedded Bearing Plate A are D = C x 1-1/2" and for Beveled Plate B are D = C x 1-1/2" Min.

9. Slope is determined along E Beam at E Bearing. See BEARING PLATE DATA TABLE in the Structures Plans for Slope and Angle B.
Attachment B

Florida-I Beam Related Data Tables (CADD Cells)

- Cell No. 20010 (1 Sheet): Florida-I Beam Table of Beam Variables
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- Cell No. 20511 (1 Sheet): Bearing Plate – Data Table (Florida-I Beam)
### Build-Up & Deflection Data Table for AASHTO, Bulb-T and Florida-I Beams

<table>
<thead>
<tr>
<th>Location</th>
<th>Required Build-Up Over &amp; Beam</th>
<th>Theoretical Beam</th>
<th>Net Beam Camber (Prestress - Dead Load) of Beam @ 120 Days</th>
<th>Dead Load Deflection During Deck Pour @ 120 Days</th>
<th>Build-Up Case No.</th>
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<tbody>
<tr>
<td>Span No.</td>
<td>Span Dim &quot;B&quot;</td>
<td>Span Dim &quot;C&quot;</td>
<td>Span Dim &quot;D&quot;</td>
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**NOTES:** Work this sheet with Design Standard Index No. 20299.
<table>
<thead>
<tr>
<th>SPAN NO(s.)</th>
<th>BEAM NO(s.)</th>
<th>PAD TYPE</th>
<th>BEAM TYPE</th>
<th>BEAM END #</th>
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</tbody>
</table>

**NOTE:**
Work this table with Index No. 20510 for Pad Types D, E, F, G, H, J & K, and/or any project specific bearing pads.

* END 1 = Begin Bridge end of beam (Back station).
* END 2 = End Bridge end of beam (Ahead station).

**INSTRUCTIONS TO DESIGNER:**

This table is intended for use with prestressed beam bridges, but may be modified for steel/girders or other bridge types.
Supplement the BEARING PAD DATA TABLE with additional columns or notes as required to clearly identify the location and type of bearing pads.

PLEASE DELETE THIS NOTE UPON COMPLETION OF THIS DRAWING.
### BEARING PLATE DATA TABLE

<table>
<thead>
<tr>
<th>BRG. PLATE MARK</th>
<th>SPAN NOT.</th>
<th>BEAM NOT.</th>
<th>PAG TYPE</th>
<th>BEAM END</th>
<th>PLAN VIEW CASE</th>
<th>SLOPE ID</th>
<th>ANGLE B (°)</th>
<th>PLATE DIMENSIONS (PLATE A) (inches)</th>
<th>BEVELED PLATE DIMENSIONS (PLATE B) (inches)</th>
<th>BEVELED PLATE REQUIRED (Yes/No)</th>
<th>C</th>
<th>D</th>
<th>C+D/TAN B</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

**NOTES:**

- 0 = Acute angle (≤ 90°) measured from left or right side of θ Beam as required.
- ** = Slope measured along θ of Beam at θ of Bearing.
- *** See "TABLE OF BEAM VARIABLES" and Index No. 20010.
- See Index No. 20512 for additional notes and details.

### INSTRUCTIONS TO DESIGNER:

1. Fill in the table to correspond with data on the "TABLE OF REAR VARIABLES" using Inch units for Beveled Plate dimensions. X", Y", Z" rounded to 1/16 of an inch.
2. Use the following equations to determine the Beveled Plate thicknesses for PLAN VIEW CASES and END ELEVATION CONDITIONS corresponding to those shown on Design Standards Index No. 20010. The slope parameter in these equations requires decimal units and correct sign convention:

### END 1

#### (I) PLAN VIEW CASE 1:

- **END ELEVATION CONDITION 1 or 2 (Positive Slope):**
  - X = 0.5° + (C) x Slope
  - Y = Z = 0.5° + (C) x Slope

#### (II) PLAN VIEW CASE 2:

- **END ELEVATION CONDITION 1 or 2 (Positive Slope):**
  - X = 0.5° + (C + D / tan θ) x Slope
  - Z = 0.5° + (C + D / tan θ) x Slope

### END 2

#### (III) PLAN VIEW CASE 3

- **END ELEVATION CONDITION 1 or 2 (Positive Slope):**
  - X = 0.5° + (C + D / tan θ) x Slope
  - Z = 0.5° + (C + D / tan θ) x Slope

### ISOMETRIC VIEW OF BEVELED BEARING PLATES

(SKewed PLATES SHOWN, NON-SKewed PLATES SIMILAR)

PLEASE DELETE THIS NOTE UPON COMPLETION OF THIS DRAWING
Attachment C

Instructions for Design Standards

- Index 20000 Series (1 Sheet): Prestressed Florida-I Beam Instructions
- Index 20510 (1 Sheet): Composite Elastomeric Bearing Pad Instructions for Florida-I Beams
GENERAL INSTRUCTIONS:
The Standard Drawings for prestressed beams depict details and notes that are fully developed. These drawings are included in the contract documents by reference to the Index No in the plans. Companion MicroStation CAD0 cells are located on the FDOT Structures Bar Menu, and they contain generic details and notes that require completion including the Table of Beam Variables, the Strand Pattern Details and the Strand Debonding Legend. When completed, the CAD0 cells shall be included in the plans.

Standard Drawings and completed CAD0 cell provide sufficient information to permit beam fabrication without the submission of shop drawings.

The prestressed beams in these Standard Drawings are generally assumed to act as simple spans under both Dead Load and Live Load even where the deck is designed continuous across the support.

The elastic and time dependant shortening effects (0.2M) should be reported at mid-height of the beam & 120 days. The average of the calculated values for the top and bottom of the beam may be used.

The following example shows the data required for completion of a Florida-1 Beam Table of Beam Variables CAD0 cell. This case shows a Florida-1 Beam (Index No. 20045).

The example assumes a three span bridge designed for the following conditions:
Live Load: HL-93
No Intermediate Diaphragms
Stiff-Flange Steel Panels
Allowance of 20 PSF non-composite dead load over the projected plan area of the beams (this includes the unit weight of metal forms and the concrete required to fill the form flutes).

Environment (Superstructure) - Moderately Aggressive
Bridge Characteristics:
Length 273 ft.
Width 51-1/2" (out-to-out)
Clear Roadway: 48 ft.
Superstructure:
Three simple spans of prestressed concrete beams with 8-inch composite deck slab.

Vertical Alignment - 0.002% (Grade)
Skew Angle: 15 degrees (Right)

OTHER CONSIDERATIONS:
When the number of beams or strand patterns exceed the capacity of a single plan sheet using the standard "FLORIDA-1 BEAM VARIABLES", use additional sheets. It special conditions require dimensions, details or notes not shown in the standard CAD0 cells, modifications are permitted. However, the "TABLE OF BEAM VARIABLES" should not be modified when utilizing the Standard Drawings.

When required by design, intermediate diaphragms shall be shown on the FRP Plan sheet included with the bridge drawings. Insert locations with respect to the beam ends and beam forces shall be tabulated for each beam. The table shall include length adjustments for beams placed on grade and for elastic and time dependent shortening effects. Type 33 No. 8 reinforcing bars with 3" thread lengths must be shown on the intermediate diaphragms and included in the list for attachment to the diaphragms.

Embedded plate areas are required for all beams. If the beam grade exceeds 52, provide bonded bearing plates at each end of the beam as shown in Index No. 2051.

Angle 0, as defined in Design Standards Index No. 20010, shall be rounded up to the nearest degree. The shear shriping spacing VI for Bars OK should be specified to the nearest inch.

EXAMPLE PROBLEM:
The following example shows the data required for completion of a Florida-1 Beam Table of Beam Variables CAD0 cell. This case shows a Florida-1 Beam (Index No. 20045).

The example assumes a three span bridge designed for the following conditions:
Live Load: HL-93
No Intermediate Diaphragms
Stiff-Flange Steel Panels
Allowance of 20 PSF non-composite dead load over the projected plan area of the beams (this includes the unit weight of metal forms and the concrete required to fill the form flutes).

Environment (Superstructure) - Moderately Aggressive
Bridge Characteristics:
Length 273 ft.
Width 51-1/2" (out-to-out)
Clear Roadway: 48 ft.
Superstructure:
Three simple spans of prestressed concrete beams with 8-inch composite deck slab.

Vertical Alignment - 0.002% (Grade)
Skew Angle: 15 degrees (Right)

DINMENSIONS #

LENGTH (L) 10' 12'
DIA. (D) 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100

BEARING PLATES

NOTE: Work this sheet with Design Standards Index No. 20010 and the applicable "Florida-1 Beam Standard Details" Index.

DIMENSION NOTES
All longitudinal beam dimensions shown on this sheet with a single asterisk (*) are measured along the centerline of beam. Dimension "P" is calculated at mid-height of the beam.
End beam dimensions "U" and "W" are measured perpendicular to E Bearing along the bottom of the beam.

BEARING PLATES
*** See Index No. 20511 and the Bearing Plate Data Table for details.
GENERAL INSTRUCTIONS:

Design Standard No. 20501 depicts details and notes for elastomeric bearing pads for prestressed concrete beams with or without skewed and inclined. Include the BEARING PAD DATA TABLE in the plans. (See FDOT Structures Bar Manual).

Design Standard No. 20501 contains generic details and notes for embedded and embossed bearing plates.

Include the BEARING PLATE DATA TABLE in the plans. (See FDOT Structures Bar Manual).

For beam grades greater than 3% provide beveled bearing plates. For Florida-I beams on grades less than equal to 3%, any embedded bearing plates A need to be installed in the BEARING PLATE DATA TABLE.

LIMITING PARAMETERS FOR ELASTOMERIC BEARING PADS USED WITH PRESTRESSED FLORIDA-I BEAMS

<table>
<thead>
<tr>
<th>PAD TYPE</th>
<th>LENGTH (in)</th>
<th>WIDTH (in)</th>
<th>MAXIMUM SERVICE LIVE LOAD (lbs)</th>
<th>MAXIMUM SERVICE DEAD LOAD (lbs)</th>
<th>SHEAR ANGLE (degrees)</th>
<th>MAXIMUM SHEAR MODULUS (kips)</th>
<th>SHEAR MODULUS, G (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>8</td>
<td>12</td>
<td>135</td>
<td>0</td>
<td>0°</td>
<td>0.75 G</td>
<td>110</td>
</tr>
<tr>
<td>E</td>
<td>10</td>
<td>12</td>
<td>110</td>
<td>0</td>
<td>0°</td>
<td>0.75 G</td>
<td>110</td>
</tr>
<tr>
<td>F</td>
<td>12</td>
<td>12</td>
<td>150</td>
<td>0</td>
<td>0°</td>
<td>0.75 G</td>
<td>110</td>
</tr>
<tr>
<td>G</td>
<td>12</td>
<td>12</td>
<td>150</td>
<td>0</td>
<td>0°</td>
<td>0.75 G</td>
<td>110</td>
</tr>
<tr>
<td>H</td>
<td>12</td>
<td>12</td>
<td>150</td>
<td>0</td>
<td>0°</td>
<td>0.75 G</td>
<td>110</td>
</tr>
<tr>
<td>J</td>
<td>12</td>
<td>12</td>
<td>125</td>
<td>0</td>
<td>0°</td>
<td>0.75 G</td>
<td>110</td>
</tr>
</tbody>
</table>

The Service Live Load (including impact) and Service Dead Load Reactions can be determined from the beam design. The Shear Deflection is the product of the coefficient of Thermal Expansion, 65% of the Thermal gradient and the length of bridge contributing to movement, plus the contribution of beam creep and shrinkage at the bottom of beam. Assume beam creep and shrinkage from day 120 to day 420 (this value can be determined from the beam design output).

Standard Elastomeric bearing pads have been designed in accordance with AASHTO LRFD Specifications, Method 18. For maximum static rotation (beam end, camber rotation, and load rotation) of 0.0125 radians and a cyclic rotation (live load) of 0.004 radians. Live load rotations are assumed to be in the opposite direction to static rotations. Rotation does not need to be checked for standard prestressed beams provided that the top of the beveled bearing plates (when required) in the bearing seats (pedestals) are positioned parallel to the slope of the beam. The effects of camber (i.e. day 120) from prestressing and dead load rotation may be neglected when determining the slope angle in the end of the beam, unless the sum of these effects exceeds 0.0125 radians (1.4°).

Bearing seat angles may be fixed level for beam grades less than 3%, or when the combined effects of beam grade, camber and dead load rotation do not exceed 1.5%. Where possible, the bearing seats at each end of the beam should be detailed with the same slope.

For design values exceeding the limiting parameters shown in this sheet, the designer must develop custom designs and details. For skew angles greater than 45°, consider round pads with elastomer and plate thicknesses similar to those shown in Design Standard No. 20502.

EXAMPLES:

The following examples show the information required to determine the correct standard elastomeric bearing pad type to use:

EXAMPLE 1

Given Information:

Superstructure Type = One Simple Span
45° Florida-I beams [5]-[2] long, spaced at 0°-0° centers (99-8” center to center bearing)
No longitudinal restraint except friction between the pad and the concrete substructure
Service Live Load Reaction = 106 kips
Service Dead Load Reaction = 109 kips
Coefficient of Thermal Expansion = 0.000006/F
Thermal Gradient = 70°F
Creep and Shrinkage at the Bottom of Beam from day 120 to day 240 = 0.58
Shear Deflection = (0.000006/F) x 0.58 x 70°F = 0.0297 x 70°F = 0.21 kips
Beam Grade = 3%
Skew Angle = 15°
Service Dead Load Rotation = 0.007 radians (0.7°)
Beam Camber Rotation @ 120 days = 0.012 radians (1.2°)
Net Beam Camber - Rotation after Dead Load Deflection = 0.012 - 0.007 = 0.005 radians (0.5°)

Elastomeric Bearing Pad Type Determination:

Compare the design values to the Limiting Parameters Table, Pad Type D for Florida-I Beams. Limiting Parameters Versus Design Values:

Maximum Service Live Load Reaction of 110 kips versus Design Value of 106 kips therefore, OK
Maximum Service Dead Load Reaction of 190 kips versus Design Value of 109 kips therefore, OK
Maximum Shear Deflection of 0.75° versus Design Value of 0.3° therefore, OK
Skew Angle is between 0° and 15° therefore, OK

Conclusion:

Use Elastomeric Bearing Pad Type D.

No Skew plate is required because the beam seat has a 2% slope along the centerline of beam. Complete BEARING PLATE DATA TABLE for embedded bearing plate only.

EXAMPLE 2

Given Information:

Superstructure Type = Four Simple Spans with Continuous Deck
45° Florida-I beams [5]-[2] long, spaced at 0°-0° centers (99-8” center to center bearing)
No longitudinal restraint except friction between the pad and the concrete substructure
Service Live Load Reaction = 106 kips
Service Dead Load Reaction = 109 kips
Coefficient of Thermal Expansion = 0.000006/F
Thermal Gradient = 70°F
Creep and Shrinkage at the Bottom of each Beam from day 120 to day 240 = 0.28
Shear Deflection = (0.000006/F) x 0.28 x 70°F = 0.019 x 70°F = 0.6 kips
Beam Grade = 3%
Skew Angle = 15°
Service Dead Load Rotation = 0.007 radians (0.7°)
Beam Camber Rotation @ 120 days = 0.012 radians (1.2°)
Net Beam Camber - Rotation after Dead Load Deflection = 0.012 - 0.007 = 0.005 radians (0.5°)

Elastomeric Bearing Pad Type Determination:

Compare the design values to the Limiting Parameters Table, Pad Type F for Florida-I Beams. Limiting Parameters Versus Design Values:

Maximum Service Live Load Reaction of 120 kips versus Design Value of 106 kips therefore, OK
Maximum Service Dead Load Reaction of 190 kips versus Design Value of 109 kips therefore, OK
Maximum Shear Deflection of 0.75° versus Design Value of 0.3° therefore, OK
Skew Angle is between 0° and 15° therefore, OK

Conclusion:

Use Elastomeric Bearing Pad Type F. Additionally, because beam end slope exceeds 2%, include a beveled bearing plate in the BEARING PLATE DATA TABLE and detail bearing seats level. Neglect the effects of net beam camber in the beveled bearing plate design since rotation is less than 0.0125 radians.
Attachment D

Design Aids

- ‘Florida-I Beam Section Properties’ (1 Sheet)
- ‘Florida-I Beam Estimated Maximum Span Lengths’ charts (2 Sheets)

Note: For preliminary design and cost estimating purposes only, not a substitute for beam design
<table>
<thead>
<tr>
<th>Section</th>
<th>Area (ft²)</th>
<th>Perimeter (in)</th>
<th>Ixx (in⁴)</th>
<th>Iyy (in⁴)</th>
<th>yl (in)</th>
<th>yb (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.B.-36</td>
<td>808.58</td>
<td>206.57</td>
<td>127,564</td>
<td>65,130</td>
<td>19.51</td>
<td>16.49</td>
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<tr>
<td>I.B.-72</td>
<td>1,058.58</td>
<td>278.57</td>
<td>740,895</td>
<td>82,187</td>
<td>40.09</td>
<td>31.91</td>
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<tr>
<td>I.B.-45</td>
<td>869.58</td>
<td>224.57</td>
<td>226,625</td>
<td>81,397</td>
<td>24.79</td>
<td>20.21</td>
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<td>I.B.-54</td>
<td>932.58</td>
<td>242.57</td>
<td>360,042</td>
<td>81,656</td>
<td>29.97</td>
<td>24.03</td>
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<td>1,300.58</td>
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<td>43.40</td>
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<td>995.58</td>
<td>260.57</td>
<td>530,580</td>
<td>81,919</td>
<td>35.06</td>
<td>27.94</td>
</tr>
</tbody>
</table>
Florida-I Beam Estimated Maximum Span Lengths

*Moderately Aggressive Environment, FDOT Limits with 8.5 ksi Concrete

**Chart Design Assumptions:**
- interior design
- moderately aggressive corrosive conditions
- beam concrete strength:
  - 8.5 ksi @ final
  - 6.0 ksi @ release
- deck concrete strength:
  - 4.5 ksi @ final
- 6 beams in bridge section
- 2"=32" F Shape barriers applied and distributed evenly over all beams
- 8 inch composite bridge deck
  with additional non-structural 1/2" sacrificial surface
- 20 psf S-I-P form weight applied
- 1 inch structural build-up applied (min. required for 2% cross slope)
- 0.1 kip/LF applied per beam for additional misc. dead loads including build-up
- HL-93 Live Load applied
- FDOT Standard splitting/bursting reinforcement used
- All revised FDOT 2009 SDG criteria regarding splitting, debonding, and stress limits are followed
- Spans shown are bearing to bearing
- 0.6"=270K Low Lax Strands used

Note: Chart is intended to provide preliminary estimates only and is not a substitute for case-specific beam design.
**Florida-I Beam Estimated Maximum Span Lengths**

*Extremely Aggressive Environment, FDOT Limits with 8.5 ksi Concrete*

**Chart Design Assumptions:**
- Interior beam design
- Extremely aggressive corrosive conditions
- Beam concrete strength:
  - 8.5 ksi @ final
  - 6.0 ksi @ release
- Deck concrete strength:
  - 4.5 ksi @ final
- 6 beams in bridge section
- 2”=32” F Shape barriers applied and distributed evenly over all beams
- 8 inch composite bridge deck with additional non-structural 1/2” sacrificial surface
- 20 psf S-1-P form weight applied
- 1 inch structural build-up applied (min. required for 2% cross slope)
- 0.1 kip/LF applied per beam for additional misc. dead loads including build-up
- HL-93 Live Load applied
- FDOT Standard splitting/bursting reinforcement used
- All revised FDOT 2009 SDG criteria regarding splitting, debonding, and stress limits are followed
- Spans shown are bearing to bearing
- 0.6”=270K Low Lax Strands used

*Note:
Chart is intended to provide preliminary estimates only and is not a substitute for case-specific beam design.*