TO: District Design Engineers and District Structures Design Engineers
FROM: Robert Robertson, State Structures Design Engineer
COPIES: Lora Hollingsworth, Timothy Lattner, David Sadler, Jeffrey Ger (FHWA)
SUBJECT: Temporary Design Bulletin C08-06
Design Standards and Structures Manual Changes for Prestressed Slab Units

This Design Bulletin outlines the requirements for implementation of Prestressed Slab Unit Design Standards.

REQUIREMENTS

   a) Volume 1 – Structures Design Guidelines
      Section 4.4 A, delete the last sentence.
   b) Volume 3 - Instructions for Design Standards
      Add the Design Instructions and example included in Attachment A.

2) Design Standards
   New Prestressed Slab Unit Design Standards will be released as of January 2009 Interim Design Standard effective for lettings beginning July 2009. Preliminary copies of Index Nos. 20350, 20353, 20354, 20355, 20363, 20364, 20365 and 20399 are attached as Attachment B.

COMMENTARY

The Prestressed Slab Units with cast-in-place reinforced concrete overlay can be used as an alternate to cast-in-place flat slab and should be considered in the Bridge Development Report (BDR). Until additional experience is gained by the Department, this system shall be restricted to off system bridges only.

BACKGROUND

The Prestressed Slab Unit Design Standards were developed based on the results of a Department Research Project titled “Crack Control in Topping for Precast Flat Slab BridgeDeck Construction.”

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IMPLEMENTATION

The Prestressed Slab Unit Design Standards is effective for project lettings beginning July 2009. Related changes to other specifications and procedures are as follows:

1) Construction Specifications
Changes to Specification 346 will be included in the July 2009 FDOT Specifications Workbook. The changes include provisions for steel or polymeric fiber for slightly and moderately aggressive environments and extremely aggressive environment respectively; plus shrinkage reducing admixtures to be included into the reinforced concrete overlay.

2) Basis of Estimates
Pay Item 450-3-AB Prestressed Slab Units, LF will be effective with the July 2009 letting.

3) Plans Preparation Manual
No changes required.

4) CADD
New Tables will be provided to the Cadpilot Menu in May 2009. MicroStation CADD cells for these tables will be available on the Structures Design Office website in January 2009.

5) Design and Analysis Software
Prestressed Slab Units can be designed using currently available software; no additional software is required.

CONTACT

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RR/AVP/b
Attachment
Attachment A

Structures Manual – Volume 3
Instruction for Design Standards Index No. 20300 Series
GENERAL INSTRUCTIONS:
The Standard Drawings for Prestressed Slab units depict details and notes that are fully developed. For Prestressed Slab Units with skewed end conditions not greater than 3°, these drawings are included in the contract documents by reference to the Index No. in the Plans.

Companion MicroStation CADD cells are located on the FDOT Structures CadPict Menu which contain generic details and notes that require the completion of the Prestressed Slab Units — Table of Variables, the Strand Pattern Details and the Strand Debonding Legend. Complete the CADD cells and include the completed drawing in the Plans.

Standard Drawings and properly completed CADD cells provide sufficient information to permit Prestressed Slab Unit fabrication without the necessity of a shop drawings submittal.

When the actual number of Prestressed Slab Units or strand patterns exceed those that can be accommodated on a single plan sheet with the "PRESTRESSED SLAB UNITS — TABLE OF VARIABLES" use additional sheets. If special conditions require dimensions, details or notes not shown in the standard CADD cells, modifications are permitted, however the "PRESTRESSED SLAB UNITS — TABLE OF VARIABLES" should not be modified.

The drawings shall be matched as follows:

Design Standards

<table>
<thead>
<tr>
<th>FDOT Structure</th>
<th>Sheet No.</th>
<th>CADD Model Name, CADD Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>20350</td>
<td>All Prestressed Slab Units</td>
<td></td>
</tr>
<tr>
<td>20355</td>
<td>20355b</td>
<td></td>
</tr>
<tr>
<td>20356</td>
<td>20356b</td>
<td></td>
</tr>
<tr>
<td>20357</td>
<td>20357b</td>
<td></td>
</tr>
<tr>
<td>20358</td>
<td>20358b</td>
<td></td>
</tr>
<tr>
<td>20359</td>
<td>20359b</td>
<td></td>
</tr>
</tbody>
</table>

The Angle θ, for the ends of each Prestressed Slab Unit, shall be rounded to the nearest degree. The shear stirrup spacings V1, V2 and V3 should be specified to the nearest inch.

OTHER CONSIDERATIONS:

Section No. 1 represents a symmetrical crowned bridge section.

Section No. 2 represents a bridge section with constant cross slope.

Section No. 3 represents an un-symmetrical bridge section with crowned and skewed side slope. The exterior slab requires additional detailing for vertical shape of traffic railing.

Section No. 4 represents a variation of Section No. 3. This case, the overhang is rotated above the riding surface. The exterior slab requires additional detailing for vertical shape of traffic railing.

Provide three (3) bearing pads per Prestressed Slab Unit; one (1) bearing locate at each end and two (2) smaller bearings located at other and alternated the bearings for the next Prestressed Slab Unit as shown in "PARTIAL PLAN SHOWING TYPICAL BEARING PAD LAYOUT".

EXAMPLE PROBLEM — INSTRUCTIONAL NOTES TO DESIGNERS:
The following example shows the data required for completion of a Prestressed Slab Unit — Table of Variables CADD cell, in this case a Prestressed Slab Unit (Index No. 20350).

The example assumes a single span bridge designed for the following conditions:

**Superstructure:**
- One simple span of prestressed slab unit with 6-inch minimum composite concrete overlay with constant cross slope of 0.02 ft./ft.
- Span: 76 ft.
- Sidewalk: None
- Horizontal Alignment: Straight
- Vertical Alignment: 0.00% Grade
- Skew Angle: 0°
- Prestressed Slab Unit Design:
  - Prestressed Slab Units: 12"x48" Prestressed Slab Unit (exterior)
  - 12"x60" Prestressed Slab Unit (interior)

**Bridge Characteristics:**
- Length: 76 ft.
- Width: 43'x1" (coping to coping)
- Clear roadway: 40'x0" with two - 32° f shape traffic railing

**Design Span Length:** 37.5 ft. (5 Bearing to 5 Bearing)

**Bonded Strand Development Multiplier:** 1.60

**Concrete Slab Unit Load:** 94 PFL

**Live Load Distribution Factors per AASHO LRFD:**
- Exterior Prestressed Slab Unit
  - Interior Prestressed Slab Unit

**Shear:** 0.394
**Moment:** 0.560

### SAMPLE DRAWING USING CADD CELL 20350b

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRESTRESSED STANDARD SLAB UNITS — TABLE OF VARIABLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPAN NO.</td>
<td>CONCRETE SLAB TYPE</td>
</tr>
<tr>
<td></td>
<td>LENGTH</td>
</tr>
<tr>
<td></td>
<td>28 Day</td>
</tr>
<tr>
<td>1</td>
<td>1/12&quot;x48&quot;</td>
</tr>
<tr>
<td></td>
<td>1/12&quot;x48&quot;</td>
</tr>
</tbody>
</table>

**NOTE:** Work this sheet with Design Standards Index No. 20350, 20354 and 20355.

**STRAIN 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 slab unit dimensions shown on this sheet with a single asterisk (*) are measured along the top of unit at the centerline of slab unit.
- **End of slab unit bearing dimensions "Y" and "Y" are measured along the bottom of the slab unit.**

**STRAND PATTERNS**
- TYPE 1 22 STRANDS
- TYPE 2 18 STRANDS

**PRESTRESSED SLAB UNITS INSTRUCTIONS**

Design Instructions & Information For FDOT Design Standards

Last Revised: 01/01/06
Sheet No. 03-01
20300 Series
PARTIAL PLAN SHOWING TYPICAL BEARING PAD LAYOUT
Attachment B

Design Standards Index Nos. 20350, 20353, 20354, 20355, 20363, 20364, 20365 and 20399
ARCHIVED

GENERAL NOTES

1. All dimensions are out-to-out.

2. Strands N should be ASTM A416, Grade 250 or 270, 3/8" or larger, stressed to 10,000 lbs. each.

3. Unless otherwise noted, the minimum concrete cover for reinforcing steel should be 2".

4. For slab units with skew and conditions, the end reinforcement, defined as Bars 402 and Y within the limits of the first 2°-0" shall be placed parallel to the skewed ends of the slab unit. The next three bars 402 & 4K shall be fanned to perpendicular to the longitudinal axis of the slab unit. Provide additional bars for end skew > 2°. (See "SKEWED END TREATMENT DETAIL").

5. Bars 402, 402, & 4K shall be placed and tied to Strands N and a fully bonded strand in the bottom row. (See "STAND PATTERNS").

6. At the option of the Contractor, deformed welded wire reinforcement (ASTM A497) may be used in lieu of bars 402 & 4K. Submit details to the Engineer for approval.

7. For referenced dimensions, Angles and Case Numbers see Table of Variables in Structures Plans.

8. Top surface of the slab units shall have either a smooth or a roughened surface with a 1/4" to 1/2" discontinuous V-Groove (length of unit).

9. Cut Strands 3" beyond the face of the slab unit.

10. Use the same thickness of slab units within each span.

11. Provide reinforced concrete keepers blocks on the low side of Prestressed Slab Units (PSU) when the cross slope or grade exceeds 3%. 

SCHEMATIC SIDE ELEVATION OF SLAB UNITS
(Positive Grade shown. Negative Grade or Horizontal Grade similar)

END 1 Direction of Stationing END 2
CASE 1

END 1 Direction of Stationing END 2
CASE 2

V-GROOVE DETAIL (Exterior Units)

END 1 Direction of Stationing END 2
CASE 3

SCHEMATIC PLAN VIEWS AT SLAB ENDS

INSTRUCTIONS TO DESIGNER:

To limit Bursting Forces the maximum prestress force at the slab unit ends from fully bonded strands must be limited to the following:

**Slab Unit Type**

- 12" or 15" x 48"
- 12" or 15" x 60"

**Max. Bonded Prestress Force**

- 1160 kips
- 1550 kips

**Index No.**

- 20354 & 20364
- 20355 & 20365

**Last Revision Date**

- 01/01/2009
- 01/01/2009

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 Structures Design Engineer. Avoid placing slab units within the limits of superspans because the cross slope for individual and adjacent slab units must be constant from begin span to end span. Small superspans may be accommodated by increasing the slab overlay thickness across the width of the span.
# Prestressed Custom Width Slab Units - Table of Variables

<table>
<thead>
<tr>
<th>Location</th>
<th>Concrete Properties</th>
<th>Reinforcing Steel</th>
<th>Slab Unit No. / Type</th>
<th>Span No. / Case</th>
<th>2B Day Release</th>
<th>Type End 1</th>
<th>End 2</th>
<th>End 3</th>
<th>End 4</th>
<th>Plan View</th>
<th>Angle</th>
<th>Dimensions</th>
<th>D1</th>
<th>D2</th>
<th>Y</th>
<th>4K</th>
<th>No. of Bar Spaces</th>
<th>Bar Spacing</th>
<th>Railings</th>
<th>Reinforcement</th>
</tr>
</thead>
</table>

**NOTE:** Work this sheet with Design Standard Index Nos. 20350, 20353 and 20363.

## Strand Debonding Legend
- **Full bonded strands.**
- **Strands debonded \( \ldots \) from end of beam.**
- **Strands debonded \( \ldots \) from end of beam.**
- **Strands debonded \( \ldots \) from end of beam.**

**NOTE:** On slab units with skewed ends the debonded length shall be measured along the debonded strand.

## Dimension Notes
- All longitudinal slab unit dimensions shown on this sheet with a single asterisk (*) are measured along the top of slab at the centerline of slab unit.
- End of slab unit bearing dimensions "J" and "K" are measured along the bottom of the slab unit.

## Strand Patterns

**INSTRUCTION TO DESIGNER**

Dim. B, C & D should be calculated using the following equations:

\[
B = W / \text{Sin}(90° - \theta) \\
D = B / 2 + 1 \times \text{Sin}(90° - \theta) \\
C = B / 2 + 1 \\
D = W / 2 + 1
\]

**PLEASE DELETE THIS NOTE UPON COMPLETION OF THIS DETAIL.**
### Table of Variables

<table>
<thead>
<tr>
<th>Location</th>
<th>Concrete Properties</th>
<th>Stdg.</th>
<th>Plan View</th>
<th>End of Unit</th>
<th>Unit Dimensions</th>
<th>Reinforcing Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span No.</td>
<td>Slab UNIT No. / Type</td>
<td>Class</td>
<td>Strengths (spa)</td>
<td>Tprk.</td>
<td>Case</td>
<td>Angle Ø</td>
</tr>
<tr>
<td>1</td>
<td>4Kc</td>
<td>25 Spc. Ø 2&quot; = 4'-2&quot;</td>
<td>4'-11½&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4Kc</td>
<td>19 Spc. Ø 2&quot; = 3'-2&quot;</td>
<td>3'-11½&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4Kc</td>
<td>25 Spc. Ø 2&quot; = 4'-2&quot;</td>
<td>4'-11½&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4Kc</td>
<td>19 Spc. Ø 2&quot; = 3'-2&quot;</td>
<td>3'-11½&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Strand Bonding Legend
- Fully bonded strands.
- Strands debonded "-" from end of beam.
- Strands debonded "-" from end of beam.
- Strands debonded "-" from end of beam.

#### Dimension Notes
- All longitudinal slab unit dimensions shown on this sheet with a single asterisk (*) are measured along the top of unit at the centerline of slab unit.
- End of slab unit bearing dimensions "J" and "K" are measured along the bottom of the slab unit.

#### Strand Patterns

**Strand Description**: Use _____ Diameter, Grade _____ _____ Strands stressed at _____ kips each. Area per strand equals _____ sq. in.

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**NOTES:**
- Work this sheet with Design Standards Index Nos. 20350, XXXX and XXXX.
- **STRAND DEBONDING LEGEND**
  - Fully bonded strands.
  - Strands debonded "-" from end of beam.
  - Strands debonded "-" from end of beam.
- **DIMENSION NOTES**
  - All longitudinal slab unit dimensions shown on this sheet with a single asterisk (*) are measured along the top of unit at the centerline of slab unit.
  - End of slab unit bearing dimensions "J" and "K" are measured along the bottom of the slab unit.

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**INSTRUCTION TO DESIGNER**
- **Dim. B & C should be calculated using the following equations**: $B=W/7", C=100°-90°-B/2, C=100°-90°-B/2"$ Where W = Width of Unit.
- **PLEASE DELETE THIS NOTE UPON COMPLETION OF THIS DETAIL**
## Prestressed Slab Units - Traffic Railing Reinforcing Layout Table

<table>
<thead>
<tr>
<th>Span No.</th>
<th>Slab Unit No.</th>
<th>Railing Index No.</th>
<th>Bar Mark (Mod.)</th>
<th>Dim. L_i</th>
<th>Dim. X_i</th>
<th>LOCATION (Left Edge Offset to Railing Reinforcement)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Case (Orientation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.00 L_i (END 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.10 L_i</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.20 L_i</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.30 L_i</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.40 L_i</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.50 L_i</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.60 L_i</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.70 L_i</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>0.80 L_i</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.90 L_i</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00 L_i (END 2)</td>
</tr>
</tbody>
</table>

**Notes:**

- Work this table with Index No. 20350, Sheet 2 and the Prestressed Slab Unit - Table of Variables in the Structures Plans.

- Dim. X_i is measured perpendicular from the left most edge of the slab unit (looking from END 1 towards END 2) to the vertical leg of the Traffic Railing reinforcement.

- See Index No. 20350, Sheet 2 for treatment of the Railing and Parapet reinforcement and Case "Left" or "Right" placement orientation of the modified railing bars.

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**Schematic Plan View of Modified Railing Reinforcement Placement**

- END 1: Left most edge of slab unit
- END 2
- Dimension: L_i (Tangent Length, Gutter Line reinforcement)

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**Instruction to Designer:**

Include this data table in the Structures Plans for Traffic Railings on horizontal curves. Please delete this note upon completion of this detail.
PRESTRESSED SLAB UNIT CAMBER AND BUILD-UP NOTES:
The build-up values given in the table are based on theoretical unit cambers. The Contractor shall monitor unit cambers for the purpose of predicting camber values at the time of the deck pour. If the predicted cambers based on field measurements differ more than ± 5/16" from the theoretical net Unit Camber @ 120 Days" shown in the table, propose modified build-up dimensions as required and submit to the Engineer for approval at least 21 days prior to casting overlay concrete.

BUILD-UP DIAGRAM FOR TANGENT SPANS
(ALONG & SLAB UNIT) (CASE 1)

BUILD-UP DIAGRAM FOR SAG VERTICAL CURVE SPANS
- CONTROL AT Ε SPAN
(ALONG & SLAB UNIT) (CASE 2)

BUILD-UP DIAGRAM FOR CREST VERTICAL CURVE SPANS
- CONTROL AT Ε SPAN
(ALONG & SLAB UNIT) (CASE 3)

BUILD-UP DIAGRAM FOR CREST VERTICAL CURVE SPANS
- CONTROL AT BEGIN OR END SPAN
(ALONG & SLAB UNIT) (CASE 4)

DEAD LOAD DEFLECTION DIAGRAM

BUILD-UP OVER SLAB UNITS

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 Prestressed Slab Units in Structures Plans.
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>REQUIRED THEORETICAL BUILD-UP OVER SLAB UNIT</th>
<th>NET BEAM CAMBER (PRESTRESS - DEAD LOAD DURING OVERLAY POUR)</th>
<th>DEAD LOAD DEFLECTION DURING OVERLAY POUR</th>
<th>BUILD-UP CASE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPAN NO.</td>
<td>SLAB UNIT NO.</td>
<td>AT BEGIN</td>
<td>SPAN DIM &quot;B&quot;</td>
<td>AT END</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Work this sheet with Design Standard Index No. 20398.