

## Index 20510 Composite Elastomeric Bearing Pads - Prestressed Florida-I Beams

### Design Criteria

**AASHTO LRFD Bridge Design Specifications**, 6th Edition; **Structures Design Guidelines (SDG)**

### Design Assumptions and Limitations

This standard depicts details and notes for elastomeric bearing pads for prestressed concrete Florida-I Beams with or without skewed end conditions.

This standard is intended for use with prestressed concrete Florida-I Beams, but may be used for steel girder or other bridge types with the appropriate notes and cross references.

Use this standard with Indexes 20010, 20036, 20045, 20054, 20063, 20072, 20078, 20084, 20096, 20511 and 20512.

Beveled Bearing Plates B are required for beams on grades greater than 2%, see instructions for Index 20511 and/or 20512.

<b>LIMITING PARAMETERS FOR COMPOSITE ELASTOMERIC BEARING PADS                  USED WITH FDOT STANDARD FLORIDA-I BEAMS</b>					
<b>Pad Type</b>	<b>Maximum Service Live Load (kips)</b>	<b>Maximum Service Dead Load (LL = Actual Service Live Load)</b>	<b>Skew Angle (degrees)</b>	<b>Maximum Shear Deflection (in)</b>	<b>Shear Modulus, G (Psi)</b>
D	135	DL=147+1.75(135-LL)	0 - 5	0.75	110
	110	DL=120+1.75(110-LL)	0 - 15		
E	150	DL=233+1.75(150-LL)	0 - 5	0.75	110
	110	DL=113+1.75(110-LL)	0 - 20		
F	150	DL=290+1.75(150-LL)	0 - 5	1	110
	120	DL=139+1.75(120-LL)	0 - 30		
G	145	DL=230+1.75(145-LL)	0 - 30	1	150
	95	DL=98+1.75(95-LL)	0 - 45		
H	180	DL=268+1.75(180-LL)	0 - 35	1.25	150
	135	DL=230+1.75(135-LL)	0 - 45		
J	145	DL=227+1.75(145-LL)	0 - 45	1.5	150
K	200	DL=383+1.75(200-LL)	0 - 45	1.5	150

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 contributing beam creep and shrinkage at the bottom of beam. Assume beam creep and shrinkage from day 120 to day 240 (this value can be determined from data in the beam design output).

Standard Elastomeric bearing pads have been designed in accordance with the **AASHTO LRFD Bridge Design Specifications**, Method "B" (2009 Interim), for a maximum static rotation (beam grade, camber and dead 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) or the bearing seats (pedestals) are finished approximately parallel to the slope of the beam. The effects of camber (at day 120) from prestressing and dead load deflection may be neglected when determining the slope at the ends of the beam, unless the sum of these effects exceeds 0.0125 radians (1.25%). Bearing seats may be finished level for beam grades less than 0.5%, or when the combined effects of beam grade, camber and dead load rotation do not exceed 1.25%. Whenever possible, the bearing seats at each end of the beam should be detailed with the same slope. See also instructions for Index 20511.

For design values exceeding the limiting parameters shown on 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 Index 20510.

## Plan Content Requirements

In the Structures Plans:

Complete the following "BEARING PAD DATA TABLE" and "ESTIMATED BEARING PAD QUANTITIES" table and include them on the supplemental sheets. See [Introduction I.3](#) for more information regarding use of Data Tables.

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

For beam grades greater than 2%, provide beveled bearing plates in accordance with Index 20511 and include a "BEARING PLATE DATA TABLE" in the plans.



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  $120 + 1.75(110 - 106) = 127$  kips versus Design Value of 109 kips; therefore, OK

Maximum Shear Deflection of 0.75" versus Design Value of 0.30"; therefore, OK

Skew Angle is between  $0^\circ$  and  $15^\circ$ ; therefore, OK

#### Conclusion:

Use Elastomeric Bearing Pad Type D.

No beveled plate is required. Detail beam seat with a 2% slope along the centerline of beam.

Complete "BEARING PLATE DATA TABLE" for embedded bearing plate only, see instructions for Index 20511 and/or 20512.

### EXAMPLE 2

#### Given Information:

Superstructure Type - Four Simple Spans with Continuous Deck  
45" Florida I Beams 101'-0" long, spaced at 9'-0" centers  
(99'-8" center to center bearing)

No longitudinal restraints 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 =  $0.000006/^\circ\text{F}$

Thermal Gradient =  $70^\circ\text{F}$

Creep and Shrinkage at the Bottom of each Beam (from day 120 to day 240) = 0.28"

Shear Deflection =  $(0.000006/^\circ\text{F} \times 65\% \times 70^\circ\text{F} \times 202' \times 12'/') + 0.280"/2 = 0.80"$

Beam Grade = 5%

Skew Angle =  $15^\circ$

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  $139 + 1.75(120 - 106) = 163.5$  kips versus Design Value of 109 kips; therefore, OK

Maximum Shear Deflection of 1.0" versus Design Value of 0.80"; therefore, OK

Skew angle is between 0° and 30°; 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, see instructions for Index 20511 and/or 20512. Neglect the effects of net beam camber in the beveled bearing plate design since rotation is less than 0.0125 radians.