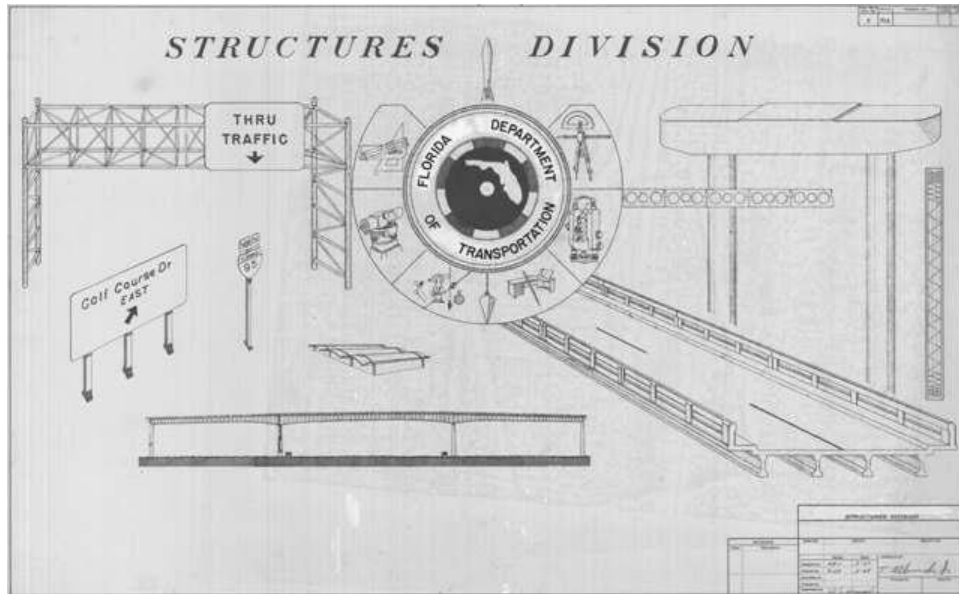


FLORIDA DEPARTMENT OF TRANSPORTATION



**INSTRUCTIONS FOR
DESIGN STANDARDS**

FISCAL YEAR 2012/2013

**EFFECTIVE BEGINNING JULY 2012 LETTINGS
FOR ALL INCLUDED DESIGN STANDARDS**

The Office of Design
Florida's Transportation Engineers



Table of Contents

Table of Contents.	i
Introduction	1
Index 289 Concrete Box Culvert Details (LRFD) (Rev. 01/12).	3
Index 291 Supplemental Details for Precast Concrete Box Culverts.	7
Index 292 Standard Precast Concrete Box Culverts	8
Index 302 Traffic Separators	9
Index 402 Guardrail Transitions and Connections for Existing Bridges (Rev. 01/12)	10
Index 403 Guardrail Transitions for Existing Bridge Traffic Railing Retrofits (Rev. 01/12)	28
Index 411 Pier Protection Barrier (Rev. 01/12)	30
Index 414 Type K Temporary Concrete Barrier System	32
Index 420 Traffic Railing (32" F Shape).	34
Index 421 Traffic Railing (Median 32" F Shape)	36
Index 422 Traffic Railing (42" Vertical Shape).	37
Index 423 Traffic Railing (32" Vertical Shape).	39
Index 424 Traffic Railing (Corral Shape) (Rev. 01/12).	41
Index 425 Traffic Railing (42" F Shape) (Rev. 01/12)	43
Index 470 Series Traffic Railing - (Thrie Beam Retrofit) (Rev. 01/12)	45
Index 480 Series Traffic Railing - (Vertical Face Retrofit) (Rev. 01/12)	57
Index 501 Geosynthetic Reinforced Soils	67
Index 521 Concrete Steps	69
Index 810 Bridge Fencing (Vertical).	70
Index 811 Bridge Fencing (Curved Top)	72
Index 812 Bridge Fencing (Enclosed)	74
Index 820 Pedestrian/Bicycle Bullet Railing.	76
Index 821 Aluminum Pedestrian/Bicycle Bullet Railing for Traffic Railing (32" F Shape)	77
Index 822 Aluminum Pedestrian/Bicycle Bullet Railing Details	78
Index 825 42" Concrete Pedestrian/Bicycle Railing (Rev. 01/12)	79
Index 851 Bridge Pedestrian/Bicycle Railing (Steel)	80
Index 852 Steel Pedestrian/Bicycle Railing	81
Index 861 Bridge Pedestrian/Bicycle Railing (Aluminum)	86
Index 862 Aluminum Pedestrian/Bicycle Railing	87
Index 870 Aluminum Pipe Guiderail (Rev. 01/12)	92
Index 880 Steel Pipe Guiderail (Rev. 01/12)	93
Index 5200 Precast Sound Barriers (Rev. 01/12)	94
Index 5210 Traffic Railing/Sound Barrier (8'-0") (Rev. 01/12)	105

Index 5211 Traffic Railing/Sound Barrier (14'-0")	109
Index 5212 Traffic Railing/Sound Barrier (8'-0") Junction Slab	111
Index 5213 Traffic Railing/Sound Barrier T-Shaped Spread Footing.	112
Index 5214 Traffic Railing/Sound Barrier L-Shaped Spread Footing.	113
Index 5215 Traffic Railing/Sound Barrier Trench Footing	114
Index 6010 C-I-P Cantilever Retaining Wall	115
Index 6011 C-I-P Gravity Wall (Rev. 01/12).	119
Index 6020 Permanent MSE Retaining Wall Systems.	121
Index 6030 Temporary MSE Retaining Wall Systems.	124
Index 6040 Precast Concrete Sheet Pile Wall.	127
Index 6100 Series Wall Copings and Traffic Railings/Junction Slabs	132
Index 11200 Multi-Column Ground Sign	134
Index 11310 Cantilever Sign Structure	135
Index 11320 Span Sign Structure	139
Index 11860 Single Column Ground Signs	142
Index 11870 Single Post Bridge Mounted Sign Support (Rev. 01/12).	143
Index 17502 High Mast Lighting	144
Index 17515 Standard Aluminum Lighting (Rev. 01/12)	145
Index 17723 Steel Strain Pole	147
Index 17725 Concrete Poles (Rev. 01/12).	148
Index 17743 Standard Mast Arm "D" & "E" Assemblies (Rev. 01/12)	151
Index 17745 Mast Arm Assemblies (Rev. 01/12).	163
Index 20005 Prestressed I-Beam Temporary Bracing (Rev. 01/12)	169
Index 20010 Series Prestressed Florida-I Beams (Rev. 01/12).	173
Index 20199 Build-Up and Deflection Data for Florida-I Beams (Rev. 01/12)	183
Index 20210 Series Florida U Beams (Rev. 01/12)	185
Index 20299 Build-Up and Deflection Data for Florida U Beams (Rev. 01/12)	195
Index 20502 Beveled Bearing Plate Details Prestressed Florida U-Beams	197
Index 20510 Composite Elastomeric Bearing Pads - Prestressed Florida-I Beams (Rev. 01/12)	204
Index 20511 Bearing Plates (Type 1) - Prestressed Florida-I Beams (Rev. 01/12)	209
Index 20512 Bearing Plates (Type 2)- Prestressed Florida-I Beams (Rev. 01/12)	212
Index 20600 Series Concrete Piles (Rev. 01/12).	215
Index 20654 54" Precast / Post-Tensioned Concrete Cylinder Pile (Rev. 01/12)	224
Index 20660 60" Prestressed Concrete Cylinder Pile (Rev. 01/12)	227
Index 20900 Approach Slabs (Flexible Pavement Approaches) (Rev. 01/12).	230
Index 20910 Approach Slabs (Rigid Pavement Approaches) (Rev. 01/12).	232
Index 21100 Strip Seal Expansion Joint (Rev. 01/12)	234

Index 21110 Poured Joint with Backer Rod Expansion Joint System	239
Index 21200 Light Pole Pedestal	241
Index 21210 Conduit Details (Rev. 01/12)	242
Index 21220 Navigation Light System Details (Fixed Bridges)	244
Index 21240 Maintenance Lighting For Box Girders	245
Index 21250 Series Access Hatch Assembly	246
Index 21300 Standard Bar Bending Details (Rev. 01/12)	247
Index 21600 Series Temporary Detour Bridge (Rev. 01/12)	249
Index 21800 Series Post-Tensioning (Rev. 01/12)	252
Index 21900 Fender System - Polymeric Piles	257
Index 21930 Fender Systems - Prestressed Concrete Piles	260
IDS - Revision History	R-1

Introduction

I.1 General

The *Instructions for Design Standards* provides general instructions to assist the Design Engineer of Record when incorporating these *Design Standards* in the Contract Plans. Instructions including design criteria, usage limitations, plan content requirements, pay item information and in some cases examples and sample drawings are provided for bridge component, overhead sign structure, box culvert and mast arm standards.

Instructions are organized by *Design Standard* index number. Some structural items are addressed in a series of standard drawings, e.g., prestressed beams and traffic railing retrofits. Instructions for all the standards in each respective series are included in the instructions for the lead standard of the series.

It is the responsibility of the Design Engineer of Record using these instructions to determine the fitness for a particular use of each standard in the design of a project. The inappropriate use of and adherence to these instructions does not exempt the engineer from the professional responsibility of developing an appropriate design.

I.2 Use of Design Standards

The *Design Standards* comprise the latest and best practices of the FDOT as follows:

1. Structures related Design Standards comply with various design specifications as modified or adopted by FDOT including the *AASHTO LRFD Bridge Design Specifications*, etc.
2. Compliance with various Federal laws and regulations including U.S. Access Board ADA Standards for Transportation Facilities; Code of Federal Regulations Title 33, Chapter 1, Part 118 Bridge Lighting and Other Signals; etc.
3. Application of FDOT design criteria, policies and preferences
4. Pay Item, Qualified Products List and Construction Specification consistency and coordination
5. Detail clarity
6. Proven designs for constructability and long term maintenance
7. Reserve structural capacity and / or redundancy of design
8. Material usage
9. Contractor familiarity
10. Formwork availability for concrete components

In this regard, incorporate the *Design Standards* as appropriate on all projects unless a need to develop project specific designs can be documented. Examples of where a project specific design might be required include, but are not limited to:

1. A modified prestressed concrete beam for a bridge widening
2. A single modular expansion joint that can accommodate large movements in lieu of multiple strip seal expansion joints

I.3 Data Tables (Rev. 01/12)

Many **Design Standards** require Data Tables that must be completed by the designer and then included in the Contract Plans. These Data Tables provide critical information to the contractor that supplements or completes individual **Design Standards**. These Data Tables are presented as CADD Cells and are included with the FDOT CADD Software on the "FDOT CADD Bar Menu". Typically, the most current Data Tables cannot be included in the FDOT CADD Software until the next version (or Maintenance Release) following the posting of the annual Design Standards to the website (usually in January). If the most current Data Tables are needed prior to release of the concurrent version of the FDOT CADD Software, they are available on the Design Standards website at:

<http://www.dot.state.fl.us/rddesign/DS/12/STDs.shtm>

Data Tables within this Volume include a "Table Date" in the upper right corner of the table. Do not change or delete the "Table Date" when completing and including the table in the plans. Use of custom built or recreated versions of the Data Tables (i.e. when the officially issued CADD cell is not used to build a given table) is discouraged. The "Table Date" reflects the latest modification of the CADD cell and is intended to be used in a Quality Control process, in conjunction with these instructions and the CADD cells provided with the Structures Bar Menu and/or available at the website listed above, to confirm that the current Data Table is being used. The "Table Date" will not necessarily be the same as the "Last Revision" date shown on the associated **Design Standard** or **Design Standard Revision**. The current "Table Date" for a given standard will be that shown in these instructions.

Index 289 Concrete Box Culvert Details (LRFD) (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

Designs for box culverts shown in this Index are to be produced only by computer analysis, utilizing the Department's **LRFD** Box Culvert Program. Designs are to be limited to the live loads and dimensional restraints shown in the General Notes of this Index and to the fill on the barrel(s), as shown in the Contract Plans.

Headwalls with skew angles less than -50° or greater than $+50^\circ$ require special design authorization. In these cases, other design options should be considered. Contact the District Drainage Engineer to obtain authorization.

At the contractor's option, Index 292 Standard Precast Concrete Box Culverts may be substituted for Index 289 cast-in-place box culverts unless specifically prohibited by a plan note. See also Instructions for [Index 292](#).

Plan Content Requirements

In the Roadway or Structures Plans:

For box culvert extensions with skewed joints at the connection location, consider providing additional reinforcing parallel to the joint for the full width of the culvert to ensure proper load paths for transverse forces. Provide details for these additional reinforcing bars in the plans and manually add these bars to the reinforcing bar list.

Complete the following "Box Culvert Data Tables" and include them in the plans. See [Introduction 1.3](#) for more information regarding use of Data Tables.

Work these data tables with the FDOT MathCAD **LRFD** Box Culvert Program and Index 289.

Fill in tables using the "Include" Key-In Utility in MicroStation and line1.prn thru line6.prn files located in the program root directory.

Use Structures Site Menu>Text>Table Data, which uses "Chart_TTF" Text Style and True Type Font FDOT Mono.

Complete Notes 1 thru 8.

In Note 7 of the Data Table show Differential Settlement (ΔY) and Effective Length (L) for single curvature deflection where significant long-term settlement is anticipated and precast box culverts are not specifically excluded. See Index 291 (Sheet 5) for details. If precast box culverts are specifically excluded, delete Note 7.

If a box culvert extension is required, investigate the constraints and condition of the existing structure to determine whether a Type I and/or Type II Connection Detail is appropriate for each Structure/Bridge Number within the project. Contact the District Structures Design Engineer (DSDE) to obtain concurrence with the recommended Connection Detail. Based on concurrence from the DSDE, in Note 8 of the Data Table specify either "Type I ", "Type II", or "Type I or Type II" for each Structure/Bridge Number within the project. If no box culvert extension is required, delete Note 8.

For box culverts meeting the definition of a bridge structure (See *PPM*, Volume 1, Chapter 33) include the Bridge Number in the plans and the Load Rating Sheet per *SDG* 3.15.14.

BOX CULVERT DATA TABLES

BOX, HEADWALL AND CUTOFF WALL DATA TABLE (inches unless shown otherwise)																				Table Date 7-01-09	
LOCATION	STRUCTURE /BRIDGE NUMBER	BOX										HEADWALL AND CUTOFF WALL									
		Wc(ft)	Hc(ft)	Tt	Tw	Tb	Ti	#cells	Lc(ft)	Cover	Bhwh	Hhwh	Brhw	Hrhw	Blcw	Hlcw	Brcw	Hrcw	SL(deg)	SR(deg)	

LEFT SIDE WINGWALLS DATA TABLE (inches unless shown otherwise)																Table Date 01-01-11			
STRUCTURE /BRIDGE NUMBER	LEFT END WINGWALL								LEFT BEGIN WINGWALL										
	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)	

RIGHT SIDE WINGWALLS DATA TABLE (inches unless shown otherwise)																Table Date 01-01-11			
STRUCTURE /BRIDGE NUMBER	RIGHT END WINGWALL								RIGHT BEGIN WINGWALL										
	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)	

ESTIMATED CONCRETE QUANTITIES (CY)																				Table Date 7-01-09			
STRUCTURE /BRIDGE NUMBER	BOX							LEFT END WINGWALL			LEFT BEGIN WINGWALL			RIGHT END WINGWALL			RIGHT BEGIN WINGWALL			Culvert Total			
	Left Cutoff Wall	Right Cutoff Wall	Bottom Slab	Walls	Top Slab	Left Head Wall	Right Head Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall		Sub Total		

MAIN STEEL REINFORCEMENT SPACING (inches)																Table Date 7-01-09		
STRUCTURE /BRIDGE NUMBER	BOX														HEADWALLS		CUTOFF WALLS	
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115, 116...	803	806	809

WINGWALL STEEL REINFORCEMENT SPACING (inches)																						Table Date 7-01-09							
STRUCTURE /BRIDGE NUMBER	LEFT END WINGWALL								LEFT BEGIN WINGWALL								RIGHT END WINGWALL						RIGHT BEGIN WINGWALL						
	401 (407(8))	402 (403)	404 (405)	406	409	410	411	501 (507(8))	502 (503)	504 (505)	506	509	510	511	601 (607(8))	602 (603)	604 (605)	606	609	610	611	701 (707(8))	702 (703)	704 (705)	706	709	710	711	

WINGWALL NOTE: Bar designations in '()' are only required for variable height wingwalls.

NOTES:

1. Environmental Class -----
2. Reinforcing Steel, Grade -----
3. Concrete Class ----- f'c = ----- ksi
4. Soil Properties:
 Friction Angle -----
 Modulus of Subgrade Reaction -----
 Nominal Bearing Resistance -----
5. Total Estimated Quantity of Reinforcing Steel ----- lbs
6. Work this Drawing with Design Standards Index No. 289 and Sheet Nos. -----
7. Settlement criteria for Precast Box Culvert option (Index No. 291):
 Long Term Differential Settlement (ΔY) = ----- ft.
 Effective Length for Settlement (L) = ----- ft.
8. Connection Types permitted for Box Culvert Extensions:
 Structure/ Bridge Number XXXXX -
 (Type I/Type II/Type I or Type II)

Payment

Item number	Item description	Unit Measure
400-2-1	Concrete Class II, Culverts	CY
400-4-1	Concrete Class IV, Culverts	CY
415-1-6	Reinforcing Steel - Miscellaneous	LB

Index 291 Supplemental Details for Precast Concrete Box Culverts

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; ***Structures Design Guidelines (SDG)***

Design Assumptions and Limitations

Work this Index with the Cast-In-Place Concrete Box Culvert Details and Data Tables shown in the plans, Indexes 289 and 292, and the Precast Concrete Box Culverts shown in the shop drawings.

Plan Content Requirements

Show Differential Settlement (ΔY) and Effective Length (L) for single curvature deflection in the Contract Plans where significant long-term settlement is anticipated. See Index 291(Sheet 5 of 5) for details.

Payment

Item number	Item description	Unit Measure
400-2-1	Concrete Class II, Culverts	CY
400-4-1	Concrete Class IV, Culverts	CY
415-1-6	Reinforcing Steel - Miscellaneous	LB

Index 292 Standard Precast Concrete Box Culverts

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

At the contractor's option, these precast designs may be substituted for cast-in-place box culverts designed to **AASHTO LRFD Bridge Design Specifications**, 4th Edition. Designs are based on the design criteria shown in the **SDG**.

Use this standard with Index 291.

This index may be used in lieu of Index 289 when a precast box culvert is determined to be more cost effective or more appropriate for the project. In such cases, the designer shall show the box culvert Span, Rise and Design Earth Cover in the plans. The designer shall also provide the headwall and wing wall design in the plans by completing the relevant data tables and notes for [Index 289](#) (Box Culvert Data Tables).

Plan Content Requirements

Include references to and completed data tables for Index 289 Concrete Box Culvert Details in the plans. Use of Index 292 in lieu of Index 289 is at the contractor's option unless specifically excluded by plan note.

Payment

Item number	Item description	Unit Measure
400-2-1	Concrete Class II, Culverts	CY
400-4-1	Concrete Class IV, Culverts	CY
415-1-6	Reinforcing Steel - Miscellaneous	LB

Index 302 Traffic Separators

Design Criteria

AASHTO A Policy on Geometric Design of Highways and Streets, Fourth Edition, 2001 (AASHTO Green Book)

Design Assumptions and Limitations

Bridge mounted Traffic Separators are intended to match up geometrically with adjacent roadway Traffic Separators. They are essentially the same as roadway Traffic Separators but with the addition of reinforcing steel to limit cracking caused by shrinkage and deflection of the bridge deck due to live load.

Plan Content Requirements

In the Structures Plans:

In the Materials Note on the General Notes sheet, specify the use of Class NS concrete meeting the requirements of **Specifications** Section 347.

Show and label the Traffic Separator on the Plan and Elevation, Typical Section and Superstructure sheets, and other sheets as required. Specify the same shape Traffic Separator (Type "E" or "F") as is used on the roadway approach. Include cross references to **Design Standards** Index 302.

Estimated concrete quantities and reinforcing steel lists are not required.

Payment

Item number	Item description	Unit Measure
520-5-AB	Concrete Traffic Separator	LF
520-70	Concrete Traffic Separator, Special- Variable Width	SY

Index 402 Guardrail Transitions and Connections for Existing Bridges (Rev. 01/12)

Design Criteria

NCHRP Report 350; AASHTO LRFD Bridge Design Specifications, 4th Edition, Section 13; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

This standard contains details for attaching thrie beam guardrail approach transition retrofits to Index 470 and 480 Series bridge railing retrofits and also to existing safety shape bridge traffic railings. Use this standard with Indexes 410, 470, 471, 472, 473, 474, 475, 476, 480, 481, 482, 483 and 484.

The appropriate Index 402 approach transition retrofit for Index 470 and 480 Series bridge railing retrofits must be selected and specified in the plans based on the shapes and designs of the existing bridge traffic railings, approach slabs and end bent wing walls. See the Instructions for [Index 470](#) and [Index 480](#) and **SDG** 6.7 for more information.

The following three sections of instructions address the use of Index 402 with existing safety shape bridge traffic railings:

1. A Historical Compilation of Superseded Florida Department of Transportation "Structures Standard Drawings" for "F" and "New Jersey" Shape Structure Mounted Traffic Railings
2. Guardrail Approach Transition Retrofit Instructions for Existing Flat Slab Bridges
3. Guardrail Approach Transition Retrofit Instructions for Existing Beam/Girder Bridges

Index 402 Thrie-Beam Guardrail transition retrofits are bolted to existing safety shape bridge traffic railings through field drilled holes utilizing the pre-drilled Thrie-Beam Terminal Connector as a template. This method of attachment creates the potential for conflicts between the new attachment bolts and existing utilities and/or conduits. Compare the locations of the new attachment bolts with the positions of any existing utilities and/or conduits. Guidance is provided on Index 402 for selecting a bolt pattern for the Thrie-Beam Terminal Connector that may avoid existing utilities and/or conduits. Existing utilities and/or conduits that conflict with the possible bolt patterns shall be relocated if possible or placed out of service. Include all necessary utility adjustment information in the Roadway Plans.

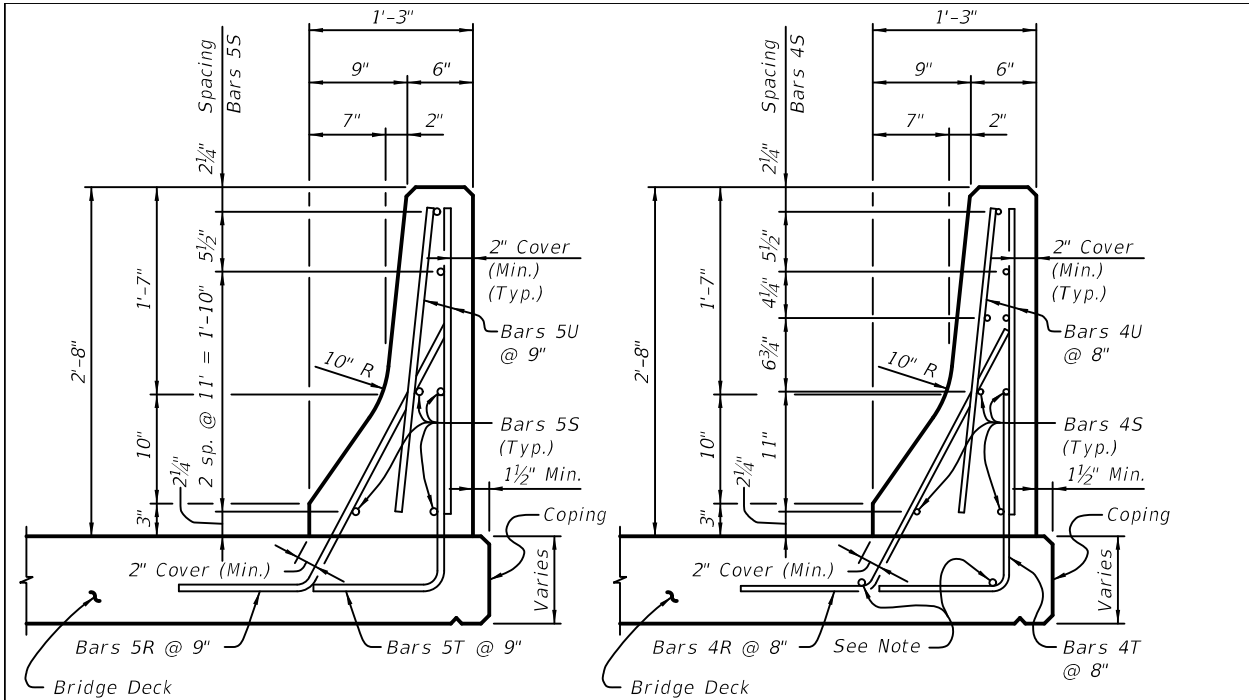
1. A Historical Compilation of Superseded FDOT Structures Standard Drawings for "F" and "New Jersey" Shape Structure Mounted Traffic Railings:

The following list of superseded standard drawings and associated railing typical sections and end transition details are presented as a historical reference for use when evaluating existing safety shape structure mounted traffic railings.

Utilities and/or conduits may exist in or adjacent to existing traffic railings and will vary in size, number and location. Utilities and/or conduits are not shown on these railing typical sections or end transition details.

Welded Wire Reinforcing (WWR) may have been used in place of the conventional reinforcing steel shown on the railing typical sections. Reinforcing steel was not standardized for railing end transitions but was instead included with the end bent reinforcing steel as a project specific design. Thus, some degree of variability can be expected for this reinforcing steel.

Superseded FDOT Structure Mounted Traffic Railing Standards			
Standard Index No.	Railing Type	Drawing Date	Revision Date(s)
11407	New Jersey	3/74	10/74
11407	New Jersey	3/78	10/77, 1/78, 9/78, 7/80, 3/81 & 8/81
11460	New Jersey	5/74	6/75, 8/75, 10/77, 9/78, 3/80, 7/80, 3/81, 8/81 & 5/82
12670	New Jersey	3/78	1/81 & 8/81
12931	New Jersey	1/79	3/81, 8/81, 10/84 & 11/84
13857	New Jersey	10/83	11/84
14101	New Jersey	1/86	N.A.
14286	F	9/87	10/87, 11/87, 12/87 & 1/88
700 (English Units)	F	2/89	1990, 1992 & 1994
700 (Metric Units)	F	2/89	1994, 1996, 1997 & 1998



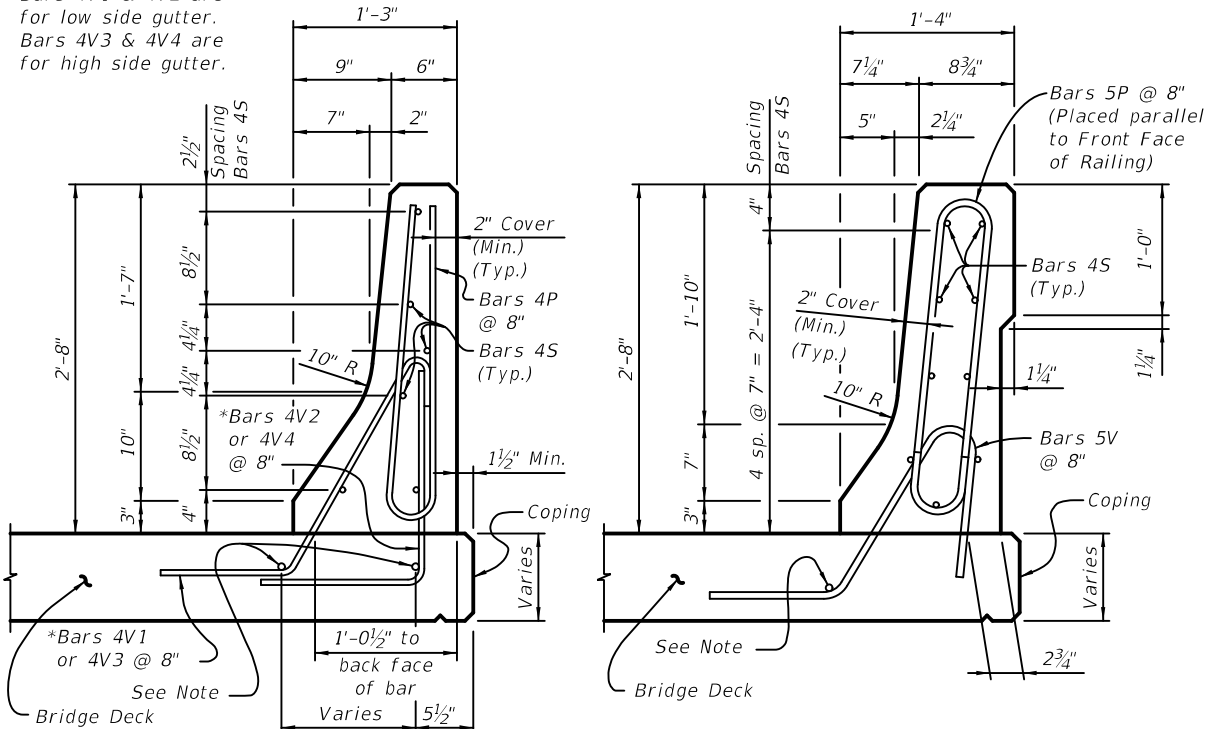
**TYPICAL SECTION THRU
NEW JERSEY SHAPE RAILING
INDEX NOS. 11407 & 11460**

(Index No. 11407 shown, Index No. 11460 similar)

**TYPICAL SECTION THRU
NEW JERSEY SHAPE RAILING
INDEX NOS. 11407, 11460, 12670 & 12931**

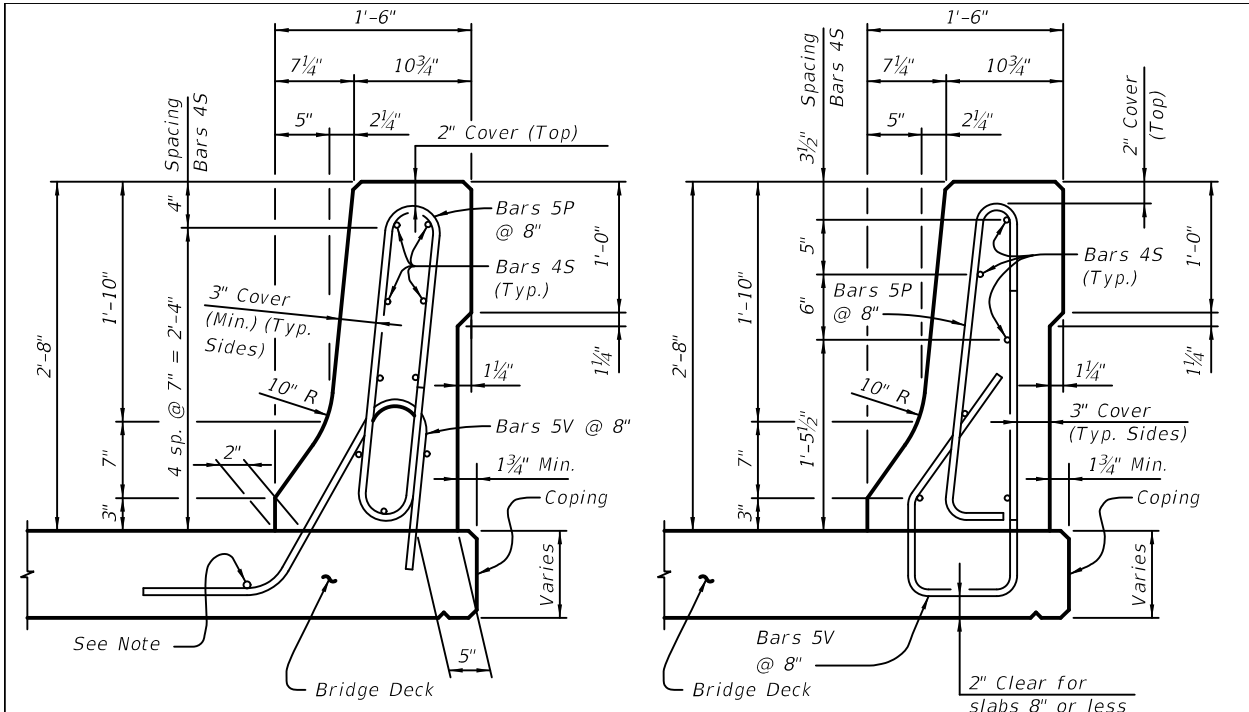
(Index No. 11407 shown,
Index Nos. 11460, 12670 & 12931 similar)

*Bars 4V1 & 4V2 are for low side gutter.
Bars 4V3 & 4V4 are for high side gutter.



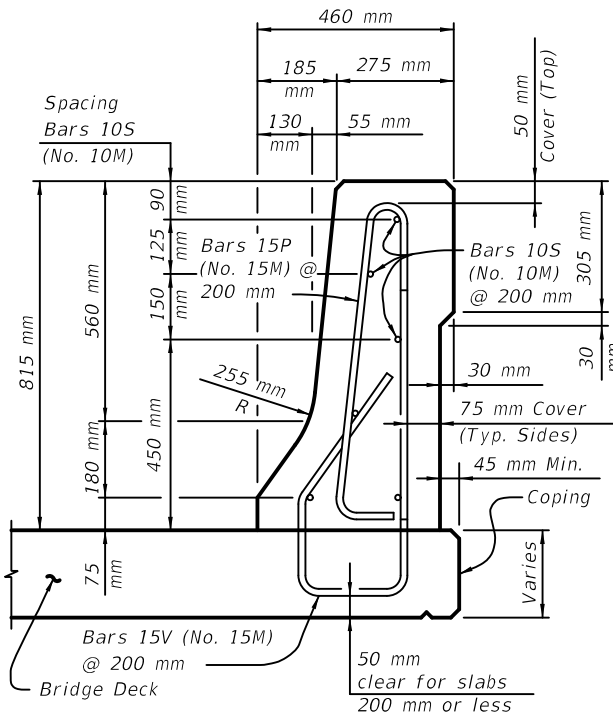
**TYPICAL SECTION THRU
NEW JERSEY SHAPE RAILING
INDEX NOS. 13857 & 14101**

**TYPICAL SECTION THRU
F SHAPE RAILING
INDEX NO. 14286**

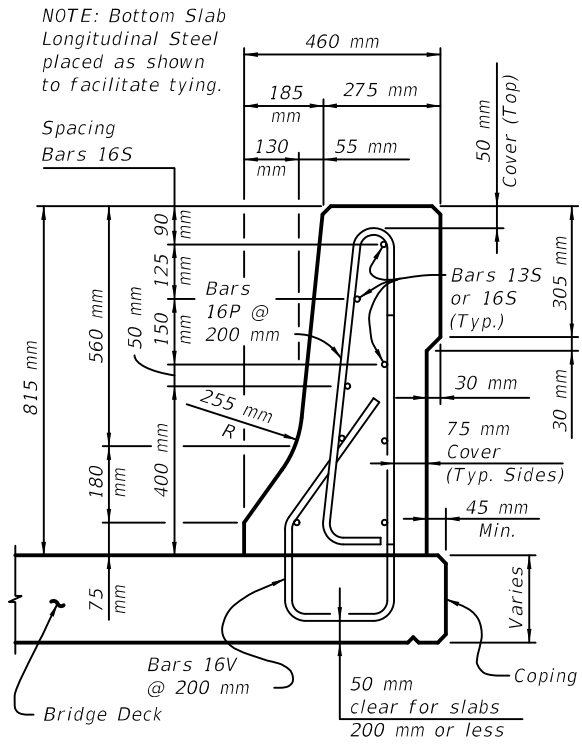


TYPICAL SECTION THRU
F SHAPE RAILING
INDEX NO. 700

TYPICAL SECTION THRU
F SHAPE RAILING
INDEX NO. 700

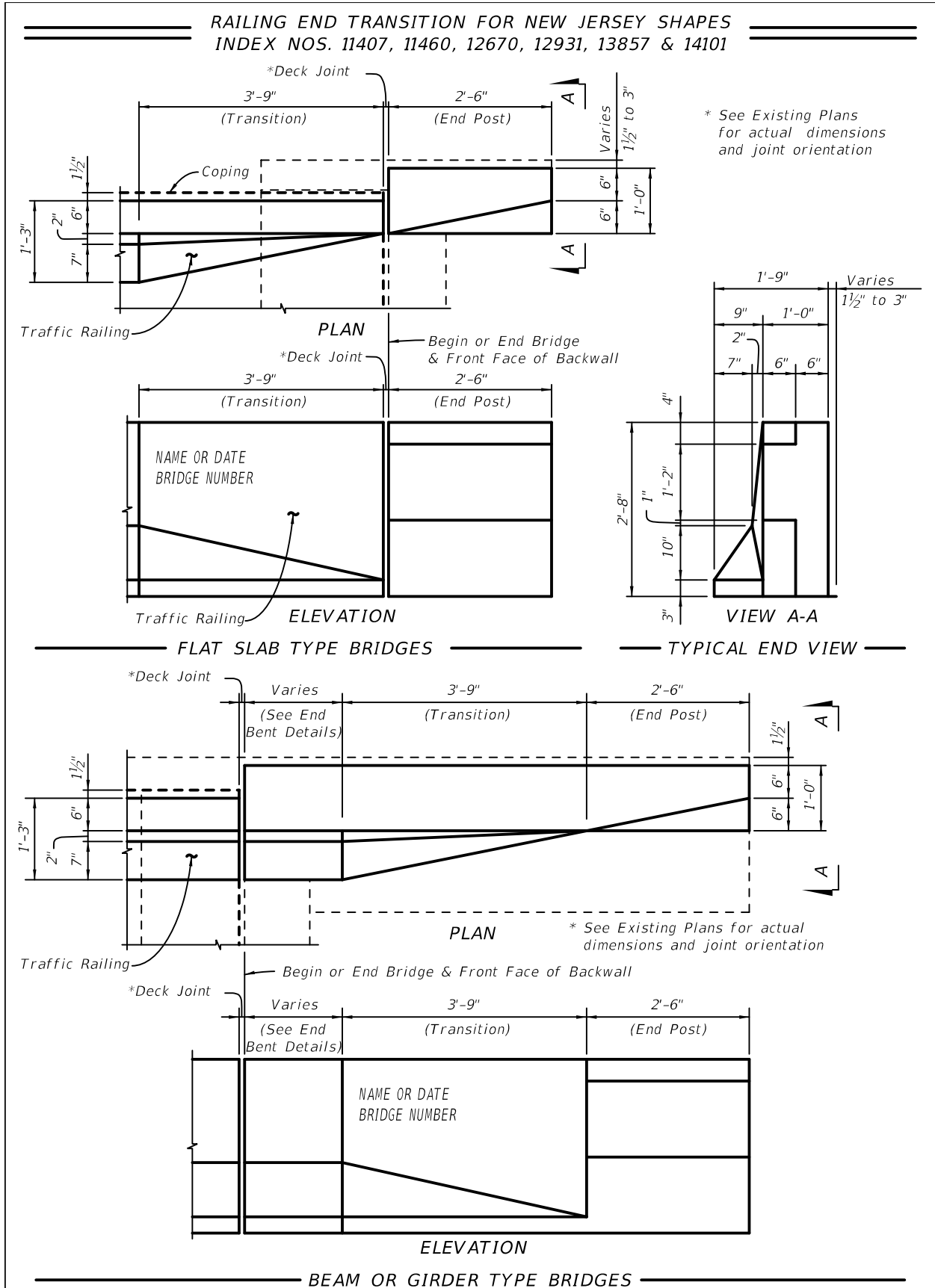


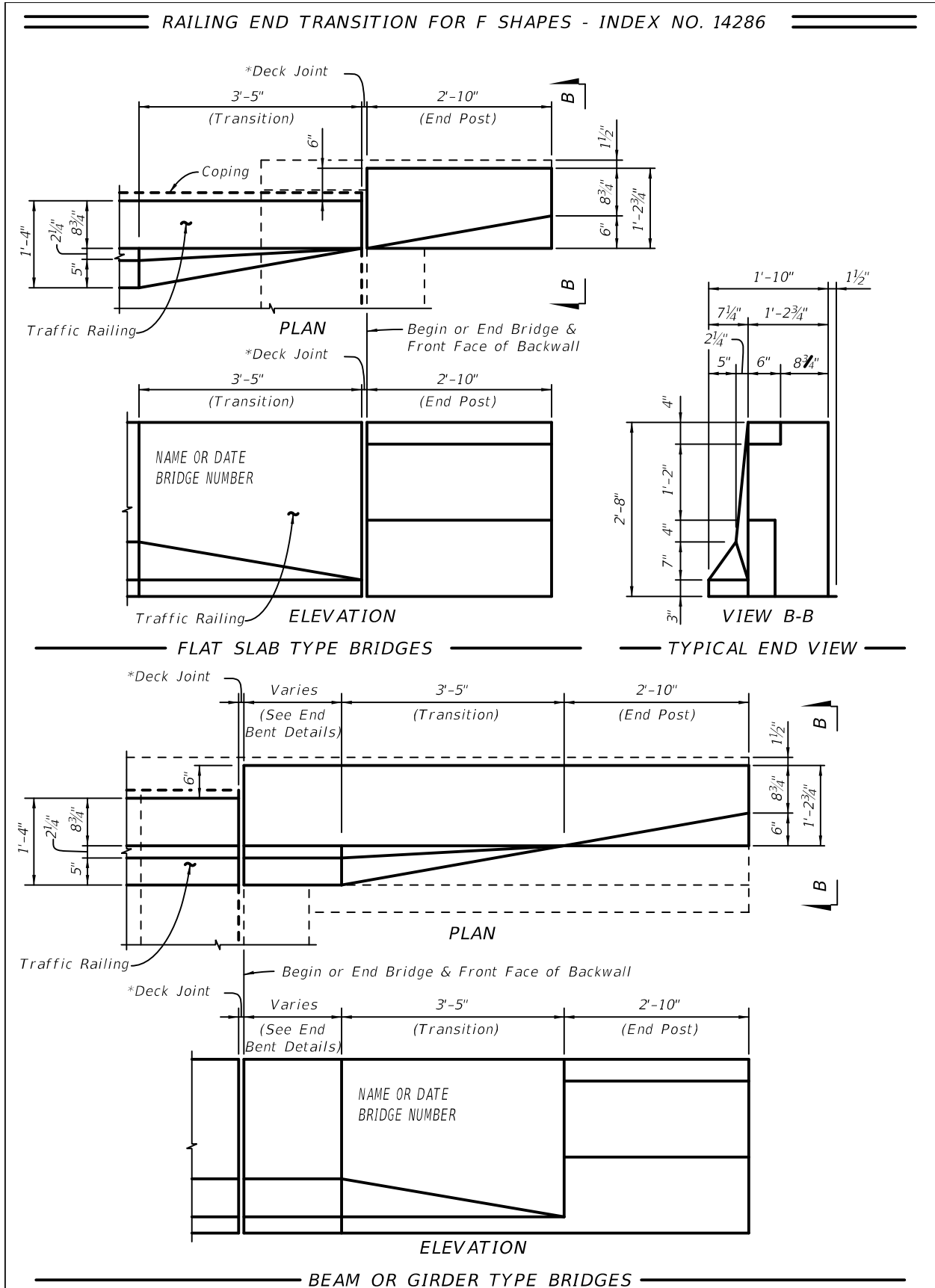
TYPICAL SECTION THRU
F SHAPE RAILING
(Metric with hard converted rebar)
INDEX NO. 700

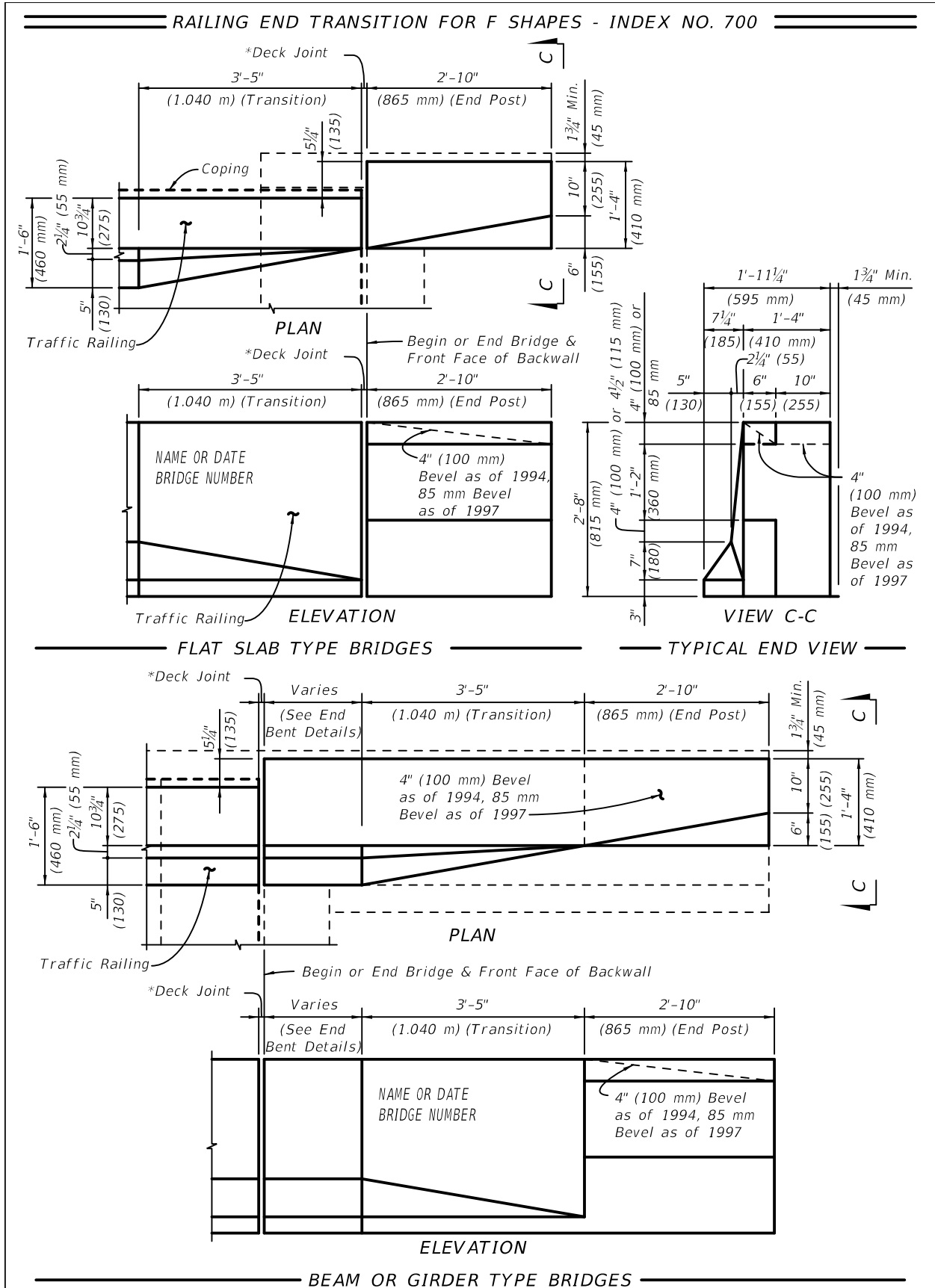


TYPICAL SECTION THRU
F SHAPE RAILING
(Metric with soft converted rebar)
INDEX NO. 700

NOTE: Bottom Slab
Longitudinal Steel
placed as shown
to facilitate tying.







2. Guardrail Approach Transition Retrofit Instructions for Existing Flat Slab Bridges:

These instructions are applicable only to bridges with concrete flat slab superstructures.

The retrofitting of existing "W" beam guardrail transitions is accomplished by installing new Thrie-Beam Guardrail transitions in accordance with Scheme A or Scheme B as presented herein. It is permissible to use both Scheme A and Scheme B on a single bridge as required; e.g. Scheme A at begin bridge and Scheme B at end bridge. Scheme A shall be considered as the preferred choice for retrofitting the existing guardrail transitions. Scheme B should only be used where Scheme A is not applicable. Use of either scheme is dependent on the existing Traffic Railing and End Transition being in sound structural condition, for the portions that will remain in place.

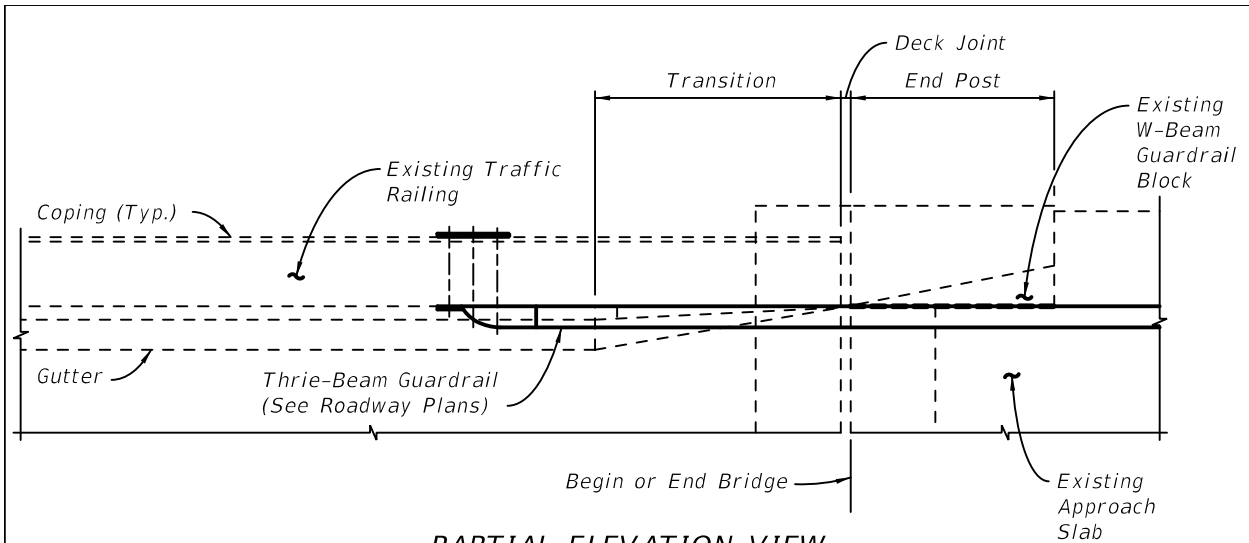
Flat Slab Scheme A

The Thrie-Beam Guardrail transition retrofit details shown in Scheme A are applicable for existing bridges meeting both of the following requirements:

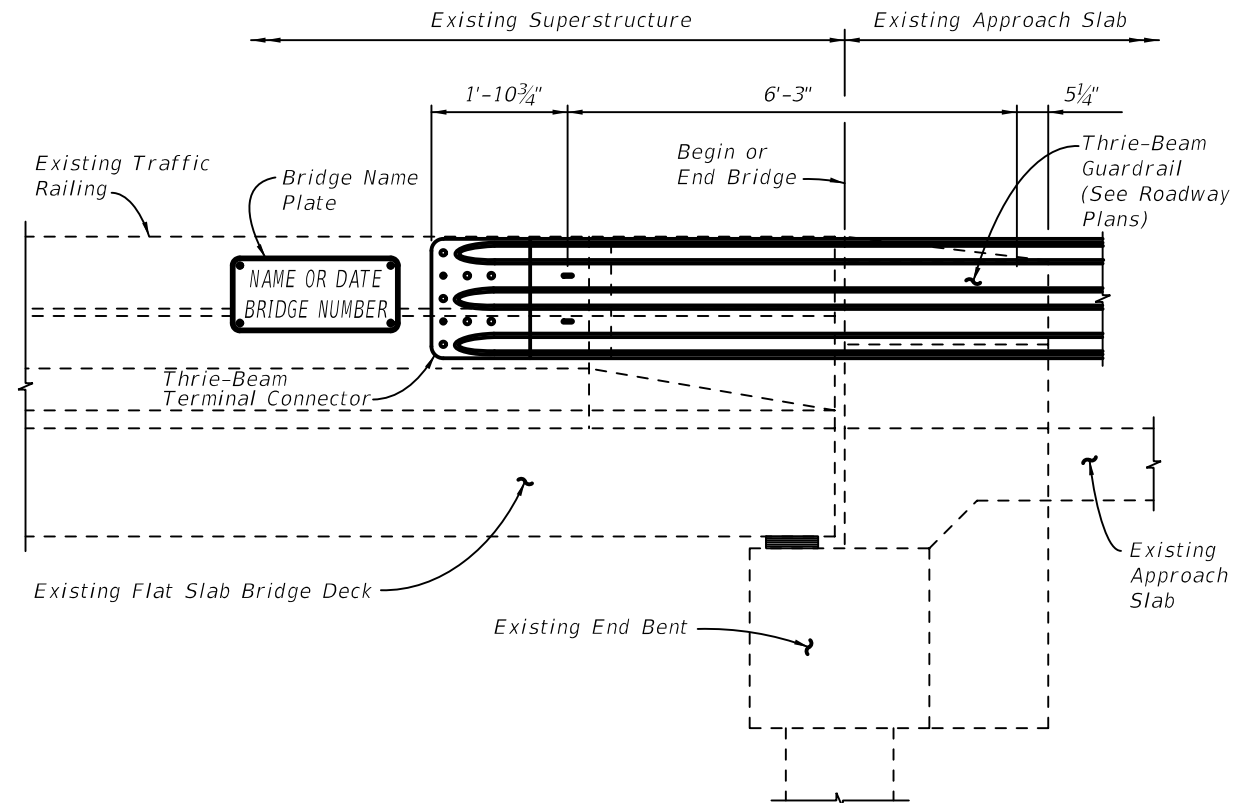
1. The existing bridge Traffic Railings are "F" or "New Jersey" shape railings conforming to one of the superseded FDOT standard designs shown in Section 1 of these Instructions (see above).
2. The total amount of thermal movement at the bridge end expansion joint does not exceed 1½" (¾" in each direction). The total amount of thermal movement at the expansion joint shall be determined by theoretical calculation and confirmed by field measurement where possible. It should be noted that the actual in-service movement due to thermal effects may be less than the value determined by theoretical calculation.

If both of the above requirements cannot be met, then Scheme B shall be evaluated for use. If both of the above requirements are met, the Scheme A details shown below and the following guidelines shall be used to assist in the preparation of the plans.

Generally, if Scheme A is applicable, Structures Plans will not be required for the Thrie-Beam Guardrail transition retrofit. Only Roadway Plans which include a reference to **Design Standards** Index 402, Sheet 24 of 24, Scheme I are required.



PARTIAL ELEVATION VIEW
 (Existing W-Beam Guardrail to be removed not shown for clarity.
 "F" Shape Railing shown, "New Jersey" Shape Railing similar)



PARTIAL ELEVATION VIEW
 (Existing W-Beam Guardrail to be removed not shown for clarity.
 "F" Shape Railing shown, "New Jersey" Shape Railing similar)

SCHEME A

Flat Slab Scheme B

The Thrie-Beam Guardrail transition retrofit details shown in Scheme B are applicable for existing bridges meeting both of the following requirements:

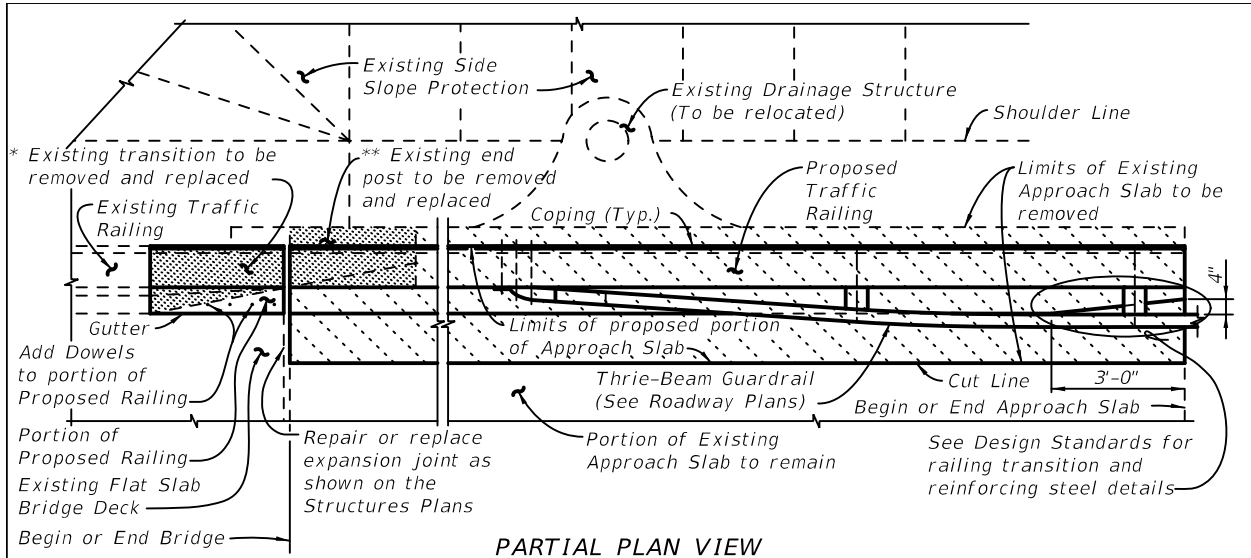
1. The existing bridge Traffic Railings are "F" or "New Jersey" shape railings conforming to one of the superseded FDOT standard designs shown in Section 1 of these Instructions (see above).
2. The total amount of thermal movement at the bridge end expansion joint exceeds 1½" (¾" in each direction). The total amount of thermal movement at the expansion joint shall be determined by theoretical calculation and confirmed by field measurement where possible. It should be noted that the actual in-service movement due to thermal effects may be less than the value determined by theoretical calculation.

If both of the above requirements are met, then Scheme B details shown below and the following guidelines shall be used to assist in the preparation of the plans.

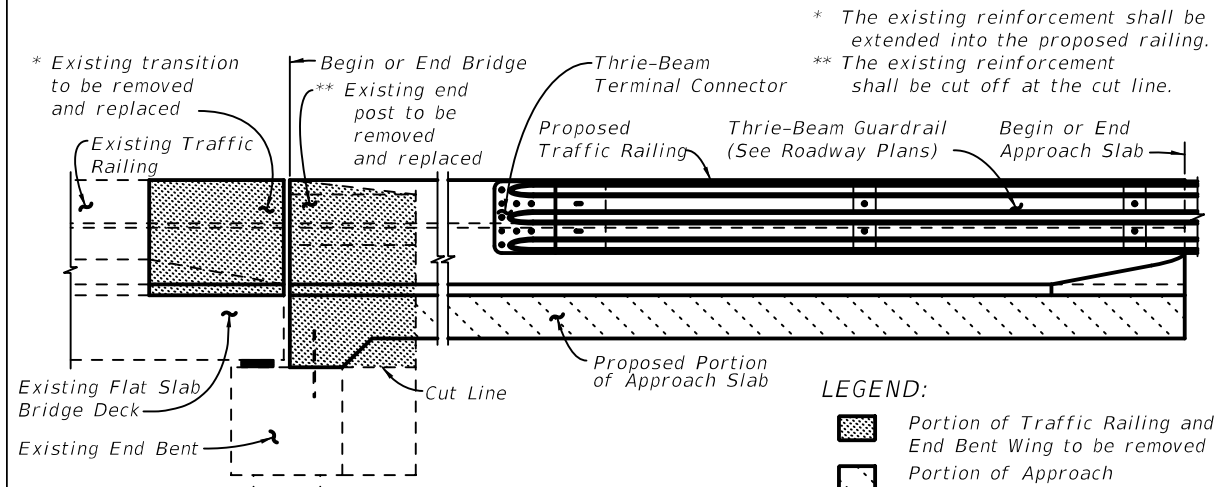
If Scheme B is used, then Structures and Roadway Plans will be required for the Thrie-Beam Guardrail retrofit. The Roadway Plans shall address traffic control issues, removal of the existing "W" Beam Guardrail transition and installation of the new Thrie-Beam Guardrail transition utilizing **Design Standards** Index 400, Detail J. The Structures Plans shall address demolition and reconstruction of the required portion of the existing Traffic Railing end transition and approach slab.

If the existing traffic railing is an "F" Shape traffic railing, the appropriate **Design Standards** Indexes 420 and 421 shall be referenced and used in their entirety or modified as required by project specific designs included in the Structures Plans. Applicable details from **Design Standards** Index 20900 or 20910 shall be used as required for the approach slab reconstruction.

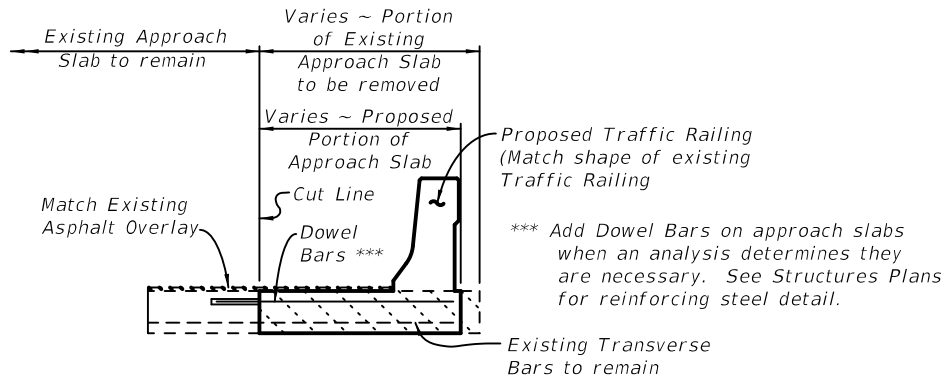
If the existing traffic railing is a "New Jersey" Shape traffic railing, project specific railing details will be required. Applicable details from **Design Standards** Index 20900 or 20910 shall be used as required for the approach slab reconstruction.



PARTIAL PLAN VIEW
 (Existing W-Beam Guardrail to be removed not shown for clarity.
 "F" Shape Railing shown, "New Jersey" Shape Railing similar.)



PARTIAL ELEVATION VIEW
 (Existing W-Beam Guardrail to be removed not shown for clarity.
 "F" Shape Railing shown, "New Jersey" Shape Railing similar.)



SECTION A-A
 (Showing one layer of existing reinforcement)

SCHEME B

3. Guardrail Approach Transition Retrofit Instructions for Existing Beam/Girder Bridges

These instructions are applicable only to bridges with beam or girder superstructures.

The retrofitting of existing "W" beam guardrail transitions is accomplished by installing new Thrie-Beam Guardrail transitions in accordance with Schemes A, B or C as presented herein. It is permissible to use any combination of Schemes A, B and C on a single bridge as required; e.g. Scheme A at begin bridge and Scheme C at end bridge. Schemes A and B shall be considered as the preferred choices for retrofitting the existing guardrail transitions. Scheme C should only be used where Schemes A or B are not applicable. Use of any schemes is dependent on the existing Traffic Railing and End Transition being in sound structural condition, for the portions that will remain in place.

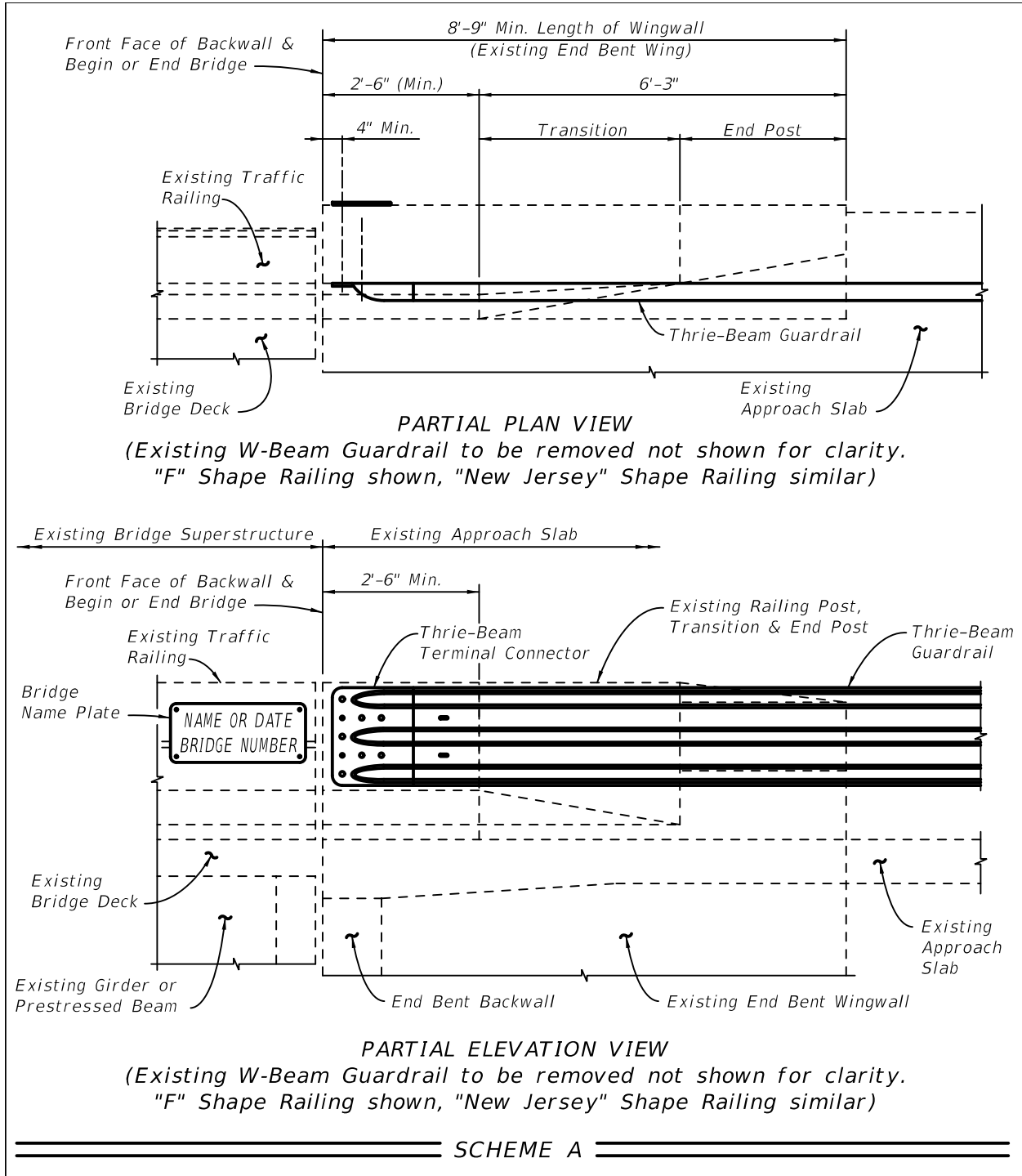
Beam/Girder Scheme A

The Thrie-Beam Guardrail transition retrofit details shown in Scheme A are applicable for existing bridges meeting both of the following requirements:

1. The existing bridge Traffic Railings are "F" or "New Jersey" shape railings conforming to one of the superseded FDOT standard designs shown in Section 1 of these Instructions (see above).
2. The existing end bent wingwalls that support the Traffic Railing end transitions are a minimum of 8'-9" in length and are directly supported by a pile or drilled shaft.

If both of the above requirements cannot be met, then Scheme B shall be evaluated for use. If both of the above requirements are met, the Scheme A details shown below and the following guidelines shall be used to assist in the preparation of the plans.

Generally, if Scheme A is applicable, Structures Plans will not be required for the Thrie-Beam Guardrail transition retrofit. Only Roadway Plans which include a reference to ***Design Standards*** Index 402, Sheet 24 of 24, Scheme II are required.



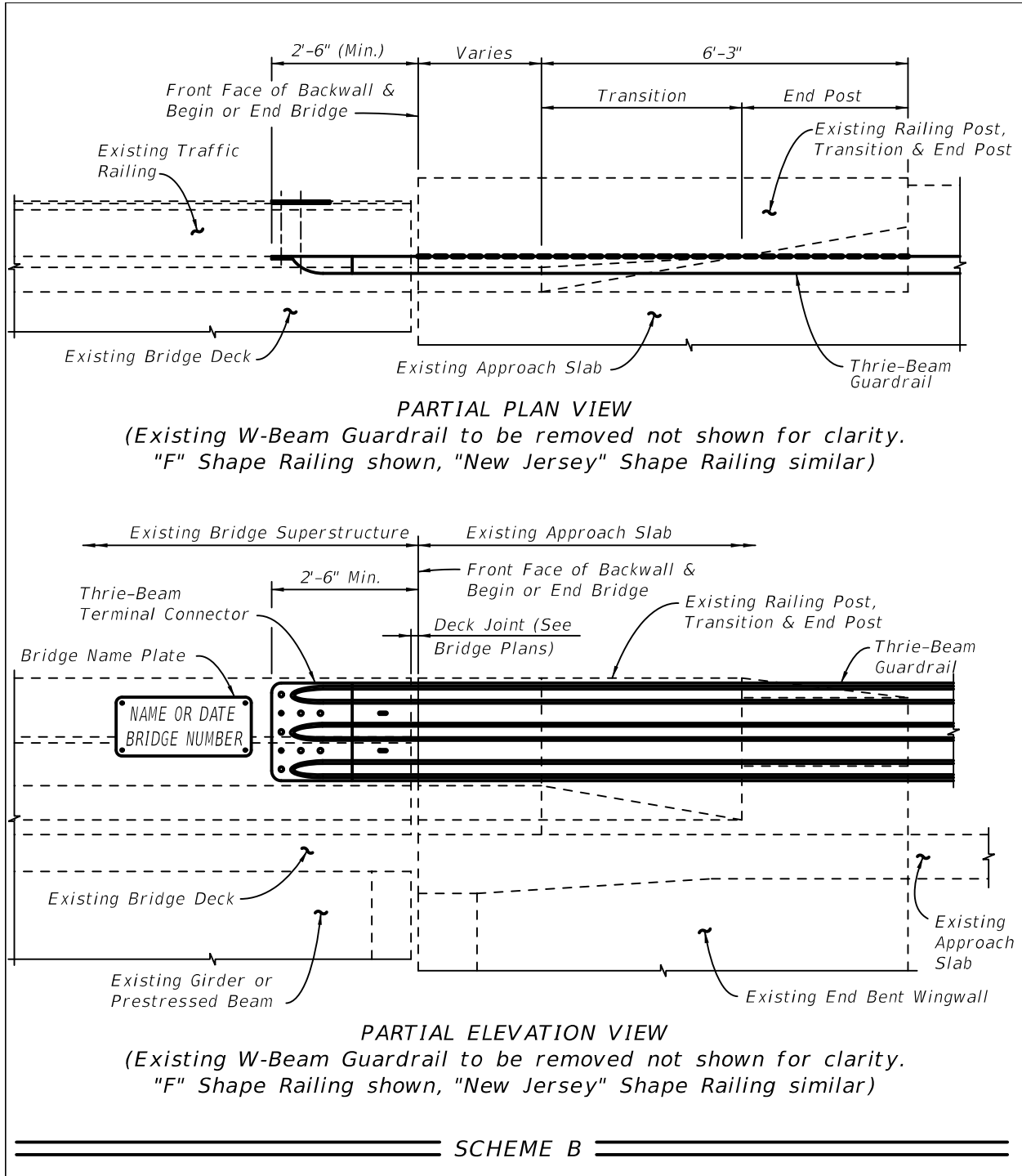
Beam/Girder Scheme B

The Thrie-Beam Guardrail transition retrofit details shown in Scheme B are applicable for existing bridges meeting both of the following requirements:

1. The existing bridge Traffic Railings are "F" or "New Jersey" shape railings conforming to one of the superseded FDOT standard designs shown in Section 1 of these Instructions (see above).
2. The total amount of thermal movement at the bridge end expansion joint does not exceed 1½" (¾" in each direction). The total amount of thermal movement at the expansion joint shall be determined by theoretical calculation and confirmed by field measurement where possible. It should be noted that the actual in-service movement due to thermal effects may be less than the value determined by theoretical calculation.

If both of the above requirements cannot be met then Scheme C shall be evaluated for use. If both of the above requirements are met, the Scheme B details shown below and the following guidelines shall be used to assist in the preparation of the plans.

Generally, if Scheme B is determined to be applicable, Structures Plans will not be required for the Thrie-Beam Guardrail retrofit. Only Roadway Plans which include a reference to **Design Standards** Index 402, Sheet 24 of 24, Scheme III shall be used for the Thrie-Beam Guardrail retrofit.



Beam/Girder Scheme C

The Thrie-Beam Guardrail transition retrofit details shown in Scheme C are applicable for existing bridges meeting both of the following requirements:

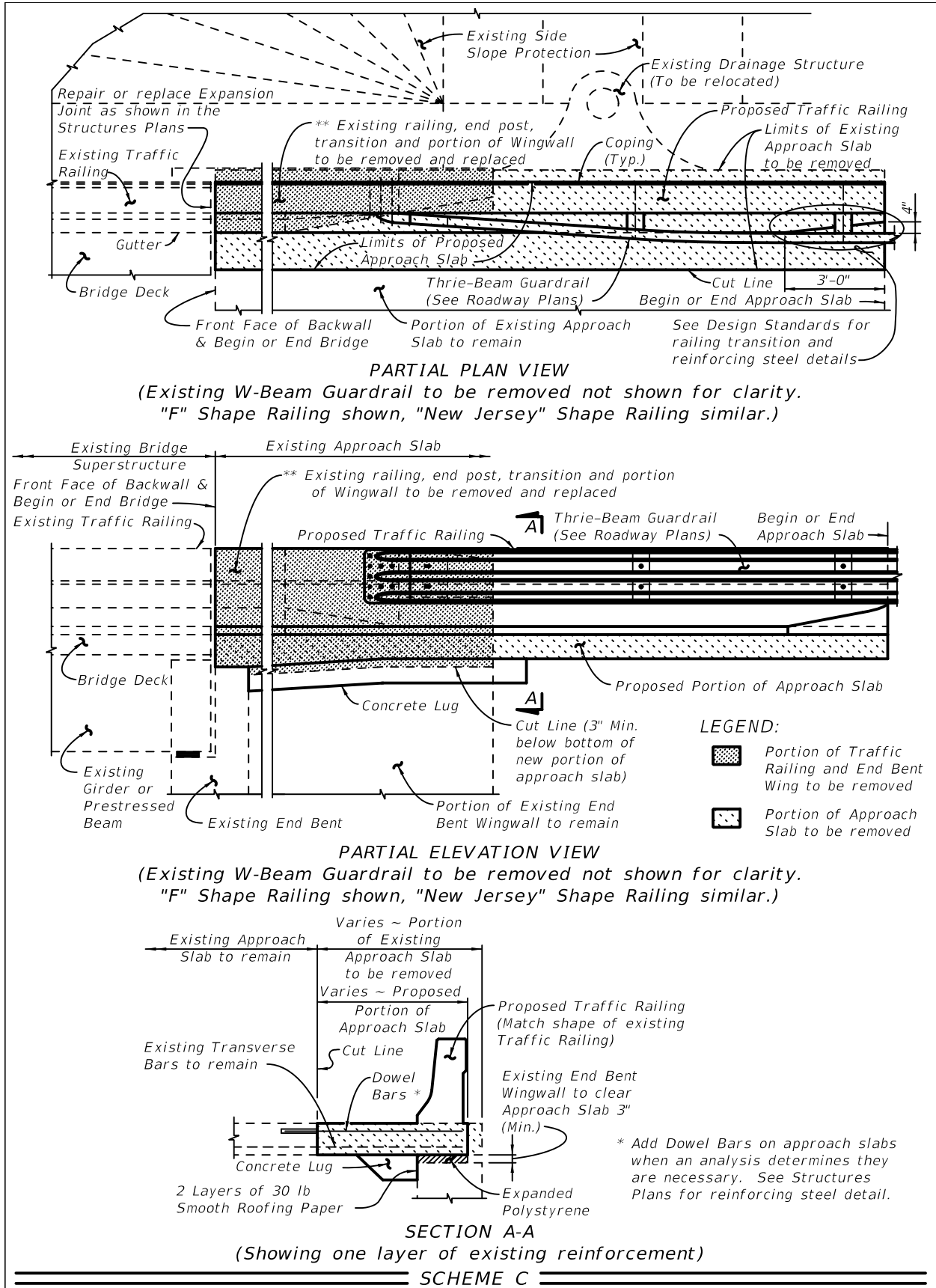
1. The existing bridge Traffic Railings are "F" or "New Jersey" shape railings conforming to one of the superseded FDOT standard designs shown in Section 1 of these Instructions (see above).
2. The total amount of thermal movement at the bridge end expansion joint exceeds 1½" (¾" in each direction). The total amount of thermal movement at the expansion joint shall be determined by theoretical calculation and confirmed by field measurement where possible. It should be noted that the actual in-service movement due to thermal effects may be less than the value determined by theoretical calculation.

If both of the above requirements are met then Scheme C shall be used for the retrofit. In this event, the details shown below and the following guidelines shall be used to assist in the preparation of the plans.

If Scheme C is determined to be applicable, then Structures and Roadway Plans will be required for the Thrie-Beam Guardrail retrofit. The Roadway Plans shall address traffic control issues, removal of the existing "W" Beam Guardrail transition and installation of the new Thrie-Beam Guardrail transition utilizing **Design Standards** Index 400, Detail J. The Structures Plans shall address demolition and reconstruction of the required portion of the existing Traffic Railing end transition and approach slab.

If the existing traffic railing is an "F" Shape traffic railing, the appropriate **Design Standards** Indexes 420 and 421 shall be referenced and used in their entirety or modified as required by project specific designs included in the Structures Plans. Applicable details from **Design Standards** Indexes 20900 or 20910 shall be used as required for the approach slab reconstruction.

If the existing traffic railing is a "New Jersey" Shape traffic railing, project specific railing details will be required. Applicable details from **Design Standards** Index 20900 or 20910 shall be used as required for the approach slab reconstruction.



Plan Content Requirements

In the Roadway Plans:

Include the following note in the General Notes:

Paint reinforcing steel that is exposed during drilling/coring of the Terminal Connector bolt holes with a zinc rich galvanizing compound in accordance with Section 562 of the *Specifications*.

Payment

Item number	Item description	Unit Measure
536-1-1	Guardrail - Roadway	LF
536-1-5	Guardrail - Roadway, Thrie Beam	LF
536-8	Guardrail - Bridge Anchorage Assembly (Furnish & Install)	EA
536-73	Guardrail Removal	LF

Use 536-1-1 when approach guardrail is W-beam guardrail.

Use 536-1-5 when approach guardrail is Thrie beam guardrail.

Use 536-8 with Index 480 retrofits and when attaching guardrail to existing safety shape bridge traffic railings.

Index 403 Guardrail Transitions for Existing Bridge Traffic Railing Retrofits (Rev. 01/12)

Design Criteria

NCHRP Report 350 Test Level 4 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition; **Structures Design Guidelines (SDG)**; **PPM**

Design Assumptions and Limitations

This standard works with existing bridge traffic railing retrofits constructed in accordance with the obsolete standard entitled "Guardrail Anchorage and Continuous Barrier for Existing Bridges", Index 401, which was included in the **Roadway and Traffic Design Standards** from 1987 until 2000.

Schemes 1 and 19 of obsolete Index 401 entitled "Concrete Safety Barrier" are based on a design that has been crash tested as documented in **Transportation Research Report TRP-03-19-90** and accepted by FHWA at **NCHRP Report 350** Test Level 4.

Scheme 16 of obsolete Index 401 entitled "Guardrail Continuous Across Bridge" has been structurally evaluated and has been determined to be acceptable to FDOT and FHWA to leave in place on RRR projects provided the installation meets the criteria set forth in the **PPM**, Vol. 1, Chapter 25.

See **SDG** 6.7.4 for more information.

Plan Content Requirements

In the Roadway Plans:

Evaluate the existing guardrail approach transitions and specify in the Plans the necessary upgrades to the transitions as follows.

For the w-beam approach transition shown as Detail J in the 1987 edition of the **Roadway and Traffic Design Standards**, Index 400 without a continuation of curb beyond the bridge or approach slab, use the following Plan Sheet note placed adjacent to bridge ends:

Construct Transition Block, nested W Beam Guardrail and additional Guardrail Posts and Offset Blocks as shown in **Design Standards** Index 403.

For the nested w-beam approach transition shown as Detail J in the 1987 edition of the **Roadway and Traffic Design Standards**, Index 400 with a continuation of curb beyond the bridge or approach slab, use the following Plan Sheet note placed adjacent to bridge ends:

Construct nested W Beam Guardrail and additional Guardrail Posts and Offset Blocks as shown in **Design Standards** Index 403.

For the nested w-beam approach transition shown as Detail J in the 1998 edition of the **Roadway and Traffic Design Standards**, Index 400 without a continuation of curb beyond the bridge or approach slab, use the following Plan Sheet note placed adjacent to bridge ends:

Construct Transition Block as shown in **Design Standards** Index 403.

For all trailing end treatments, specify the necessary guardrail upgrades as appropriate.

Payment

Item number	Item description	Unit Measure
520-2-9	Curb, Special	LF
538-1	Guardrail Reset	LF

Index 411 Pier Protection Barrier (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

Use the Pier Protection Barrier to shield bridge piers that theoretically do not have sufficient strength to resist the **LRFD** equivalent static impact force and for other specialized applications. If the minimum set back requirements of this standard cannot be met, see **SDG** Chapter 2 for options.

If the bridge pier can withstand the **LRFD** equivalent static impact force, Index 400 or Index 410 would be applicable.

Although intended for shielding bridge piers, the Pier Protection Barrier can be used on a project specific basis to shield other critical roadside objects when deemed necessary or appropriate.

As used in this standard, setback distance is as defined by **LRFD**. See **PPM** and Index 700 for minimum recoverable terrain and horizontal clearance requirements.

Establish the offset from the Pier Protection Barrier to the bridge pier, column or pile bent based on project constraints.

Determine the required Pier Protection Barrier height, i.e. 42" or 54", in accordance with the requirements of **LRFD** and the **SDG**.

Determine the appropriate limiting stations of the Pier Protection Barrier and its end treatment(s) using the Pier Protection Barrier Length of Advancement diagrams provided on the standard.

Select Pier Protection Barrier terminal treatment for design speeds greater than or equal to 50 mph from the following options:

- a. Terminated outside of the clear zone of any approach traffic;
- b. Terminated within a shielded location;
- c. Terminal protection by the use of a crash cushion system; or,
- d. Terminated in conjunction with a suitably designed transition to another barrier.

Determine the appropriate footing configuration(s) (T, Front Cantilever or Back Cantilever) for a continuous run of Pier Protection Barrier using the Pier Protection Barrier Footing Layout Schematics. Select the footing configuration(s) based on traffic control needs and locations of piers, pier footings, utilities, drainage structures, etc. as shown. Footing configurations along a continuous run of Pier Protection Barrier may be intermixed as shown on the standard.

If the existing adjacent pier footing is too shallow to provide the 6 inch minimum clearance between footings as shown, reduce the riser dimension between the barrier and the barrier footing and prepare project specific details to supplement the standard. The Pier Protection Barrier itself should not be modified, only its footing and riser should be modified adjacent to the pier footing so as to provide adequate clearance. A project specific shallow footing must provide comparable overturning and sliding resistance to the standard footing.

In absence of continuous concrete barrier, determine guardrail requirements in accordance with Indexes 400 and 410.

Plan Content Requirements

In the Structures or Roadway Plans:

Designate the Pier Protection Barrier height, footing configuration(s) and limiting stations on the Plan-Profile, Plan and Elevation and or Pier sheets, e.g.:

Begin 42" Pier Protection Barrier with Front Cantilever Footing, Sta. 100+00.00

Indicate Crash Wall locations (when required) and lengths on the Plan-Profile sheets. Designate Crash Wall height to match height of adjacent Pier Protection Barrier.

Show Cross Sections as required to locate Pier Protection Barrier, Crash Wall (when required) and footings adjacent to bridge piers, columns or footings, drainage structures, utilities, etc.

Prepare Traffic Control Plans to accommodate Pier Protection Barrier, Crash Wall (when required) and footing construction.

Prepare project specific footing and riser details as required.

Payment

Item number	Item description	Unit Measure
521-72-10	Shoulder Concrete Barrier Wall, Rigid Shoulder 42"	LF
521-72-11	Shoulder Concrete Barrier Wall, Rigid Shoulder 54"	LF

Index 414 Type K Temporary Concrete Barrier System

Design Criteria

NCHRP Report 350 Test Level 3 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition, Section 13; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The Type K Temporary Concrete Barrier System has been crash tested to **NCHRP Report 350** Test Level 3 criteria or structurally evaluated to meet the requirements of **NCHRP Report 350** Test Level 3 criteria for the installation configurations as shown on the Design Standard utilizing the types, sizes, lengths, shapes, strengths and grades of the fabrication and installation materials as shown.

Type K Barriers are required for temporary installations on bridges for traffic separation, shielding drop-offs and shielding work zones without drop-offs. Type K Barriers are required for temporary installations on retaining walls for shielding drop-offs. Type K Barriers can be used on roadways for traffic separation and for shielding work zones, above ground hazards and drop-offs.

Plan Content Requirements

Designate location(s) where Type K's are to be used along with installation requirements, e.g. freestanding, bolted or staked down, or backfilled.

In order to maintain crashworthiness of the system, do not specify different grades, sizes, shapes or types of reinforcing steel for those shown for constructing Type K Barriers. Also, do not specify different type, size, length or material grade anchor bolts, nuts, washers, adhesives, connector pins, stakes, keeper pins, or guardrail components for installing Type K Barriers. Use only in the configurations shown on the **Design Standard**.

In the Structures Plans:

Show and label Type K Barriers on the Construction Sequence drawings and other sheets as required. Show offsets to drop-offs, above ground hazards and adjacent lanes as appropriate. Include cross references to **Design Standards** Index 414.

In the Roadway Plans:

Show and label Type K Barriers on the Traffic Control Plans and other sheets as required. Show offsets to drop-offs, above ground hazards and adjacent lanes as appropriate. Include cross references to **Design Standards** Index 414.

Payment

Item number	Item description	Unit Measure
102-71-14	Barrier Wall, Temporary, F&I, Type K	LF
102-71-24	Barrier Wall, Temporary, Relocate, Type K	LF
102-79	Lights, Barrier Wall Mount, Temp, Type C, Steady Burn	ED

Index 420 Traffic Railing (32" F Shape)

Design Criteria

NCHRP Report 350 Test Level 4 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The 32" F-Shape Traffic Railing is the basic default traffic railing for use on FDOT bridges and retaining walls. Use this railing in accordance with the requirements of **SDG 6.7**.

Design bridge decks supporting 32" F-Shape Traffic Railings in accordance with the requirements of **SDG 4.2**. For bridge decks up to a maximum thickness of 9", the two Bars 5S placed in the bridge deck may substitute for the longitudinal deck steel located within the limits of Bars 5V, provided that the total area of longitudinal deck steel beneath the railing, as required by calculation, is not reduced.

Design Standards Indexes 20900, 20910 and 6100 Series contain details for the use of 32" F-Shape Traffic Railings on retaining walls and approach slabs.

Plan Content Requirements

In the Structures Plans:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure environment classification. See **SDG 1.4**.

Include the following Bridge Name Note on the General Notes Sheet:

Place the following bridge name on the traffic railing in accordance with the Traffic Railing Design Standard:

[Use the name of the bridge or non-roadway facility crossed, or include the name of both facilities for roadway crossings, e.g.:

THOMASVILLE ROAD FLYOVER
TOMOKA RIVER
CSX RAILROAD
US 19 OVER EAST BAY DR

For multiple bridges, identify the associated bridge number, e.g.:

Bridge No.	Name
600103	CHOCTAWHATCHEE BAY
600104	CHOCTAWHATCHEE BAY RELIEF]

Show and label the 32" F-Shape Traffic Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, Retaining Wall Control Drawings, and other sheets as required. Show limiting

stations when transitioning to other type traffic railings. Include cross references to **Design Standards** Index 420 and 20900 or 20910 as appropriate.

On the Superstructure section sheets, show the two Bars 5S placed in the bridge deck within the Bars 5V along with the rest of the deck steel.

In the Roadway Plans when the 32" F-Shape Traffic Railing is used on retaining walls:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the retaining wall environment classification. See **SDG** 1.4.

Show and label the 32" F-Shape Traffic Railing on the Retaining Wall Control Drawings, and other sheets as required. Show limiting stations when transitioning to other type traffic railings. Include cross references to **Design Standards** Index 420 and 6100 Series as appropriate.

All concrete and Bars 5P, 5S and 5V required to construct the traffic railing are included in the Estimated Traffic Railing Quantities. Do not include traffic railing concrete in the estimated concrete quantities, or Bars 5P, 5S and 5V in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks, approach slabs or retaining walls.

Payment

Item number	Item description	Unit Measure
521-5-1	Concrete Traffic Railing, Bridge 32" F - Shape	LF
521-8-1	Concrete Traffic Railing Barrier, Retaining Wall System, Mounted with Sleeper Slab	LF

Index 421 Traffic Railing (Median 32" F Shape)

Design Criteria

NCHRP Report 350 Test Level 4 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The 32" F-Shape Median Traffic Railing is the basic default median traffic railing for use on FDOT bridges. Use this railing in accordance with the requirements of **SDG 6.7**.

Design bridge decks supporting 32" F-Shape Median Traffic Railings in accordance with the requirements of **SDG 4.2**. For bridge decks up to a maximum thickness of 9", the three Bars 5S placed in the bridge deck may substitute for the longitudinal deck steel located within the limits of Bars 5W, provided that the total area of longitudinal deck steel beneath the railing, as required by calculation, is not reduced.

Plan Content Requirements

In the Structures Plans:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure environment classification. See **SDG 1.4**.

Show and label the 32" F-Shape Median Traffic Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, and other sheets as required. Include cross references to **Design Standards** Index 421.

On the Superstructure section sheets, show the three Bars 5S placed in the bridge deck within the Bars 5W along with the rest of the deck steel.

All concrete and Bars 5R, 5S and 5W required to construct the traffic railing are included in the Estimated Traffic Railing Quantities. Do not include traffic railing concrete in the estimated concrete quantities, or Bars 5R, 5S and 5W in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks or approach slabs.

Payment

Item number	Item description	Unit Measure
521-5-3	Concrete Traffic Railing, Bridge, 32" F-Shape, Median, Double Face	LF

Index 422 Traffic Railing (42" Vertical Shape)

Design Criteria

NCHRP Report 350 Test Level 4 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The 42" Vertical Shape Traffic Railing is intended for use on bridges and retaining walls with raised sidewalks. Use this railing in accordance with the requirements of **SDG 6.7**.

Design bridge decks supporting 42" Vertical Shape Traffic Railings in accordance with the requirements of **SDG 4.2**. For bridge decks up to a maximum thickness of 9", the two Bars 5S placed in the bridge deck may substitute for the longitudinal deck steel located within the limits of Bars 5T, provided that the total area of longitudinal deck steel beneath the railing, as required by calculation, is not reduced.

Design Standards Indexes 20900, 20910 and 6100 Series contain details for the use of 42" Vertical Shape Traffic Railings on retaining walls and approach slabs.

For treatment of 42" Vertical Shape Traffic Railings on skewed bridges see [Index 420](#).

Plan Content Requirements

In the Structures Plans:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure environment classification. See **SDG 1.4**.

Include the following Bridge Name Note on the General Notes Sheet:

Place the following bridge name on the traffic railing in accordance with the Traffic Railing Design Standard:

[Use the name of the bridge or non-roadway facility crossed, or include the name of both facilities for roadway crossings, e.g.:

THOMASVILLE ROAD FLYOVER
TOMOKA RIVER
CSX RAILROAD
US 19 OVER EAST BAY DR

For multiple bridges, identify the associated bridge number, e.g.:

Bridge No.	Name
600103	CHOCTAWHATCHEE BAY
600104	CHOCTAWHATCHEE BAY RELIEF]

Show and label the 42" Vertical Shape Traffic Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section

sheets, and other sheets as required. Include cross references to **Design Standards** Index 422.

On the Superstructure section sheets, show the two Bars 5S placed in the bridge deck within the Bars 5T along with the rest of the deck steel.

In the Roadway Plans when the 42" Vertical Shape Traffic Railing is used on retaining walls:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the retaining wall environment classification. See **SDG** 1.4.

Show and label the 42" Vertical Shape Traffic Railing on the Retaining Wall Control Drawings, and other sheets as required. Include cross references to **Design Standards** Index 422 and 6100 Series as appropriate.

All concrete and Bars 5S, 5T and 5X required to construct the traffic railing are included in the Estimated Traffic Railing Quantities. Do not include traffic railing concrete in the estimated concrete quantities, or Bars 5S, 5T and 5X in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks, approach slabs or retaining walls.

Payment

Item number	Item description	Unit Measure
521-5-5	Concrete Traffic Railing, Bridge, 42" Vertical Face	LF

Index 423 Traffic Railing (32" Vertical Shape)

Design Criteria

NCHRP Report 350 Test Level 4 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The 32" Vertical Shape Traffic Railing is intended for use on bridges and retaining walls with raised sidewalks. Use this railing in accordance with the requirements of **SDG 6.7**.

Design bridge decks supporting 32" Vertical Shape Traffic Railings in accordance with the requirements of **SDG 4.2**. For bridge decks up to a maximum thickness of 9", the two Bars 5S placed in the bridge deck may substitute for the longitudinal deck steel located within the limits of Bars 5T, provided that the total area of longitudinal deck steel beneath the railing, as required by calculation, is not reduced.

Design Standards Indexes 20900, 20910 and 6100 Series contain details for the use of 32" Vertical Shape Traffic Railings on retaining walls and approach slabs.

For treatment of 32" Vertical Shape Traffic Railings on skewed bridges see [Index 420](#).

The standard height railing is the Pedestrian / Bicycle Railing (42" height). The Special Height Bicycle Railing (54" height) should only be used where warranted by **LRFD [C13.9.2]**.

Plan Content Requirements

In the Structures Plans:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure environment classification. See **SDG 1.4**.

Include the following Bridge Name Note on the General Notes Sheet:

Place the following bridge name on the traffic railing in accordance with the Traffic Railing Design Standard:

[Use the name of the bridge or non-roadway facility crossed, or include the name of both facilities for roadway crossings, e.g.:

THOMASVILLE ROAD FLYOVER
TOMOKA RIVER
CSX RAILROAD
US 19 OVER EAST BAY DR

For multiple bridges, identify the associated bridge number, e.g.:

Bridge No.	Name
600103	CHOCTAWHATCHEE BAY
600104	CHOCTAWHATCHEE BAY RELIEF]

Show and label the 32" Vertical Shape Traffic Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, and other sheets as required. Include cross references to **Design Standards** Index 423.

On the Superstructure section sheets, show the two Bars 5S placed in the bridge deck within the Bars 5T along with the rest of the deck steel.

In the Roadway Plans when the 32" Vertical Shape Traffic Railing is used on retaining walls:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the retaining wall environment classification. See **SDG 1.4**.

Show and label the 32" Vertical Shape Traffic Railing on the Retaining Wall Control Drawings, and other sheets as required. Include cross references to **Design Standards** Index 423 and 6100 Series as appropriate.

All concrete and Bars 5S, 5T and 5X required to construct the traffic railing are included in the Estimated Traffic Railing Quantities. Do not include traffic railing concrete in the estimated concrete quantities, or Bars 5S, 5T and 5X in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks, approach slabs or retaining walls.

Payment

Item number	Item description	Unit Measure
521-5-4	Concrete Traffic Railing, Bridge, 32" Vertical Face	LF

Index 424 Traffic Railing (Corral Shape) (Rev. 01/12)

Design Criteria

NCHRP Report 350 Test Level 4 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The Corral Shape Traffic Railing is intended for use on bridges and retaining walls when an open traffic railing is desired. When constructed between the traveled way and sidewalks, the Corral Shape Traffic Railing can be used selectively with and without curbs to allow for and control deck drainage between the traveled way and adjacent sidewalks. Note that the "aesthetic openness" of the railing is effectively lost when it is used in an inboard application such as this. Use this railing in accordance with the requirements of **SDG 6.7**.

Design bridge decks supporting Corral Shape Traffic Railings in accordance with the requirements of **SDG 4.2**. For bridge decks up to a maximum thickness of 9", the two Bars 5R2 placed in the bridge deck may substitute for the longitudinal deck steel located within the limits of Bars 5T, provided that the total area of longitudinal deck steel beneath the railing, as required by calculation, is not reduced.

Design Standards Indexes 20900, 20910 and 6100 Series contain details for the use of Corral Shape Traffic Railings on retaining walls and approach slabs.

Indicate use of Curb beneath railing on low side of deck without sidewalks and other locations where required to contain bridge deck runoff. Define Curb location in Structures Plans Superstructure Sheets by Stationing limits or other appropriate methods.

Plan Content Requirements

In the Structures Plans:

Define lengths of End Posts in Structures Plans Superstructure Sheets.

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure environment classification. See **SDG 1.4**.

Include the following Bridge Name Note on the General Notes Sheet:

Place the following bridge name on the traffic railing in accordance with the Traffic Railing Design Standard:

[Use the name of the bridge or non-roadway facility crossed, or include the name of both facilities for roadway crossings, e.g.:

THOMASVILLE ROAD FLYOVER
TOMOKA RIVER
CSX RAILROAD
US 19 OVER EAST BAY DR

For multiple bridges, identify the associated bridge number, e.g.:

Bridge No.	Name
600103	CHOCTAWHATCHEE BAY
600104	CHOCTAWHATCHEE BAY RELIEF]

Show and label the Corral Shape Traffic Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, and other sheets as required. Include cross references to **Design Standards** Index 424.

On the Superstructure section sheets, show the two Bars 5R2 placed in the bridge deck within the limits of Bars P along with the rest of the deck steel.

In the Roadway Plans when the Corral Shape Traffic Railing is used on retaining walls:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the retaining wall environment classification. See **SDG** 1.4.

Show and label the Corral Shape Traffic Railing on the Retaining Wall Control Drawings, and other sheets as required. Include cross references to **Design Standards** Index 424 and 6100 Series as appropriate.

All concrete and Bars P, R, S, T, U and V required to construct the traffic railing are included in the Estimated Traffic Railing Quantities. Do not include traffic railing concrete in the estimated concrete quantities, or Bars P, R, S, T, U and V in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks, approach slabs or retaining walls.

Payment

Item number	Item description	Unit Measure
521-5-6	Concrete Traffic Railing, Bridge, Corral W/Curb	LF
521-5-7	Concrete Traffic Railing, Bridge, Corral Without Curb	LF

Index 425 Traffic Railing (42" F Shape) (Rev. 01/12)

Design Criteria

NCHRP Report 350 Test Level 4 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The 42" F-Shape Traffic Railing should be used where a railing with Test Level 5 crashworthiness is warranted. Use this railing in accordance with the requirements of **SDG 6.7**.

Design bridge decks supporting 42" F-Shape Traffic Railings in accordance with the requirements of **SDG 4.2**. For bridge decks up to a maximum thickness of 11", the two Bars 5S2 placed in the bridge deck may substitute for the longitudinal deck steel located within the limits of Bars 5V, provided that the total area of longitudinal deck steel beneath the railing, as required by calculation, is not reduced.

Design Standards Indexes 20900, 20910 and 6100 Series contain details for the use of 42" F-Shape Traffic Railings on retaining walls and approach slabs.

For treatment of 42" F-Shape Traffic Railings on skewed bridges see [Index 420](#).

Plan Content Requirements

In the Structures Plans:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure environment classification. See **SDG 1.4**.

Include the following Bridge Name Note on the General Notes Sheet:

Place the following bridge name on the traffic railing in accordance with the Traffic Railing Design Standard:

Use the name of the bridge or non-roadway facility crossed, or include the name of both facilities for roadway crossings, e.g.:

THOMASVILLE ROAD FLYOVER
TOMOKA RIVER
CSX RAILROAD
US 19 OVER EAST BAY DR

For multiple bridges, identify the associated bridge number, e.g.:

Bridge No.	Name
600103	CHOCTAWHATCHEE BAY
600104	CHOCTAWHATCHEE BAY RELIEF

Show and label the 42" F-Shape Traffic Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, Retaining Wall Control Drawings, and other sheets as required. Show limiting stations when transitioning to other types of traffic railings. Include cross references to **Design Standards** Index 425 and 20900 or 20910 as appropriate.

On the Superstructure section sheets, show the two Bars 5S2 placed in the bridge deck within the Bars 5V along with the rest of the deck steel.

In the Roadway Plans when the 42" F-Shape Traffic Railing is used on retaining walls:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the retaining wall environment classification. See **SDG** 1.4.

Show and label the 42" F-Shape Traffic Railing on the Retaining Wall Control Drawings, and other sheets as required. Show limiting stations when transitioning to other types of traffic railings. Include cross references to **Design Standards** Index 425 and 6100 Series as appropriate.

All concrete and Bars 5P, 5S, 8S, 8T and 5V required to construct the traffic railing are included in the Estimated Traffic Railing Quantities. Do not include traffic railing concrete in the estimated concrete quantities, or Bars 5P, 5S, 8S, 8T and 5V in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks, approach slabs or retaining walls.

Payment

Item number	Item description	Unit Measure
521-5-2	Concrete Traffic Railing, Bridge 42" F-Shape	LF

Index 470 Series Traffic Railing - (Thrie Beam Retrofit) **(Rev. 01/12)**

Design Criteria

NCHRP Report 350, Test Level 4; **AASHTO LRFD Bridge Design Specifications**, 4th Edition, Section 13; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

Index 470 is the lead standard for the Traffic Railing (Thrie-Beam Retrofit) standard series which includes Indexes 470 through 476. Use this standard with Indexes 402, 471, 472, 473, 474, 475 and 476.

The Traffic Railing (Thrie-Beam Retrofit) Indexes 470 through 476, are applicable for retrofitting specific types of existing bridge mounted traffic railings (a.k.a. concrete handrails) that are not based on crash tested designs.

These Standards are to be used in conjunction with Index 402. The appropriate Index 402 approach transition retrofit for Index 470 Series bridge railing retrofits must be selected and specified in the plans based on the shapes and designs of the existing bridge traffic railings, approach slabs and end bent wing walls. See the Instructions for [Index 402](#) and **SDG** 6.7 for more information.

The applicability of the Thrie-Beam Retrofit to a particular bridge shall be determined based on a review of the Load Rating of the existing bridge, a comparison of the existing bridge geometry to that shown for the Thrie-Beam Retrofit and an evaluation of the structural adequacy of the existing bridge deck and wing walls in accordance with the requirements of the **SDG**. See **SDG** 2.2 for average weight per linear foot of the retrofit.

The Traffic Railing (Thrie-Beam Retrofit) is based on a design that has been successfully crash tested in accordance with **NCHRP Report 350** Test Level 4 criteria. The Standards all utilize 10 Gauge Thrie-Beam Guardrail that is installed adjacent to the face of the existing curb and in front of, or in place of, all or part of the existing traffic railing. The Standards work with existing traffic railings that incorporate either solid concrete parapet type or concrete post and beam type railings with or without top mounted metal railings. These existing traffic railings are typically mounted on top of concrete curbs of varying widths and heights. The individual Standards address both narrow and wide curbs (a.k.a. "safety curbs"), and skewed and non-skewed bridges with parallel, perpendicular, angled or flared end bent wing walls. Each Standard includes several schemes that address the given wing wall configurations. Examples depicting existing curb and end bent wing wall configurations are shown in the Existing Curb Schematics and the Partial Plan Views of Existing Bridges herein.

Generally, the Roadway Plans shall include all of the sheets necessary to define and detail the retrofit of the existing traffic railings. Index 470, Traffic Railing (Thrie-Beam Retrofit) General Notes and Details shall be referenced in the Roadway Plans, or a similar project specific drawing depicting general notes and details, shall be included in

the Roadway Plans. In addition, one or more of the appropriate Indexes 471 through 476, that most closely matches the configuration of the existing traffic railing and curb is to be referenced in the Roadway Plans for each bridge as required. Generally, these Standards can be used without any modifications being made to them. More than one of the Indexes 471 through 476 may be required for a single bridge due to the curbs or sidewalks on the two sides of the bridge possibly having different widths. A separate Plan and Elevation sheet of the type used in Structures Plans is generally not required.

The heights of the exposed portions of the existing bridge curbs may vary and shall be determined by field measurement. These Standards are applicable for bridges with exposed curb heights from 5" to 1'-0". If resurfacing of the bridge deck is proposed, then the Roadway Engineer shall ensure sufficient milling depth is shown in the Plans in order to maintain the 5" minimum exposed curb height. The appropriate post designation of "A", "B" or "C" shall be determined and shown in the Plans for each bridge based on the criteria given in the Post Dimension Table on **Design Standards** Index 470. The selection of the appropriate post shall consider any proposed milling and resurfacing work.

The need to remove all or part of the existing traffic railing down to the top of the curb in order to provide room for the construction of the retrofit is addressed in the individual Standards. Payment for the removal of all or part of the existing traffic railing shall be included in Removal of Existing Structures, Pay Item 110-3. As part of the overall retrofit concept for a bridge, the existing traffic railing may be removed, even though it is not specifically required to be, in order to reduce the dead load carried by the bridge. In these cases, the potential drop off hazard for pedestrians that will be created behind the retrofit shall be addressed in the Plans.

The treatment of the approach end of the retrofit shall consist of Index 402 or another appropriate site specific treatment. The appropriate treatment of the trailing end of the retrofit shall be determined by the Roadway Engineer. As a minimum, if no other hazards are present, an Index 400, W-Thrie Beam Transition Section and an End Anchorage Assembly Type II shall be provided on the trailing end of the retrofit. On approach ends, a Transition Block or Curb is required if the existing Approach Slab does not have a curb. A Transition Block is not required on trailing ends with no opposing traffic; however, a Curb may be required due to drainage needs. An Index 300, Type D Concrete Curb is generally suitable for this application. The appropriate site specific approach and trailing end treatments shall be shown in the Plans.

Indexes 402 and 470 through 476 shall be supplemented as required with project specific details that may be deemed necessary to complete the installation of the retrofit. These details may include locations and details of any existing utilities, conduits, drainage structures, sign structures and luminaire supports, and/or any other needed information not included in these Standards. In the event that the designs and details presented in the Standards do not closely match the existing conditions, the Structures and/or Roadway Engineer(s) shall prepare a customized project specific retrofit design based on the crash tested bridge railing and guardrail transition designs presented in Indexes 402 and 470 through 476 as guides. Contact the Structures Design Office and Roadway Design Office for guidance in this event.

The Structures Engineer shall evaluate the thermal movements of the existing bridge using the following criteria and shall identify the locations in the Plans (if any are required) where a Thrie-Beam Expansion Section is to be included in the guardrail. If the total thermal movement at an individual bridge deck expansion joint is 1½" (¾" in each direction) or less, the Thrie-Beam Guardrail shall span the joint without the use of an expansion section. If the total thermal movement at an individual bridge deck expansion joint exceeds 1½", a Thrie-Beam Expansion Section must be installed at that location. The total amount of thermal movement at bridge deck expansion joints shall be determined by theoretical calculation and confirmed by field measurements where possible. It should be noted that the actual in-service movement due to thermal effects may be less than the value determined by theoretical calculation.

The Utility Adjustment Plans, if required, shall contain all necessary utility adjustment information required for the construction of the retrofit. Utilities and/or conduits may exist in or adjacent to the existing traffic railings and will vary in size, number and location. The presence, size, number and locations of existing utilities and/or conduits shall be determined by a review of existing Plans and confirmed by field verification. It should be noted that utility and/or conduit installations may vary by location on a single bridge. Thus, a field verification shall be conducted for each individual installation of the retrofit. Existing utilities and/or conduits that conflict with the retrofit shall be relocated if possible or placed out of service. The required field verification work should be completed as early in the evaluation phase as possible.

The Traffic Control Plans for the construction of the retrofit shall be prepared in accordance with Index 600 Series. The Plans shall address all aspects of the full or partial removal of the existing traffic railing (when required) and construction of the retrofit. Generally, the use of Indexes 471 and 474 will require the removal of the existing traffic railing and will require traffic control consisting of shifting, narrowing and/or closing of travel lanes and/or shoulders. In this case, the use of crash tested Precast Concrete Temporary Barriers will also be required to protect the drop-off exposed by the removal of the existing traffic railing.

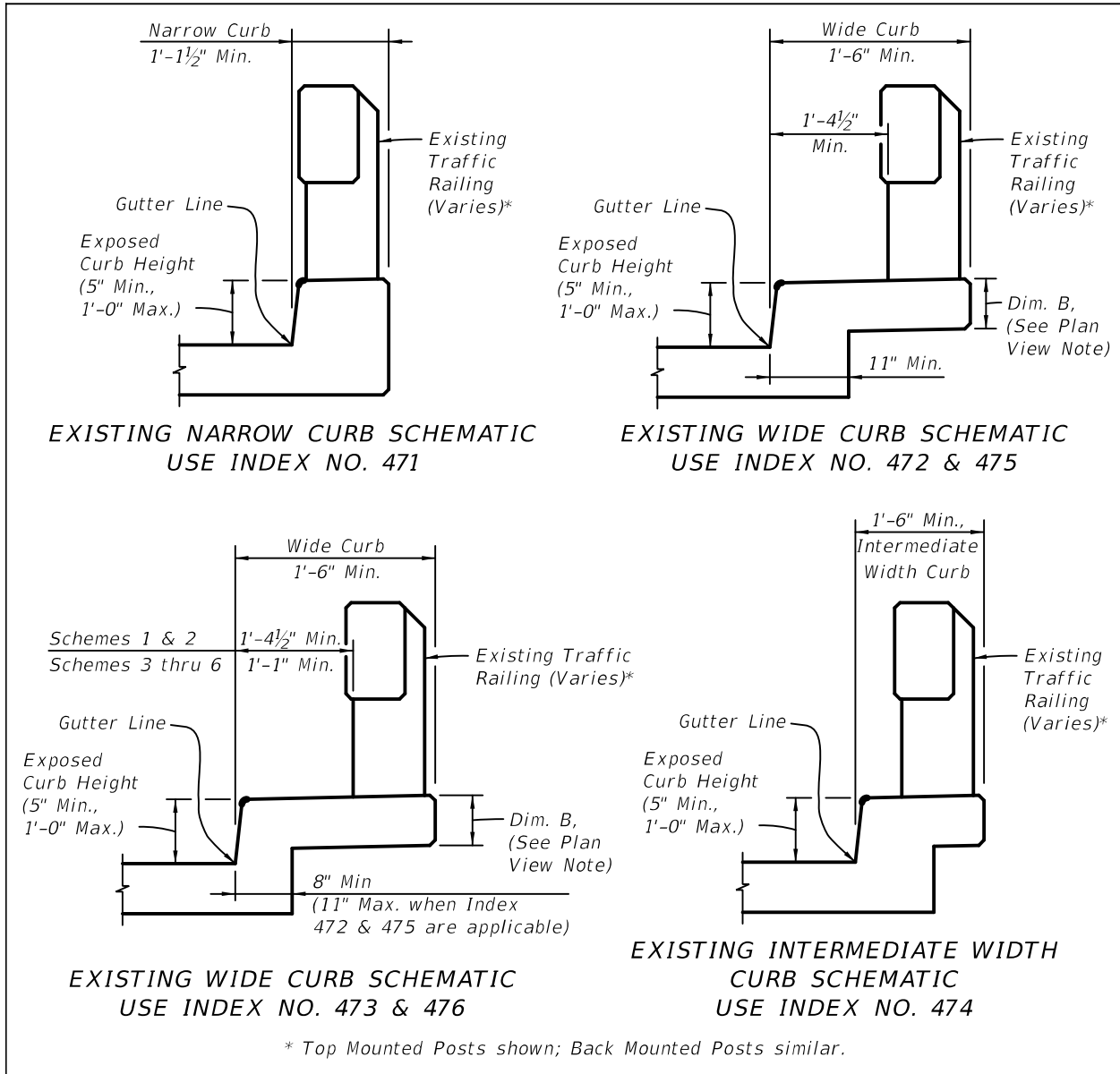
Indexes 470 through 476 do not address retrofitting of the existing traffic railings, curbs or sidewalks for pedestrian use. The potential need to retrofit the existing bridge for pedestrian use shall be evaluated on a project by project basis and the necessary Plans developed accordingly. Generally, the potential effects on pedestrian use of the bridge will be confined to bridges with sidewalks or wide curbs. The use of the Side Mounted Bridge Pedestrian/Bicycle Retrofit Railing shown in Indexes 851 and 861, and the Pedestrian Safety Pipe Rail shown in Index 400 shall be evaluated and noted in the Plans where appropriate. See the **IDS** for Indexes 851 and 861 for more information. The potential reduction in clear width of the curb or sidewalk caused by the installation of the retrofit and Pedestrian Safety Pipe Rail shall be considered.

It should be noted that the existing traffic railings and/or guardrail end transitions may have been previously retrofitted utilizing a scheme presented in Roadway and Traffic **Design Standards** Index 401 (2000 and earlier Editions). In this event, the requirements for removal or replacement of the prior retrofit shall be evaluated and addressed in the

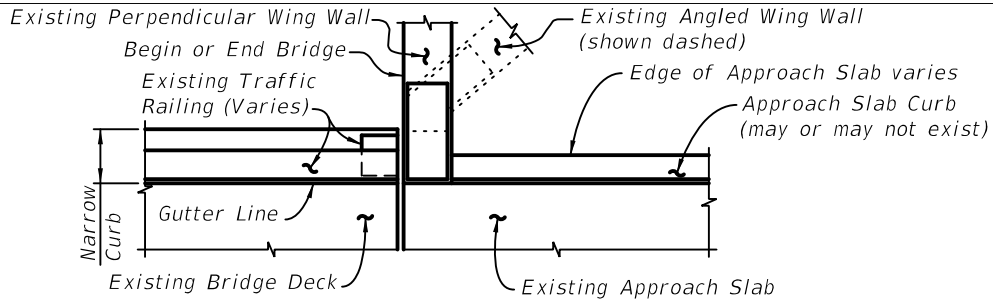
Plans as required. The removal of the prior retrofit may be considered as incidental work with no separate payment made.

The applicability of the individual Standards to different curb widths and superstructure types is described as follows:

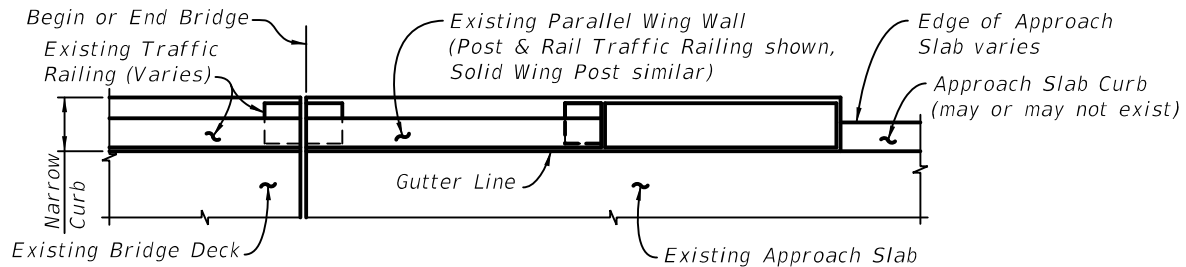
- Index 471 - Applicable for existing narrow curbs as shown below. This index requires removal of the existing traffic railing to the top of the existing curb along the entire length of the bridge and wing walls. On flat slab type superstructures, the potential reduction in the vertical clearance beneath the bridge due to the installation of this index shall be considered.
- Index 472 - Applicable for existing wide curbs or sidewalks as shown below. This index generally allows the entire existing traffic railing to remain in place.
- Index 473 - Applicable for existing wide curbs or sidewalks as shown below. This index generally allows the entire existing traffic railing to remain in place.
- Index 474 - Applicable for existing intermediate width curbs as shown below. This index requires removal of the existing traffic railing to the top of the existing curb along the entire length of the bridge and wing walls.
- Index 475 - Applicable for existing wide curbs or sidewalks as shown below on bridges with decks that do not meet the strength requirements for Index 472. This index generally allows the entire existing traffic railing to remain in place. This index is primarily intended for use on bridges with superstructures consisting of longitudinally prestressed, transversely post-tensioned, solid or voided concrete slab units but it can also be used for other types of superstructures.
- Index 476 - Applicable for existing wide curbs or sidewalks as shown below on bridges with decks that do not meet the strength requirements for Index 473. This index generally allows the entire existing traffic railing to remain in place. On flat slab type superstructures, the potential reduction in the vertical clearance beneath the bridge due to the installation of this index shall be considered. Indexes 471, 472 and 476 cannot be used on bridges with superstructures consisting of longitudinally prestressed, transversely post-tensioned, solid or voided concrete slab units.



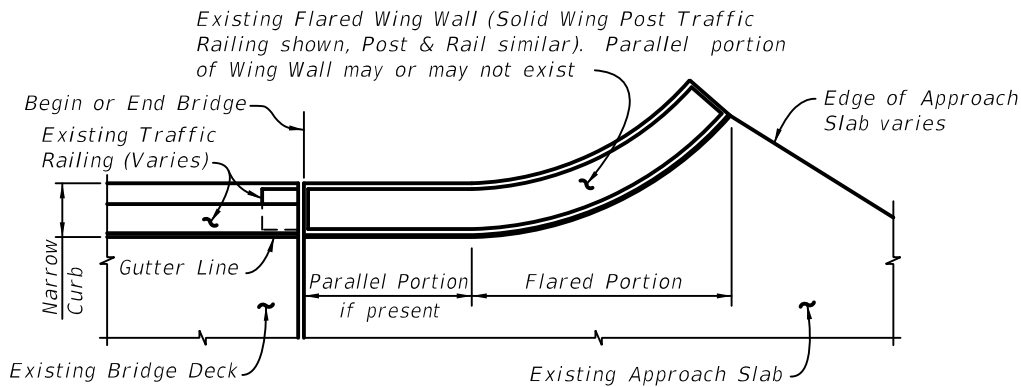
The applicability of the individual retrofit schemes to different wing wall configurations is shown below.



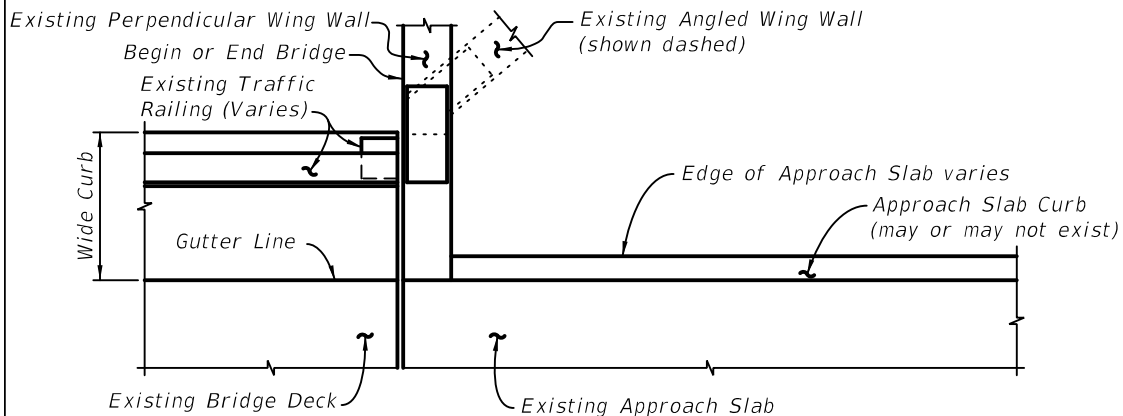
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH NARROW CURBS AND PERPENDICULAR OR ANGLED WING WALLS - USE INDEX NO. 471, SCHEME 1



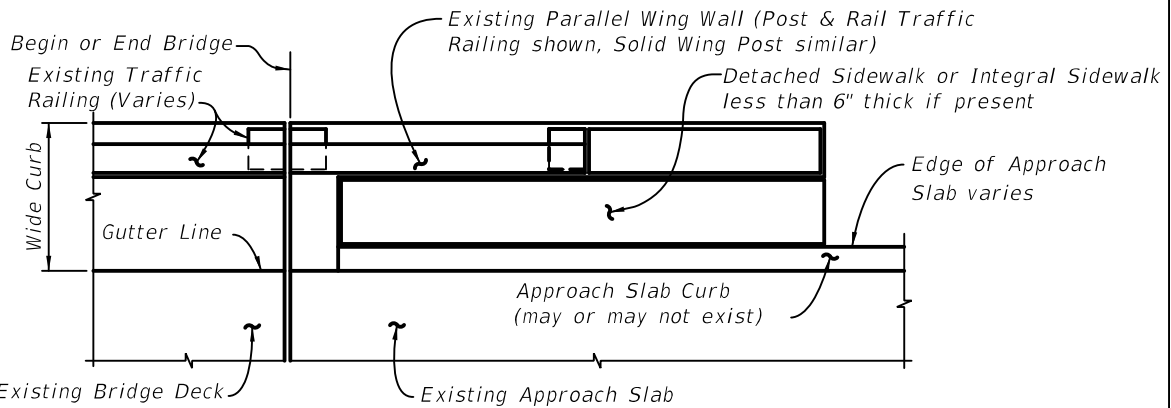
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH NARROW CURBS AND PARALLEL WING WALLS - USE INDEX NO. 471, SCHEME 2



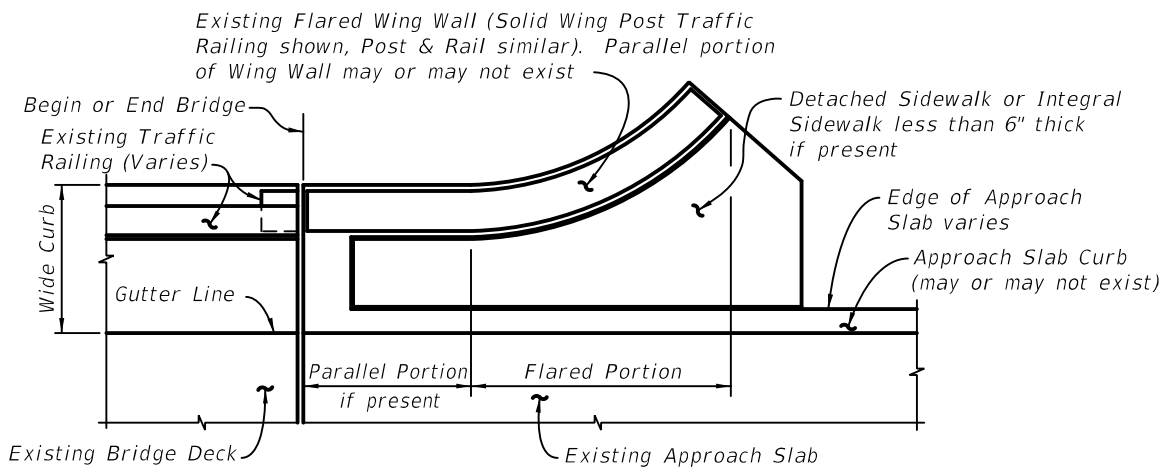
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH NARROW CURBS AND FLARED WING WALLS - USE INDEX NO. 471, SCHEME 3



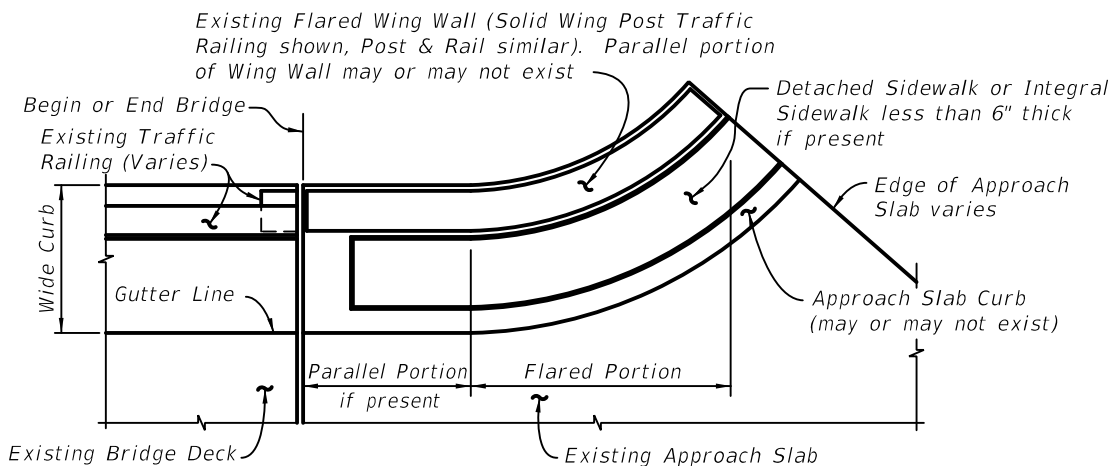
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS AND PERPENDICULAR OR ANGLED WING WALLS - USE INDEX NOS. 472, 473, 475 OR 476, SCHEME 1



PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, PARALLEL WING WALLS AND APPROACH SLABS WITH DETACHED SIDEWALKS OR SIDEWALKS LESS THAN 6" THICK - USE INDEX NOS. 472, 473, 475 OR 476 SCHEME 2

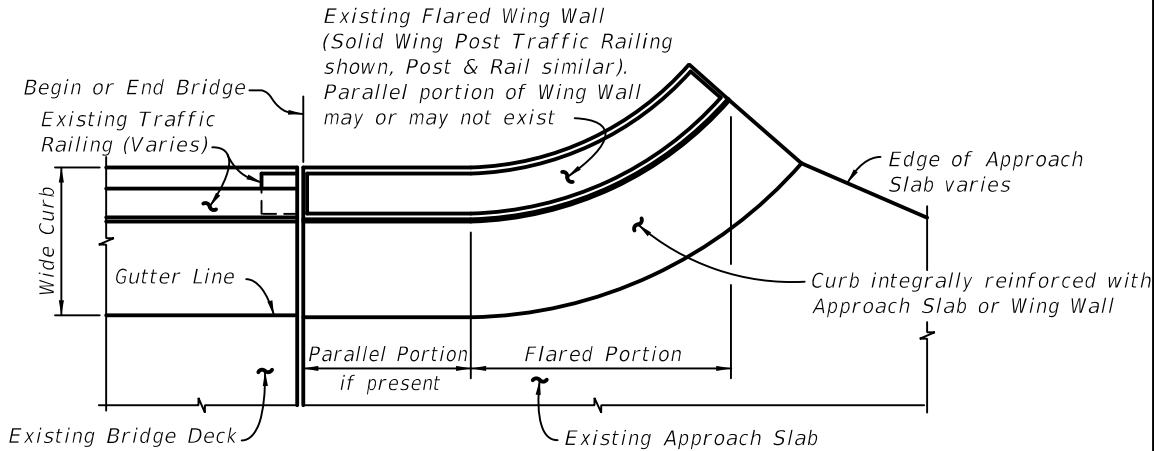


PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, FLARED WING WALLS AND APPROACH SLABS WITH DETACHED SIDEWALKS OR SIDEWALKS LESS THAN 6" THICK - USE INDEX NOS. 472, 473, 475 OR 476 SCHEME 2



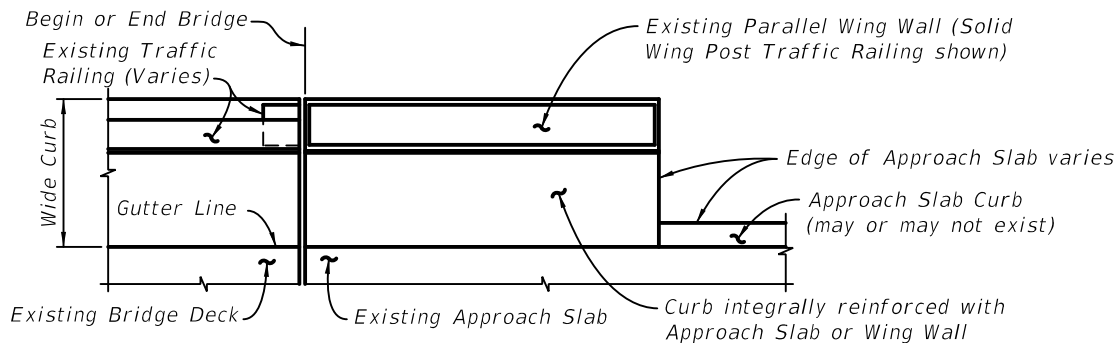
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, FLARED WING WALLS AND APPROACH SLABS WITH DETACHED SIDEWALKS OR SIDEWALKS LESS THAN 6" THICK - USE INDEX NOS. 472, 473, 475 OR 476 SCHEME 2

NOTE: If Existing Curb or Wing Wall Dimension B is 1'-3" or greater use Scheme 3. If Existing Curb or Wing Wall Dimension B is equal to or greater than 6" but less than 1'-3", use Scheme 4. If Dimension B is less than 6", use Scheme 2. See Sheet 1 of 5 for Dimension B.



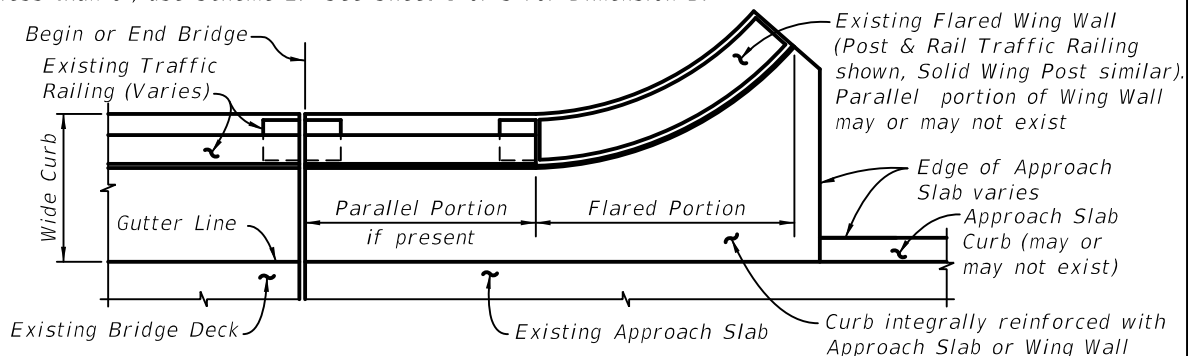
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, FLARED WING WALLS AND FLARED INTEGRALLY REINFORCED APPROACH SLAB CURBS - USE INDEX NOS. 472, 473, 475 OR 476 SCHEMES 3 OR 4

NOTE: If Existing Curb or Wing Wall Dimension B is 1'-3" or greater use Scheme 5. If Existing Curb or Wing Wall Dimension B is equal to or greater than 6" but less than 1'-3", use Scheme 6. If Dimension B is less than 6", use Scheme 2. See Sheet 1 of 5 for Dimension B.

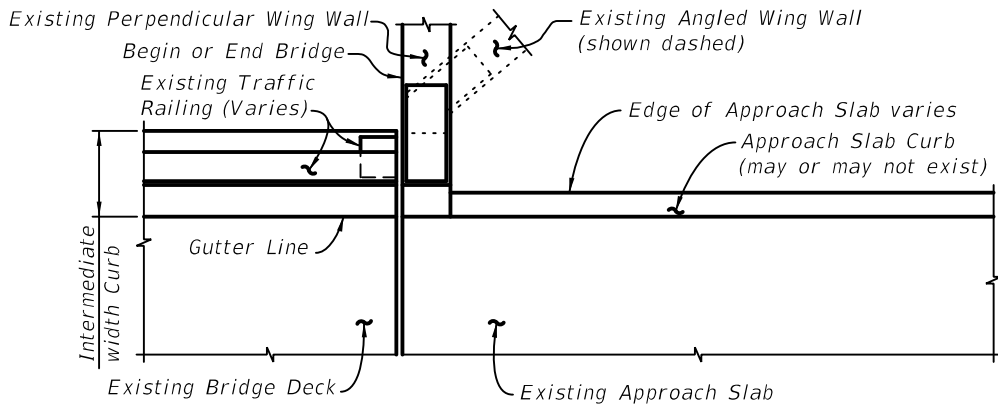


PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, PARALLEL WING WALLS AND INTEGRALLY REINFORCED APPROACH SLAB CURBS - USE INDEX NOS. 472, 473, 475 OR 476 SCHEMES 5 OR 6

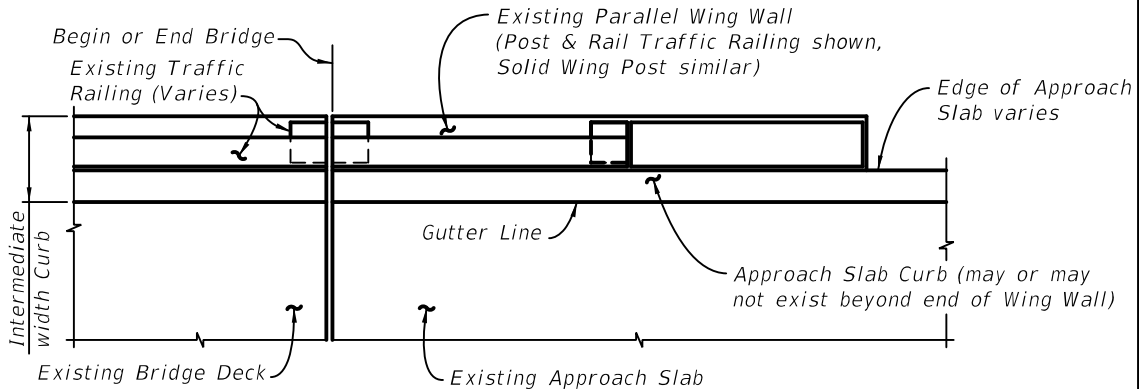
NOTE: If Existing Curb or Wing Wall Dimension B is 1'-3" or greater use Scheme 5. If Existing Curb or Wing Wall Dimension B is equal to or greater than 6" but less than 1'-3", use Scheme 6. If Dimension B is less than 6", use Scheme 2. See Sheet 1 of 5 for Dimension B.



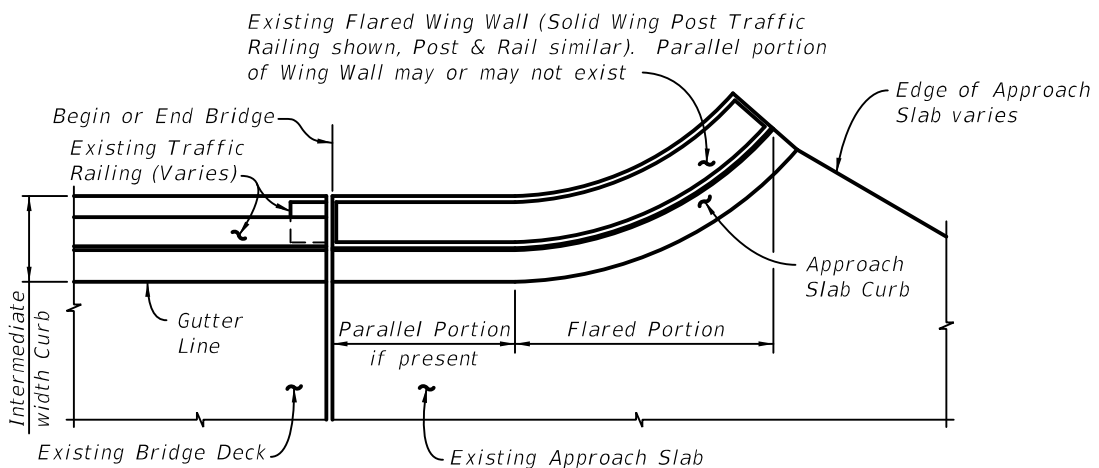
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, FLARED WING WALLS AND PARALLEL INTEGRALLY REINFORCED APPROACH SLAB CURBS - USE INDEX NOS. 472, 473, 475 OR 476 SCHEMES 5 OR 6



PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH INTERMEDIATE WIDTH CURBS AND PERPENDICULAR OR ANGLED WING WALLS - USE INDEX NO. 474, SCHEME 1



PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH INTERMEDIATE WIDTH CURBS AND PERPENDICULAR OR ANGLED WING WALLS - USE INDEX NO. 474, SCHEME 2



PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH INTERMEDIATE WIDTH CURBS, FLARED WING WALLS AND FLARED INTEGRAL APPROACH SLAB CURBS - USE INDEX NO. 474, SCHEME 3

Plan Content Requirements

The appropriate **Design Standards** Index number and Scheme number shall be shown in the Roadway Plans for each bridge along with the limiting stations of the retrofit. The appropriate post designation of "A", "B" or "C" shall be determined and shown in the Plans for each bridge based on the criteria given in the Post Dimension Table on **Design Standards** Index 470. The selection of the appropriate post shall consider any proposed milling and resurfacing work.

The limiting stations or overall length of the retrofit for each bridge shall also be shown. An example of a note containing the required information as it would appear on a Plan or Plan-Profile sheet is as follows:

"Construct Traffic Railing (Thrie-Beam Retrofit), Index No. 47X, Scheme X, from Sta. XX+XX.XX (at or near Begin Bridge) to Sta. XX+XX.XX (at or near End Bridge). On left side of bridge utilize Post "X". On right side of bridge utilize Post "X". See **Design Standards** Index 470 for post details."

If the same height post can be used on both sides of the bridge, a single post designation is all that is required.

For projects with multiple bridges, a tabular format may be used to convey the necessary information.

A separate Plan and Elevation sheet of the type used in Structures Plans is generally not required.

Payment

Item number	Item description	Unit Measure
460-71-1	Metal Traffic Railing, Thrie Beam Retrofit	LF

Example Quantity Calculations

The following examples cover the three general cases for quantity calculations for the length of payment along each side of a bridge:

CASE I - Indexes 471 and 474 Scheme 2 and Indexes 472, 473, 475 and 476 Schemes 5 and 6 - Traffic Railing (Thrie-Beam Retrofit) extends close to the end of the wing wall or parallel curb on the approach slab.

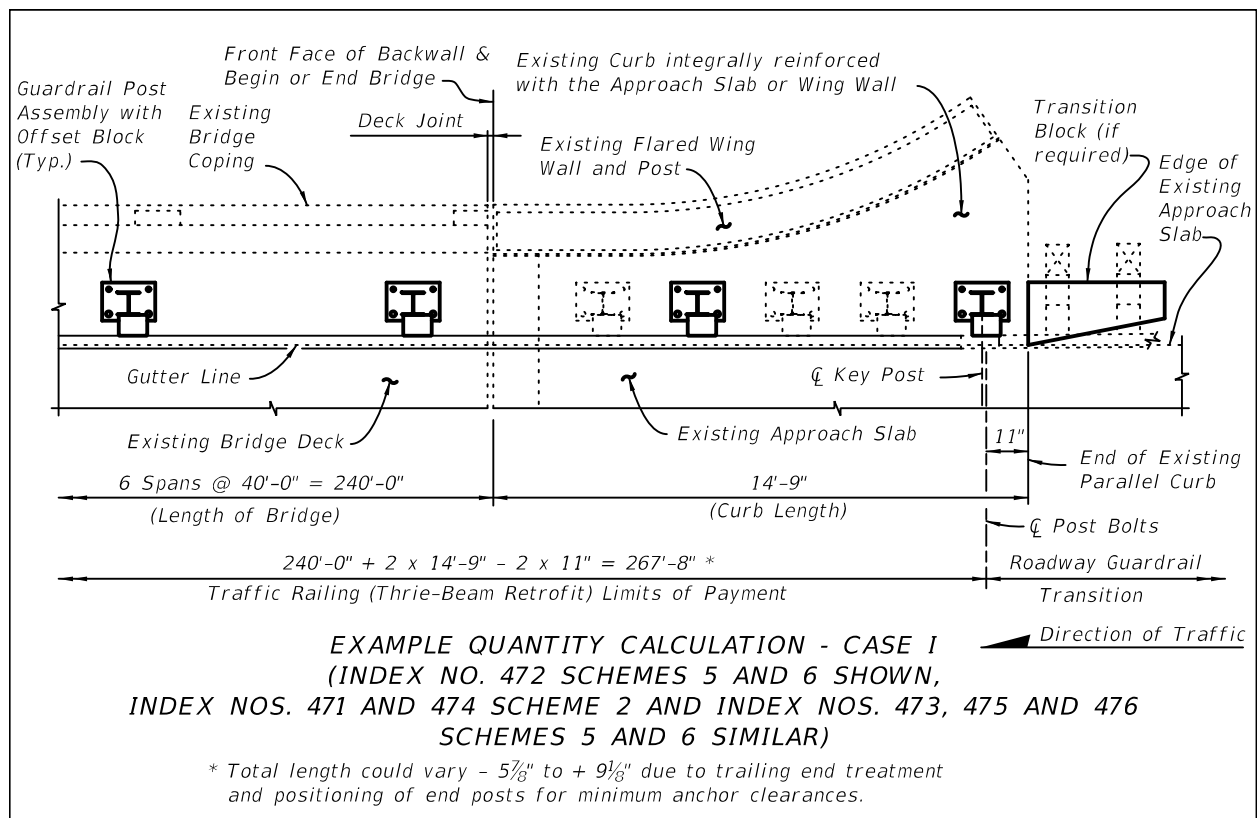
CASE II - Indexes 471, 472, 473, 474, 475 and 476 Scheme 1 and Indexes 472, 473, 475 and 476 Scheme 2 - Traffic Railing (Thrie-Beam Retrofit) extends close to the end of the bridge deck.

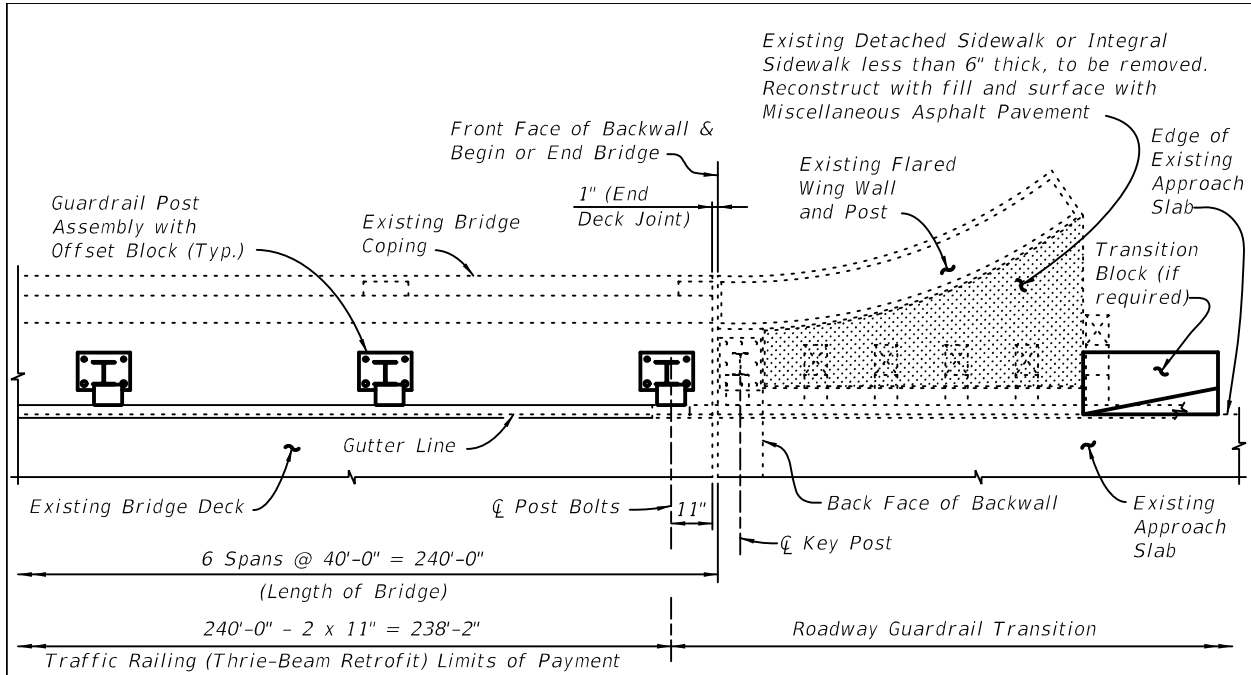
CASE III - Indexes 472, 473, 475 and 476 Schemes 3 and 4 and Index 474 Scheme 3 - Traffic Railing (Thrie-Beam Retrofit) extends far enough along the flared curb until the Special Steel Guardrail Post can be located on the approach slab.

In the following examples, it is assumed that the trailing end treatment is the same as the approach end treatment. For Case III, Indexes 472, 473, 475 and 476 Schemes 3 and 4, different trailing end treatments usually give an error of less than one foot for each side of the bridge. Different trailing end treatments for Case III, Index 474 Scheme 3 may give an error of $\pm 3'-0"$, due to the flexibility given to the Contractor for locating the posts on the flared wing wall. The Designer may need to show stationing limits in the plans for these Standard Indexes when the location of a site specific end treatment is critical. Different trailing end treatments for Case I and Case II will have no effect on the length of payment.

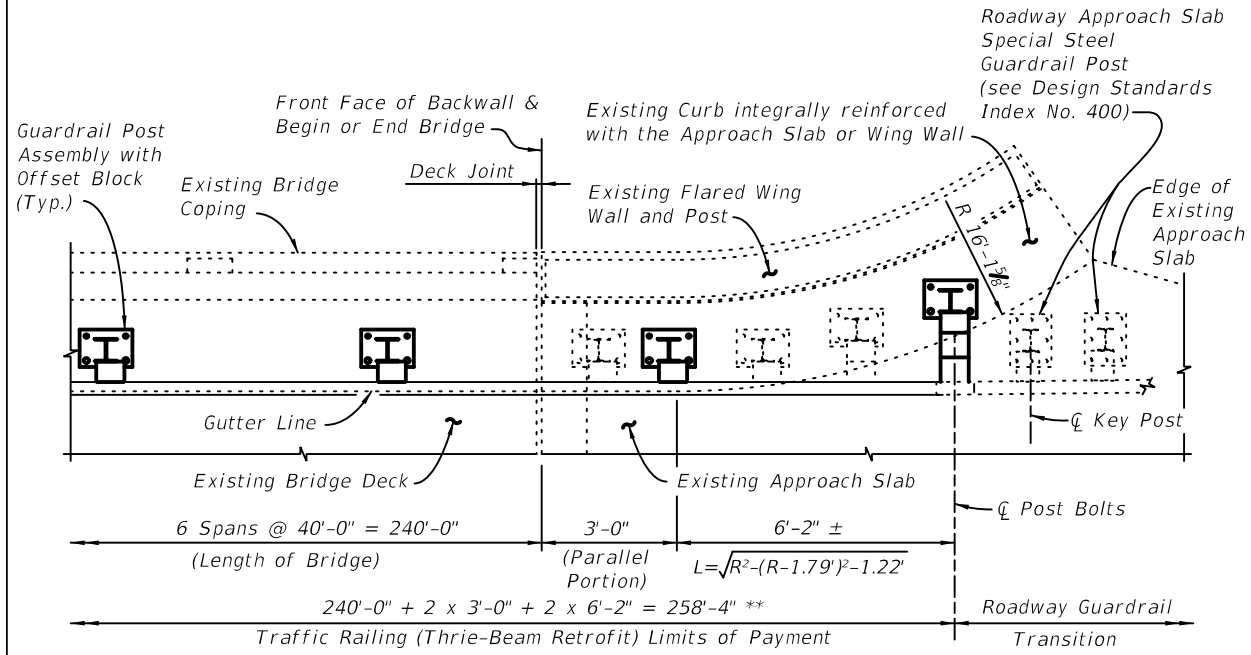
For bridges with different wing wall lengths at begin and end bridge, such as skewed bridges, the calculated lengths should be adjusted accordingly for Cases I & III.

For curved bridges the length of payment shall be measured along the gutter line, and the arc angle projection of the gutter line for flared curbs (Case III).





EXAMPLE QUANTITY CALCULATION - CASE II ▲ Direction of Traffic
 (INDEX NO. 472 SCHEME 2 SHOWN,
 INDEX NOS. 471, 472, 473, 474, 475 AND 476
 SCHEME 1 AND INDEX NOS. 473 AND 476 SCHEME 2 SIMILAR)



EXAMPLE QUANTITY CALCULATION - CASE III ▲ Direction of Traffic
 (INDEX NO. 472 SCHEMES 3 AND 4 SHOWN,
 INDEX NOS. 473, 475 AND 476 SCHEMES 3 AND 4
 AND INDEX NO. 474 SCHEME 3 SIMILAR)

** Total length could vary due to trailing end treatment.

Index 480 Series Traffic Railing - (Vertical Face Retrofit) **(Rev. 01/12)**

Design Criteria

NCHRP Report 350, Test Level 4; **AASHTO LRFD Bridge Design Specifications**, 4th Edition, Section 13; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

Index 480 is the lead standard for the Traffic Railing (Vertical Face Retrofit) standard series which includes Indexes 480 through 484. Use this standard with Indexes 402, 410, 481, 482, 483 and 484.

The Traffic Railing (Vertical Face Retrofit), Indexes 480 through 483, are applicable for retrofitting specific types of existing bridge mounted traffic railings (a.k.a. concrete handrails) that are not based on crash tested designs.

Index 484 should only be used when space is limited, which precludes the use of a guardrail end treatment or crash cushion. Determine the Length of Advancement for the Tapered End Transition using the criteria shown on Index 484, Sheet 1.

These Standards are to be used in conjunction with Indexes 402 and 410. The appropriate Index 402 approach transition retrofit for Index 480 Series bridge railing retrofits or Index 484 Tapered End Transition must be selected and specified in the plans based on the shapes and designs of the existing bridge traffic railings, approach slabs and end bent wing walls. See the Instructions for [Index 402](#) and **SDG** 6.7 for more information.

The applicability of the Vertical Face Retrofit to a particular bridge shall be determined based on a review of the Load Rating of the existing bridge, a comparison of the existing bridge geometry to that shown for the Vertical Face Retrofit and an evaluation of the structural adequacy of the existing bridge deck and wing walls in accordance with the requirements of the **SDG**. See **SDG** 2.2 for average weight per linear foot of the retrofit.

The Traffic Railing (Vertical Face Retrofit) has been structurally evaluated to be equivalent or greater in strength to a design which has been successfully crash tested previously and approved for a **NCHRP Report 350** Test Level 4 rating. The Standards all utilize a cast in place, vertical face, reinforced concrete block that is installed adjacent to the face of the existing curb and in front of, or in place of, all or part of the existing traffic railing. The Standards work with existing traffic railings that incorporate either solid concrete parapet type or concrete post and beam type railings with or without top mounted metal railings. These existing traffic railings are typically mounted on top of concrete curbs of varying widths and heights. The individual Standards address both narrow and wide curbs (a.k.a. "safety curbs"), and skewed and non-skewed bridges with parallel, perpendicular, angled or flared end bent wing walls. Each Standard includes several schemes that address the given wing wall configurations. Examples depicting existing curb and end bent wing wall configurations are shown in the Existing Curb Schematic and the Partial Plan Views of Existing Bridges herein.

Generally, the Roadway Plans shall include all of the sheets necessary to define and detail the retrofit of the existing traffic railings. Index 480, Traffic Railing (Vertical Face Retrofit) General Notes and Details, shall be referenced in the Roadway Plans or a similar project specific drawing depicting general notes and details, shall be included in the Roadway Plans. In addition, one or more of the appropriate Indexes 481 through 484, that most closely matches the configuration of the existing traffic railing and curb is to be referenced in the Roadway Plans for each bridge as required. Generally, these Standards can be used without any modifications being made to them. More than one of the Indexes 481 through 484, may be required for a single bridge due to the curbs or sidewalks on the two sides of the bridge possibly having different widths.

The need to remove all or part of the existing traffic railing down to the top of the curb in order to provide room for the construction of the retrofit is addressed in the individual retrofit indexes. Payment for the removal of all or part of the existing traffic railing shall be included in Removal of Existing Structures, Pay Item 110-3. As part of the overall retrofit concept for a bridge, the existing traffic railing may be removed, even though it is not specifically required to be, in order to reduce the dead load carried by the bridge. In these cases, the potential drop off hazard for pedestrians that will be created behind the retrofit shall be addressed in the Plans.

The treatment of the approach end of the retrofit shall consist of Index 402, 484 or another appropriate site specific treatment. The appropriate treatment of the trailing end of the retrofit shall be determined by the Roadway Engineer. On approach ends, a Transition Block or Curb is required if the existing Approach Slab does not have a curb. A Transition Block is not required on trailing ends with no opposing traffic, however, a Curb may be required due to drainage needs. An Index 300, Type D Concrete Curb is generally suitable for this application. The appropriate site specific approach and trailing end treatments shall be shown in the Plans.

If an Index 402 Roadway Guardrail Transition is used, the defining station of the end of the transition must be shown in the Plans. The attachment point for the Thrie-Beam Terminal Connector shall be determined based on the shape, length, structural adequacy and direct means of support of the end most section of the Vertical Face Retrofit, the existing wing wall and/or approach slab as follows:

Perpendicular or Angled Wing Walls -

Attach the Thrie-Beam Terminal Connector to the Vertical Face Retrofit on the bridge.

Parallel Wing Walls -

1. If the Vertical Face Retrofit is supported by the wing wall, attach the Thrie-Beam Terminal Connector to the Vertical Face Retrofit along the wing wall if the wing wall is a minimum of 5'-0" long, directly pile supported and structurally adequate. If the Vertical Face Retrofit is supported by the approach slab, attach the Thrie-Beam Terminal Connector along the approach slab section of the retrofit if that section is a minimum of 5'-0" long.

2. Attach Thrie-Beam Terminal Connector to the Vertical Face Retrofit on the bridge if the any of the appropriate preceding criteria for parallel wing walls or approach slabs are not met.

Flared Wing Walls with parallel portions -

1. If the Vertical Face Retrofit is supported by the wing wall, attach the Thrie-Beam Terminal Connector to the Vertical Face Retrofit along the parallel portion of the Vertical Face Retrofit if the wing wall is a minimum of 5'-0" long, directly pile supported, structurally adequate and if the parallel portion of Vertical Face Retrofit is a minimum of 2'-0" long. If the Vertical Face Retrofit is supported by the approach slab, attach the Thrie-Beam Terminal Connector along the approach slab section of the retrofit if that section is a minimum of 5'-0" long and has a parallel portion that is a minimum of 2'-0" long.
2. Attach Thrie-Beam Terminal Connector to the Vertical Face Retrofit on the bridge if any of the preceding criteria for flared wing walls with parallel portions are not met.

Flared Wing Walls without parallel portions -

Attach Thrie-Beam Terminal Connector to the Vertical Face Retrofit on the bridge.

Indexes 402 and 480 through 484 shall be supplemented as required with project specific details that may be deemed necessary to complete the installation of the retrofit railing. These details may include locations and details of any existing utilities, conduits, drainage structures, sign structures and luminaire supports, or designs and details of traffic railing sliding plate assemblies for large expansion joints and any other needed information not included in these Standards. In the event that the details and indexes presented in these Standards do not closely match the existing conditions, the Structures and/or Roadway Engineer(s) shall prepare a customized project specific retrofit design using the crash tested bridge railing and guardrail transition designs presented in Indexes 402 and 480 through 484 as guides. Contact the Structures Design Office and Roadway Design Office for guidance in this event.

The Utility Adjustment Plans, if required, shall contain all necessary utility adjustment information required for the retrofit of the existing traffic railings. Utilities and/or conduits may exist in or adjacent to the existing traffic railings and will vary in size, number and location. The presence, size, number and locations of existing utilities and/or conduits shall be determined by a review of existing Plans and confirmed by field verification. It should be noted that utility and/or conduit installations may vary by location on a single bridge. Thus, a field verification shall be conducted for each individual installation of the retrofit. Existing utilities and/or conduits that conflict with the retrofit shall be relocated if possible or placed out of service. The required field verification work should be completed as early in the evaluation phase as possible.

The Traffic Control Plans for the construction of the retrofit shall be prepared in accordance with Index 600 Series. The Plans shall address all aspects of the full or partial removal of the existing traffic railing (when required) and construction of the retrofit. Generally, the use of Indexes 481 and 483 will require the removal of the existing traffic railing and will require traffic control consisting of shifting, narrowing and/or closing

of travel lanes and/or shoulders. In this case, the use of crash tested Precast Concrete Temporary Barriers will also be required to protect the drop-off exposed by the removal of the existing traffic railing.

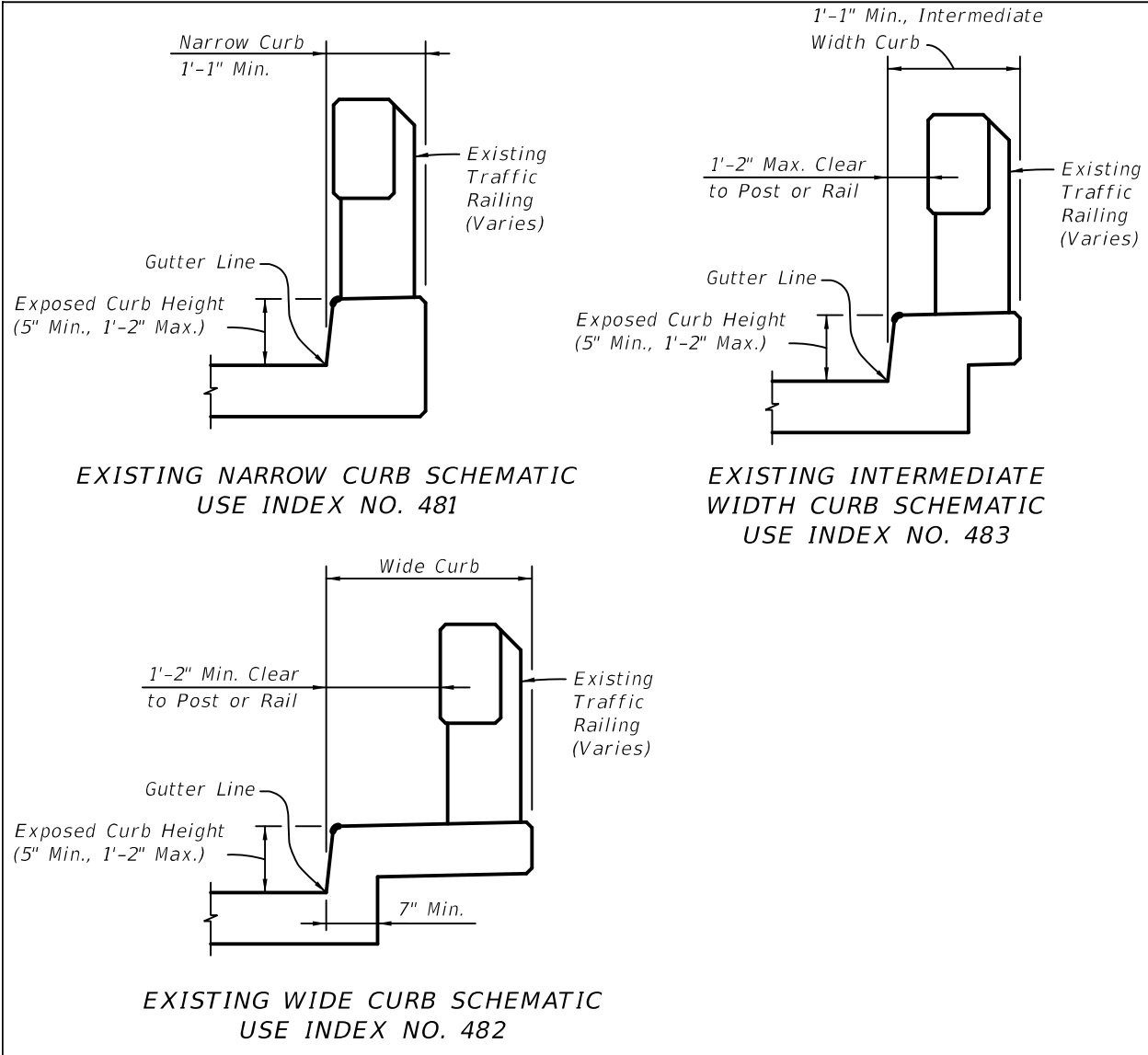
Indexes 480 through 484 do not address retrofitting of the existing traffic railings, curbs or sidewalks for pedestrian use. The potential need to retrofit the existing bridge for pedestrian use shall be evaluated on a project by project basis and the necessary Plans developed accordingly. Generally, the potential effects on pedestrian use of the bridge will be confined to bridges with sidewalks or wide curbs. The use of the Side Mounted Bridge Pedestrian/Bicycle Retrofit Railing shown in Indexes 851 and 861 shall be evaluated and noted in the Plans where appropriate. See the IDS for Indexes 851 and 861 for more information. The potential reduction in clear width of the curb or sidewalk caused by the installation of the retrofit shall be considered.

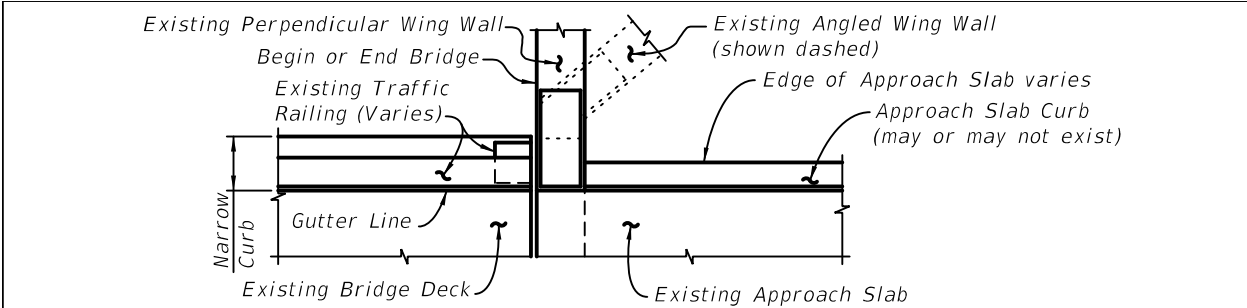
It should be noted that the existing traffic railings and/or guardrail end transitions may have been previously retrofitted utilizing a scheme presented in Roadway and Traffic **Design Standards** Index 401 (2000 and earlier Editions). In this event, the requirements for removal, modification or replacement of the prior retrofit shall be evaluated and addressed in the Plans as required. Of the retrofit schemes presented in Roadway and Traffic **Design Standards** Index 401, only Schemes 1 and 19 can be left in place and utilized as a component of the crash tested designs presented in Indexes 402 and 480 through 484. The removal of the prior retrofit, if required, may be considered as incidental work with no separate payment made.

The applicability of the individual retrofit schemes to different wing wall configurations is shown in the following views.

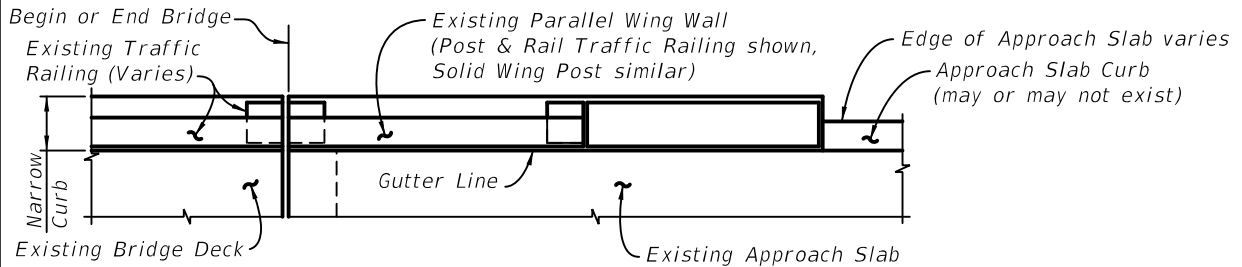
The applicability of the individual Standards to different curb widths is described as follows:

- Index 481 - Applicable for existing narrow curbs as shown below. This index requires removal of the existing traffic railing to the top of the existing curb along the entire length of the bridge and wing walls.
- Index 482 - Applicable for existing wide curbs or sidewalks as shown below. This index generally allows the entire existing traffic railing to remain in place.
- Index 483 - Applicable for existing intermediate width curbs as shown below. This index requires removal of the existing traffic railing to the top of the existing curb along the entire length of the bridge and wing walls.

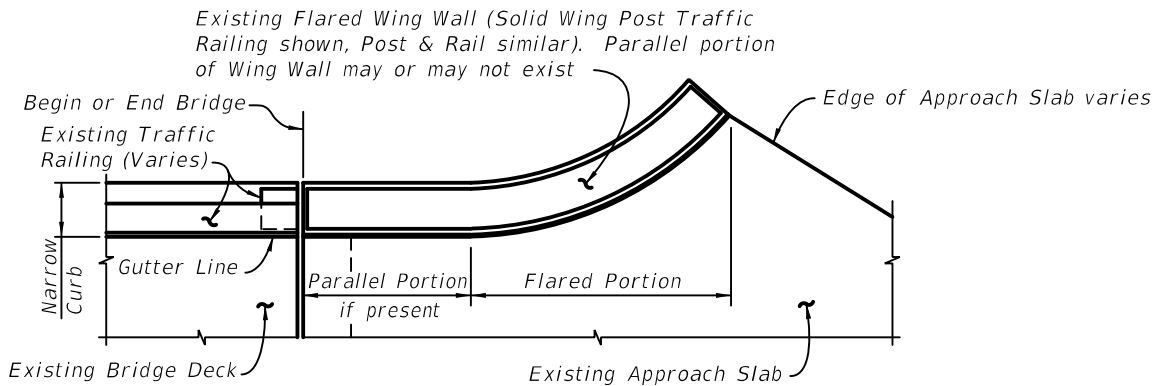




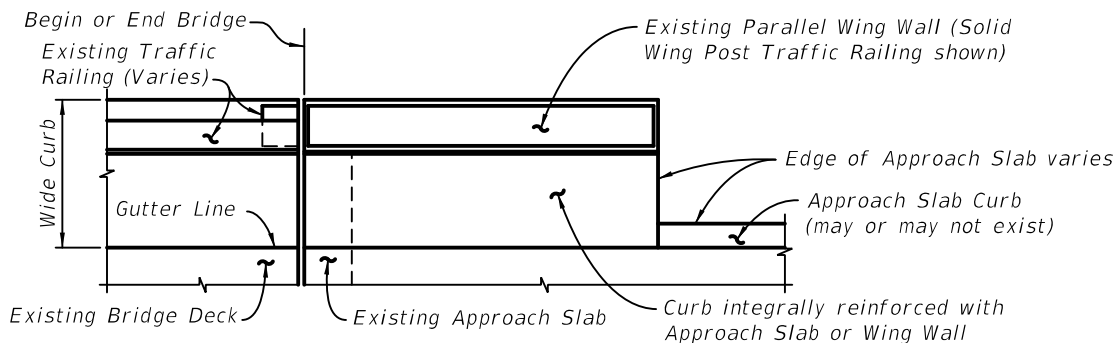
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH NARROW CURBS AND PERPENDICULAR OR ANGLED WING WALLS - USE INDEX NO. 481, SCHEME 1



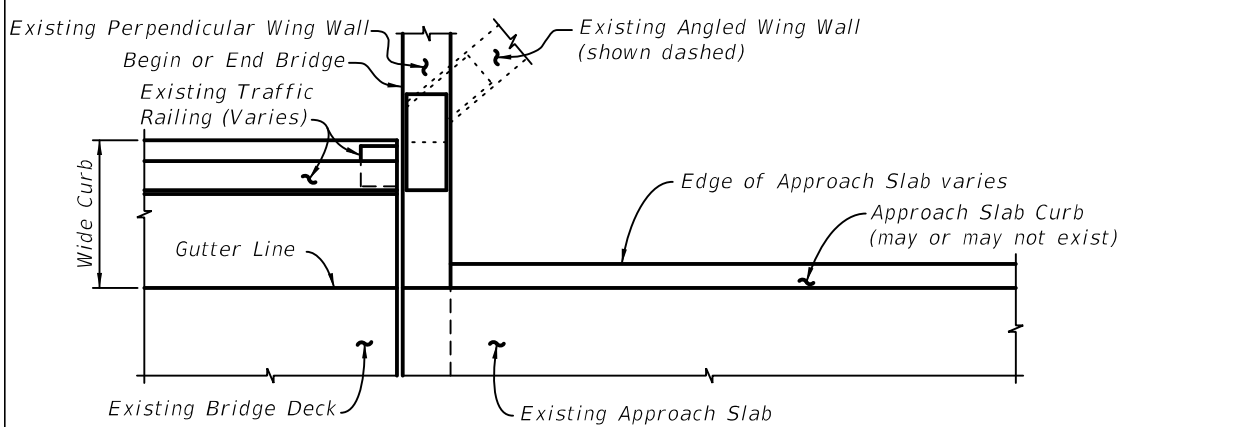
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH NARROW CURBS AND PARALLEL WING WALLS - USE INDEX NO. 481, SCHEME 2



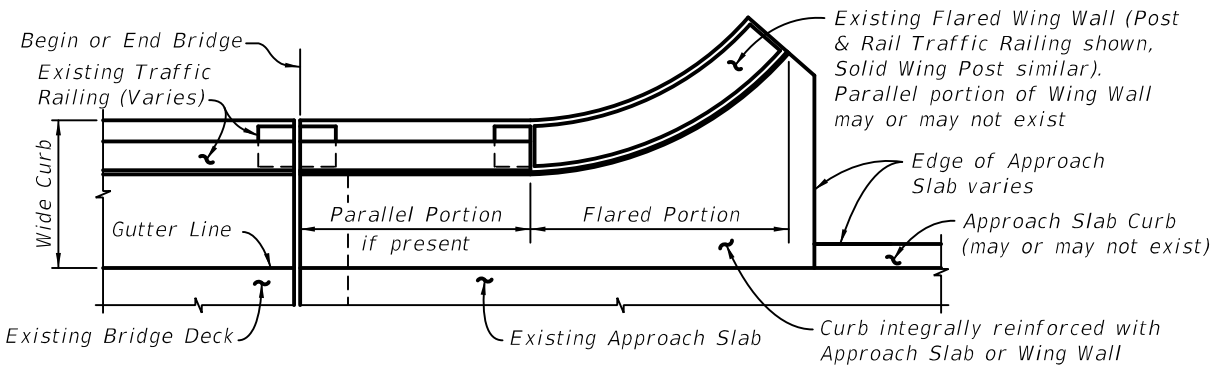
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH NARROW CURBS AND FLARED WING WALLS - USE INDEX NO. 481, SCHEME 3



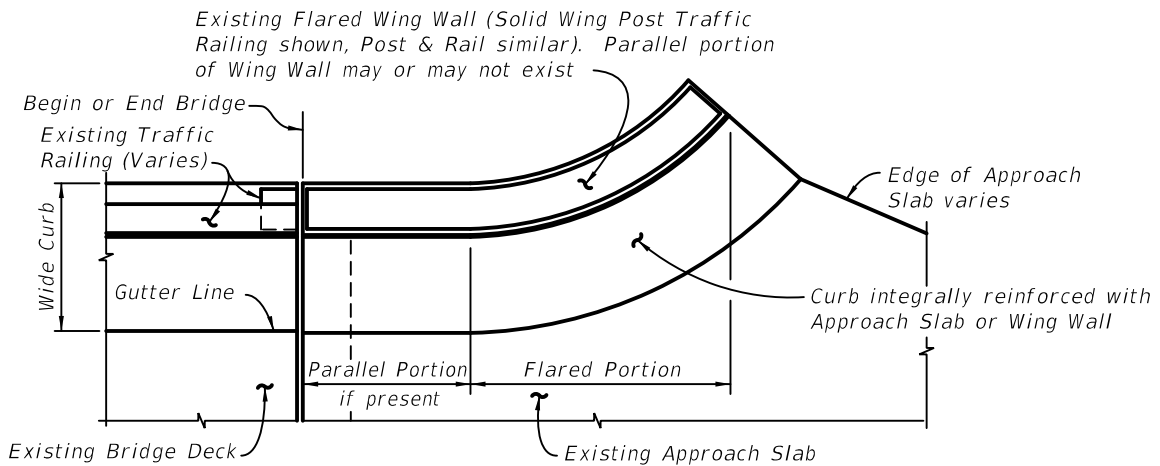
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, PARALLEL WING WALLS AND INTEGRALLY REINFORCED APPROACH SLAB CURBS - USE INDEX NO. 482, SCHEME 2



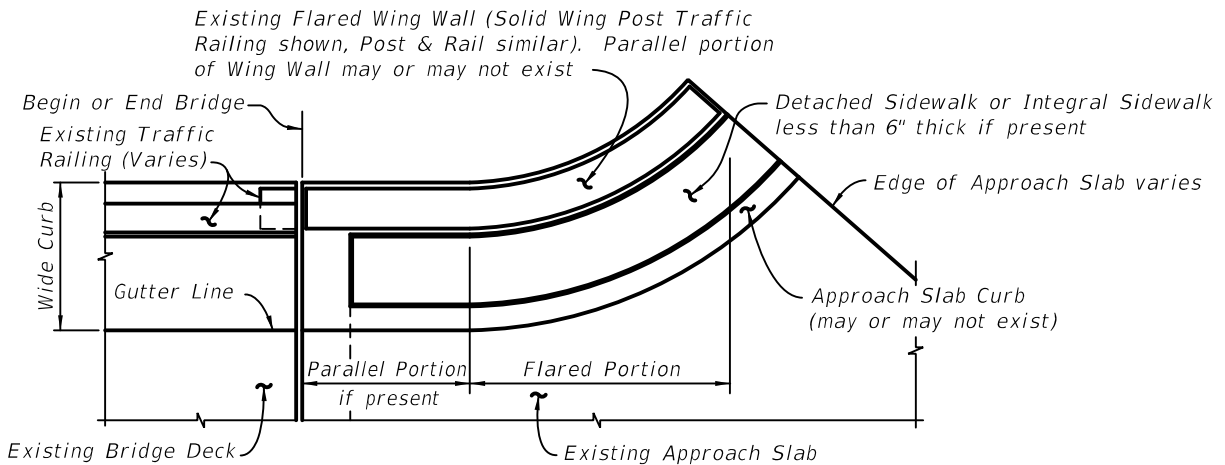
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS AND PERPENDICULAR OR ANGLED WING WALLS - USE INDEX NO. 482, SCHEME 1



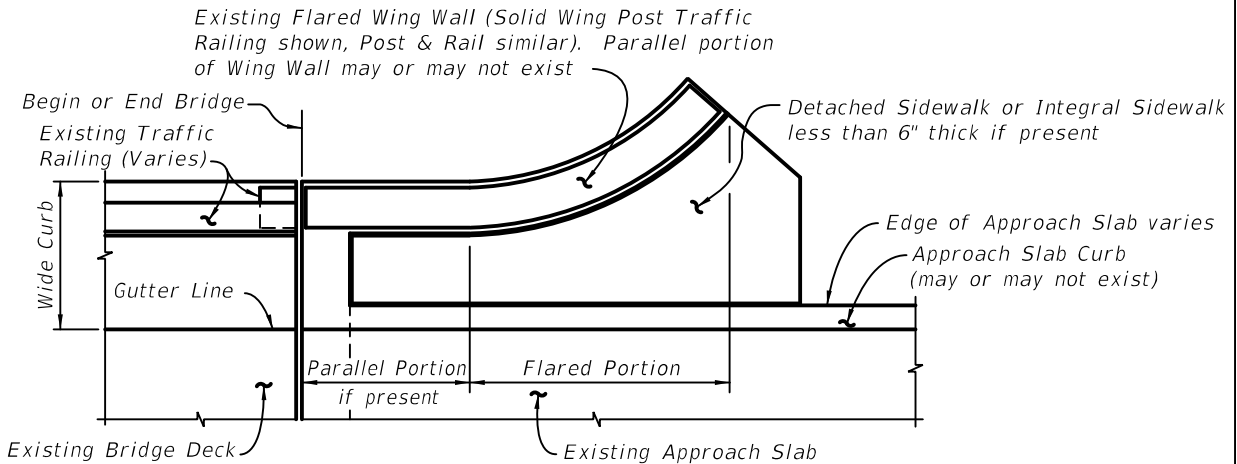
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, FLARED WING WALLS AND PARALLEL INTEGRALLY REINFORCED APPROACH SLAB CURBS - USE INDEX NO. 482, SCHEME 2



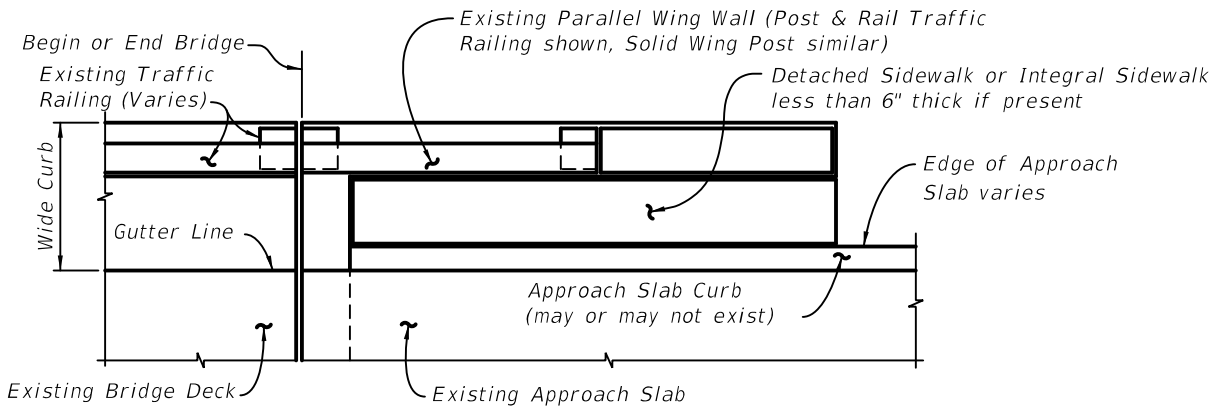
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, FLARED WING WALLS AND FLARED INTEGRALLY REINFORCED APPROACH SLAB CURBS - USE INDEX NO. 482, SCHEME 3



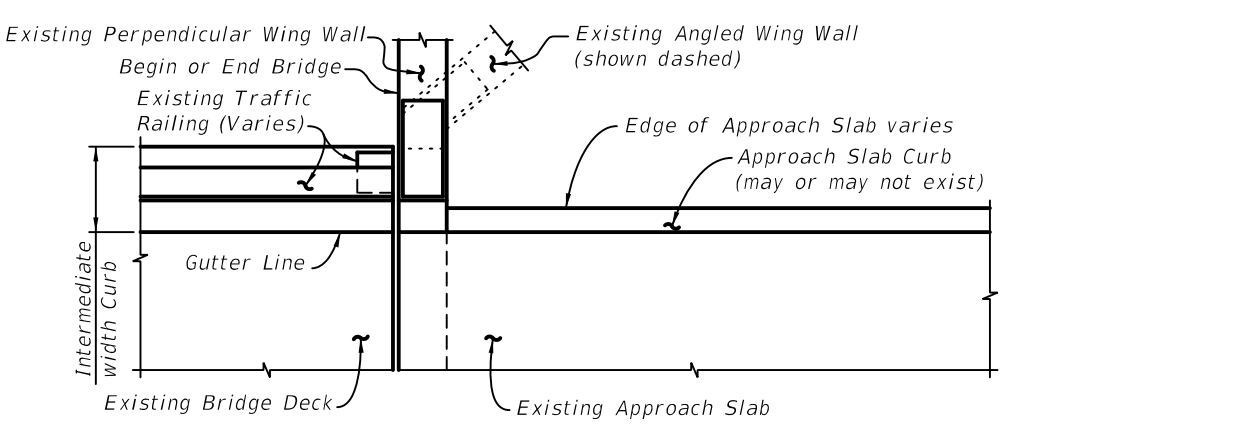
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, FLARED WING WALLS AND APPROACH SLABS WITH DETACHED SIDEWALKS OR SIDEWALKS LESS THAN 6" THICK - USE INDEX NO. 482, SCHEME 4



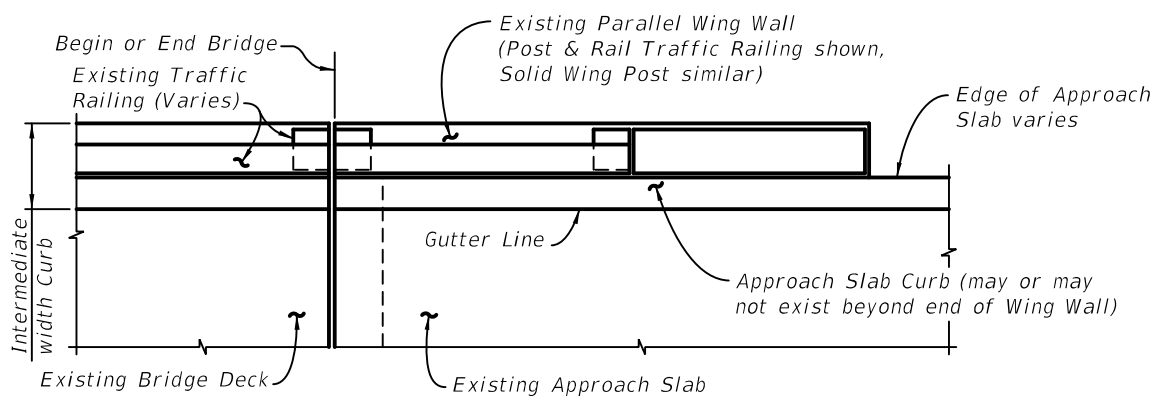
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, FLARED WING WALLS AND APPROACH SLABS WITH DETACHED SIDEWALKS OR SIDEWALKS LESS THAN 6" THICK - USE INDEX NO. 482, SCHEME 5



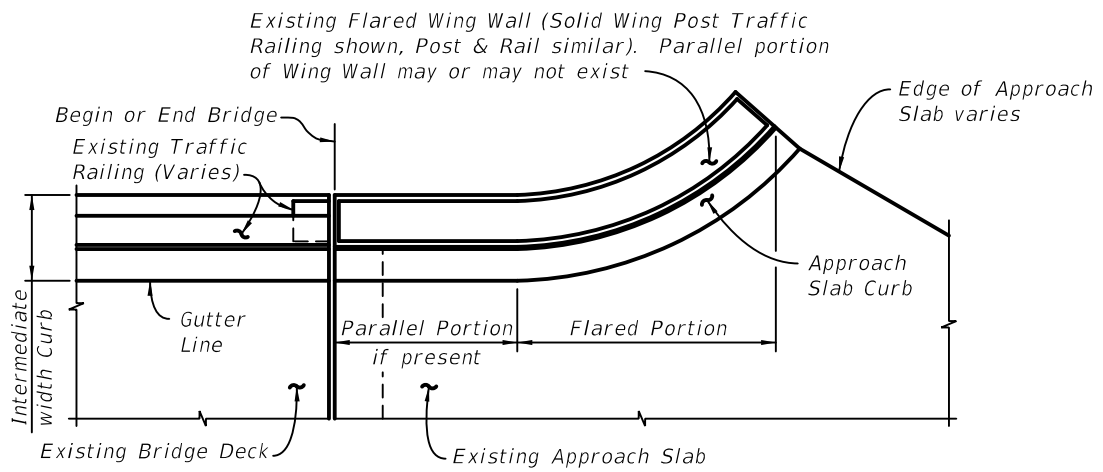
PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH WIDE CURBS, PARALLEL WING WALLS AND APPROACH SLABS WITH DETACHED SIDEWALKS OR SIDEWALKS LESS THAN 6" THICK - USE INDEX NO. 482, SCHEME 5



PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH INTERMEDIATE WIDTH CURBS AND PERPENDICULAR OR ANGLED WING WALLS - USE INDEX NO. 483, SCHEME 1



PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH INTERMEDIATE WIDTH CURBS, PARALLEL WING WALLS AND PARALLEL INTEGRAL APPROACH SLAB CURBS - USE INDEX NO. 483, SCHEME 2



PARTIAL PLAN VIEW OF EXISTING BRIDGE WITH INTERMEDIATE WIDTH CURBS, FLARED WING WALLS AND FLARED INTEGRAL APPROACH SLAB CURBS - USE INDEX NO. 483, SCHEME 3

Plan Content Requirements

The appropriate **Design Standards** Index number and Scheme number shall be shown in the Roadway Plans for each bridge along with the limiting stations of the retrofit. Examples of notes containing the required information as they would appear on a Plan or Plan-Profile sheet are as follows:

"Construct Traffic Railing (Vertical Face Retrofit), Index 48X, Scheme X, from Sta. XX+XX.XX (at or near Begin Bridge) to Sta. XX+XX.XX (at or near End Bridge)."

"Construct Traffic Railing (Vertical Face Retrofit) Spread Footing Approach, Index 484, Scheme X, from Sta. XX+XX.XX (at beginning of Length of Advancement, or at or near End Bridge) to Sta. XX+XX.XX (at or near Begin Bridge, or end of Length of Advancement)."

For projects with multiple bridges, a tabular format may be used to convey the necessary information.

A separate Plan and Elevation sheet of the type used in Structures Plans is generally not required.

Payment

Item number	Item description	Unit Measure
521-5-8	Concrete Traffic Railing, Bridge, Retrofit-Vertical Face	LF

Index 501 Geosynthetic Reinforced Soils

Design Criteria

PPM, Vol. 1, Chapter 31 and *Soils and Foundations Handbook*, Chapter 8.

Design Assumptions and Limitations

For reinforced slopes and reinforced foundation over soft soils applications (application usages 1 & 2), refer to *PPM*, Vol. 1, Chapter 31.

For reinforced embankment and construction expedient applications (application usages 4 & 5), refer to Chapter 8 of the *Soils and Foundations Handbook*.

Plan Content Requirements

For all usages, provide the description of the application for which the geosynthetic selected from Index 501 must be approved.

Additional plan content requirements are as follows:

Control drawings are required which depict the geometrics (plan and elevation view) of the area being reinforced. These designs are generic and are not based upon any one specific product or supplier. For reinforced slopes the designer shall design the slopes using the maximum reinforcement spacings allowed. For soft soils the designer shall design the reinforcement and provide the minimum total strength required.

The plans shall depict the required reinforcement strength based on the maximum allowed spacing of these materials, the extent and the number of layers of geosynthetic reinforcement, vertical spacing of geosynthetic reinforcement, orientation of geosynthetic facing details, details at special structures or obstructions, typical construction sequence, and top and bottom elevations of the geosynthetic reinforcement. Product names are not to be shown in the plans. Surface treatments and any other required design parameters or limitations shall also be shown in the plans.

When specifying Reinforcement Grid (Pay Item 145-71), for reinforced embankment and construction expedient applications a geogrid strength and the application usage must be provided to assist the contractor in selecting an applicable product. Provide the required geogrid strength as follows:

- For reinforced embankment applications include the required T_a values for both layers (as determined using the equation in Note 2 on Sheet 1) for the geosynthetic material.
- For construction expedient usage, provide the required strength of the geosynthetic at either 2% strain or 5% strain, whichever is most appropriate for the project.

Payment

Item number	Item description	Unit Measure
145-1	Geosynthetic Reinforced Soil Slope	SF
145-2	Geosynthetic Reinforced Foundation Over Soft Soil	SY
145-71	Reinforcement Grid, Biaxial	SY

Index 521 Concrete Steps

Design Criteria

Florida Building Commission "*Florida Building Code*", 2004 Edition

Design Assumptions and Limitations

Do not use this Index for suspended (structural) steps or stairways.

Maximum of 12 risers permitted between level landing areas.

Use of Index 850, 860, 870, 880 or project specific pedestrian railings is required.

Plan Content Requirements

Show locations and lengths of steps in the plans. Consider maximum number of risers between landings, landing widths and tie-ins to adjacent sidewalks when establishing overall limits of steps. Coordinate profile of steps and landings with shapes of supporting embankments.

Show Index 850, 860, 870, 880 or project specific pedestrian railings.

Include references to *Design Standards* Index 521 and pedestrian railing standard index (if used).

Payment

Item number	Item description	Unit Measure
400-0-13	Concrete Class NS, Concrete Steps	CY
415-1-6	Reinforcing Steel - Miscellaneous	LB

Index 810 Bridge Fencing (Vertical)

Design Criteria

NCHRP Report 350 Test Level 3 Criteria; **AASHTO LRFD Bridge Design Specifications**, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The Traffic Railing mounted version of this fence (back of railing mounted with tension wires) is based on a design that was successfully crash tested in accordance with the **AASHTO Guide Specifications for Bridge Railings** Performance Level 2 pickup test. Modifications have been made to improve the crashworthiness to **NCHRP Report 350** Test Level 3 Criteria. This fence can be used on Index 420, 422, 423, 424, 425 and 480 Series Traffic Railings, certain non-FDOT standard concrete traffic railings meeting the requirements of **SDG 6.7** and on existing New Jersey and F-Shape Traffic Railings listed in the **Instructions for Design Standards Index 402**.

The Concrete Parapet mounted version of this fence (top of parapet mounted with horizontal rails) is not a crash tested design and cannot be used on traffic railings. This fence can be used on Concrete Parapets constructed in accordance with Index 820 in lieu of the bullet railing shown on Indexes 820 and 822.

Evaluate the expansion joint movements of the bridge. Expansion rails are required for concrete parapet installations at expansion joints where the total movement exceeds 1-inch. If the total movement at an individual expansion joint is 6-inches or less, the bridge fence will span the joint without using an expansion assembly. If the total movement at an individual expansion joint exceeds 6-inches, an Expansion Assembly must be installed at that location.

Use of the Concrete Parapet mounted version of this fence in lieu of Index 811 Bridge Fencing (Curved Top) or Index 812 Bridge Fencing (Enclosed) should be based on project and site specific requirements.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Show and label the Bridge Fencing (Vertical) on the Plan and Elevation, Typical Section, Superstructure and Approach Slab sheets, Retaining Wall Control Drawings, and other sheets as required. Include cross references to **Design Standards** Index 810 as appropriate.

Show the limits of fencing in the plans if they are not from begin of approach slab at Begin Bridge to end of approach slab at End Bridge.

Show estimated quantities for bridge fencing with estimated quantities for Traffic Railing and/or concrete parapets in the superstructure details sheets.

Determine if bridge fencing requires grounding. If required, provide details in the superstructure sheets.

Provide locations for expansion joints requiring expansion rails or expansion assemblies in the superstructure layout sheets.

Designate the required finish in the General Notes, e.g., zinc or aluminum coated, or polyvinyl chloride (PVC) coated. If PVC coated fence is used, include the following notes in the General Notes:

1. A note specifying the color of the PVC coating for chain link fabric.
2. A note to paint the fence framework to match the color of the PVC chain link fabric.
3. A note for preparation of galvanized steel for painting.
4. A note to coat tension wire and fence fittings to match the color of the PVC chain link fabric.

Payment

Item number	Item description	Unit Measure
550-10-315	Fencing, Type R, 0 - 5.0', Vertical	LF
550-10-325	Fencing, Type R, 5.1 - 6.0', Vertical	LF
550-10-335	Fencing, Type R, 6.1 - 7.0', Vertical	LF

Index 811 Bridge Fencing (Curved Top)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

This fence is not a crash tested design and cannot be used on traffic railings. This fence can be used on Concrete Parapets constructed in accordance with Index 820 in lieu of the bullet railing shown on Indexes 820 and 822.

Evaluate the expansion joint movements of the bridge. Expansion rails are required for concrete parapet installations at expansion joints where the total movement exceeds 1-inch. If the total movement at an individual expansion joint is 6-inches or less, the bridge fence will span the joint without using an expansion assembly. If the total movement at an individual expansion joint exceeds 6-inches, an Expansion Assembly must be installed at that location.

Use of this fence in lieu of Index 810 Bridge Fencing (Vertical) or Index 812 Bridge Fencing (Enclosed) should be based on project and site specific requirements.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Show and label the Bridge Fencing (Vertical) on the Plan and Elevation, Typical Section, Superstructure and Approach Slab sheets, Retaining Wall Control Drawings, and other sheets as required. Include cross references to **Design Standards** Index 811 as appropriate.

Show the limits of fencing in the plans if they are not from begin of approach slab at Begin Bridge to end of approach slab at End Bridge.

Show estimated quantities for bridge fencing with estimated quantities for Traffic Railing and/or concrete parapets in the superstructure details sheets.

Determine if bridge fencing requires grounding. If required, provide details in the superstructure sheets.

Provide locations for expansion joints requiring expansion rails or expansion assemblies in the superstructure layout sheets.

Designate the required finish in the General Notes, e.g., zinc or aluminum coated, or polyvinyl chloride (PVC) coated. If PVC coated fence is used, include the following notes in the General Notes:

1. A note specifying the color of the PVC coating for chain link fabric.
2. A note to paint the fence framework to match the color of the PVC chain link fabric.

3. A note for preparation of galvanized steel for painting.
4. A note to coat tension wire and fence fittings to match the color of the PVC chain link fabric.

Payment

Item number	Item description	Unit Measure
550-10-344	Fencing, Type R, 7.1 - 8.0', W / Partial Enclosure	LF
550-10-354	Fencing, Type R, 8.1 - 10.0', W/ Partial Enclosure, Type R Only	LF

Index 812 Bridge Fencing (Enclosed)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **NCHRP Report 350** Test Level 3 Criteria (portion of fence adjacent to traffic railing only); **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The Traffic Railing mounted side of this fence is based on a design that was successfully crash tested in accordance with the **AASHTO Guide Specifications for Bridge Railings** Performance Level 2 pickup test. Modifications have been made to improve the crashworthiness to **NCHRP Report 350** Test Level 3 Criteria.

This fence can be used on Index 820 Concrete Parapets, Indexes 410, 420, 422, 423, 424 and 425 Traffic Railings, certain non-FDOT standard concrete traffic railings meeting the requirements of **SDG 6.7** and on existing New Jersey and F-Shape Traffic Railings listed in the **Instructions for Design Standards Index 402**.

Evaluate the expansion joint movements of the bridge. Expansion rails are required for concrete parapet installations at expansion joints where the total movement exceeds 1-inch. If the total movement at an individual expansion joint is 6-inches or less, the bridge fence will span the joint without using an expansion assembly. If the total movement at an individual expansion joint exceeds 6-inches, an Expansion Assembly must be installed at that location.

Use of this fence in lieu of Index 810 Bridge Fencing (Vertical) or Index 811 Bridge Fencing (Curved Top) should be based on project and site specific requirements.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Show and label the Bridge Fencing (Enclosed) on the Plan and Elevation, Typical Section, Superstructure and Approach Slab sheets, Retaining Wall Control Drawings, and other sheets as required. Include cross references to **Design Standards** Indexes 812, 820 and the traffic railing standard as appropriate.

Show the limits of fencing in the plans if they are not from begin of approach slab at Begin Bridge to end of approach slab at End Bridge.

Show estimated quantities for bridge fencing with estimated quantities for Traffic Railing and/or concrete parapets in the superstructure details sheets.

Determine if bridge fencing requires grounding. If required, provide details in the superstructure sheets.

Provide locations for expansion joints requiring expansion rails or expansion assemblies in the superstructure layout sheets.

Designate the required finish in the General Notes, e.g., zinc or aluminum coated, or polyvinyl chloride (PVC) coated. If PVC coated fence is used, include the following notes in the General Notes:

1. A note specifying the color of the PVC coating for chain link fabric.
2. A note to paint the fence framework to match the color of the PVC chain link fabric.
3. A note for preparation of galvanized steel for painting.
4. A note to coat tension wire and fence fittings to match the color of the PVC chain link fabric.

Payment

Item number	Item description	Unit Measure
550-10-343	Fencing, Type R, 7.1 - 8.0', With Full Enclosure	LF
550-10-353	Fencing, Type R, 8.1 - 10.0', With Full Enclosure	LF

Index 820 Pedestrian/Bicycle Bullet Railing

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The standard height railing is the Pedestrian / Bicycle Railing (42" height). The Special Height Bicycle Railing (54" height) should only be used where warranted by **AASHTO LRFD C13.9.2**.

Index 820 cannot be used as a traffic railing. A crashworthy traffic railing is required between Index 820 and adjacent traffic lanes.

Use this standard in conjunction with Indexes 420, 424, or 425 and 810, 811, 812 or 822.

Plan Content Requirements

In the Structures and / or Roadway Plans:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure or retaining wall environment classification. See **SDG 1.4**.

Show and label the Pedestrian / Bicycle Bullet Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, Retaining Wall Control Drawings, and other sheets as required. Specify the type of railing required, e.g., Pedestrian / Bicycle Bullet Railing or Special Height Bicycle Bullet Railing. Include cross references to **Design Standards** Index 810, 811, 812 or 822 as appropriate.

All concrete required to construct the parapet and Bars 4P and 4S are included in the Estimated Concrete Parapet Quantities. Do not include parapet concrete in the estimated concrete quantities, or Bars 4P and 4S in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks, approach slabs or retaining walls.

Payment

Item number	Item description	Unit Measure
521-6-11	27" Concrete Parapet, Pedestrian/Bicycle	LF

Index 821 Aluminum Pedestrian/Bicycle Bullet Railing for Traffic Railing (32" F Shape)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

This railing is intended for use when a Bicycle Lane is required and a raised pedestrian sidewalk is not provided.

The standard height railing is the Pedestrian / Bicycle Railing. The Special Height Bicycle Railing should only be used where warranted by **AASHTO LRFD** C13.9.2.

Use this standard in conjunction with Indexes 420 and 822.

Plan Content Requirements

Show and label the Aluminum Pedestrian / Bicycle Bullet Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, Retaining Wall Control Drawings, and other sheets as required. Specify the type of railing required, e.g., Pedestrian / Bicycle Railing or Special Height Bicycle Railing. Include cross references to **Design Standards** Indexes 420 and 822 as appropriate.

Payment

Item number	Item description	Unit Measure
460-70-1	Aluminum Bullet Railings, Single Rail	LF
460-70-2	Aluminum Bullet Railings, Double Rail	LF

Index 822 Aluminum Pedestrian/Bicycle Bullet Railing Details

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The standard height railing is the Pedestrian / Bicycle Railing. The Special Height Bicycle Railing should only be used where warranted by **AASHTO LRFD** C13.9.2.

Use this standard in conjunction with Indexes 420, 423, 820 and/or 821.

Plan Content Requirements

Show and label the Aluminum Pedestrian / Bicycle Bullet Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, Retaining Wall Control Drawings, and other sheets as required. Specify the type of railing required, e.g., Pedestrian / Bicycle Railing or Special Height Bicycle Railing. Include cross references to **Design Standards** Indexes 420, 423, 820 and 821 as appropriate.

Payment

Item number	Item description	Unit Measure
460-70-1	Aluminum Bullet Railings, Single Rail	LF
460-70-2	Aluminum Bullet Railings, Double Rail	LF
460-70-3	Aluminum Bullet Railings, Triple Rail	LF

Index 825 42" Concrete Pedestrian/Bicycle Railing (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

Index 825 cannot be used as a traffic railing. A crashworthy traffic railing is required between this railing and adjacent traffic lanes.

Use this standard in conjunction with Indexes 420, 424, or 425.

This railing is intended for locations where theft of the aluminum components on Index 820 is a warranted concern as determined by the District Maintenance Office.

Plan Content Requirements

In the Structures and/or Roadway Plans:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure or retaining wall environment classification. See **SDG** 1.4.

In the Applied Finish Coating Note on the General Notes, specify any special textured surface requirements and/or colors for the Class 5 Finish Coating. See **Design Standards** Index 5200 for examples of textured surface options. Use only those with depth or amplitude less than or equal to 1/2" to maintain 2" cover for reinforcement.

Show and label the 42" Concrete Pedestrian/Bicycle Railing on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, Retaining Wall Control Drawings, and other sheets as required.

All concrete required to construct the railing and Bars 3R and 4S are included in the Estimated Concrete Railing Quantities. Do not include railing concrete in the estimated concrete quantities, or Bars 3R and 4S in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks, approach slabs or retaining walls.

Payment

Item number	Item description	Unit Measure
521-6-12	42" Concrete Parapet, Pedestrian/Bicycle	LF
521-6-32	42" Concrete Parapet, Pedestrian/Bicycle, Retaining Wall Mounted with Sidewalk	LF

Index 851 Bridge Pedestrian/Bicycle Railing (Steel)

Design Criteria

See Instructions for *Design Standards* [Index 852](#).

Design Assumptions and Limitations

Bridge Pedestrian/Bicycle Railing is limited to use on bridges with expansion joint thermal movements not exceeding 5". Scheme 3 is limited to bridge retrofit applications where additional sidewalk width is required.

See Instructions for *Design Standards* [Index 852](#) for additional information.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Provide railing layout Control Drawings to show post spacing, curb joint, V-groove, deck joint, expansion joint locations and Scheme number.

For existing bridge retrofits special end treatment details may be required for perpendicular or flared wingwalls at Begin and End Bridge. Provide existing railing removal details when required.

Include cross references to *Design Standards* Index 851 as appropriate.

When either Index 851 or 861 are acceptable, include cross references to both indexes and use Pay Items 515-2-1BB or 515-2-1BB as appropriate.

Payment

Item number	Item description	Unit Measure
515-2-1BB	Pedestrian, Bicycle Railing, Non Specified, 42" (Type___)	LF
515-2-1BB	Pedestrian, Bicycle Railing, Non Specified, 54" (Type___)	LF
515-2-2BB	Pedestrian / Bicycle Railing, Steel Only, 42" (Type___)	LF
515-2-2BB	Pedestrian / Bicycle Railing, Steel Only, 54" (Type___)	LF

Include concrete and reinforcing steel quantities for the concrete curb (Scheme 2) in the bridge deck plan quantity pay items.

Index 852 Steel Pedestrian/Bicycle Railing

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition, including 75 year Design Life
U.S. Access Board "**ADA Standards for Transportation Facilities**" November 2006 as
adopted with amendments by the USDOT under 49 CFR Part 37.

DESIGN LIVE LOADS:

Post and Base Plate: Equivalent point load = 200 lb. load + (50 lb./ft. x Post Spacing (ft.))
applied transversely at top rail connection.

Top & Bottom Rails: 50 lb./ft. uniform load applied simultaneously vertically and
transversely, plus 200 lb. concentrated point load applied at midspan in the directions for
both maximum stress and deflection.

Handrails: Maximum of either 50 lb./ft. uniform load applied in any direction or 200 lb.
concentrated load applied in any direction at any point along the top.

Pickets and Infill areas: Concentrated 200 lb. load applied transversely over an area of
1.0 square foot.

GEOMETRY:

Clear Openings: Shall reject the passage of a 6" diameter sphere below 27" height, and
an 8" diameter sphere above 27" height. Additionally, for special conditions (see below) a
4" diameter sphere shall not pass through openings below 31" height.

Clear Opening under Bottom Rail: Shall reject the passage of a 4" diameter sphere,
except bridge installations over traffic and waterways without curbs directly beneath the
railing shall reject the passage of a 2" diameter sphere.

ADA Handrail Height: 34" at centerline of handrail.

Standard Pedestrian/Bicycle Railing Height: 42" minimum.

Special Height Bicycle Railing Height: 54" minimum.

DEFLECTION:

Total combined deflection of the railing system including the resilient or neoprene pads,
due to the top rail design live loads, shall not exceed 1 1/2" when measured at midspan
of the top rail.

Design Assumptions and Limitations

For the purpose of these instructions, the following definitions shall apply:

4" Sphere Rule - Clear openings of the railing below 31" height shall reject the
passage of a 4" diameter sphere and clear openings above 31" height shall reject the
passage of an 8" diameter sphere. This rule applies only to special conditions as
discussed below.

6" Sphere Rule - Clear openings of the railing below 27" height shall reject the passage of a 6" diameter sphere and clear openings above 27" height shall reject the passage of an 8" diameter sphere.

This railing is not applicable for shielding drop-off hazards for motor vehicle traffic. This railing is applicable for cases where a pedestrian or bicyclist drop-off hazard exceeds 5'-0" or when a drop-off hazard is less than 5'-0" and is required by design or permit stipulations. Refer to PPM, Vol. 1, Chapters 4 & 8, for the definition of vehicular, pedestrian and bicyclist "drop-off hazards".

For FDOT installations subject to Florida Building Code provisions or other applicable locations along FDOT corridors as defined below, the 4" Sphere Rule may apply. Examples of applicable locations include the following:

- Highway rest areas and travel information centers
- Parking garages
- Bridges and their approaches along shared-use paths
- View points on bridges where seating is provided
- Fishing piers or bridges where fishing is permitted along the sidewalk
- Other public gathering areas with amenities (i.e. seating, interpretive displays, drinking fountains, etc.)

Providing adequate site distance always takes priority over the 4" Sphere Rule. Typically the clear space between the top and intermediate horizontal rails provides for adequate site distances, however, for railing installations adjacent to sloped intersections, the infill area between the intermediate and bottom horizontal rails may still adversely affect the site distance. Of the standard infill alternatives that meet the 4" Sphere Rule, the standard "Type 2 - Chain-Link" infill alternative creates the least obstruction to site distance through the infill areas.

Pedestrian railings on bridges and other structures adjacent to sidewalks having standard widths should generally follow the 6" Sphere Rule.

Aesthetics play a crucial role in the determination of which railing infill type should be specified for a particular project. Infill Panel alternates within the Design Standard, include those that meet the 6" Sphere Rule and others that meet the 4" Sphere Rule. Custom designs for the In-fill Panels may be designed in accordance with the Design Criteria above, specified in the Data Tables and detailed in the plans. Ensure dimensions of the elements within the Custom Infill Panels have adequate strength to resist the loads specified in the Design Criteria above. See [PPM](#), Volume 1, Section 8.8 for responsibilities of Local Maintaining Agencies. Contact the District for further guidance.

When a colored coating is desired and the addition cost is justified or reimbursed by the requesting local agency, then specify a coating in accordance with FDOT Standard Specifications for Road and Bridge Construction, Section 649-4. See [PPM](#), Volume 1, Section 8.8 for responsibilities of Local Maintaining Agencies.

Adequate foundation support for anchorage and stability against overturning must be provided. When necessary, design a site specific railing or anchorage system for unusual site conditions.

A handrail is required for use on ramps with a grade steeper than 5% to conform to the requirements of the Americans with Disabilities Act (ADA).

Expansion joints shall be spaced at a maximum 40'-0" (differs from Index 862). Railing must be continuous across a minimum of two posts.

Indexes 852 and 862 are similar in form and function. Select which of these railings to use at a given site based on District preferences, aesthetic or finish color requirements, corrosion concerns, theft potential issues, fabrication issues, weight of railing and any other project specific requirements. In some cases, both of these railings are acceptable for use and the selection of which to provide is left to the contractor by the use of Pay Items 515-2-1BB or 515-2-1BB.

See Index 851 for special requirements and modifications for use on bridges.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Show Pedestrian Railings on sidewalks and walls as required. Designate locations where handrails are required.

Include cross references to Design Standards Index 852 as appropriate.

When either Index 852 or 862 are acceptable, include cross references to both indexes and use Pay Items 515-2-1BB or 515-2-1BB as appropriate.

Prepare project specific Infill Panel details when required using the Pedestrian/Bicycle Railing Custom Infill Panel CADD cell and include them in the plans. Designate each individual project specific Infill Panel with a unique name for identification and cross reference purposes.

All custom Infill Panels shall be fully detailed in the contract plans. A Custom Type Infill Panel Cell (00852-CTIP.cel) as shown below is available through the Structures CADD bar menu.

Complete the following Data Tables and include them in the plans. See Introduction I.3 for more information regarding use of Data Tables.

In the HEIGHT column of the Data Table, enter either "42" for standard height railings or "54" for special height railings.

In the STYLE column of the Data Table, enter either "Type X" (where X = 1 thru 5 for the standard Infill Panel options) or "Custom" where custom Infill Panels are fully detailed in the plans.

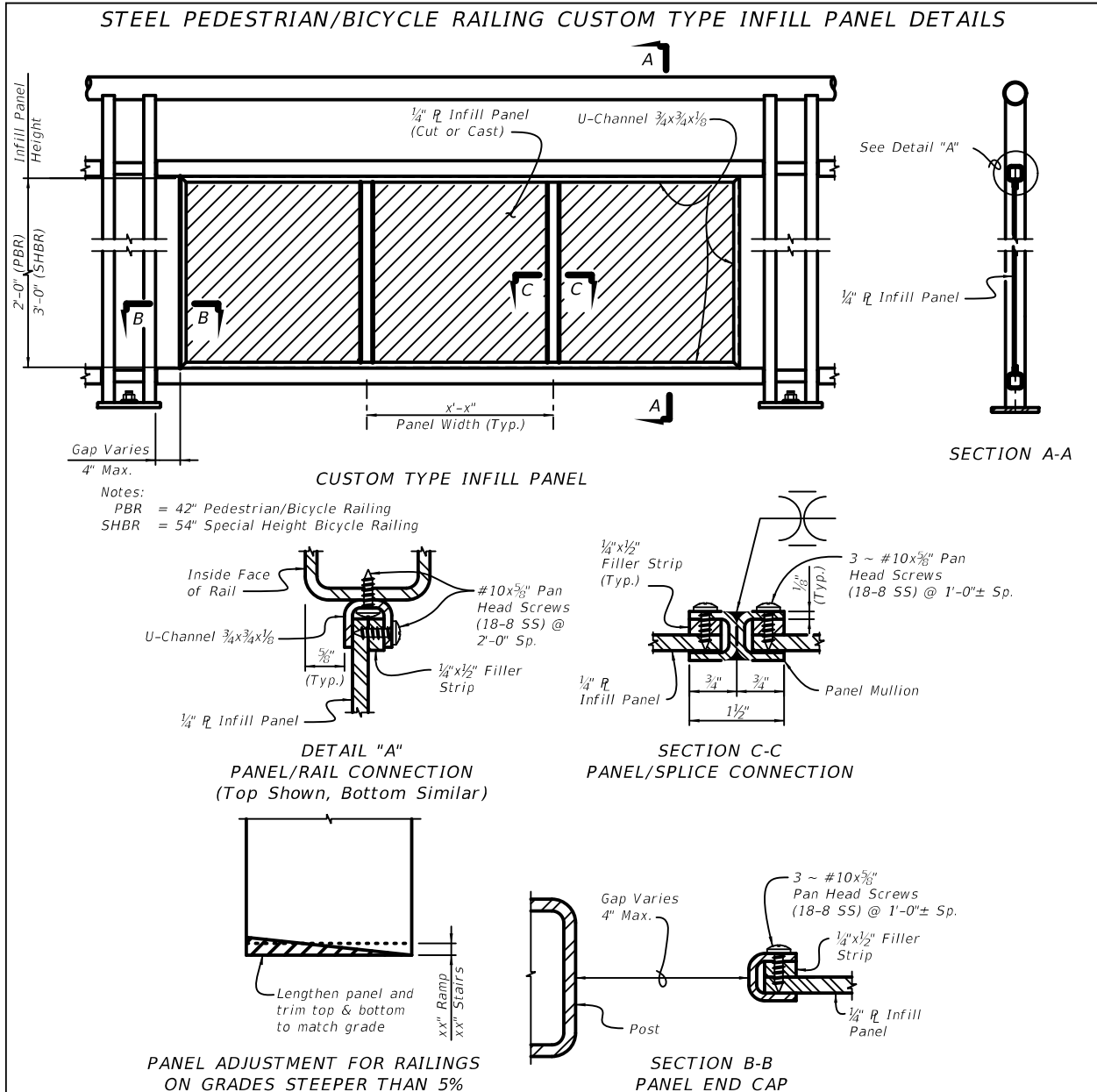
STEEL PEDESTRIAN/BICYCLE RAILING DATA TABLES

PROJECT REQUIREMENTS					Table Date 01-01-11
Station to Station (Lt. or Rt.)	Height (in.)	Style Type (1)	Required: (Yes/No)		
			Bottle Guard	Colored Coatings (2)	Infill Panel to Reject Passage of 4" Sphere (Special conditions only)

(1) For "CUSTOM" Style Types, see plans for in-fill panel details.
 (2) The color shall be per Federal Color Chart, Federal Standard No. 595B, Table _____, Color _____.

ESTIMATED QUANTITIES		
ITEM	UNIT	QUANTITY

NOTES:
 1. Work this Data Table with Index No. 852.



Payment

Item number	Item description	Unit Measure
515-2-1BB	Pedestrian / Bicycle Railing, Non Specified, 42" (Type___)	LF
515-2-1BB	Pedestrian / Bicycle Railing, Non Specified, 54" (Type___)	LF
515-2-2BB	Pedestrian / Bicycle Railing, Steel Only, 42" (Type___)	LF
515-2-2BB	Pedestrian / Bicycle Railing, Steel Only, 54" (Type___)	LF

Index 861 Bridge Pedestrian/Bicycle Railing (Aluminum)

Design Criteria

See Instructions for *Design Standards* [Index 862](#).

Design Assumptions and Limitations

Bridge Pedestrian/Bicycle Railing is limited to use on bridges with expansion joint thermal movements not exceeding 5". Scheme 3 is limited to bridge retrofit applications where additional sidewalk width is required.

See Instructions for *Design Standards* [Index 862](#) for additional information.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Provide railing layout Control Drawings in the Plans to show post spacing, curb joint, V-groove, deck joint, expansion joint locations and Scheme number.

For existing bridge retrofits special end treatment details may be required for perpendicular or flared wingwalls at Begin and End Bridge. Provide existing railing removal details when required.

Include cross references to *Design Standards* Index 861 as appropriate.

When either Index 851 or 861 are acceptable, include cross references to both indexes and use Pay Items 515-2-1BB or 515-2-1BB as appropriate.

Payment

Item number	Item description	Unit Measure
515-2-1BB	Pedestrian, Bicycle Railing, Non Specified, 42" (Type ___)	LF
515-2-1BB	Pedestrian, Bicycle Railing, Non Specified, 54" (Type ___)	LF
515-2-3BB	Pedestrian, Bicycle Railing, Aluminum Only, 42" (Type ___)	LF
515-2-3BB	Pedestrian, Bicycle Railing, Aluminum Only, 54" (Type ___)	LF

Index 862 Aluminum Pedestrian/Bicycle Railing

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition, including 75 year Design Life U.S. Access Board "**ADA Standards for Transportation Facilities**" November 2006 as adopted with amendments by the USDOT under 49 CFR Part 37.

The Aluminum Association, **Aluminum Design Manual 2010** (for weld design only)

DESIGN LIVE LOADS:

Post and Base Plate: Equivalent point load = 200 lb. load + (50 lb./ft. x Post Spacing (ft.)) applied transversely at top rail connection.

Top & Bottom Rails: 50 lb./ft. uniform load applied simultaneously vertically and transversely, plus 200 lb. concentrated point load applied at midspan in the directions for both maximum stress and deflection.

Handrails: Maximum of either 50 lb./ft. uniform load applied in any direction or 200 lb. concentrated load applied in any direction at any point along the top.

Pickets and Infill areas: Concentrated 200 lb. load applied transversely over an area of 1.0 square foot.

GEOMETRY:

Clear Openings: Shall reject the passage of a 6" diameter sphere below 27" height, and an 8" diameter sphere above 27" height. Additionally, for special conditions (see below) a 4" diameter sphere shall not pass through openings below 31" height.

Clear Opening under Bottom Rail: Shall reject the passage of a 4" diameter sphere, except bridge installations over traffic and waterways without curbs directly beneath the railing shall reject the passage of a 2" diameter sphere.

ADA Handrail Height: 34" at centerline of handrail.

Standard Pedestrian/Bicycle Railing Height: 42" minimum.

Special Height Bicycle Railing Height: 54" minimum.

DEFLECTION:

Total combined deflection of the railing system including the resilient or neoprene pads, due to the top rail design live loads, shall not exceed 1 1/2" when measured at midspan of the top rail.

Design Assumptions and Limitations

For the purpose of these instructions, the following definitions shall apply:

4" Sphere Rule - Clear openings of the railing below 31" height shall reject the passage of a 4" diameter sphere and clear openings above 31" height shall reject the passage of an 8" diameter sphere. This rule applies only to special conditions as discussed below.

6" Sphere Rule - Clear openings of the railing below 27" height shall reject the passage of a 6" diameter sphere and clear openings above 27" height shall reject the passage of an 8" diameter sphere.

This railing is not applicable for shielding drop-off hazards for motor vehicle traffic. This railing is applicable for cases where a pedestrian or bicyclist drop-off hazard exceeds 5'-0" or when a drop-off hazard is less than 5'-0" and is required by design or permit stipulations. Refer to PPM, Vol. 1, Chapters 4 & 8, for the definition of vehicular, pedestrian and bicyclist "drop-off hazards".

For FDOT installations subject to Florida Building Code provisions or other applicable locations along FDOT corridors as defined below, the 4" Sphere Rule may apply. Examples of applicable locations include the following:

- Highway rest areas and travel information centers
- Parking garages
- Bridges and their approaches along shared-use paths
- View points on bridges where seating is provided
- Fishing piers or bridges where fishing is permitted along the sidewalk
- "Other public gathering areas with amenities (i.e. seating, interpretive displays, drinking fountains, etc.)

Providing adequate site distance always takes priority over the 4" Sphere Rule. Typically the clear space between the top and intermediate horizontal rails provides for adequate site distances, however, for railing installations adjacent to sloped intersections, the infill area between the intermediate and bottom horizontal rails may still adversely affect the site distance. Of the standard infill alternatives that meet the 4" Sphere Rule, the standard "Type 2 - Chain-Link" infill alternative creates the least obstruction to site distance through the infill areas.

Pedestrian railings on bridges and other structures adjacent to sidewalks having standard widths should generally follow the 6" Sphere Rule.

Aesthetics play a crucial role in the determination of which railing infill type should be specified for a particular project. Infill Panel alternates within the Design Standard, include those that meet the 6" Sphere Rule and others that meet the 4" Sphere Rule. Custom designs for the In-fill Panels may be designed in accordance with the Design Criteria above, specified in the Data Tables and detailed in the plans. Ensure dimensions of the elements within the Custom Infill Panels have adequate strength to resist the loads specified in the Design Criteria above. See *PPM*, Volume 1, Section 8.8 for responsibilities of Local Maintaining Agencies. Contact the District for further guidance.

When a colored coating is desired and the addition cost is justified or reimbursed by the requesting local agency, then specify a coating complying with AAMA 2605, "Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels", (American Architectural Manufacturers Association, 2005) except that only fluoropolymer based powders are permitted. See *PPM*, Volume 1, Section 8.8 for responsibilities of Local Maintaining Agencies.

Adequate foundation support for anchorage and stability against overturning must be provided. When necessary, design a site specific railing or anchorage system for unusual site conditions.

A handrail is required for use on ramps with a grade steeper than 5% to conform to the requirements of the Americans with Disabilities Act (ADA).

Expansion joints shall be spaced at a maximum 30'-0" (differs from Index 852). Railing must be continuous across a minimum of two posts.

Indexes 852 and 862 are similar in form and function. Select which of these railings to use at a given site based on District preferences, aesthetic or finish color requirements, corrosion concerns, theft potential issues, fabrication issues, weight of railing and any other project specific requirements. In some cases, both of these railings are acceptable for use and the selection of which to provide is left to the contractor by the use of Pay Items 515-2-1BB or 515-2-1BB.

See Index 861 for special requirements and modifications for use on bridges.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Show Pedestrian Railings on sidewalks and walls as required. Designate locations where handrails are required.

Include cross references to Design Standards Index 862 as appropriate.

When either Index 852 or 862 are acceptable, include cross references to both indexes and use Pay Items 515-2-1BB or 515-2-1BB as appropriate.

Prepare project specific Infill Panel details when required using the Pedestrian/Bicycle Railing Custom Infill Panel CADD cell and include them in the plans. Designate each individual project specific Infill Panel with a unique name for identification and cross reference purposes.

All custom Infill Panels shall be fully detailed in the contract plans. A Custom Type Infill Panel Cell (00862-CTIP.cel) as shown below is available through the Structures CADD bar menu.

Complete the following Data Tables and include them in the plans. See Introduction I.3 for more information regarding use of Data Tables.

In the HEIGHT column of the Data Table, enter either "42" for standard height railings or "54" for special height railings.

In the STYLE column of the Data Table, enter either "Type X" (where X = 1 thru 5 for the standard Infill Panel options) or "Custom" where custom Infill Panels are fully detailed in the plans.

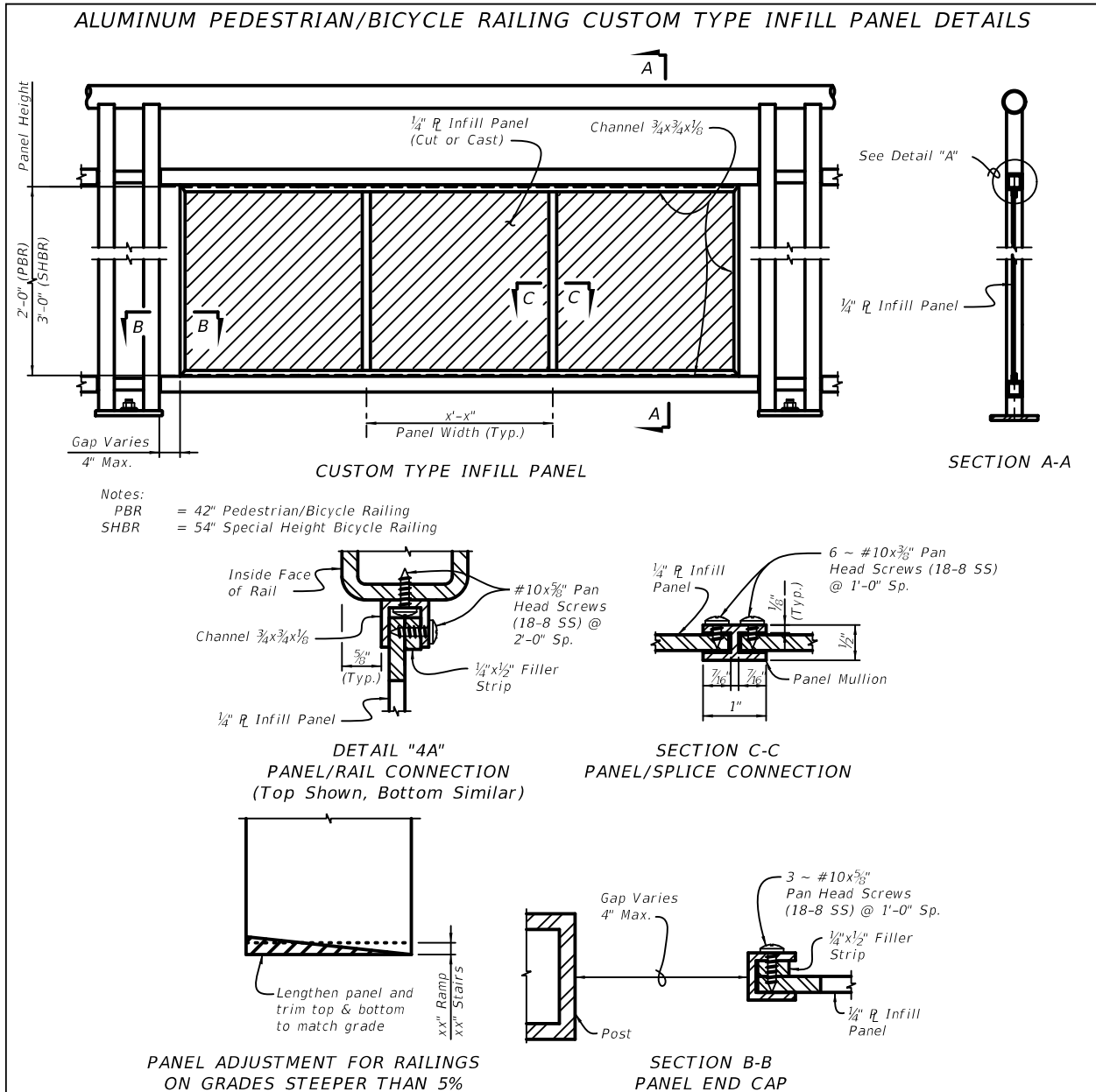
ALUMINUM PEDESTRIAN/BICYCLE RAILING DATA TABLES

PROJECT REQUIREMENTS					Table Date 01-01-11
Station to Station (Lt. or Rt.)	Height (in.)	Style Type (1)	Required: (Yes/No)		
			Bottle Guard	Colored Coatings (2)	Infill Panel to Reject Passage of 4" Sphere (Special conditions only)

(1) For "CUSTOM" Style Types, see plans for in-fill panel details.
 (2) The color shall be per Federal Color Chart, Federal Standard No. 595B, Table _____, Color _____.

ESTIMATED QUANTITIES		
ITEM	UNIT	QUANTITY

NOTES:
 1. Work this Data Table with Index No. 862.



Payment

Item number	Item description	Unit Measure
515-2-1BB	Pedestrian, Bicycle Railing, Non Specified, 42" (Type___)	LF
515-2-1BB	Pedestrian, Bicycle Railing, Non Specified, 54" (Type___)	LF
515-2-3BB	Pedestrian, Bicycle Railing, Aluminum Only, 42" (Type___)	LF
515-2-3BB	Pedestrian, Bicycle Railing, Aluminum Only, 54" (Type___)	LF

Index 870 Aluminum Pipe Guiderail (Rev. 01/12)

Design Criteria

ADA Accessibility Guidelines July 2004 as adopted with amendments by the USDOT under 49 CFR Part 37

Design Assumptions and Limitations

This Guiderail was tested by the FDOT Structural Research Center and found to resist an equivalent Service Loading of 50 lbs./ft. acting simultaneously in the transverse and vertical direction when applied at the height of the Top Rail.

This Index is not approved for use on bridges. This railing is not applicable for shielding drop-off hazards for vehicular traffic. This railing is applicable for all cases where Florida Building Code permit is not required and pedestrian or bicyclist drop-off hazards do not exceed 5'-0". Refer to *PPM*, Volume 1, Chapters 4 & 8, for the definition of vehicular, pedestrian and bicyclist "drop-off hazards". This railing is also applicable for select uses on sidewalks within service areas and similar locations or maintenance areas where the drop off exceeds 5'-0".

Adequate foundation support for anchorage and stability against overturning must be provided. Design a site specific railing for unusual site conditions.

Indexes 870 and 880 are similar in form and function. Select which of these railings to use at a given site based on District preferences, aesthetic or finish color requirements, corrosion concerns, theft potential issues, fabrication issues, weight of railing and any other project specific requirements.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Show Pipe Guiderail on sidewalks and walls as required. Designate locations where guiderails are required.

Include cross references to *Design Standards* Index 870 as appropriate.

Payment

Item number	Item description	Unit Measure
515-1-2	Pipe Handrail - Guiderail, Aluminum	LF

Index 880 Steel Pipe Guiderail (Rev. 01/12)

Design Criteria

ADA Accessibility Guidelines July 2004 as adopted with amendments by the USDOT under 49 CFR Part 37

Design Assumptions and Limitations

This Guiderail resists an equivalent Service Loading of 50 lbs./ft. acting simultaneously in the transverse and vertical direction when applied at the height of the Top Rail.

This Index is not approved for use on bridges. This railing is not applicable for shielding drop-off hazards for vehicular traffic. This railing is applicable for all cases where Florida Building Code permit is not required and pedestrian or bicyclist drop-off hazards do not exceed 5'-0". Refer to *PPM*, Volume 1, Chapters 4 & 8, for the definition of vehicular, pedestrian and bicyclist "drop-off hazards". This railing is also applicable for select uses on sidewalks within service areas and similar locations or maintenance areas where the drop off exceeds 5'-0".

Adequate foundation support for anchorage and stability against overturning must be provided. Design a site specific railing for unusual site conditions.

Indexes 870 and 880 are similar in form and function. Select which of these railings to use at a given site based on District preferences, aesthetic or finish color requirements, corrosion concerns, theft potential issues, fabrication issues, weight of railing and any other project specific requirements.

Plan Content Requirements

In the Structures and/or Roadway Plans:

Show Pipe Guiderail on sidewalks and walls as required. Designate locations where guiderails are required.

Include cross references to *Design Standards* Index 880 as appropriate.

Payment

Item number	Item description	Unit Measure
515-1-1	Pipe Handrail - Guiderail, Steel	LF

Index 5200 Precast Sound Barriers (Rev. 01/12)

Design Criteria

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

Design Assumptions and Limitations

See **SDG 3.16** for structural design criteria.

This Design Standard has not been designed for vehicle impact loads. If there is insufficient room to accommodate the sound barrier and required set back, use Index 5210 and/or 5211.

General Assumptions/Limitations:

- Elevation at the base of the wall is the same as the surrounding terrain.
- Foundations depths are calculated using Broms method for overturning.
- Post heights range from 12' to 22' in 1'-0" increments.
- Post Spacing is either 10' or 20'.
- Panels are designed for the 150 MPH wind speed (wind pressure = 52 psf) and a maximum panel height of 12'.
- Posts are designed for 110 MPH, 130 MPH and 150 MPH wind speeds.

Ensure system is constructible with consideration of overhead clearances (i.e. overhead services, tree canopies, existing overhead structures, etc.) and existing underground services along the entire length of barrier. Field stake wall alignment at 20'-0" spacing during the design process to locate potential conflicts or severe base elevation changes.

- If vertical clearance is limited, consider the low clearance post/foundation option and shorter panel heights. (minimum of 4'). Minimum vertical clearance for use of Standard designs is controlled by the height of the post plus the tallest required panel height and the panel lifting mechanism. Special construction and/or connection details may be required if vertical clearance is severely limited and is not covered by this Standard.
- If underground services/restrictions exist and make the use of an auger cast pile impractical, consider the use of spread footings at the affected locations. Special construction details for all special footings and required locations shall be included in the plans.
- If non-standard soils (N values less than 4 or greater than 40) are present within the project limits, special foundation designs may be required. If rock or very strong soils are encountered at shallow depths, project specific foundation designs are required. See Plan Content Requirements below.
- Consider the aesthetic and sound barrier qualities if the barrier or panel is to traverse a section with dramatic base elevation changes (drainage ditch crossings etc.).

Plan Content Requirements

Include the "Report of Core Borings" (Soil Information Data) on a separate sheet in the plans.

All non-standard sound barrier components such as spread footings, special foundations, posts, panels, etc. shall be fully detailed in the plans.

Drainage Holes: Locate wall drainage holes based on site requirements. Show drainage holes in the Control Drawings (including Type).

Fire Access Holes: Locate fire access holes at all existing and proposed hydrant locations. If fire access holes are required, consider marking the panel with the adjoining street name where the hydrant is located.

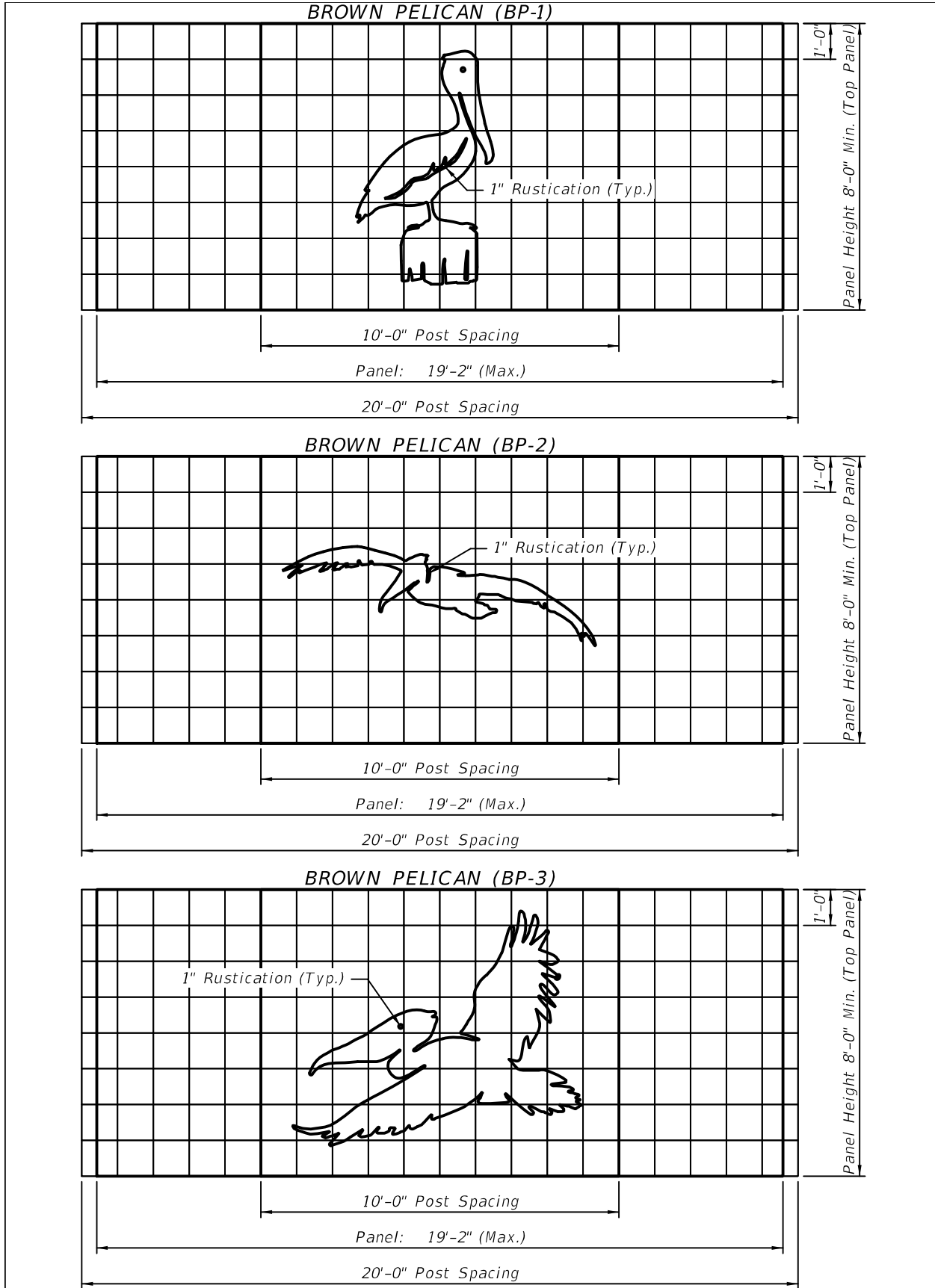
Anti-Graffiti Coating: Consider coating all publicly accessible portions of the wall panels and posts with an anti-graffiti coating (front and/or back of wall). See **SDM 4.4** for limits of anti-graffiti coatings. Tabulate limits of anti-graffiti shown on the "LIMITS OF ANTI-GRAFFITI COATING" Data Table. Specify "sacrificial", "non-sacrificial" or "water cleanable" coating system based on District Maintenance recommendations (See Pay Items). Anti-Graffiti Coating shall match the Class 5 Finish color.

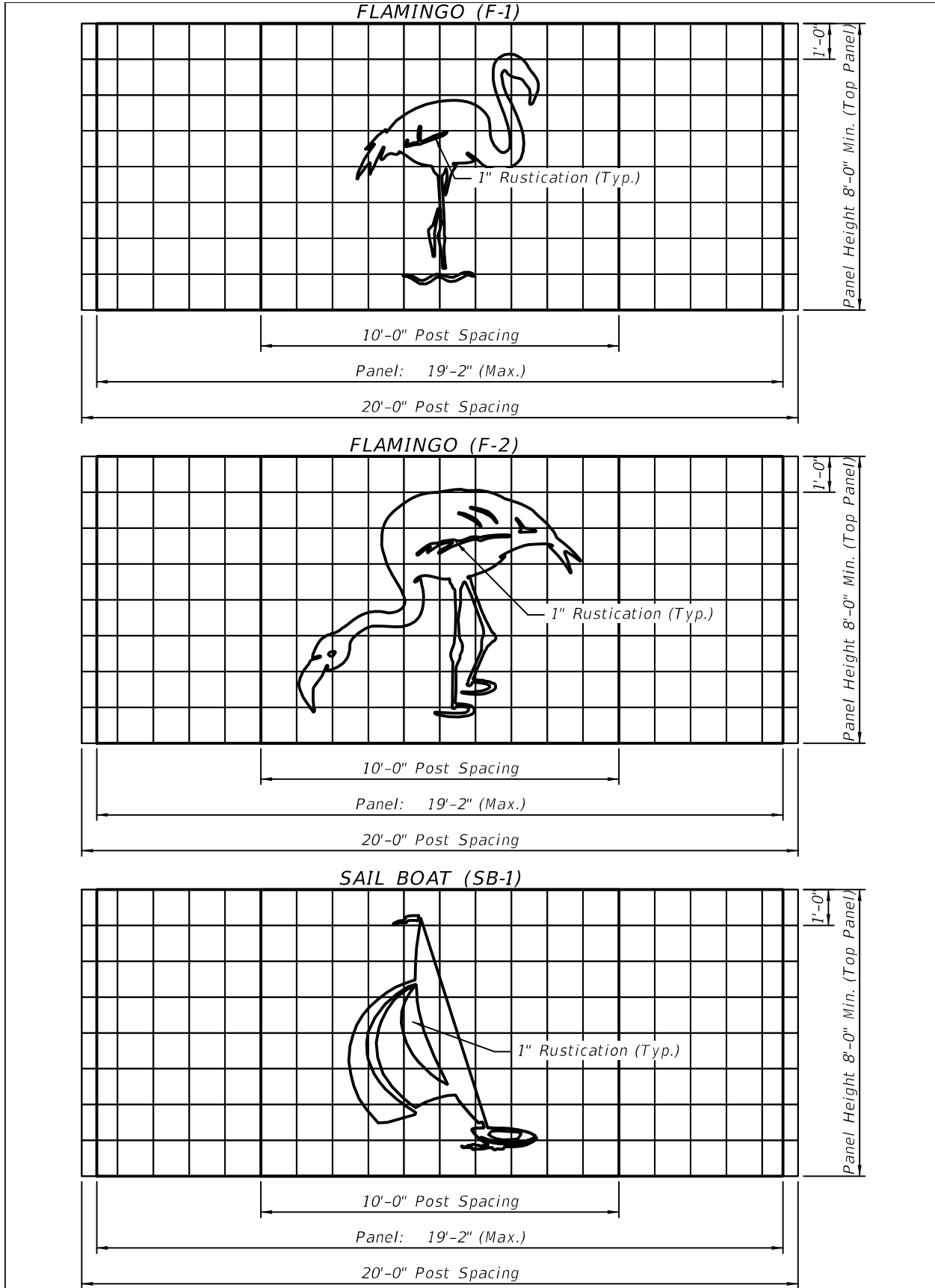
Wall Textures: Specify textures for the front and/or back face of wall. All textures except Type "H" may be used for either the back face or front face of the wall. The Type "H" texture is limited to the front face only. Textures on the front face shall be formed. If wall panels are cast horizontally, textures on the back face must be rolled or pressed, therefore random pattern types on the back face may be more suitable. If wall panels are cast vertically, textures on the back face will be formed, rolled or pressed. For flush face panel options, the textures on the back face may be limited to either "Broom" finish or Type "A" (smooth) finish due to the forming techniques of some manufactures. Type "A" (smooth) finish will provide a surface requiring less maintenance cleaning than that with a "Broom" finish.

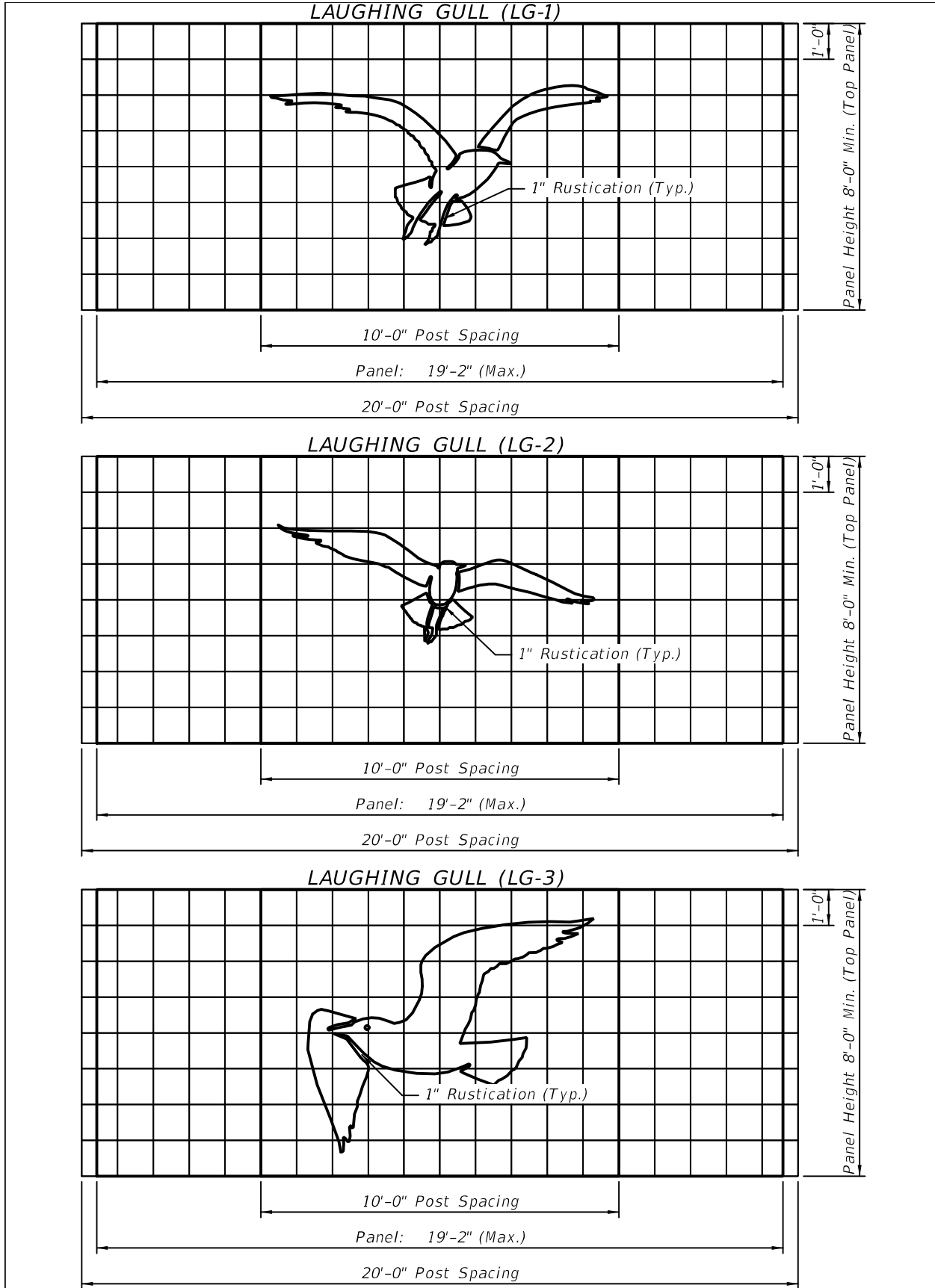
Graphics: When required for aesthetics, form wall graphics into the wall panels. Show all graphic locations in the Control Drawings.

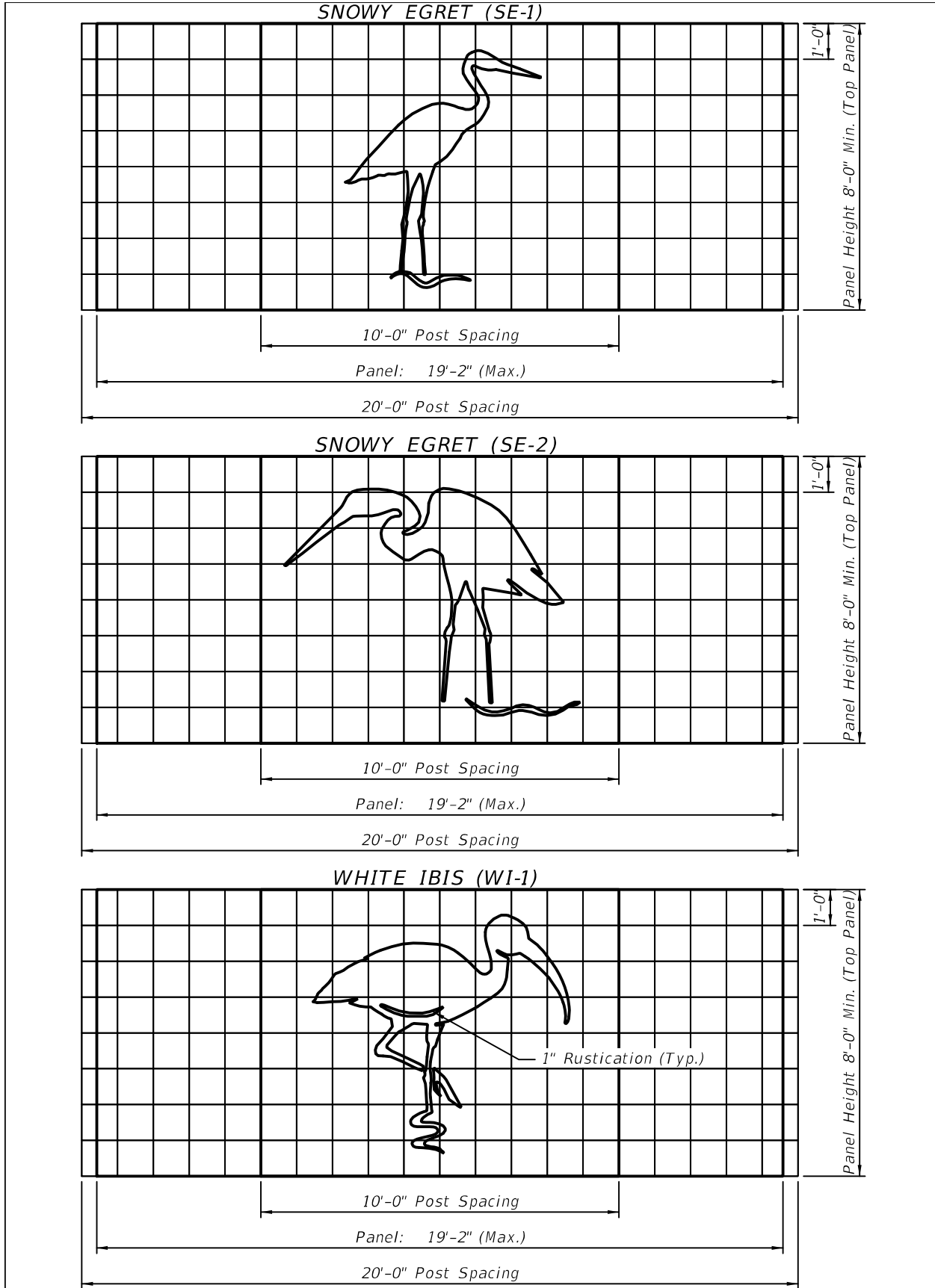
Prepare project specific graphics details when required using the Blank Grid Sound Barrier Graphics CADD cell and include them in the plans. Designate each individual project specific graphic with a unique name for identification and cross reference purposes.

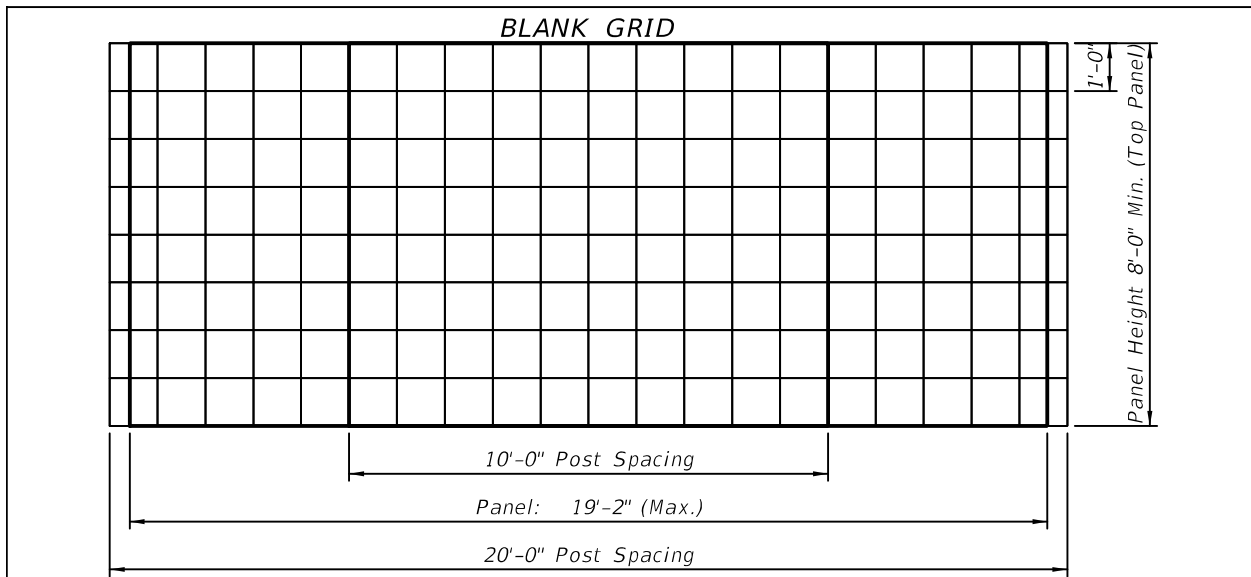
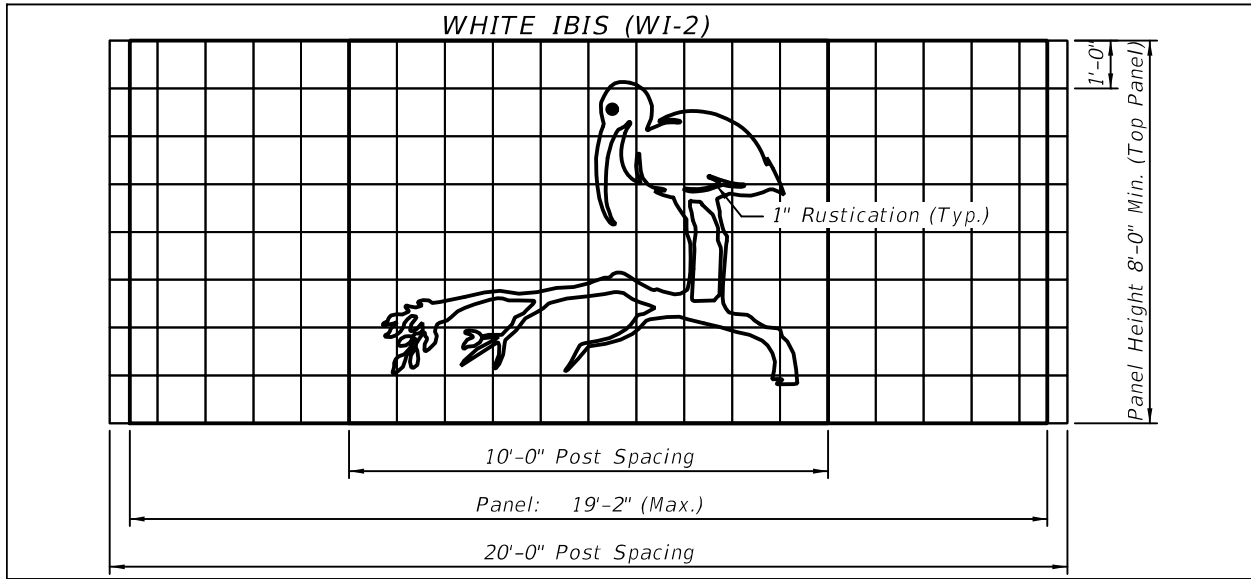
The following possible standard graphic options are available in the FDOT Structures Bar Menu (and/or CADD cell updates) as Sound Barrier Graphics CADD cells:











Using the Blank Grid shown above, the Designer may create other graphics as project requirements dictate. Designate each individual project specific graphic with a unique name for identification and cross-reference purposes. General considerations in creating graphics are as follows:

Wall graphics shall be simple and fully detailed in the plans.

Wall graphics should be as large as possible (approximately 8 ft. in height).

Local community input should be considered when determining graphic types.

Post Caps: Indicate in the "PROJECT AESTHETIC REQUIREMENTS" Data Table if Post Caps are required. Only consider Post Caps when enhanced aesthetics are necessary.

Guardrails and delineators may be required at the back face of wall along local streets.

Prepare Control Drawings containing the following information and include them in the plans.

Plan View

- Sound Barrier Alignment / Location
- Begin/End Sound Barrier Stationings and Offsets
- Offset definition, usually from baseline to front face of Sound Barrier
- Step Locations
- Fire Access Hole Stations
- Drainage Hole Stations
- Adjacent Overhead or In-ground Services
- Limits of sod or seeding/topsoil application
- Emergency access doors - min 6' high by 3' wide (if required)
- Where removal of or improvements to organic soils are necessary, show the limits of organic soils and the limits of required improvements in the plans along with removal/improvement methods and method of payment.

Elevation

- Ground line Elevations
- Top of Sound Barrier Elevations
- Bottom of Sound Barrier Elevations
- Fire Access Holes
- Drainage Holes (Including type)
- Adjacent Overhead or In-ground Services
- Locations and names of Sound Barrier Graphics
- Limits of Anti-graffiti coating (if required)
- Emergency access doors (if required)

Complete the following Data Tables and include them in the plans. See [Introduction I.3](#) for more information regarding use of Data Tables.

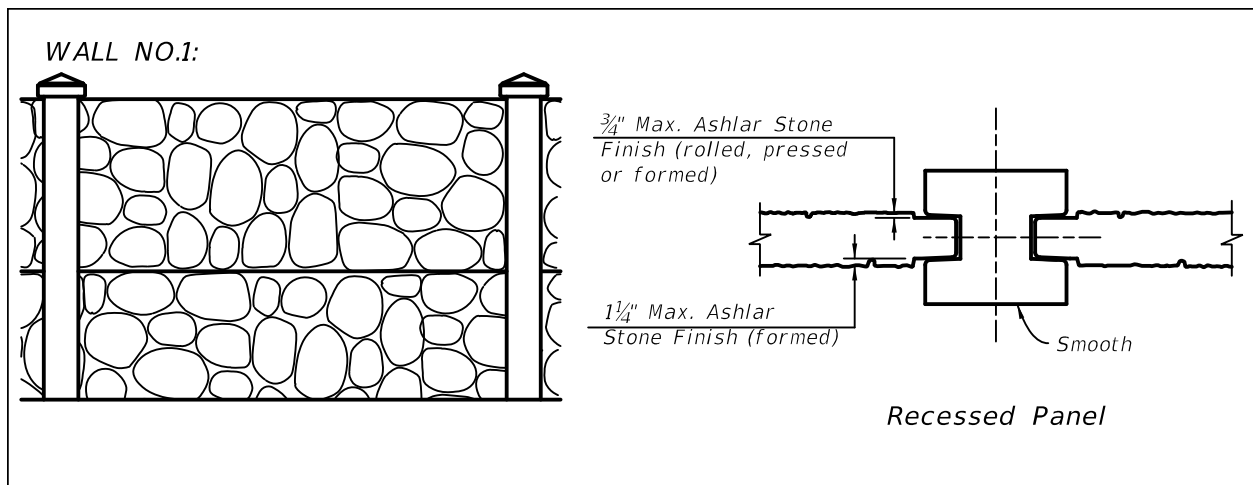
In the FOUNDATION column of the "SUMMARY OF FOUNDATIONS AND WALL QUANTITIES" enter either "1" for Medium Dense Granular Soils (SPT N values between 10 and 40), "2" for Loose Granular Soils (SPT N values between 4 and 9) or "SD" for Special Design. Use "1" for the majority of foundations (SPT values between 10 and 40). Use "2" only if soil conditions warrant (SPT values between 4 and 9) and "SD" only when required.

Payment

Item number	Item description	Unit Measure
534-72-101	Concrete Sound Barrier, Permanent	SF
534-72-102	Concrete Sound Barrier, Temporary	SF

Example

Wall No. 1 is located in a 130 MPH zone. Aesthetics require a recessed panel type wall with Type C post caps. The front and back face panel textures are to be Ashlar Stone. The post texture is to be smooth. The wall will not have any graphics. The color of the wall, posts and caps is to be a light brown, (color number 33446).



Wall No. 2 is to be located in an interior County with 110 MPH wind requirements. Aesthetics require a flush panel type wall. The front face of panels and posts are to be Trapezoid Vertical Fins with Fractured Face (Colorado Drag), with graphics. The Back Face Panel texture is to be Pea Gravel. The color of the wall is to be light brown, color number 33446. Post caps are not required.

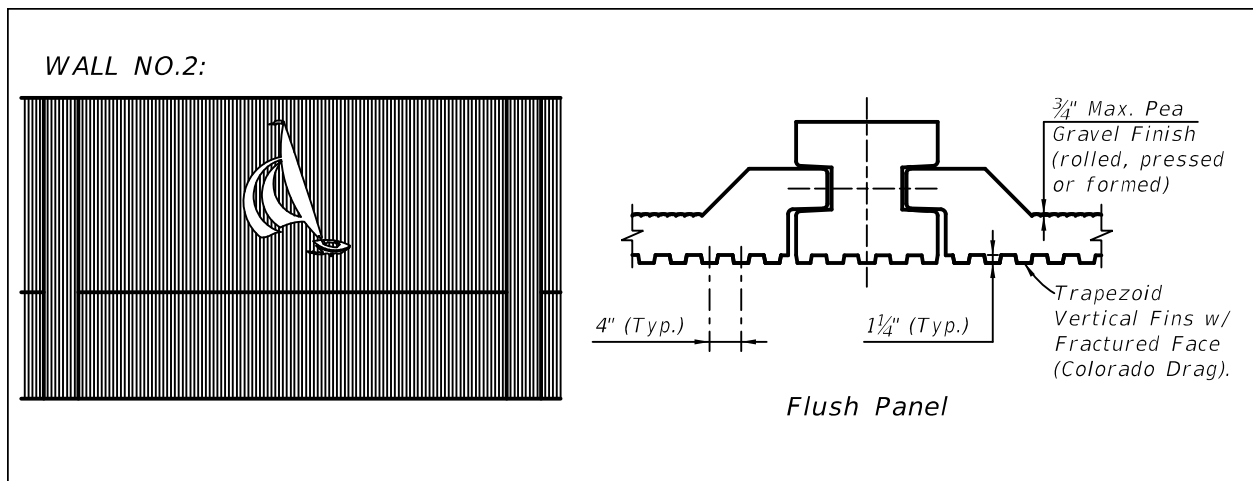


TABLE OF VARIABLES, CADD CELL 05200 "SOUND BARRIER DATA TABLE"

PROJECT REQUIREMENTS									Table Date 1-01-12
BARRIER NO.	WIND SPEED (MPH)	REQUIRED: (YES/NO)			REQUIRED TEXTURES:				PANEL TYPE (FLUSH/ RECESSED/ EITHER)
		GRAPHICS (1)	COLORED COATINGS (2)	PRECAST POST CAP (3)	PANELS:		POSTS:		
					FRONT FACE	BACK FACE	FRONT FACE	BACK FACE	
1	130	NO	YES	C	B	B	A	A	RECESSED
2	110	YES	YES	NO	H	F	H	A	FLUSH

- (1) See Control Drawings.
- (2) Coat all exposed faces of panels with Class 5 Applied Finish Coating. The color shall be per Federal Color Chart, Federal Standard No. 595C color 33446.
- (3) Coat post caps the same color as posts, with a Class 5 Applied Finish Coating. The color shall be per Federal Color Chart, Federal Standard No. 595C color 33446.

Index 5210 Traffic Railing/Sound Barrier (8'-0") (Rev. 01/12)

Design Criteria

NCHRP Report 350 TL-4; **NCHRP Report 663**; **AASHTO LRFD Bridge Design Specifications**, 5th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The Traffic Railing / Sound Barrier (8'-0") is the basic non-proprietary crash tested traffic railing / sound barrier combination for use on FDOT bridges and retaining walls. It can also be used for ground mounted applications within the clear zone when used in conjunction with the foundations presented in Indexes 5212, 5213 and 5214. This railing is first and foremost a traffic railing that also serves as a sound barrier. To preserve the crashworthiness of the design, this railing must be used in accordance with the requirements of **SDG** 6.7 for all applications.

For bridge applications, design bridge decks supporting Traffic Railing / Sound Barriers (8'-0") in accordance with the requirements of **SDG** 4.2. For bridge decks up to a maximum thickness of 9", the two Bars 5S1 placed in the bridge deck may substitute for the longitudinal deck steel located within the limits of Bars 5V, provided that the total area of longitudinal deck steel beneath the railing, as required by calculation, is not reduced.

For retaining wall applications (Index 5212), resistance for overturning is calculated using a point of rotation located at the outside face of retaining wall. A special design may be required if bearing conditions between the junction slab and retaining wall warrant consideration for an alternate point of rotation. See NCHRP Report 663 for more information.

Form liners providing a textured finish are permitted on the outside face of the Traffic Railing / Sound Barrier (8'-0") with the following provisions: (1) The maximum amplitude of the form liner on the lower 2'-8" section shall be limited to 1" depth; (2) Any form liner used above 2'-8", must provide a thickened concrete section to maintain 2" cover. Full details of this thickened section and the form liner shall be provided in the plans. Form liners complying with the requirements of **SDG** 6.7 are allowed on the upper vertical portion of the inside face of the Traffic Railing / Sound Barrier but are not recommended.

When the Traffic Railing / Sound Barrier (8'-0") terminates on the bridge, the End Taper shall be located at an open joint. When the Traffic Railing / Sound Barrier (8'-0") terminates on the Approach Slab, the End Taper shall terminate at Begin or End Approach Slab as shown.

Indexes 6011, 5212, 5213, 5214, 5215, 20900 and 20910 contain details for the use of Traffic Railing / Sound Barriers (8'-0") on retaining walls, approach slabs and footings.

Project specific details are required for the use of 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers on footings. Base these details on Indexes 5210 and 5211.

For treatment of Traffic Railing / Sound Barriers (8'-0") on skewed bridges see [Index 420](#).

Details are available for increasing the crashworthiness of this Traffic Railing / Sound Barrier to **NCHRP Report 350** Test Level 5. Contact the Structures Design Office for more information.

Plan Content Requirements

In the Structures Plans:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the superstructure environment classification. See **SDG** 1.4.

Show and label the Traffic Railing / Sound Barrier (8'-0") on the Plan and Elevation, Typical Section, Superstructure, Approach Slab and Finish Grade Elevations Cross Section sheets, Retaining Wall Control Drawings, and other sheets as required. Include cross references to **Design Standards** Index 5210 and 20900 or 20910 as appropriate.

When the Traffic Railing / Sound Barrier (8'-0") ends on a bridge, provide an End Taper and terminate the low end of the End Taper at an open joint in the traffic railing, preferably at the end of a span. Continue the bridge mounted traffic railing along the remainder of the bridge.

When the Traffic Railing / Sound Barrier (8'-0") ends on an Approach Slab, provide an End Taper and terminate the low end of the End Taper at Begin or End Approach Slab. Provide an Index 400 Detail J Guardrail Approach Transition, Index 410 Concrete Barrier Wall or crash cushion at the low end of the End Taper.

On the Superstructure section sheets, show the two Bars 5S1 placed in the bridge deck within the Bars 5V along with the rest of the deck steel.

All concrete and Bars 5P, 5R, 5S and 5V required to construct the Traffic Railing / Sound Barrier are included in the Estimated Traffic Railing Quantities. Do not include Traffic Railing / Sound Barrier concrete in the estimated concrete quantities, or Bars 5P, 5R, 5S and 5V in the reinforcing bar lists and estimated reinforcing steel quantities for supporting bridge decks, approach slabs or retaining walls.

In the Roadway or Structures Plans when the Traffic Railing / Sound Barrier (8'-0") is used on retaining walls:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the retaining wall environment classification. See **SDG** 1.4.

Show and label the Traffic Railing / Sound Barrier (8'-0") on the Retaining Wall Control Drawings, and other sheets as required. Include cross references to **Design Standards** Index 5210 and 5212 and/or 6100 Series as appropriate.

For Index 5212, show and label the junction slab as either TYPE 1 or TYPE 2, based on the required width for stability. Determine the appropriate TYPE using Table 1 below. Project specific designs may be required for locations exceeding the listed design parameters.

When the Traffic Railing / Sound Barrier (8'-0") ends on a retaining wall, provide an End Taper and terminate the low end of the End Taper at an open joint in the traffic railing. Continue the retaining wall mounted traffic railing along the remainder of the retaining wall.

Table 1 Junction Slab Selection

Wind Speed (mph)	Retaining Wall Height (ft)	Junction Slab Width (ft)
110	≤ 50	5 ft. (TYPE 1)
130	≤ 50	5 ft. (TYPE 1)
150	≤ 50	6 ft. (TYPE 2)

In the Roadway Plans when the Traffic Railing / Sound Barrier (8'-0") is used for ground mounted applications:

In the Materials Note on the General Notes Sheet, specify the concrete class in accordance with the substructure or retaining wall environment classification. See **SDG 1.4**.

Show and label the Traffic Railing / Sound Barrier (8'-0") on the Plan and Profile, Cross Section and other sheets as required. Include cross references to **Design Standards** Index 5210, 5213, 5214 and 5215 as appropriate.

When the approach end of the Traffic Railing / Sound Barrier (8'-0") ends along the roadway within the clear zone, use one of the following treatments:

- Provide an End Taper and Index 400 Detail J Guardrail Approach Transition, Index 410 Concrete Barrier Wall or crash cushion at the low end of the End Taper.
- Flare the full height Traffic Railing / Sound Barrier (8'-0") out beyond the clear zone. Flare rates vary based on both design speed and highway application (i.e., Interstate, urban or rural installations). See **Design Standards** and **PPM** for applicable flare rates.
- Terminate the full height Traffic Railing / Sound Barrier (8'-0") within the clear zone and shield the end with a wide crash cushion. Ensure the traffic face of the wide crash cushion is offset at least 24-inches from vertical face of Traffic Railing / Sound Barrier (8'-0").

When the trailing end of the Traffic Railing / Sound Barrier (8'-0") ends along the roadway within the clear zone of adjacent traffic, and the trailing end is not within the clear zone of opposing traffic, the Traffic Railing / Sound Barrier (8'-0") can remain full height all the way to the end or the End Taper can be used. Provide Index 400 Guardrail or Index 410 Concrete Barrier Wall as required to shield hazards beyond the end of the Traffic Railing/Sound Barrier.

Include project specific details for 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers.

Payment

Item number	Item description	Unit Measure
521-5-20	Concrete Traffic Railing-Bridge, F Shaped With Sound Barrier Wall 8' Height	LF
521-7-1	Concrete Traffic Railing Barrier Retaining Wall System, F Shape With Sound Barrier Wall, 8' Height	LF
521-72-20	Shoulder Concrete Barrier Wall, F Shaped, With 8' Sound Wall	LF
521-72-21	Shoulder Concrete Barrier Wall, F Shaped, With 10' Sound Wall	LF
521-72-22	Shoulder Concrete Barrier Wall, F Shaped, With 12' Sound Wall	LF
521-72-23	Shoulder Concrete Barrier Wall, F Shaped, With 14' Sound Wall	LF

Index 5211 Traffic Railing/Sound Barrier (14'-0")

Design Criteria

NCHRP Report 350 TL-4; ***AASHTO LRFD Bridge Design Specifications***, 4th Edition; ***Structures Design Guidelines (SDG)***

Design Assumptions and Limitations

The Traffic Railing / Sound Barrier (14'-0") is a non-proprietary traffic railing / sound barrier combination that is based on the crash tested Traffic Railing / Sound Barrier (8'-0"). It can only be used for ground mounted applications, usually within the clear zone, and cannot be used on bridges or retaining walls. This railing is first and foremost a traffic railing that also serves as a sound barrier. To preserve the crashworthiness of the design, this railing must be used in accordance with the requirements of ***SDG*** 6.7 for all applications.

Work this Standard Index 5210 - Traffic Railing / Sound Barrier (8'-0") and one or more of the following:

Index 5213 - Traffic Railing / Sound Barrier T-Shaped Spread Footing,
Index 5214 - Traffic Railing / Sound Barrier L-Shaped Spread Footing or
Index 5215 - Traffic Railing / Sound Barrier Trench Footing

Form liners providing a textured finish are permitted on the outside face of the Traffic Railing / Sound Barrier (14'-0") with the following provisions: (1) The maximum amplitude of the form liner on the lower 2'-8" section shall be limited to 1" depth; (2) Any form liner used above 2'-8", must provide a thickened concrete section to maintain 2" cover. Full details of this thickened section and the form liner shall be provided in the plans. Form liners complying with the requirements of ***SDG*** 6.7 are allowed on the upper vertical portion of the inside face of the Traffic Railing / Sound Barrier but are not recommended.

Project specific details are required for the use of 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers on footings. Base these details on Indexes 5210 and 5211.

Plan Content Requirements

In the Roadway Plans when the Traffic Railing / Sound Barrier (14'-0") is used for ground mounted applications:

In the Materials Note on the General Notes Sheet, specify the use of Class II or IV concrete in accordance with the substructure or retaining wall environment classification. See ***SDG*** 1.4.

Show and label the Traffic Railing / Sound Barrier (14'-0") on the Plan and Profile, Cross Section and other sheets as required. Include cross references to ***Design Standards*** Index 5211 and 5212, 5213, 5214 and 5215 as appropriate.

When the approach end of the Traffic Railing / Sound Barrier (14'-0") ends along the roadway within the clear zone, use one of the following treatments:

- Provide a Traffic Railing / Sound Barrier (8'-0") End Taper adjacent to the Traffic Railing / Sound Barrier (14'-0") End Taper. Continue the footing for Traffic Railing/Sound Barrier (14'-0") End Taper as the foundation for the Traffic Railing/Sound Barrier (8'-0") End Taper. Provide an Index 400 Detail J Guardrail Approach Transition, Index 410 Concrete Barrier Wall or crash cushion at the low end of the Traffic Railing / Sound Barrier (8'-0") End Taper.
- Provide a Traffic Railing / Sound Barrier (8'-0") End Taper adjacent to the full height Traffic Railing / Sound Barrier (14'-0"). Continue the footing for Traffic Railing/Sound Barrier (14'-0") as the foundation for the Traffic Railing/Sound Barrier (8'-0") End Taper. Provide an Index 400 Detail J Guardrail Approach Transition, Index 410 Concrete Barrier Wall or crash cushion at the low end of the Traffic Railing / Sound Barrier (8'-0") End Taper.
- Flare the full height Traffic Railing / Sound Barrier (14'-0") out beyond the clear zone. Flare rates vary based on both design speed and highway application (i.e., Interstate, urban or rural installations). See **Design Standards** and **PPM** for applicable flare rates.
- Terminate the full height Traffic Railing / Sound Barrier (14'-0") within the clear zone and shield the end with a wide crash cushion. Ensure the traffic face of the wide crash cushion is offset at least 24-inches from vertical face of Traffic Railing / Sound Barrier (14'-0").

When the trailing end of the Traffic Railing / Sound Barrier (14'-0") ends along the roadway within the clear zone of adjacent traffic, and the trailing end is not within the clear zone of opposing traffic, the Traffic Railing / Sound Barrier (14'-0") can remain full height all the way to the end or the End Taper can be used. Provide Index 400 Guardrail or Index 410 Concrete Barrier Wall as required to shield hazards beyond the end of the Traffic Railing / Sound Barrier.

Include project specific details for 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers.

Payment

Item number	Item description	Unit Measure
521-72-23	Shoulder Concrete Barrier Wall, F Shaped, With 14' Sound Wall	LF

Index 5212 Traffic Railing/Sound Barrier (8'-0") Junction Slab

Design Criteria

See Instructions for [Index 5210](#).

Design Assumptions and Limitations

Use this Standard with Index 5210 when the Traffic Railing / Sound Barrier (8'-0") is installed on a retaining wall.

Plan Content Requirements

See Instructions for [Index 5210](#).

Payment

Item number	Item description	Unit Measure
521-7-1	Concrete Traffic Railing Barrier Retaining Wall System, F Shape With Sound Barrier Wall, 8' Height	LF

Index 5213 Traffic Railing/Sound Barrier T-Shaped Spread Footing

Design Criteria

See Instructions for [Index 5210](#) and/or [Index 5211](#).

Design Assumptions and Limitations

Use this Standard with Index 5210 and/or 5211 when the Traffic Railing / Sound Barrier (8'-0") and/or (14'-0") is installed on a T-Shaped spread footing.

Project specific details are required for the use of 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers. Base these details on Indexes 5210 and 5211.

Plan Content Requirements

See Instructions for [Index 5210](#) and/or [Index 5211](#).

Include project specific details for 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers.

Payment

Item number	Item description	Unit Measure
521-72-20	Shoulder Concrete Barrier Wall, F Shaped, With 8' Sound Wall	LF
521-72-21	Shoulder Concrete Barrier Wall, F Shaped, With 10' Sound Wall	LF
521-72-22	Shoulder Concrete Barrier Wall, F Shaped, With 12' Sound Wall	LF
521-72-23	Shoulder Concrete Barrier Wall, F Shaped, With 14' Sound Wall	LF

See also Instructions for [Index 5210](#) and/or [Index 5211](#).

Index 5214 Traffic Railing/Sound Barrier L-Shaped Spread Footing

Design Criteria

See Instructions for [Index 5210](#) and/or [Index 5211](#).

Design Assumptions and Limitations

Use this Standard with Index 5210 and/or 5211 when the Traffic Railing / Sound Barrier (8'-0") and/or (14'-0") is installed on a L-Shaped spread footing.

Project specific details are required for the use of 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers. Base these details on Indexes 5210 and 5211.

Plan Content Requirements

See Instructions for [Index 5210](#) and/or [Index 5211](#).

Include project specific details for 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers.

Payment

Item number	Item description	Unit Measure
521-72-20	Shoulder Concrete Barrier Wall, F Shaped, With 8' Sound Wall	LF
521-72-21	Shoulder Concrete Barrier Wall, F Shaped, With 10' Sound Wall	LF
521-72-22	Shoulder Concrete Barrier Wall, F Shaped, With 12' Sound Wall	LF
521-72-23	Shoulder Concrete Barrier Wall, F Shaped, With 14' Sound Wall	LF

See also Instructions for [Index 5210](#) and/or [Index 5211](#).

Index 5215 Traffic Railing/Sound Barrier Trench Footing

Design Criteria

See Instructions for [Index 5210](#) and/or [Index 5211](#).

Design Assumptions and Limitations

Use this Standard with Index 5210 and/or 5211 when the Traffic Railing / Sound Barrier (8'-0") and/or (14'-0") is installed on a trench footing.

Project specific details are required for the use of 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers. Base these details on Indexes 5210 and 5211.

Plan Content Requirements

See Instructions for [Index 5210](#) and/or [Index 5211](#).

Include project specific details for 10'-0" and 12'-0" tall Traffic Railing / Sound Barriers.

Payment

Item number	Item description	Unit Measure
521-72-20	Shoulder Concrete Barrier Wall, F Shaped, With 8' Sound Wall	LF
521-72-21	Shoulder Concrete Barrier Wall, F Shaped, With 10' Sound Wall	LF
521-72-22	Shoulder Concrete Barrier Wall, F Shaped, With 12' Sound Wall	LF
521-72-23	Shoulder Concrete Barrier Wall, F Shaped, With 14' Sound Wall	LF

See also Instructions for [Index 5210](#) and/or [Index 5211](#).

Index 6010 C-I-P Cantilever Retaining Wall

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

Use this standard with Indexes 6100 and 6200 Series as appropriate.

The Retaining Wall Standard Drawings consist of **Design Standards** Index 6010 and companion Data Tables, located in the FDOT Structures Bar Menu as MicroStation CADD cells. These Standard Drawings are intended to work in conjunction with each other and the **LRFD** Retaining Wall Program, developed by the Structures Design Office.

Design assumptions used in the development of the Standard Drawings may be found in 'Retaining Wall Notes' within the Program. The Standard Drawings and Program are intended for C-I-P cantilever retaining walls only, not abutments. At a minimum, the EOR should consider the applicability of the following: overall stability, settlement and seismic loading.

The Engineer of Record (EOR) shall be responsible for the Retaining Wall Design in its entirety. The EOR should complete and/or alter the Standard Drawings to suit the particular design. The EOR should consider the appropriateness of the use of the Standard Drawings and Program if the particulars of the design conflict significantly with the assumptions used in the development of the Standard Drawings.

The Standard Drawings are intended to work in conjunction with Retaining Wall Control Drawings located within the Plans. The Control Drawings should define geometrics, locations and other specifics of the Retaining Wall such that when used in conjunction with the Standard Drawings, the Contractor has sufficient information for construction.

Table 6010-1 Durability Requirements for Applicable FDOT Wall Type

Applicable FDOT Wall Types	Durability Requirements		
	Concrete Cover (in.)*	Concrete Class	Pozzolan Additions (Y/N)**
Type 1A	2	II	No
Type 1B	2	IV	No
Type 1C	3	IV	No
Type 1D	3	IV	Yes

* See SDG for concrete cover requirements for external surfaces cast against earth.

** See SDG 1.4.3.G

Plan Content Requirements

See [PPM](#) Vol. 1, Chapter 30 for more information.

Prepare Control Drawings containing the following information and include them in the plans.

Plan View

- Wall Location
- Begin/End Wall Stationing and Offset
- Wall Joint/Expansion Joint Stationing and Offset
- Offset definition, usually from baseline to front face of wall
- Step Locations

Elevation

- Top/Bottom of Footing Elevation
- Ground line Elevation
- Top of Wall Elevation
- Top of Barrier Elevation

The Program outputs five text files:

- retwall_line1.txt
- retwall_line2.txt
- retwall_line3.txt
- retwall_line4.txt
- retwall_line5.txt

These five text files correspond sequentially to the five Retaining Wall Data tables contained in the companion Data Tables for Index 6010. Complete these data tables using the five text files and include the Data Tables in the plans. Complete the Notes and add/modify/delete as necessary. See [Introduction I.3](#) for more information regarding use of Data Tables.

The text files can be inserted into the tables by using the 'Include' Key-In Utility in MicroStation at the active points in each table. True Type Font, 'FDOT Mono' must be used to align inserted text with table columns.

Payment

Item number	Item description	Unit Measure
400-2-11	Concrete Class II, Retaining Walls	CY
400-4-11	Concrete Class IV, Retaining Walls	CY
415-1-3	Reinforcing Steel - Retaining Wall	LB

Commentary: See Instructions for Design Standards Index 6100 Series for Traffic Railing/Junction Slab Pay Items as required.

Retaining Wall quantities shall not include concrete nor reinforcing steel for Traffic Railings. Traffic Railing (including Bars 5V) shall be paid for under Concrete Traffic Railing (Bridge).

Index 6011 C-I-P Gravity Wall (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; ***Structures Design Guidelines (SDG)***

Design Assumptions and Limitations

Index 6011 has been developed as a self-contained standard having pre-designed wall sections; therefore, no additional reinforcing list is required in the Contract Plans.

Gravity walls are generally most efficient when the difference in height between the ground levels is less than 5 feet. If the difference in height between ground levels is greater than 5 feet, other wall types or project specific designs are required.

Gravity wall design is based on the following soil criteria which covers the majority of soil types found in Florida:

Classification = Cohesion less (Fine Sand)

Friction Angle = 30 Degrees

Moist Unit Weight of Backfill = 120 lbs./cu. ft.

Presumptive Allowable Bearing Pressure:

= 2,500 psf for slopes equal to or flatter than 1:1½

= 3,300 psf for slopes steeper than 1: 1½.

Corrected SPT Blow Count for foundation = 10 blows/ft.

(average value within the range of depth from the base of wall to 2.0 x base width below wall).

Max. Seasonal High Water Table (SHWT) is one (1) foot below the horizontal ground surface at the toe of the wall, except as noted.

In cases where the Designer considers the soil at the specific site location to be of lesser strength, an analysis is required to verify that sliding, bearing, overturning and stability requirements are satisfied.

Overall stability of the wall shall be analyzed when the backfill slope exceeds 1:2 (vert.:horiz.) or the seasonal high water (SHW) is less than 2 ft. below the ground surface.

Stability of the slope above the top of the gravity wall shall be analyzed for slopes steeper than 1:2 (vert. : horiz.) with a minimum Factor of Safety = 1.3.

For Scheme 1 or Scheme 2, when a roadside barrier is required above the wall (guardrail, barrier wall, etc.) the deflection space required for the barrier must be considered. Locate the barrier so that there is no conflict between guardrail posts or barrier footing and the gravity wall or soil reinforcement. This may result in an offset greater than the minimum offset for the live load limit.

Plan Content Requirements

See **PPM** Vol. 1, Chapter 30 for more information.

In the Structures or Roadway Plans:

Add any aesthetic requirements (e.g. coordinating appearance of exposed surface with adjacent walls) to the General Notes.

Prepare Control Drawings containing the following information and include them in the plans:

Plan View*

1. Wall Location;
2. Begin/End Wall Stationing and Offset;
3. Offset definition, usually from the baseline to the front face of the wall;
4. Reference to "Index 6011 C-I-P Gravity Wall" and Wall Scheme (Scheme 1, Scheme 2 or Scheme 3) in accordance with that shown on the Design Standard.

Cross Sections (Roadway Plans only)

1. Base of Wall Elevation;
2. Existing Ground Line;
3. Proposed Ground Line;
4. Top of Wall Elevation;
5. Traffic Railing with Junction Slab (if Scheme 3 is required).

Elevation* (Wall Control Drawings)

1. Base of Wall Elevation at 25ft. intervals;
2. Existing Ground Line;
3. Proposed Ground Line Elevation;
4. Top of Wall Elevation at 25ft. intervals;
5. Top of Traffic Railing Elevation at 25ft. intervals (if Scheme 3 is required).

* Where Structures component of plan set is used, place these drawings in the Structures Plans, otherwise, include these drawings in the Roadway Plans. Elevation of wall may not be necessary for short walls or walls on constant grade.

Payment

Item number	Item description	Unit Measure
400-0-1	Concrete Class NS, Gravity Wall	CY

Commentary: See Instructions for Design Standards Index 6100 Series for Traffic Railing/Junction Slab Pay Items as required.

Commentary for Reviewers: Class NS Concrete - This class of concrete was determined to be appropriate for Index 6011 based on consultation with the Structures Design, Roadway Design, State Materials and Construction Offices in 2005 during the LRFD redesign. This class of concrete is an economical choice and structurally appropriate for a non-flexural (gravity) earth retention system.

Index 6020 Permanent MSE Retaining Wall Systems

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; **Structures Design Guidelines (SDG)**; AASHTO-AGC-ARTBA Task Force 27 (Ground Modification Techniques), **Insitu Soil Improvement Techniques**, January 1990.

Design Assumptions and Limitations

See the "Design Criteria" note on the Standard.

Plan Content Requirements

In the Structures or Roadway Plans:

Prepare Control Plans in accordance with the requirements of **PPM** Vol. 1, Chapter 30, and include them in the plans.

Complete the following Data Tables using the following instructions and include the Data Tables on the retaining wall supplemental detail sheets. See [Introduction I.3](#) for more information regarding use of Data Tables.

1. Complete the Notes and add/modify/delete as necessary.
2. List each wall in Note 3 separately, showing applicable wall systems.
3. Complete the "Geotechnical Information" table based on project soil conditions. See **SDG** Chapter 3 for required design based internal friction angle and unit weight of Reinforced Soil and Random Backfill.
4. Complete the "Retaining Wall Variables" and "Soil Reinforcement Lengths for External Stability" tables based on project requirements. The Wall Heights in the "Soil Reinforcement Lengths for External Stability" table refer to the height above the leveling pad, measured to the top of the wall coping. See **SDG** Chapter 3 Figures for details.
5. Transverse Differential Settlement is only applicable for widening of existing embankments.

PERMANENT MSE RETAINING WALL SYSTEM DATA TABLES

GEOTECHNICAL INFORMATION		Table Date 1-01-11				
		Reinforced Soil & Random Backfill	Loose Fine Sand	Firm Fine Sand	Loose Clayey Fine Sand	Firm Clayey Fine Sand
Depth Below Existing Ground Line (ft.)	Wall No. 1	---				
	Wall No. 2	---				
Effective Unit Weight (pcf)						
Cohesion (psf)		0				
Internal Friction Angle						

NOTE:
 If the unit weight and/or internal friction angle of the fill proposed by the Contractor differs from that shown above, the Project Engineer will contact both the District Geotechnical Engineer and the Wall Designer for a possible redesign.

RETAINING WALL VARIABLES		Table Date 1-01-11		
Wall No.	Wall Settlement			
	Long Term Settlement (in.)	Short Term Settlement (in.)	Differential Settlement	
			Longitudinal (%) (ft./100ft.)	Transverse (in.)
1			N/A	
2			N/A	

NOTE:
 Design walls for the settlements noted in the table.
 Long term settlement is measured from the end of wall fill placement.
 Transverse differential settlement is measured from the face of wall to the end of the soil reinforcement.

SOIL REINFORCEMENT LENGTHS FOR EXTERNAL STABILITY		Table Date 1-01-11										
Wall No. 1	Wall Height (ft.)											
	Reinforcement Length (ft.)											
	Factored Bearing Resistance (psf)											
Wall No. 2	Wall Height (ft.)											
	Reinforcement Length (ft.)											
	Factored Bearing Resistance (psf)											

NOTES:
 1. The reinforcement strap lengths shown above are the minimum lengths required for external stability. The reinforcement lengths used in the construction of the retaining walls will be the longer of that required for external or internal stability (determined by proprietary wall companies).
 2. The Factored Bearing Resistances shown above are the critical (lowest) values from all the load cases analyzed using LRFD methodology.

NOTES:

- Concrete facing panel surfaces treatment will be _____.
- If required, the soil reinforcement and fasteners for the abutment back wall will be designed and furnished by the proprietary wall company. The soil reinforcement will be designed to resist a factored horizontal load of _____ kips/ft. of back wall width. The cost of soil reinforcement and fasteners will be included in the cost of the Retaining Wall System.
- Applicable FDOT Wall Types for each wall location are listed below. See the Qualified Products List for approved Wall Systems and Design Standards Index No. 6020 for allowable Wall Type substitutions.
 Wall No. 1 - FDOT Wall Type _____
 Wall No. 2 - FDOT Wall Type _____
- Concrete for Coping and/or Junction Slab shall be Class _____ (f'c = _____ psi) with/without silica fume, metakaolin or ultrafine fly ash.
- See Design Standards Index, No. 6020 for General Notes and Details.

ESTIMATED QUANTITIES			
WALL NO.	ITEM	UNIT	QUANTITY
1	Retaining Wall System, Permanent, Excluding Barrier	SF	##
	Concrete Traffic Railing With Junction Slab (32" F-Shape)	LF	##
2	Retaining Wall System, Permanent, Excluding Barrier	SF	##
	Concrete Traffic Railing With Junction Slab (32" F-Shape)	LF	##

Payment

Item number	Item description	Unit Measure
548-12	Retaining Wall System, Permanent, Excluding Barrier	SF
548-14	Retaining Wall System, Permanent - Widening, Attached To Existing Wall	SF

Commentary: See Instructions for Design Standards Index 6100 Series for Traffic Railing/Junction Slab Pay Items as required.

Index 6030 Temporary MSE Retaining Wall Systems

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; **Structures Design Guidelines (SDG)**; AASHTO-AGC-ARTBA Task Force 27 (Ground Modification Techniques), Insitu Soil Improvement Techniques, January 1990.

Design Assumptions and Limitations

See the "Design Criteria" note on the Standard.

Plan Content Requirements

In the Structures or Roadway Plans:

Prepare Control Plans in accordance with the requirements of **PPM** Vol. 1, Chapter 30, and include them in the plans.

Complete the following Data Tables using the following instructions and include the Data Tables on the retaining wall supplemental detail sheets. See [Introduction I.3](#) for more information regarding use of Data Tables.

1. Complete the Notes and add/modify/delete as necessary.
2. Complete the "Geotechnical Information" table based on project soil conditions. See **SDG** Chapter 3 for required design based internal friction angle and unit weight of Reinforced Soil and Random Backfill.
3. Complete the "Retaining Wall Variables" and "Soil Reinforcement Lengths for External Stability" tables based on project requirements. The Wall Heights in the "Soil Reinforcement Lengths for External Stability" table refer to the height above the leveling pad, measured to the top of the wall coping. See **SDG** Chapter 3 Figures for details.

TEMPORARY MSE RETAINING WALL SYSTEM DATA TABLES

GEOTECHNICAL INFORMATION		Table Date 1-01-11				
		Reinforced Soil & Random Backfill	Loose Fine Sand	Firm Fine Sand	Loose Clayey Fine Sand	Firm Clayey Fine Sand
Depth Below Existing Ground Line (ft.)	Wall No. 1	—				
	Wall No. 2	—				
Effective Unit Weight (pcf)						
Cohesion (psf)		0				
Internal Friction Angle						

NOTES:

1. See the Qualified Products List for approved Wall Systems (FDOT Wall Type 3).
2. See Design Standards Index No. 6030 for General Notes and Details.

NOTE:

If the unit weight and/or internal friction angle of the fill proposed by the Contractor differs from that shown above, the Project Engineer will contact both the District Geotechnical Engineer and the Wall Designer for a possible redesign.

RETAINING WALL VARIABLES				Table Date 1-01-11
Wall No.	Wall Settlement			Air Contaminants Classification
	Long Term Settlement (in.)	Short Term Settlement (in.)	Differential Settlement (%) (ft./100ft.)	
1				
2				

NOTE:

Design walls for the settlements noted in the table.
 Long term settlement is measured from the beginning of wall construction.

ESTIMATED QUANTITIES			
WALL NO.	ITEM	UNIT	QUANTITY
1	Retaining Wall System, Temporary, Excluding Barrier	SF	##
2	Retaining Wall System, Temporary, Excluding Barrier	SF	##

SOIL REINFORCEMENT LENGTHS FOR EXTERNAL STABILITY										Table Date 1-01-11	
Wall No. 1	Wall Height (ft.)										
	Reinforcement Length (ft.)										
	Factored Bearing Resistance (psf)										
Wall No. 2	Wall Height (ft.)										
	Reinforcement Length (ft.)										
	Factored Bearing Resistance (psf)										

NOTES:

1. The reinforcement strap lengths shown above are the minimum lengths required for external stability. The reinforcement lengths used in the construction of the retaining walls will be the longer of that required for external or internal stability (determined by proprietary wall companies).
2. The Factored Bearing Resistances shown above are the critical (lowest) values from all the load cases analyzed using LRFD methodology.

Payment

Item number	Item description	Unit Measure
548-13	Retaining Wall System, Temporary, Excluding Barrier	SF

Index 6040 Precast Concrete Sheet Pile Wall

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

These piles are typically jetted into place rather than driven like a bearing pile. If shallow rock formations exist within the wall limits, other wall types must be considered.

A cast-in-place reinforced concrete bulkhead cap is required to structurally tie the tops of the concrete sheet piles together and to provide corrosion protection for the reinforcing and prestressing steel that extend from the tops of the piles.

These piles can be used for cantilevered walls or tie-backed walls. Project specific designs and details are required for tie-backs. If the length of piles required for a cantilevered wall exceeds the limits shown on the standard drawings, consider using tie-backs.

These piles can be used in all environments with the appropriate concrete admixtures.

The grouted keyway used in combination with plastic filter fabric (the limits of both are defined by dimension "X") are assumed to not be watertight. Thus they contain the soil behind the wall while still allowing groundwater behind the wall to weep through. No other separate weep holes are generally required. The bottom of the "X" dimension is required to be 1'-8" below the mud line.

The tip elevation of piles shall be determined by the Geotechnical Engineer.

See additional information on the Standard Drawing.

Plan Content Requirements

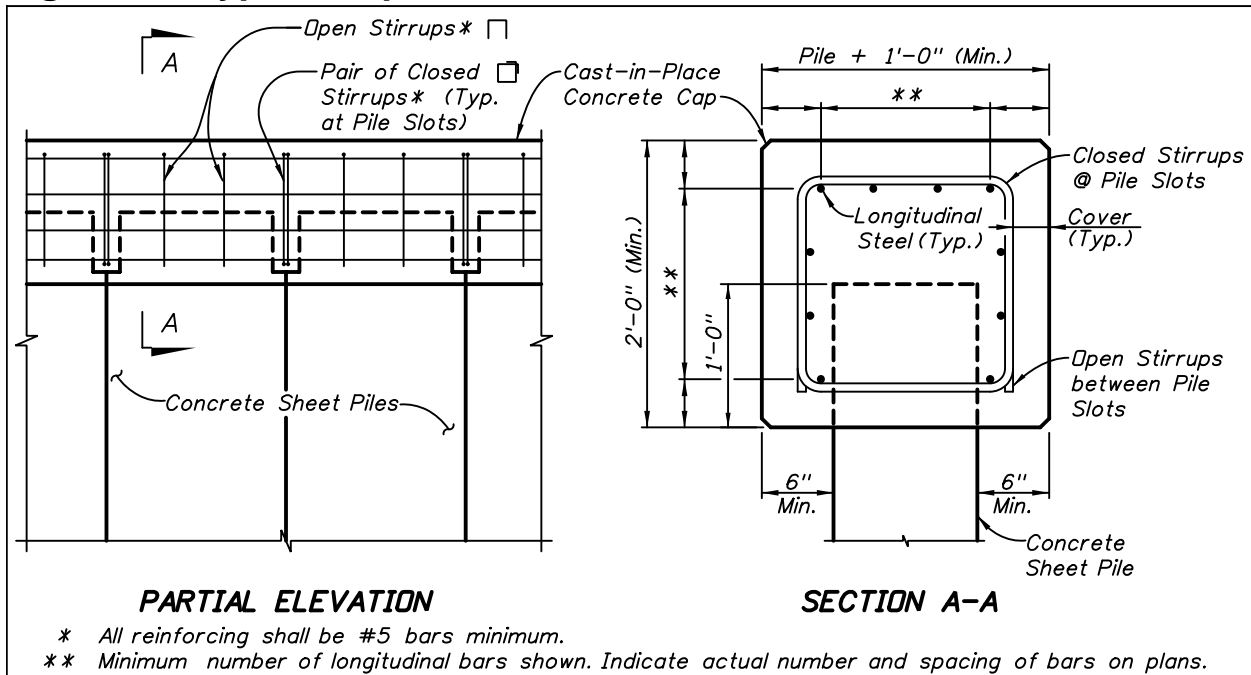
In the Structures or Roadway Plans:

Prepare Wall Control Drawings and related drawings as specified in **SDM** Chapter 19 and **PPM** Vol. 1, Chapter 30, and include them in the plans. Use combinations of straight and corner piles to accommodate project specific geometric requirements.

Show one Starter Pile location for a given wall. In the Elevation View, show the wall construction sequence proceeding away from the Starter Pile by locating the 11" by 11" corner clip on each Typical Pile on the side farthest away from the Starter Pile. Consider necessary tie-ins with adjacent structures when selecting the Starter Pile location.

Prepare project specific cast-in-place concrete bulkhead cap, tie-back and utility accommodation details and include them in the plans. See Figure 1 for typical cap details. In the Materials Note on the General Notes Sheet, specify the concrete class for the cast-in-place cap in accordance with the retaining wall environment classification. See **SDG** 1.4.

Figure 1 Typical Cap Details



Complete the following "Anchored Concrete Sheet Pile Data Table" or "Cantilever Concrete Sheet Pile Wall Data Table" as applicable and include it on the supplemental sheets. Complete the Notes and add/modify/delete as necessary. See [Introduction I.3](#) for more information regarding use of Data Tables.

Payment

Item number	Item description	Unit Measure
400-2-8	Concrete Class II, Bulkhead	CY
400-3-8	Concrete Class III, Bulkhead	CY
400-4-8	Concrete Class IV, Bulkhead	CY
415-1-8	Reinforcing Steel - Bulkhead	LB
415-2-8	Reinforcing Steel - Stainless, Bulkhead	LB
455-14-AA	Concrete Sheet Piling	LF

Index 6100 Series Wall Copings and Traffic Railings/Junction Slabs

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; **Structures Design Guidelines (SDG)**; **NCHRP Report 663**, Design of Roadside Barrier Systems Placed on MSE Retaining Walls

A combination MSE wall mounted, precast coping / cast-in-place traffic railing similar to the design included throughout this standard series was successfully crash tested at Terre Armee International (France). See report "Field Test of a "GBA" Safety Barrier Erected on a Reinforced Earth Wall", May, 1982.

Design Assumptions and Limitations

This Index Series provides recommended details of various conditions typically encountered at the interface of retaining walls and other components. Work this Index with project specific details for End Bents, drainage structures and other adjacent features, structures or components.

Plan Content Requirements

In the Structures or Roadway Plans:

Show details and/or cross-sections as required in the Plans. Include cross references to traffic/pedestrian railings heights and shapes, but do not reference the traffic/pedestrian railing Index numbers.

Commentary: Standard bridge traffic railings, when installed on junction slabs require modification to the reinforcement; therefore, do not include a reference to the associated traffic railing Index number, but instead, reference the Design Standards for the junction slab/traffic railing combinations within the Index 6100 Series. These Design Standards show the appropriate cross references to the bridge traffic railings and details for the modified reinforcing steel.

Although the reinforcement for the Index 820 pedestrian railing is similar to that shown within Index 6130, in order to allow for the precast option include a reference to Index 6130 only.

Payment

Item number	Item description	Unit Measure
521-6-3	Concrete Parapet, Retaining Wall Mounted with Sidewalk	LF
521-6-4	Concrete Parapet, Retaining Wall Mounted with Sidewalk and 8' Sound Wall	LF
521-7-1	Concrete Traffic Railing Barrier, Retaining Wall System, F Shape with Sound Barrier Wall, 8' Height	LF
521-8-AA	Concrete Traffic Railing Barrier With Junction Slab	LF

Index 11200 Multi-Column Ground Sign

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); **Structures Manual** Volume 9, FDOT Modifications to LTS-5; **Structures Manual Introduction**, I.6 References.

Design Assumptions and Limitations

See notes on the **Design Standard** and **Structures Manual Volume 9**.

The rectangular unidirectional slipbase sign support systems can be used where both posts are within a 7-foot span. Two-post systems with both posts within a 7-foot span must use posts with a mass of 18 lb/ft or less. Larger posts with masses up to 45 lb/ft may also be used as dual post systems but the posts must be more than 7 feet apart. In no case, however, should the total mass of all the sign posts above the slip-plane and below the hinge be greater than 600 pounds.

The following computer-based design programs available for use on the [Structures Design Office Website](#):

- FDOT Multi-Post 2001 Sign Program (current)
- FDOT Multi-Post Program (old)

Plan Content Requirements

See [PPM](#) Volume 1, Chapter 7.

Payment

Item number	Item description	Unit Measure
700-21-AB	Multi-Post Sign	AS

Index 11310 Cantilever Sign Structure

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5).; ***Structures Manual***, Volume 9, FDOT Modifications to LTS-5.; ***Structures Manual*** Introduction I.6 References; ***Structures Design Guidelines (SDG)***.

Design Assumptions and Limitations

The maximum span length of Cantilever Sign Structures is 50 feet. See the [PPM](#), Volume 1, Chapter 29 for additional information.

See notes on the ***Design Standard, Structures Manual Volume 9*** and ***SDG***.

Use this ***Design Standard*** in conjunction with the [FDOT Cantilever Overhead Sign Program](#).

Plan Content Requirements

See [PPM](#), Volume 1, Chapters 7 and 29.

Complete the appropriate Cantilever Sign Structures Data Table and include it in the plans. There is a choice of two tables, one for a sign structure with a flat slab foundation and the other for a sign structure with a drilled shaft foundation. Much of the data for inclusion in the table may be found in the FDOT Cantilever Overhead Sign Program output. Include Design Wind Speed and soils information. See [Introduction I.3](#) for more information regarding use of Data Tables.

Table for use with a Spread Footing Foundation:

CANTILEVER SIGN STRUCTURES DATA TABLE											Table Date 01-01-11			
SIGN NO.	STATION / OFFSET	DIMENSIONS				PANELS	MEMBER SIZES			BACKRAKE				
		A	B	C	N	D (CHORD)	E (WEB)	F (UPRIGHT)	G					
		ft	ft	in	in	#	O. D. x Wall Thk. (in)	Angle (in)	O. D. x Wall Thk. (in)	in				

NOTES:

- Design Wind Speed = mph
- Bolts (except Anchor Bolts) are

FOUNDATION NOTES:

- Design based on Borings taken sealed by
- Assumptions and Values used in design:
 Soil Type
 Soil Layer Thickness = ft.
 Soil Friction Angle = deg.
 Soil Weight = pcf
 Design Water Table is ft. below surface

NOTE - Work with Index 11310.

CANTILEVER SIGN STRUCTURES DATA TABLE (CONT.)																				Table Date 01-01-11			
SIGN NO.	GUSSET PLATES												TRUSS CONNECTION						SPLICE				
	GA	GB	GC	GD	GE	GF	GG	GH	GJ	GK	TA	TB	TC	TD	TE	TF	TG	TH	TJ	SA	SB	SC	SD
	in	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	in	in	in	in	in	Angle (in)	#	in	#

CANTILEVER SIGN STRUCTURES DATA TABLE (CONT.)																						Table Date 01-01-11				
SIGN NO.	BASE CONNECTION										ANCHOR		FOOTING DIMENSIONS								FOOTING REINF.				PED. REINF.	
	BA	BB	BC	BD	BE	BF	BG	BH	BJ	BK	FA	FB	FC	FD	FE	FF	FG	FH	FJ	FK	FL					
	in	#	in	in	ft	in	in	in	in	ft	in	ft	in	ft	in	ft	in	ft	in	size	size	size	size	in	# / Size	

Table for use with a Drilled Shaft Foundation:

CANTILEVER SIGN STRUCTURES DATA TABLE											Table Date 01-01-11			
SIGN NO.	STATION / OFFSET	DIMENSIONS				PANELS	MEMBER SIZES			BACKRAKE				
		A	B		C	N	D (CHORD)	E (WEB)	F (UPRIGHT)	G				
		ft	ft	in	in	#	O. D. x Wall Thk. (in)	Angle (in)	O. D. x Wall Thk. (in)	in				

NOTES:
 1. Design Wind Speed = mph
 2. Bolts (except Anchor Bolts) are

FOUNDATION NOTES:
 1. Design based on Borings taken sealed by
 2. Assumptions and Values used in design:
 Soil Type
 Soil Layer Thickness = ft.
 Soil Friction Angle = deg.
 Soil Weight = pcf
 Design Water Table is ft. below surface

NOTE - Work with Index 11310.

CANTILEVER SIGN STRUCTURES DATA TABLE (CONT.)																				Table Date 01-01-11			
SIGN NO.	GUSSET PLATES												TRUSS CONNECTION						SPLICE				
	GA	GB	GC	GD	GE	GF	GG	GH	GJ	GK	TA	TB	TC	TD	TE	TF	TG	TH	TJ	SA	SB	SC	SD
	in	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	in	in	in	in	in	Angle (in)	#	in	#

CANTILEVER SIGN STRUCTURES DATA TABLE (CONT.)														Table Date 01-01-11			
SIGN NO.	BASE CONNECTION										ANCHOR		FOOTING - DRILLED SHAFT				
	BA	BB	BC	BD	BE	BF	BG	BH	BJ	BK	FA	FB	FC	FD			
	in	#	in	in	ft	in	in	in	in	ft	in	ft	in	# / Size	ft	in	

ALTERNATE
 DRILLED SHAFT
 FOUNDATION

Payment

Item number	Item description	Unit Measure
700-23-ABC	Overhead Truss Cantilever Sign	AS

Index 11320 Span Sign Structure

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); ***Structures Manual*** Volume 9, FDOT Modifications to LTS-5; ***Structures Manual*** Introduction, I.6 References; ***Structures Design Guidelines (SDG)***.

Design Assumptions and Limitations

The maximum span length of Span Sign Structures is 250 feet. See the [PPM](#), Volume 1, Chapter 29 for additional information.

See notes on the ***Design Standard, Structures Manual***, Volume 9 and ***SDG***.

Use this ***Design Standard*** in conjunction with the [FDOT Span Overhead Sign Program](#).

Plan Content Requirements

See [PPM](#) Volume 1, Chapters 7 and 29.

Complete the Span Sign Structures Data Table and include it in the plans. Much of the data for inclusion in the table may be found in the FDOT Span Overhead Sign Program output. Include Design Wind Speed and soils information. See [Introduction I.3](#) for more information regarding use of Data Tables.

Payment

Item number	Item description	Unit Measure
700-22-ABC	Overhead Truss Span Sign	AS

Index 11860 Single Column Ground Signs

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); **Structures Manual** Volume 9, FDOT Modifications to LTS-5; **Structures Manual** Introduction, I.6 References.

Design Assumptions and Limitations

See notes on the **Design Standard** and **Structures Manual** Volume 9. See also **PPM** Volume 1, Chapters 7 and 29.

The rectangular unidirectional slipbase sign support system can be used with any single post up to a mass of 45 lb/ft. In no case, however, should the total mass of all the sign posts above the slip-plane and below the hinge be greater than 600 pounds.

Plan Content Requirements

See **PPM** Volume 2, Chapter 23. Include cross references to Design Standards Index 11860.

Payment

Item number	Item description	Unit Measure
700-20-ABC	Single Post Sign	AS

Index 11870 Single Post Bridge Mounted Sign Support (Rev. 01/12)

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); **Structures Manual** Volume 9, FDOT Modifications to LTS-5; **Structures Manual** Introduction, I.6 References; **Structures Design Guidelines (SDG)**.

Design Assumptions and Limitations

See notes on the **Design Standard** and **Structures Manual** Volume 9. See also **PPM** Volume 1, Chapters 7 and 29.

Limit the use of the Single Post Bridge Mounted Signs to Traffic Railings on Bridges and MSE walls where ground mounting is not feasible and signing cannot be placed outside of their limits.

Tabulated Maximum Sign Area, Dim A and Dim C, are based on Wind Speeds of 110 MPH, 130 MPH and 150 MPH at a bridge height of 75' above surrounding areas.

Sign Post clearance from front face of barrier is detailed to meet the maximum setback distance requirements of **SDG** 6.7.

Sign Supports have been detailed for placement on new or existing concrete traffic and pedestrian railings.

Undercut Anchors may be used in lieu of Adhesive bonded Anchors when approved by the DSDE and the State Structures Engineer, on a project-by-project basis. If approved, project specific details will be required in the plans. When using Undercut Anchors, the designer must submit a request to the District Specifications Office to use Developmental Specifications Dev 416 and Dev 937 for Post-installed Anchor Systems which includes provisions for both Adhesive Bonded Anchors and Undercut Anchors. See **SDG** 1.6 for more information.

Plan Content Requirements

See **PPM** Volume 2, Chapter 23. Include cross reference to Design Standards Index 11870 and show minimum distance from gutterline to bottom of the sign or sign cluster.

Payment

Item number	Item description	Unit Measure
700-20-AB	Single Post Sign	AS

Sign structures are included in the cost of the Sign under 700-20-AB.

Index 17502 High Mast Lighting

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); ***Structures Manual*** Volume 9, FDOT Modifications to LTS-5; ***Structures Manual*** Introduction, I.6 References.

Design Assumptions and Limitations

See notes on the ***Design Standard*** and ***Structures Manual*** Volume 9.

Plan Content Requirements

See ***PPM*** Volume 1, Chapters 7 and 29.

Payment

Item number	Item description	Unit Measure
715-19-ABC	High Mast Light Pole	AS

Index 17515 Standard Aluminum Lighting (Rev. 01/12)

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); **Structures Manual** Volume 9, FDOT Modifications to LTS-5; **Structures Manual** Introduction, I.6 References.

Design Assumptions and Limitations

See notes in the **Design Standard** and **Structures Manual** Volume 9.

Selection Procedure:

Determine the height difference between the top of foundation and the top of roadway used to set the fixture mounting height, round as necessary.

1. Determine the design mounting height (40, 45, or 50 feet) and fixture arm length (8, 10, 12, or 15 feet) required.
2. The wind height at fixture equals the design mounting height for poles not on fill. For poles on fill, determine the height of the roadway above the surrounding terrain. The wind height at fixture will equal the design mounting height plus the fill height, rounded up to the next highest 5-foot increment.
3. Determine the pole design variables for each light pole.

Design:

- A. Fixture Arm Length of 8-feet, 10-feet, 12-feet or 15-feet. Single arm only.
 1. Design Mounting Height of 40-feet, 45-feet or 50-feet. (May differ from Fixture Mounting Height, see Selection Procedure).
 2. 25-foot maximum height above adjoining ground surface.
 3. Design weight of luminaire assumed to be 75 lbs.
 4. Equivalent projected area of luminaire for design is 1.55 square feet.
- B. No bridge or wall mounting permitted.
- C. Maximum fill slope at the pole of one vertical to four horizontal. Steeper slopes can be accommodated provided the face of the slope on a horizontal projection from the foundation base is no closer than it would be if a 1:4 slope were projected from the top of the foundation.
- D. Unique site circumstances where poorer soil conditions are encountered than shown on Index No. 17515 may require the foundation variables to be modified from those shown. If custom designs are required, the Geotechnical Engineer will provide the soil information to be used by the EOR during the design phase of the project.
- E. Use an Importance Factor (I_r) = 0.80 (25-year recurrence interval).

Plan Content Requirements

When used on bridges, in order to minimize vibration of light poles due to traffic, locate light poles near substructure supports.

See [PPM](#), Volume 1, Chapter 7.

Payment

Item number	Item description	Unit Measure
715-41-ABC	Light Pole	EA

Index 17723 Steel Strain Pole

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); **Structures Manual** Volume 9, FDOT Modifications to LTS-5; **Structures Manual** Introduction, I.6 References.

Design Assumptions and Limitations

The maximum span length for the Steel Strain Poles with Signal Cable is 250 feet. See the [PPM](#), Volume 1, Chapter 29 for more information.

See notes on the **Design Standard** and **Structures Manual** Volume 9.

The following computer-based design programs available for use on the [Structures Design Office Website](#):

- FDOT Strain Pole Program
- University of Florida Bridge Software Institute ATLAS Program

Plan Content Requirements

See [PPM](#) Volume 1, Chapter 7.

Payment

Item number	Item description	Unit Measure
649-1-ABC	Steel Strain Pole	EA

Index 17725 Concrete Poles (Rev. 01/12)

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); **Structures Manual** Volume 9, FDOT Modifications to LTS-5; **Structures Manual** Introduction, I.6 References.

Design Assumptions and Limitations

The maximum span length for the Concrete Poles with Signal Cable is 250 feet. See the [PPM](#), Volume 1, Chapter 29 for more information.

See notes on the **Design Standard** and **Structures Manual** Volume 9.

The following computer-based design programs available for use on the [Structures Design Office Website](#):

- FDOT Strain Pole Program
- University of Florida Bridge Software Institute ATLAS Program

For Pole Types P-III through P-VIII, design poles within the following limits:

30 ft. \leq Length (L) \leq 65 ft.

Pole Height (H) \leq 50 ft.

Foundation Depth (D) \geq 7 ft.

Determine maximum loads to be placed on poles, and select the required pole type meeting the requirements of Table 17725-1 and Table 17725-2 below.

Table 17725-1 Service Moment Capacity, M_s^* , at Final Grade

H (feet)	Type of Strain Pole				
	P-IV (kip-ft)	P-V (kip-ft)	P-VI (kip-ft)	P-VII (kip-ft)	P-VIII (kip-ft)
20	21	86	121	165	204
22	24	90	126	171	210
24	26	93	131	176	215
26	29	97	135	182	221
28	32	101	140	187	227
30	34	104	144	192	232
32	37	108	149	197	238
34	39	111	153	202	243
36	41	114	157	207	248
38	44	117	161	212	253
40	46	120	165	217	258
42	48	123	169	221	263
44	50	126	173	226	268
46	52	129	177	230	272
48	54	132	180	235	277
50	56	135	184	239	281

* $M_s \geq MDL$, where MDL = moment due to dead load only

Table 17725-2 Ultimate Moment Capacity, ϕM_n^* , at Final Grade

H (feet)	Type of Strain Pole				
	P-IV (kip-ft)	P-V (kip-ft)	P-VI (kip-ft)	P-VII (kip-ft)	P-VIII (kip-ft)
20	43	138	198	273	346
22	48	145	206	283	357
24	53	151	215	294	369
26	58	158	224	304	381
28	63	165	232	315	392
30	68	172	241	325	404
32	73	178	250	335	415
34	77	185	258	346	427
36	82	192	267	356	439
38	87	199	276	367	450
40	92	205	284	377	462
42	97	212	293	387	474
44	102	219	302	398	485
46	107	226	310	408	497
48	112	232	319	419	508
50	117	239	328	429	520

* $\phi M_n \geq Mu = 1.3 (MDL+MWL)$, where MDL = moment due to dead load, MWL = moment due to wind load and $\phi = 0.9$

Plan Content Requirements

Complete the "Strain Pole Schedule" provided with the FDOT CAD Bar Menu and include in the Roadway Plans.

See [PPM](#) Volume 1, Chapter 7.

Payment

Item number	Item description	Unit Measure
641-2-AB	Prestressed Concrete Poles	EA

Index 17743 Standard Mast Arm "D" & "E" Assemblies (Rev. 01/12)

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); **Structures Manual** Volume 9, FDOT Modifications to LTS-5; **Structures Manual** Introduction, I.6 References.

Design Assumptions and Limitations

The maximum span length of Standard Mast Arm Assemblies is 78 feet. See the [PPM](#), Volume 1, Chapter 29 for additional information.

See notes on the **Design Standard** and **Structures Manual** Volume 9.

Design all mast arm traffic signal assemblies with backplates in accordance with the [PPM](#), Volume 1, Section 7.4.17

Standard mast arm assemblies must comply with all the requirements and design criteria shown on **Design Standards** Index 17745.

Standard Mast Arm Assemblies: Mast arms that utilize all pre-designed components for the selected Load Trees shown in Figure 1.

Standard Mast Arm assemblies are limited to 110,130 or 150 mph design wind speeds with one of the load tree configurations shown in Figure 1, and either single arm, single arm with luminaire, or double arms with arm orientations of 90° or 270° only.

Foundations and base plates for standard mast arm assemblies are pre-designed based on the following soil criteria:

Classification:	Cohesionless (Fine Sand)
Friction Angle:	30 Degrees
Unit Weight:	50 lbs./cubic foot (assumed submerged)

When the designer considers soil types at the specific site location to be of lesser strength properties than shown above, an analysis is required. Auger borings, SPT borings, or CPT soundings may be used as needed to verify the assumed soil properties, and at sites confirmed to be uniform, a single boring or sounding may cover several foundations. Borings in the area that were performed for other purposes may be used to confirm the assumed soil properties. Unique site circumstances may require the foundation variables to be modified from those shown on Index 17743. Accomplish this by completing the "Special Drilled Shaft Data" in the "Standard Mast Arm Assemblies Data Table". The Geotechnical Engineer must justify the differing foundation criteria to the District Structures Design Engineer during the design phase of the project.

To use standard mast arm assemblies:

1. Confirm that the information furnished by the signal designer in the "Mast Arm Tabulation Sheet" meets the geometric and load tree limitations shown in Figure 1.
2. Follow the procedure described in the design examples in the *PPM*, Volume 2, Chapter 24, complete the necessary information required in the "Standard Mast Arm Assemblies Data Table" and include in the Traffic Plans.

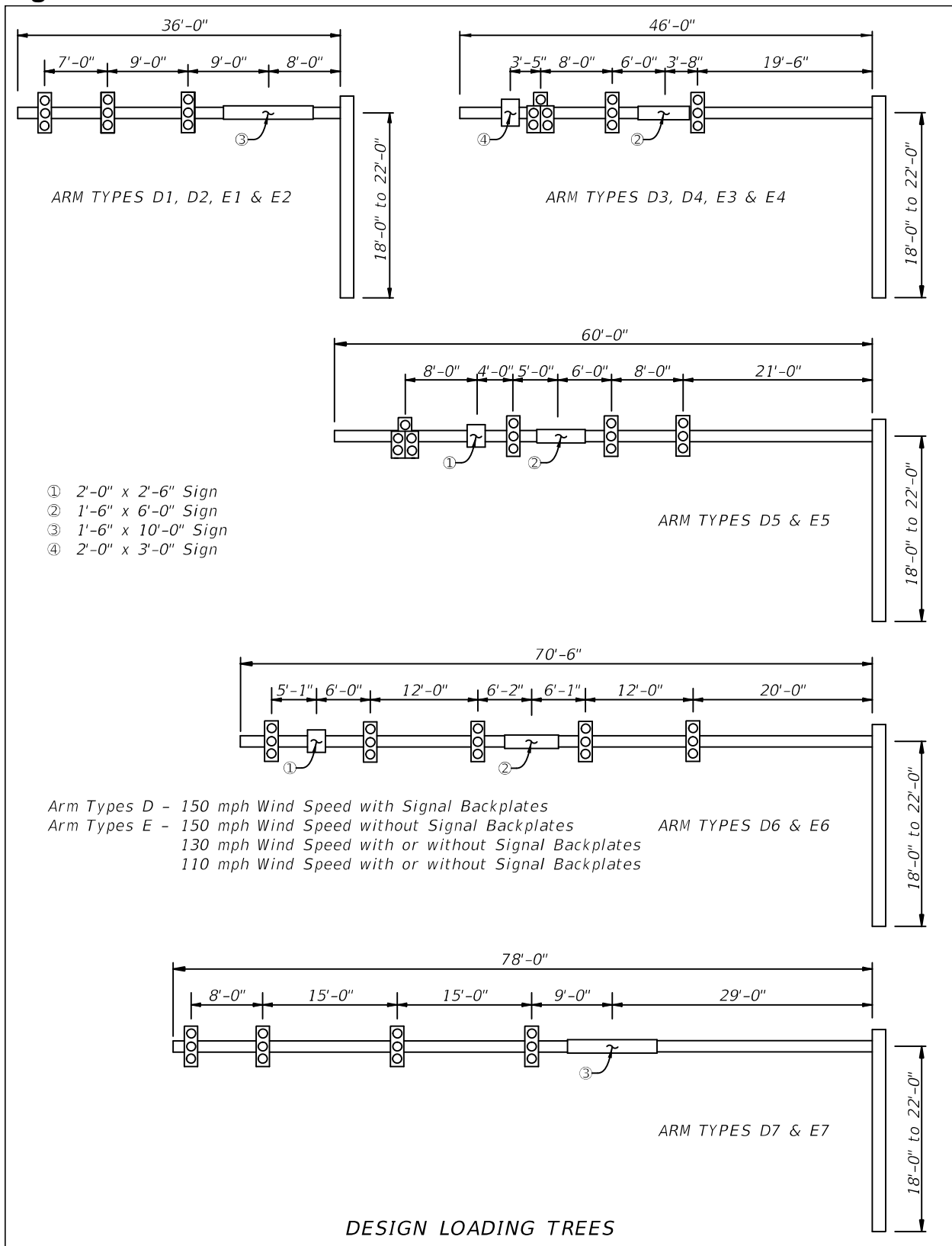
Standard Mast Arm Assemblies for Site-Specific Loadings: Mast arms for unique loadings but which utilize all pre-designed components.

The FDOT Mast Arm Program will select component parts from those shown on Index 17743 for site specific load configurations differing from those shown in Figure 1.

In order to be eligible for utilization of pre-designed component parts, the mast arm assemblies must utilize only arms and poles from the components listed in the tables on Index 17743. As for standard mast arm assemblies, the foundation design is included with the pole selection and needs no further information.

Design and detail standard mast arm assemblies utilizing pre-designed component parts in the plans in the same manner as for standard mast arm assemblies by use of the "Standard Mast Arm Assemblies Data Table" cell. Similarly, because all pre-designed component parts are used, shop drawings are not required.

Figure 1



Plan Content Requirements

The signal designer completes the Mast Arm Tabulation Sheets, and the structures designer completes the Standard Mast Arm Assemblies Data Table, both of which will be included in the plans. These are the only plan sheets required for mast arm assemblies which meet the Department's Standard. The structures data table may be placed on a signal plan sheet, if space permits. Mast arm assemblies that do not meet the mast arm standard will require a special design (See Index 17745). See [Introduction I.3](#) for more information regarding use of Data Tables.

The following instructions are for use with the Mast Arm Tabulation Sheets:

1. Each mast arm assembly is identified by a unique ID number.
2. Dimensions 1-5 are for signals and dimensions A-E are for signs. Record the distance from the edge of the pole, at ground level, to the center of the signal or sign.
3. Signals may be mounted vertically or horizontally. Indicate the mounting in the appropriate column in the table.
4. The entire line for arm #2 and the space for the angle between dual arms are left blank for single arm assemblies.
5. All arms and poles will be galvanized. If a color is required, indicate the color in the table, otherwise leave blank.
6. Starting at the pole, select the signals and/or signs that match the configuration you are tabulating. The spaces representing the signs or signals not used will be blank. Example 1: If no sign is located between the pole and signal 1, the spaces for Sign A would be blank. Example 2: A configuration for three signals and one sign between signal 1 and signal 2 - Only the spaces for signals 1, 2, 3 and sign B would be completed; the others will be blank.
7. Record the number of sections in each signal head in the space following the distance to that head.
8. Record the height and width of each sign in the space following the distance to the sign.
9. When double arm poles are used for a skewed intersection, the standard design should be used whenever possible. The standard orientation for arm #2 is 90 or 270 degrees measured in a counter clockwise direction from arm #1. The normal orientation of the mast arm is perpendicular to the roadway. Adjustments in mounting hardware can compensate for a skew angle of approximately 15 degrees or more from the normal, depending upon the attachment method. The designer should verify the mounting hardware capability before specifying an arm with a skew greater than 15 degrees.
10. The arm mounting height should be calculated to provide a minimum vertical clearance of 17'-6" from the roadway crown elevation to the lowest sign or signal. A standard signal section is approximately 14" square. Therefore the length of a 3-section head is about 42" and a 5-section is about 70". The use of back plates will add about 6" to each side of the signal head. Additionally, approximately 3" should be added to the end of the signal head to compensate for the attachment hardware. The

designer should coordinate with the maintaining agency to insure the signal assembly and all appropriate hardware has been considered in determining the vertical clearance. The maintaining agency can also provide guidance on the vertical or horizontal mounting of the signal assemblies. This information may be used to determine the arm mounting height.

11. The standard handhole location is 180 degrees from arm #1. Other handhole locations must be noted in the Special Instructions.
12. A free swinging internally illuminated street name sign may be attached to the Upright by an independent bracket arm if the sign area does not exceed 12 square feet and weigh more than 75 pounds. The Structures Design Engineer must review other signs attached to the pole or any size sign of this type attached to the signal mast arm.
13. The "Special Instructions" Table is used to tabulate pedestrian buttons and pedestrian signal locations and handhole locations when the handholes are not in the standard location. Tabulate the ID No. and the orientation of the pedestrian buttons and signals in degrees measured counter clockwise from arm #1. The handhole location should be left blank if the handhole is in the standard location (see note 11).
14. Arm #1 is the arm for a single arm assembly or the longer arm for a double arm assembly. If the arms are equal length, arm #1 is over the project roadway.

STANDARD MAST ARM ASSEMBLIES DATA TABLE																		Table Date 01-01-12	
STRUCTURE ID NUMBERS	ASSEMBLY NUMBERS ⁽¹⁾	FIRST ARM			SECOND ARM			UF (deg)	LL (deg)	POLE				SPECIAL DRILLED SHAFT ⁽⁴⁾					
		ARM TYPE	FAA ⁽²⁾ (ft.)	FBA ⁽²⁾ (in.)	ARM TYPE	FAA ⁽²⁾ (ft.)	FBA ⁽²⁾ (in.)			POLE TYPE	UAA ⁽³⁾ (ft.)	UB (ft.)	UCA ⁽³⁾ (in.)	DA (ft.)	DB (ft.)	RA	RB	RC	RD (in.)

TABLE NOTES:

1. Assembly Number Legend

Single Arm:

Arm Type - Pole Type = D# - S#
 = E# - T#

Double Arm:

First Arm Type - Second Arm Type - Pole Type = D# - D# - S#
 = E# - E# - T#

2. If an entry appears in columns "FAA" and "FBA", a shorter arm is required. This is obtained by removing length from the arm tip. For these cases the mast arm length shall be shortened from "FA" to "FAA" and the tip diameter shall be increased from "FB" to "FBA".

3. If an entry appears in columns "UAA" and "UCA", a shorter pole is required. This is obtained by removing length from the pole tip. For these cases the pole height shall be shortened from "UA" to "UAA" and the pole tip diameter shall be increased from "UC" to "UCA".

4. The foundations for Standard Mast Arm Assemblies are pre-designed and are based upon the following conservative soil criteria which covers the great majority of soil types found in Florida. Only complete the "Special Drilled Shaft" data information if site conditions dictate drilled shafts with additional foundation capacity.

Classification = Cohesionless (Fine Sand)
 Friction Angle = 30 Degrees (30°)
 Unit Weight = 50 lbs. / cu. ft. (assumed saturated)

GENERAL NOTES:

1. Work this sheet with the Signal Designer's "Mast Arm Tabulation". See "Mast Arm Tabulation" for special instructions that include non-standard Handhole location, paint color, terminal compartment requirement, and pedestrian features.

2. Work with Index Nos. 17743 and 17745.

Payment

Item number	Item description	Unit Measure
649-3A-BCC	Steel Mast Arm Assembly	EA

Examples

Following are examples for use with the Standard Mast Arm Assemblies Data Table:

EXAMPLE 1

1. Select Arm Type.

Investigate Arm E1. Compare attachment sizes and locations with design loading tree in [Figure 1](#). All signals and signs are no further from the pole than shown in the Arm E1 design loading tree. Select Arm Type E1.

2. Select Pole Type.

Use Pole Selection Tables in Index 17743 of the *Design Standards*. Select Pole Type T1.

3. Determine Arm Mounting Height.

$$UB + 10' = 12.5' + 17.5'\text{min.} + 2'$$

$$UB = 22'\text{min. Use } 22'$$

EXAMPLE 2

1. Select First Arm Type.

Designate longest arm as First Arm. For 52' arm, investigate Arm D5. Compare attachment sizes and locations with design loading tree. All signals and signs are no larger than and are no further from the pole than shown in the Arm D5 design loading tree. Select Arm Type D5.

2. Specify shorter arm.

Enter 28' under FAA.

$$FAA + FE - \text{Splice} = 28' + 26' - 2' = 52'$$

Determine actual tip diameter.

$$FBA = FB + (60' - 52') \times \text{taper} = 7.96" + 8' (0.14"/\text{ft}) = 9.08"$$

3. Select Second Arm Type.

Select Arm Type D2.

4. Enter angle between arms.

Angle UF is measured counter-clockwise from the First Arm and must be either 90° or 270°.

5. Select Pole Type.

Use Pole Selection Tables. Select Pole Type S3.

6. Determine Arm Mounting Height.

$$UB + 10' = 9.5' + 17.5'\text{min.} + 2'$$

$$UB = 19' \text{ min. Use } 20'$$

7. Specify shorter pole.

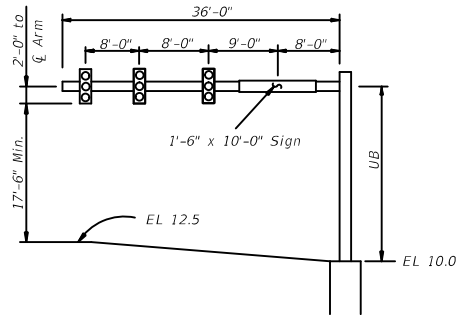
Enter 22' under UAA.

Determine actual tip diameter.

$$UCA = UC + (24' - 22') \times \text{taper} = 17.64" + 2' (0.14"/\text{ft}) = 17.92"$$

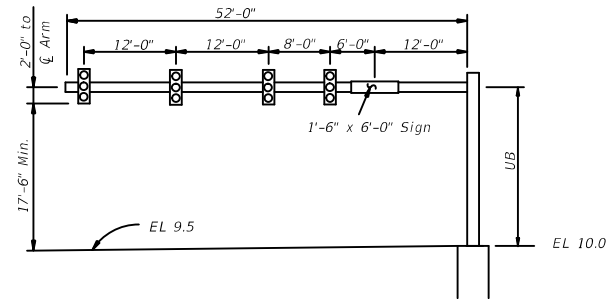
EXAMPLE 1

Single Arm Structure as shown,
 110 mph Wind Speed with Signal Backplates.



EXAMPLE 2

First Arm Structure as shown, Second Arm same as Example 1
 except 150 mph Wind Speed with Signal Backplates.



STANDARD MAST ARM ASSEMBLIES DATA TABLE																		Table Date 01-01-12	
STRUCTURE ID NUMBERS	ASSEMBLY NUMBERS (1)	FIRST ARM			SECOND ARM			UF (deg)	LL (deg)	POLE				SPECIAL DRILLED SHAFT (4)					
		ARM TYPE	FAA(2) (ft.)	FBA(2) (in.)	ARM TYPE	FAA(2) (ft.)	FBA(2) (in.)			POLE TYPE	UAA(3) (ft.)	UB (ft.)	UCA(3) (in.)	DA (ft.)	DB (ft.)	RA	RB	RC	RD (in.)
Example 1	E1 - T1	E1								T1		22							
Example 2	D5 - D2 - S3	D5	28	9.08	D2			270		S3	22	20	17.92						

TABLE NOTES:

- Assembly Number Legend

Single Arm:
 Arm Type - Pole Type = D# - S#
 = E# - T#

Double Arm:
 First Arm Type - Second Arm Type - Pole Type = D# - D# - S#
 = E# - E# - T#

- If an entry appears in columns "FAA" and "FBA", a shorter arm is required. This is obtained by removing length from the arm tip. For these cases the mast arm length shall be shortened from "FA" to "FAA" and the tip diameter shall be increased from "FB" to "FBA".

TABLE NOTES (CONT.):

- If an entry appears in columns "UAA" and "UCA", a shorter pole is required. This is obtained by removing length from the pole tip. For these cases the pole height shall be shortened from "UA" to "UAA" and the pole tip diameter shall be increased from "UC" to "UCA".
- The foundations for Standard Mast Arm Assemblies are pre-designed and are based upon the following conservative soil criteria which covers the great majority of soil types found in Florida. Only complete the "Special Drilled Shaft" data information if site conditions dictate drilled shafts with additional foundation capacity.

Classification= Cohesionless (Fine Sand)
 Friction Angle= 30 Degrees (30°)
 Unit Weight= 50 lbs. / cu. ft. (assumed saturated)

GENERAL NOTES:

- Work this sheet with the Signal Designer's "Mast Arm Tabulation". See "Mast Arm Tabulation" for special instructions that include non-standard Handhole location, paint color, terminal compartment requirement, and pedestrian features.
- Work with Index Nos. 17743 and 17745.

Index 17745 Mast Arm Assemblies (Rev. 01/12)

Design Criteria

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition (LTS-5); **Structures Manual** Volume 9, FDOT Modifications to LTS-5; **Structures Manual** Introduction, I.6 References.

Design Assumptions and Limitations

See notes on the **Design Standard** and **Structures Manual** Volume 9.

See the **PPM**, Volume 1, Chapter 29 for additional information.

Design all mast arm traffic signal assemblies with backplates in accordance with the **PPM**, Volume 1, Chapter 7.

Custom Mast Arm Designs: Special Mast arms for unique loadings and/or geometric constraints that contain any component (arm or pole) that is outside the range of those in Index 17743.

The FDOT Mast Arm Program will provide the necessary variables to be shown in the "Special Mast Arm Assemblies Data Table" cell from the FDOT CADD Menu.

Plan Content Requirements

The signal designer completes the Mast Arm Tabulation Sheet, and the structures designer completes the Special Mast Arm Assemblies Data Table, both of which will be included in the plans. These are the only plan sheets required for mast arm assemblies which meet the Department's Standard. The structures data table may be placed on a signal plan sheet, if space permits. See [Introduction I.3](#) for more information regarding use of Data Tables.

The following instructions are for use with the Mast Arm Tabulation Sheet:

1. Each mast arm assembly is identified by a unique ID number.
2. Dimensions 1-5 are for signals and dimensions A-E are for signs. Record the distance from the edge of the pole, at ground level, to the center of the signal or sign.
3. Signals may be mounted vertically or horizontally. Indicate the mounting in the appropriate column in the table.
4. The entire line for arm #2 and the space for the angle between dual arms are left blank for single arm assemblies.
5. All arms and poles will be galvanized. If a color is required, indicate the color in the table, otherwise leave blank.
6. Starting at the pole, select the signals and/or signs that match the configuration you are tabulating. The spaces representing the signs or signals not used will be blank.

Example 1: If no sign is located between the pole and signal 1, the spaces for Sign A would be blank. Example 2: A configuration for three signals and one sign between signal 1 and signal 2 - Only the spaces for signals 1, 2, 3 and sign B would be completed; the others will be blank.

7. Record the number of sections in each signal head in the space following the distance to that head.
8. Record the height and width of each sign in the space following the distance to the sign.
9. When double arm poles are used for a skewed intersection, the standard design should be used whenever possible. The standard orientation for arm #2 is 90 or 270 degrees measured in a counter clockwise direction from arm #1. The normal orientation of the mast arm is perpendicular to the roadway. Adjustments in mounting hardware can compensate for a skew angle of approximately 15 degrees or more from the normal, depending upon the attachment method. The designer should verify the mounting hardware capability before specifying an arm with a skew greater than 15 degrees.
10. The arm mounting height should be calculated to provide a minimum vertical clearance of 17'-6" from the roadway crown elevation to the lowest sign or signal. A standard signal section is approximately 14" square. Therefore the length of a 3-section head is about 42" and a 5-section is about 70". The use of back plates will add about 6" to each side of the signal head. Additionally, approximately 3" should be added to the end of the signal head to compensate for the attachment hardware. This information may be used to determine the arm mounting height. The designer should coordinate with the maintaining agency to insure the signal assembly and all appropriate hardware has been considered in determining the vertical clearance. The maintaining agency can also provide guidance on the vertical or horizontal mounting of the signal assemblies.
11. The standard handhole location is 180 degrees from arm #1. Other handhole locations must be noted in the Special Instructions.
12. A free swinging internally illuminated street name sign may be attached to the pole by an independent bracket arm if the sign area does not exceed 12 square feet and weigh more than 75 pounds. The Structures Design Engineer must review other signs attached to the pole or any size sign of this type attached to the signal mast arm.
13. The "Special Instructions" Table is used to tabulate pedestrian buttons and pedestrian signal locations and handhole locations when the handholes are not in the standard location. Tabulate the ID No. and the orientation of the pedestrian buttons and signals in degrees measured counter clockwise from arm #1. The handhole location should be left blank if the handhole is in the standard location (see note 11).
14. Arm #1 is the arm for a single arm assembly or the longer arm for a double arm assembly. If the arms are equal length, arm #1 is over the project roadway.

SPECIAL MAST ARM ASSEMBLIES DATA TABLE																							Table Date 01-01-12
NUMBER OF LOCATIONS	STRUCTURE NUMBER	FIRST ARM				FIRST ARM EXTENSION				SECOND ARM				SECOND ARM EXTENSION				POLE					
		FA(ft)	FB(in)	FC(in)	FD(in)	FE(ft)	FF(in)	FG(in)	FH(in)	SA(ft)	SB(in)	SC(in)	SD(in)	SE(ft)	SF(in)	SG(in)	SH(in)	UA(ft)	UB(ft)	UC(in)	UD(in)	UE(in)	UF(deg)

SPECIAL MAST ARM ASSEMBLIES DATA TABLE (CONT.)																				Table Date 01-01-12			
STRUCTURE NUMBER	FIRST ARM CONNECTION (in)					First Arm Camber Angle = 2 Degrees					SECOND ARM CONNECTION (in)					Second Arm Camber Angle = 2 Degrees							
	#Bolts	HT	FJ	FK	FL	FN	FO	FP	FR	FS	FT	#Bolts	HT	SJ	SK	SL	SN	SO	SP	SR	SS	ST	

SPECIAL MAST ARM ASSEMBLIES DATA TABLE (CONT.)																				Table Date 01-01-12			
STRUCTURE NUMBER	POLE BASE CONNECTION (in)					SHAFT AND REINF.					LUMINAIRE AND LUMINAIRE CONNECTION												
	#Bolts	BA	BB	BC	BF	DA(ft)	DB(ft)	RA	RB	RC	RD(in)	LA(ft)	LB(ft)	LC(in)	LD(in)	LE	LF(ft)	LG(in)	LH(in)	LI(in)	LK(in)	LL(deg)	

- NOTES:
1. Work with Index 17745.
 2. Design Wind Speed = mph
 3. Contractor shall coordinate anchor bolt requirements with fabricator.
 4. Contractor shall identify Structures Numbers and submit detailed shop drawings.

- FOUNDATION NOTES:
1. Design based on Borings taken sealed by
 2. Assumptions and Values used in design:
 Soil Type
 Soil Layer Thickness = ft.
 Soil Friction Angle = deg.
 Soil Weight = pcf
 Design Water Table is ft. below surface

Payment

Item number	Item description	Unit Measure
649-3A-BCC	Steel Mast Arm Assembly	EA

Index 20005 Prestressed I-Beam Temporary Bracing (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; ***Structures Detailing Manual (SDM)***; ***Structures Design Guidelines (SDG)***

Design Assumptions and Limitations

Index 20005 depicts notes and details that are schematic for use in the development of shop drawings for temporary I-beam bracing. Use this standard for all superstructures having simply supported Florida-I and non-FDOT standard pretensioned concrete I-Beams. Use this standard with Indexes 20010, 20036, 20045, 20063, 20072, 20078, 20084, 20096, 20199, 20510, 20511 and 20512.

This Index is generally not applicable in its entirety to segmented beams that are erected utilizing temporary shoring and then spliced together using post-tensioning

Companion MicroStation CADD cell 20005 includes the "TABLE OF TEMPORARY BRACING VARIABLES", the "TABLE OF WIND LOAD VARIABLES", the "TABLE OF ASSUMED CONSTRUCTION LOADS (UNFACTORED)", and the "BEAM TEMPORARY BRACING NOTES". These tables are to be completed and included in the plans along with the provided bracing notes. The FDOT Beam Stability MathCAD program may be used to determine the variables to be input into these tables. See ***SDG*** Chapters 2 and 4 for more information and requirements.

The assumed weight for the finishing machine is left to the discretion of the designer, but suggested total weights for the finishing machine are 10 kips for bridge widths less than 45 feet and 20 kips otherwise.

Plan Content Requirements

In the Structures Plans:

Complete the following "TABLE OF WIND LOAD VARIABLES", "TABLE OF ASSUMED CONSTRUCTION LOADS (UNFACTORED)" and "TABLE OF TEMPORARY BRACING VARIABLES" and include them in the plans for all bridges with prestressed concrete I-beam superstructures. Use additional sheets when the actual number of spans exceeds the capacity of a single plan sheet using the standard tables. Supplemental details and modifications are permitted if special conditions require dimensions, details or notes. However, the tables themselves should not be modified. See [Introduction I.3](#) for more information regarding use of Data Tables.

The forces that are entered into the columns for beam end and intermediate horizontal bracing forces in the 'TABLE OF TEMPORARY BRACING VARIABLES' shall be the horizontal reaction forces at each brace point. Forces should not be resolved into a diagonal component, regardless of any inclination of the actual bracing. These forces are to be used by the Contractor to design bracing members and connections.

If intermediate span braces are not required, enter "N/A" in the "Horizontal Force At Each Intermediate Span Brace" and "Overturning Force At Each Intermediate Span Brace" columns for each span in which intermediate span braces are not required.

Include the 'BEAM TEMPORARY BRACING NOTES' in the plans.

PRESTRESSED BEAM TEMPORARY BRACING DATA TABLES

TABLE OF WIND LOAD VARIABLES		Table Date 1-01-10
WIND SPEED, BASIC (MPH)		
WIND SPEED, CONSTRUCTION INACTIVE (MPH)		
WIND SPEED, CONSTRUCTION ACTIVE (MPH)		
VELOCITY PRESSURE EXPOSURE COEFFICIENT		
GUST EFFECT FACTOR		

TABLE OF ASSUMED CONSTRUCTION LOADS (UNFACTORED)		Table Date 1-01-10
BUILD-UP (PLF)		
FORM WEIGHT (PSF)		
FINISHING MACHINE TOTAL WEIGHT (KIP)		
FINISHING MACHINE WHEEL LOCATION BEYOND EDGE OF DECK OVERHANG (IN.)		
DECK WEIGHT (PSF)		
LIVE LOAD (PSF)		
LIVE LOAD AT EXTREME DECK EDGE (PLF)		

TABLE OF TEMPORARY BRACING VARIABLES							Table Date 7-01-10	
SPAN NO.	L_B , MAXIMUM UNBRACED LENGTH (FT)	HORIZONTAL FORCE AT EACH BEAM END AND ANCHOR BRACE (KIP)	HORIZONTAL FORCE AT EACH INTERMEDIATE SPAN BRACE (KIP)	OVERTURNING FORCE AT EACH BEAM END AND ANCHOR BRACE (KIPxFT)	OVERTURNING FORCE AT EACH INTERMEDIATE SPAN BRACE (KIPxFT)	BRACE ENDS PRIOR TO CRANE RELEASE?	TOTAL LINES OF BRACING	
						YES/NO		
						YES/NO		
						YES/NO		
						YES/NO		

BEAM TEMPORARY BRACING NOTES:

- Based on investigation of the beam stability, temporary bracing as shown in the 'TABLE OF TEMPORARY BRACING VARIABLES' and Design Standard Index No. 20005 is required. The Table and following information is provided to aid the Contractor in design of beam temporary bracing:
1. Design the bracing members and connections to transfer both compressive and tensile forces equal to the horizontal forces given in the 'TABLE OF TEMPORARY BRACING VARIABLES'. Also design bracing members and connections to be capable of resisting the overturning forces given in the Table, non-simultaneously with horizontal forces. Assume that horizontal bracing forces are applied perpendicular to the beam web at mid-height of the beam, and assume that overturning bracing forces are applied at the centerline of the beam at the top of the top flange.
 2. The horizontal brace forces have been determined by application of the Construction Inactive Wind Load as listed in the 'TABLE OF WIND LOAD VARIABLES'. The overturning brace forces have been determined by application of the Construction Active Wind Load as listed in the 'TABLE OF WIND LOAD VARIABLES' plus the assumed construction loads shown in the 'TABLE OF ASSUMED CONSTRUCTION LOADS'. It is the Contractor's responsibility to re-calculate the bracing requirements if the actual construction loads exceed the assumed loads shown, or if the finishing machine wheel location from the edge of the deck overhang exceeds the value listed.
 3. The temporary bracing at the ends of the beams shall be installed prior to crane release if indicated in the 'TABLE OF TEMPORARY BRACING VARIABLES'. Beams shall not be left un-braced during non-work hours. Bracing shall remain in place until bridge deck concrete reaches 2500 psi.
 4. The exposure period (defined as the time period for which temporary load cases of the superstructure exist) is assumed to be less than one year. Horizontal bracing forces, as specified in the 'TABLE OF TEMPORARY BRACING VARIABLES', are not valid if the exposure period is more than one year; for this case the Contractor shall re-calculate bracing requirements.
 5. Horizontal and overturning forces are factored per the Strength III limit state for construction.

Payment

The cost of temporary bracing is incidental to the cost of the prestressed beams it is used with. No separate payment is made.

Example Problem

The following example shows the data required for completion of the Data Table for the Prestressed Beam Temporary Bracing Index No. 20005. This case shows a Florida-I 78 Beam (Index No. 20078). The example assumes a three equal span bridge designed for the following conditions:

Girder Span: 182'-0"

Girder Spacing: 6'-0"

Number of Girder Lines: 7

Deck Thickness: 8½"

Deck Overhang: 3'-0"

Skew Angle: 45°

Bridge Height: 60'-0"

Construction Inactive Wind Load: 44.0 psf (150 mph reduced by 0.6 to 90 mph)

Construction Active Wind Load (20 MPH): 2.2 psf (girder only), 1.1 psf (bridge with forms in place)

Based on beam stability calculations, (1) intermediate brace point would be sufficient, but the bracing force would be very large. Therefore, the bracing requirements will be calculated based on (2) intermediate brace points.

The maximum unbraced length is: $182'-0" / 3 = 60'-8"$

PRESTRESSED BEAM TEMPORARY BRACING DATA TABLES

TABLE OF WIND LOAD VARIABLES		Table Date 1-01-10
WIND SPEED, BASIC (MPH)		150
WIND SPEED, CONSTRUCTION INACTIVE (MPH)		90
WIND SPEED, CONSTRUCTION ACTIVE (MPH)		20
VELOCITY PRESSURE EXPOSURE COEFFICIENT		1.137
GUST EFFECT FACTOR		0.85

TABLE OF ASSUMED CONSTRUCTION LOADS (UNFACTORED)		Table Date 1-01-10
BUILD-UP (PLF)		50
FORM WEIGHT (PSF)		20
FINISHING MACHINE TOTAL WEIGHT (KIP)		20
FINISHING MACHINE WHEEL LOCATION BEYOND EDGE OF DECK OVERHANG (IN.)		2½
DECK WEIGHT (PSF)		113.3
LIVE LOAD (PSF)		20
LIVE LOAD AT EXTREME DECK EDGE (PLF)		75

TABLE OF TEMPORARY BRACING VARIABLES							Table Date 7-01-10	
SPAN NO.	L_b MAXIMUM UNBRACED LENGTH (FT)	HORIZONTAL FORCE AT EACH BEAM END AND ANCHOR BRACE (KIP)	HORIZONTAL FORCE AT EACH INTERMEDIATE SPAN BRACE (KIP)	OVERTURNING FORCE AT EACH BEAM END AND ANCHOR BRACE (KIPxFT)	OVERTURNING FORCE AT EACH INTERMEDIATE SPAN BRACE (KIPxFT)	BRACE ENDS PRIOR TO CRANE RELEASE?	TOTAL LINES OF BRACING	
1	60.67	8.69	23.90	35.31	71.95	NO	4	
2	60.67	8.69	23.90	35.31	71.95	NO	4	
3	60.67	8.69	23.90	35.31	71.95	NO	4	

BEAM TEMPORARY BRACING NOTES:

Based on investigation of the beam stability, temporary bracing as shown in the 'TABLE OF TEMPORARY BRACING VARIABLES' and Design Standard Index No. 20005 is required. The Table and following information is provided to aid the Contractor in design of beam temporary bracing:

- Design the bracing members and connections to transfer both compressive and tensile forces equal to the horizontal forces given in the 'TABLE OF TEMPORARY BRACING VARIABLES'. Also design bracing members and connections to be capable of resisting the overturning forces given in the Table, non-simultaneously with horizontal forces. Assume that horizontal bracing forces are applied perpendicular to the beam web at mid-height of the beam, and assume that overturning bracing forces are applied at the centerline of the beam at the top of the top flange.
- The horizontal brace forces have been determined by application of the Construction Inactive Wind Load as listed in the 'TABLE OF WIND LOAD VARIABLES'. The overturning brace forces have been determined by application of the Construction Active Wind Load as listed in the 'TABLE OF WIND LOAD VARIABLES' plus the assumed construction loads shown in the 'TABLE OF ASSUMED CONSTRUCTION LOADS'. It is the Contractor's responsibility to re-calculate the bracing requirements if the actual construction loads exceed the assumed loads shown, or if the finishing machine wheel location from the edge of the deck overhang exceeds the value listed.
- The temporary bracing at the ends of the beams shall be installed prior to crane release if indicated in the 'TABLE OF TEMPORARY BRACING VARIABLES'. Beams shall not be left un-braced during non-work hours. Bracing shall remain in place until bridge deck concrete reaches 2500 psi.
- The exposure period (defined as the time period for which temporary load cases of the superstructure exist) is assumed to be less than one year. Horizontal bracing forces, as specified in the 'TABLE OF TEMPORARY BRACING VARIABLES', are not valid if the exposure period is more than one year; for this case the Contractor shall re-calculate bracing requirements.
- Horizontal and overturning forces are factored per the Strength III limit state for construction.

Index 20010 Series Prestressed Florida-I Beams (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; ***Structures Detailing Manual (SDM)***; ***Structures Design Guidelines (SDG)***

Design Assumptions and Limitations

Index 20010 is the lead standard for the Prestressed Florida-I Beam standard series which includes Indexes 20010 through 20096. Use this standard with Indexes 20005, 20036, 20045, 20054, 20063, 20072, 20078, 20084, 20096, 20199, 20510, and 20511 or 20512.

These 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.

Data tables for associated Indexes 20005, 20199, 20510, and 20511 or 20512 must also be completed and included in the plans.

The use of End Diaphragms is not preferred on simple span, pretensioned, Florida-I Beam structures. In lieu of End Diaphragms, the preferred detail is a Thickened Slab End at all locations of slab discontinuity. Where End Diaphragms are required by design or for widening projects, partial depth diaphragms are preferred. See ***SDM*** Chapter 15 for suggested details.

Except for widening projects where special details may be required, squared beam ends are preferred on all Florida-I Beam structures.

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 detailed to be continuous across the intermediate supports or back-to-back diaphragms are present. For detailing purposes, Prestressed Florida-I Beams are assumed to be erected plumb.

When the total initial tensioning force of the fully bonded strands required by design exceeds the values shown below, 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, Index 20010 and the appropriate Standard Detail Drawings must then be modified for inclusion in the contract documents and signed and sealed by the EOR.

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

Index No.	Beam Type	Max. Bonded Prestress Force	Last Revision Date
20036	Florida-I 36	1450 Kips	07/01/09
20045	Florida-I 45	1670 Kips	07/01/09
20054	Florida-I 54	1740 Kips	07/01/09
20063	Florida-I 63	1740 Kips	07/01/09
20072	Florida-I 72	1980 Kips	07/01/09
20078	Florida-I 78	2230 Kips	07/01/09
20084	Florida-I 84	2375 Kips	07/01/10
20096	Florida-I 96	2375 Kips	07/01/10

Do not apply losses when calculating the Bonded Prestress Force.

Embedded Bearing Plates are required for all beams. If the beam grade exceeds 2%, provide Beveled Bearing Plates at each end of the beam as shown in Index 20511 or Index 20512.

Prestressed Beam Suppliers typically utilize side forms for casting which are not easily or economically modified. If modifications to beam cross-sections are required for any reason other than haunched sections, maintain profile dimensions of the form. For example: To thicken the web, increase the spacing between side forms. To increase the beam height, increase the thickness of the top flange. In any case, do not reduce the standard thickness of either the top or bottom flange.

See additional instructions in the **SDG**.

Plan Content Requirements

In the Structures Plans:

Complete the following "FLORIDA-I 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 "FLORIDA-I 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 mid-height of the beam @ 120 days. The average of the calculated values for the top and bottom of the beam may be used.

Show strands in the outermost positions of the two lowest rows to support Bars D.

Round Angle Φ up to the nearest degree.

Specify shear stirrup spacing V1 for Bars 5K to the nearest inch.

Prepare a Framing Plan for bridges meeting the criteria stated in the **SDM**.

When diaphragms are required by design, show them on the Framing Plan. Tabulate insert locations with respect to the beam ends and beam faces. Include length adjustments for beams placed on grade and for elastic and time dependent shortening effects. See **Structures Design Bulletin C10-05** for diaphragm and reinforcing details.

Payment

Item number	Item description	Unit Measure
450-2-AAA	Prestressed Beams: Florida-I Beam	LF

Example Problem

The following example shows the data required for completion of a Florida-I Beam Table of Beam Variables. The example assumes a three span bridge with Florida-I 45 Beams designed for the following conditions:

Live Load: HL-93

No intermediate Diaphragms

Stay-in-Place Metal Forms:

Allowance of 20 PSF non-composite dead load over the projected plan area of the forms (this includes the unit weight of metal forms and the concrete required to fill the form flutes).

Environment (Superstructure): Moderately Aggressive

Bridge Characteristics:

Length: 276 ft.

Width: 51'-1" (out-to-out)

Clear Roadway: 48 ft.

Superstructure:

Three simple spans of prestressed concrete beams with 8-inch composite deck slab (plus 1/2" sacrificial deck thickness)

Span: 87'-0", 102'-0", 87'-0"

Sidewalk: None

Horizontal Alignment: Straight

Vertical Alignment: 0.00% Grade

Skew Angle: 15 degrees (Right)

Beam Design:

Beam: Florida-I 45 Beam

Spacing:

11'-3", 87' Span (5 Beams)

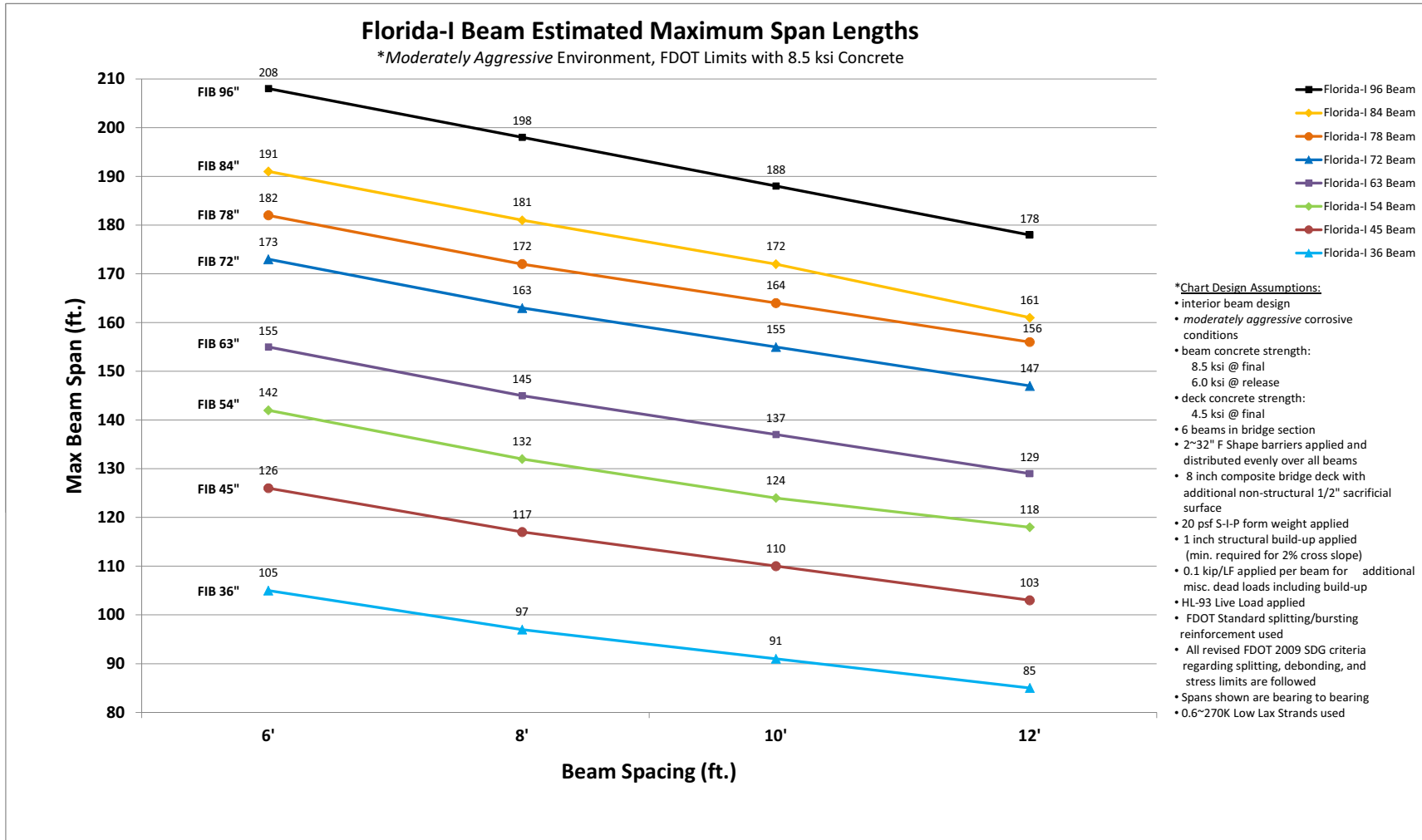
9'-0", 102' Span (6 Beams)

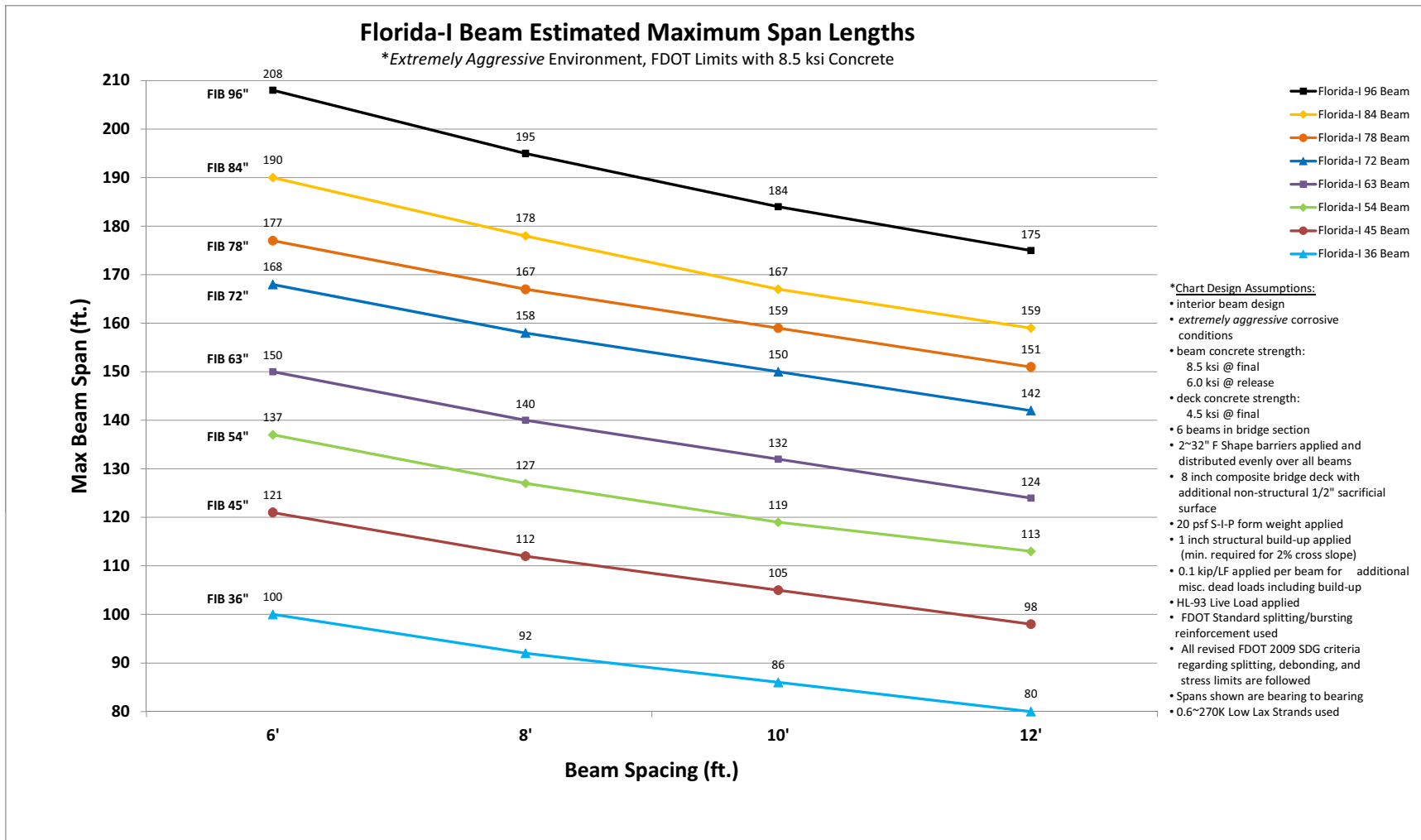
Design Span Length:

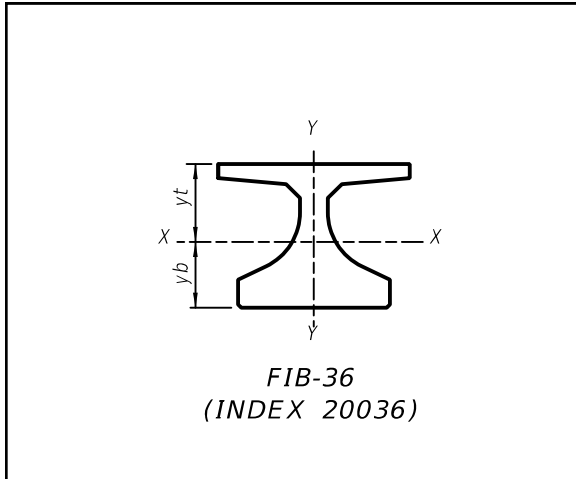
84'-6" (Spans 1 & 3)

99'-8" (Span 2)

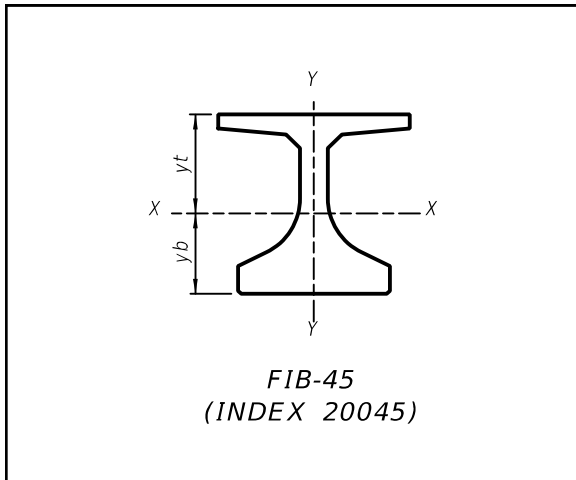
Design Aids



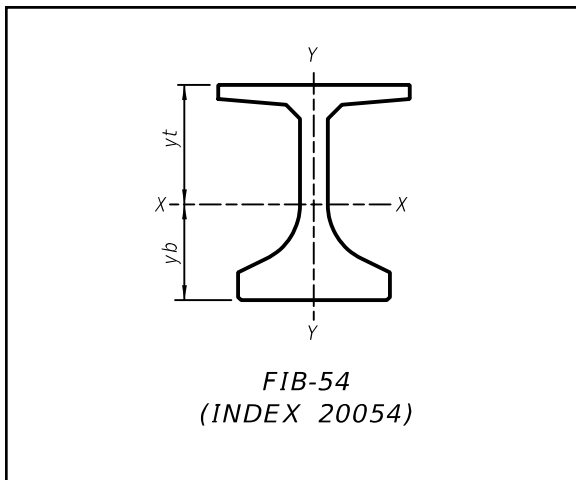




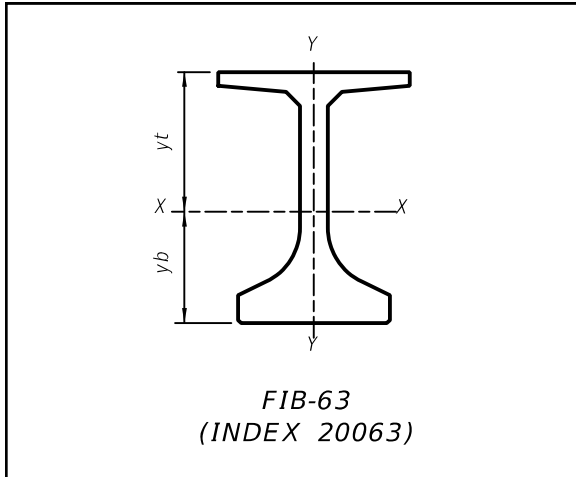
FIB-36 SECTION PROPERTIES	
Area (in. ²)	806.58
Perimeter (in.)	206.57
I _{xx} (in. ⁴)	127,545
I _{yy} (in. ⁴)	81,070
yt (in.)	19.51
y _b (in.)	16.49



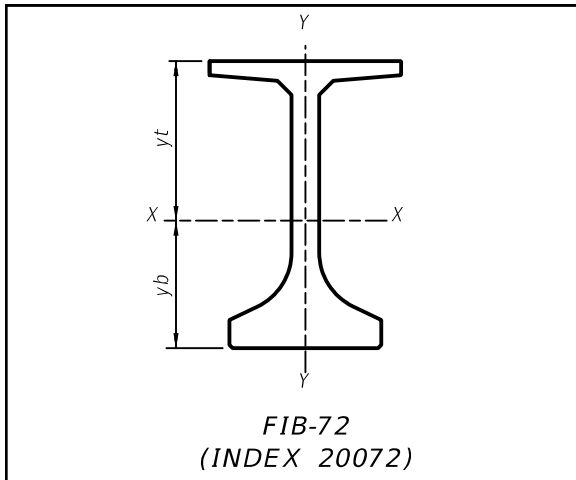
FIB-45 SECTION PROPERTIES	
Area (in. ²)	869.58
Perimeter (in.)	224.57
I _{xx} (in. ⁴)	226,581
I _{yy} (in. ⁴)	81,327
yt (in.)	24.79
y _b (in.)	20.21



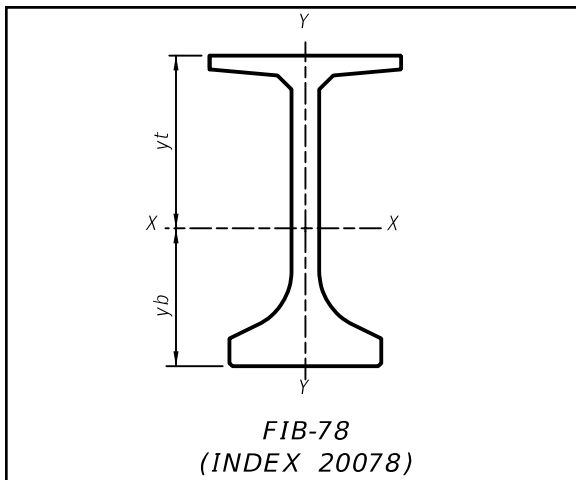
FIB-54 SECTION PROPERTIES	
Area (in. ²)	932.58
Perimeter (in.)	242.57
I _{xx} (in. ⁴)	359,929
I _{yy} (in. ⁴)	81,584
yt (in.)	29.96
y _b (in.)	24.04



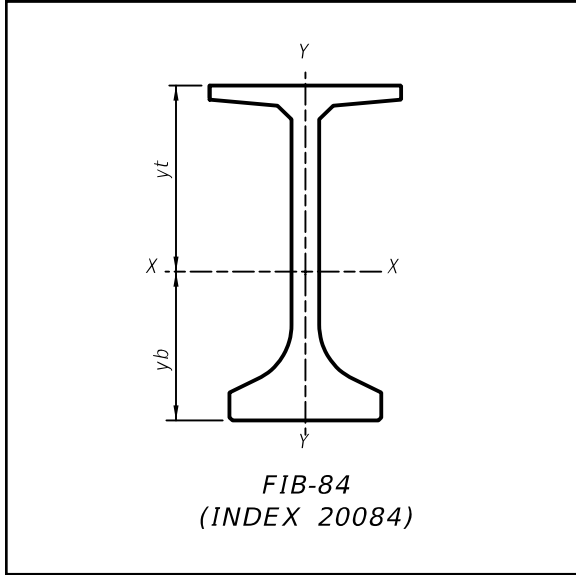
FIB-63 SECTION PROPERTIES	
Area (in. ²)	995.58
Perimeter (in.)	260.57
I _{xx} (in. ⁴)	530,313
I _{yy} (in. ⁴)	81,842
yt (in.)	35.04
yb (in.)	27.96



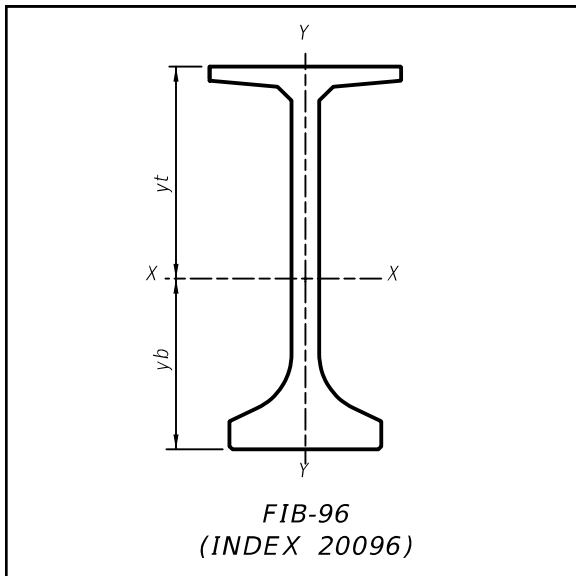
FIB-72 SECTION PROPERTIES	
Area (in. ²)	1,058.58
Perimeter (in.)	278.57
I _{xx} (in. ⁴)	740,416
I _{yy} (in. ⁴)	82,099
yt (in.)	40.06
yb (in.)	31.94



FIB-78 SECTION PROPERTIES	
Area (in. ²)	1,100.58
Perimeter (in.)	290.57
I _{xx} (in. ⁴)	903,861
I _{yy} (in. ⁴)	82,270
yt (in.)	43.37
yb (in.)	34.63



FIB-84 SECTION PROPERTIES	
Area (in. ²)	1,142.58
Perimeter (in.)	302.57
I _{xx} (in. ⁴)	1.087 x 10 ⁶
I _{yy} (in. ⁴)	82,442
y _t (in.)	46.66
y _b (in.)	37.34



FIB-96 SECTION PROPERTIES	
Area (in. ²)	1,226.58
Perimeter (in.)	326.57
I _{xx} (in. ⁴)	1.515 x 10 ⁶
I _{yy} (in. ⁴)	82,785
y _t (in.)	53.18
y _b (in.)	42.82

Index 20199 Build-Up and Deflection Data for Florida-I Beams (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Detailing Manual (SDM)**; **Structures Design Guidelines (SDG)**

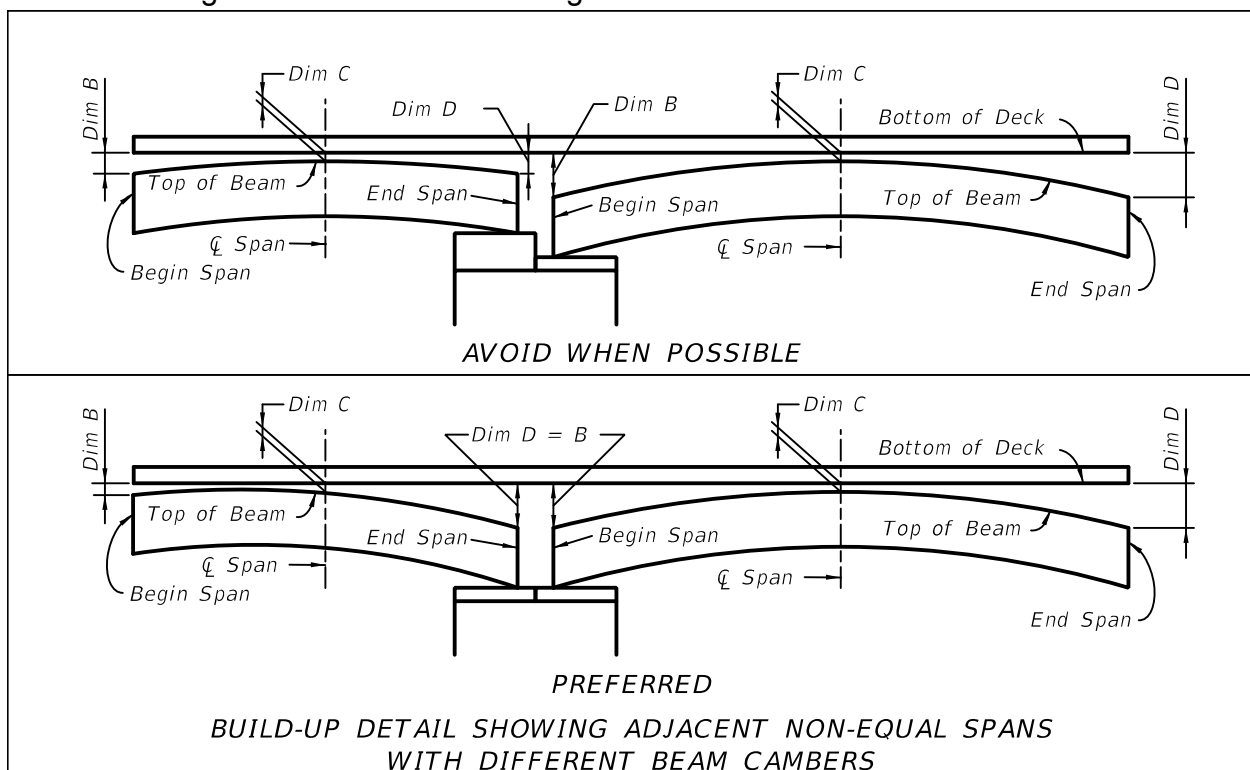
Design Assumptions and Limitations

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

Unless otherwise required as a design parameter, beam camber for computing the theoretical build-up must be based on 120-day old beam concrete.

Consider the effects of horizontal curvature with bridge deck cross slope when determining the minimum theoretical build-up over the tip of the inside flange.

For a given size and type of beam, beam camber and associated Dim B and Dim D will vary due to span lengths and beam spacings. Dim B and Dim D will also vary from span to span along the length of a bridge due to deck geometry. To provide for better aesthetics and potentially easier detailing of the supporting pedestals, where possible adjust the values of Dim B and Dim D over equal height beams in adjacent spans so as to allow the beam bottom flanges to line up. Dim B and Dim D do not necessarily have to be the same value for a single beam. See the following sketch:



Plan Content Requirements

Complete the following "Build-Up and Deflection Data Table for AASHTO, Bulb-T and Florida-I Beams" and include it on the superstructure detail sheets. See [Introduction I.3](#) for more information regarding use of Data Tables.

<i>BUILD-UP & DEFLECTION DATA TABLE FOR FLORIDA-I BEAMS</i>						<i>Table Date 01/01/12</i>	
<i>LOCATION</i>		<i>REQUIRED THEORETICAL BUILD-UP OVER \bar{C} BEAM</i>			<i>NET BEAM CAMBER (PRESTRESS - DEAD LOAD OF BEAM) @ 120 DAYS</i>	<i>DEAD LOAD DEFLECTION DURING DECK POUR @ 120 DAYS DIM A</i>	<i>BUILD-UP CASE NO.</i>
<i>SPAN NO.</i>	<i>BEAM NO.</i>	<i>AT BEGIN SPAN DIM B</i>	<i>AT \bar{C} SPAN DIM C</i>	<i>AT END SPAN DIM D</i>			

*NOTES: Work this sheet with Design Standard
Index No. 20199.*

Payment

Include estimated build-up concrete quantities with the estimated deck concrete quantities. Do not break out estimated build-up concrete quantities.

In the absence of more refined calculations, the following method to calculate estimated concrete build-up quantities may be used:

$$V = \frac{LW \left[C + \left(\frac{B + D - 2C}{6} \right) \right]}{27}$$

For Case 1, 2 & 3:

$$V = \frac{LW \left[\left(\frac{B + D}{2} \right) + \left(\frac{2}{3} \left(C - \frac{B + D}{2} \right) \right) \right]}{27}$$

For Case 4:

Where:

V = Total Volume of build-up per beam (CY)

L = Beam Length (ft)

W = Width of beam top flange (ft)

B; C; D = Build-up Thickness (ft)

Index 20210 Series Florida U Beams (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; ***Structures Detailing Manual (SDM)***; ***Structures Design Guidelines (SDG)***

Design Assumptions and Limitations

Index 20210 is the lead standard for the Florida-U Beam standard series which includes Indexes 20210 through 20272. Use this standard with Indexes 20248, 20254, 20263, 20272, 20299 and 20502.

The standard Florida U Beams are applicable for spans with skewed end conditions less than or equal to 15 degrees. For beams with skewed end conditions greater than 15 degrees the EOR shall develop a custom design and details using the standards as a basis.

These 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.

Data tables for associated Indexes 20299 and 20502 must also be completed and included in the plans.

Florida-U Beams are typically placed parallel to the cross slope of the bridge deck.

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 detailed to be continuous across the intermediate supports.

When the total initial tensioning force of the fully bonded strands required by design exceeds the values shown below, 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, Index 20210 and the appropriate Standard Detail Drawings must then be modified for inclusion in the contract documents and signed and sealed by the EOR.

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

Index No.	Beam Type	Max. Bonded Prestress Force	Last Revision Date
20248	Florida U 48	2790 Kips	07/01/05
20254	Florida U 54	2790 Kips	07/01/05
20263	Florida U 63	3070 Kips	07/01/05
20272	Florida U 72	3070 Kips	07/01/05

Stay-In-Place Metal Forms are required to be used to form the deck within the individual Florida-U Beams.

Due to the absence of external end diaphragms between individual Florida U Beams, a thickened deck edge beam at deck expansion joints is required to support wheel loads. Generally, the depth of the Edge Beam shall extend from the top of the deck to the bottom face of the top flanges of the Florida U Beams.

Plan Content Requirements

In the Structures Plans:

Complete the following "FLORIDA U 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 "FLORIDA U BEAM - TABLE OF BEAM VARIABLES" itself should not be modified. See [Introduction I.3](#) for more information regarding use of Data Tables.

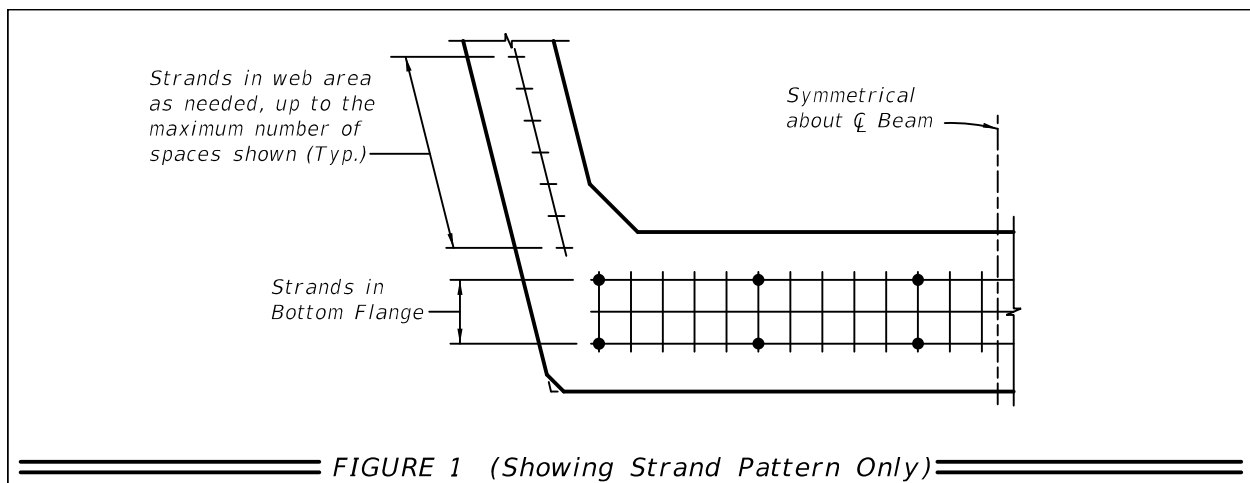
Place strands in configurations to distribute stress in the ends of beams and minimize potential for diaphragm cracking.

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 Φ up to the nearest degree.

Specify shear stirrup spacings V1 and V2 for Bars 5K to the nearest inch.

Show fully bonded strands in the following locations to support Bars D:



Prepare a Framing Plan for bridges meeting the criteria stated in the **SDM**.

Show Stay-In-Place Metal Form details for the forms within the individual Florida-U Beams.

Design and detail a thickened deck edge beam at deck expansion joints between individual Florida U Beams.

Payment

Item number	Item description	Unit Measure
450-4-AAA	Prestressed Beam - FL U-Beam	LF

Example Problem

The following example shows the data required for completion of a Florida U Beam Table of Beam Variables. The example assumes a two span bridge with Florida U 72 Beams designed for the following conditions:

Live Load: HL-93

Future Wearing Surface: Design includes allowance for 15 PSF.

Stay-in-Place Metal Forms: Design includes allowance for 20 PSF non-composite dead load over the projected plan area of the forms for the unit weight of metal forms and concrete required to fill the form flutes.

Environment (Superstructure): Moderately Aggressive

Bridge Characteristics:

Length: 249'-4"

Width: 59'-1" (out-to-out)

Clear Roadway: 56'-0"

Superstructure:

Two simple spans of prestressed concrete beams with 8-inch composite deck slab

Span: 124'-8", 124'-8"

Sidewalk: None

Horizontal Alignment: Straight

Vertical Alignment: 0.00% Grade

Skew Angle: 0 degrees

Beam Design:

Beam: Florida U 72 Beam

Spacing: 21'-0"

Design Span Length: 122'-4"

Composite Dead Load

(per girder): 603 PLF

Non-Composite Dead Load:

124'-8" Span: 4163 PLF

Diaphragm Dead Load:

End: 8.6 kips each

Intermediate: 4.3 kips each

Bonded Strand Development Multiplier = 1.60

Tension Stress Limits at Release as per **SDG** Live Load Distribution Factors (interior beam):

Shear: 1.50

Moment: 1.50

Sample Drawing

FLORIDA U BEAM - TABLE OF BEAM VARIABLES																						Table Date 1-01-06									
FUB TYPE	LOCATION		CONCRETE PROPERTIES		STND. PTRN. TYPE	END ELEV. COND.	PLAN VIEW CASE			BRG. PLATE MARK ***		END OF BEAM AND BEARING DIMENSIONS **					BEAM DIMENSIONS *		REINFORCING STEEL												
	SPAN NO.	BEAM NO.	CLASS	STRENGTHS (psi)			END 1	END 2	END 1	END 2	END 1	END 2	ANGLE θ		DIM P	DIM J	DIM K1	DIM K2	DIM L	DIM R	4G	4H	4M	5K	NO. OF SPACES BARS 5K & 4M			SPACING BARS 5K & 4M *			
				28 Day									Release	END 1							END 2	END 1	END 2	NO.	NO.	NO.	NO.	S1	S2	S3	V1
72	1	1 to 3	VI	8500	6000	1	1	1	1			90°	90°	0"	10 $\frac{1}{2}$ "	1'-2 $\frac{3}{4}$ "	1'-2"	124'-3 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	42	84	382	410	30	21	1	9"	1'-0"	1'-1 $\frac{3}{4}$ "		
72	2	1 to 3	VI	8500	6000	1	1	1	1			90°	90°	0"	10 $\frac{1}{2}$ "	1'-2 $\frac{3}{4}$ "	1'-2"	124'-3 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	42	84	382	410	30	21	1	9"	1'-0"	1'-1 $\frac{3}{4}$ "		

TYPE ① 78 STRANDS

STRAND DESCRIPTION: Use 0.60" Diameter, Grade 270, Low Relaxation Strands stressed at 43.94 kips each. Area per strand equals 0.217 sq. in.

STRAND PATTERN

NOTE:
Work this sheet with Design Standards Index Nos. 20210, 20248, 20254, 20263 and 20272.

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 "J" and "K" are measured along the bottom of the beam.

BEARING PLATES
 *** Mark indicates beveled bearing plate and embedded bearing plate required. See Index No. 20502 for details.

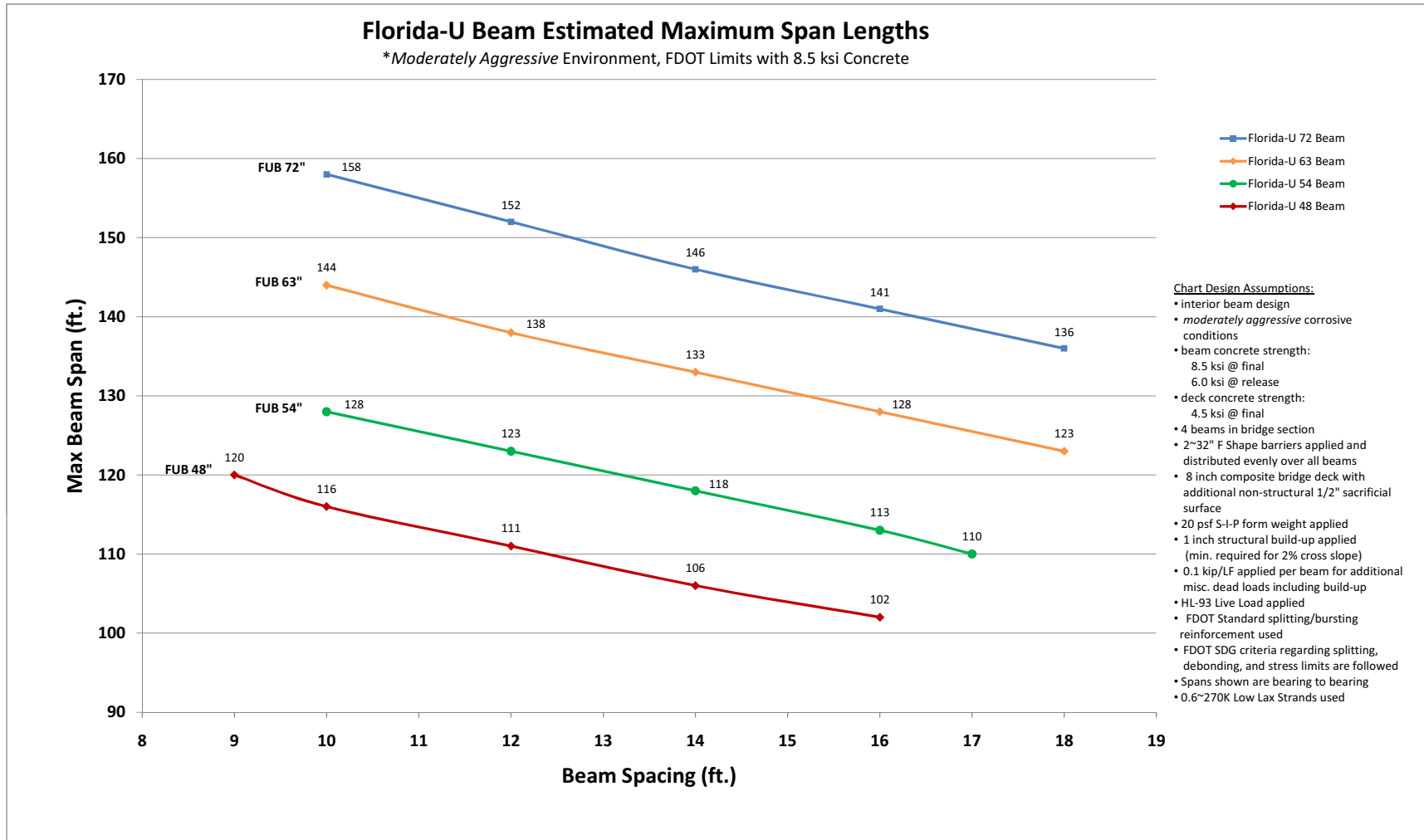
STRAND DEBONDING LEGEND

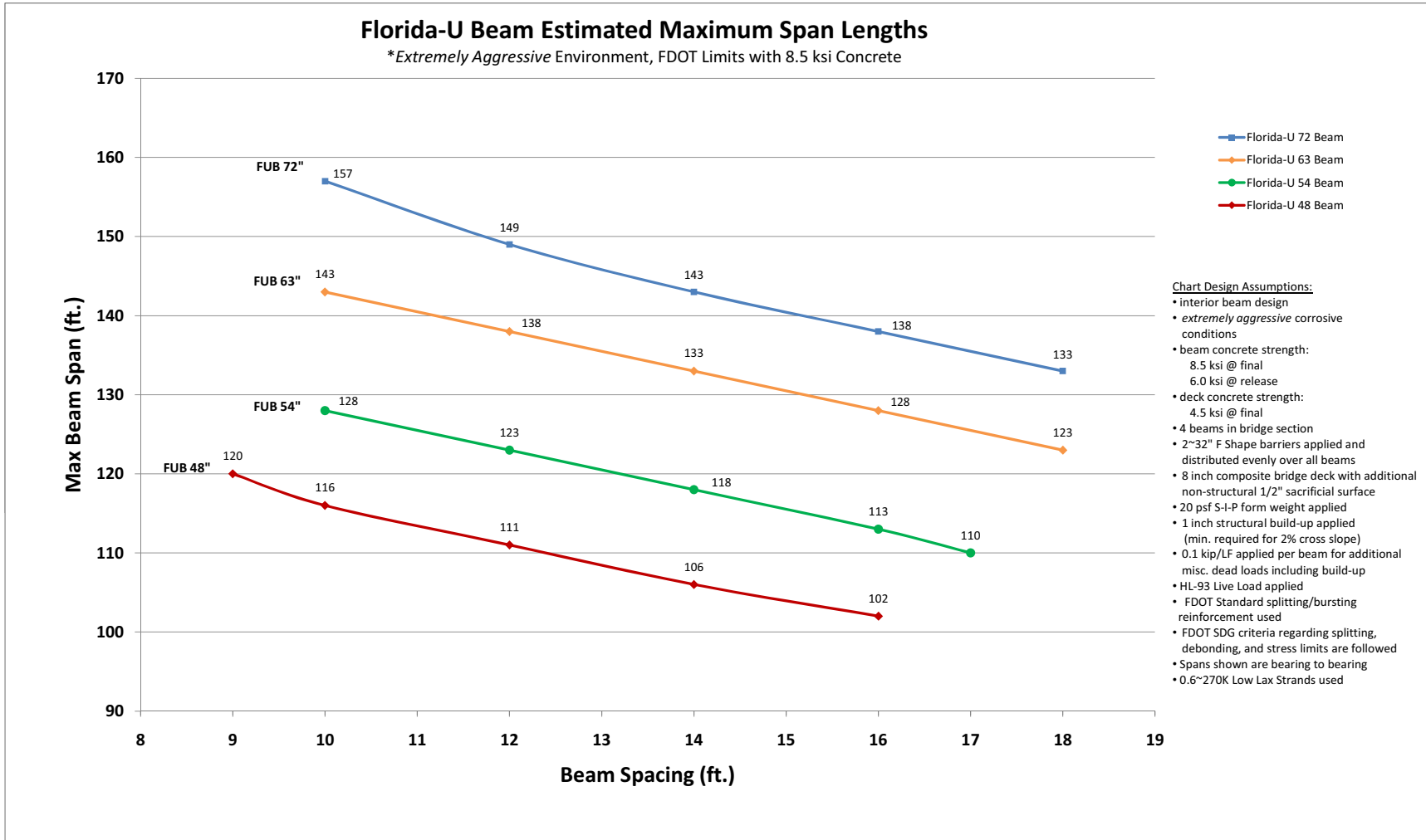
- - fully bonded strands.
- - strands debonded 21'-0" from end of beam.
- △ - strands debonded 24'-0" from end of beam.
- ◇ - strands debonded 27'-6" from end of beam.

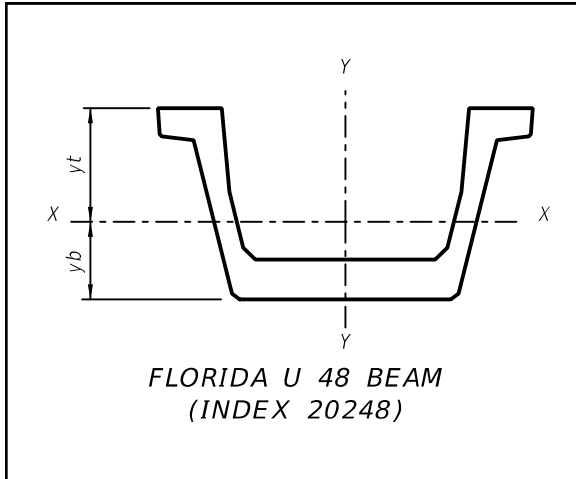
NOTE: On beams with skewed ends the debonded length shall be measured along the shielded strand.

REVISIONS				DRAWN BY:			STATE OF FLORIDA			SHEET TITLE:	REF. Dwg. NO.
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	XXX MM-TT	DEPARTMENT OF TRANSPORTATION			SAMPLE	
							ROAD NO.	COUNTY	FINANCIAL PROJECT ID	PROJECT NAME	SHEET NO.

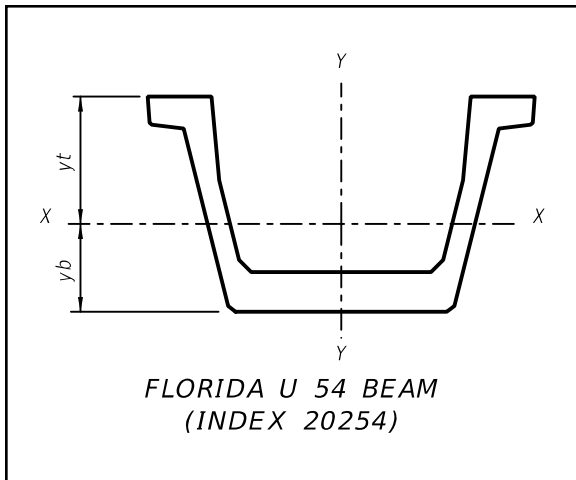
Design Aids



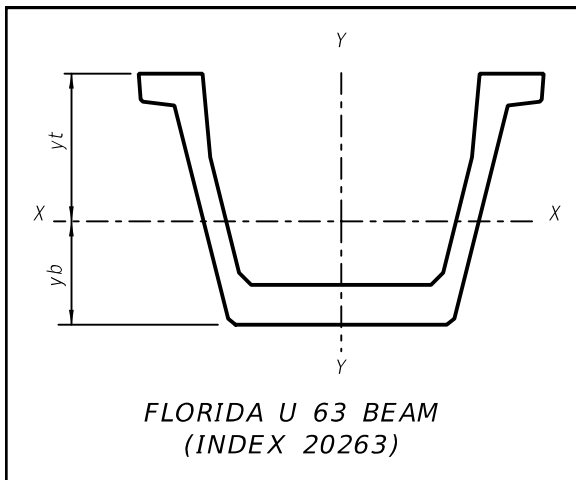




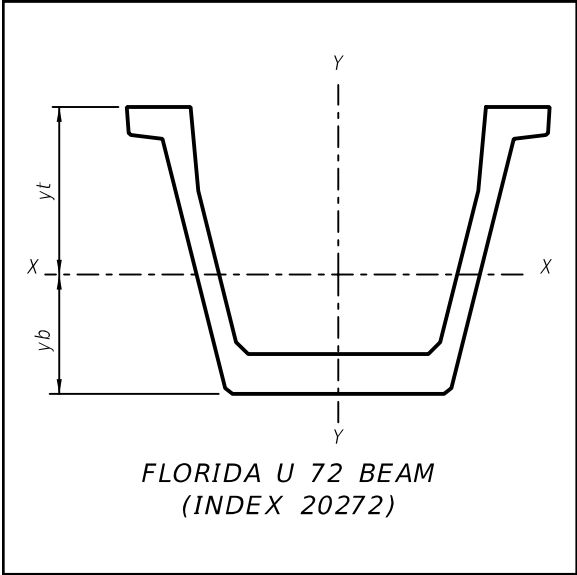
FUB-48 SECTION PROPERTIES	
Area (in. ²)	1,206
I _{xx} (in. ⁴)	321,222
I _{yy} (in. ⁴)	905,815
yt (in.)	28.53
y _b (in.)	19.47



FUB-54 SECTION PROPERTIES	
Area (in. ²)	1,275
I _{xx} (in. ⁴)	439,370
I _{yy} (in. ⁴)	1.026 x 10 ⁶
yt (in.)	31.99
y _b (in.)	22.01



FUB-63 SECTION PROPERTIES	
Area (in. ²)	1,377
I _{xx} (in. ⁴)	659,103
I _{yy} (in. ⁴)	1.222 x 10 ⁶
yt (in.)	37.08
y _b (in.)	25.92



FUB-72 SECTION PROPERTIES	
Area (in. ²)	1,479
Ixx (in. ⁴)	933,707
Iyy (in. ⁴)	1.438 x 10 ⁶
yt (in.)	42.09
yb (in.)	29.91

Index 20299 Build-Up and Deflection Data for Florida U Beams (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Detailing Manual (SDM)**; **Structures Design Guidelines (SDG)**

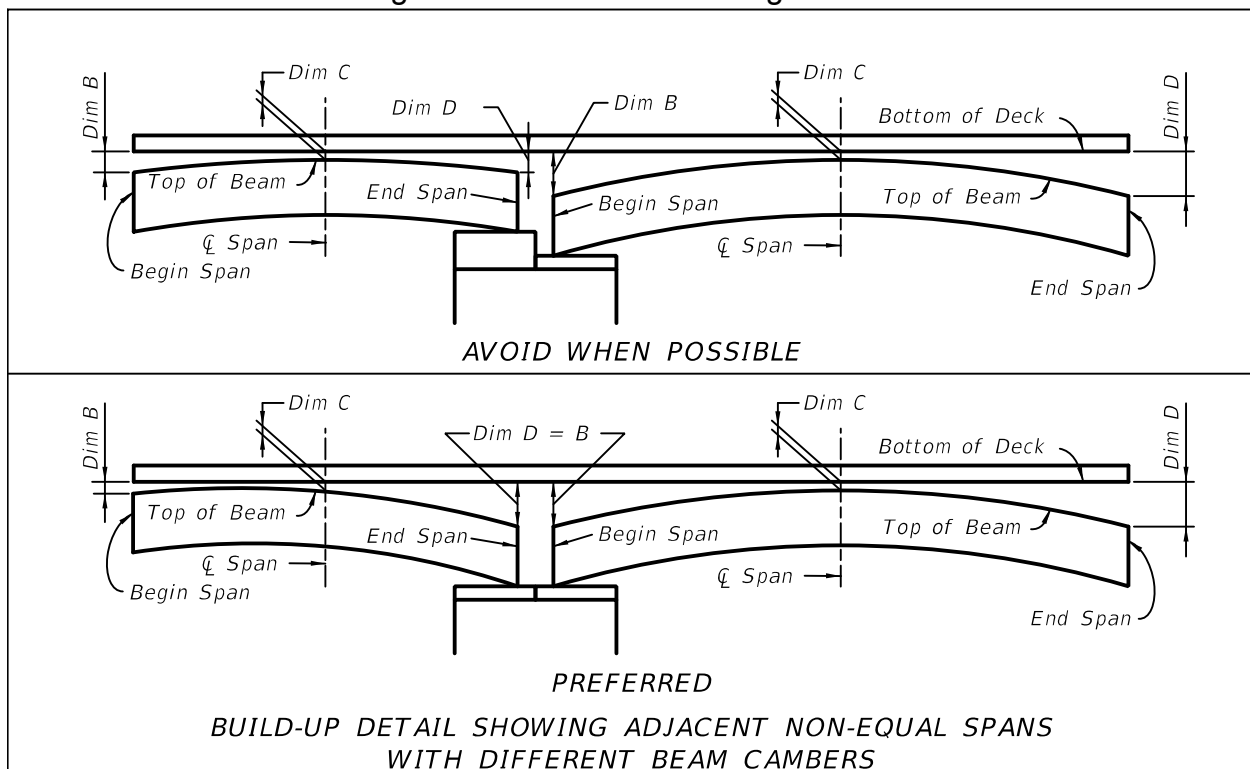
Design Assumptions and Limitations

Use this standard in conjunction with Indexes 20210, 20248, 20254, 20263 and 20272.

Unless otherwise required as a design parameter, beam camber for computing the theoretical build-up must be based on 120-day old beam concrete.

Consider the effects of horizontal curvature with bridge deck cross slope when determining the minimum theoretical build-up over the tip of the inside flange.

For a given size and type of beam, beam camber and associated Dim B and Dim D will vary due to span lengths and beam spacings. Dim B and Dim D will also vary from span to span along the length of a bridge due to deck geometry. To provide for better aesthetics and potentially easier detailing of the supporting pedestals, where possible adjust the values of Dim B and Dim D over equal height beams in adjacent spans so as to allow the beam bottom flanges to line up. Dim B and Dim D do not necessarily have to be the same value for a single beam. See the following sketch:



Plan Content Requirements

Complete the following "Build-Up and Deflection Data Table for Florida-U Beams" and include it on the superstructure detail sheets. See [Introduction I.3](#) for more information regarding use of Data Tables.

BUILD-UP & DEFLECTION DATA TABLE FOR FLORIDA U BEAMS										Table Date 01/01/12
LOCATION		REQUIRED THEORETICAL BUILD-UP OVER \bar{C} LEFT FLANGE			REQUIRED THEORETICAL BUILD-UP OVER \bar{C} RIGHT FLANGE			NET BEAM CAMBER (PRESTRESS - DEAD LOAD OF BEAM) @ 120 DAYS	DEAD LOAD DEFLECTION DURING DECK POUR @ 120 DAYS DIM A	BUILD-UP CASE NO.
SPAN NO.	BEAM NO.	AT BEGIN SPAN DIM B	AT \bar{C} SPAN DIM C	AT END SPAN DIM D	AT BEGIN SPAN DIM B	AT \bar{C} SPAN DIM C	AT END SPAN DIM D			

NOTES: Work this sheet with Design Standard Index No. 20299.

Payment

Include estimated build-up concrete quantities with the estimated deck concrete quantities. Do not break out estimated build-up concrete quantities.

In the absence of more refined calculations, the following method to calculate estimated concrete build-up quantities may be used:

For Case 1, 2 & 3

V = Left Flange + Right Flange:

$$V = \frac{LW \left[C + \left(\frac{B + D - 2C}{6} \right) \right]}{27} + \frac{LW \left[C + \left(\frac{B + D - 2C}{6} \right) \right]}{27}$$

For Case 4

V = Left Flange + Right Flange:

$$V = \frac{LW \left[\left(\frac{B + D}{2} \right) + \left(\frac{2}{3} \left(C - \frac{B + D}{2} \right) \right) \right]}{27} + \frac{LW \left[\left(\frac{B + D}{2} \right) + \left(\frac{2}{3} \left(C - \frac{B + D}{2} \right) \right) \right]}{27}$$

Where:

V = Total Volume of build-up per beam (CY)

L = Beam Length (ft)

W = Width of beam top flange (ft)

B; C; D = Build-up Thickness (ft)

Index 20502 Beveled Bearing Plate Details Prestressed Florida U-Beams

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; ***Structures Detailing Manual (SDM)***; ***Structures Design Guidelines (SDG)***

Design Assumptions and Limitations

This Index contains generic details and notes for beveled and embedded bearing plates for use with Prestressed Florida U-Beams. Completion of the "Bearing Plate Data Table" is required. Use this standard with Indexes 20210, 20248, 20254, 20263 and 20272.

Embedded Bearing Plates A and Beveled Bearing Plates B are required for all beams on grades greater than 2%.

Plan Content Requirements

In the Structures Plans:

Bearing seats (pedestals) may be finished level for beam grades less than 0.5%.

For beam grades between 0.5% and 2%, show the bearing seats (pedestals) to be finished parallel to the beam grade with no allowance for beam camber or deflection.

For beam grades greater than 2%, show the bearing seats (pedestals) to be finished level and use Bearing Plates A and B.

Complete the following "BEARING PLATE DATA TABLE" and include it in the plans when Bearing Plates are required. Fill in the table to correspond with data on the 'TABLE OF BEAM VARIABLES' using inch units for Beveled Plate dimensions 'W', 'X', 'Y' & 'Z' rounded to 1/16th of an inch. See [Introduction I.3](#) for more information regarding use of Data Tables.

Use the average deck cross slope perpendicular to centerline of beam from End 1 and End 2, for the beam cross slope for spans with superelevation transitions.

Use the following equations to determine the Beveled Plate thicknesses for 'PLAN VIEW CASES' and 'END ELEVATION CONDITIONS' corresponding to those shown on Index 20210, when single pedestals are used beneath the beam ends. For split pedestals beneath double bearings, adjust the upper pedestal elevation to utilize the same thickness bearing plate on the left and right sides of the beam as shown below. Slope and Cross Slope parameters in these equations require decimal units and correct sign convention:

END 1	END 2
(I) PLAN VIEW CASE 1 (No Skew):	
(a) END ELEVATION CONDITION 1 (Positive Slope)	
(i) Positive Cross Slope (C.S.), Single Bearing & Left Side Double Bearing	
$W = 0.5" + (C) \times \text{Slope} + (D) \times \text{C.S.}$	$W = 0.5" + (D) \times \text{C.S.}$
$X = 0.5" + (C) \times \text{Slope}$	$X = 0.5"$
$Y = 0.5"$	$Y = 0.5" + (C) \times \text{Slope}$
$Z = 0.5" + (D) \times \text{C.S.}$	$Z = 0.5" + (C) \times \text{Slope} + (D) \times \text{C.S.}$
(ii) Negative Cross Slope (C.S.), Single Bearing & Right Side Double Bearing	
$W = 0.5" + (C) \times \text{Slope}$	$W = 0.5"$
$X = 0.5" + (C) \times \text{Slope} - (D) \times \text{C.S.}$	$X = 0.5" - (D) \times \text{C.S.}$
$Y = 0.5" - (D) \times \text{C.S.}$	$Y = 0.5" + (C) \times \text{Slope} - (D) \times \text{C.S.}$
$Z = 0.5"$	$Z = 0.5" + (C) \times \text{Slope}$
(iii) Positive Cross Slope (C.S.), Right Side Double Bearing	
$W = 0.5" + (C) \times \text{Slope} + (2D+E) \times \text{C.S.}$	$W = 0.5" + (2D+E) \times \text{C.S.}$
$X = 0.5" + (C) \times \text{Slope} + (D+E) \times \text{C.S.}$	$X = 0.5" + (D+E) \times \text{C.S.}$
$Y = 0.5" + (D+E) \times \text{C.S.}$	$Y = 0.5" + (C) \times \text{Slope} + (D+E) \times \text{C.S.}$
$Z = 0.5" + (2D+E) \times \text{C.S.}$	$Z = 0.5" + (C) \times \text{Slope} + (2D+E) \times \text{C.S.}$
(iv) Negative Cross Slope (C.S.), Left Side Double Bearing	
$W = 0.5" + (C) \times \text{Slope} - (D+E) \times \text{C.S.}$	$W = 0.5" - (D+E) \times \text{C.S.}$
$X = 0.5" + (C) \times \text{Slope} - (2D+E) \times \text{C.S.}$	$X = 0.5" - (2D+E) \times \text{C.S.}$
$Y = 0.5" - (2D+E) \times \text{C.S.}$	$Y = 0.5" + (C) \times \text{Slope} - (2D+E) \times \text{C.S.}$
$Z = 0.5" - (D+E) \times \text{C.S.}$	$Z = 0.5" + (C) \times \text{Slope} - (D+E) \times \text{C.S.}$
(b) END ELEVATION CONDITION 3 (Negative Slope)	
(i) Positive Cross Slope (C.S.), Single Bearing & Left Side Double Bearing	
$W = 0.5" + (D) \times \text{C.S.}$	$W = 0.5" - (C) \times \text{Slope} + (D) \times \text{C.S.}$
$X = 0.5"$	$X = 0.5" - (C) \times \text{Slope}$
$Y = 0.5" - (C) \times \text{Slope}$	$Y = 0.5"$
$Z = 0.5" - (C) \times \text{Slope} + (D) \times \text{C.S.}$	$Z = 0.5" + (D) \times \text{C.S.}$

END 1	END 2
(ii) Negative Cross Slope (C.S.), Single Bearing & Right Side Double Bearing	
$W = 0.5''$	$W = 0.5'' - (C) \times \text{Slope}$
$X = 0.5'' - (D) \times \text{C.S.}$	$X = 0.5'' - (C) \times \text{Slope} - (D) \times \text{C.S.}$
$Y = 0.5'' - (C) \times \text{Slope} - (D) \times \text{C.S.}$	$Y = 0.5'' - (D) \times \text{C.S.}$
$Z = 0.5'' - (C) \times \text{Slope}$	$Z = 0.5''$
(iii) Positive Cross Slope (C.S.), Right Side Double Bearing	
$W = 0.5'' + (2D+E) \times \text{C.S.}$	$W = 0.5'' - (C) \times \text{Slope} + (2D+E) \times \text{C.S.}$
$X = 0.5'' + (D+E) \times \text{C.S.}$	$X = 0.5'' - (C) \times \text{Slope} + (D+E) \times \text{C.S.}$
$Y = 0.5'' - (C) \times \text{Slope} + (D+E) \times \text{C.S.}$	$Y = 0.5'' + (D+E) \times \text{C.S.}$
$Z = 0.5'' - (C) \times \text{Slope} + (2D+E) \times \text{C.S.}$	$Z = 0.5'' + (2D+E) \times \text{C.S.}$
(iv) Negative Cross Slope (C.S.), Left Side Double Bearing	
$W = 0.5'' - (D+E) \times \text{C.S.}$	$W = 0.5'' - (C) \times \text{Slope} - (D+E) \times \text{C.S.}$
$X = 0.5'' - (2D+E) \times \text{C.S.}$	$X = 0.5'' - (C) \times \text{Slope} - (2D+E) \times \text{C.S.}$
$Y = 0.5'' - (C) \times \text{Slope} - (2D+E) \times \text{C.S.}$	$Y = 0.5'' - (2D+E) \times \text{C.S.}$
$Z = 0.5'' - (C) \times \text{Slope} - (D+E) \times \text{C.S.}$	$Z = 0.5'' - (D+E) \times \text{C.S.}$
(II) PLAN VIEW CASE 2:	
(a) END ELEVATION CONDITION 1 OR 2 (Positive Slope)	
(i) Positive Cross Slope (C.S.), Single Bearing & Left Side Double Bearing	
$W = 0.5'' + (C+D/\tan \Phi) \times \text{Slope} + (D) \times \text{C.S.}$	$W = 0.5'' + (D) \times \text{C.S.}$
$X = 0.5'' + (C+D/\tan \Phi) \times \text{Slope}$	$X = 0.5''$
$Y = 0.5''$	$Y = 0.5'' + (C) \times \text{Slope}$
$Z = 0.5'' + (D/\tan \Phi) \times \text{Slope} + (D) \times \text{C.S.}$	$Z = 0.5'' + (C+D/\tan \Phi) \times \text{Slope} + (D) \times \text{C.S.}$
(ii) Negative Cross Slope (C.S.), Single Bearing & Right Side Double Bearing	
$W = 0.5'' + (C) \times \text{Slope}$	$W = 0.5''$
$X = 0.5'' + (C) \times \text{Slope} - (D) \times \text{C.S.}$	$X = 0.5'' - (D) \times \text{C.S.}$
* $Y = 0.5'' - (D/\tan f) \times \text{Slope} - (D) \times \text{C.S.}$	$Y = 0.5'' + (C) \times \text{Slope} - (D) \times \text{C.S.}$
$Z = 0.5''$	$Z = 0.5'' + (C+D/\tan \Phi) \times \text{Slope}$

END 1	END 2
(iii) Positive Cross Slope (C.S.), Right Side Double Bearing	
$W = 0.5" + [(2D+E)/\tan\Phi + C] \times \text{Slope} + (2D+E) \times \text{C.S.}$	$W = 0.5" + (D+E)/\tan\Phi \times \text{Slope} + (2D+E) \times \text{C.S.}$
$X = 0.5" + [(2D+E)/\tan\Phi + C] \times \text{Slope} + (D+E) \times \text{C.S.}$	$X = 0.5" + (D+E)/\tan\Phi \times \text{Slope} + (D+E) \times \text{C.S.}$
$Y = 0.5" + (D+E)/\tan\Phi \times \text{Slope} + (D+E) \times \text{C.S.}$	$Y = 0.5" + [(D+E)/\tan\Phi + C] \times \text{Slope} + (D+E) \times \text{C.S.}$
$Z = 0.5" + (2D+E)/\tan\Phi \times \text{Slope} + (2D+E) \times \text{C.S.}$	$Z = 0.5" + [(2D+E)/\tan\Phi + C] \times \text{Slope} + (2D+E) \times \text{C.S.}$
(iv) Negative Cross Slope (C.S.), Left Side Double Bearing	
$W = 0.5" + [C - (D+E)/\tan\Phi] \times \text{Slope} - (D+E) \times \text{C.S.}$	$* W = 0.5" - (D+E)/\tan\Phi \times \text{Slope} - (D+E) \times \text{C.S.}$
$X = 0.5" + [C - (D+E)/\tan\Phi] \times \text{Slope} - (2D+E) \times \text{C.S.}$	$* X = 0.5" - (D+E)/\tan\Phi \times \text{Slope} - (2D+E) \times \text{C.S.}$
$* Y = 0.5" - (2D+E)/\tan\Phi \times \text{Slope} - (2D+E) \times \text{C.S.}$	$Y = 0.5" + [C - (D+E)/\tan\Phi] \times \text{Slope} - (2D+E) \times \text{C.S.}$
$* Z = 0.5" - (D+E)/\tan\Phi \times \text{Slope} - (D+E) \times \text{C.S.}$	$Z = 0.5" + [C - E/\tan\Phi] \times \text{Slope} - (D+E) \times \text{C.S.}$
(b) END ELEVATION CONDITION 3 (Negative Slope)	
(i) Positive Cross Slope (C.S.), Single Bearing & Left Side Double Bearing	
$W = 0.5" + (D) \times \text{C.S.}$	$W = 0.5" - (C) \times \text{Slope} + (D) \times \text{C.S.}$
$X = 0.5"$	$X = 0.5" - (C) \times \text{Slope}$
$Y = 0.5" - (C+D/\tan\Phi) \times \text{Slope}$	$Y = 0.5"$
$Z = 0.5" - (C) \times \text{Slope} + (D) \times \text{C.S.}$	$* Z = 0.5" + (D/\tan\Phi) \times \text{Slope} + (D) \times \text{C.S.}$
(ii) Negative Cross Slope (C.S.), Single Bearing & Right Side Double Bearing	
$W = 0.5"$	$W = 0.5" - (C+D/\tan\Phi) \times \text{Slope}$
$X = 0.5" - (D) \times \text{C.S.}$	$X = 0.5" - (C+D/\tan\Phi) \times \text{Slope} - (D) \times \text{C.S.}$
$Y = 0.5" - (C+D/\tan\Phi) \times \text{Slope} - (D) \times \text{C.S.}$	$Y = 0.5" - (D/\tan\Phi) \times \text{Slope} - (D) \times \text{C.S.}$
$Z = 0.5" - (C) \times \text{Slope}$	$Z = 0.5"$
(iii) Positive Cross Slope (C.S.), Right Side Double Bearing	
$* W = 0.5" + (D+E)/\tan\Phi \times \text{Slope} + (2D+E) \times \text{C.S.}$	$W = 0.5" - [C - (D+E)/\tan\Phi] \times \text{Slope} + (2D+E) \times \text{C.S.}$
$* X = 0.5" + (D+E)/\tan\Phi \times \text{Slope} + (D+E) \times \text{C.S.}$	$X = 0.5" - [C - (D+E)/\tan\Phi] \times \text{Slope} + (D+E) \times \text{C.S.}$
$Y = 0.5" - [C - E/\tan\Phi] \times \text{Slope} + (D+E) \times \text{C.S.}$	$* Y = 0.5" + (D+E)/\tan\Phi \times \text{Slope} + (D+E) \times \text{C.S.}$
$Z = 0.5" - [C - (D+E)/\tan\Phi] \times \text{Slope} + (2D+E) \times \text{C.S.}$	$* Z = 0.5" + (2D+E)/\tan\Phi \times \text{Slope} + (2D+E) \times \text{C.S.}$

END 1	END 2
(iv) Negative Cross Slope (C.S.), Left Side Double Bearing	
$W = 0.5" - (D+E)/\tan \Phi \times \text{Slope} - (D+E) \times \text{C.S.}$	$W = 0.5" - [C+(2D+E)/\tan \Phi] \times \text{Slope} - (D+E) \times \text{C.S.}$
$X = 0.5" - (D+E)/\tan \Phi \times \text{Slope} - (2D+E) \times \text{C.S.}$	$X = 0.5" - [C+(2D+E)/\tan \Phi] \times \text{Slope} - (2D+E) \times \text{C.S.}$
$Y = 0.5" - [C+(2D+E)/\tan \Phi] \times \text{Slope} - (2D+E) \times \text{C.S.}$	$Y = 0.5" - (2D+E)/\tan \Phi \times \text{Slope} - (2D+E) \times \text{C.S.}$
$Z = 0.5" - [C + (D+E)/\tan \Phi] \times \text{Slope} - (D+E) \times \text{C.S.}$	$Z = 0.5" - (D+E)/\tan \Phi \times \text{Slope} - (D+E) \times \text{C.S.}$
(III) PLAN VIEW CASE 3:	
(a) END ELEVATION CONDITION 1 OR 2 (Positive Slope)	
(i) Positive Cross Slope (C.S.), Single Bearing & Left Side Double Bearing	
$W = 0.5" + (C) \times \text{Slope} + (D) \times \text{C.S.}$	$W = 0.5" + (D) \times \text{C.S.}$
$X = 0.5" + (C) \times \text{Slope}$	$X = 0.5"$
$Y = 0.5"$	$Y = 0.5" + (C+D/\tan \Phi) \times \text{Slope}$
$* Z = 0.5" - (D/\tan \Phi) \times \text{Slope} + (D) \times \text{C.S.}$	$Z = 0.5" + (C) \times \text{Slope} + (D) \times \text{C.S.}$
(ii) Negative Cross Slope, Single Bearing & Right Side Double Bearing	
$W = 0.5" + (C+D/\tan \Phi) \times \text{Slope}$	$W = 0.5"$
$X = 0.5" + (C+D/\tan \Phi) \times \text{Slope} - (D) \times \text{C.S.}$	$X = 0.5" - (D) \times \text{C.S.}$
$Y = 0.5" - (D/\tan \Phi) \times \text{Slope} - (D) \times \text{C.S.}$	$Y = 0.5" + (C+D/\tan \Phi) - (D) \times \text{C.S.}$
$Z = 0.5"$	$Z = 0.5" + (C) \times \text{Slope}$
(iii) Positive Cross Slope, Right Side Double Bearing	
$W = 0.5" + [C - (D+E)/\tan \Phi] \times \text{Slope} + (2D+E) \times \text{C.S.}$	$* W = 0.5" - (D+E)/\tan \Phi \times \text{Slope} + (2D+E) \times \text{C.S.}$
$X = 0.5" + [C - (D+E)/\tan \Phi] \times \text{Slope} + (D+E) \times \text{C.S.}$	$* X = 0.5" - (D+E)/\tan \Phi \times \text{Slope} + (D+E) \times \text{C.S.}$
$* Y = 0.5" - (D+E)/\tan \Phi \times \text{Slope} + (D+E) \times \text{C.S.}$	$Y = 0.5" + (C - E/\tan \Phi) \times \text{Slope} + (D+E) \times \text{C.S.}$
$* Z = 0.5" - (2D+E)/\tan \Phi \times \text{Slope} + (2D+E) \times \text{C.S.}$	$Z = 0.5" + [C - (D+E)/\tan \Phi] \times \text{Slope} + (2D+E) \times \text{C.S.}$
(iv) Negative Cross Slope, Left Side Double Bearing	
$W = 0.5" + [C + (2D+E)/\tan \Phi] \times \text{Slope} - (D+E) \times \text{C.S.}$	$W = 0.5" + (D+E)/\tan \Phi \times \text{Slope} - (D+E) \times \text{C.S.}$
$X = 0.5" + [C + (2D+E)/\tan \Phi] \times \text{Slope} - (2D+E) \times \text{C.S.}$	$X = 0.5" + (D+E)/\tan \Phi \times \text{Slope} - (2D+E) \times \text{C.S.}$
$Y = 0.5" + (2D+E)/\tan \Phi \times \text{Slope} - (2D+E) \times \text{C.S.}$	$Y = 0.5" + [C + (2D+E)/\tan \Phi] \times \text{Slope} - (2D+E) \times \text{C.S.}$
$Z = 0.5" + (D+E)/\tan \Phi \times \text{Slope} - (D+E) \times \text{C.S.}$	$Z = 0.5" + [C + (D+E)/\tan \Phi] \times \text{Slope} - (D+E) \times \text{C.S.}$

END 1	END 2
(b) END ELEVATION CONDITION 3 (Negative Slope)	
(i) Positive Cross Slope (C.S.), Single Bearing & Left Side Double Bearing	
$W = 0.5" + (D) \times C.S.$	$W = 0.5" - (C+D/\tan \Phi) \times \text{Slope} + (D) \times C.S.$
$X = 0.5"$	$X = 0.5" - (C+D/\tan \Phi) \times \text{Slope}$
$Y = 0.5" - (C) \times \text{Slope}$	$Y = 0.5"$
$Z = 0.5" - [C+D/\tan \Phi] \times \text{Slope} + (D) \times C.S.$	$Z = 0.5" - (D/\tan \Phi) \times \text{Slope} + (D) \times C.S.$
(ii) Negative Cross Slope (C.S.), Single Bearing & Right Side Double Bearing	
$W = 0.5"$	$W = 0.5" - (C) \times \text{Slope}$
$X = 0.5" - (D) \times C.S.$	$X = 0.5" - (C) \times \text{Slope} - (D) \times C.S.$
$Y = 0.5" - (C) \times \text{Slope} - (D) \times C.S.$	$Y = 0.5" + (D/\tan \Phi) \times \text{Slope} - (D) \times C.S.$
$Z = 0.5" - (C+D/\tan \Phi) \times \text{Slope}$	$Z = 0.5"$
(iii) Positive Cross Slope (C.S.), Right Side Double Bearing	
$W = 0.5" - (D+E)/\tan \Phi \times \text{Slope} + (2D+E) \times C.S.$	$W = 0.5" - [C+(2D+E)/\tan \Phi] \times \text{Slope} + (2D+E) \times C.S.$
$X = 0.5" - (D+E)/\tan \Phi \times \text{Slope} + (D+E) \times C.S.$	$X = 0.5" - [C+(2D+E)/\tan \Phi] \times \text{Slope} + (D+E) \times C.S.$
$Y = 0.5" - [C + (D+E)/\tan \Phi] \times \text{Slope} + (D+E) \times C.S.$	$Y = 0.5" - (D+E)/\tan \Phi \times \text{Slope} + (D+E) \times C.S.$
$Z = 0.5" - [C+(2D+E)/\tan \Phi] \times \text{Slope} + (2D+E) \times C.S.$	$Z = 0.5" - (2D+E)/\tan \Phi \times \text{Slope} + (2D+E) \times C.S.$
(iv) Negative Cross Slope (C.S.), Left Side Double Bearing	
$* W = 0.5" + (D+E)/\tan \Phi \times \text{Slope} - (D+E) \times C.S.$	$W = 0.5" - [C - (D+E)/\tan \Phi] \times \text{Slope} - (D+E) \times C.S.$
$* X = 0.5" + (D+E)/\tan \Phi \times \text{Slope} - (2D+E) \times C.S.$	$X = 0.5" - [C - (D+E)/\tan \Phi] \times \text{Slope} - (2D+E) \times C.S.$
$Y = 0.5" - [C - (D+E)/\tan \Phi] \times \text{Slope} - (2D+E) \times C.S.$	$* Y = 0.5" + (2D+E)/\tan \Phi \times \text{Slope} - (2D+E) \times C.S.$
$Z = 0.5" - [C - (E)/\tan \Phi] \times \text{Slope} - (D+E) \times C.S.$	$* Z = 0.5" + (D+E)/\tan \Phi \times \text{Slope} - (D+E) \times C.S.$

* Could be less than 0.5" for steep slopes. Adjust plate thickness equally at all corners of both left and right side plates to provide a minimum 0.5" thickness.

Index 20510 Composite Elastomeric Bearing Pads - Prestressed Florida-I Beams (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th 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.

LIMITING PARAMETERS FOR COMPOSITE ELASTOMERIC BEARING PADS USED WITH FDOT STANDARD FLORIDA-I BEAMS					
Pad Type	Maximum Service Live Load (kips)	Maximum Service Dead Load (LL = Actual Service Live Load)	Skew Angle (degrees)	Maximum Shear Deflection (in)	Shear Modulus, G (Psi)
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° and 15° ; 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°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°

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.

Index 20511 Bearing Plates (Type 1) - Prestressed Florida-I Beams (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

This standard is intended for use on bridges where full depth end diaphragms are required and/or widenings where squared end beams are not feasible as determined by the EOR. For all other cases, use Index 20512 and its Instructions. Index 20512 may be used for all projects with squared end beams, with or without end diaphragms.

This standard contains generic details and notes for beveled and embedded bearing plates for prestressed concrete Florida-I Beams with or without skewed end conditions.

Use this standard with Indexes 20010, 20036, 20045, 20054, 20063, 20072, 20078, 20084, 20096 and 20510.

Embedded Bearing Plates A are required for all Florida-I Beams. Embedded Bearing Plates A and Beveled Bearing Plates B are required for beams on grades greater than 2%.

Plan Content Requirements

In the Structures Plans:

Bearing seats (pedestals) may be finished level for beam grades less than 0.5%. Use Embedded Bearing Plates A but do not use Beveled Bearing Plates B.

For beam grades between 0.5% and 2%, show the bearing seats (pedestals) to be finished parallel to the beam grade with no allowance for beam camber or deflection. Use Embedded Bearing Plates A but do not use Beveled Bearing Plates B.

For beam grades greater than 2%, show the bearing seats (pedestals) to be finished level and use Bearing Plates A and B.

See also instructions for Index 20510.

Complete the following "BEARING PLATE DATA TABLE" and include it in the plans. Fill in the table to correspond with data on the "FLORIDA-I BEAM TABLE OF BEAM VARIABLES" using inch units for Beveled Plate dimensions 'W', 'X', 'Y' & 'Z' rounded to 1/16th of an inch. If Beveled Bearing Plates B are not required, fill in the corresponding columns with "N/A". See [Introduction I.3](#) for more information regarding use of Data Tables.

Use the following equations to determine the Beveled Bearing Plate B thicknesses for "PLAN VIEW CASES" and "END ELEVATION CONDITIONS" corresponding to those shown on Index 20010. The Slope parameter in these equations requires decimal units and correct sign convention:

END 1	END 2
(I) PLAN VIEW CASE 1:	
(a) END ELEVATION CONDITION 1 or 2 (Positive Slope)	
$W = X = 0.5" + (C) \times \text{Slope}$	$W = X = 0.5"$
$Y = Z = 0.5"$	$Y = Z = 0.5" + (C) \times \text{Slope}$
(b) END ELEVATION CONDITION 1 or 3 (Negative Slope)	
$W = X = 0.5"$	$W = X = 0.5" - (C) \times \text{Slope}$
$Y = Z = 0.5" - (C) \times \text{Slope}$	$Y = Z = 0.5"$
(II) PLAN VIEW CASE 2:	
(a) END ELEVATION CONDITION 1 or 2 (Positive Slope)	
$W = 0.5" + (C / \sin \Phi + D / \tan \Phi) \times \text{Slope}$	$W = 0.5" + (D / \tan \Phi) \times \text{Slope}$
$X = 0.5" + (C / \sin \Phi) \times \text{Slope}$	$X = 0.5"$
$Y = 0.5"$	$Y = 0.5" + (C / \sin \Phi) \times \text{Slope}$
$Z = 0.5" + (D / \tan \Phi) \times \text{Slope}$	$Z = 0.5" + (C / \sin \Phi + D / \tan \Phi) \times \text{Slope}$
(b) END ELEVATION CONDITION 1 or 3 (Negative Slope)	
$W = 0.5"$	$W = 0.5" - (C / \sin \Phi) \times \text{Slope}$
$X = 0.5" - (D / \tan \Phi) \times \text{Slope}$	$X = 0.5" - (C / \sin \Phi + D / \tan \Phi) \times \text{Slope}$
$Y = 0.5" - (C / \sin \Phi + D / \tan \Phi) \times \text{Slope}$	$Y = 0.5" - (D / \tan \Phi) \times \text{Slope}$
$Z = 0.5" - (C / \sin \Phi) \times \text{Slope}$	$Z = 0.5"$
(III) PLAN VIEW CASE 3:	
(a) END ELEVATION CONDITION 1 or 2 (Positive Slope)	
$W = 0.5" + (C / \sin \Phi) \times \text{Slope}$	$W = 0.5"$
$X = 0.5" + (C / \sin \Phi + D / \tan \Phi) \times \text{Slope}$	$X = 0.5" + (D / \tan \Phi) \times \text{Slope}$
$Y = 0.5" + (D / \tan \Phi) \times \text{Slope}$	$Y = 0.5" + (C / \sin \Phi + D / \tan \Phi) \times \text{Slope}$
$Z = 0.5"$	$Z = 0.5" + (C / \sin \Phi) \times \text{Slope}$
(b) END ELEVATION CONDITION 1 or 3 (Negative Slope)	
$W = 0.5" - (D / \tan \Phi) \times \text{Slope}$	$W = 0.5" - (C / \sin \Phi + D / \tan \Phi) \times \text{Slope}$
$X = 0.5"$	$X = 0.5" - (C / \sin \Phi) \times \text{Slope}$
$Y = 0.5" - (C / \sin \Phi) \times \text{Slope}$	$Y = 0.5"$
$Z = 0.5" - (C / \sin \Phi + D / \tan \Phi) \times \text{Slope}$	$Z = 0.5" - (D / \tan \Phi) \times \text{Slope}$

For all cases:

$$E = C / \sin \Phi$$

$$G = 13.5" / \sin \Phi$$

Index 20512 Bearing Plates (Type 2)- Prestressed Florida-I Beams (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 5th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

This standard is intended for use with squared-end Florida-I Beams with or without end diaphragms.

This standard contains generic details and notes for beveled and embedded bearing plates for prestressed concrete Florida-I Beams with or without skewed support conditions.

Use this standard with Indexes 20010, 20036, 20045, 20054, 20063, 20072, 20078, 20084, 20096 and 20510.

Embedded Bearing Plates A are required for all Florida-I Beams. Embedded Bearing Plates A and Beveled Bearing Plates B are required for beams on grades greater than 2%.

Plan Content Requirements

In the Structures Plans:

Bearing seats (pedestals) may be finished level for beam grades less than 0.5%. Use Embedded Bearing Plates A but do not use Beveled Bearing Plates B.

For beam grades between 0.5% and 2%, show the bearing seats (pedestals) to be finished parallel to the beam grade with no allowance for beam camber or deflection. Use Embedded Bearing Plates A but do not use Beveled Bearing Plates B.

For beam grades greater than 2%, show the bearing seats (pedestals) to be finished level and use Bearing Plates A and B.

See also instructions for Index 20510.

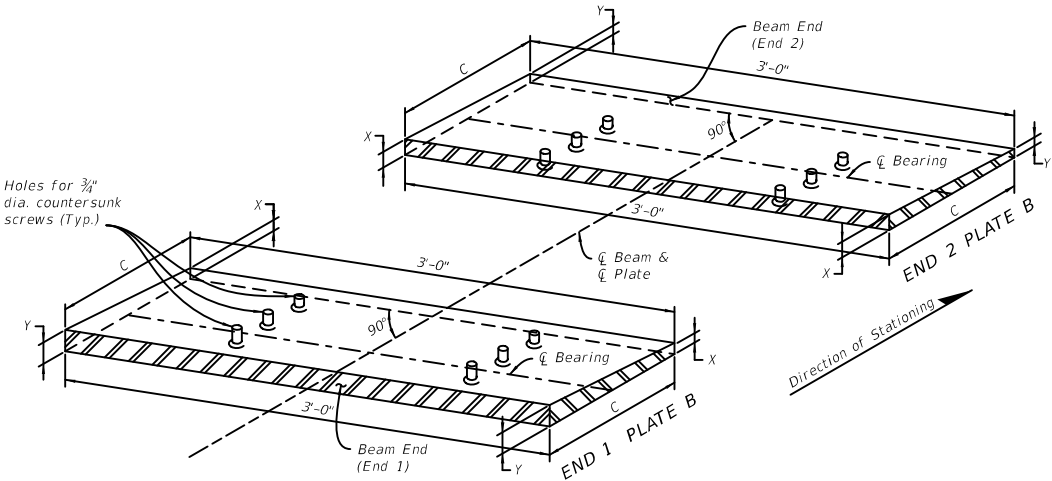
Complete the following "BEARING PLATE DATA TABLE" and include it in the plans. Fill in the table to correspond with data on the "FLORIDA-I BEAM TABLE OF BEAM VARIABLES" using inch units for Beveled Plate dimensions 'X' and 'Y' rounded to 1/16th of an inch. If Beveled Bearing Plates B are not required, fill in the corresponding columns with "N/A". See [Introduction I.3](#) for more information regarding use of Data Tables.

Use the following equations to determine the Beveled Bearing Plate B thicknesses for "PLAN VIEW CASES" and "END ELEVATION CONDITIONS" corresponding to those shown on Index 20010. The Slope parameter in these equations requires decimal units and correct sign convention:

END 1	END 2
(I) PLAN VIEW CASE 1:	
(a) END ELEVATION CONDITION 1 or 2 (Positive Slope)	
$X = 0.5" + (C) \times \text{Slope}$	$X = 0.5"$
$Y = 0.5"$	$Y = 0.5" + (C) \times \text{Slope}$
(b) END ELEVATION CONDITION 1 or 3 (Negative Slope)	
$X = 0.5"$	$X = 0.5" - (C) \times \text{Slope}$
$Y = 0.5" - (C) \times \text{Slope}$	$Y = 0.5"$

BEARING PLATE DATA TABLE - TYPE 2								Table Date 1-01-12		
GENERAL BEARING PLATE DATA							BEVELED PLATE REQUIRED (Yes/No)	BEVELED PLATE DIMENSIONS (PLATE B) (inches)		
BRG. PLATE MARK **	SPAN NO(s).	BEAM NO(s).	PAD TYPE	BEAM END	PLAN VIEW CASE	SLOPE (%) *		C	X	Y

NOTES:
 See Index No. 20512 for additional notes and details.
 Embedded Bearing Plate A dimensions are 1/2" x 1'-1 1/2" x 3'-0"
 * Slope measured along \bar{c} of Beam at \bar{c} of Bearing.
 ** See "TABLE OF BEAM VARIABLES" and Index No. 20010.



ISOMETRIC VIEW OF BEVELED BEARING PLATES (TYPE 2) FOR FLORIDA I-BEAMS

Payment

The cost of beveled and embedded bearing plates is incidental to the cost of the prestressed beams they are used with. No separate payment is made.

Index 20600 Series Concrete Piles (Rev. 01/12)

Design Criteria

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

Design Assumptions and Limitations

Index 20600 is the lead standard for the Square Prestressed Concrete Pile standard series which includes Indexes 20600 through 20631. Use this standard with Indexes 20601, 20602, 20612, 20614, 20618, 20620, 20624, 20630 and 20631.

Standard piles are designed to have 1000 psi uniform compression after prestress losses without any applied loads.

The piles are designed to have 0.0 psi tension using a load factor of 1.5 times the pile self weight during pick-up, storage and transportation as shown in the "Table of Maximum Pile Pick-Up and Support Lengths" on the standard.

Plan Content Requirements

In the Structures Plans:

Show and label the piles on the Foundation Layout, End Bent, Intermediate Bent, Pier, Footing, Typical Section and other sheets as required.

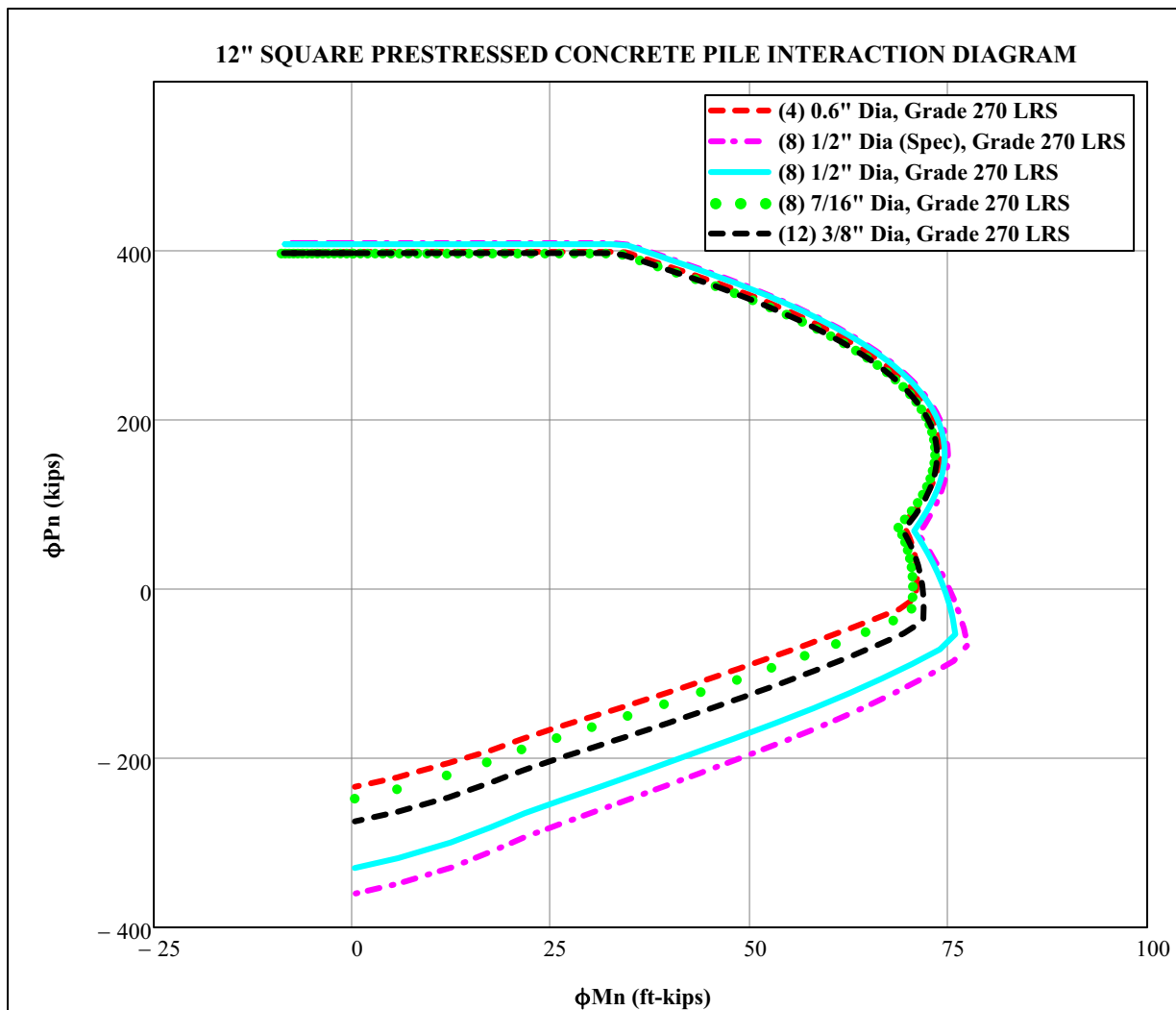
Complete the following "Data Table" in accordance with **SDG** 3.5 and **SDM** 11.4 and include it in the contract plans with the "Foundation Layout" sheets. Modify table and notes as required to accommodate the required number of piles, piers and/or bents, use of Test Piles and instrumentation. When not enough space is available on one plan sheet, continuations of the Data Table and/or separate pile cut-off elevation tables are acceptable. See [Introduction I.3](#) for more information regarding use of Data Tables.

For projects without Test Piles change data table column heading "TEST PILE LENGTH (ft.)" to "PILE ORDER LENGTH (ft.)".

Payment

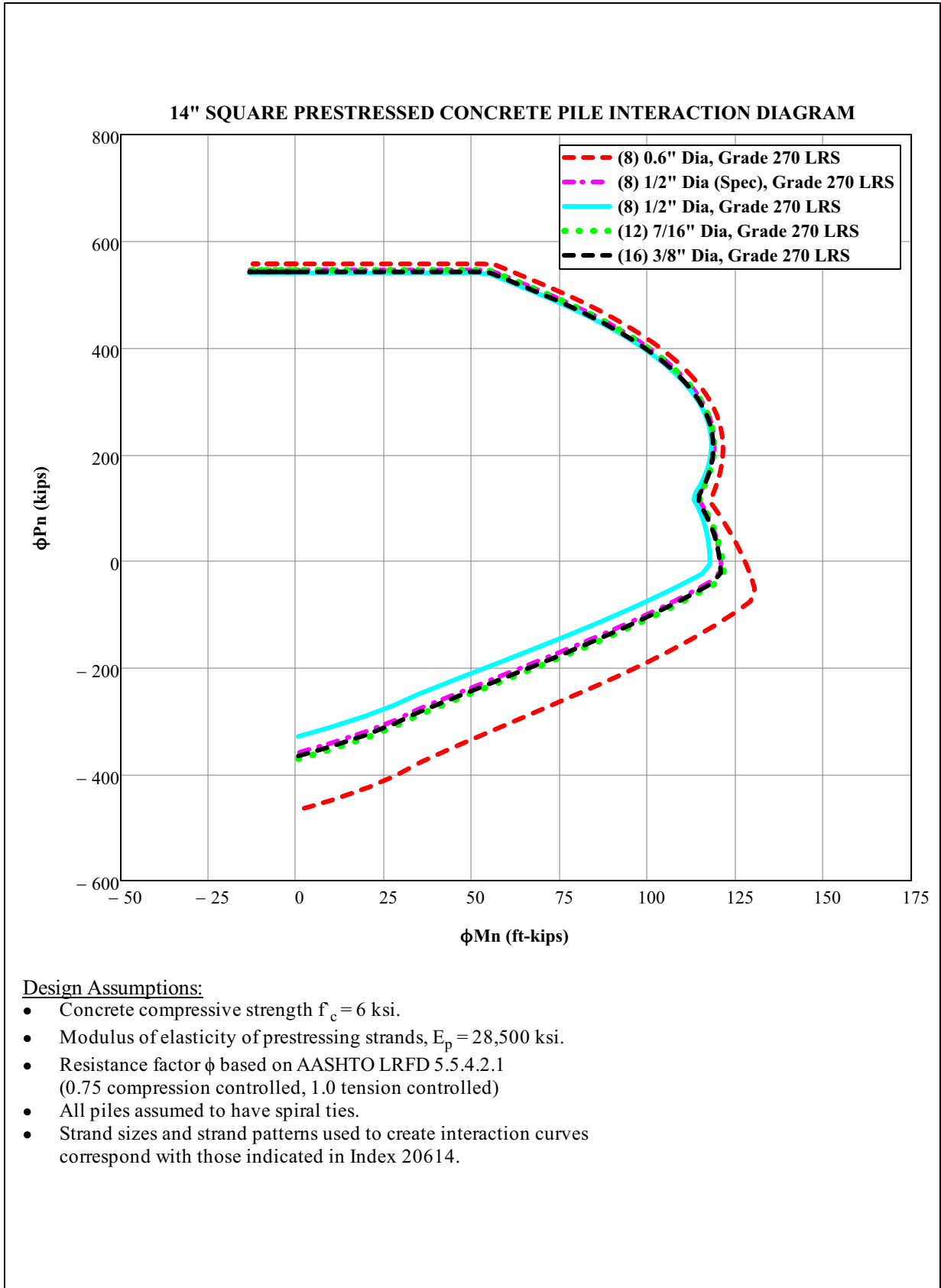
Item number	Item description	Unit Measure
455-34-AA	Prestressed Concrete Piling	LF

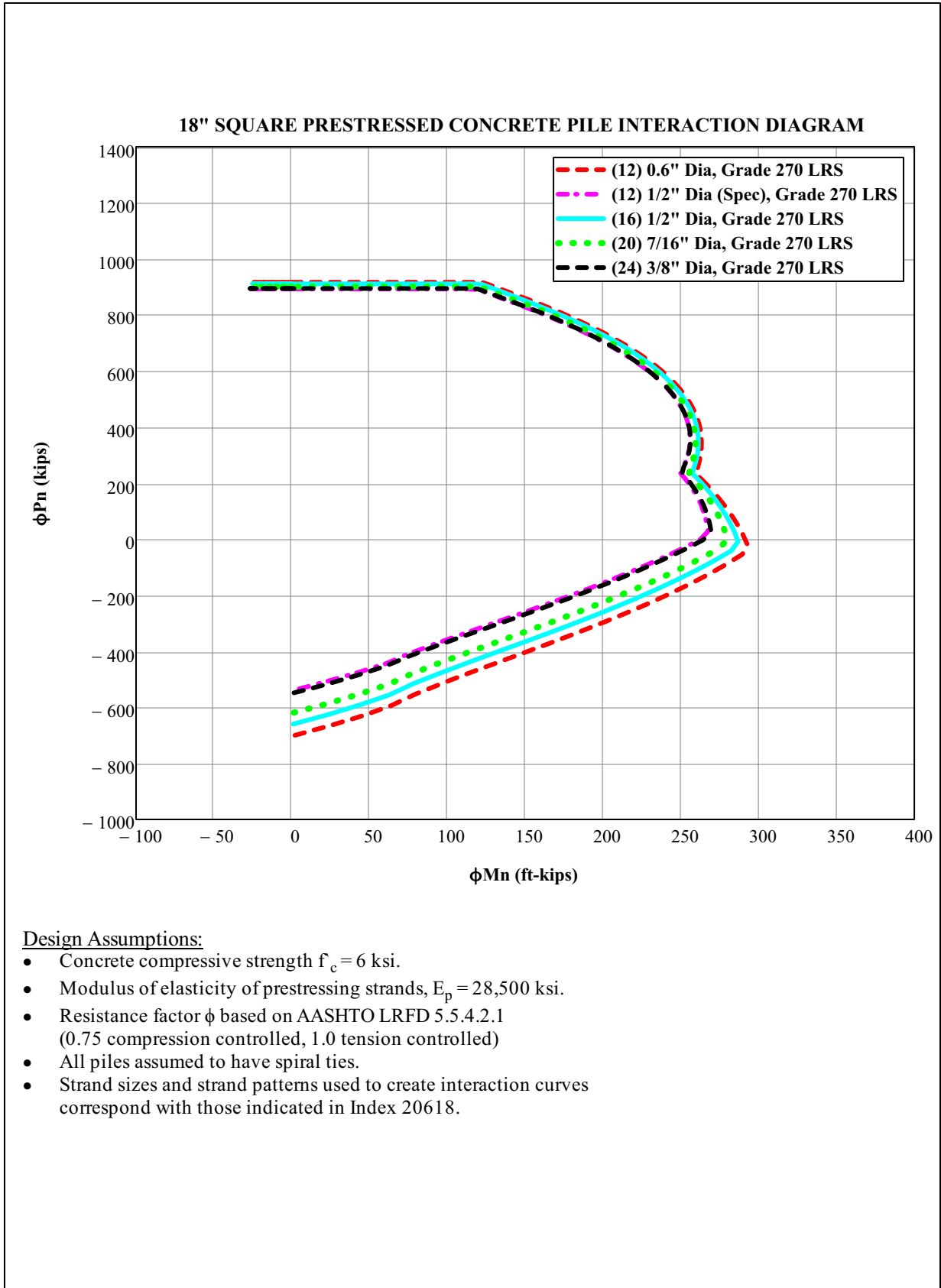
Design Aids

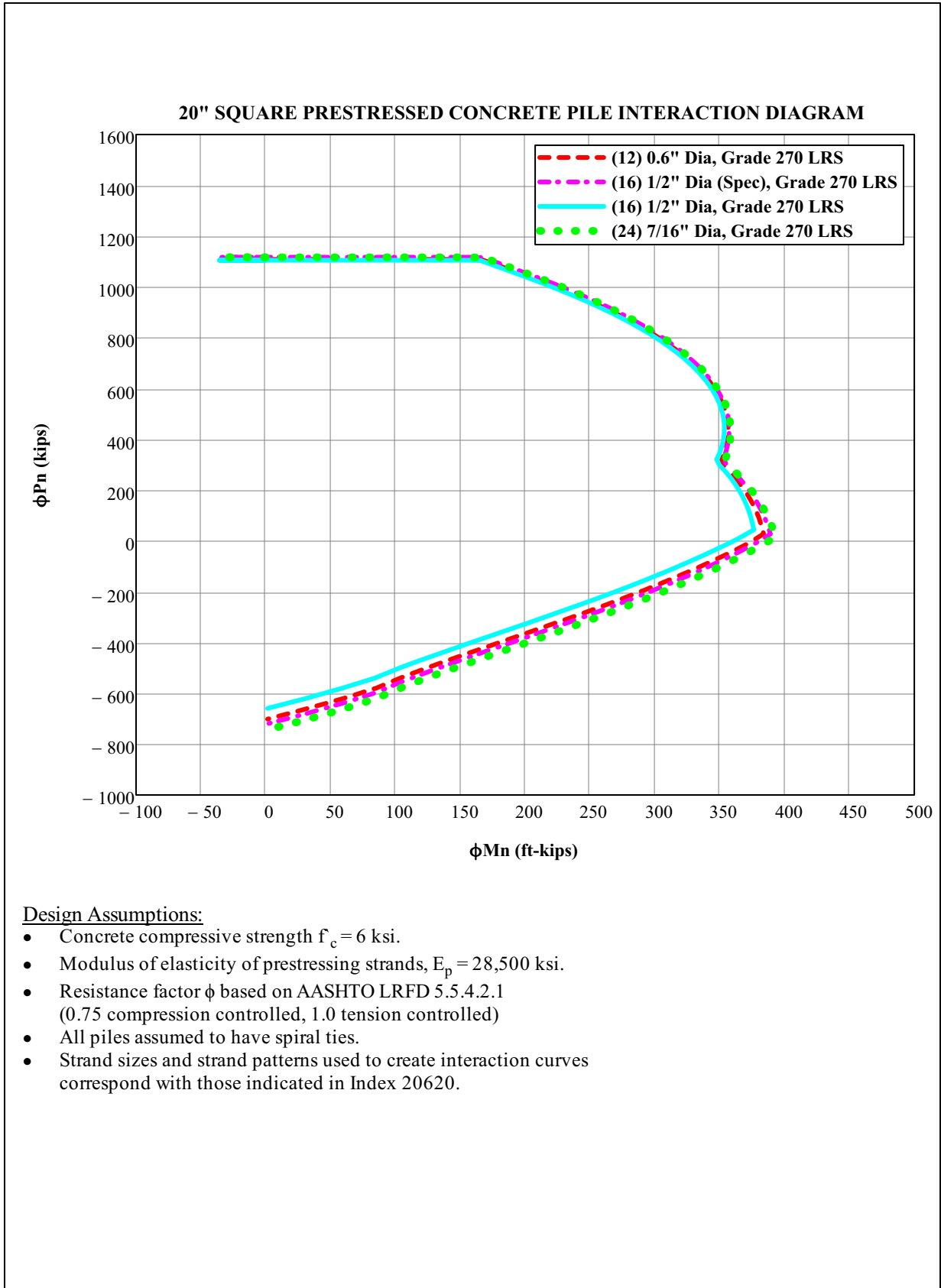


Design Assumptions:

- Concrete compressive strength $f_c = 6$ ksi.
- Modulus of elasticity of prestressing strands, $E_p = 28,500$ ksi.
- Resistance factor ϕ based on AASHTO LRFD 5.5.4.2.1 (0.75 compression controlled, 1.0 tension controlled).
- All piles assumed to have spiral ties.
- Strand sizes and strand patterns used to create interaction curves correspond with those indicated in Index 20612.

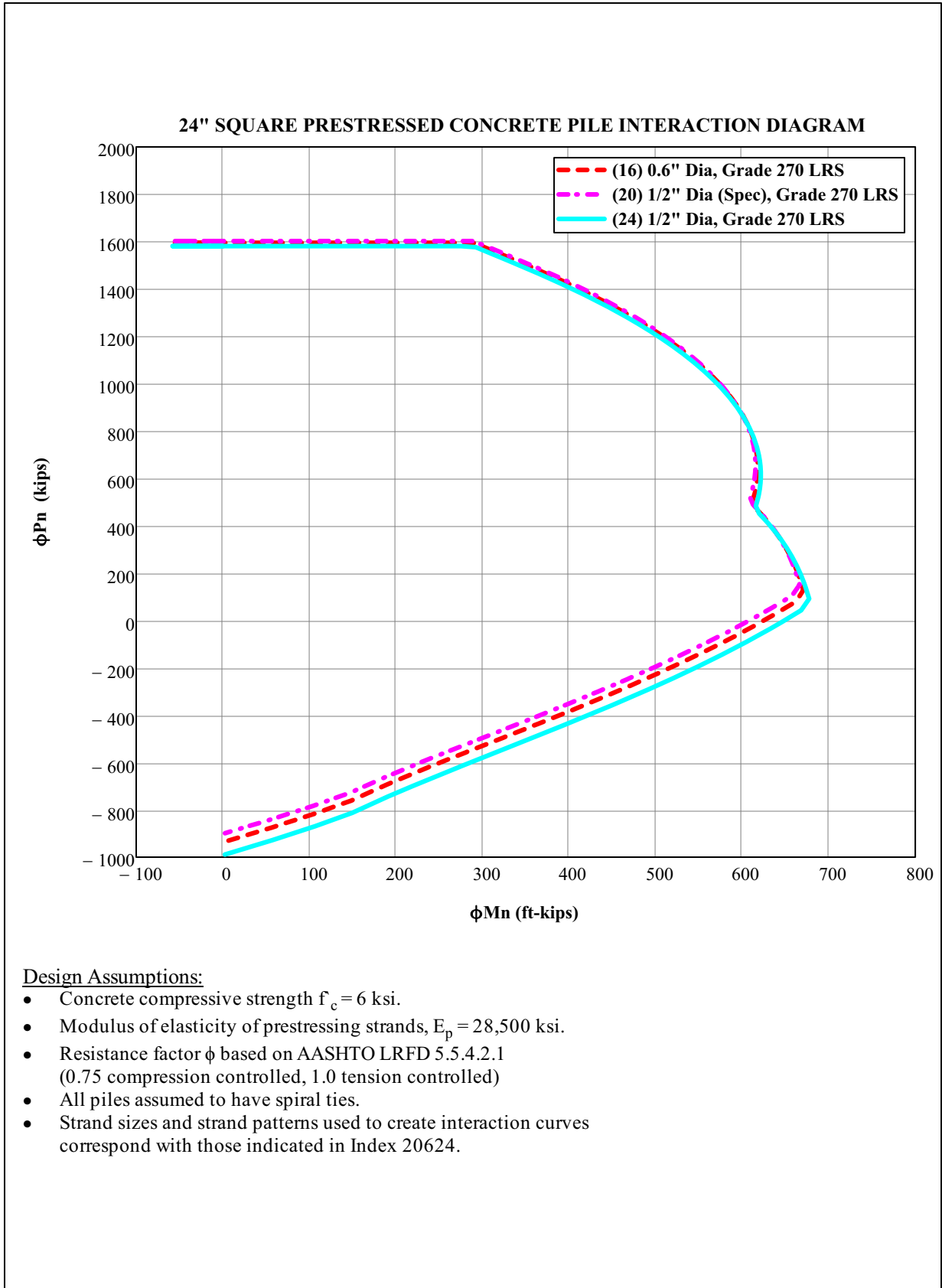


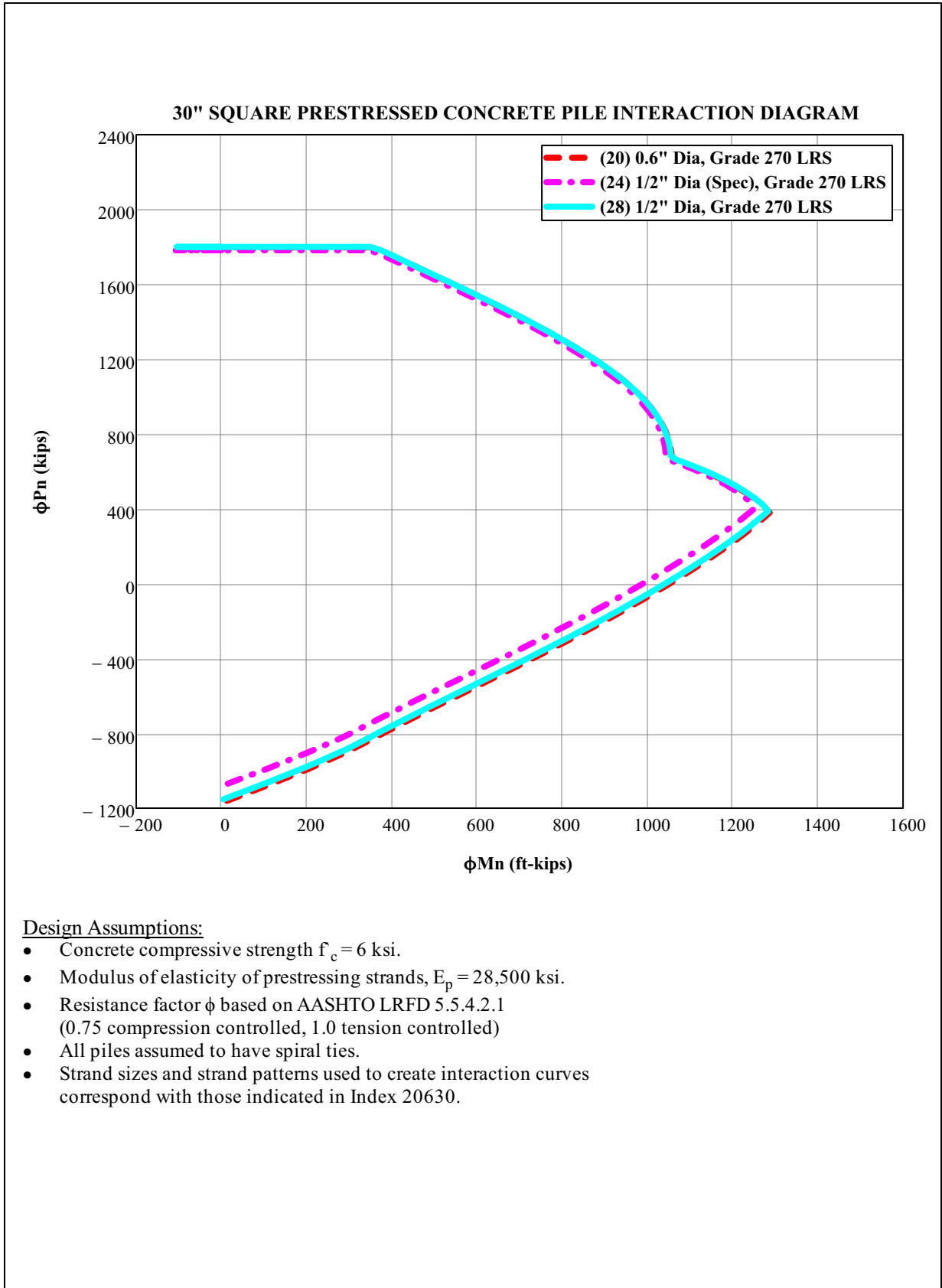


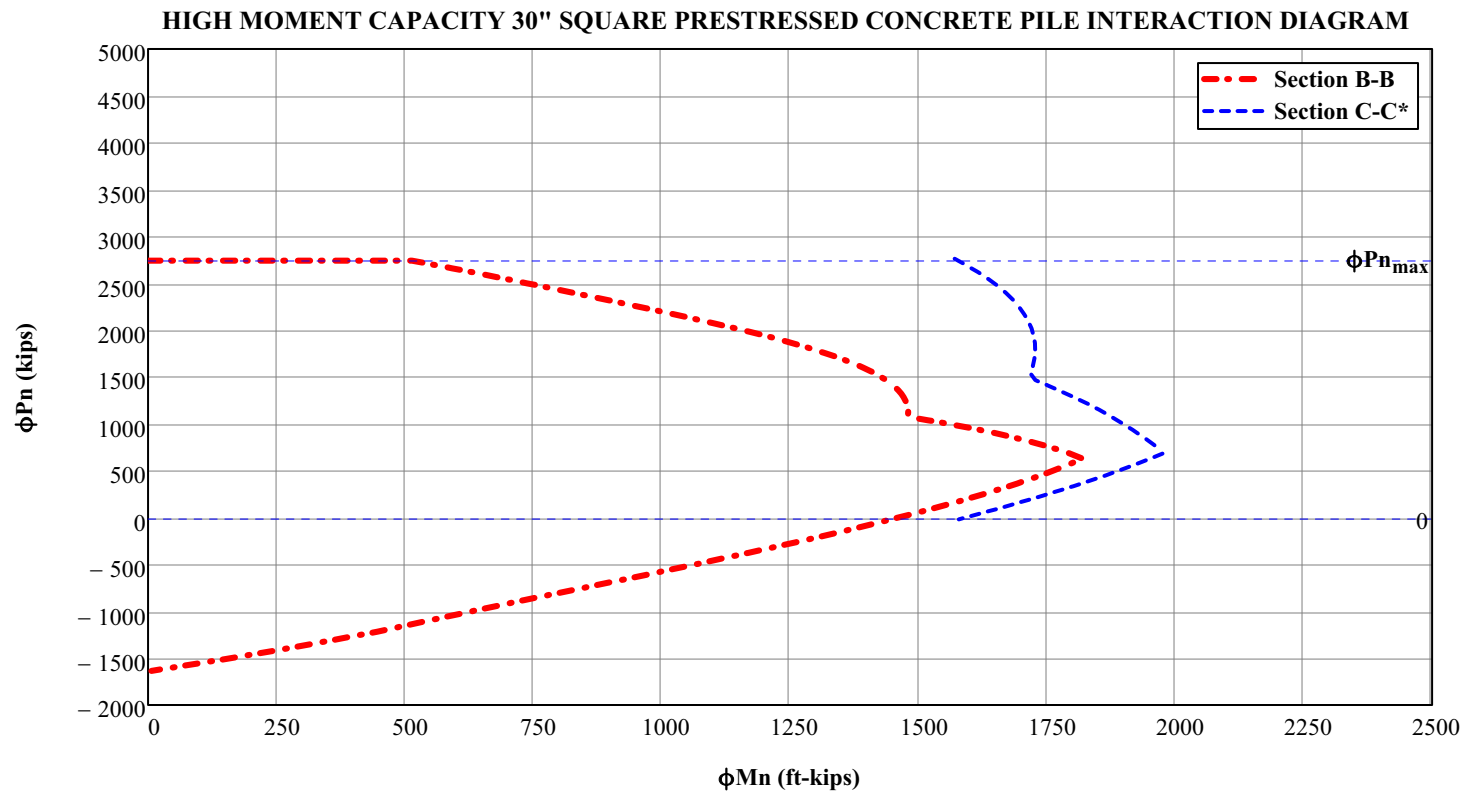


Design Assumptions:

- Concrete compressive strength $f_c = 6$ ksi.
- Modulus of elasticity of prestressing strands, $E_p = 28,500$ ksi.
- Resistance factor ϕ based on AASHTO LRFD 5.5.4.2.1 (0.75 compression controlled, 1.0 tension controlled)
- All piles assumed to have spiral ties.
- Strand sizes and strand patterns used to create interaction curves correspond with those indicated in Index 20620.







Design Assumptions:

- Concrete compressive strength $f_c = 8.5$ ksi.
- Strand Pattern: (28) 0.6" Diameter, Grade 270 LRS.
- Modulus of elasticity of prestressing strands, $E_p = 28,500$ ksi.
- Resistance factor ϕ based on AASHTO LRFD 5.5.4.2.1 (0.75 compression controlled, 1.0 tension controlled)
- All piles assumed to have spiral ties.
- Refer to Design Standard Index 20631 for details of pile sections B-B and C-C.

*The curve for Section C-C is limited by the axial capacity (tension and compression) of the voided section of the pile (Section B-B).

Index 20654 54" Precast / Post-Tensioned Concrete Cylinder Pile (Rev. 01/12)

Design Criteria

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

Design Assumptions and Limitations

Standard piles are designed to have 1000 psi uniform compression after prestress losses without any applied loads.

The piles are designed to have 0.0 psi tension using a load factor of 1.5 times the pile self weight during pick-up, storage and transportation as shown in the "Table of Maximum Pile Pick-Up and Support Lengths" on the standard.

Plan Content Requirements

In the Structures Plans:

Show and label the piles on the Foundation Layout, End Bent, Intermediate Bent, Pier, Footing, Typical Section and other sheets as required.

Complete the following "Data Table" in accordance with **SDG** 3.5 and **SDM** 11.4 and include it in the contract plans with the "Foundation Layout" sheets. Modify table and notes as required to accommodate the required number of piles, piers and/or bents and use of Test Piles. When not enough space is available on one plan sheet, continuations of the Data Table and/or separate pile cut-off elevation tables are acceptable. See [Introduction I.3](#) for more information regarding use of Data Tables.

For projects without Test Piles change column heading "TEST PILE LENGTH (ft.)" to "PILE ORDER LENGTH (ft.)".

PILE DATA TABLE																							Table Date 01/01/12		
INSTALLATION CRITERIA								DESIGN CRITERIA							PILE CUT-OFF ELEVATIONS										
PIER or BENT NUMBER	PILE SIZE (in.)	NOMINAL BEARING RESISTANCE (tons)	NOMINAL UPLIFT RESISTANCE (tons)	MINIMUM TIP ELEVATION (ft.)	TEST PILE LENGTH (ft.)	REQUIRED JET ELEVATION (ft.)	REQUIRED PREFORM ELEVATION (ft.)	FACTORED DESIGN LOAD (tons)	FACTORED DESIGN UPLIFT LOAD (tons)	DOWN DRAG (tons)	TOTAL SCOUR RESISTANCE (tons)	NET SCOUR RESISTANCE (tons)	100-YEAR SCOUR ELEVATION (ft.)	LONG TERM SCOUR ELEVATION (ft.)	Ø COMPRESSION	Ø UPLIFT	PILE 1	PILE 2	PILE 3	PILE 4	PILE 5	PILE 6	PILE 7	PILE 8	PILE 9

Payment

Item number	Item description	Unit Measure
455-36-1	Concrete Cylinder Piles Furnished & Driven (54" Diameter)	LF

Index 20660 60" Prestressed Concrete Cylinder Pile (Rev. 01/12)

Design Criteria

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

Design Assumptions and Limitations

Standard piles are designed to have 1000 psi uniform compression after prestress losses without any applied loads.

The piles are designed to have 0.0 psi tension using a load factor of 1.5 times the pile self weight during pick-up, storage and transportation as shown in the "Table of Maximum Pile Pick-Up and Support Lengths" on the standard.

Plan Content Requirements

In the Structures Plans:

Show and label the piles on the Foundation Layout, End Bent, Intermediate Bent, Pier, Footing, Typical Section and other sheets as required.

Complete the following "Data Table" in accordance with **SDG** 3.5 and **SDM** 11.4 and include it in the contract plans with the "Foundation Layout" sheets. Modify table and notes as required to accommodate the required number of piles, piers and/or bents and use of Test Piles. When not enough space is available on one plan sheet, continuations of the Data Table and/or separate pile cut-off elevation tables are acceptable. See [Introduction I.3](#) for more information regarding use of Data Tables.

For projects without Test Piles change column heading "TEST PILE LENGTH (ft.)" to "PILE ORDER LENGTH (ft.)".

Payment

Item number	Item description	Unit Measure
455-36-2	Concrete Cylinder Piles Furnished & Driven (60" Diameter)	LF

Index 20900 Approach Slabs (Flexible Pavement Approaches) (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Detailing Manual (SDM)**

Design Assumptions and Limitations

Index 20900 is intended to be used with asphalt (flexible) roadway approach pavement.

Approach Slabs are intended to provide a smooth vertical transition between the roadway approach pavement and the bridge. They are supported at the bridge end by the end bent and by the embankment at the roadway approach end. This support configuration allows the Approach Slabs to rotate and settle as the roadway approach embankment settles. No additional supports (piles, footings, etc.) are required or allowed.

The approach slab is designed with the following assumptions:

- From the back face of the End Bent Backwall, a 10' length of the approach slab is assumed to span unsupported while the remainder of the approach slab beyond this 10' length is designed as a beam on an elastic foundation.
- For simplicity, 50% of the dead load and the maximum reaction from an HL93 loading is applied to the backwall of the end bent.

The details adjacent to the End Bent Backwall as shown on the standard are intended for use with Poured Joint with Backer Rod and Strip Seal Expansion Joints. If other expansion joint types are used, e.g. finger or modular expansion joints, modifications to the standard may be required to accommodate the expansion joints and the blockouts used to install them.

Plan Content Requirements

Index 20900 requires supplemental sheets, a completed data table and reinforcing bar lists to be included in the Structures Plans. Some roadway elements may need to be carried onto the approach slab, and in these cases special attention must be given to clarifying in the plans which elements are to be included as part of the roadway.

In the Structures Plans:

Include supplemental sheets showing as a minimum a Plan View with geometry and pertinent information not covered by this standard e.g., Survey Lines, PGL, Direction of Stationing, Phase Construction Joints, Raised Sidewalks and any other information necessary to accurately complete detailing of the Approach Slabs. Match the skew angle of the bridge at both ends of the Approach Slab. Include cross references to **Design Standards** Index 20900.

Urban roadway approaches usually have a 6-inch raised sidewalk. If the raised sidewalk is not continued across the bridge, when possible, transition the raised sidewalk to the bridge sidewalk over the length of the approach slab. Design and detail the transition to prohibit low spots or ponding and to redirect or collect runoff from the bridge and approach slab into suitable roadway or drainage structures.

Include Approach Slab Finish Grade Elevations with the Bridge Finish Grade Elevations. Show Finish Grade Elevations at the top of the asphalt overlay.

Include reinforcing bars in the Reinforcing Steel List. All reinforcing bars are straight bars (Types 1 and 2). Bars 5C are 5'-0" long.

Complete the following "Approach Slab Index No. 20900 Table of Dimensions and Estimated Quantities" and include it on the supplemental sheets. See [Introduction I.3](#) for more information regarding use of Data Tables.

APPROACH SLAB INDEX NO. 20900 TABLE OF DIMENSIONS AND ESTIMATED QUANTITIES								Table Date 01-01-12
LOCATION	DIMENSIONS					ANGLE θ	REINFORCING STEEL (Lbs.)	CLASS II (Bridge Deck) CONCRETE (C.Y.)
	L1	L2	M1	M2	N			

Dimension and Quantity Notes:
 Dimensions L1 & L2 are measured along gutter line, inside face of parapet or inside face of railing on raised sidewalks.
 Dimensions L1 & L2 are arc dimensions within curved alignments.

Quantities shown are for one Approach Slab and where applicable, raised sidewalks. Quantities do not include items placed on the slab such as Traffic Railing, Pedestrian/Bicycle Railings or Traffic Separators.

For Traffic Railing, Pedestrian/Bicycle Railing and Traffic Separator Quantities see Bid Item List.

Payment.

Item number	Item description	Unit Measure
400-2-10	Concrete Class II, Approach Slabs	CY
415-1-9	Reinforcing Steel - Approach Slabs	LB

The stabilization required under the approach slabs shall be paid for using the standard roadway pay item and the quantity included in the roadway plans. In addition, roadway elements such as guardrail, earthwork, sidewalks, approach slab surfacing, etc., which are part of the roadway approaches to the bridge and which interface with the approach slabs, will also be included and paid for in the roadway quantities.

Index 20910 Approach Slabs (Rigid Pavement Approaches) **(Rev. 01/12)**

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; ***Structures Detailing Manual (SDM)***

Design Assumptions and Limitations

Index 20910 is intended to be used with concrete (rigid) roadway approach pavement.

Approach Slabs are intended to provide a smooth vertical transition between the roadway approach pavement and the bridge. They are supported at the bridge end by the end bent and by the embankment at the roadway approach end. This support configuration allows the Approach Slabs to rotate and settle as the roadway approach embankment settles. No additional supports (piles, footings, etc.) are required or allowed.

Index 20910 works with Index 306 Bridge Approach Expansion Joint Concrete Pavement. The roadway approach end of the Approach Slab must be non-skewed to match up with Index 306.

The approach slab is designed with the following assumptions:

- From the back face of the End Bent Backwall, a 10' length of the approach slab is assumed to span unsupported while the remainder of the approach slab beyond this 10' length is designed as a beam on an elastic foundation.
- For simplicity, 50% of the dead load and the maximum reaction from an HL93 loading is applied to the backwall of the end bent.

The details adjacent to the End Bent Backwall as shown on the standard are intended for use with Poured Joint with Backer Rod and Strip Seal Expansion Joints. If other expansion joint types are used, e.g. finger or modular expansion joints, modifications to the standard may be required to accommodate the expansion joints and the blockouts used to install them.

Plan Content Requirements

Index 20910 requires supplemental sheets, a completed data table and reinforcing bar lists to be included in the Structures Plans. Some roadway elements may need to be carried onto the approach slab, and in these cases special attention must be given to clarifying in the plans which elements are to be included as part of the roadway.

In the Structures Plans:

Include supplemental sheets showing as a minimum a Plan View with geometry and pertinent information not covered by this standard e.g., Survey Lines, PGL, Direction of Stationing, Phase Construction Joints, Raised Sidewalks and any other information

necessary to accurately complete detailing of the Approach Slabs. Match the skew angle of the bridge at the bridge end of the Approach Slab. The roadway approach end of the Approach Slab shall be non-skewed (perpendicular to the stationing line) to match up with the details shown on Index 306 Bridge Approach Expansion Joint Concrete Pavement. Include cross references to **Design Standards** Index 20910.

Urban roadway approaches usually have a 6-inch raised sidewalk. If the raised sidewalk is not continued across the bridge, when possible, transition the raised sidewalk to the bridge sidewalk over the length of the approach slab. Design and detail the transition to prohibit low spots or ponding and to redirect or collect runoff from the bridge and approach slab into suitable roadway or drainage structures.

Include Approach Slab Finish Grade Elevations with the Bridge Finish Grade Elevations.

Include reinforcing bars in the Reinforcing Steel List. All reinforcing bars are straight bars (Types 1 and 2). Bars 5C1 are 5'-0" long.

Complete the following "Approach Slab Index No. 20910 Table of Dimensions and Estimated Quantities" and include it on the supplemental sheets. See [Introduction I.3](#) for more information regarding use of Data Tables.

APPROACH SLAB INDEX NO. 20910 TABLE OF DIMENSIONS AND ESTIMATED QUANTITIES								Table Date 01-01-12
LOCATION	DIMENSIONS					ANGLE θ	REINFORCING STEEL (Lbs.)	CLASS II (Bridge Deck) CONCRETE (C.Y.)
	L1	L2	M1	M2	N			

Dimension and Quantity Notes:
 Dimensions L1 & L2 are measured along gutter line, inside face of parapet or inside face of railing on raised sidewalks.
 Dimensions L1 & L2 are arc dimensions within curved alignments.
 Quantities shown are for one Approach Slab and where applicable, raised sidewalks. Quantities do not include items placed on the slab such as Traffic Railing, Pedestrian/Bicycle Railings or Traffic Separators.
 For Traffic Railing, Pedestrian/Bicycle Railing and Traffic Separator Quantities see Bid Item List.

Payment.

Item number	Item description	Unit Measure
400-2-10	Concrete Class II, Approach Slabs	CY
400-9	Bridge Deck Grooving and Planing - Deck Thickness 8.5" or Greater	SY
415-1-9	Reinforcing Steel - Approach Slabs	LB

The stabilization required under the approach slabs shall be paid for using the standard roadway pay item and the quantity included in the roadway plans. In addition, roadway elements such as guardrail, earthwork, sidewalks, etc., which are part of the roadway approaches to the bridge and which interface with the approach slabs, will also be included and paid for in the roadway quantities.

Figure 1 Curved Bridge (Single Continuous Unit) with Skewed Joints

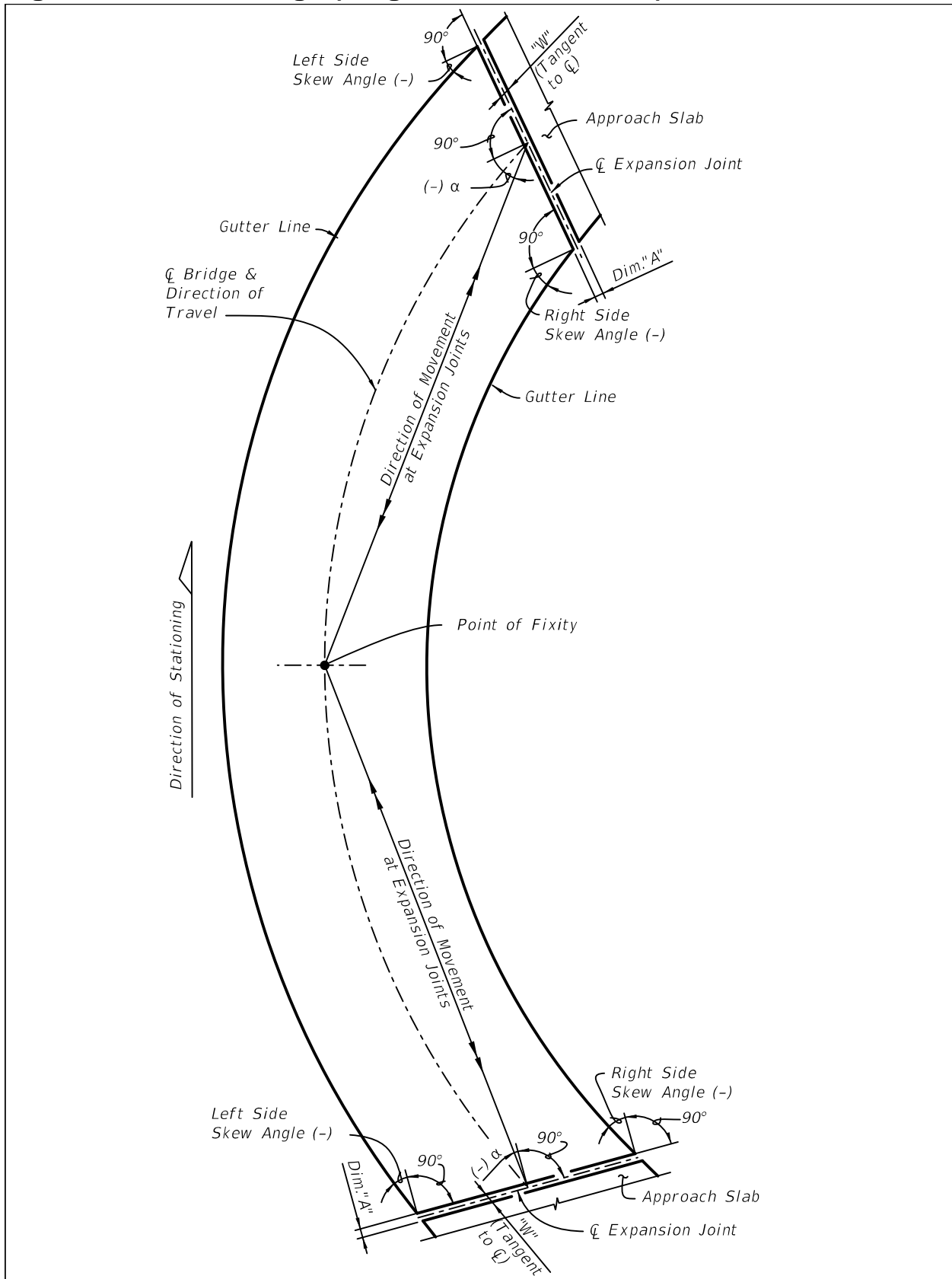


Figure 2 Curved Bridge (Single Continuous Slab) with Radial Joints

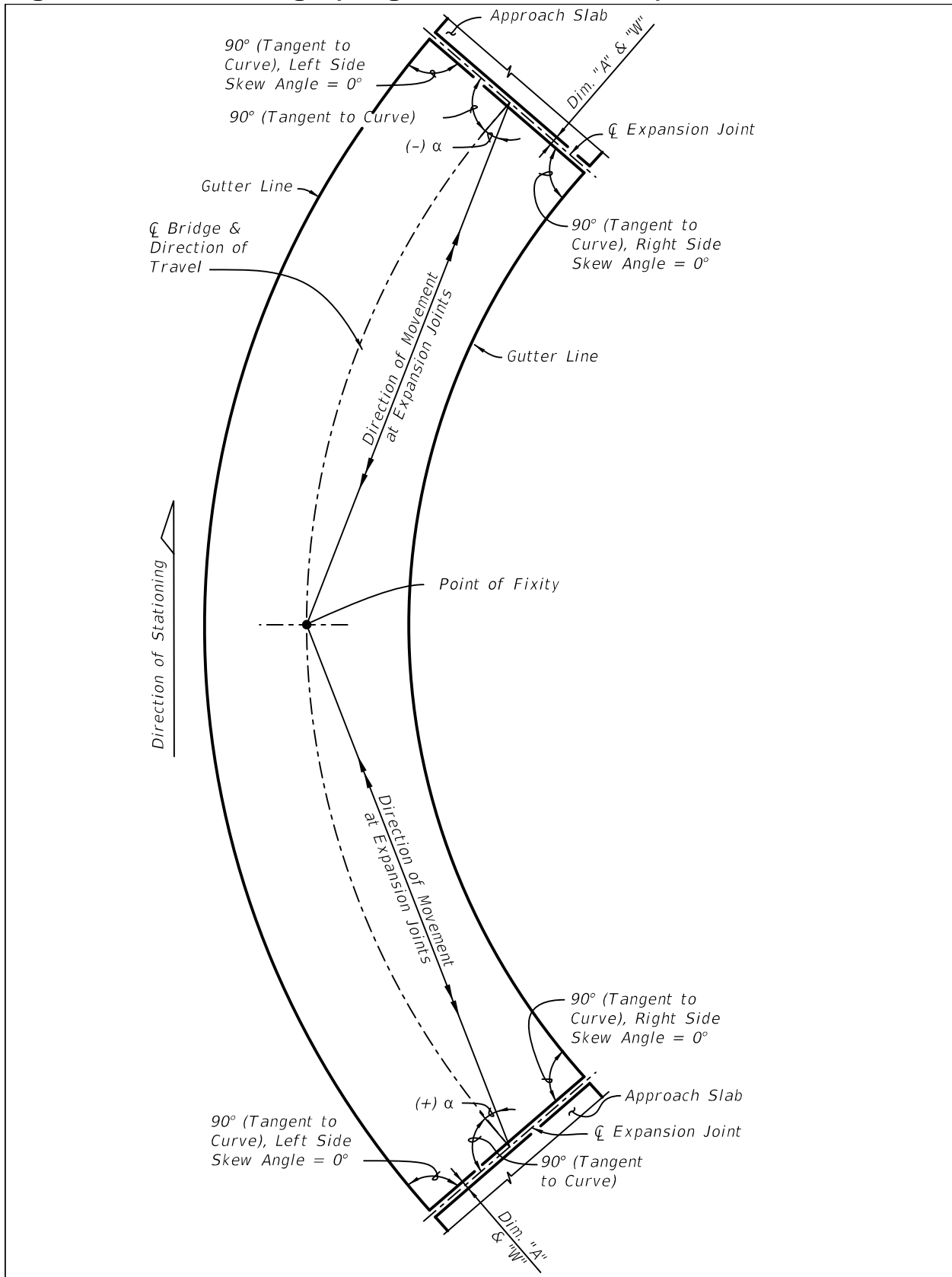


Figure 3 Curved Bridge (Multiple Continuous Units) with Radial Joints

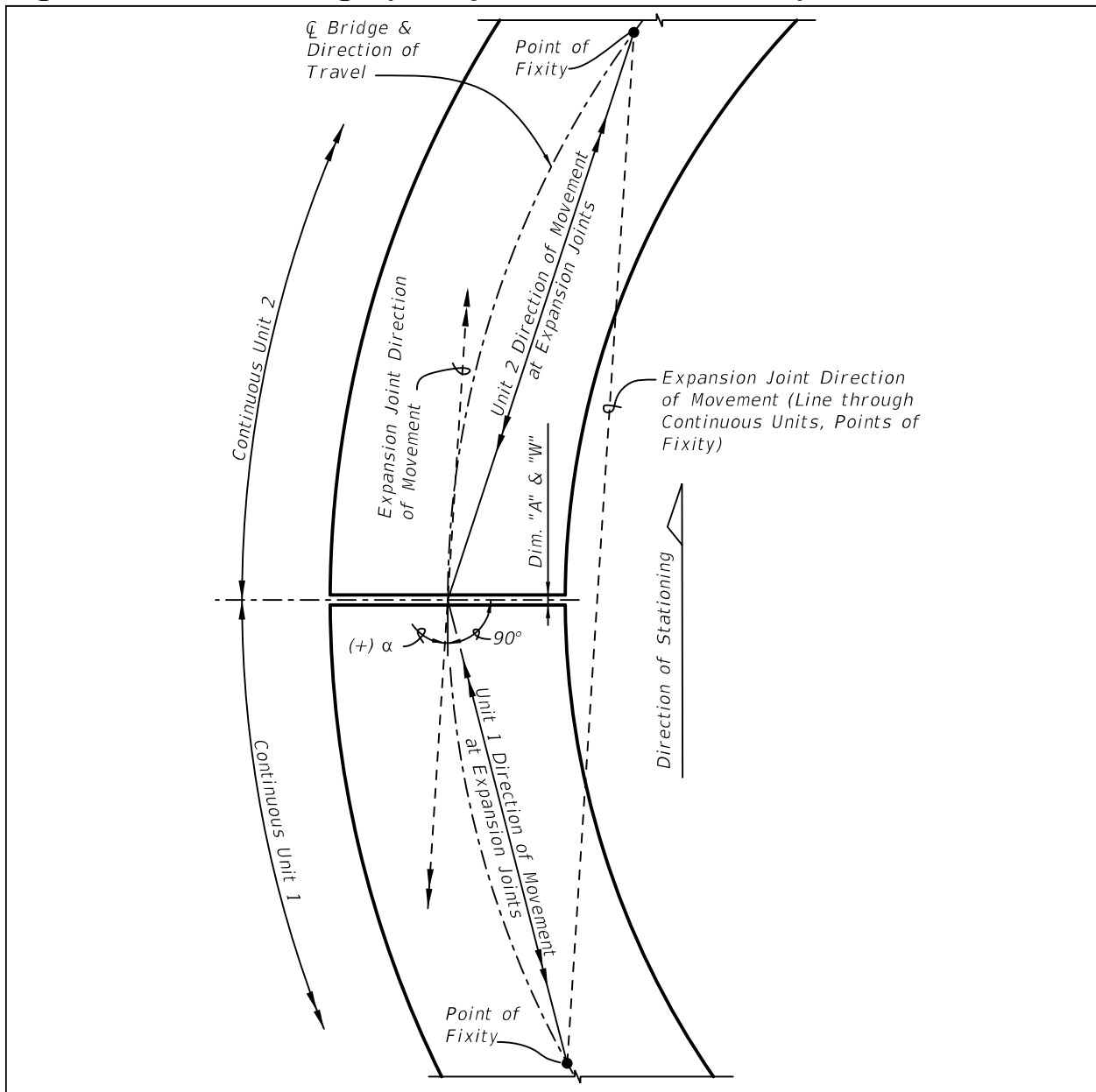
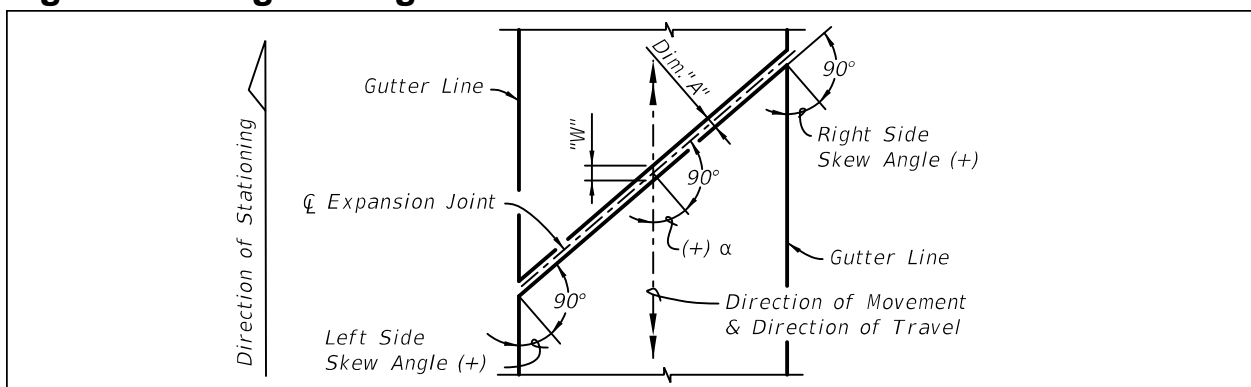


Figure 4 Straight Bridge with Skewed Joints



Payment.

Item number	Item description	Unit Measure
458-1-12	Bridge Deck Expansion Joint; New Construction - F&I; Strip Seal Joint System	LF

Index 21110 Poured Joint with Backer Rod Expansion Joint System

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

Use Index 21110 in accordance with the requirements of **SDG 6.4**.

Allow for a minimum (fully closed) opening of 50% of Dimension "A" and a maximum opening of 3" (measured in the direction of travel).

Plan Content Requirements

Show Poured Joint with Backer Rod Expansion Joints on Superstructure and Approach Slab detail sheets and other sheets as required. Show Sidewalk Cover Plates at all expansion joint locations along sidewalks. Include cross references to **Design Standards** Index 21110.

Complete the following "Poured Expansion Joint Data Table Index No. 21110" using the instructions provided and include the table in the plans. See [Introduction I.3](#) for more information regarding use of Data Tables.

Instructions:

1. Total Design Movement shall be the factored movement.
2. Dimension "A" (measured perpendicular to the joint) @ 70°F is normally set at 2 inches for a total design movement up to 2 inches for non-skewed joints. The designer may reduce Dimension "A" when necessary to account for skews or smaller design movement with the following considerations:
 - a. The design joint opening (Dimension "A") should not be less than twice the joint contraction;
 - b. The minimum joint opening in the Direction of Movement is ½ inch for the factored movement;
 - c. The maximum joint opening in the Direction of Travel is 3 inches for the factored movement;
 - d. The minimum joint opening recommended by manufacturers at the time of installation is 1 inch.
3. Dimension "A" adjustments for 10°F shall be based on the unfactored movements.
4. See Instructions for Index 21100 (Figures 1 through 4) for determining the Direction of Movement.

<i>POURED EXPANSION JOINT DATA TABLE</i>			<i>Table Date 1-01-09</i>
<i>INDEX NO. 21110</i>			
<i>LOCATION</i>	<i>DIM. "A" @ 70°F</i>	<i>TOTAL DESIGN MOVEMENT</i>	<i>DIM. "A" ADJUSTMENT PER 10°F</i>
<p><i>NOTE:</i> <i>Dim. "A" adjustment per 10°F shown is measured perpendicular to \perp</i> <i>Expansion Joint. Work this table with Design Standards Index No. 21110.</i></p>			

Payment

Item number	Item description	Unit Measure
458-1-AB	Bridge Deck Expansion Joint	LF

Index 21200 Light Pole Pedestal

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**

Design Assumptions and Limitations

The pedestal and supporting deck are designed to resist the following Working Loads from the light pole applied at the top of the pedestal:

Axial Dead Load = 1.560 kip

Wind Load Moment about Transverse Axis = 40.60 kip-ft

Wind Load Moment about Longitudinal Axis = 28.30 kip-ft

Dead Load Moment about Longitudinal Axis = 1.690 kip-ft

Maximum Shear = 1.380 kip

Torsion about Pole Axis = 3.560 kip-ft

In order to minimize vibration of light poles due to traffic, locate pedestals near substructure supports.

Locate the centerlines of pedestals a minimum 3'-10" away from centerlines of open joints in railings and ends of railings.

Design of the additional bridge deck reinforcement is based on the minimum transverse top deck reinforcing required by the **SDG**.

Use this standard with Indexes 420, 422, 423, 424, 425, 820, 821, 5210 and 5212 as appropriate.

Plan Content Requirements

In the Structures Plans:

Show Light Pole Pedestals on Plan and Elevation, Superstructure and Approach Slab Supplemental Detail sheets. Use stations or longitudinal dimensions along bridge to define pedestal locations.

Payment

No separate payment is made for Light Pole Pedestals. See Payment Note on the **Design Standard**.

Index 21210 Conduit Details (Rev. 01/12)

Design Criteria

NFPA National Electric Code; Structures Detailing Manual (SDM); AASHTO LRFD Bridge Design Specifications, 4th Edition and ***NCHRP Report 350*** Test Level 4 Criteria (for traffic railing installations)

Design Assumptions and Limitations

This standard can be used for electrical service for highway or navigation lighting or ITS applications.

The details as shown for installing two 2" diameter conduits and associated pull boxes in traffic railings have been determined to be crashworthy in accordance with the requirements of ***NCHRP Report 350*** and the ***AASHTO LRFD Bridge Design Specifications***.

Plan Content Requirements

Provide supplemental designs, notes, details, wiring diagrams and wiring specifications in the plans as required to complement this Standard.

Coordinate with the highway lighting designer and/or navigation lighting designer as appropriate to determine the present and future electrical service requirements at the project location.

In the Structures and/or Retaining Wall Plans:

For Pull Boxes located within Traffic Railings, specify in the plans the type of Pull Boxes required: Pull Box "A" - multiple raceways; Pull Box "B" - single raceways. Generally, multiple raceway Pull Boxes can be used where services contained within individual raceways (conduits) can share a common Pull Box. Single raceway Pull Boxes should be used where it is desirable or required that services contained within individual raceways (conduits) be isolated from each other.

At locations where conduit exits the bridge or retaining wall and is designated for future use, specify in the plans the termination location for conduit. Evaluate the accessibility of the conduit termination points and, if necessary or even questionable, specify in the plans an in-ground Pull Box per Index 17700 in lieu of a driven Steel Pipe marker as shown in Index 21210.

Specify the type of fittings required at Expansion Joint locations on bridges: Expansion Fittings or Expansion / Deflection Fittings. Generally, Expansion Fittings can be typically used for bridges on tangent or large radius curved alignments where little or no transverse movement is expected at Expansion Joints. Expansion / Deflection Fittings are typically required for bridges on curved alignments or combined curved and tangent alignments where transverse movement is expected at Expansion Joints.

For electrical service, specify the use of THWN or XHHW conductors only.

Payment

Generally the cost of furnishing and installing Conduit, Pull Boxes, Expansion and Expansion / Deflection Fittings and all associated hardware required to complete the installation is included in the cost for the Traffic Railing or Pedestrian Railing (Parapet) that the conduit is installed in.

- | However, there may be special cases where other arrangements have been made.

Index 21220 Navigation Light System Details (Fixed Bridges)

Design Criteria

Structures Design Guidelines (SDG); Code of Federal Regulations Title 33, Chapter 1, Part 118; United States Coast Guard **Bridge Lighting and Other Signals** manual.

Design Assumptions and Limitations

If actual conditions differ from the typical configurations shown on the standard and/or it is a movable bridge, design a project specific Navigation Light System to comply with **Code of Federal Regulations Title 33, Chapter 1, Part 118** and United States Coast Guard **Bridge Lighting and Other Signals** manual.

Project specific designs are required for structures supporting Green Center Channel and Red Channel Margin Lights.

Provide design of RFL locations and configurations in Fender System drawings if applicable.

Provide design of CGL locations as shown in the Standard Drawing.

Include the height of Green Center Channel and Red Channel Margin Lights when establishing superstructure heights to comply with vertical clearance requirements.

Use this standard with Indexes 21210, 21900 and 21930, and/or project specific details as required.

Plan Content Requirements

In the Structures Plans:

Show fully detailed project specific designs of structures supporting Green Center Channel and Red Channel Margin Lights. Specify requirement for automatic lock positions for service and operating. Specify light and Service Chain mounting locations.

Show fully detailed project specific designs for Red Pier / Fender and Red Channel Margin Lights.

Prepare supplemental designs as required showing locations and details of conduit runs, power sources and other electrical components and incidental items.

Payment

Item number	Item description	Unit Measure
510-1	Navigation Lights - Fixed Bridge	LS

Index 21240 Maintenance Lighting For Box Girders

Design Criteria

NFPA National Electric Code; Structures Design Guidelines (SDG)

Design Assumptions and Limitations

This standard shows basic details and requirements for maintenance lighting systems located inside concrete and steel box girder superstructures. It does not show all structural elements and is not intended to show the exact location of conduit runs.

Lighting fixtures and equipment locations must be coordinated with the box girder superstructure details, e.g., structural steel components, metal stay-in-place deck formwork and post tensioning systems in concrete box girders.

This standard may be used in conjunction with Index 21210.

Plan Content Requirements

In the Structures Plans:

Show interior lighting and electrical outlets spaced at not more than 50 feet. Where inside box girder heights permit, show lighting mounted along center of box.

Prepare supplemental designs as required showing locations and details of conduit runs, power sources and other electrical components and incidental items.

Payment

Item number	Item description	Unit Measure
715-50	Lighting - Inside Box Girder	LS

Index 21250 Series Access Hatch Assembly

Design Criteria

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

Design Assumptions and Limitations

The Access Hatch Assembly series includes Index 21250 for use with steel box sections and Index 21251 for use with concrete box sections.

Use Index 21250 in accordance with the requirements of **SDG** 5.6 for steel box sections and Index 21251 in accordance with the requirements of the **SDG** 4.6 for concrete box sections.

The Designer shall analyze access opening sizes and their locations along the bottom flange for structural effects on the girder.

Plan Content Requirements

Locate Access Hatch Assembly locations on framing plans or segment layout sheets and include a cross reference to **Design Standards** Index 21250 or 21251 as appropriate.

Payment

Item number	Item description	Unit Measure
460-9-1	Access Hatch Assembly (Concrete Box Section)	EA
460-9-2	Access Hatch Assembly (Steel Box Section)	EA

Payment

Item number	Item description	Unit Measure
415-1-A	Reinforcing Steel	LB

Index 21600 Series Temporary Detour Bridge (Rev. 01/12)

Design Criteria

AASHTO Standard Specifications for Highway Bridges, 17th Edition (superstructure); **AASHTO LRFD Bridge Design Specifications**, 5th Edition (substructure); **Structures Design Guidelines (SDG)**; **Acrow Panel Bridging Series 300 Technical Handbook**

Design Assumptions and Limitations

These Standards apply to non-limited access facilities with design speeds of 45 mph and less. A variation is required otherwise.

These Standards are based on the FDOT current inventory of temporary bridge components which are manufactured in accordance with Acrow Series 300 Double Wide design. Details presented in these Standards are for a Double Single configuration and incorporating the Double Wide Light Transom. Refer to "**Acrow Panel Bridging Series 300 Technical Handbook**" for temporary bridge dimensions, capacities and component designations. Contact the Structures Design Office to obtain a copy of this handbook.

The Acrow Panel Bridging with the Double Single configuration with two lanes of traffic is designed to meet a HS20-44 loading for simple spans up to 50 feet and continuous spans up to 60 feet (ref. page 86 of the Technical Handbook). Department policy allows only Florida Legal Trucks (ref. FDOT Bridge Load Rating Manual) to cross Acrow Panel bridges. If permit trucks are allowed to cross an Acrow bridge, a Variation is required.

The FDOT Office of Maintenance maintains the inventory of FDOT owned temporary bridge components. Contact the Office of Maintenance to coordinate the availability of temporary bridge components that are required for a given project.

In cooperation with the State Bridge Evaluation Engineer (Office of Maintenance), assess the impact on commercial truck mobility and determine the necessary plan requirements for rerouting of vehicles exceeding Legal Weights to prevent them from crossing these structures. See **PPM**, Volume 1, Chapter 10 for guidance on signage and possible Temporary Traffic Control Plan Details and include them in the Contract Plans. Refer also to Index No. 17355 of the FDOT Design Standards for design and installation of special signing.

Establish temporary bridge length to accommodate project geometric needs, environmental permits, drainage requirements, etc., using the following span length and arrangement criteria.

Details presented in the standards assume one single span or the use of continuous spans for multiple span bridges. Limit continuous length of bridge to 360' in accordance with these standard details. If a total bridge length in excess of 360' is required, supplemental details are required for the mid-bridge expansion joint(s) and associated intermediate bent support(s).

Vary span lengths in increments of 10' with 30' minimum and 60' maximum span lengths. For continuous spans the ratio of adjacent span lengths shall not be less than 6:10 to prevent the shorter span from lifting off its bearings under live load. Specify Distributing Beams at all intermediate supports for all span lengths.

The Approach Span and Ramp Span are to be simple spans, each 5' -0" in length, to eliminate Live Load uplift at the backwall bent and grade beam support.

Do not place the temporary bridge on a vertical curve. A constant grade is acceptable. Refer to "**Acrow Panel Bridging Series 300 Technical Handbook**" for maximum grade and elevation tolerance from constant grade (Bent to Bent and Cross-Slope) for final cap elevations.

The temporary bridge is to have a zero cross-slope. Provide asphalt buildup transitions to a zero cross slope outside the limits of the temporary bridge.

To accommodate debris drift clearances, set Low Member Elevation as follows:

For single span bridges, at the bottom of the Transom.

For multiple span bridges, at the bottom of the Distributing Beam.

Design the pile cap connection to pile assuming the truss reaction with a minimum of 3" eccentricity. Design of this connection detail is the responsibility of the Engineer of Record.

Select the pile type considering the driving capacity requirements of the production piles on the permanent bridge, free standing height, water levels if present and soil conditions.

Design the substructure according to current **AASHTO LRFD Bridge Design Specifications** Strength Limit States III & V and Service Limit State I:

Calculate reactions using superstructure dead load unit weight = 1.26 Kip/Ft. Include a concentrated dead load = 250 Lbs. per truss plane at abutments. This load accounts for 1 end post and 1 bearing per truss plane.

Calculate wind force on superstructure (WS) using basic wind force of 0.45 Kip/Ft. Ratio the above loading using wind pressures in Table 3.8.1.2.2-1 of **AASHTO LRFD Bridge Design Specifications**.

Example-

For wind skew of 30°

$$W \text{ Lateral} = 0.45 (0.065/0.075) = 0.39 \text{ Kip/Ft.}$$

$$W \text{ Longitudinal} = 0.45 (0.028/0.075) = 0.17 \text{ Kip/Ft.}$$

Plan Content Requirements

Plans for temporary bridge shall, as a minimum, cover the following:

1. General Note Sheet.
2. Simple span bearing details if non-continuous spans are selected.
3. Grade change details at the extremities of the bridge.
4. Plan and elevation sheets with span lengths, stationing, alignment, grade and boring locations.
5. Foundation layout sheet including pile spacing & bent stationing.
6. Pile data table showing pile type, size, cut off elevations, capacity & estimated lengths.
7. Bent detail sheet.
8. A parts list as required for shipping purposes.
9. Plans for special signing for vehicles exceeding Legal Weights and, if necessary, Traffic Control Plans for detouring vehicles exceeding Legal Weights. Include references to Index 17355 for required special signing.

Payment

Item number	Item description	Unit Measure
102-2-AA	Special Detour	LS

Index 21800 Series Post-Tensioning (Rev. 01/12)

Design Criteria

AASHTO LRFD Bridge Design Specifications, 4th Edition; **Structures Design Guidelines (SDG)**; **Specification** Sections 452, 453 and 462

Design Assumptions and Limitations

Indexes 21801, 21802 and 21803 depict various details and requirements for post-tensioning systems used on department projects. Use these standards with Specification Sections 452, 453 and 462 and the Approved Post Tensioning Systems List on the SDO website.

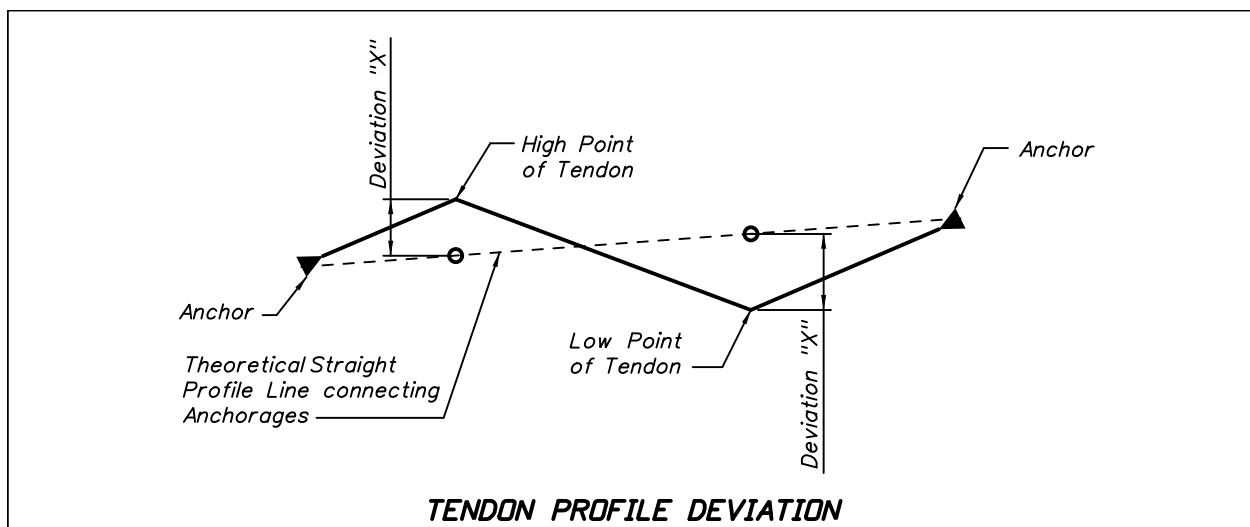
Plan Content Requirements

In the Structures Plans:

Grouting and Anchor Protection: In addition to providing post tensioning quantity and stressing information on the plans, the designer shall provide general grouting information for each tendon type and anchor protection information for all tendons on the project, see Index 21801, 21802 and 21803. See below for example post-tensioning schedules for both PT Bars and tendons, respectively. In cases where the tendon types and anchor protection details shown in the Index are not sufficient for specific project requirements, the designer shall supplement the drawings as necessary. Deviations from Standard Drawings however, require the Department's approval.

Detail to the following FDOT Standard tendon anchorage sizes: 4k6, 7k6, 12k6, 15k6, 19k6, 27k6.

Top slab transverse tendons, top slab cantilever tendons and bottom slab continuity tendons with Deviation "X" less than or equal to 20" shall be treated as a Profile 12 tendon for grouting procedures (see sketch below).



For projects that utilize post tensioning bars, complete the following "Post-Tensioning Bar Data Table" and include it in the plans:

POST-TENSIONING BAR DATA TABLE											Table Date 01-01-12	
BAR DESIGNATION	NO. REQUIRED	BAR SIZE	BAR LENGTH (Ft-in)	BAR WEIGHT (lbs)	TOTAL WEIGHT (lbs)	STRESSING FORCE/BAR (kips)	*** STRESSING END	ELONGATION (in)	* TENDON PROFILE	** ANCHOR PROTECTION TYPE		
										AHEAD STA.	BACK STA.	

For non-longitudinal bars, ahead-station denotes left anchor, back-station denotes right anchor (looking ahead-station). For mostly vertical bars, ahead-station denotes top anchor, back-station denotes bottom anchor.
 * See Post-Tensioning Vertical Profiles, Design Standards Index 21801.
 ** See Post-Tensioning Anchorage Protection, Design Standards Index 21802.
 *** Stressing End Definitions:
 - Ahead Station: Bar Live/Stressing End is ahead-station anchor.
 - Back Station: Bar Live/Stressing End is back-station anchor.

For projects that utilize post tensioning tendons, complete the following "Post-Tensioning Tendon Data Table" and include it in the plans:

POST-TENSIONING TENDON DATA TABLE														Table Date 01-01-12	
TENDON DESIGNATION	NO. REQUIRED	TENDON SIZE	TENDON LENGTH (Ft-in)	TENDON WEIGHT (lbs)	TOTAL WEIGHT (lbs)	AHEAD-STATION STRESSING FORCE / TENDON (kips)	BACK-STATION STRESSING FORCE / TENDON (kips)	FORCE @ AHEAD-STATION END AFTER ANCHOR SET (kips)	FORCE @ BACK-STATION END AFTER ANCHOR SET (kips)	*** STRESSING END	THEORETICAL ELONGATION @ AHEAD-STATION END (in)	THEORETICAL ELONGATION @ BACK-STATION END (in)	* TENDON PROFILE	** ANCHOR PROTECTION TYPE	
														AHEAD STA.	BACK STA.

In general, for non-longitudinal tendons, ahead-station denotes left anchor, back-station denotes right anchor (looking ahead-station). For mostly vertical tendons, ahead-station denotes top anchor, back-station denotes bottom anchor.
 * See Post-Tensioning Vertical Profiles, Design Standards Index 21801.
 ** See Post-Tensioning Anchorage Protection, Design Standards Index 21802.
 *** Stressing End Definitions:
 - Ahead Station: Tendon Live/Stressing End is ahead-station anchor.
 - Back Station: Tendon Live/Stressing End is back-station anchor.
 - Alternate (ahead/back): Tendon Initial Live/Stressing End is ahead-station anchor with associated elongation.
 Tendon Subsequent Live/Stressing End is back-station anchor with associated elongation.
 - Alternate (back/ahead): Tendon Initial Live/Stressing End is back-station anchor with associated elongation.
 Tendon Subsequent Live/Stressing End is ahead-station anchor with associated elongation.
 - Double: Tendon Live/Stressing End is simultaneously the ahead-station and back-station anchor with respective elongations.

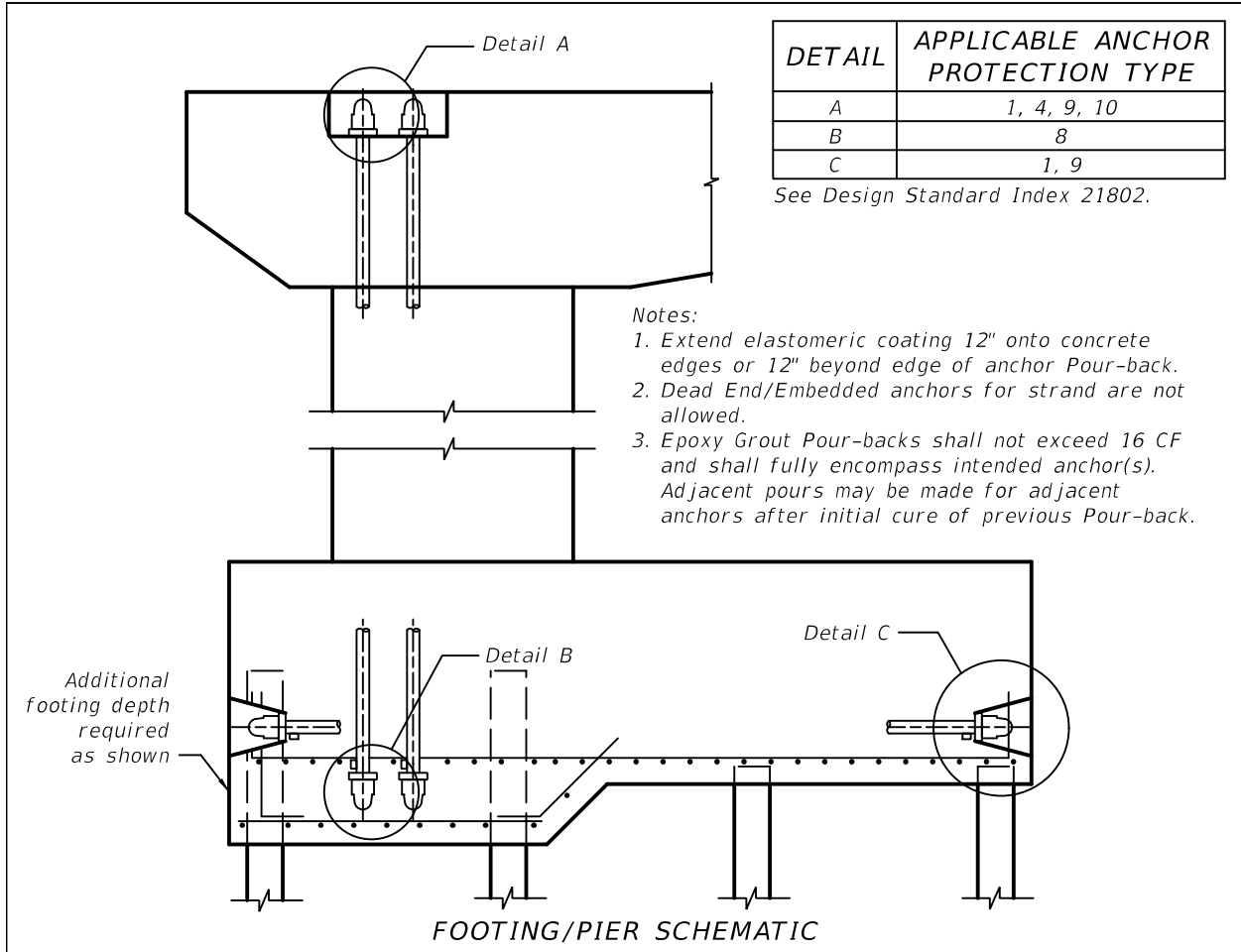
Include the geometric effects of the profile grade and cross slope on tendon geometry when determining the appropriate vertical profile to specify in the data tables.

If necessary, the note(s) below the Data Tables may be modified by the EOR on a project by project basis to better clarify a unique tendon profile or arrangement.

When specifying the anchor protection type in the Post-Tensioning Bar Data Table or the Post-Tensioning Tendon Data Table, use the following descriptions in conjunction with the following figure and the details shown on Index 21802 for determining the appropriate callout:

- Type 1** - Anchor protection used for exposed surfaces for strand or bar tendons on Segmental Box Girder Superstructures, Integral or Straddle Pier Caps, Footings, etc.
- Type 2** - Anchor protection used for strand tendons anchoring in top flange blockouts or end of spliced Girder Segments.
- Type 3** - Top inspected anchor protection used for strand or bar tendons on Segmental Box Girder Superstructures constructed using the balanced cantilever method.
- Type 4** - Anchor protection used for strand tendons on the top surfaces of Piers.
- Type 5** - Anchor protection used for strand or bar tendons with interior blisters on Segmental Box Girder Superstructures.
- Type 6** - Anchor protection used for strand tendons on Flat Slab Superstructures.
- Type 7** - Anchor protection used for transverse strand tendons (generally 4 strands or less) on Segmental Box Girder Superstructures and other transversely post-tensioned superstructures.
- Type 8** - Dead end anchor protection used for vertical bar tendons.
- Type 9** - Anchor protection used for bar tendons on Segmental Box Girder Pier Diaphragms, Footings, top surfaces of Piers, Integral or Straddle Pier Caps, etc.
- Type 10** - Anchor protection used for bar tendons on the top surfaces of Piers.
- Types 11 & 12** - Anchor protection used for bar tendons primarily on Integral or Straddle Pier Caps.

Anchor Protection Types for Footing and Pier Post-Tensioning Applications



Payment

Item number	Item description	Unit Measure
462-2-AA	Post Tensioning Tendons	LB
462-3	Additional Post Tensioning in Segmental Box Span <i>Note: Use for rehabilitation projects only</i>	EA

Sample Tables:

POST-TENSIONING BAR DATA TABLE											Table Date 01-01-12	
BAR DESIGNATION	NO. REQUIRED	BAR SIZE	BAR LENGTH (Ft-in)	BAR WEIGHT (lbs)	TOTAL WEIGHT (lbs)	STRESSING FORCE/BAR (kips)	*** STRESSING END	ELONGATION (in)	* TENDON PROFILE	** ANCHOR PROTECTION TYPE		
										AHEAD STA.	BACK STA.	
PT-1	6	1 1/4 Ø	21'-9"	95.50	573.0	131	AHEAD STA.	0.940"	12	10	10	
PT-2	8	1 3/8 Ø	16'-6"	91.74	733.9	165	BACK STA.	0.713"	12	10	10	
PT-3	24	1 3/4 Ø	80'-0"	737.60	17,702	280	BACK STA.	3.540"	17	9	8	

For non-longitudinal bars, ahead-station denotes left anchor, back-station denotes right anchor (looking ahead-station). For mostly vertical bars, ahead-station denotes top anchor, back-station denotes bottom anchor.

* See Post-Tensioning Vertical Profiles, Design Standards Index 21801.

** See Post-Tensioning Anchorage Protection, Design Standards Index 21802.

*** Stressing End Definitions:

- Ahead Station: Bar Live/Stressing End is ahead-station anchor.
- Back Station: Bar Live/Stressing End is back-station anchor.

POST-TENSIONING TENDON DATA TABLE														Table Date 01-01-12	
TENDON DESIGNATION	NO. REQUIRED	TENDON SIZE	TENDON LENGTH (Ft-in)	TENDON WEIGHT (lbs)	TOTAL WEIGHT (lbs)	AHEAD-STATION STRESSING FORCE / TENDON (kips)	BACK-STATION STRESSING FORCE / TENDON (kips)	FORCE @ AHEAD-STATION END AFTER ANCHOR SET (kips)	FORCE @ BACK-STATION END AFTER ANCHOR SET (kips)	*** STRESSING END	THEORETICAL ELONGATION @ AHEAD-STATION END (in)	THEORETICAL ELONGATION @ BACK-STATION END (in)	* TENDON PROFILE	** ANCHOR PROTECTION TYPE	
														AHEAD STA.	BACK STA.
1	6	12-0.6	650'-0 7/8"	5757	34542	562.5	562.5	454.9	468.9	Alt. (back/ahead)	10.9	32.2	15	1	1
2	6	12-0.6	650'-1 3/4"	5758	34548	562.5	562.5	456.3	456.3	Alt. (back/ahead)	10.8	31.6	15	1	1
3	6	12-0.6	650'-3 3/8"	5759	34554	562.5	562.5	458.4	459.8	Alt. (back/ahead)	10.6	31.0	15	1	1
4	6	12-0.6	650'-6 1/4"	5761	34566	562.5	562.5	465.4	465.4	Alt. (back/ahead)	10.6	30.3	15	1	1

In general, for non-longitudinal tendons, ahead-station denotes left anchor, back-station denotes right anchor (looking ahead-station). For mostly vertical tendons, ahead-station denotes top anchor, back-station denotes bottom anchor.

* See Post-Tensioning Vertical Profiles, Design Standards Index 21801.

** See Post-Tensioning Anchorage Protection, Design Standards Index 21802.

*** Stressing End Definitions:

- Ahead Station: Tendon Live/Stressing End is ahead-station anchor.
- Back Station: Tendon Live/Stressing End is back-station anchor.
- Alternate (ahead/back): Tendon Initial Live/Stressing End is ahead-station anchor with associated elongation.
- Tendon Subsequent Live/Stressing End is back-station anchor with associated elongation.
- Alternate (back/ahead): Tendon Initial Live/Stressing End is back-station anchor with associated elongation.
- Tendon Subsequent Live/Stressing End is ahead-station anchor with associated elongation.
- Double: Tendon Live/Stressing End is simultaneously the ahead-station and back-station anchor with respective elongations.

Index 21900 Fender System - Polymeric Piles

Design Criteria

Structures Design Guidelines (SDG) 3.14

Design Assumptions and Limitations

Design Standards Index 21900 includes standard geometry and details for Polymeric Fender Systems.

Refer to **SDG 3.14** for Fender System design criteria, assumptions and limitations.

Use this standard with Index 21220.

Plan Content Requirements

In the Structures Plans:

Prepare and include in the plans supplemental project specific designs and details for the following items:

- Electrical service for navigation lights including conduit path from bridge to fender system and identification of service point. Coordinate design with Index 21220 and **Specification** Section 510.
- Access ladders and catwalks from bridge to fender system are optional and may be included at the discretion of the District.

Designate in the plans the type of decking material to be used for catwalks: 2" x 12" Plastic Lumber or Fiberglass Open Grating. Catwalk decking material shall be determined by the District.

Complete the following "Data Tables" and include them in the plans. One "Estimated Bill of Materials Table", one "Fender System Table of Variables" and one "Estimated Quantities Block" are required for each Fender System location within a project. For projects with multiple fender systems or configurations, clearly note which Fender System the Tables and Blocks are applicable to. Place the value for "Required Energy" of each Fender System in the note provided. The Contractor will use this "Required Energy" value to select the appropriate fender system from the QPL. See [Introduction I.3](#) for more information regarding use of Data Tables.

Table for use with Index 21900 Fender System - Polymeric Piles:

ESTIMATED BILL OF MATERIALS FENDER SYSTEM - POLYMERIC PILES DESIGN STANDARDS INDEX NO. 21900				Table Date 07-01-11
MARK	NO. REQ'D.	UNIT	QUANTITY	
A1		MB		
A2		MB		
A3		MB		
A4		MB		
A5		MB		
A6		MB		
B		MB		
C		MB		
D		MB		
* E		MB		
F1		MB		
F2		MB		
F3		MB		
F4		MB		
F5		MB		
F6		MB		
G1		MB		
G2		MB		
H1		MB		
H2		MB		

NOTE: For Member Marks, Sizes and Dimensions see Design Standards Index No. 21900, Sheet 7.

Bill of Materials Table above is for an entire fender system (left and right fenders).

* Provide 2'-6" wide Fiberglass Open Grating for full length of fender in lieu of 2" X 12" Plastic Lumber when called for in Plans. Provide Stainless Steel Mounting Hardware and install per Manufacturer's recommendations. See Index 21900 for notes. Include the cost of Fiberglass Open Grating and miscellaneous items required to install the grating in the price for Plastic Marine Lumber (Non-Reinforced).

ESTIMATED QUANTITIES, INDEX NO. 21900			Table Date 07-01-11
MARK	UNIT	QUANTITY	
Plastic Marine Lumber (Reinforced)	MB		
Plastic Marine Lumber (Non-Reinforced)	MB		
Polymeric Piles	LS		

NOTE: Estimated Quantities are for one entire fender system (left and right fenders).

FENDER SYSTEM TABLE OF VARIABLES INDEX NO. 21900			Table Date 07-01-11
CONTROL POINTS	STATION	OFFSET Lt. or Rt.	
A			
B			
C			
D			
DIMENSION "L"			
CLEAR CHANNEL WIDTH			
CHANNEL SKEW ANGLE			
MHW or NHW ELEVATION			
MLW or NLW ELEVATION			
PILE CUTOFF ELEVATION			
MINIMUM PILE TIP ELEVATION LEFT FENDER		**	
PILE LENGTH LEFT FENDER		**	
MINIMUM PILE TIP ELEVATION RIGHT FENDER		**	
PILE LENGTH RIGHT FENDER		**	
NUMBER OF WALE ROWS			

NOTE: Work this Table with Design Standards Index 21900.

** See QPL drawings for required pile embedment lengths to determine pile tip elevations and pile lengths.

See the Qualified Products List for approved fender system pile configurations. Select a pile configuration having an Energy Capacity greater than the following Required Energy: Fender System Required Energy = _____ ft-k

Payment

Include quantity for Composite Marine Lumber 10" X 10" Wales Mark A under Pay Item for Plastic Marine Lumber (Reinforced). Include quantity for all other Plastic Lumber under Pay Item for Plastic Marine Lumber (Non-Reinforced).

Item number	Item description	Unit Measure
471-1-1	Fender System, Plastic Marine Lumber, Reinforced	MB
471-1-2	Fender System, Plastic Marine Lumber, Non- Reinforced	MB
471-2	Fender System, Polymeric Piles	LS

Index 21930 Fender Systems - Prestressed Concrete Piles

Design Criteria

Structures Design Guidelines (SDG) 3.14

Design Assumptions and Limitations

Do not use this fender system unless approved by the District for use on the specific project.

Design Standards Index 21930 includes a fully designed Fender System with 14" square prestressed concrete piling having an **"Energy Capacity" of 38 ft-kip.**

Refer to **SDG 3.14** for additional Fender System design criteria, assumptions and limitations.

Use this standard with Index 21220.

Plan Content Requirements

In the Structures Plans:

Include both Indexes 21900 and 21930 as alternates. The Contractor will select which fender system to construct. See also the IDS for Index 21900 plan requirements.

Prepare and include in the plans supplemental project specific designs and details for the following items:

- Electrical service for navigation lights including conduit path from bridge to fender system and identification of service point. Coordinate design with Index 21220 and **Specification** Section 510.
- Access ladders and catwalks from bridge to fender system are optional and may be included at the discretion of the District.

Designate in the plans the type of decking material to be used for catwalks: 2" x 12" Plastic Lumber or Fiberglass Open Grating. Catwalk decking material shall be determined by the District.

Complete the following "Data Tables" and include them in the plans. One "Estimated Bill of Materials Table", one "Fender System Table of Variables" and one "Estimated Quantities Block" are required for each Fender System location within a project. For projects with multiple fender systems or configurations, clearly note which Fender System the Tables and Blocks are applicable to. See [Introduction I.3](#) for more information regarding use of Data Tables.

Base the Minimum Pile Tip Elevations on the minimum embedment of 20 feet for the 14" square prestressed concrete piles into soil having a blow count (N) greater than 6.

Table for use with Index 21930 Fender Systems - Prestressed Concrete Piles:

ESTIMATED BILL OF MATERIALS FENDER SYSTEM - PRESTRESSED CONCRETE PILES DESIGN STANDARDS INDEX NO. 21930				Table Date 07-01-11
MARK	NO. REQ'D.	UNIT	QUANTITY	
A1		MB		
A2		MB		
A3		MB		
A4		MB		
A5		MB		
A6		MB		
B		MB		
C		MB		
D		MB		
* E		MB		
F1		MB		
F2		MB		
F3		MB		
F4		MB		
F5		MB		
F6		MB		
G1		MB		
G2		MB		
H1		MB		
H2		MB		

NOTE: For Member Marks, Sizes and Dimensions see Design Standards Index No. 21930, Sheet 7.

Bill of Materials Table above is for an entire fender system (left and right fenders).

* Provide 2'-6" wide Fiberglass Open Grating for full length of fender in lieu of 2" X 12" Plastic Lumber when called for in Plans. Provide Stainless Steel Mounting Hardware and install per Manufacturer's recommendations. See Index 21930 for notes. Include the cost of Fiberglass Open Grating and miscellaneous items required to install the grating in the price for Plastic Marine Lumber (Non-Reinforced).

FENDER SYSTEM TABLE OF VARIABLES INDEX NO. 21930			Table Date 07-01-11
CONTROL POINTS	STATION	OFFSET Lt. or Rt.	
A			
B			
C			
D			
DIMENSION "L"			
CLEAR CHANNEL WIDTH			
CHANNEL SKEW ANGLE			
MHW or NHW ELEVATION			
MLW or NLW ELEVATION			
PILE CUTOFF ELEVATION			
MINIMUM PILE TIP ELEVATION LEFT FENDER			
PILE LENGTH LEFT FENDER			
MINIMUM PILE TIP ELEVATION RIGHT FENDER			
PILE LENGTH RIGHT FENDER			
NUMBER OF WALE ROWS			

NOTE: Work this Table with Design Standards Index 21930.

ESTIMATED QUANTITIES, INDEX NO. 21930			Table Date 07-01-11
MARK	UNIT	QUANTITY	
Plastic Marine Lumber (Reinforced)	MB		
Plastic Marine Lumber (Non-Reinforced)	MB		
14" Sq. Prestressed Concrete piles	LF		

NOTE: Estimated Quantities are for one entire fender system (left and right fenders).

Payment

Include quantity for Composite Marine Lumber 10" X 10" Wales Mark A under Pay Item for Plastic Marine Lumber (Reinforced). Include quantity for all other Plastic Lumber under Pay Item for Plastic Marine Lumber (Non-Reinforced).

In TRNS*PORT, include estimated quantities for both Index 21900 and Index 21930 fender systems as alternates.

Item number	Item description	Unit Measure
471-1-1	Fender System, Plastic Marine Lumber, Reinforced	MB
471-1-2	Fender System, Plastic Marine Lumber, Non- Reinforced	MB
455-34-2	Prestressed Concrete Piling, 14" Sq.	LF

IDS - REVISION HISTORY

- I.3..... Updated for new process.
- Index 289 Revised Data Table. Added guidance on use of Type 1 and Type 2 Box Culvert Extensions. Added note to consider providing additional reinforcing bars parallel to the joint for culvert extensions on skewed boxes to provide a load path for transverse forces.
- Index 402 Removed guidance for plan notes regarding Bridge Name/Date Plate(s). These notes are now in the Design Standard Drawing.
- Index 403 Added reference to SDG 6.7.4.
- Index 411 Removed Payment note.
- Index 424 Relocated sentence: "Define lengths of End Posts in Structures Plans Superstructure Sheets." from Design Criteria to Plan Content Requirements.
- Index 425 Minor text edits.
- Index 470 Added cross reference to SDG 2.2. Modified figure to allow for gutterline offsets of low as 13" for Schemes 3 thru 6 on Index 473 & 476.
- Index 480 Added cross reference to SDG 2.2. Reorganized figure for clarity.
- Index 825 Removed references to Index 826. Corrected reference to Index 5200. Clarification changes.
- Index 870 Reworded second sentence of second Paragraph of Design Assumptions and Limitations for clarity.
- Index 880 Reworded second sentence of second Paragraph of Design Assumptions and Limitations for clarity.
- Index 5200 Completely revised.
- Index 5210 Added guidance on use of Type 1 and Type 2 Junction Slabs.
- Index 6011 Added asterisk and note to clarify Plan View and Wall Control Drawings can go in either Structures or Roadway plans.
- Index 11870 Changed title. Clarified guidance on clearances. Added information for Undercut Anchors.
- Index 17515 Modified Design Weight and Equivalent Projected Area of Luminaire.
- Index 17725 Updated instructions to coordinate with completely revised Design Standard.
- Index 17743 Updated Title. Removed QPL references. Revised Figure 1, Data Table and Example Data Table.
- Index 17745 Deleted QPL reference. Added cross reference to Index 17743. Revised Data Table.

- Index 20005** Removed references to AASHTO and Bulb-T beam standards. Added reference to FIB-84 and FIB-96 Beams. Added reference to Index 20512. Clarified limitations are for simple span pretensioned beams only. Revised Data Table. Updated Example Table values based on screed load factor changing from 1.25 to 1.5 in Beam Stability v1.01.
- Index 20010** Deleted reference to SDM for Framing Plan requirements. Added reference to Index 20512. Revised Data Table.
- Index 20199** Updated Title and removed references to AASHTO and Bulb-T beams. Added reference to FIB-84 and FIB-96 Beams. Revised Data Table.
- Index 20210** Deleted reference to SDM for Framing Plan requirements in Design Criteria. Added strand configuration requirements to Plan Content Requirements.
- Index 20299** Revised Data Table. Minor text edits.
- Index 20510** Added references to Indexes 20084, 20096 and 20512.
- Index 20511** Completely revised.
- Index 20512** Completely revised.
- Index 20600** Removed reference to EDC (Embedded Data Collectors). Revised Data Table. Added Pile Interaction Diagrams.
- Index 20654** Revised Data Table.
- Index 20660** Revised Data Table.
- Index 20900** Relocated last paragraph of Design Assumptions and Limitations to Plan Content Requirements. Added new Paragraphs 3 and 4 to Design Assumptions and Limitations. Revised Data Table.
- Index 20910** Relocated last paragraph of Design Assumptions and Limitations to Plan Content Requirements. Added new Paragraphs 3 and 4 to Design Assumptions and Limitations. Revised Data Table.
- Index 21100** Revised Data Table.
- Index 21210** Updated Title. Deleted references allowing conduits to be used by a utility owner. Added new 5th Paragraph to Design Assumptions and Limitations.
- Index 21300** Relocated parameters for use of reinforcing bar list from Plan Content Requirements to Design Assumptions and Limitations.
- Index 21600** Completely revised.
- Index 21800** Completely revised.