

# ***2016 Design Standards Structures Update***



## **Structures Design Office Updates**

Steven Nolan, P.E.

Structures Design Standards Group

[steven.nolan@dot.state.fl.us](mailto:steven.nolan@dot.state.fl.us)

(850) 414-4272

# Introduction:

- ◆ Overview
- ◆ Deleted ***Design Standards***
- ◆ General Revisions
- ◆ Minor Revisions
- ◆ Significant Revisions
- ◆ Structural Revisions to Drainage related ***Design Standards***
- ◆ ***Developmental Design Standards***
- ◆ Looking Ahead



# Design Standards Overview

Index Number

Design Standards

Design Information

Instructions for Design Stds (IDS)

Data Table Cell Library

Borderless DGNs

(PDF)

Indexes  
(for Contractor)

(PDF)

(ZIP)

IDS  
(for Designer)

Data Tables  
(Convey Designer's project specific intent to the Contractor)

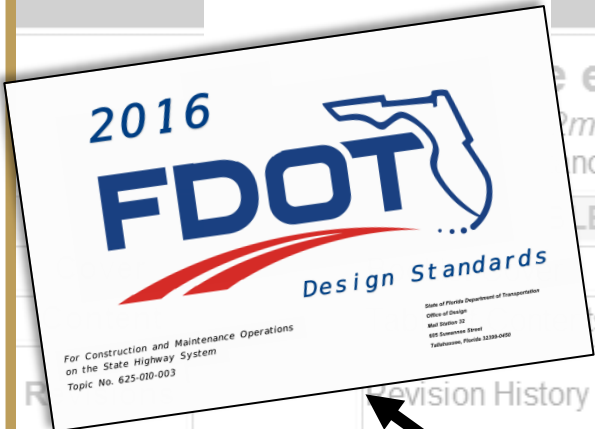
Combined Available IDS (11mb)

Combined Available (1mb)

Cover Content

**FDOT**  
Office of Design

**INSTRUCTIONS FOR DESIGN STANDARDS**  
2016



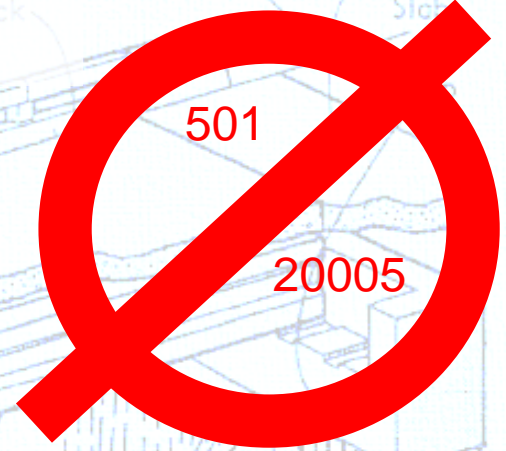
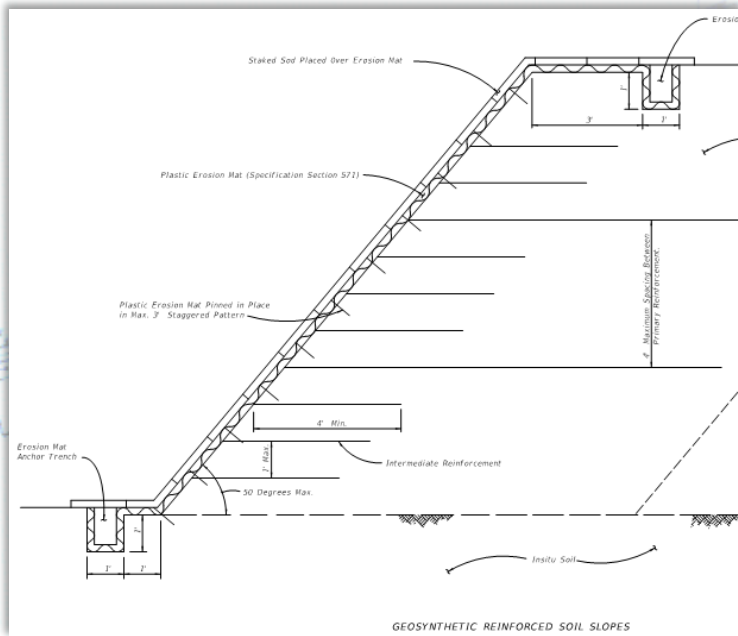
**FDOTSS3 for PowerGEOPAK**

Table with columns for LOCATION, CONCRETE PROPERTIES, STRANDS, PLAN VIEW, END OF BEAM & BEARING DIMENSIONS, BEAM DIMENSIONS, and REINFORCING STEEL. Below the table are diagrams of bridge cross-sections and a note: 'Designer should show strands of beam ends where they support'. The diagram labels include '38 STRANDS' and '30 STRANDS'.

Table titled 'STRIP SEAL EXPANSION JOINT DATA TABLE INDEX NO. 21100'. Columns include LOCATION, TOTAL DESIGN MOVEMENT (IN DIRECTION OF MOVEMENT, PERPENDICULAR TO Q JOINT, PARALLEL TO Q JOINT), MOVEMENT ALPHA, SKEW ANGLE (LEFT SIDE, RIGHT SIDE), DIM. A @ 70°F, and DIM. A ADJUSTMENT PER 10°F.

With Spread Footing  
(No Piles)

# Deleted *Design Standards*



- ◆ **Index 501: Geosynthetic Reinforced Soils**
- ◆ **Index 20005: Prestressed I-Beam Temporary Bracing**



Backwall

Wi

Direction of Increasing Stationing

# General Revisions – *Design Standards*

## ◆ **Index 810, 811 & 812:**

- ✓ Updated specification reference for repair of galvanizing to Section 562

### POST ATTACHMENT NOTES

#### **ANCHOR RODS, NUTS AND WASHERS:**

After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 562.

#### **COATINGS:**

Hot-dip galvanize all Nuts, Washers, Bolts, C-I-P Anchor Rods, Adhesive Anchors and Fence Framework (Posts, Internal Sleeves, Shim Plates, Base Plates, Pipe Clamps and Spacers) in accordance with Specification Section 962. Hot-dip galvanize Fence Framework after fabrication.



# General Revisions – *Design Standards* (Continued)

## Major Note Reorganization

### ◆ **Index: 11310, 11320, 17502, 17515, 17723, 17725 & 17745**

- ✓ Same Information
- ✓ Organized by consistent subject heading
  - Shop Drawings
  - Materials
  - Fabrication
  - Construction
- ✓ Notes similar across Indexes (simplified, less wordy)
- ✓ Soil Information - **17502 & 17723** - moved to **IDS**

# General Revisions – *IDS's*

- ◆ Editorial Change: Deleted 6<sup>th</sup> Edition from the **AASHTO LRFD** References
- ◆ Relaxed the requirement in **Plan Contents** to cross reference Standards to reference “by name or index number”.

Instructions for Design Standards  
Index 420 Traffic Railing (32" F Shape)

Topic No. 625-0

## Index 420 Traffic Railing (32" F Shape)

### Design Criteria

*NCHRP Report 350* Test Level 4 Criteria; *AASHTO LRFD Bridge Design Specifications*, ~~6th Edition~~; *Structures Design Guidelines (SDG)*

Show and label by name or index number 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.

# Minor Revisions/Updates

## ◆ **Index 423 & 821: Bullet Rails on Traffic Railings**

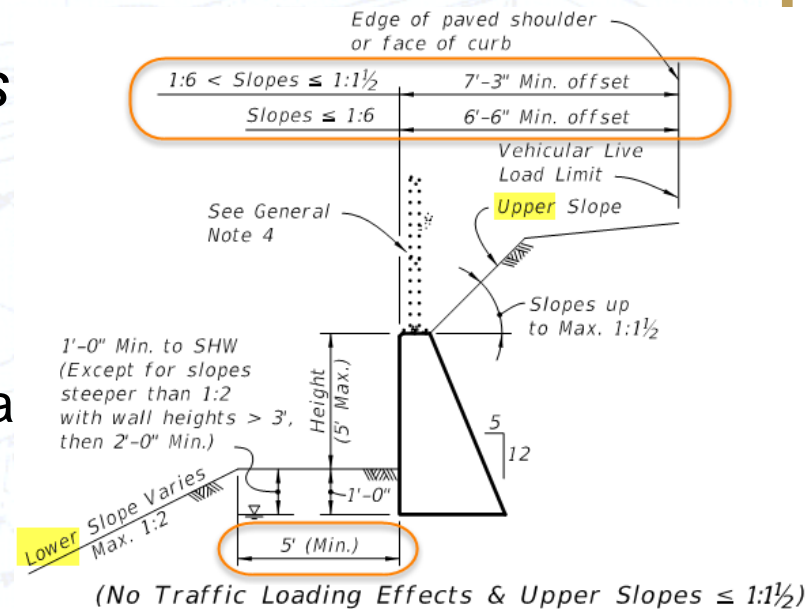
- ✓ Increased rail splice/expansion joint tolerance

## ◆ **IDS-00470: Thrie-Beam Retrofits**

- ✓ Scupper consideration

## ◆ **Index 6011: Gravity Wall**

- ✓ Added “Upper” and “Lower” slope labels
- ✓ Moved lower slope berm width information to **IDS**



## ◆ **Indexes 21250 & 20251: Access Hatch Assemblies**

- ✓ Changed Payment Note - included in cost of the box

ABUTMENT #1  
With Spread Footing  
(No Piles)

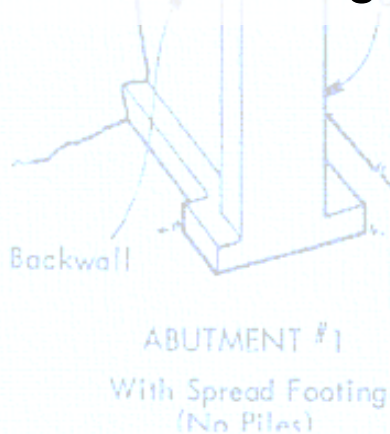
Direction of  
Increasing Stationing





# Significant Revisions – Pedestrian/Bicycle Railings

- ◆ Changed all *Special Height Pedestrian/Bicycle Railings (SHBR)* from 54" to 48" (4'-6" to 4'-0") Standard height remains at 42" (3'-6").
  - ✓ Updated to comply with **PPM Vol. 1, Chapter 8.8**
  - ✓ Picket/Panel Rail changes were minor (*Index 851, 852, 861 & 862*)
  - ✓ Bullet Railings more involved (*Index 820, 821, & 822*) and minor change to *Index 6130* drawings.



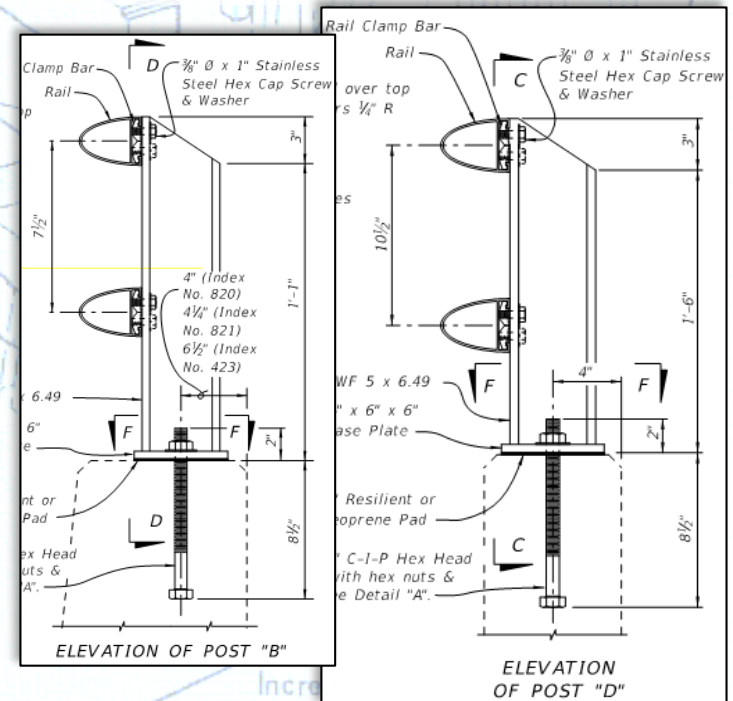
## 8.8 Drop-off Hazards for Pedestrians and Bicyclists

Drop-off hazards are defined as steep or abrupt downward slopes that can be perilous to pedestrians and bicyclists. The Engineer should consider shielding any drop-off hazards or where shielding is required as described in this section. Note that the Pedestrian/Bicycle Picket Railings (**Design Standards Index 850 or 860 Series**) and the Pipe Guiderail (**Index 870 and 880 Series**) have not been crash tested, and shall not be placed within the lateral offset of the roadway.

The standard height for pedestrian/bicycle railing is 42 inches. Provide a 48 inch tall

# Significant Revisions – Bullet Rails

- ◆ **Index 820:** Title changed to better reflect contents
  - ✓ Was: 'Bridge Pedestrian/Bicycle Bullet Railing'
  - ✓ Now: '27" Concrete Parapet with Pedestrian/Bicycle Bullet Railing'
- ◆ **Post changes (Index 820, 821 & 822):**
  - ✓ Deleted Triple Rail (Post A)
  - ✓ Combined Double Rail (Post B)
    - 42" height on 27" parapet or
    - 48" SHBR on 32" Railing.
  - ✓ Added Double Rail (Post D) for 48" SHBR on 27" parapet



With Spread Footing  
(No Piles)

# Significant Revisions – Picket/Panel Railings

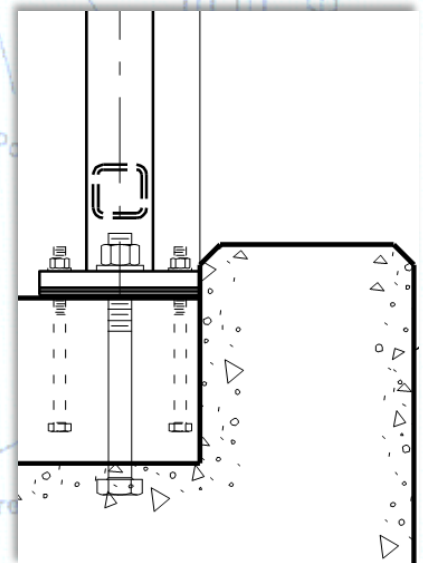
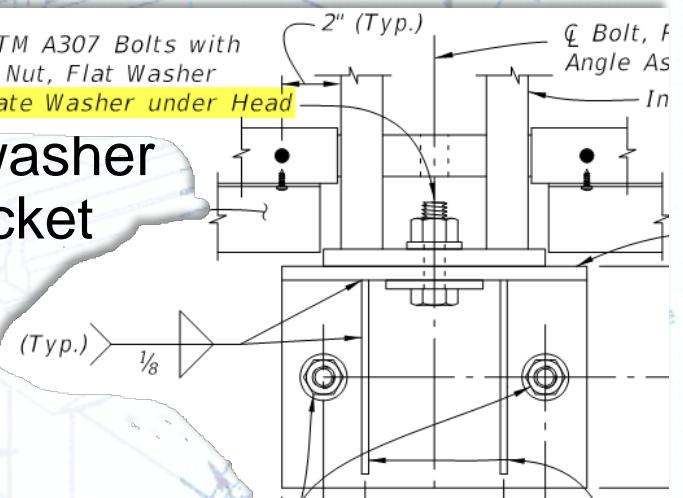
## ◆ **Index 851 & 861**

- ✓ Changed the position of the plate washer to the underside of the support bracket for *SCHEME 3*.

## ◆ **Index 852 & 862**

- ✓ Changes for *SHBR* height reduction.
- ✓ Simplify fabrication & installation
  - Added 4-bolt Anchorage Option
  - Changed recommended location of baseplate on stairways from cheekwall to top of steps.

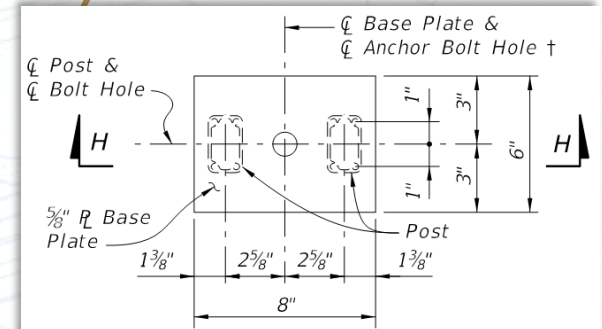
1 ~ 7/8" Ø x 3" ASTM A307 Bolts with Self Locking Hex Nut, Flat Washer under Nut and **Plate Washer under Head**



# Significant Revisions – Picket/Panel Railings (Continued)

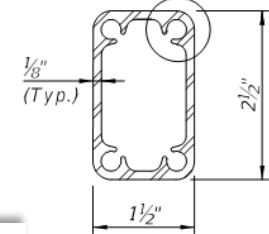
## ◆ **Index 862: Aluminum Bicycle/Pedestrian Picket Railings**

- ✓ Added Extrusion for Post (Type C)
- ✓ Added Extrusion for Post Top Plate (facilitates Post to Top Rail connection)
  - Eliminates welding of aluminum at critical connections.
  - Simplifies fabrication and Installation

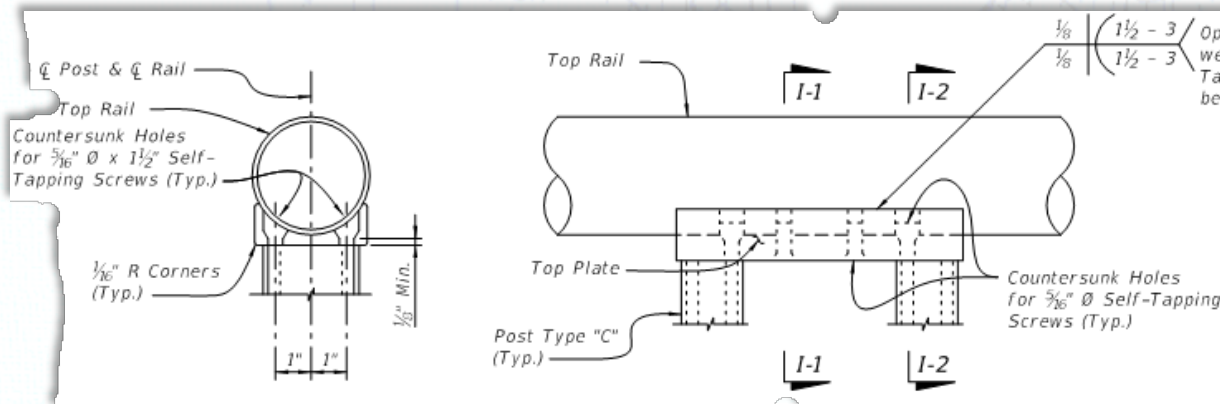


**BASE PLATE A**

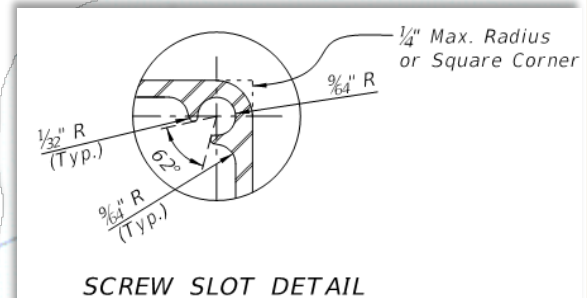
See Screw Slot Detail



**POST TYPE "C"  
CREW SLOT SECTION**



(No Pile)



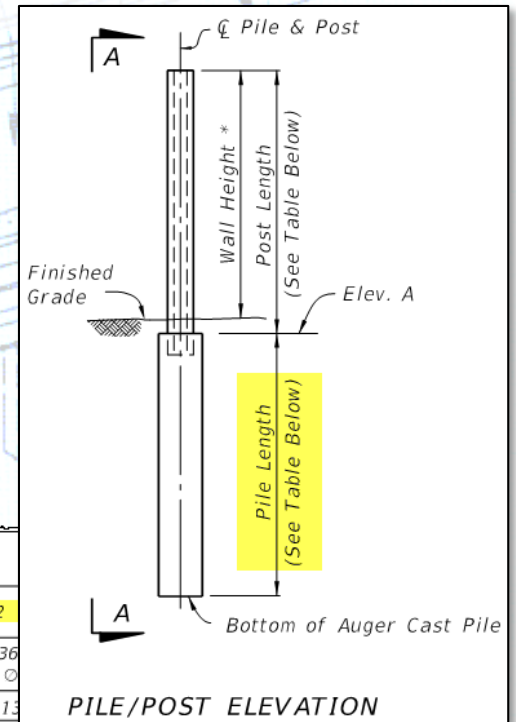
**SCREW SLOT DETAIL**

# Significant Revisions – Noise Walls

- ◆ **Index 5200:** Cleaned up note references
  - ✓ Updated Pile Lengths
  - ✓ Note 10.A.2 now includes 17' height

2. Plain Pads with a may be substituted for Fiber Reinforced Pads when sufficient bearing area is available on the concrete collar for the following:

- a. 10' Post Spacing: 4"x 4"x 1/2"
- b. 20' Post Spacing and Wall Height < 17 feet: 4"x 4"x 1/2"
- c. 20' Post Spacing and Wall Height ≥ 17 feet: 4"x 5"x 1/2"



H-POSTS			
SOIL 1		SOIL 2	
30"	36"	30"	36"
15	14	14	13
16	15	14	13
17	15	15	14
17	16	15	14
18	17	16	15
19	17	16	15
19	18	17	16
20	18	17	16
20	19	18	17
21	19	18	17
21	20	19	17

PILE/POST ELEVATION

- ◆ **IDS 5200:** Soil Type descriptions now match the Index:

- ✓ Type 1 – (N = 4 to 9)
- ✓ Type 2 – (N = 10 to 40)

**TABLE NOTE:**

1. Bars D and Bars E are for 45° Corner Posts only.
2. See Contract Plans for project wind speed.
3. Soil 1 = Loose Granular Soil, N = 4 to 9.  
Soil 2 = Medium Dense Granular Soil, N = 10 to 40.

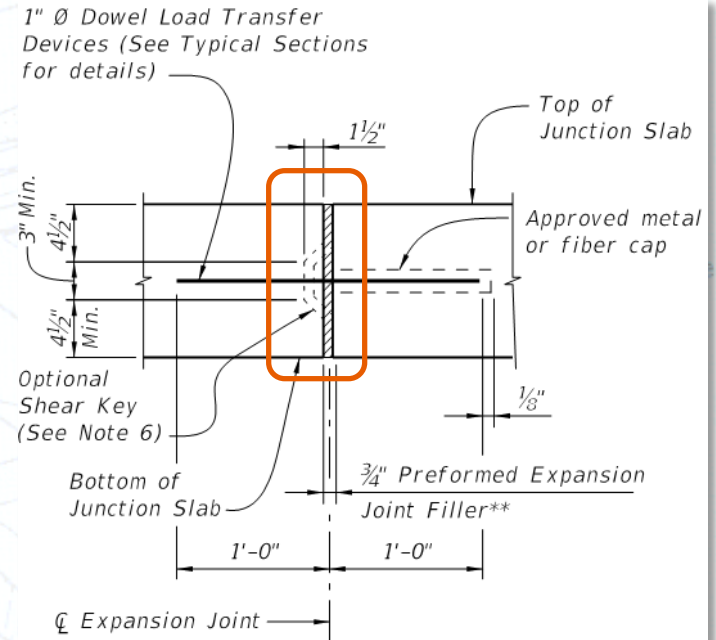
# Significant Revisions – Doweled Expansion Joints

## ◆ **Indexes 5215, 6110 & 6120**

- ✓ Added a Note to allow the use of Preformed Polymer Stay-in-Place (SIP) Bond Breaker

## ◆ **Indexes 6110 & 6120**

- ✓ Added Optional Shear Key
- ✓ Added GFRP Bars as Dowels
  - Requires use of Shear Key



### EXPANSION JOINT DETAIL

(Junction Slab expansion joints are to coincide with 3/4" open joints in Traffic Railing)

\*\* Stay-In-Place Plastic Preformed Bond Breakers are permitted to form joints.

6. Shear Keys in Junction Slab are required when GFRP bars are used for Dowel Transfer Devices and are optional with steel dowel bars. Tongue Slope on Shear Key must be constant and between 5° to 45° from horizontal.

With Spread Footing  
(No Piles)

# Significant Revisions - 6000 Series

- ◆ **Index 6020: Permanent MSE Retaining Wall Systems:**

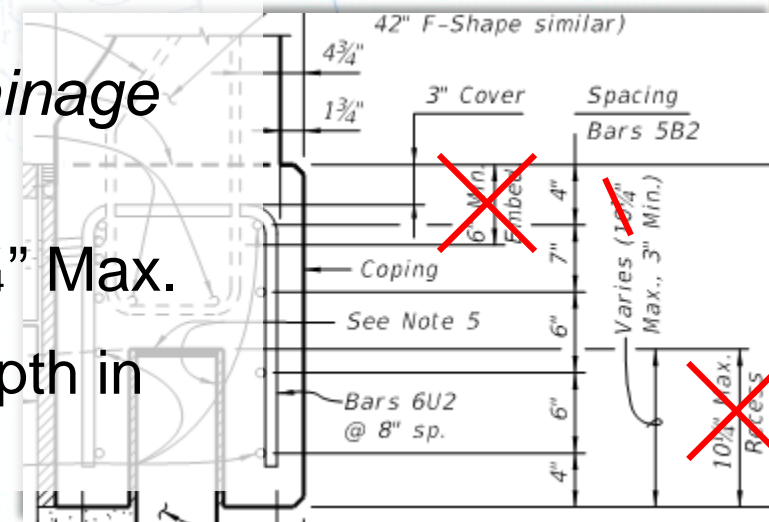
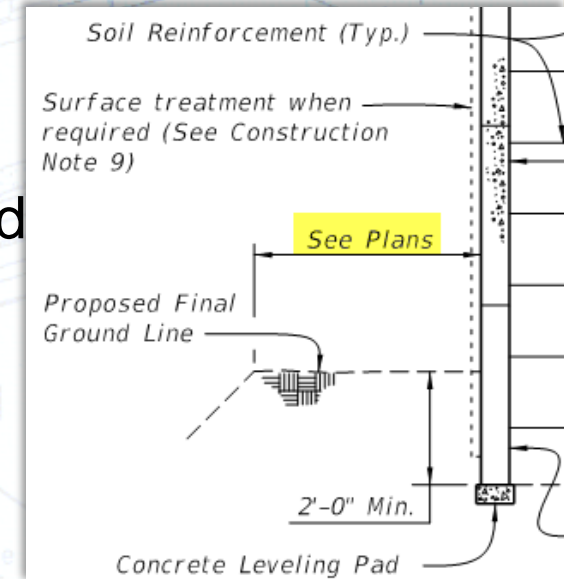
- ✓ Changed toe of wall dimension & Deleted half of Note 13 - Details moved to **IDS**

- ◆ **Index 6120: Wall Coping with Traffic Railing/Raised Sidewalk**

- ✓ Deleted slip-forming restriction.

- ◆ **Index 6201: Junction Slab at Drainage Inlet Openings:**

- ✓ Changed recess depth to 1'-1¼" Max.
- ✓ Deleted 6" Min. embedment depth in Section A-A

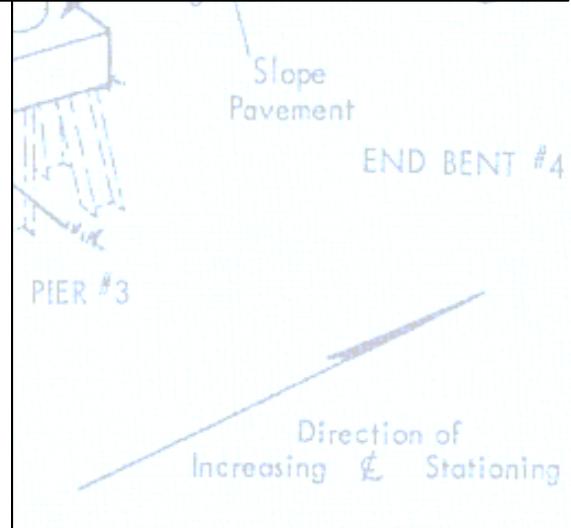
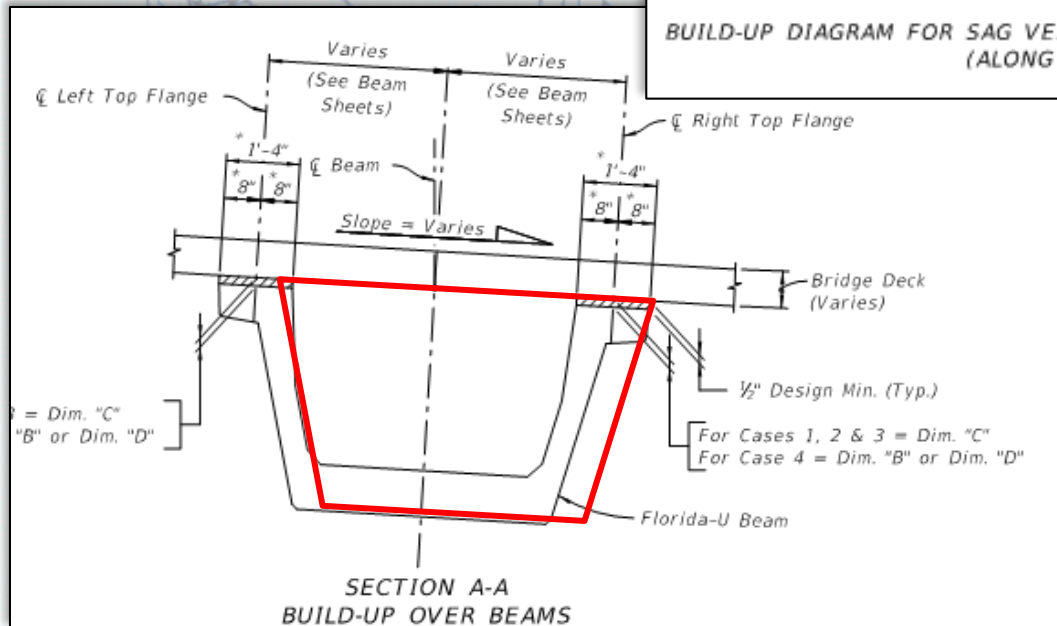
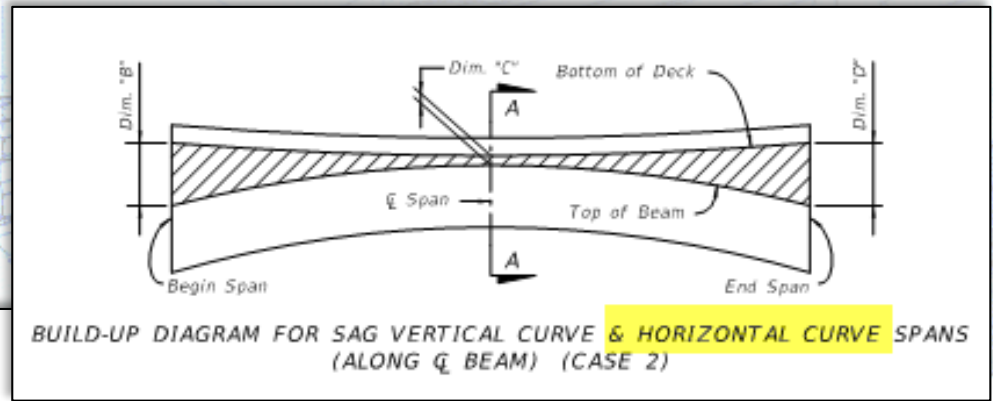




# Significant Revisions

- ◆ **Index 20199 & 20299: Build-Up & Deflection Data**

- ✓ Horizontal Curve added to CASE 2 Titles



# Significant Revisions – Elastomeric Bearing Pads

## ◆ **Index 20510: Composite Elastomeric Bearing Pads**

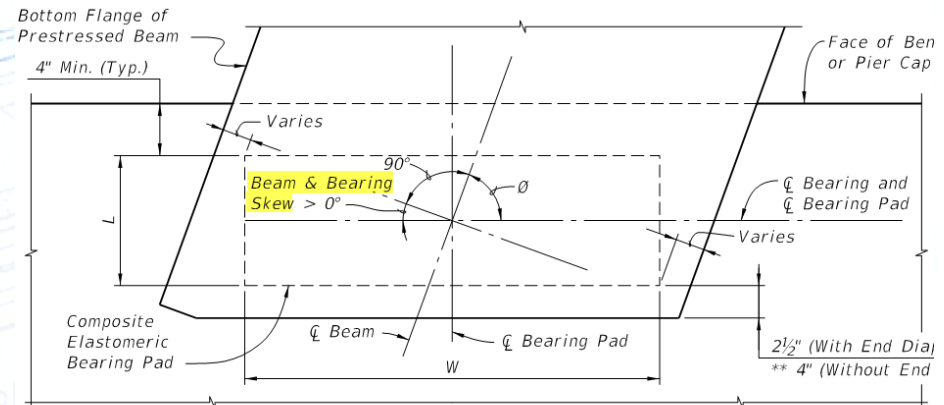
### ✓ Skew Angle Definition Clarified

- Skew of Bridge
- Skew of Bearing Pad to direction of moment

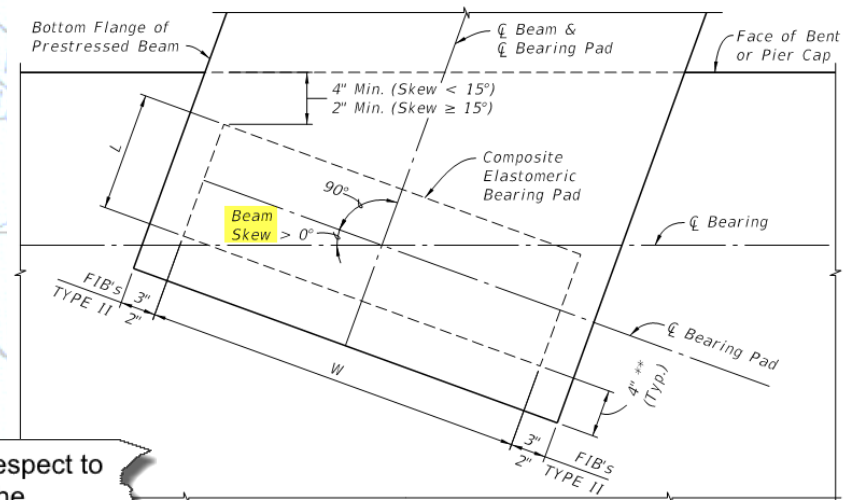
## ◆ **IDS-20510:**

- ✓ Revised to clarify design requirements

Skew angle for Bearing Pad design is based on the direction of rotation with respect to the centerline of the Bearing Pad; and is usually taken as the angle between the centerline of the beam and the longitudinal centerline of the Bearing Pad, except on curved bridges.



PARTIAL PLAN (Beam & Bearing Skew > 0°) (Use Index 20511)

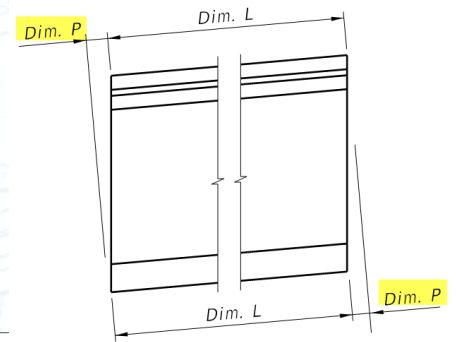


PARTIAL PLAN WITH SQUARED END BEAM (Use Index 20512)  
(Beam Skew > 0°; Bearing Skew = 0°)

# Significant Revisions – Prestressed Concrete Beams

## ◆ **IDS 20010, 20110 & 20120**

- ✓ Added Guidance for Dim. P



Report DIM P for beams placed on grade if the calculated value is equal or greater than 1" using  $\frac{1}{8}$ " increments. Also consider the effect of beam end rotations for Florida-I 84 and 96 beams, if significant. Different "P" dimensions at each end may be necessary for accommodating these effects, which will require modifying the "FLORIDA-I BEAM - TABLE OF BEAM VARIABLES" using suggested DIM P1 and DIM P2.

## ◆ **IDS-20299 Florida-U Beams**

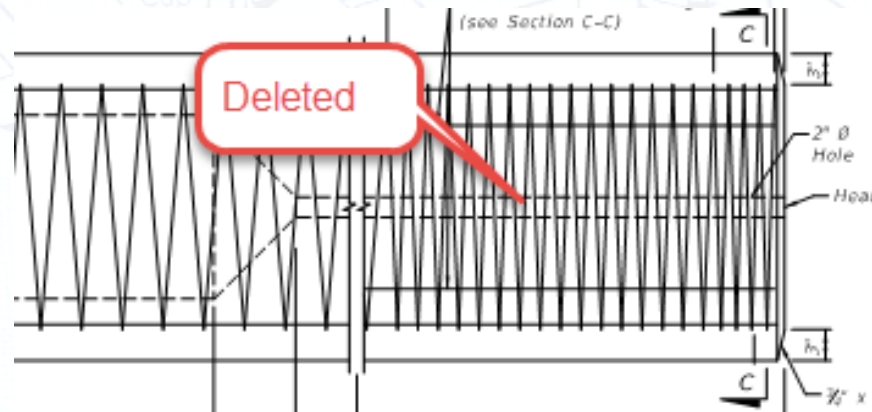
- ✓ Added clarification on vertical curve geometry along Centerline

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. Consider that the vertical curve geometry is along the effective alignment along a chord at the centerline of the beam, which may be different from the alignment parallel to the Profile Grade Line.

# Significant Revisions – Prestressed Concrete Piles

## ◆ **Indexes 20602, 20630 & 20631**

- ✓ Deleted 2" diameter upper vents from center of pile.
- ✓ Rearranged Notes to reflect the change



### NOTES:

~~1. Venting shall be provided by the use of a 1"  $\emptyset$  PVC conduit through a substructure cap or column.~~

~~— Voids between segments of spliced piles shall be connected by 2"  $\emptyset$  hole(s).~~

1. Any of the given Alternate Strand Patterns may be utilized. The strands shall be located as follows:  
Place one strand at each corner and place the remaining strands equally spaced between the corner

# Significant Revisions - Conduit

## ◆ **IDS-21200 Light Pole Pedestal**

- ✓ Moved Design Load Case Information from **Index 21200** Sheet 3 to IDS
- ✓ Added commentary on issues with use of Corral Shape Railings

*Commentary: Use of this Index with Index 424 (Corral Shape) Traffic Railings is not recommended because the Standard Corral Shape Railing cannot accommodate the required electrical conduit and embedded junction boxes (EJB's).*

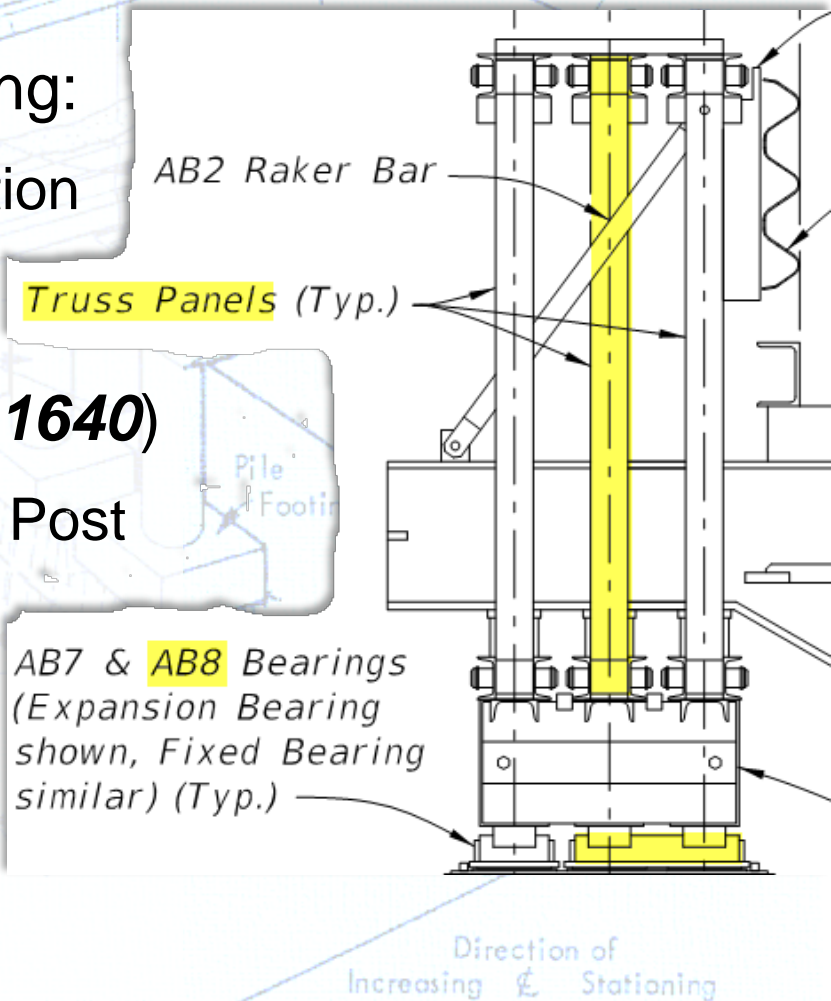
## ◆ **IDS-21210: Conduit Details**

- ✓ Added Railing Index Numbers that are crash worthy with 2" conduit
- ✓ Excludes Corral Shape

The details as shown for installing two 2" diameter conduits and associated Embedded Junction Boxes (EJBs) in traffic railings have been determined to be crashworthy in accordance with the requirements of **NCHRP Report 350** and the **AASHTO LFRD Bridge Design Specifications** for **Design Standards** Indexes **420, 421, 422, 423, 425, 5210** and **5211**.

# Significant Revisions – Temporary Detour Bridge

- ◆ To meet **FL-120 & HS 25** loading:
  - ✓ Triple-Single Panel Configuration
  - ✓ AB8 Bearings
- ◆ Thrie-Beam Guardrail (**Index 21640**)
  - ✓ Changed W-Beam height and Post spacing's to match Roadway Standards (**Index 400**).



# Significant Revisions – Post Tensioning

- ◆ **Indexes 21801, 21802 & 21803**

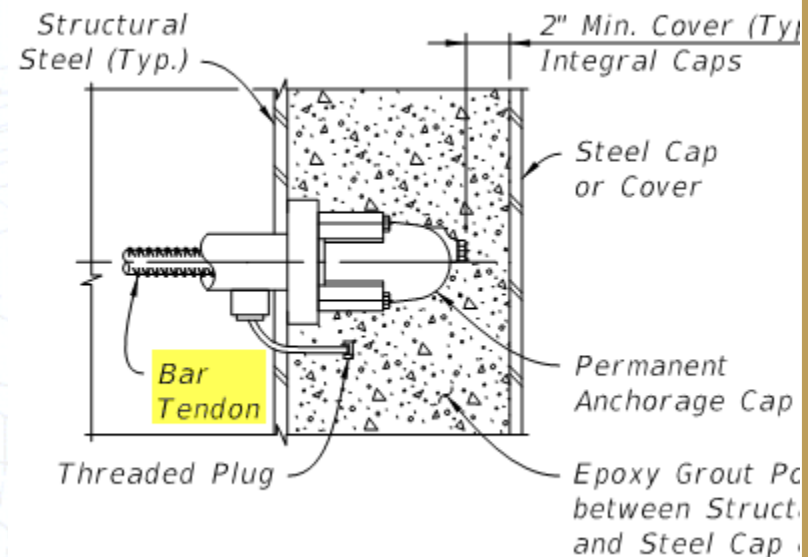
- ◆ Terminology changed:

- ✓ “PT Bar” to “Bar Tendon”
  - Consistency with industry practice

- ◆ Additional Changes for Flexible Filler

- ◆ **IDS-21800 Series**

- ✓ Major revisions to **Plan Content Requirements**
- ✓ Added Figures and References.



TYPE 11

END BENT #4

PIER #3

Direction of Increasing Stationing

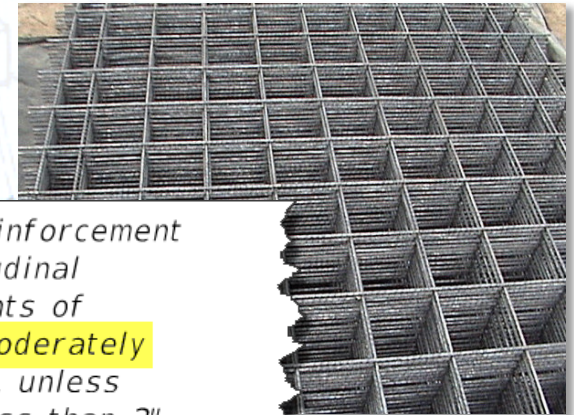
# Drainage Related Standard Updates

## ◆ **Index 201:** *Supplementary Details for Manholes & Inlets*

- ✓ Increased the minimum size of deformed wire to D4.0 to meet **ASTM** A1064-8.3.1

## ◆ **Index 292:** *Standard Precast Concrete Box Culvert*

- ✓ Increased the minimum size of deformed wire to D4.0 to meet **ASTM** A1064-8.3.1
- ✓ Cover requirement corrected in Note 4.



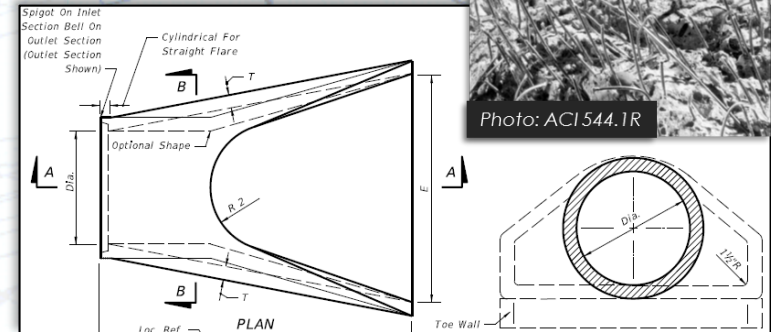
4. Reinforcing steel must consist of smooth or deformed welded wire reinforcement (WWR) meeting the requirements of Specification Section 931. Longitudinal reinforcement may consist of reinforcing bars meeting the requirements of Specification Section 931. Minimum cover must be 2" for slightly or moderately aggressive environments or 3" for extremely aggressive environments, unless otherwise shown. The spacing of circumferential wires must not be less than 2" nor more than 4". The spacing of longitudinal wires or bars must not be more than 8".



# Drainage Related Standard Updates

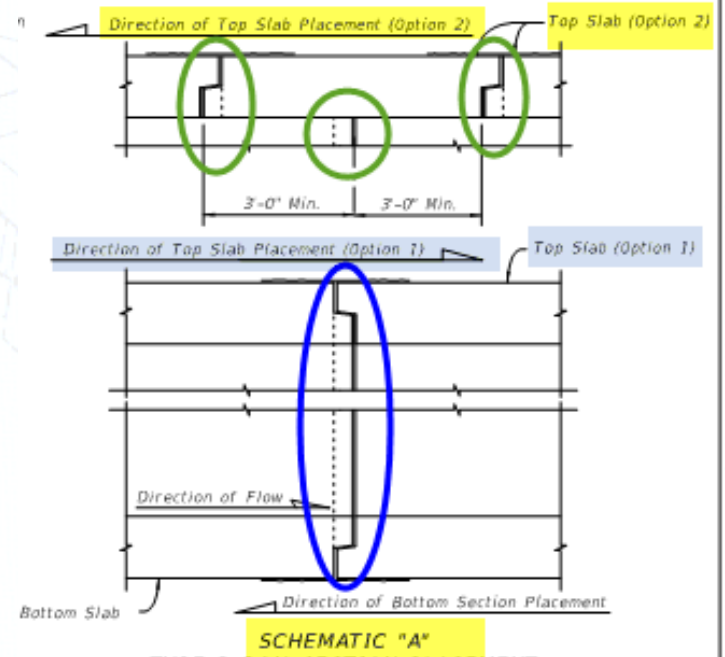
## ◆ **Index 270: Flared End Section**

- ✓ **New: Allow Fiber-Reinforced Concrete in lieu of conventional steel bar reinforcing**



## ◆ **Index 291: Supplemental Details for Precast Concrete Box Culverts**

- ✓ **Schematic "A"**
- ✓ **Added Option 2**
  - **Top Slab placement**



# Developmental Indexes & *IDDS*

- ◆ Adding ***Developmental Design Standards*** to the Plan Set.
  - ✓ Added to the IDDS's **Plan Content Requirements** section
- ◆ D6025, D17749, D20310, D20350, D22440 & D22600

## Plan Content Requirements

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

# Recently Published *DDS*

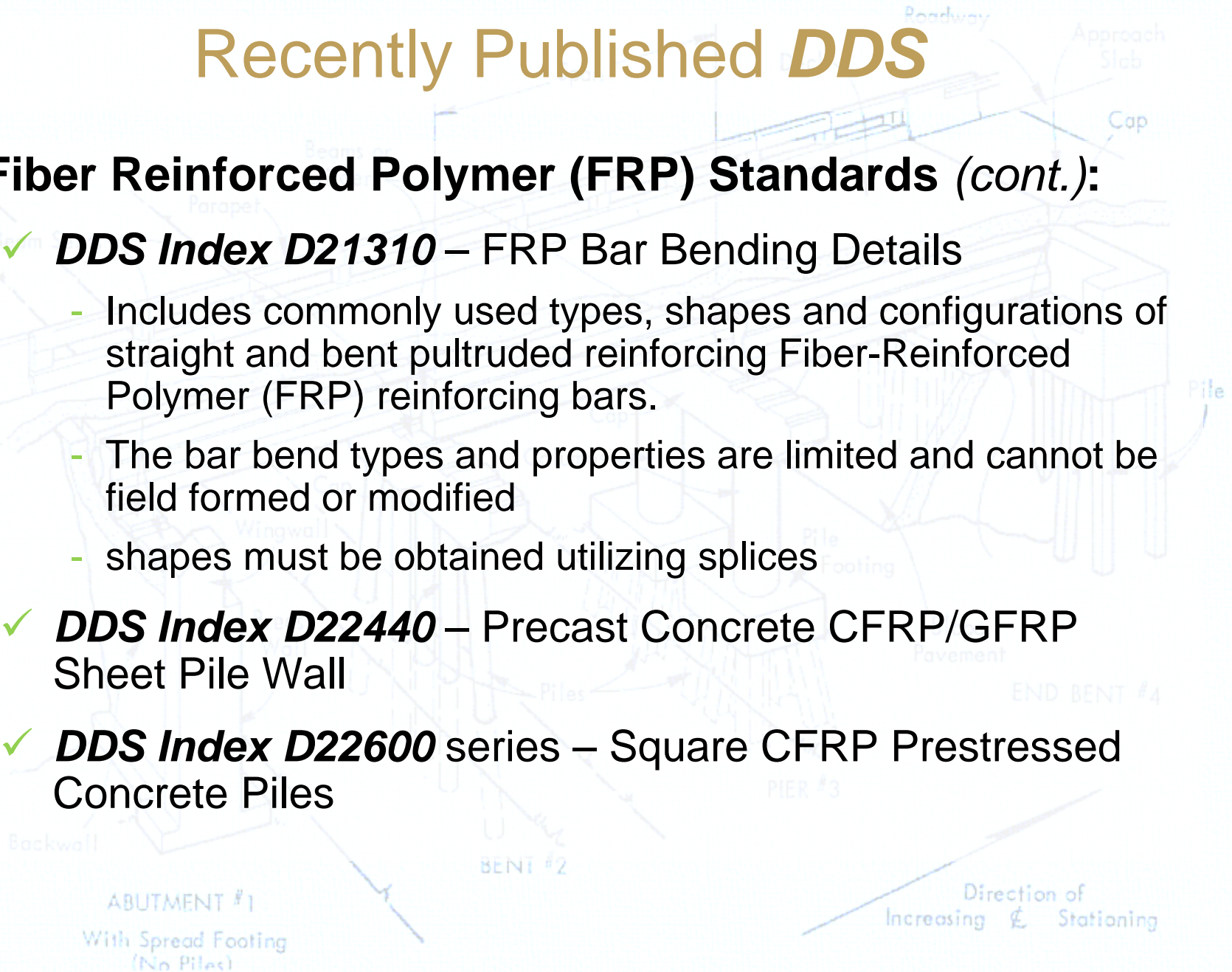
## ◆ Fiber Reinforced Polymer (FRP) Standards (*cont.*):

### ✓ *DDS Index D21310* – FRP Bar Bending Details

- Includes commonly used types, shapes and configurations of straight and bent pultruded reinforcing Fiber-Reinforced Polymer (FRP) reinforcing bars.
- The bar bend types and properties are limited and cannot be field formed or modified
- shapes must be obtained utilizing splices

### ✓ *DDS Index D22440* – Precast Concrete CFRP/GFRP Sheet Pile Wall

### ✓ *DDS Index D22600* series – Square CFRP Prestressed Concrete Piles

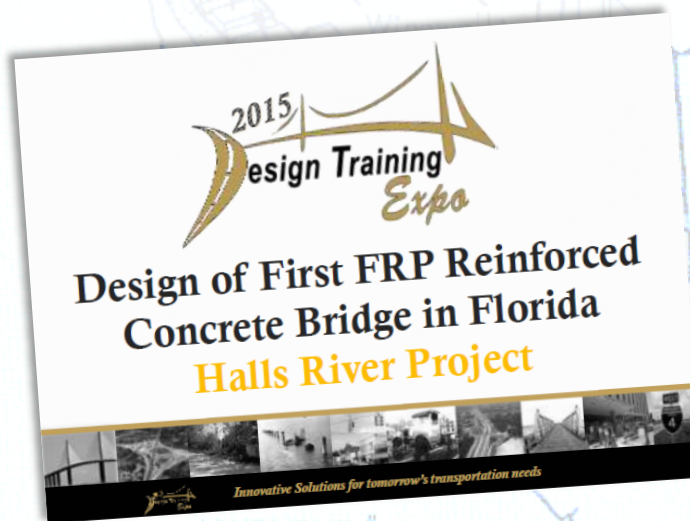


# Recently Published *DDS*

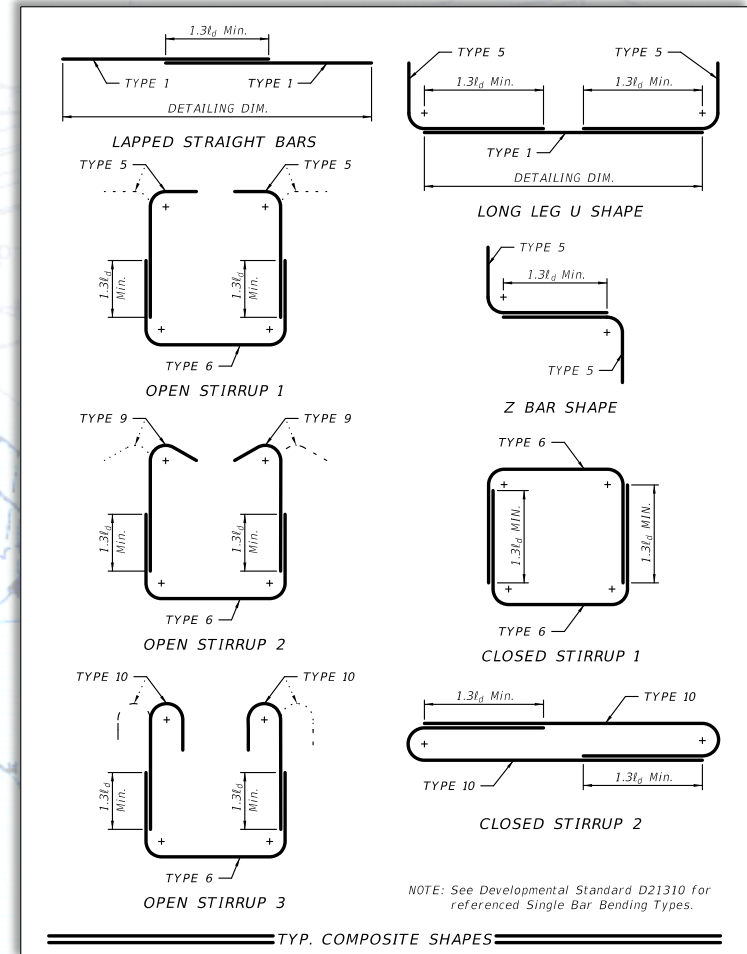
## ◆ Fiber Reinforced Polymer (FRP) Standards (*cont.*):

### ✓ *DDS Index D21310 Cont.* – FRP Bar Bending Details

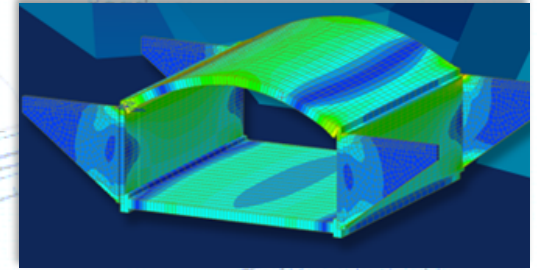
- Design Aids in the *IDS* contain examples of typical composite shapes.



<http://www.dot.state.fl.us/officeofdesign/training/designexpo/2015/presentations/DesignOfFirstFRPReinforcedConcreteBridge-Masseus-Siddiqui-Pelham-Suarez.pdf>

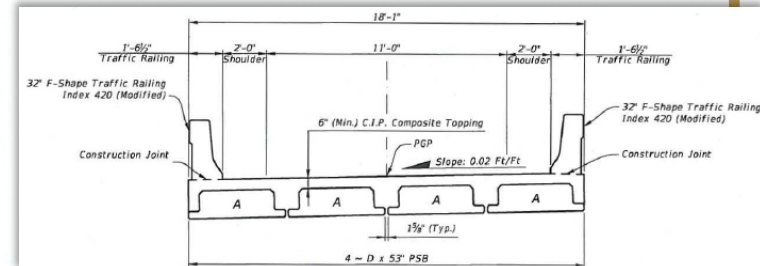


# Looking Ahead

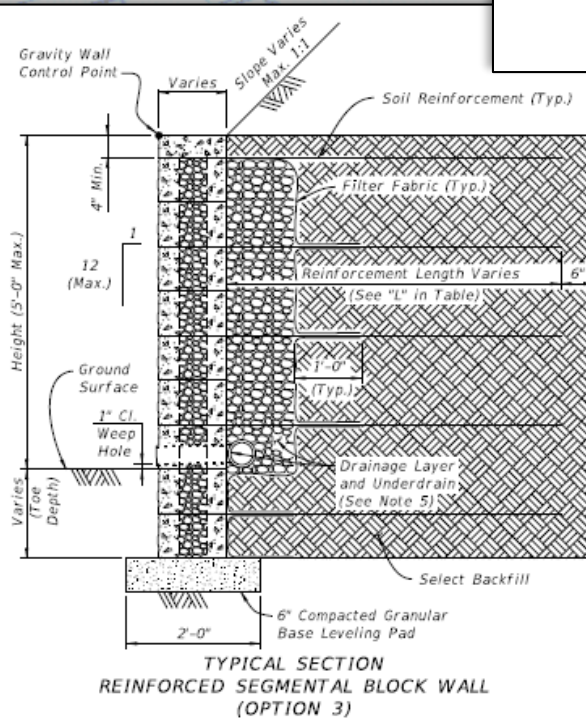
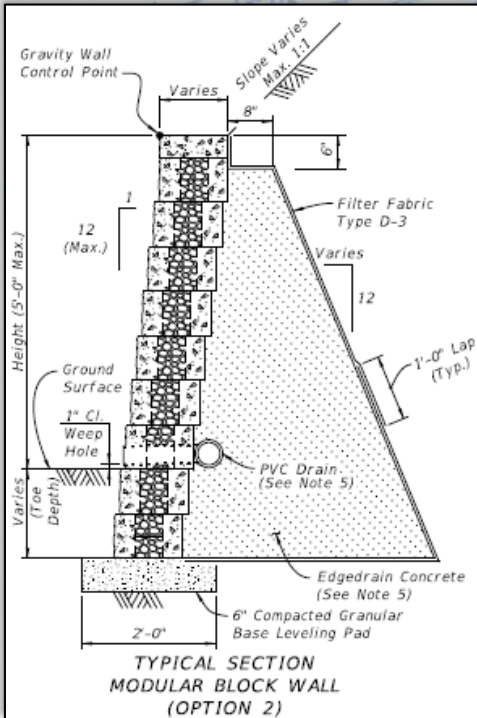
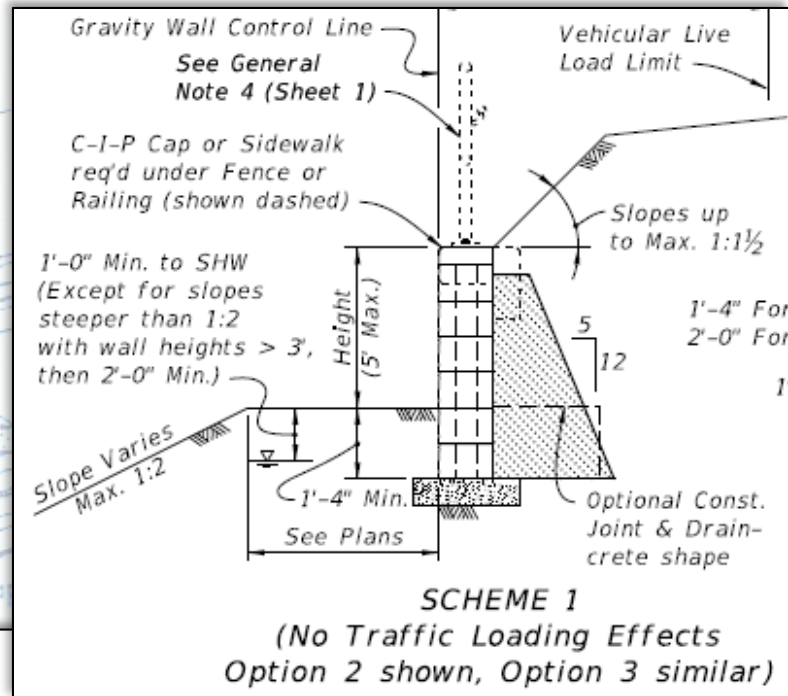


## Other *Developmental Design Standards in the works:*

- ✓ **Index D296** – Three-Sided Concrete Culvert Details (Aug. 2015);
- ✓ **Index D420** – Precast 32"-F Shape Traffic Railing;
- ✓ **Index D6011** – Gravity Block Wall (Aug. 2015);
- ✓ **Index D6012** – Slope Cut Retaining Wall;
- ✓ **Index D20700 series** – Precast Intermediate Bent Cap;
- ✓ **Index D20450 series** – Florida Slab Beam (FSB) (Aug. 2015);
- ✓ **Index D30000 series** – Off-system Bridge Packages (Superstructure):
  - 4 span lengths - 30', 40', 50' and 60';
  - 4 bridge clear widths – 18', 27', 35' and 40'.



# Developmental Design Standard Index D6011 (Gravity Block Walls)



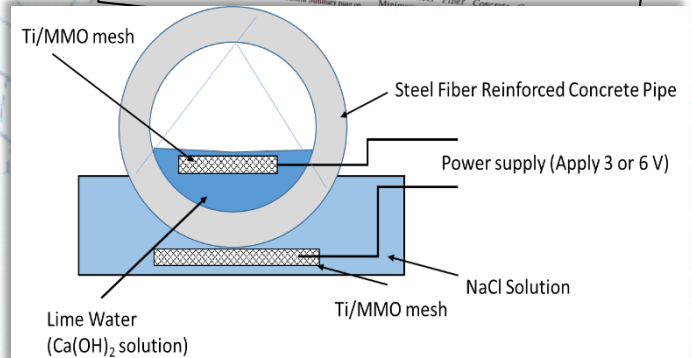
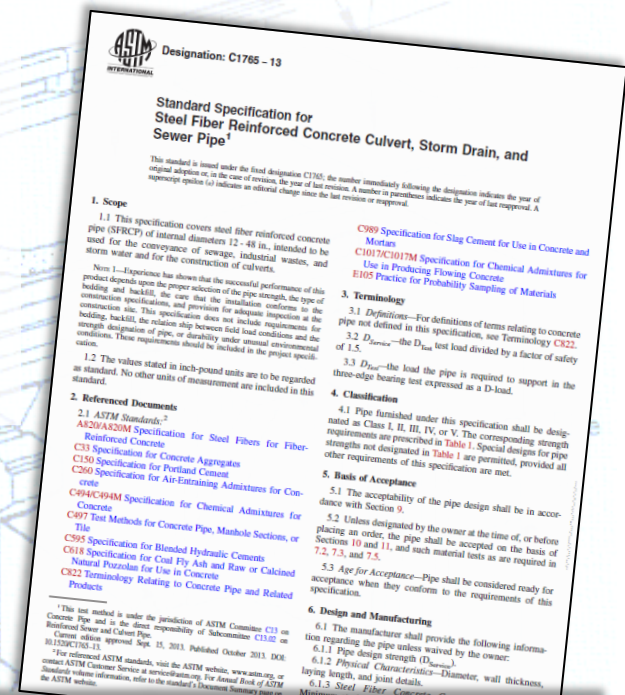
# Looking Ahead

## ◆ Fiber-Reinforced Concrete

- ✓ Prestressed Beam Research Project
- ✓ SFRC & SYNFRCC Pipe ASTM's with additional durability research promoted by the State Materials Office.



Photos courtesy of TxDOT: [FHWA/TX-06/ 0-4819-1](https://www.fhwa.gov/ohd/ohd/06/0604819111.cfm) Fiber Reinforcement in Prestressed Concrete Beams (2005)



Schematic of proposed test to accelerate the corrosion of the fibers (courtesy of FAU).

# Message from the Structures Standards Group

- ◆ We are here to assist you with your questions and concerns. Please contact us:

- ✓ If you have a suggestion:

- for a new standard or
- for an improvement to an existing standard.



- ✓ If you have any issues during design or construction:

- Fully explain the issue (photos help);
- Provide suggestions (if you have any) and;
- Provide any documentation that might support a proposed change and assist us during development.

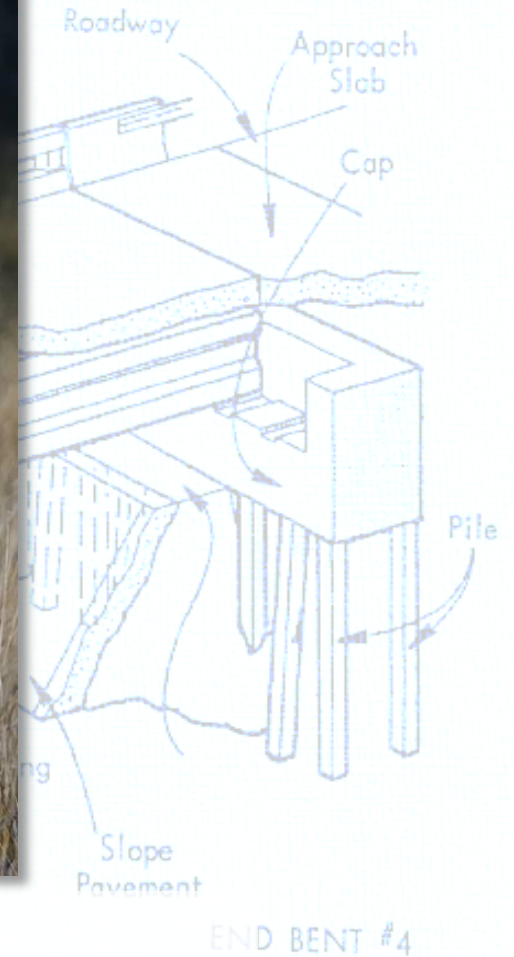
- ✓ Anytime you have questions or concerns (*but, we recommend reviewing the **IDS** first*).

With Spread Footing  
(No Piles)

Direction of  
Increasing Stationing



# Questions ?



## Contact Information:

**Steve Nolan, P.E.**

**State Structures Design Office**

**[Steven.nolan@dot.state.fl.us](mailto:Steven.nolan@dot.state.fl.us)**

**(850) 414-4272**



PIER #3

Direction of Increasing Stationing