



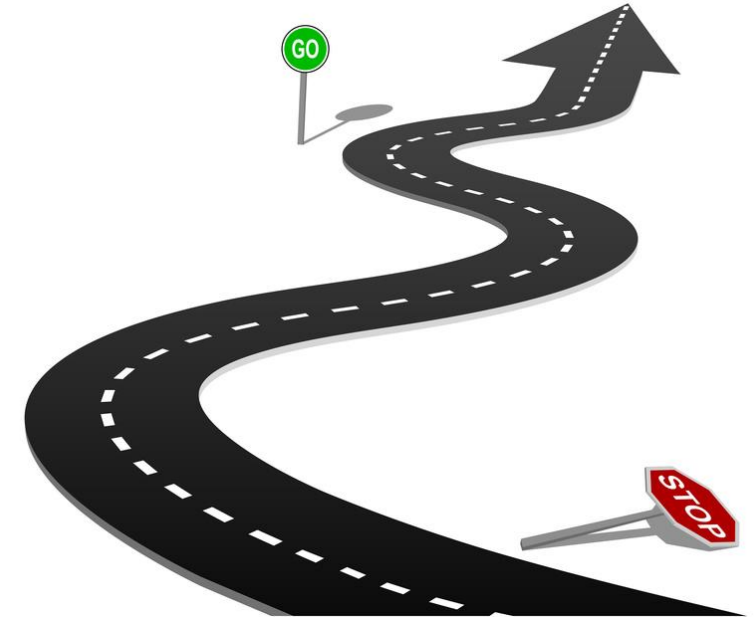
# TRANSPORTATION SYMPOSIUM 2019

## Structures Manual

James Griffith, Jacqueline Petrozzino-Roche and Scott Arnold

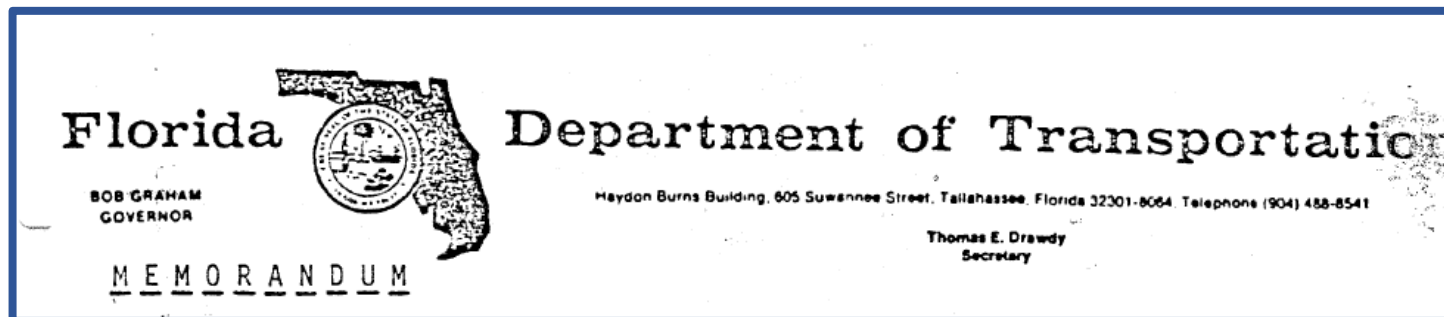
# Presentation Overview

- History
- Organization
- Major Modifications
- Upcoming Changes
- Tips and Tricks for Navigating the Digital Manual



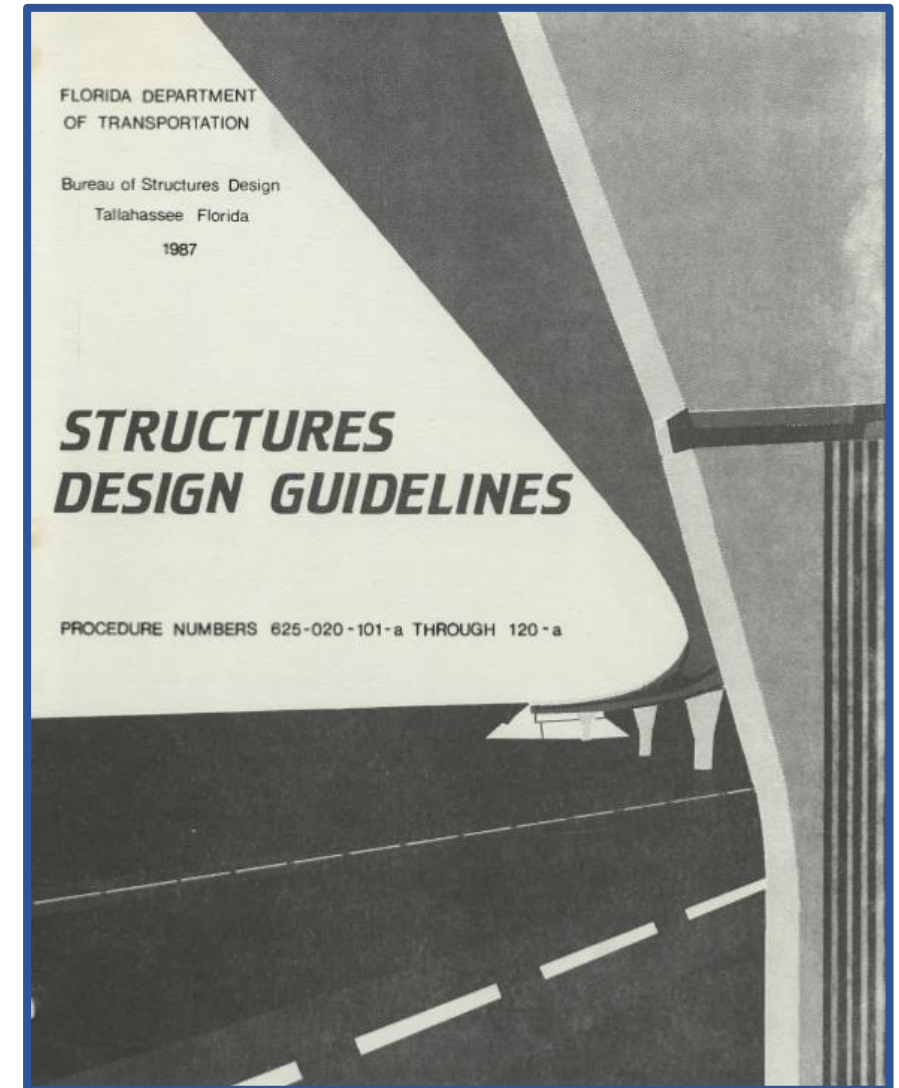
# Historical Commentary

- In the 1980s, The Bureau of Structures Design was a production office
  - In house design groups
  - Moveable bridge section
  - Shop drawing review section
  - Consultant plans review section
- Transfer of knowledge from senior engineers to junior engineers through experience working on in-house design projects
- Official directive or memorandum issued by the Bureau
  - Policy changes and new requirements



# Historical Commentary

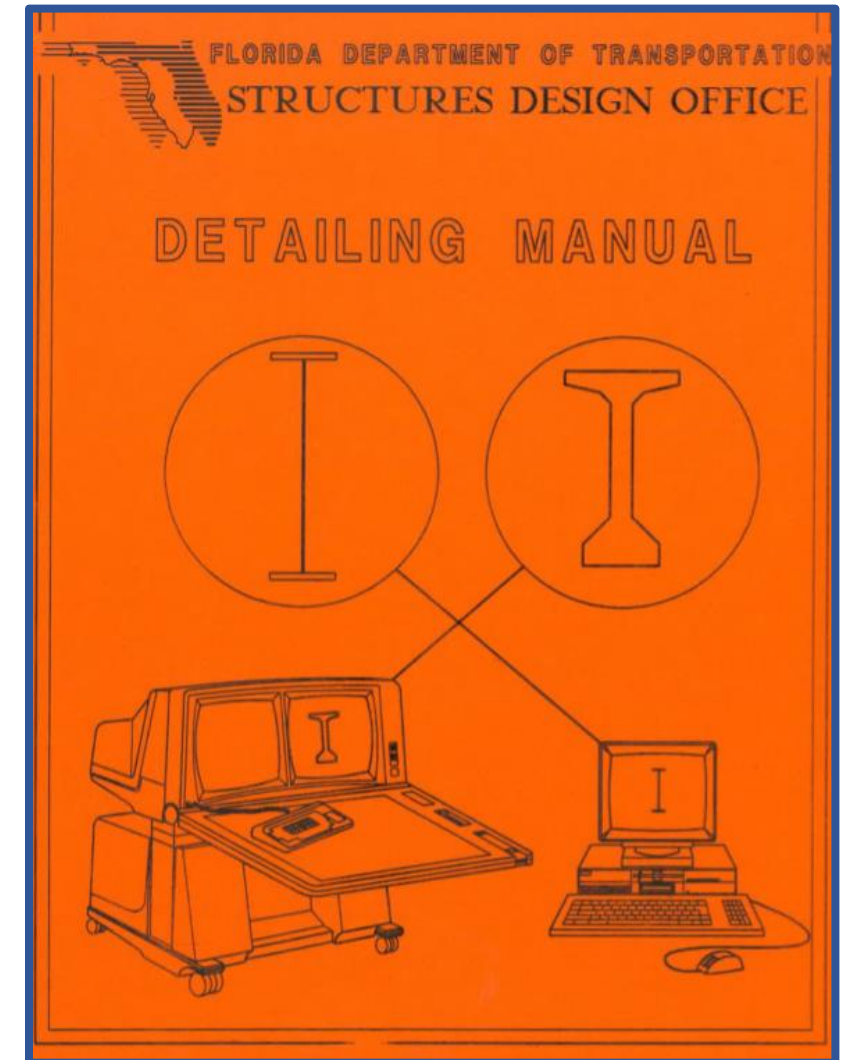
- Decentralization
  - Reduction in in-house design
  - Central Office's new role became development of policy
  - Consultants hired to produce bridge plans
- First Structures Design Guidelines was Published in 1987
  - Collection of old directives and memorandums
  - Additional input from the Bureau staff
  - Provided the engineer with a common source of FDOT design criteria



# Historical Commentary

## Mid-1990s

- Internet based Structures Manual
- Introduction of the Structures Detailing Manual
  - Includes references for traditional drafting and CADD
  - Guide to design engineer resulting in uniformity and consistency in preparing bridge and structures plans
  - Details in the Manual should be used unless special conditions warrant deviation
    - Use sound engineering judgement
    - Consultation with the Structures Design Office




# Revision Schedule


- Archived Manuals- Posted to the Department's Webpage
  - 1999 to 2018 Structures Manuals
  - Structures Directives prior to 1987
- Current Practice
  - Manual published annually on November 1<sup>st</sup>
  - Consultants and FDOT employees submit changes throughout the year
  - Last day to submit changes is July 17<sup>th</sup>
- FHWA Stewardship and Oversight Agreement
  - FHWA must approve the Structures Manual prior to publication

Structures Design / Documents & Publications

Structures Manual - Current Release



Adobe Reader is required to view the Structures Manual. You can download it by clicking the link below:


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FDOT STRUCTURES MANUAL - JANUARY 2019

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January 2019 Distribution Memo  
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Archived Structures Manuals

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[Structures Manual Introduction](#)  
[Frequently Asked Questions](#)  
[2019 Structures Manual Revision History](#)

**Volume 1 - Structures Design Guidelines (SDG)**  
Volume 1 Structures Design Guidelines  
SDG Appendix 1A  
SDG Appendix 8A  
SDG Appendix 8B  
SDG Appendix 8C  
SDG Appendix 8D  
SDG Appendix 8E  
SDG Appendix 8F

**Volume 2 - Structures Detailing Manual (SDM)**  
Volume 2 Structures Detailing Manual  
[Structures Detailing Manual Examples \[External Link\]](#)

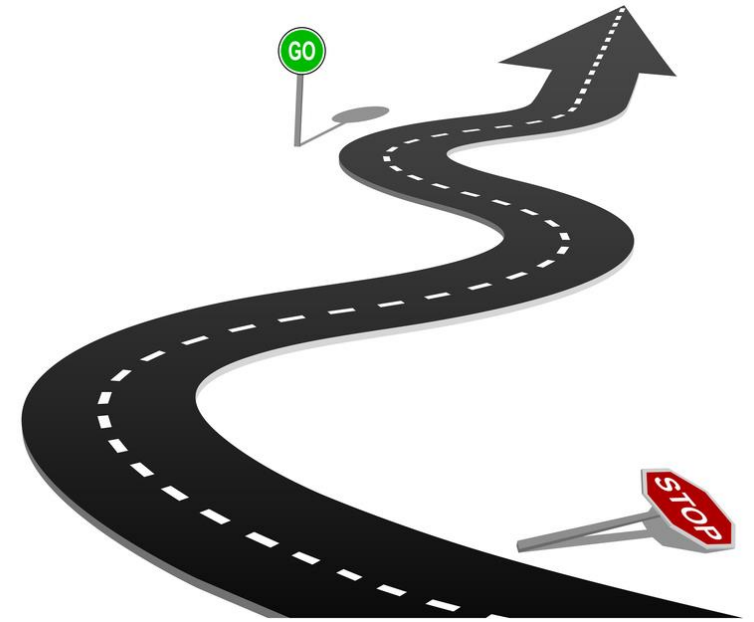
**Volume 3 - FDOT Modifications to LRFDLTS-1**  
Volume 3 FDOT Modifications to LRFDLTS-1

**Volume 4 - Fiber Reinforced Polymer Guidelines (FRPG)**  
Volume 4 Fiber Reinforced Polymer Guidelines  
*Be aware that accessing the documents in this fashion may be slower and will cause certain links between volumes of the Structures Manual to malfunction.*



# Presentation Overview

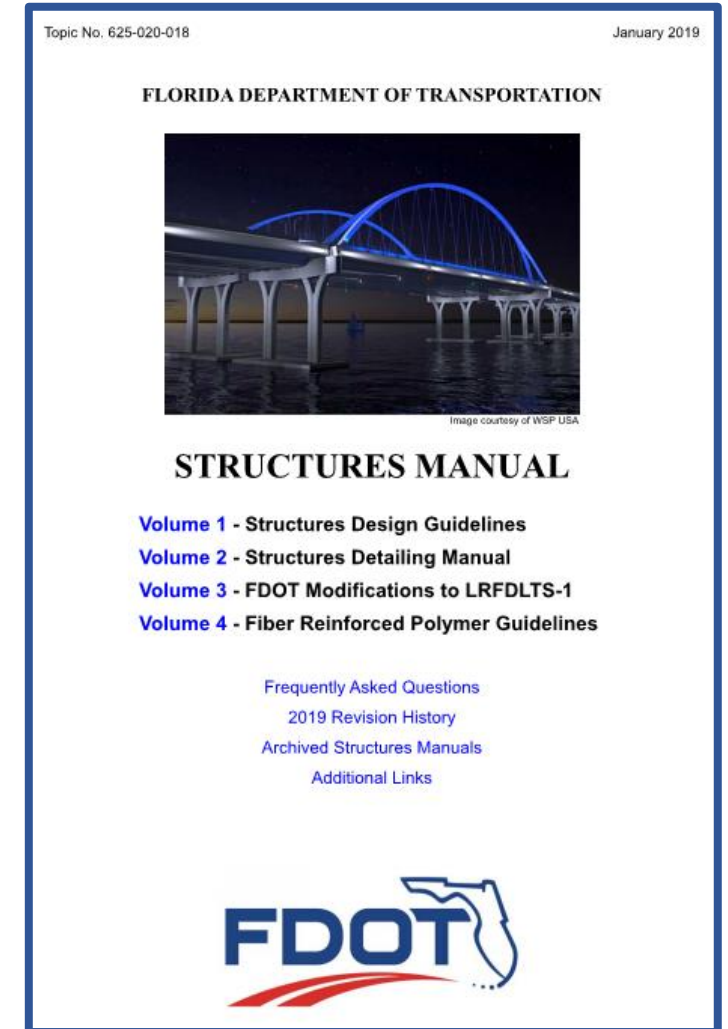
- History
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# Structures Manual

- Provides the Department's design and detailing criteria
- 4-Volume Manual
  - Introduction- 10 pages following the Home page
  - Volume 1- Structures Design Guidelines (SDG)
  - Volume 2- Structures Detailing Manual (SDM)
  - Volume 3- FDOT Modifications to LRFDLTS-1
  - Volume 4- Fiber Reinforced Polymer Guidelines





# Structures Manual Organization

## Structures Design Guidelines

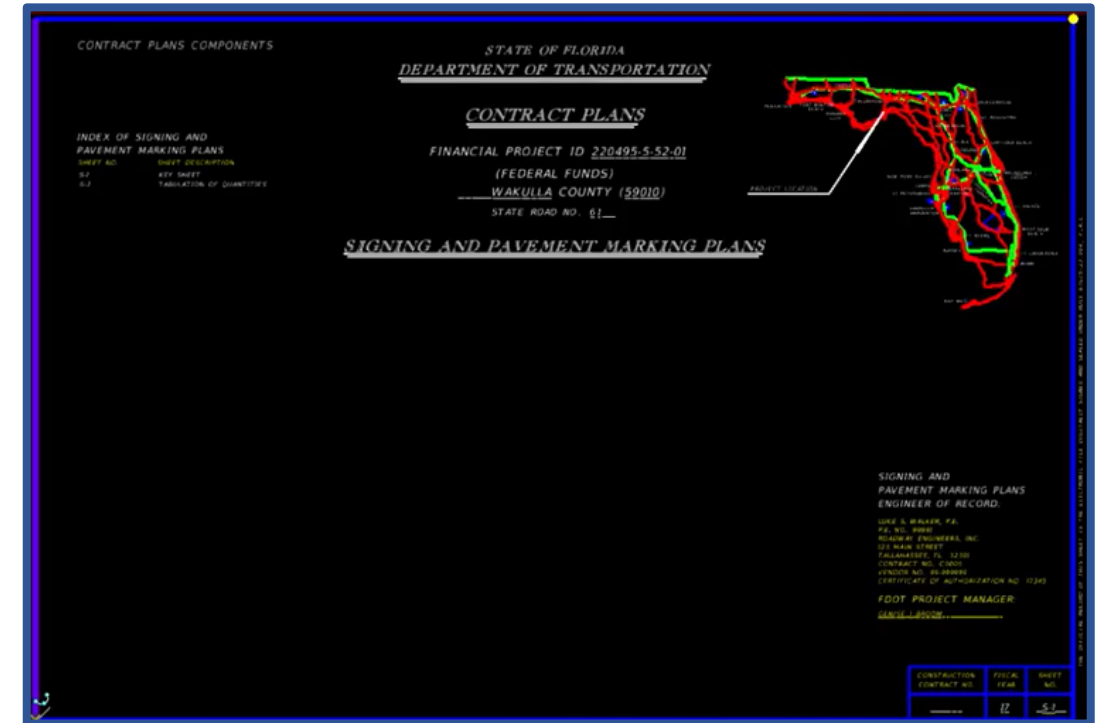
- 1. General Requirements
  - 2. Loads and Load Factors
  - 3. Substructure and Retaining, Noise and Perimeter Walls
  - 4. Superstructure- Concrete
  - 5. Superstructure-Steel
  - 6. Superstructure Components
  - 7. Widening and Rehabilitation
  - 8. Moveable Bridges
  - 9. BDR Cost Estimating
  - 10. Pedestrian Bridges
  - 11. Temporary Works
- Cross Reference between AASHTO LRFD and SDG

**Table I.3-1 Cross Reference between AASHTO LRFD & SDG**

SECTION NO.		DESCRIPTION
LRFD	SDG	
5.9.2.3.2b	4.5.4	Principal Tensile Stress Limits (Service)
5.9.3.3	4.3.1.D.6	Pretensioned Beams (When calculating Service Limit State)
5.9.3.4	4.3.1.D.6	Pretensioned Beams (When calculating Service Limit State)
5.10.3	3.6.10	Minimum Reinforcement Spacing
5.10.6	4.2.4	Temperature and Shrinkage Reinforcement
5.10.1	1.4.2	Concrete Cover
5.12.1	4.2	Decks
5.12.9.4	3.5.1	Prestressed Concrete Piles
5.12.9.5.2	3.6.10	Minimum Reinforcement Spacing

# Structures Manual Organization

- Structures Detailing Manual
  - Organized by production drawing component
- FDOT Modifications to the LRFD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (LRFDLTS-1)
  - Chapters are in the same order as the LRFDLTS-1
- Fiber Reinforced Polymer Guidelines
  - Organized by material type



# Structures Manual

- The requirements given in the Structures Manual apply to all projects.
- Not intended to set comprehensive design requirements for complex structure types
  - It is the EOR's responsibility to establish and submit appropriate load combinations and other design requirements to the SDO for approval.
- Not intended to address every possible situation
  - Engineers are expected to use judgement
  - Not a training document
- Special Requirements for Non-conventional Projects are shown in the blue "Modification for Non-Conventional Projects" boxes

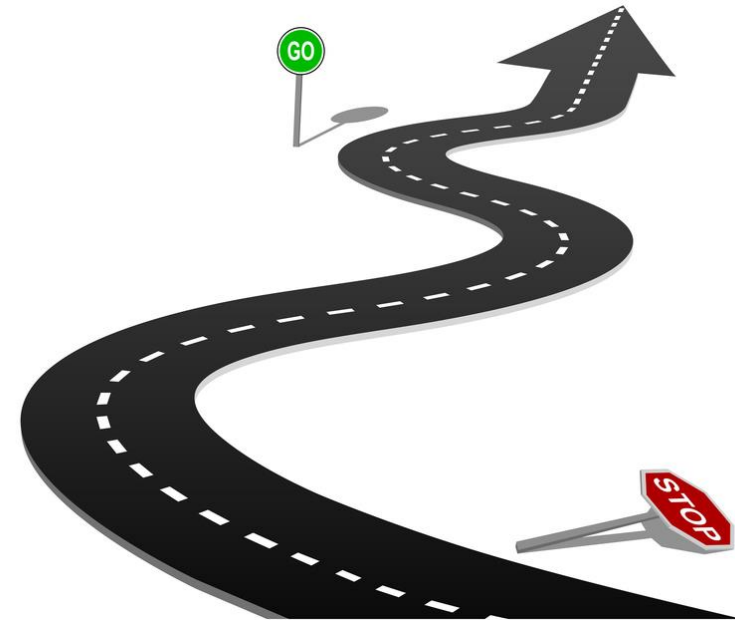
## Modification for Non-Conventional Projects:

Delete **SDG 4.2.2.C** and insert the following:

C. For "Major Widening" and "Minor Widening" (see criteria in SDG Chapter 7) the thickness of C.I.P. bridge decks on beams or girders is 8-inches unless otherwise indicated in RFP.

# Presentation Overview

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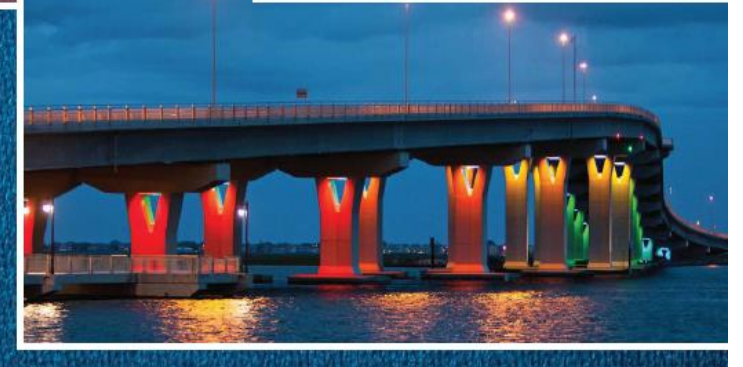
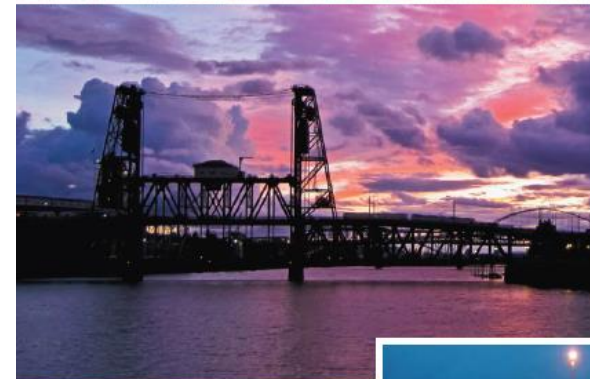


# 2019 Major Changes

## Updated References

- Current references are listed in the Introduction in Section I.6
  - Construction Handbook for Bridge Temporary Works, 2<sup>nd</sup> Edition (2017)
  - Guide Design Specifications for Bridge Temporary Works, 2<sup>nd</sup> Edition (2017)
  - LRFD Bridge Design Specifications, 8<sup>th</sup> Edition
  - 2012 Florida Accessibility Code

## AASHTO LRFD Bridge Design Specifications





# Volume 1- Structures Design Guidelines

## Micropiles

### 3.5.18: Micropiles

- New section detailing the criteria for micropiles
- Use of Micropiles must be authorized by the SSDE

### 3.6.3: Resistance Factors LRFD

**Table 3.5.18-1 Minimum Micropile Size (inches) for Bridges**

		Vehicular Bridges	Pedestrian Bridges
		OD (inches)	OD (inches)
		Micropiles	Micropiles
Pile Bents	Single or Double Row	9.5	7
Pile Footings	4 or more piles per footing	7	5
	3 or fewer piles per footing	9.5	7

**Modification for Non-Conventional Projects:**

Insert the following at the beginning of SDG 3.5.18:

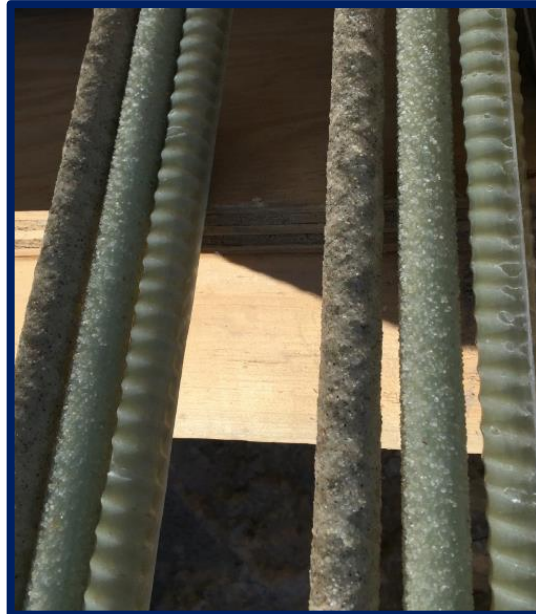
Micropiles are not permitted except where specifically allowed in the RFP.

Limit State	Design Method / Ground Condition	Resistance Factor
Compression Resistance of Single Micropile, $\Phi_{stat}$	Side Resistance (Bond Resistance): <b><i>Soils and Foundations Handbook</i></b> Appendix B	0.55 <sup>1</sup>
	Tip Resistance on Rock O'Neill and Reese (1999)	0.50
	Side Resistance and Tip Resistance Load Test	0.70
Block Failure, $\Phi_{bl}$	Clay	0.60
Uplift Resistance of Single Micropile, $\Phi_{up}$	<b><i>Soils and Foundations Handbook</i></b> Appendix B	0.55 <sup>1</sup>
	Tension Load Test	0.60
Group Uplift Resistance, $\Phi_{ug}$	Sand & Clay	0.50

# Volume 1- Structures Design Guidelines

## 3.12 Retaining Wall Types

- Sheet Pile Walls: Use FRP Reinforcement for all new Bulkheads in extremely aggressive environments





# Volume 1- Structures Design Guidelines

## Post-Tensioning- Minimum Number of Tendons

- For segmental box girders, in addition to the requirements of SDG 4.5.2, provide future post-tensioning tendons per LRFD 5.12.5.3.9c
  - Provisions shall be made for access, attachments, pass-through openings and deviation block attachments to permit future addition of corrosion-protected unbonded external tendons
- Expansion Joint Diaphragms- Vertically post-tensioned on the tension face- (4) bars per face, per cell
- Segment- Vertically post-tensioned (required when principal stress limits are exceeded)- (2) bars per web

# Volume 1- Structures Design Guidelines

## 4.5.5 Expansion Joints

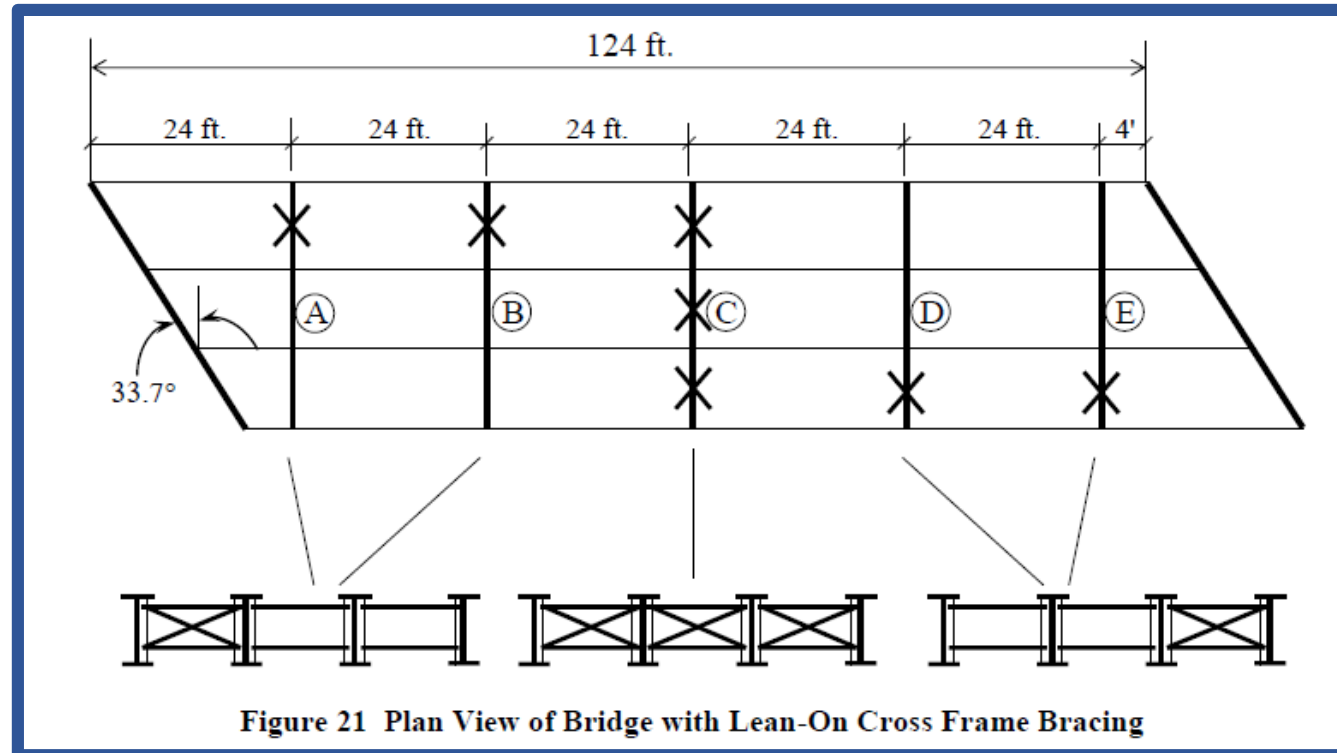
Design and detail expansion joints to be set at time of construction for the following conditions:

- For box girders compute the creep and shrinkage from the time the expansion joints are installed through day 10,000 (previously 4,000).
- Size expansion devices and set to remain in compression through the full range of design temperature from their initial installation until 10,000 days (previously 4,000).
- The structure is considered to be permanent at 10,000 days.

# Volume 1- Structures Design Guidelines

## 5.7 Diaphragms and Cross Frames for I-Girders

- Lean-on bracing systems are not permitted
  - Use of struts to transfer forces to one or two cross frames at each brace location



# Volume 1- Structures Design Guidelines

## 6.10 Erection Scheme and Beam/Girder Stability

- C. For bridges requiring special step-by-step construction methods to support or stabilize the bridge during construction (e.g., steel girder, spliced I-girder or U-girder, C.I.P. or precast segmental, C.I.P. box girder bridges on falsework, and bridges with non-integral/non-framed straddle pier caps) include in the plans a workable erection scheme that addresses all major phases of erection. Investigate superstructure stability at all major phases of construction consistent with the erection scheme shown in the plans. Show required temporary support locations and associated loads assumed in design. Coordinate temporary support locations with the Temporary Traffic Control Plans. See *FDM* 240-243. Show maximum allowable vertical displacements of the temporary supports in the plans as required for fit up, alignment, and stability, or where excessive settlements would affect stresses of the permanent structure.

# Volume 1- Structures Design Guidelines

## Chapter 9-BDR Bridge Cost Estimating

- Modifications to cost information for reinforcing, walls, bearings, Florida Slab Beams, concrete, bridge deck grooving
- Most Significant change: Addition of cost information for GFRP

### Substructure

#### 2. GFRP Reinforcing Bars, FDOT Standard Specifications 932-3; cost per linear foot

#3	#4	#5	#6	#7	#8	#9	#10	#11
\$0.60	\$0.95	\$1.15	\$1.40	\$1.80	\$2.25	\$3.15	\$3.75	\$4.45

### Superstructure

#### 2. GFRP Reinforcing Bars, FDOT Standard Specifications 932-3; cost per linear foot Post-tensioning Steel; cost per pound.

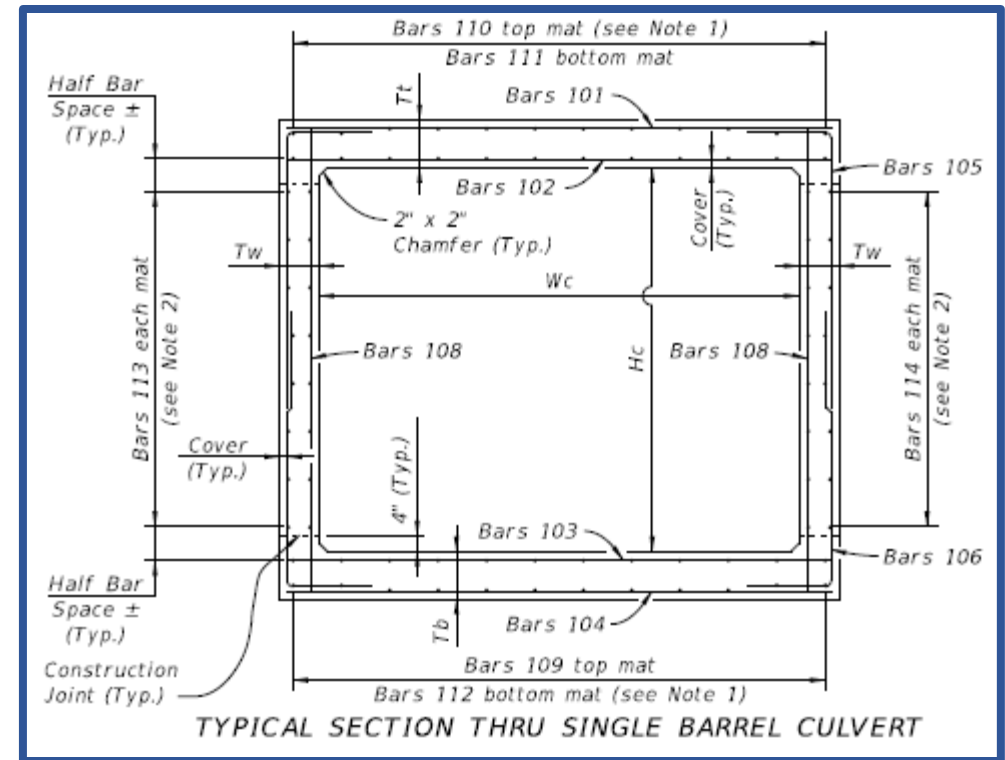
#3	#4	#5	#6	#7	#8
\$0.60	\$0.95	\$1.15	\$1.40	\$1.80	\$2.25



# Volume 2- Structures Detailing Manual

## 3.1 Structures Sheet Numbers

- Concrete box culvert and three sided culvert plans are required to be included with the Project Plans.
- Plan sheets are numbered with the “B” prefix
- Useful for the Maintenance Department



# Volume 2- Structures Detailing Manual

## 5.3 Typical Steel General Notes

- The steel superstructure shall be detailed for the steel dead load fit.
- AASHTO LRFD 6.7.2 suggests that the detailed fit condition is to be shown on the plans.
- For Statewide consistency, the Department reviewed different fit conditions and selected steel dead load fit.





# Volume 2- Structures Detailing Manual

## 5.4 Typical Post-Tensioned Concrete General Notes

- New section: The Designer must specify the properties of the post-tensioning strand and bar on the contract plans.

### 5.4 TYPICAL POST-TENSIONED CONCRETE GENERAL NOTES (Rev. 01/19)

Include the following additional general notes when post-tensioned concrete is to be used in the project. Place these notes on or after the General Notes sheet and modify for project-specific requirements:

- A. **Strand:** All strands shall be X" Ø and conform to the requirements of ASTM A416, Grade 270 for low relaxation strands.

Prestressing parameters:

Apparent modulus of elasticity 28,500 ksi

Maximum jacking stress at anchorage  $0.8 F_{pu}$

Maximum strand stress at anchorage immediately after anchorage  $0.70 F_{pu}$

Maximum strand stress at internal location immediately after anchorage  $0.74 F_{pu}$

Anchor set X"

Friction coefficient ( $\mu$ ):

Internal tendons X.XX

Deviators for external tendons X.XX

Wobble coefficient (k):

Internal tendons X.XXXX/ft.

- B. **Bars:** All bars shall conform to ASTM A722, Grade 150.

Prestressing parameters:

Modulus of elasticity 30,000 ksi

Maximum jacking stress  $0.9 F_{py}$

Maximum anchorage stress  $0.70 F_{pu}$

Anchor set X"

Friction coefficient ( $\mu$ ): X.XX

Wobble coefficient (k): X.XXXX/ft.

- C. Local zone anchorage reinforcement is required at the ends of all post-tensioning tendons, unless noted otherwise. The contractor shall adjust reinforcing as necessary to clear the local zone reinforcement.

- D. Post-tensioning anchorage details, protection, flexible filler, and grouting requirements shall be in accordance with Standard Plans Indices 462-001, 462-002 and 462-003.

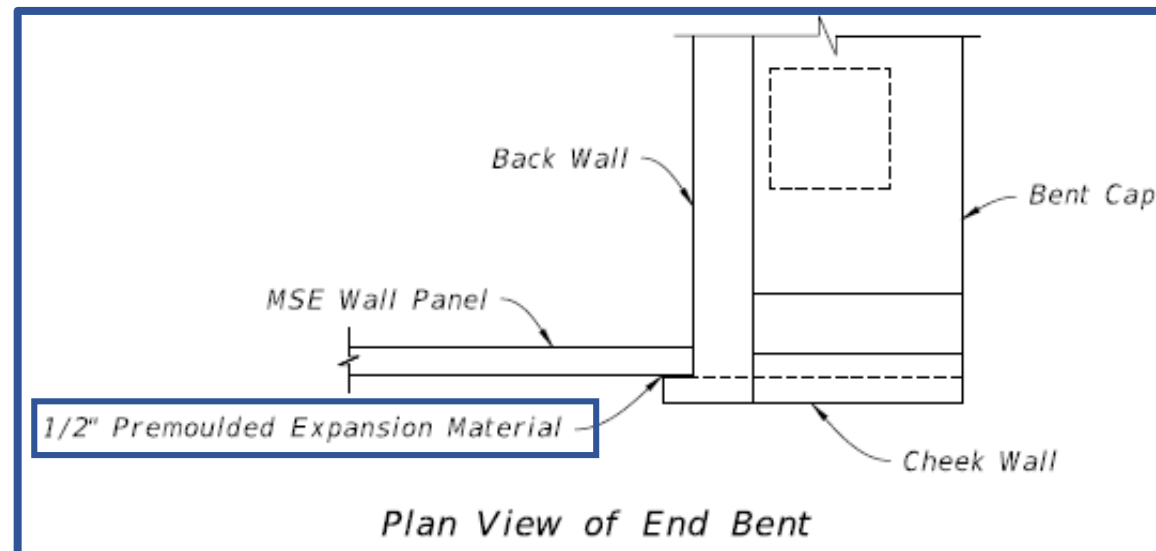
- E. All duct or pipe diameter sizes given in these plans are inside diameter.

# Volume 2- Structures Detailing Manual

## 12.3 Drawings and Details- End Bent

- Requirement to add premoulded expansion material in between the MSE wall panel and the cheek wall
  - End Bent is on a pile foundation and does not settle
  - The MSE wall will settle
  - Expansion material provides a smooth surface for the MSE wall panels to slide against

**Figure 12.3-1 Expansion Material Detail**

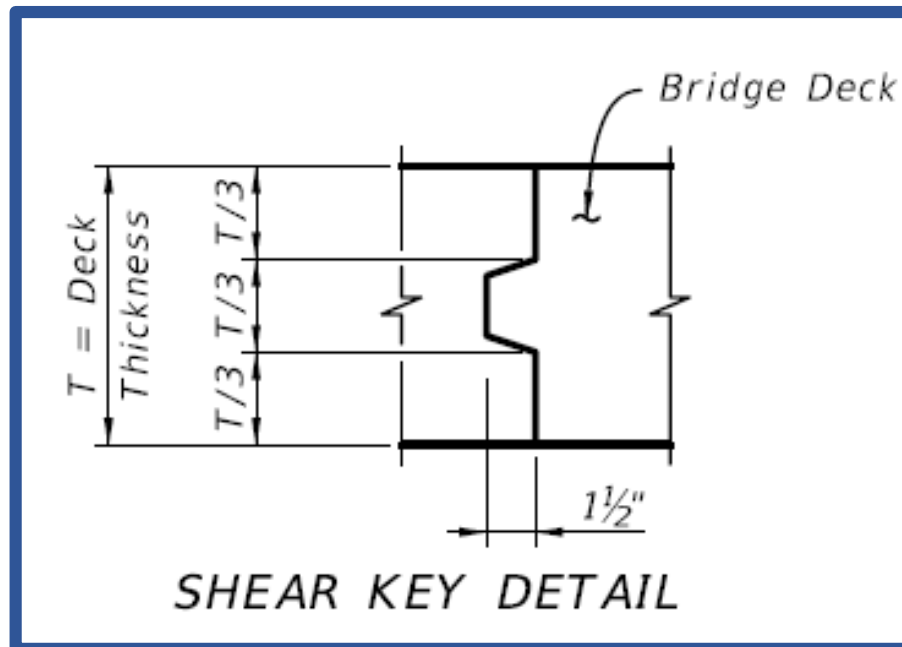




# Volume 2- Structures Detailing Manual

## Deck Casting Sequence in Figures 15.5-4 and 15.5-5

- Shear key details have been removed
- Shear key was not needed
- The shear key detail complicated construction



# Volume 2- Structures Detailing Manual

## 16.9 Girder Camber Diagrams

- Change from “Dead load deflection” to “Dead load camber”
- Change made to alleviate confusion

### 16.9 GIRDER CAMBER DIAGRAMS (Rev. 01/19)

Girder Camber sheets are required for all steel superstructures. Provide sufficient geometric reference for girder fabrication and deck placement on these sheets. For examples illustrating the content and format of completed Camber Diagram sheets, see the *Structures Detailing Manual Examples*. Typically, camber ordinates are shown in tabular format. Show **dead load camber** along the centerline of the box for box girders, and camber along the centerline of the girder for I-girders. At a minimum, include the following on the Girder Camber sheet (see Figure 16.9-1 and Figure 16.9-2):

A. Line diagram showing a graphical representation of the following:

1. Total camber including vertical curve camber\*.
2. Span number and length.
3. Horizontal increment ordinate locations.
4. Label centerline bearing.

B. Tabulated camber ordinates for the following:

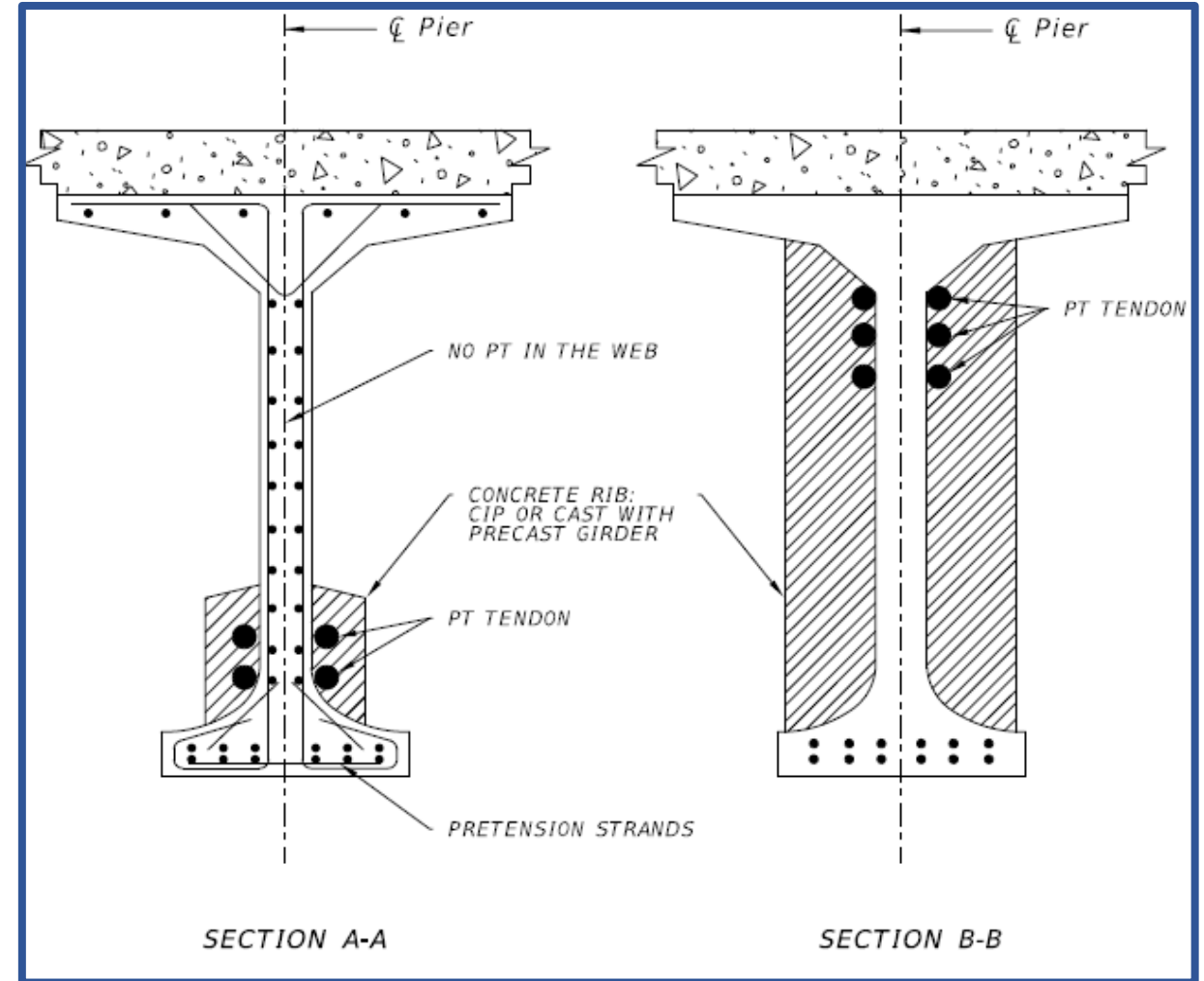
1. Steel dead load **camber**.
2. Non-Composite dead load **camber** (deck, SIP forms, build-up, haunch).
3. Composite dead load **camber** (railings, utilities, noise walls, wearing surface, traffic separators).
4. Total dead load **camber**.
5. Vertical curve\*. If not applicable, omit this row from the table.
6. Total required camber including vertical curve camber\*.

\* vertical curve ordinate not included for box girders.

# Volume 2- Structures Detailing Manual

## Figures 23.7-5 and 23.7-6 Post-Tensioned Spliced Girder Details-Tendons External to the Web

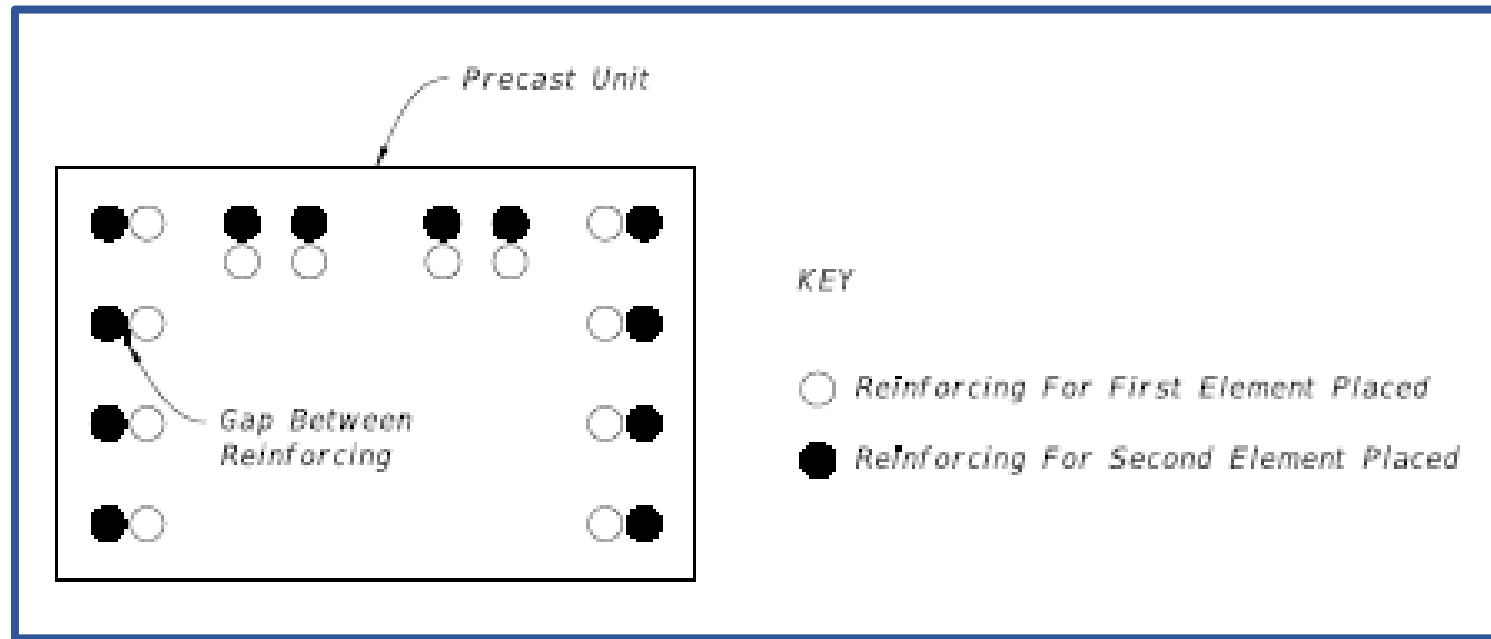
- Allows the girder's entire web to be used for shear
- Concrete blister only along the tendon path.
  - Specifications currently do not allow for exposed external tendons (except for repair procedures)



# Volume 2- Structures Detailing Manual

- **Figure 25.3.3-5 Precast Element Lap Bar Orientation**

- New figure to show the orientation of reinforcing for the precast elements based on placement sequence of the element.





# Volume 3- FDOT Modifications to LRFDLTS-1

- Design life is stated
  - Based on the ASD-LTS Specifications
  - Design life for:
    - Ground mounted sign supports-10 years
    - All other LTS structures- 50 years
- Criteria added for micropiles supporting sign supports
  - Structures designed for a 300-year mean recurrence interval basic wind speed
    - 5" Outer diameter
  - Structures designed for a 700-year mean recurrence interval basic wind speed
    - 7" outer diameter

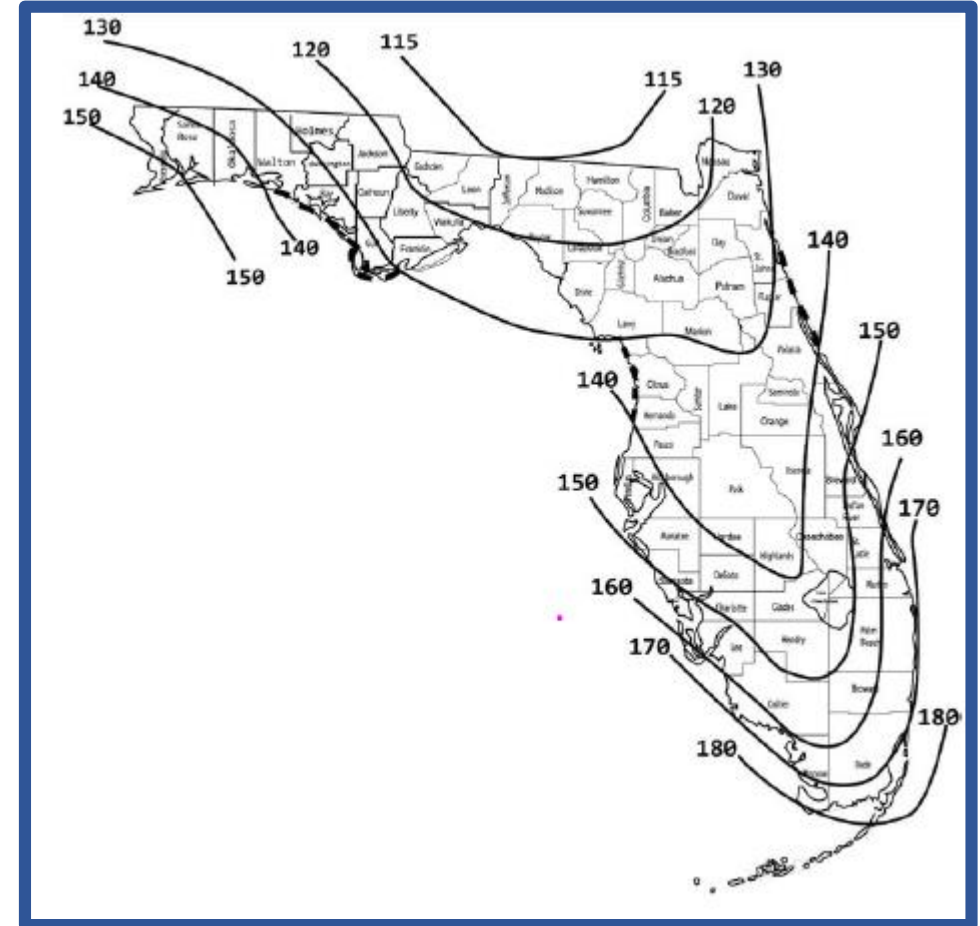


**FDOT MODIFICATIONS TO LRFD  
SPECIFICATIONS FOR STRUCTURAL SUPPORTS  
FOR HIGHWAY SIGNS, LUMINAIRES  
AND TRAFFIC SIGNALS (LRFDLTS-1)**

**STRUCTURES MANUAL  
VOLUME 3  
JANUARY 2019**

# Volume 3- FDOT Modifications to LRFDLTS-1

- New procedure for evaluating wind loads
  - All evaluations are to use the current LRFD Specifications
  - Use of a wind speed map
- Use of outdated specifications is not allowed
  - Information in the LTS-6 dated back to 1994
  - New Specifications based on the latest research
  - Program maintenance
- Moving Forward
  - Criteria reorganization



# Volume 4: Fiber Reinforced Polymer Guidelines (FRPG)

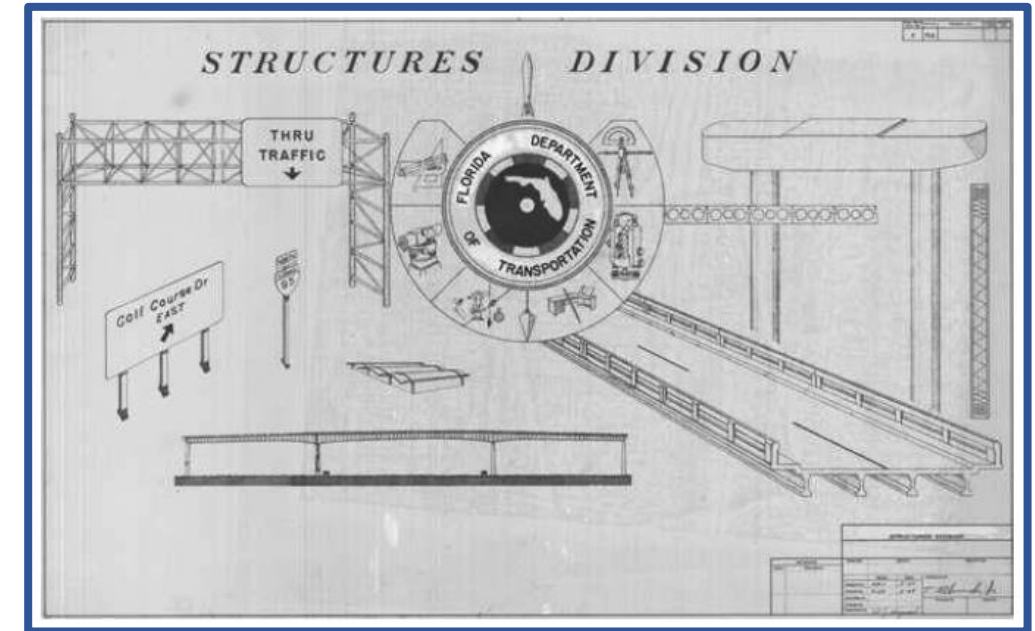
## 2.1 Permitted Use

Permitted use of Glass Fiber Reinforced Polymer (GFRP) and Carbon Fiber Reinforced Polymer (CFRP) Reinforcing Bars expanded to include the following:

- MSE Wall Panels and Copings

The following may be used with approval from the SSDE:

- Pier Columns and Footings in direct contact with water
- Traffic Railings
- Bulkhead Copings with Traffic Railings



# Volume 4: Fiber Reinforced Polymer Guidelines (FRPG)

## 2.3 Additional Guidance

- Modifications to the cover requirements for substructure components

Substructure Components	
External surfaces cast against earth	3
Exterior formed surfaces, columns, and tops of footings	2
Exterior formed surfaces of Approach Slabs other than the bottom surface	2
Beam/Girder Pedestals    No. 5 bars and smaller	1.5
Beam/Girder Pedestals    No 6 bar thru no. 10 bars	2
Prestressed Piles	3 <sup>4</sup>
Cast-in-Place Cantilever Retaining Walls and Gravity Walls	2
MSE Walls	1.5
Box and Three-sided Culverts	2
Bulkheads and Sheet Pile Wall Caps	2
Sheet Piles	Front and Back Faces - 3 <sup>5</sup> Sides - 2

# Volume 4: Fiber Reinforced Polymer Guidelines (FRPG)

The use of externally bonded systems for strengthening or repair of piers subjected to vehicular impact loads is prohibited.

# Volume 4: Fiber Reinforced Polymer Guidelines (FRPG)

## 5.1 Thermoset Pultruded Structural Shapes- Usage and Considerations

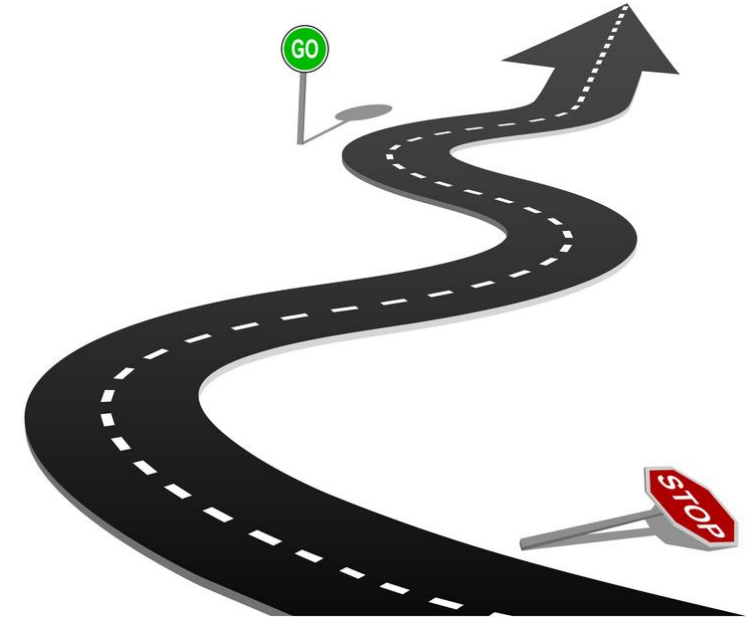
- The Department will consider the use for tubes used for concrete filled bearing piles

## 7.1 Thermoplastic Structural Shapes- Usage and Considerations

- The use of the following structural shapes are permitted without prior approval from the SSDE:
  - Bridge fender systems
  - Decking and handrails of pedestrian bridges, boardwalks and fishing piers

# Presentation Overview

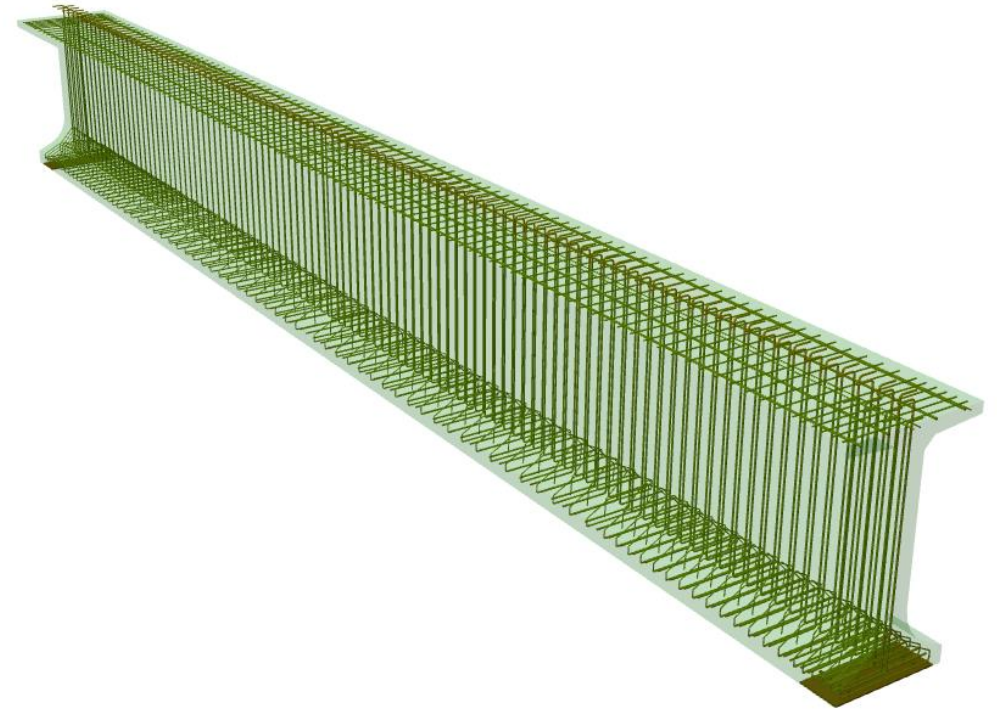
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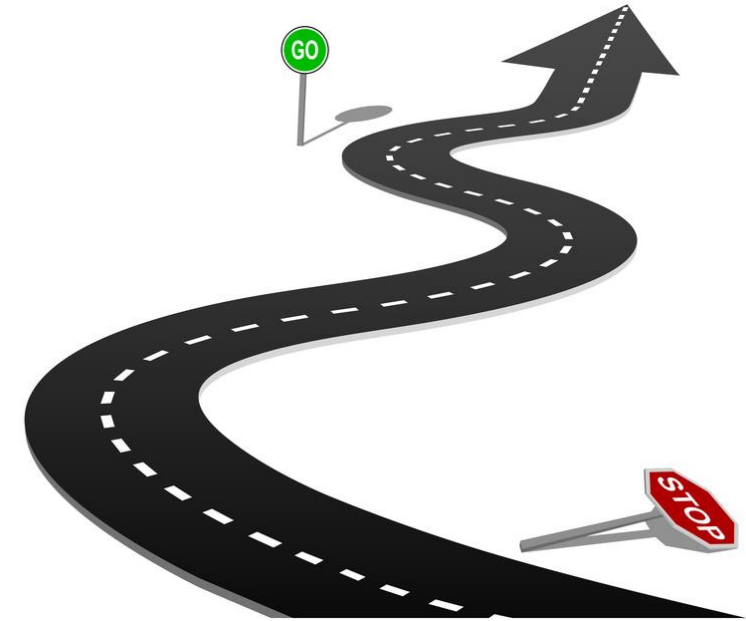
# 2020 Anticipated Changes

- Continued modification to criteria
  - July 17, 2019 is the deadline to submit modification requests
- Expanded commentary
- Revision History will include the reason for the revision
- Structures Detailing Manual will include 3-Dimension Drawings



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# Manual Magic: Tips and Tricks



FLORIDA DEPARTMENT OF TRANSPORTATION



Image courtesy of WSP USA

## STRUCTURES MANUAL

**Volume 1** - Structures Design Guidelines

**Volume 2** - Structures Detailing Manual

**Volume 3** - FDOT Modifications to LRFDLTS-1

**Volume 4** - Fiber Reinforced Polymer Guidelines

# Installed Manual Navigation

- Manual navigation home button
  - Link to manual introduction in the bottom left.

Struc

Topic No. 625-020-018

January 2019

FLORIDA DEPARTMENT OF TRANSPORTATION



Image courtesy of WSP USA

## STRUCTURES MANUAL

**Volume 1** - Structures Design Guidelines

**Volume 2** - Structures Detailing Manual

**Volume 3** - FDOT Modifications to LRFDLTS-1

**Volume 4** - Fiber Reinforced Polymer Guidelines

[Frequently Asked Questions](#)

[2019 Revision History](#)

[Archived Structures Manuals](#)

[Additional Links](#)



# Installed Manual Navigation cont.

- Navigation to and from the revision history

Structures Design Guidelines  
1 - General Requirements

Topic No. 625-020-018  
January 2019

## 1.3.2 Classification Criteria (Rev. 01/19)

- A. Bridge substructure and superstructure environments will be classified as Slightly Aggressive, Moderately Aggressive, or Extremely Aggressive environments according to the following criteria and as shown in [Figure 1.3.3-1](#). The superstructure is defined as all components from the bearings upward. Conversely, every element below the bearings is classified as substructure.
- B. Marine Structures: Structures located over or within 2500 feet of a body of water containing chloride above 2000 ppm are considered to be marine structures and all other structures will be considered non-marine structures. Only chloride test results are required to determine if a structure is classified as marine. Results of chloride tests for most locations are available on SharePoint at the following address:  
<http://smosp.dot.state.fl.us/sites/materials-str/districts/Lists/Bridge%20Environmental%20Database/Default%20View.aspx>

*NOTE: Access to this database is currently limited to FDOT personnel only. Consultants needing information from this database should contact the appropriate district office for assistance.*

Classify superstructure and substructure as follows:

1. For structures over or within 2,500 feet of a body of water with chloride concentrations in excess of 6000 ppm, both superstructure and substructure will be classified as extremely aggressive.
2. For structures over any water with chloride concentrations of 2000 to 6000 ppm, the

# Installed Manual Navigation cont.

- Table of Contents Navigation
  - Jump to Links

## 1.11.3 Design Values (Rev. 01/19)

Use the following values for the design of post-tensioned members.

### A. Concrete strengths ( $f_c$ ):

Precast components	5.5 ksi min., 10.0 ksi max.
Closure pours and joints	5.5 ksi min., 6.5 ksi max.
Cast-in-place components	5.0 ksi min., 8.5 ksi max.

See [SDG 1.4.3](#) for additional requirements.

### B. Post-Tensioning Steel:

Strand	ASTM A416, Grade 270, low relaxation, 0.6 inch diameter
Parallel wires	ASTM A421, Grade 240
Bars	ASTM A722, Grade 150, Type II

### C. Anchor set:

Strand	3/8-inch
Parallel wires	1/2-inch
Bars	1/16-inch

### D. Wobble coefficient ( $K$ ) and Coefficient of friction ( $\mu$ ):

Type of Tendon	Type of Duct	Tendon Location	K	$\mu$
Wire or Strand	Corrugated polypropylene duct	Internal	0.0003	0.14
	Smooth polyethylene duct	Internal	0.0002	0.14
	Smooth polyethylene duct	External	0.0	0.14
Bar	Corrugated polypropylene duct	Internal	0.0003	0.30
	Smooth polyethylene duct	Internal	0.0002	0.30
	Smooth polyethylene duct	External	0.0	0.30

## 1.11.4 Ducts

- A. Design and detail using smooth wall polyethylene (PE) duct and associated couplers that meet the requirements of [Specifications](#) Section 960 for all external tendons, and for internal tendons with flexible filler.
- B. Design and detail using corrugated polypropylene (PP) duct and associated couplers that meet the requirements of [Specifications](#) Section 960 for grouted internal tendons.



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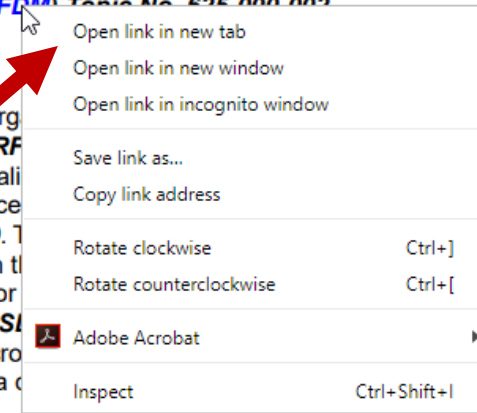
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- B. The **SDG** incorporates technical design criteria and includes additions, deletions, or modifications to the requirements of the **AASHTO LRFD Bridge Design Specifications (LRFD)**.
- C. This volume of the **Structures Manual** provides engineering standards, criteria, and guidelines for developing and designing bridges and retaining walls for which the Structures Design Office (SDO) and District Structures Design Offices (DSDO) have overall responsibility.
- D. Information on miscellaneous roadway appurtenances as well as general administrative, geometric, shop drawing, and plans processing may be found in the **FDOT Design Manual (FDM) Topic No. 625.000.002**.

## I.2 FORMAT

- A. The **SDG** chapters are organized by "material" as is the **LRFD**. **SDG** do not necessarily align as **LRFD**. **LRFD** reference criteria with that of **LRFD**. The body of the text, or in the [8.2.1]. See [Table I.3-1](#) for a cross reference of the **SDG** **Specifications**. These cross references are not necessarily a
- B. Chapters 1 through 10 of the **SDG** are written in the active voice to Structural Designers, Professional Engineers, Engineers of Record, Structural Engineers, and Geotechnical Engineers working on either Conventional or Non-Conventional projects for the Florida Department of Transportation.
- C. Chapter 11 of the **SDG** is written in the active voice to Specialty Engineers, Contractor's Engineers of Record and Prequalified Specialty Engineers working on either Conventional or Non-Conventional projects for the Florida Department of Transportation.



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## 1.11.3 Design Values (Rev. 01/19)

Use the following values for the design of post-tensioned members.

### A. Concrete strengths ( $f_c$ ):

Precast components	5.5 ksi min., 10.0 ksi max.
Closure pours and joints	5.5 ksi min., 6.5 ksi max.
Cast-in-place components	5.0 ksi min., 8.5 ksi max.

See [SDG 1.4.3](#) for additional requirements.

### B. Post-Tensioning Steel:

Strand	ASTM A416, Grade 270, low relaxation, 0.6 inch diameter
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# Online Manual Navigation cont.

- Navigation to and from the revision history

Structures Design Guidelines  
1 - General Requirements

Topic No. 625-020-018  
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## 1.3.2 Classification Criteria (Rev. 01/19)

- A. Bridge substructure and superstructure environments will be classified as Slightly Aggressive, Moderately Aggressive, or Extremely Aggressive environments according to the following criteria and as shown in [Figure 1.3.3-1](#). The superstructure is defined as all components from the bearings upward. Conversely, every element below the bearings is classified as substructure.
- B. Marine Structures: Structures located over or within 2500 feet of a body of water containing chloride above 2000 ppm are considered to be marine structures and all other structures will be considered non-marine structures. Only chloride test results are required to determine if a structure is classified as marine. Results of chloride tests for most locations are available on SharePoint at the following address:  
<http://smosp.dot.state.fl.us/sites/materials-str/districts/Lists/Bridge%20Environmental%20Database/Default%20View.aspx>

*NOTE: Access to this database is currently limited to FDOT personnel only. Consultants needing information from this database should contact the appropriate district office for assistance.*

Classify superstructure and substructure as follows:

1. For structures over or within 2,500 feet of a body of water with chloride concentrations in excess of 6000 ppm, both superstructure and substructure will be classified as extremely aggressive.
2. For structures over any water with chloride concentrations of 2000 to 6000 ppm, the

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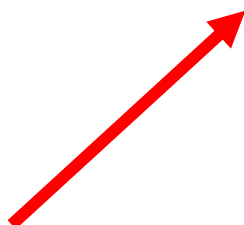
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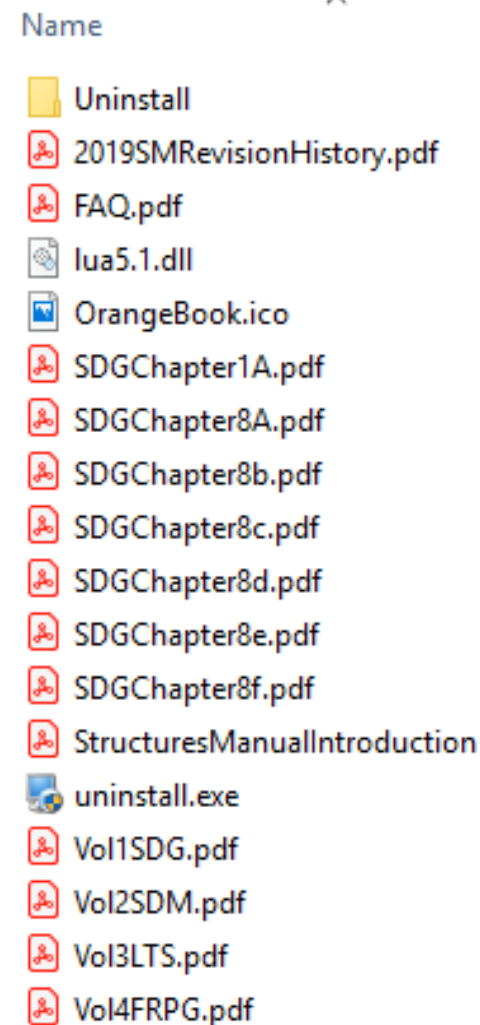
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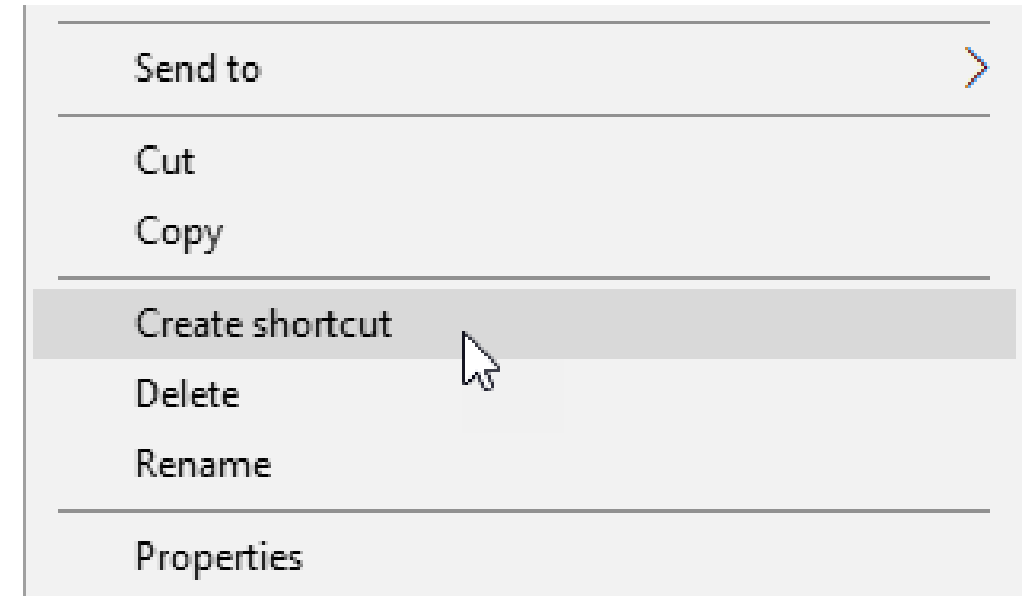
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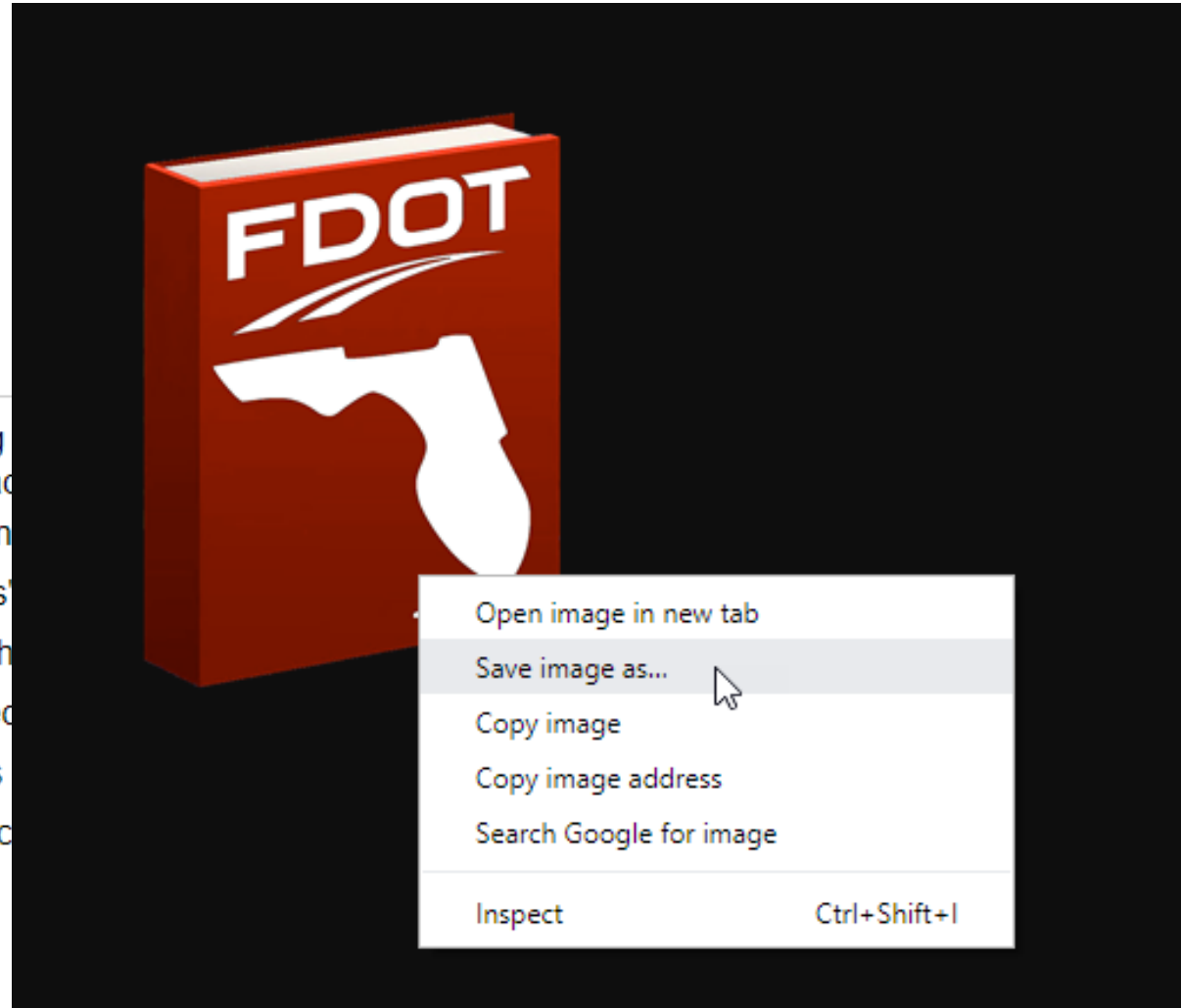
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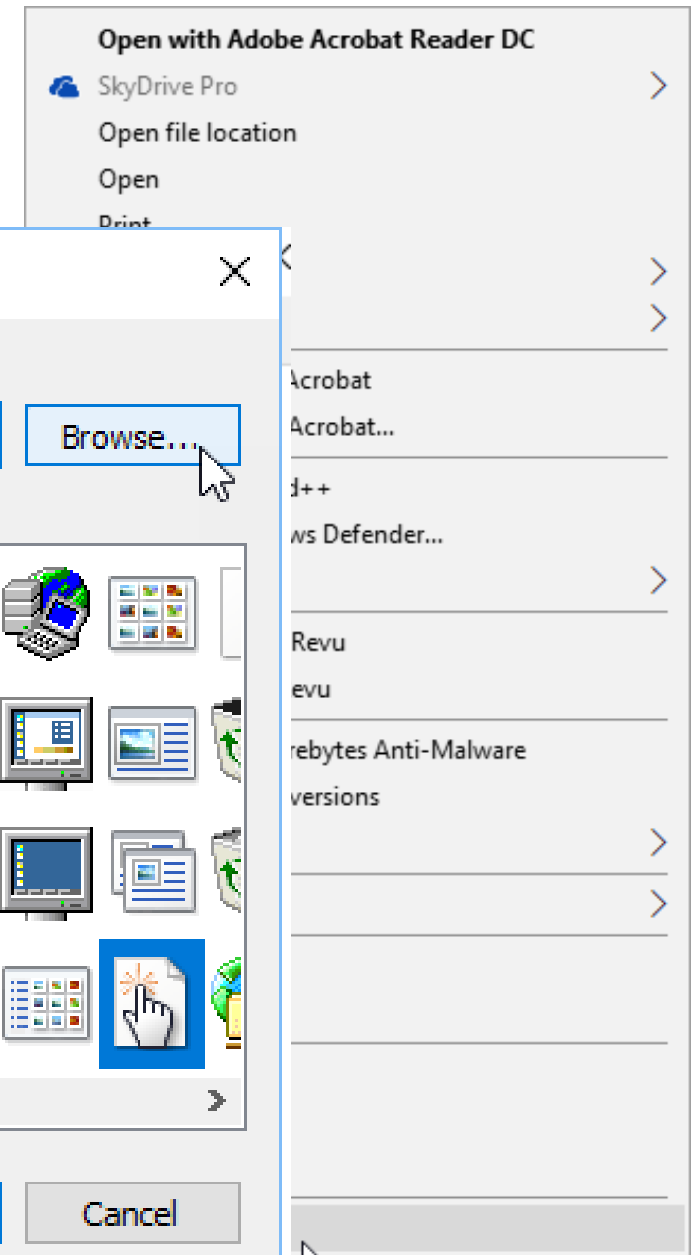
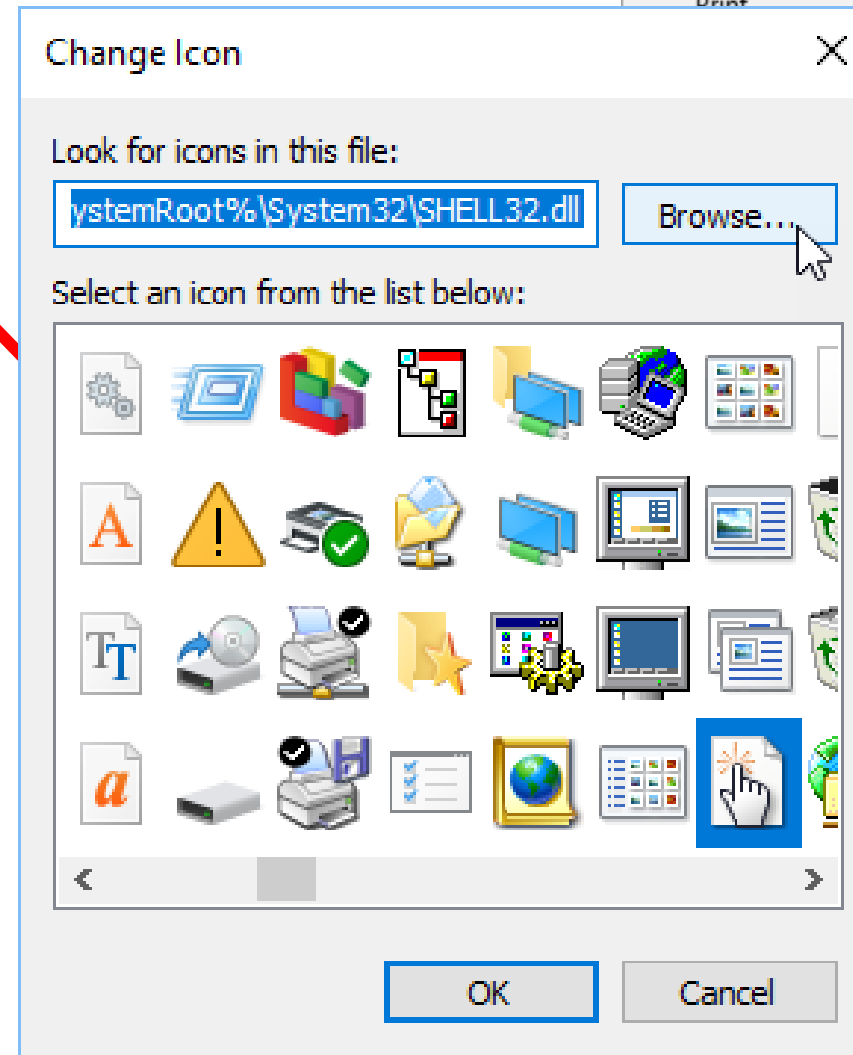
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