

2018 FDOT-FRP Industry 2nd Winter Workshop

February 9, 2018

Orlando, FL



Part 1-Reports



FDOT-FRP Industry 2nd Winter Workshop (Feb 9th, Orlando)

Part 1 - Reports

- a. FDOT FRP-RC implementation status *(Steve Nolan)*
- b. FDOT Materials Office update on durability focused research projects
- c. Update on AASHTO LRFD Guide Specification for GFRP-RC
- d. Canadian Standards Association update
- e. ACMA FRP-RMC update
- f. Action Item Status from last year



2018 FDOT-FRP Industry 2nd Winter Workshop

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FDOT FRP-RC *implementation status*

Steve Nolan (FDOT-SDO) steven.nolan@dot.state.fl.us 

FDOT FRP-RC implementation status

1. Design Guidance
2. Construction & Materials Specs
3. Developmental & Standard Plans
4. Designer Tools
5. Construction Projects
6. New Applications
7. Other Research Projects

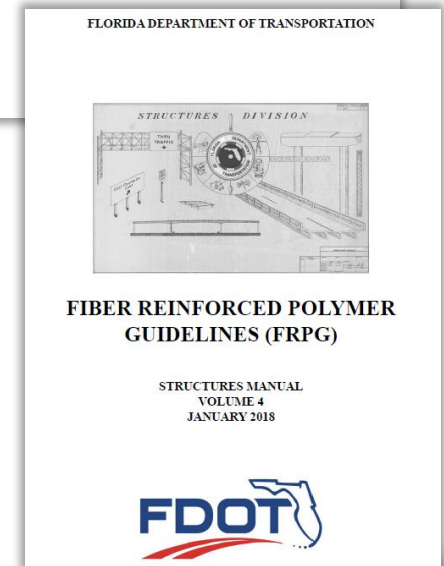
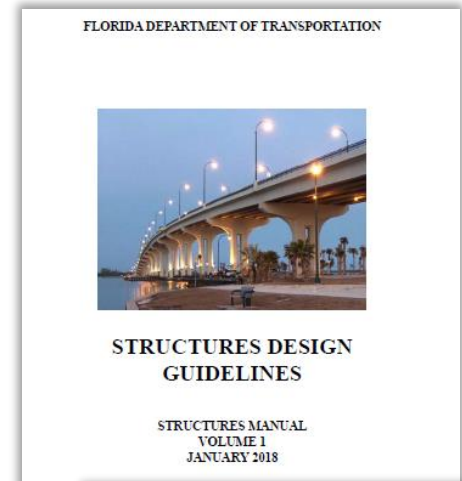


FDOT FRP-RC implementation status

1. Design Guidance:
 - i. **SDG** – Added C-R Sheet Pile usage criteria
 - ii. **FRPG** – No significant changes
 - iii. **IDDS/SPI** – No significant changes

<http://www.fdot.gov/structures/StructuresManual/CurrentRelease/StructuresManual.shtm>

<http://www.fdot.gov/design/standardplans/current/>



FDOT FRP-RC implementation status

1. Design Guidance
2. Construction & Materials Specs

i. Division II - Structures:

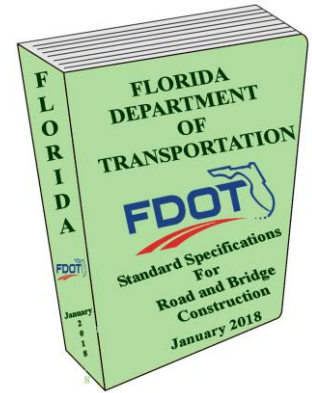
400, 407, 410, 415, & 450

ii. Division III - Materials:

932-3 & 933

- Changed strength from stress to strength;
- Now allow non-ISO certified labs for qualification and verification testing (SMO approved).

932-3.4.1 Sampling: The Engineer will select a minimum of six straight bars with minimum lengths of 7 feet each and a minimum of five bent bars from each shipment, representing a random production LOTs, per diameter bar size of FRP reinforcing for testing in accordance with Table 3-4. Testing shall be conducted, at the Contractor's expense, by a Department approved ISO 17025 accredited independent laboratory.



FDOT FRP-RC implementation status

1. Design Guidance
2. Construction & Materials Specs
3. Developmental & Standard Plans
 - i. D6011c – Gravity Wall (GFRP-RC)
 - ii. D22420 – 32” F-Shape Traffic Railing (GFRP-RC)
 - iii. D22900 – Approach Slab (GFRP-RC)
 - iv. D296 – Three-sided culvert (GFRP-RC) (*considering development*)
 - v. D20700 – Precast Bent Cap (*in development*)



FDOT FRP-RC implementation status

1. Design Guidance
2. Construction & Materials Specs
3. Developmental & Standard Plans
4. Designer Tools:
 - i. FDOT Prestressed Beam Program - *v5.2beta*
 - ii. Mathcad GFRP-RC Design Worksheets – *Flat Slab, Drainage Structures, Noisewall Panels*
 - iii. **Design Aids** in Instructions (*IDDS, SPI*)...

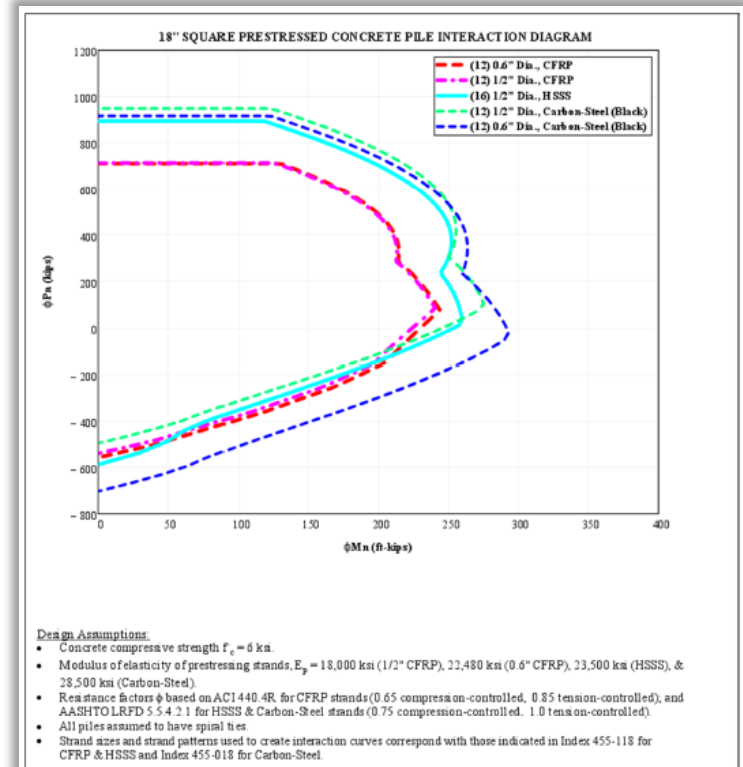
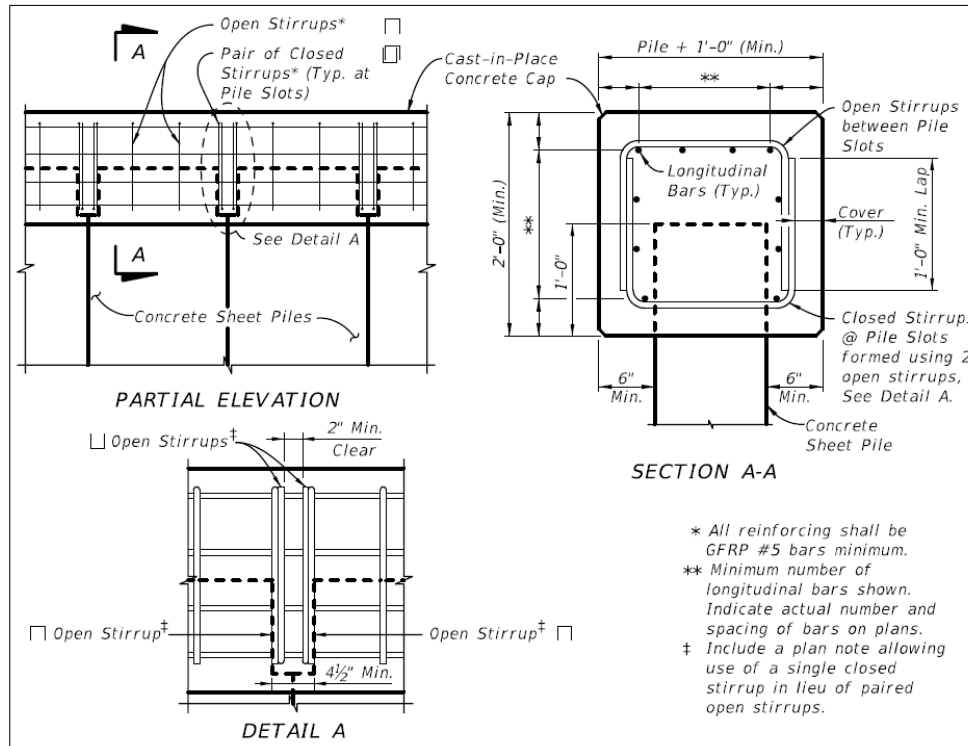


FDOT FRP-RC implementation status

4. Designer Tools:

iii. Design Aids in Instructions (IDDS, SPI)

Figure 1 Typical Cap Details



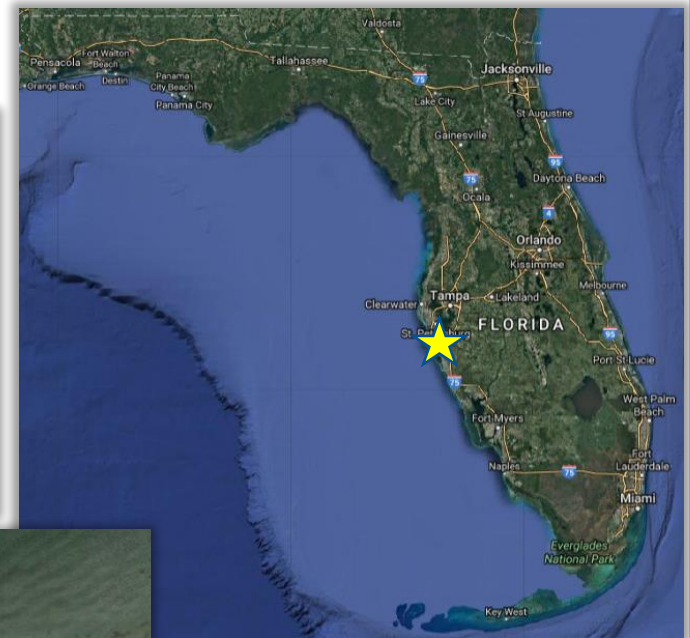
FDOT FRP-RC implementation status

5. Design & Active Construction Projects:
 - i. Skyway Rest Area Rehab & Seawall (D1 - 2017)
 - ii. Cedar Key: C-Street (D2 - 2018)
 - iii. St Joe Bay Inlet (D3 - 2019)
 - iv. Pensacola Beach Ped. Tunnels (D3 – 2018 PD&E)
 - v. A1A Flagler Beach Revetment (D5 – 2018)
 - vi. Barracuda Blvd (D5 – 2020 production)
 - vii. Bakers Haulover Cut (D6 - 2016)
 - viii. Halls River Bridge (D7 - 2016)
 - ix. 40th Ave NE Bridge (City of St. Pete - 2019 production)



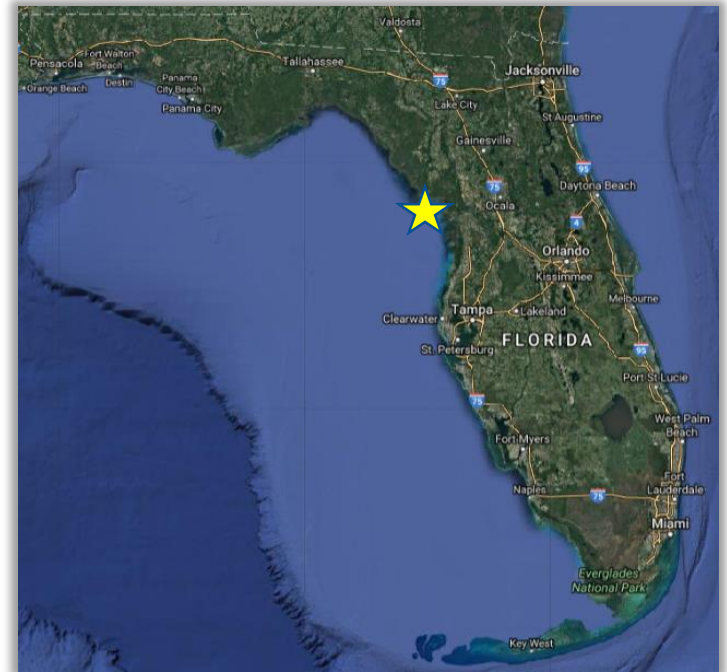
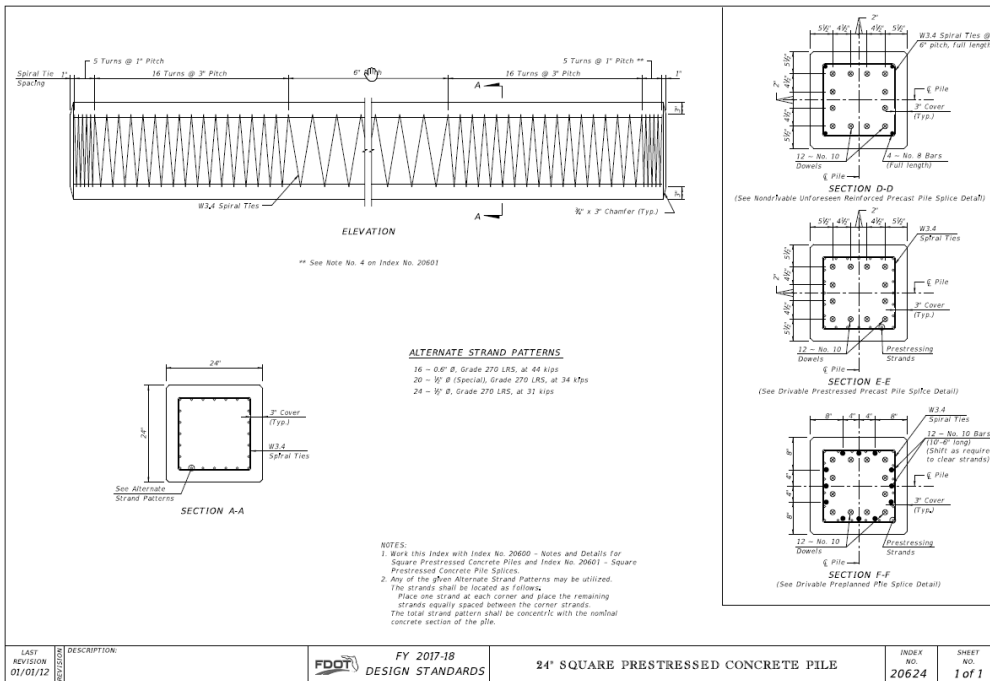
FDOT FRP-RC implementation status

D1 Project: Skyway South Rest Area Seawall Rehab.



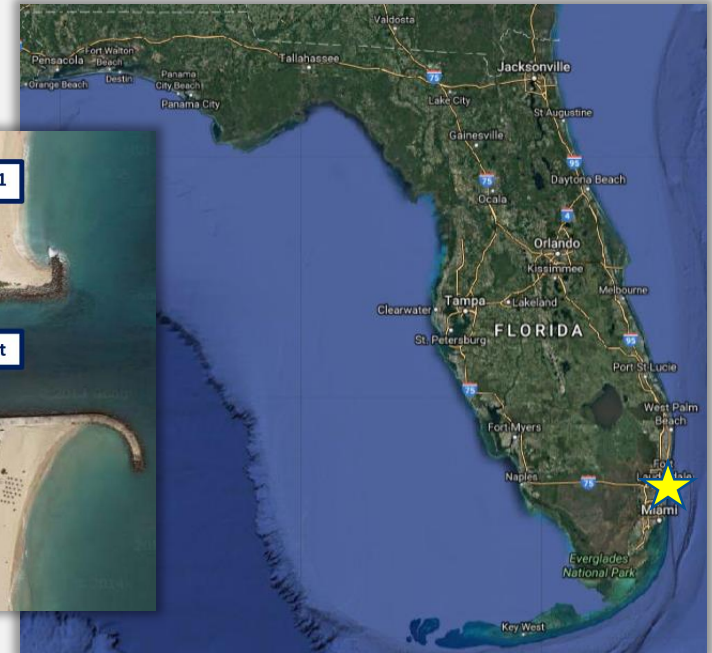
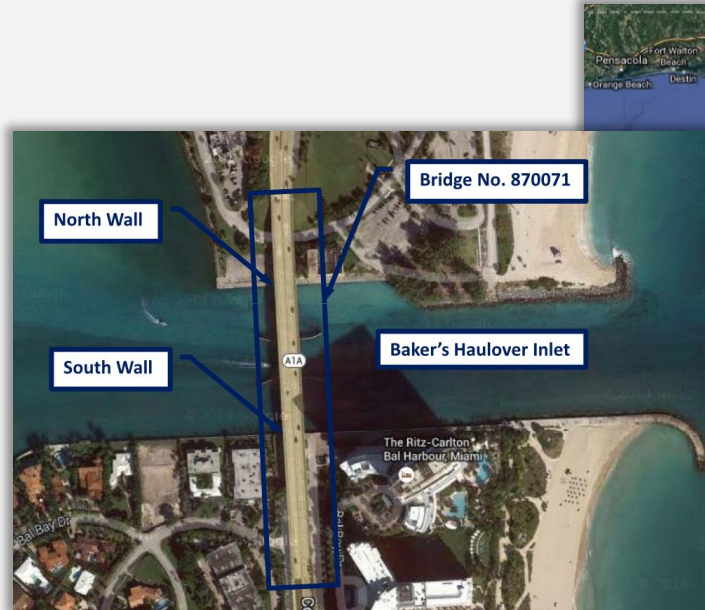
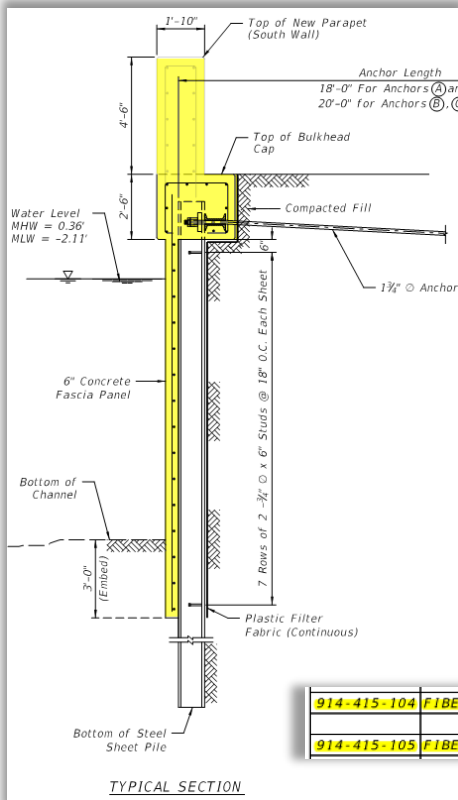
FDOT FRP-RC implementation status

D2 Project: C-Street Bridge Replacement



FDOT FRP-RC implementation status

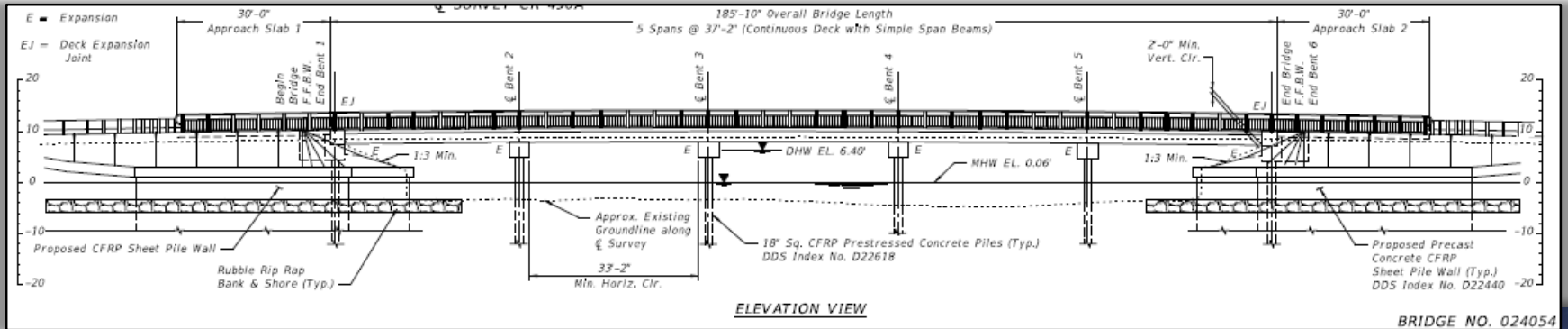
D6 Project: Bakers Haulover Cut Bridge Rehab. – Bulkhead Replacement



914-415-104	FIBER REINFORCED POLYMER BAR #4	BULKHEAD CAP, PARAPET & FASCIA PANEL	LF	12,199.32
914-415-105	FIBER REINFORCED POLYMER BAR #5	BULKHEAD CAP, PARAPET & FASCIA PANEL	LF	7,071.14

FDOT FRP-RC implementation status

D7 Project: Halls River Bridge Replacement

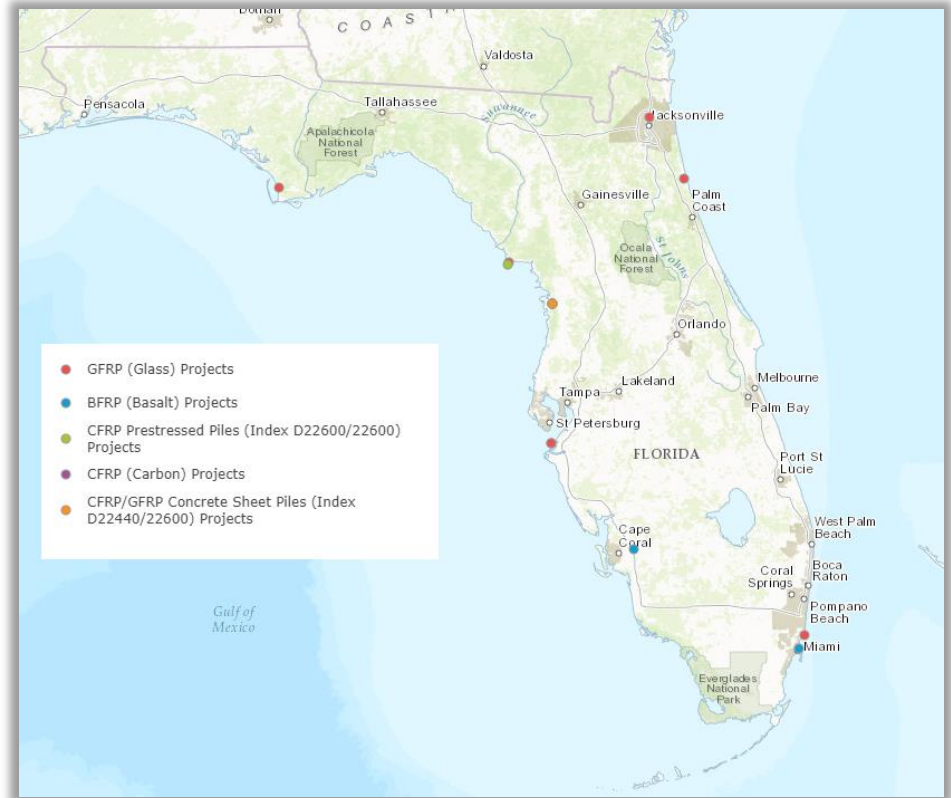


2018 FDOT FRP-RC Winter Workshop

FDOT FRP-RC implementation status

FRP Projects GIS-Mapping Tool:

- Active and Completed FRP-RC projects;
- Includes FRP-Fender Systems,
- May add bridge beam repair/strengthening projects in future (20+ year history of wet-layup repairs)



FDOT FRP-RC implementation status

Fast-Facts Sheets:

- EOR's requested to complete for each new project

FDOT Transportation Innovation Initiative: FRP – Design Innovation



Fast Facts:
Glass Fiber Reinforced Polymer

Project Location: FDOT District Two
Levy County
Cedar Key, Florida

Agency: Florida Department of Transportation

URL: http://www.fdot.gov/structures/innovation/FRP_shtm

Project Name: SR 24 over Number Three Channel
Bridge No. 340003
FPID: 426169-1

Project Description: Rehabilitation of three bridges in Cedar Key

Project Purpose & Need: Bridge Inspection Reports identified deterioration, including evidence of corroded steel reinforcement in the bulkhead cap on bridge 340003. Work activities included removal of the existing bulkhead cap and installation of a new bulkhead cap with GFRP reinforcement.

Cost Estimate: \$741,630.00 (Construction Contract)

Why about this project? GFRP reinforcement is used in the bulkhead cap, which is within the splash zone, to reduce future maintenance requirements. Removable blocks, reinforced with varying types of FRP, were cast with the bulkhead cap for monitoring long-term durability.

Describe Traditional Approach: Traditional approach includes installation of grade 60 steel rebar in a cast-in-place bulkhead cap.

Describe New Approach: Utilization of GFRP bars in lieu of traditional grade 60 steel rebar in the bulkhead cap, located in the splash zone.

Top Innovations Employed: Utilization of GFRP bars within the splash zone/marine environment.

Primary Benefits Realized/Expected: Longer service life of the bulkhead cap.

Project Start Date/Substantial Completion Date: 11/30/2015 – 8/3/2016

PE Consultant: Kisinger Campo & Associates Corp.

Construction Contractor: Pneumatic Concrete Co. Inc.

Construction Engineering Inspection: JEA Construction Engineering Services

Engineer of Record: Patrick Mulheam, P.E.
Kisinger Campo & Associates Corp.


FDOT Project Manager: Jeff Bailey
FDOT District Two
Jeff.Bailey@dot.state.fl.us

FDOT State Materials Office: Chase C. Knight, Ph.D.
FDOT Composite Materials Specialist
Chase.Knight@dot.state.fl.us

www.fdot.gov/structures/innovation/FRP_shtm

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FDOT Transportation Innovation Initiative: FRP – Design Innovation



Fast Facts:
Glass Fiber Reinforced Polymer & Carbon Fiber Reinforced Polymer

Project Location: FDOT District Three
Bay County
Lynn Haven, Florida

Agency: Florida Department of Transportation

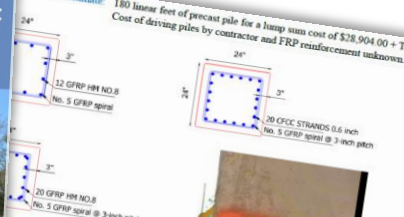
URL: http://www.fdot.gov/structures/innovation/FRP_shtm

Project Name: Arthur Drive over Lynn Haven Bayou
Bridge No. 464143
FPID: 430463-1

Project Description: Field testing of GFRP and CFRP reinforced concrete piles.

Project Purpose & Need: Three FRP reinforced precast concrete demonstration piles were manufactured and driven to test performance. One pile was prestressed with CFRP tendons, and two piles were non-prestressed with GFRP bars.

Overall Budget/Cost Estimate: 180 linear feet of precast pile for a lump sum cost of \$28,904.00 + Tax. Cost of driving piles by contractor and FRP reinforcement unknown.



Why about this project? Most piles were driven at a project site to test axial capacity of full-scale square FRP reinforced piles in the field. The piles were driven, but were allowed to remain in place, under the approach slab.

Traditional Approach: Traditional approach for piles with prestressed steel strand and mild steel stirrups is common for bridge deep water piles.

Describe New Approach: Demonstration piles contained non-prestressed GFRP reinforcement with GFRP stirrups. One pile was prestressed with CFRP tendons and two piles were non-prestressed with GFRP bars.

Primary Benefits Realized/Expected: Longer service life of the bulkhead cap.

Project Start Date/Substantial Completion Date: 3/2/2017 – 3/3/2017

www.fdot.gov/structures/innovation/FRP_shtm

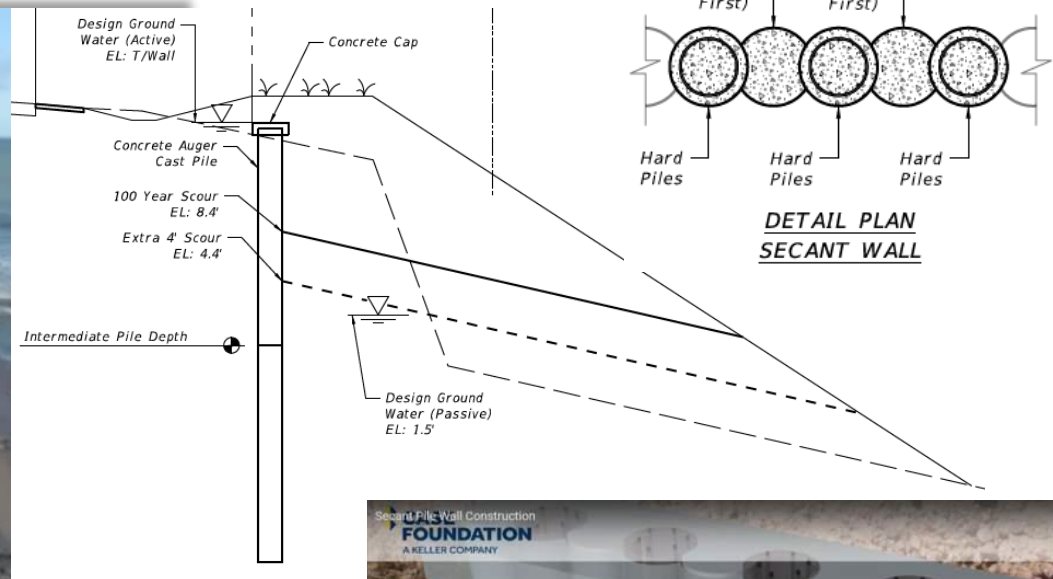
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FDOT FRP-RC implementation status

6. New Applications

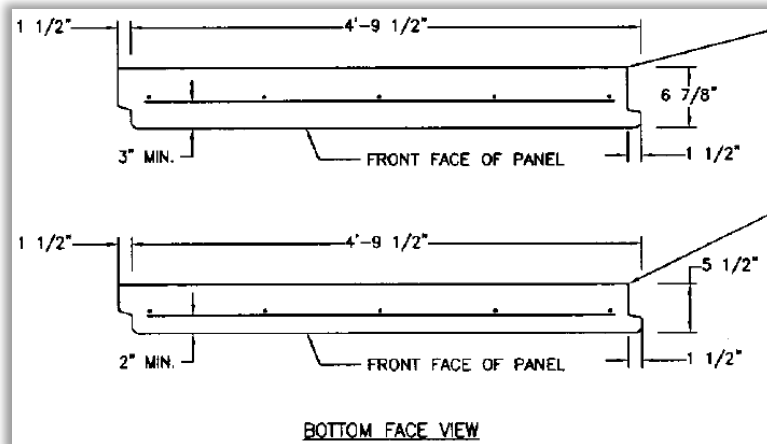
i. A1A Secant Seawall option (D5 – 2018)



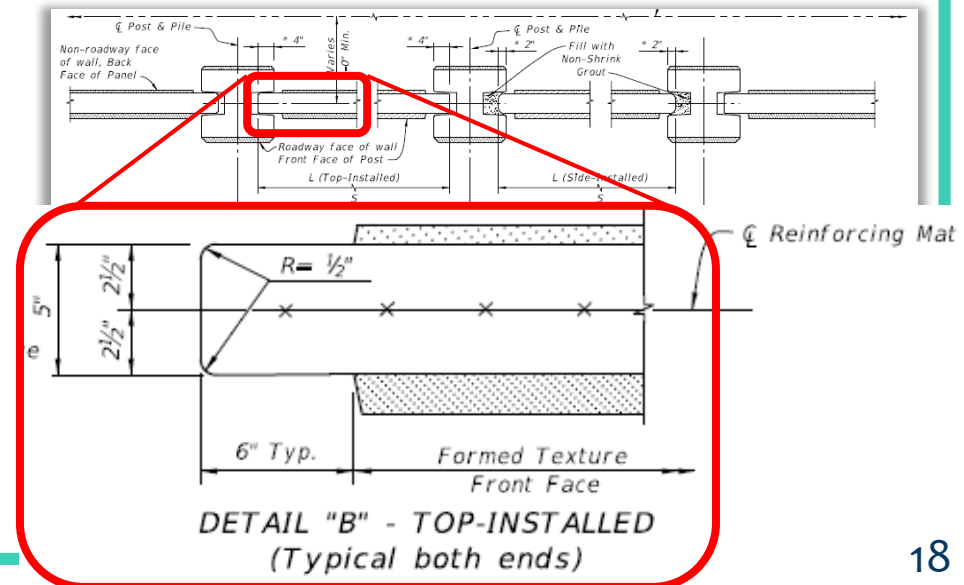
FDOT FRP-RC implementation status

6. New Applications

- i. A1A Secant Seawall (D5 – 2018)
- ii. Precast MSE Wall Panels
 - Allows using 5½” thick panel in place of 7” panel
- iii. Precast Noisewall Panels
 - Allow 4” thick panel in place of 5” panel



BOTTOM FACE VIEW



DETAIL "B" - TOP-INSTALLED
(Typical both ends)

FDOT FRP-RC implementation status

6. New Applications

- i. A1A Secant Seawall (D5 – 2018)
- ii. Precast MSE Wall Panels
 - Allows using 5½” thick panel in place of 7” panel

FDOT MSE RETAINING WALL CLASSIFICATION TABLE

Applicable FDOT Wall Type *	Durability Requirements (Carbon-Steel Reinforcing)			Durability Requirements (FRP Reinforcing)			Soil Reinforcement Type	Other Allowable FDOT Wall Types					
	Concrete Cover (in.)	Concrete Class for Panels	Pozzolan Additions **	Concrete Cover (in.)	Concrete Class for Panels	Pozzolan Additions? **		2A	2B	2C	2D	2E	2F
Type 2A	2	II	No	1.5	II	No	Metal		✓	✓	✓	✓	✓
Type 2B	2	IV	No	1.5	IV	No	Metal			✓	✓	✓	✓
Type 2C	3	IV	No	1.5	IV	No	Metal				✓	✓	✓
Type 2D	3	IV	Yes	2	IV	No	Metal					✓	✓
Type 2E	3	IV	No	2	IV	No	Plastic						✓
Type 2F	3	IV	Yes	2	IV	No	Plastic						

* See Data Table in Contract Plans.

** Silica fume, metakaolin or ultrafine fly ash.

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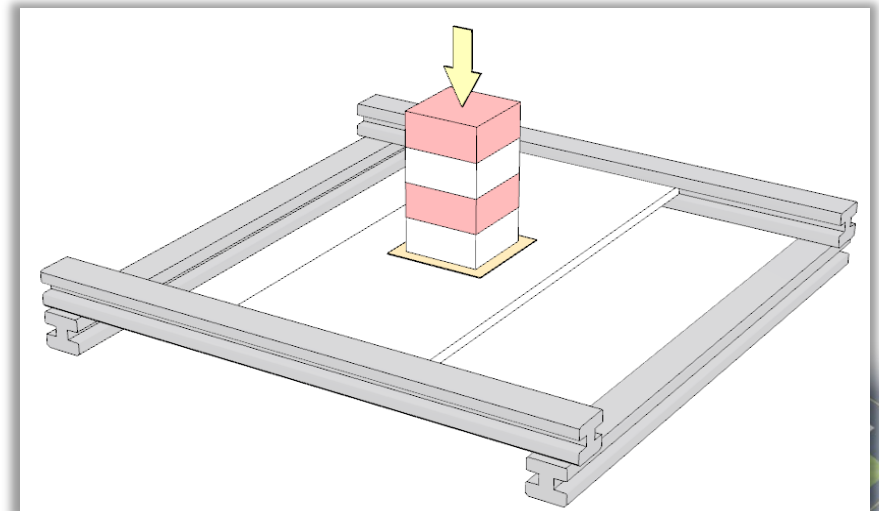
FDOT FRP-RC implementation status

STIC 2018 Proposal (*pending*)

– *Basalt-FRP Rebar Standardization*



“Develop standard (guide) **design specification**, and standard **material** and **construction specifications** for basalt fiber-reinforced polymer (BFRP) bars for the internal reinforcement of structural concrete...”

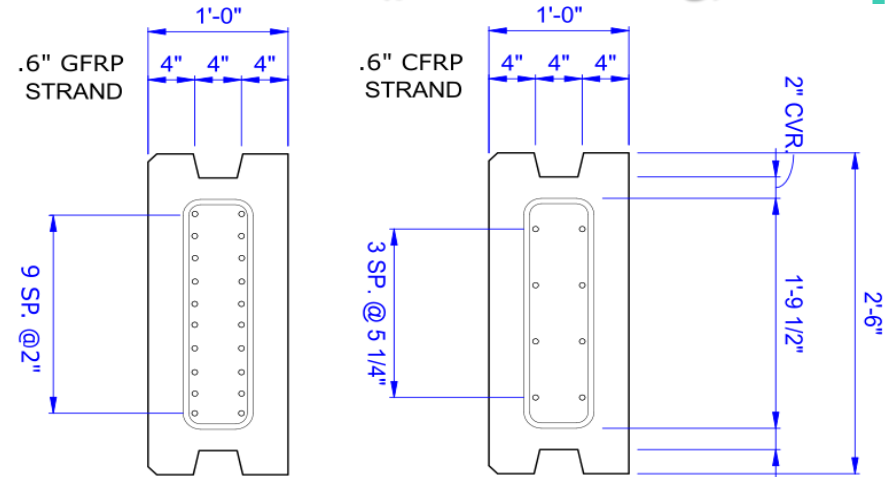


FDOT FRP-RC implementation status

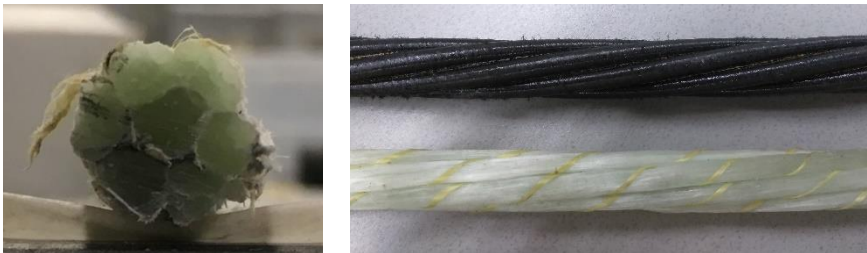
NCHRP IDEA Project – MILDGLASS (prestressing)



(a) & (b) CFRP strand failed during tensioning;
(c) cracking following strands release.



(a) GFRP-PC sheet pile concept (b) CFRP-PC sheet pile design for Halls River Bridge



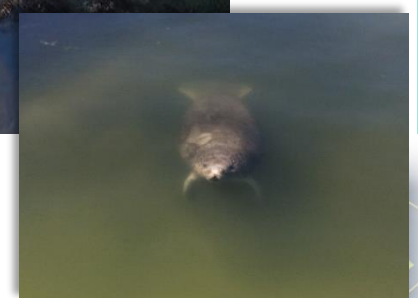
(a) GFRP strand prototype cross section;
(b) compared to a CFRP alternative.



(a) & (b) Tensioning apparatus for CFRP; versus
(c) standard steel HSCS chucks, for GFRP.

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Questions



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