FRP Institute:

2025 FRP Workshop

FDOT District 4
Fort Lauderdale, FL

December 3, 2025

FRP for Transportation Structures Engineers

Agenda - Part 1

Morning: (8.30 am to 12.30 pm) Discussion topics/presenters:

- Welcome and Orientation – D4 (FDOT)
- FRP Institute Introduction – Richard Krolewski (FRPICI)

1. AASHTO Guide Specifications Along with Michigan DOT Specific Research & Resulting Design Aids – Matt Chynoweth, RS&H (Keynote) (1-hr)
2. History of Externally Bonded FRP in DOT applications (Structural testing and applications) – Scott Arnold, Fyfe (@ (9:30am 1-hr)
3. FRP Strengthening of Concrete Highway Bridge Elements Using AASHTO Guide Specifications – Tarek Alkhrdaji, Structural Technologies (Keynote Speaker) (@ 10:30am 1-hr)
4. Workforce Development Installation of GFRP Bars – Jack Nix, JN Distribution & Don Ayres, Encore-Hartco (@ 11:00am 30-min)
5. Manufacturing & Design of GFRP Reinforcing Bar Application GFRP Reinforcing Bar Quality Control Requirement – Gene Latour, V-ROD (30-min)

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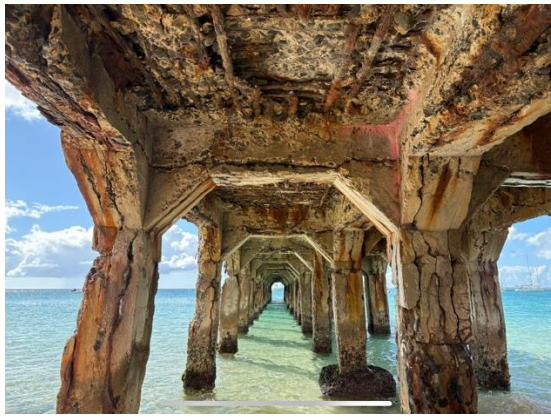
Agenda – Part 2

Afternoon: (1:00 pm to 4:30 pm) Discussion topics/presenters:

6. Design and Construction of Bridges with GFRP & BFRP Rebar – Steven Nolan (30-min)
7. Example 1 Case Studies for FRP-RC/PC Bridge Project: District 6 – Steve Nolan/Hailing Zhang (30-min)
8. Example 2 Case Studies for FRP-RC/PC Bridge Project: District 4 – David De Torres (30-min)
9. Introduction to Carbon Fiber Composite Cable & Applications – Sho Nakahama, Tokyo Rope (30-min)
10. The Future of Reinforcing in Critical Infrastructure Project – Danielle Kleinhans, Mateenbar (30-min)
11. FRP Reinforcement Options & Use in New Construction – Trevor Gundberg, Vectorply Corp. (30-min)
12. Design & Construction of Buildings & Bridges with GFRP Bar – Jesse Curtis, MST Bar (30-min)
13. T-Biscuit: An Alternative to Steel Shear Connections – Anthony Noto, Scott Hemphill, V2 Composites (30 min)

- Closing - Richard Krolewski and Steven Nolan



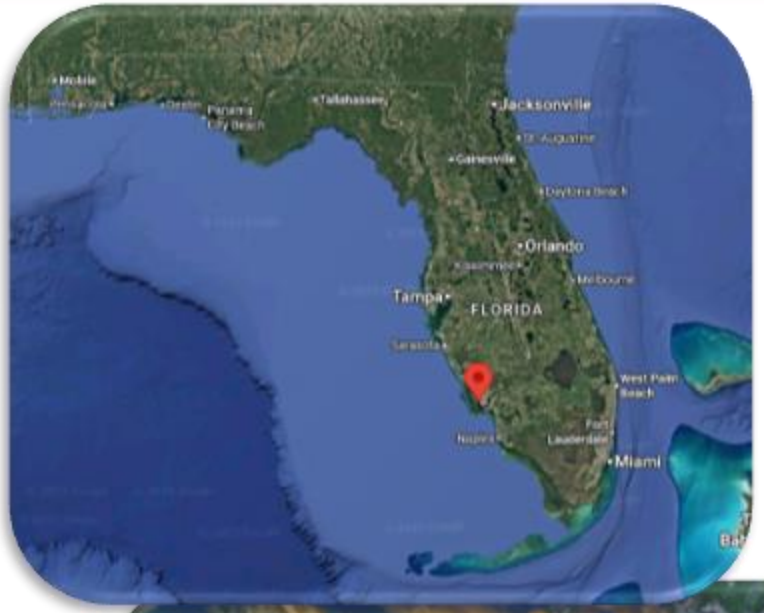
6. FDOT Design and Construction of Bridges with GFRP & BFRP Rebar Overview

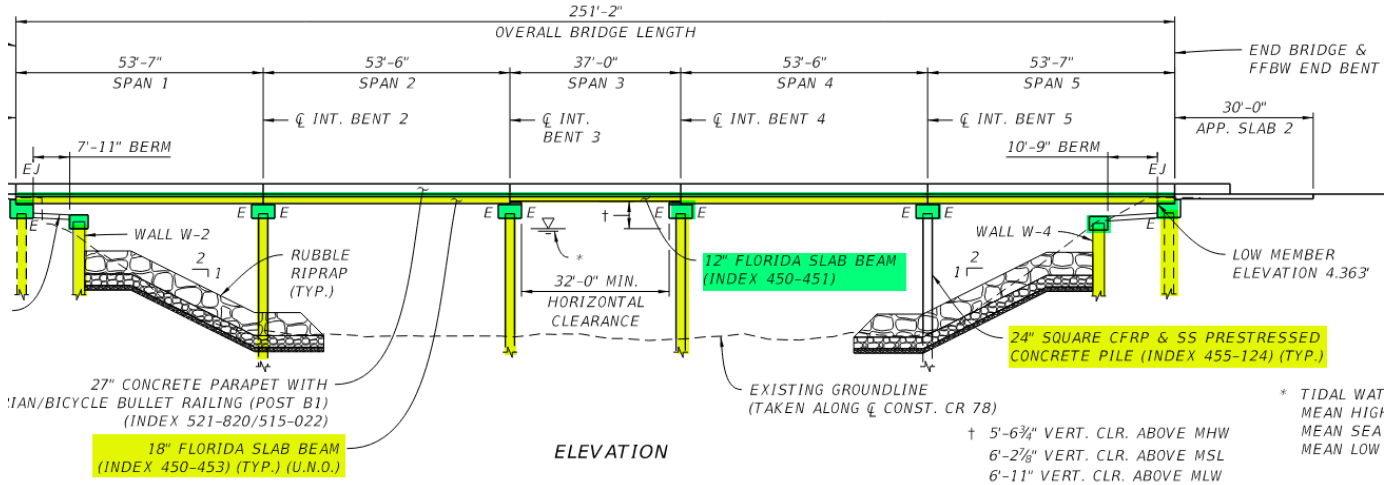
(Steven Nolan P.E.)

AGENDA

- Introduction
- District 1: Pine Island Road – Bridge Replacement
- District 2: Aucilla River Bridge Repair – Crutch Bents
- District 3:
- District 4: Earman River,
- District 5:
- District 6: Channel 5 Rehab, Cow Key, Duck Key
- District 7:
- FDOT New FRP Research of Interest

D1: PINE ISLAND RD BRIDGE REPLACEMENT





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D1: PINE ISLAND ROAD BRIDGE REPLACEMENT

Project Details *(Jesse Curtis will present more details in Part 12)*

Little Pine Island Bridge Replacement

- *FPID 451937-2*
- *Contract No: H1I24 (Design-Build)*
- EOR: RS&H
- Details: FRP-PC Piles & FSB's, GFRP-RC Bent Caps, GFRP Bulkhead Cap, *(MST bars)*
- *Letting 9/29/2023*
- ***Status:*** *Concrete Topping (Phase II) completed 11/18/25 now open to traffic.*

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D1: Other FRP-RC/PC Projects

Active Project Summaries

1. **Sanibel Island Causeway Restoration** *(452819-1) $6.6M CG H1719,* GFRP-RC Bulkhead Seawall Caps, Phased Design-Build, Letting 9/29/2023. ***status:*** *Under construction, Contract end 12/20/2025.*

2. **Caxambas Ct/Roberts Bay, Marco Island** xCR low-level bridge. PD&E under 445460-1 *Letting date 02/24/2027 -* ***status****: Phase II CO review 7/2/2025.*

3. **East Periwinkle Bridge Replacement** (City of Sanibel) *(452819-1) $0.75M PEG G2W66, $2.5M CG G3E92,* Low-level bridge replacement. ***status:*** *Preliminary*

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D1: Other FRP-RC/PC Projects

Completed Project Summaries

1. ***Skyway Rest Area*** *(Design-Build: 437635-1, 437973-1 &* *438528-1),* ***E1P44****,* ***Fast-Facts:*** *bulkhead cap replacement; xCR-sheet pile wall extension & traffic railings – complete.*

2. ***US41 over Morning Star & Sunset Waterways*** *(435390-1),* ***T1742****,* ***Fast-Facts:*** *Link-slab details (GFRP & BFRP) – 2/27/19 letting, (Bid Tabs) –* ***status:*** *completed 10/30/20.*

3. ***US41 over North Creek*** *(433550-3),* ***T1747****,* ***Fast-Facts:*** *piles (HSSS-PC), wall panels, flat-slab, traffic railings, 8/28/19 letting (Bid Tabs) –* ***status:*** *completed 7/7/21.*

D2: AUCILLA RIVER BRIDGE

Project Details *(Jesse Curtis will present more details in Part 12)*

- ***Recent presentation at ACI Fall Convention available at ACI University online)***

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D2: AUCILLA RIVER BRIDGE

Project Details *(Jesse Curtis will present more details in Part 12)*

- ***Recent presentation at ACI Fall Convention available at ACI University online)***

US90 over Aucilla River Crutch Bents

- FPID 447346-1
- *Contract No. T2984*
- Contractors EOR: Garcia Bridge Engineers
- Details: Crutch Bents on 2,3, & 4 with 36~#11 GFRP rebar/cap CSI proposal to replace post-tension cap design.
- Letting 02/28/24, *Bid Tabs*
- ***Status**: Construction started Nov. 2025*

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D2: Other FRP-RC/PC Projects

Active Project Summaries

1. **US1/King St over San Sebastian River** (437428-1), **T2A28**, *GoMap*: Using GFRP-RC overlay for FSBs, bent caps and xCR-piles, *4/30/25 new letting, BidTabs - **status:** Bids received.*
2. **CR 357 over Shired Creek** (437402-1) **T2A21**, *GoMap:* xCR-FSB Topping, Piling, FRP Caps, $16M letting ~~4/30/25~~ *BSN - **status:** All bids rejected, Reduced scope and rescheduled for 5/20/26 letting.*
3. **SR105(Hecksher Dr) over Browns Ck** (448825-1) *GoMap:* xCR-Piles, FIB36, Deck, B/GFRP Caps, letting 10/28/26 - ***status:** 90% plans due 12/8/2025.*
4. **St. Augustine A1A/Avenida Menendez Seawall replacement** (428271-2). $45M. (Videos: Constr. Sequence, 1/23/24 Public Meeting, 9/24/25 letting. GFRP-RC Parapet, Bulkhead Cap & Wall Facing on soil nail tied-back Steel Sheet pile seawall. 331,316 LF #4,5,6,9's. *Letting 12/3/2025 - **Status:** Production 7/16/2025. Notice of Lions Temporary Removal during construction.*

D2: Other FRP-RC/PC Projects

Completed Project Summaries

1. ***Cedar Key: SR24/Channel #3*** *(432194-1)* ***E2T70***, ***Fast-Facts:*** *Test Blocks 1-yr baseline (Knight), Letting 7-15-2015 – benchmarking complete. Waiting for next sampling date (2026?)*
2. ***SR117 (Norwood Ave) over Moncrief Ck*** *(437438-1),* ***T2810****, letting 5/26/21. Bid Tabs: CFRP-PC 24" piles casting at Gate –* ***status****: Pile type changed to conventional steel strands and silica fume in concrete. NTP: 8/12/21 Time Began:11/08/21. Project is 88% paid with 96% time utilized. Project Completion: Spring 2023.*
3. **SR-A1A/Myrtle & Simpson Creeks** (434041-1 & 434042-1), **T2772**, ***Fast-Facts***, GFRP-RC link slabs *5/20/20 letting* (Bid Tabs) – ***status****: Final accepted 12/6/2023*
4. **Various Bridges over Sante Fe & Suwanee Rivers** (437442-1), **E20W3,** *GoogleMap-260006, 310007, 370023 & 370030:* Pile Jackets with GFRP rebar *(Tuf-N-Lite)* (8,715 LF), 6/8/2022 letting, *Bid Tabs* – ***status****: Completion was anticipated 1/26/24.*
5. **SR5A/King St from SR-A1A to Baywall** 430897-1, **E20T7**, GFRP-RC Bulkhead Cap (#6 bars) on steel king pile sheet pile wall. 9/14/2022 Letting (Bid Tabs) – ***status:*** *Completed 3/1/2024.*
6. **SR5 over Oyster Creek** (433843-2), **T2819,** *GoMap*: weir/bulkhead rebar (*D2-PD&E-Rito Rodriguez/IEI), 10/27/21 letting, Bid Tabs* – ***status:*** ***Construction on 800 ft. stretch of U.S. 1 in St. Augustine now going on for 3 years***. *Substantially completed*

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D3: Other FRP-RC/PC Projects

Project Summaries

1. ***CR30A/Western Lake*** *(443331-1) GoMap, xCR-FSBs & xCR-PC Piles & Bulkheads; GFRP-RC Caps, letting 8/30/23 –* ***status****: Driving test piles.*
2. ***CR30B/Indian Lagoon*** *(441185-2) GoMap, Design now by County's consultant (Dewberry FPN 441185-1). xCR-FSBs & xCR-PC Piles; GFRP-RC Caps, letting 11/12/25 –* ***status****: ???*
3. ***CR 372/Surf Road over Otter Creek Rise*** *(442951-1 LAP), GoMap, xCR-FSBs & xCR-PC Piles & Bulkheads; GFRP-RC Caps, letting 2/25/26 –* ***status****: 100% Plans on shelf.*
4. **Victoria Ave over Tidal Branch** (Port St Joe) (441179-1), *GoMap,* GFRP Box Culvert to replace railroad flatcar bridge; letting 12/3/25 *–* ***status****: Advertised.*
5. ***SR 30 (US 98) from S. Franklin St to Carrabelle River Bridge*** *445761-1: GFRP-Box Culvert, Letting 6/1/2025 –* ***status****: Final Plans 4/4/2025.*
6. ***CR2302/Bridge St over Fanning Bayou*** *(442917-1) GoMap, (Ardurra-T.Bevilacqua) GFRP-RC CIP Flat-Slab with xCR-PC Piles & Bulkheads; GFRP-RC Caps & TR, letting 7/28/27 –* ***status****: 90% Plans 1/17/25.*
7. ***Rocky Comfort Creek*** *(454309-1) (PGA-M.Lauckner) Structural Pile Jackets with GFRP rebar, letting 8/14/25 –* ***status****: Production 4/11/25.*
8. ***SR 390 EB Bridge over Mill Bayou*** *(421225-2) (STV-B.Goble xCR-FIB36 & xCR-PC Piles & Bulkheads; GFRP-RC Caps, letting TBA –* ***status****: 60% Plans, BDR, BHR 4/14/25.*

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D3: Other FRP-RC/PC Projects

Completed Project Summaries

- *SR30 over St Joe Bay Inlet (435815-1), **T3632**, bulkhead cap and sheet piles – 10/30/19 letting Bid Tabs; Began 1/23/2020*

D4: FRP-RC/PC Projects

Active Project Summaries (1 of 2)

1. **US 1/Jupiter Federal Observation Platform** (428400-2) **T4564** – *06/9/21 letting, Bid Tabs, HSSS/CFRP-PC(?) FSB's LF, xCR-18" Piles, (H&H/Nolan), https://www.fdot.gov/projects/jupiterus1bridge/construction-updates – **status:** Under construction – 100% construction. **U.S. 1 bridge in Jupiter opens with more lanes, sidewalks, bikeways***
2. **SR-A1A North Causeway Bridge Observation Platform** (429936-2) **T4583**– *1/12/22 letting, Bid Tabs, HSSS/CFRP-PC FSB's(@CDS, MST bars)=1421'; CFRP-18" piles=1676'+1079' (@CDS); HSSS-24" piles=120'; CFRP-10"x30" Sheet Piles = 621', (H&H/Nolan), D4 Construction webpage – **status:** 50% construction - Beams installed for the new Observation Walkway on the west side of the bridge.*
3. **Sebastian Inlet** (445618-1) **T4729** *(Transystems) Observation Walks as part of bridge replacement only xCR piles, FSB & topping coping, but not bent caps in the Splash-Zone? - Public Meeting*, Letting 12/3/25, BSN – ***status:** Bids pending.*
4. **SR 5/US 1 Over Earman River** (442891-1) **T4714** – xCR-FSB's, GFRP Bent Caps & xCR-Piling, 09/25/24 letting, *BidTabs - **status:** Construction began 2/10/2025. Piles driven Phase 1.*

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D4: FRP-RC/PC Projects

Active Project Summaries (2 of 2)

1. **17th St/Indian River, East End-Vero Beach** (446106-2) **E4W37** - Replace east end spans (56 to 64) with xCR-Beams (1-span) + CFRP/GFRP-FSB's (7-spans), SSRC deck Span 56, CS-Barrier, xCR-piling, (GFRP-Bent Caps w/ SS-couplers) – 3/3/23 letting - ***status:*** *50% construction.*
2. **I-95 NB Off-Ramp at Indiantown Rd** (439758-1) **E4W59** – xCR-Piling 18"x18" (1277 LF) – 5/5/2023 letting- ***status:*** *86% Construction.*
3. **SE Martin County Line Bridge Replacement** *(L. Rodriguez/DRMP)* maplink – FRP-PC/RC foundation and superstructure - ***status:*** *60% Plans 2023?*
4. **SR-A1A over Big Mud Creek & Blind Creek** (449179-1) – xCR-FIB/FSB's, -Bents, Piles, and deck. 07/31/30 letting - ***status:*** *D4 in-house. Pushed out 5-yrs.*
5. **NE 36th St/Sample Road over Cap Knight Bayou Waterway** (LAP-City Lighthouse Point) (453177-1) – $1M Congressional CPFR: Candidate xCR-FSB - ***status:*** *In design.*
6. **NE 31st Court over Heron WW** (LAP-City Lighthouse Point) (453176-1) – $1M Congressional CPFR: Candidate xCR-FSB - ***status:*** *In design.*
7. **Seawall & Pump Station Resiliency Project** (448576-1, 448577-1, 448574-1) – Letting 9/25/24 - ***status:***

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D4: FRP-RC/PC Projects

Completed Project Summaries

- NE 23rd Ave/Ibis Waterway (434359-1) **T4500** (LAP), ***Fast-Facts:*** GFRP-RC Flat-Slab *(Bayard) – 02/27/19 letting (Bid Tabs) – Began 11/04/19 –* ***status****: Construction completed 4/26/21. NDT vibration monitoring testing completed by UM/FIU on 5/1/21.*

D5: Other FRP-RC/PC Projects

Active Project Summaries

1. **SR-A1A Seawall #3 & #4** (452443-1 & 452444-1) **H5461**, $82.5M (4.0 lane miles) + $21.4M (13.2 lane miles), incl. $25.5M PROTECT + $87.6M ER (incl. $61.3M+$24.5 ER01-2022 + $1.8M ER03-2022/23), **Fast-Facts:** GFRP-RC Secant Pile wall for protection, Hurricanes Ian & Nicole permanent repairs. *Construction Video #3 began May 24; #3 began 9/10/24, V-ROD bars - **Status:** Under construction. **Construction of Ormond-by-the-Sea Progressing** Northern wall: www.cflroads.com/project/452444-1; Southern wall: www.cflroads.com/project/452443-1*
2. **SR-404 over Indian & Banana Rivers** (445395-1) **E55A2**, CP Pile Jackets with GFRP bars (contractor proposal), 5*/3/22 letting BidTabs - **Status:** completed 1/3/2024.*
3. **N. Banana Rv Dr. Merritt Island** (LAP-*Atkins) Map – 18" Sq. xCR-Piles optional CFRP or HSSS, xCR-FSB's or GFRP-RC Flat-Slab & Soldier Pile Walls. **Status:** Preliminary Cost study.*
4. **US1 over Pellicer Ck** (447118-*1); Potential xCR bridge in splash zone; letting 1/25/2026. **Status:** 90% 2025*
5. **SR44 Sth Cswy over Indian River** (450561-1) *Bulkhead Rehab (Map), GFRP rebar in cap and 62' xCR Sheet Piles, Letting 5/7/2024, BSN. **Status:** Advertised.*

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D5: FRP-RC/PC Projects

Completed Project Summaries

1. **Barracuda Blvd New Smyrna** (437935-1) **T5743**, *Bent Caps, CFRP-18" Piles=1508'+224' (@CDS); 73~CFRP-12"x30" Sheet piles=2269', 8~corner piles, BSN, Bid Tabs, Letting 2/23/2022. 4 new sheet pile walls to be added to this project ~$1.5M to address existing wall damage (Phase 2).* ***Status:*** *100% completed 10/28/2024.*
2. **5th Street over Yacht Club Cut** (437936-1) (LAP-*DRMP)* Map – *24" Sq. xCR-Piles optional CFRP or HSSS.* ***Status:*** *Completed 1/31/2025.*
3. **SR5/US1 NB Over Turnbull Creek** (447117-1), **T5830** *Bridge Replacement, xCR-Piles, Superstructure TBA, Letting 8/28/24, BidTab.* ***Status:*** *Construction began 11/13/2024. Est completion 10/27/2025.*
4. **SR-A1A Seawall #1** (440557-7) T5641, **Fast-Facts:** Secant wall for revetment – *complete. 2.1 lane miles improved, $13.6M const.* ***status:*** *Hurricanes Ian & Nicole exposed wall face approx. 10-feet height.*
5. **SR 520 over Indian River** (440969-1) **E5Z68**, ***Fast-Facts:*** Bulkhead Cap Replacement - *3/5/19 letting (Bid Tabs) – no issues with the GFRP in the bulkheads that made it back to the EOR.*
6. **SR 404 /Indian & Banana Rivers** (439275-1) **E5Z32**, Bulkhead Rehab xCR-Sheet piles only – *2/26/18 letting.*
7. **SR 528 /Indian & Banana Rivers** (441166-1) **E5Z96**,

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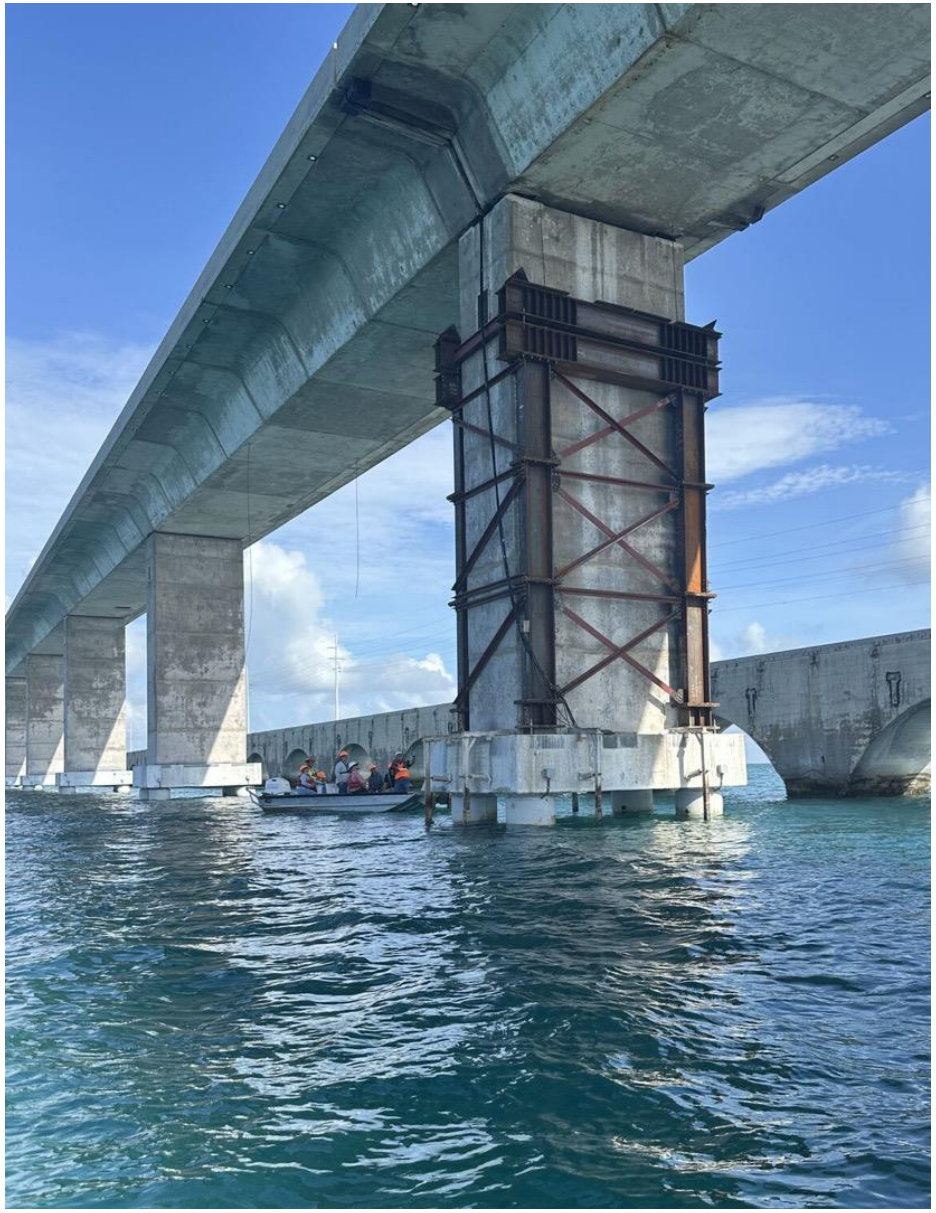
D6: Channel 5 Pier Rehabilitation

Project Details

- Monroe County, Florida:



D6: FRP-RC/PC Projects

Active Project Summaries

1. **SR /Channel 5** (436523-1) **E6K61** - Precast/PT Pier rehab, Letting 8/27/2020. BSN. ***status**: Under construction, FRP-RC repair proposed (Revision 3).*
2. **117th St/Vaca Channel #2** (448208-1) LAP – xCR substructure consideration. Design with grant to City of Marathon, letting Nov. 2027. ***Status**: 90% Plans due 12/6/24.*
3. **FKOHT over Bow Channel Old Bridge Rehab.** for SUNTRAIL (440909-2 & 3) – Grant to FDEP $0.6M design, $10M construction in 2027/28. ***Status**: Kickoff meeting 12/6/2024.*
4. **SR 907/Alton Rd** (430444-2) Raising Road and adding pump stations. $60M with $18M PROTECT Grant. Structures should be GFRP-RC due to saltwater. New letting 2029 – ***Status**: Shelved for now.*
5. **Snake Creek Bridge PD&E Study** (442670-2) New high-level bridge to replace Bascule. XCR foundations will be required. ***Status:** PD&E Kickoff 2/3/2026. Construction 2035.*
6. **Atlantic Isle Lagoon Historic Bridge Replacement** (430029-2), LAP – xCR end bents & arched FSB's, upper drilled shaft connection? $2M, Letting 12/22/2027 – ***Status:** 60% Plans 6/4/2025.*

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D6: FRP-RC/PC Projects

Future Projects ???

1. **Long Key Bridge Replacement** (448206-1) – xCR substructure considerations, letting 03/15/2027. ***Status:*** *PD&E underway - Public Kickoff Meeting 2/16/2023, Alternatives Meeting 9/12/2023. Pushing out construction to 2040?*
2. **Seven Mile Bridge Replacement** (448207-1) - xCR substructure considerations, letting 03/15/2027 – ***Status:*** *PD&E. Public Kickoff Meeting 5/16/2024, 30% Plans 12/9/2024. Design-Build Advertisement 5/18/2026*
3. **Snake Creek Bridge PD&E Study** (442670-2) New high-level bridge to replace Bascule. XCR foundations will be required. ***Status:*** *PD&E Kickoff 2/3/2026. Construction 2035.*
4. **Julia Tuttle Causeway over ICWW** (449664-1), Rehab project includes and Integral Pile Jacket Cathodic Protection with GFRP bars, Letting 1/28/2027 – ***Status:*** *60% Plans 9/18/2025*

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D6: FRP-RC/PC Projects

Completed Project Summaries

1. **City of Key West Bight Ferry Dock Extension** (412194-1 LAP Grant), ***Fast-Facts:*** CFRP-PC Piles.
2. **Bakers Haulover Cut** (433378-1), ***Fast-Facts:*** bulkhead cap and facing.
3. **US-1 over Cow Key Channel** (441740-1), **E6L95**, ***Fast-Facts:*** 6 spans (3 per bridge) replacement *(Luis Vargas/BPA) – 10/31/19 letting (BidTabs) – complete (Nov 2020).*
4. **SR-112/I-195 Westshore waterway** (441967-1) **E6M50**, ***Fast-Facts*** - bridge rehab: piles, bent cap & bulkhead cap repairs – *11/19/2020 letting BSN - complete 8/30/22.*
5. **SRA1A/Indian Creek Drive Drainage Mitigation** (439228-2) **AS343**-City of Miami Beach. GFRP-RC Pump Station Pile Cap and Bulkhead Caps.

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D7: Other FRP-RC/PC Projects

Active Project Summaries

1. **Halls River Bridge Research** (430021-1) **T7386**, ***Fast-Facts:*** Bulkhead cap *(D7-Nolan)* – ***Status****: +7-year Durability FRP-RC Bulkhead Beam Extraction and Testing pending (UM), December.*
2. **I-275 over Big Island Gap** (449109-1) **E7U17** - Bridge Substructures – *(HDR Jos van Dijk)*, xCR piling and caps; Bridge Superstructure 1 (LHS) – xCR beams and deck for SUP; Bridge Superstructure 2 (RHS) – Conventional materials; Bulkhead Extensions using xCR Sheetpiles and Caps, *Letting 3/31/25, BidTabs* ***- Status****: Awarded 5/2/2025.*

D7: Other FRP-RC/PC Projects

Completed Project Summaries

1. **Halls River Bridge** (430021-1) T7386, ***Fast-Facts:*** bridge & bulkhead – *Completed 1/21/2020). Load Testing performed by FDOT-SRC in Oct 2021; Monitoring (FAMU-FSU):*
2. **Bayway Structure E Seawalls** - (427143-2) **E7R20**, Design-Build: GFRP-RC Cap and Deadman for anchored Steel Sheet pile wall. *drone footage* - – *Completed 1/30/2023*.
3. **4th St at Big Island Gap** – (430500-1) **E7O03**, *letting 7/21/21 (Siddiqui)* – Bent caps are GFRP (Piles are SS-PC), *Bid Tabs* **40th Ave. NE/Placido Bayou**, City of St Pete (443600-1), ***Fast-Facts*** *(Siddiqui/Cardno) 9/15/20 letting*: full bridge.

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FDOT FRP NEW RESEARCH OF INTEREST

BEE77-977-01 (UM)

- Completed May 2025
- TRB TRD database: https://trid.trb.org/View/2601703

Waterline Pile Cap Footings for Bridges using Large Diameter FRP Reinforcing – Material Characterization and Design

Contract Number: BEE76-977-01

Final Report

Prepared by:

Principal Investigator: Antonio Nanni, Ph.D., P.E.
Co-Principal Investigator: Francisco De Caso, Ph.D., LEED A.P.
Postdoctoral Associate: Alvaro Ruiz Emparanza, Ph.D., P.E.
Research Associate: Juan Manuel Palacios
Graduate Student: Mattia Mairone
Graduate Student: Khashayar Heydarpour

Project Manager:

Steven Nolan, P.E.
State Structures Design Office
605 Suwannee St, Tallahassee, FL 32399
steven.nolan@dot.state.fl.us; (850) 414-4272

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THANK YOU FOR ATTENDING

Steven Nolan, P.E.

Assistant State Structures Design Engineer

FDOT State Structures Design Office

Steven.nolan@dot.state.fl.us

Member:

- ACI 440C, Code Committee – GFRP Reinforced Concrete for Building Specifications