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FDOT Composite Retrofits and Repairs

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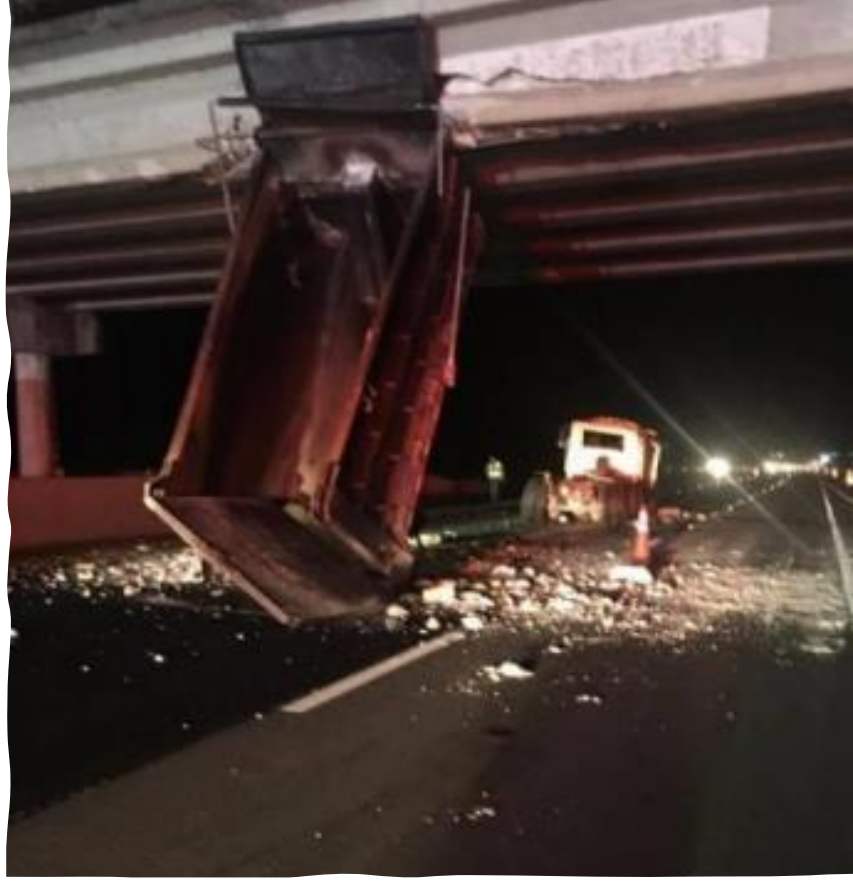
Outline

- CFRP Externally Bonded (EB) Applications
  - Background
  - Design/Construction Guidance
  - Project Examples
    - Repairs
    - Retrofits/Strengthening
  - Research/Durability
  - Future possibilities…

- GFRP/BFRP Applications
  - Design/Construction Guidance
  - Project Examples
    - Repairs/Retrofits

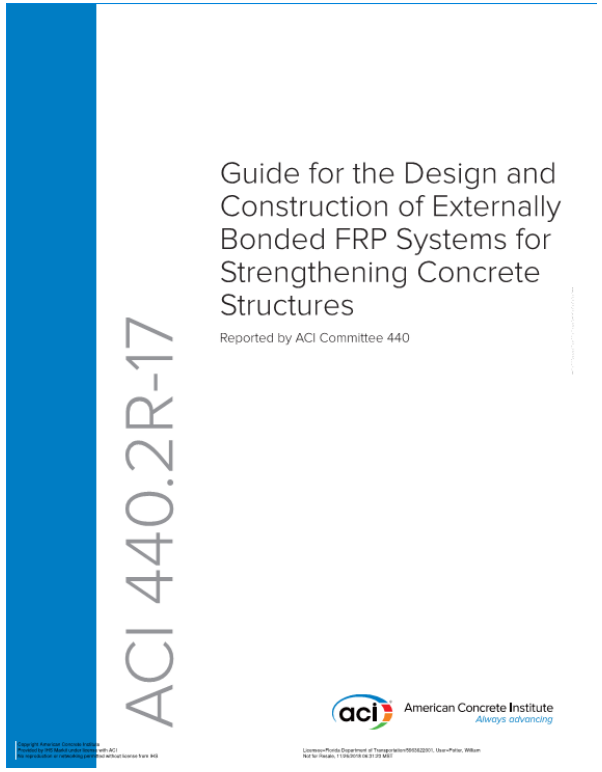


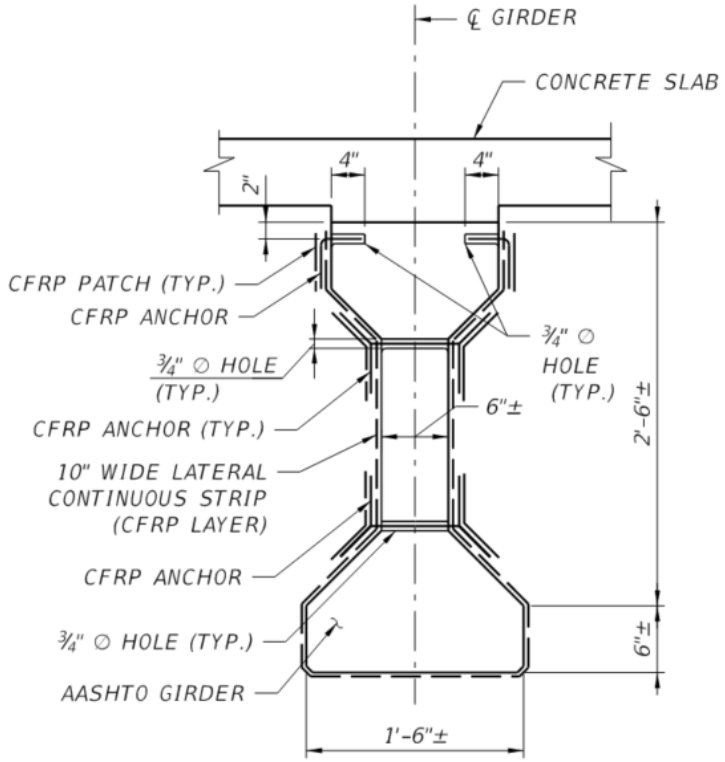
CFRP EB Wrap - Background

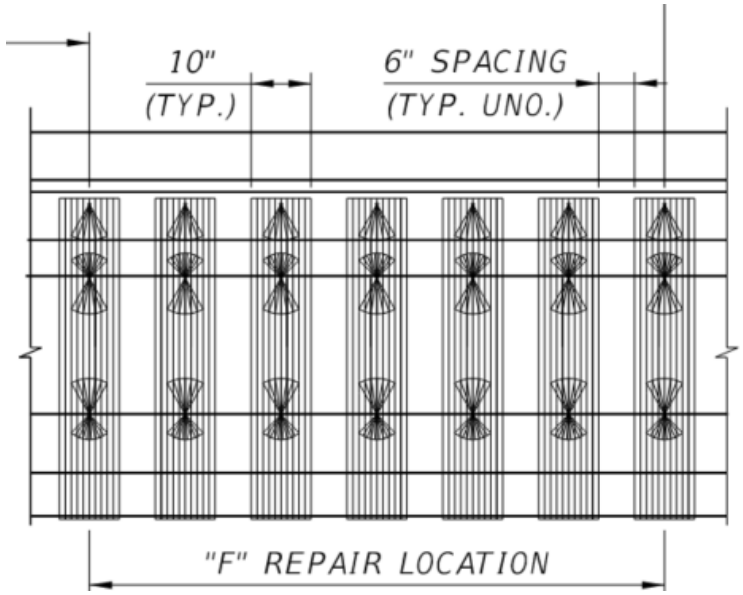
- Research and installations performed since the early 1990s
  - FDOT in-house installations until early 2000s (research staff)
  - Primary installations
    - Over-height vehicle damage
    - Corrosion deterioration
- Considered routine practice for certain applications
  - Flexural strengthening/repairs
  - Confinement
  - Some shear strengthening…

Current FDOT Guidance

- FDOT utilizes ACI 440.2R-17 to design for now…
- Exceptions per FDOT Structures Design Manual Volume 4
  - Complete or 3-sided anchored u-wraps for shear strengthening
  - U-wraps for end anchorage for flexure
- Construction follows Technical Special Provisions (TSP)
  - NCHRP 609 Appendix A with adjustments per project







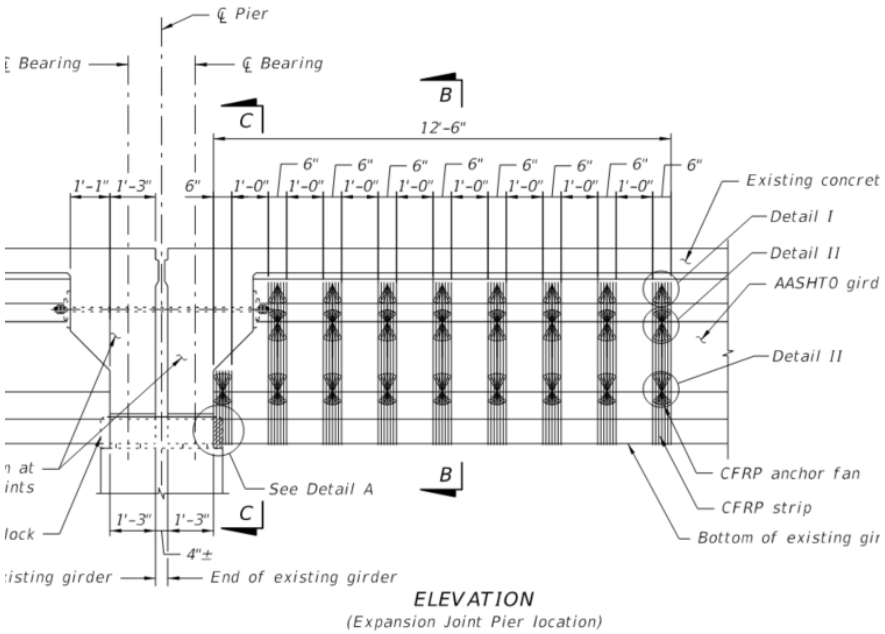
QC Methods for CFRP Wraps

- Direct Pull-off Testing – ASTM D7522 (200 psi requirement)
- Acoustic Tap Test – ACI 440.2R-17

Project Examples
CFRP Wraps

Over-Height Impact Damaged Concrete

Impact Damaged Concrete



Shear/End Region Strengthening

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Bearing Repair (Confinement)

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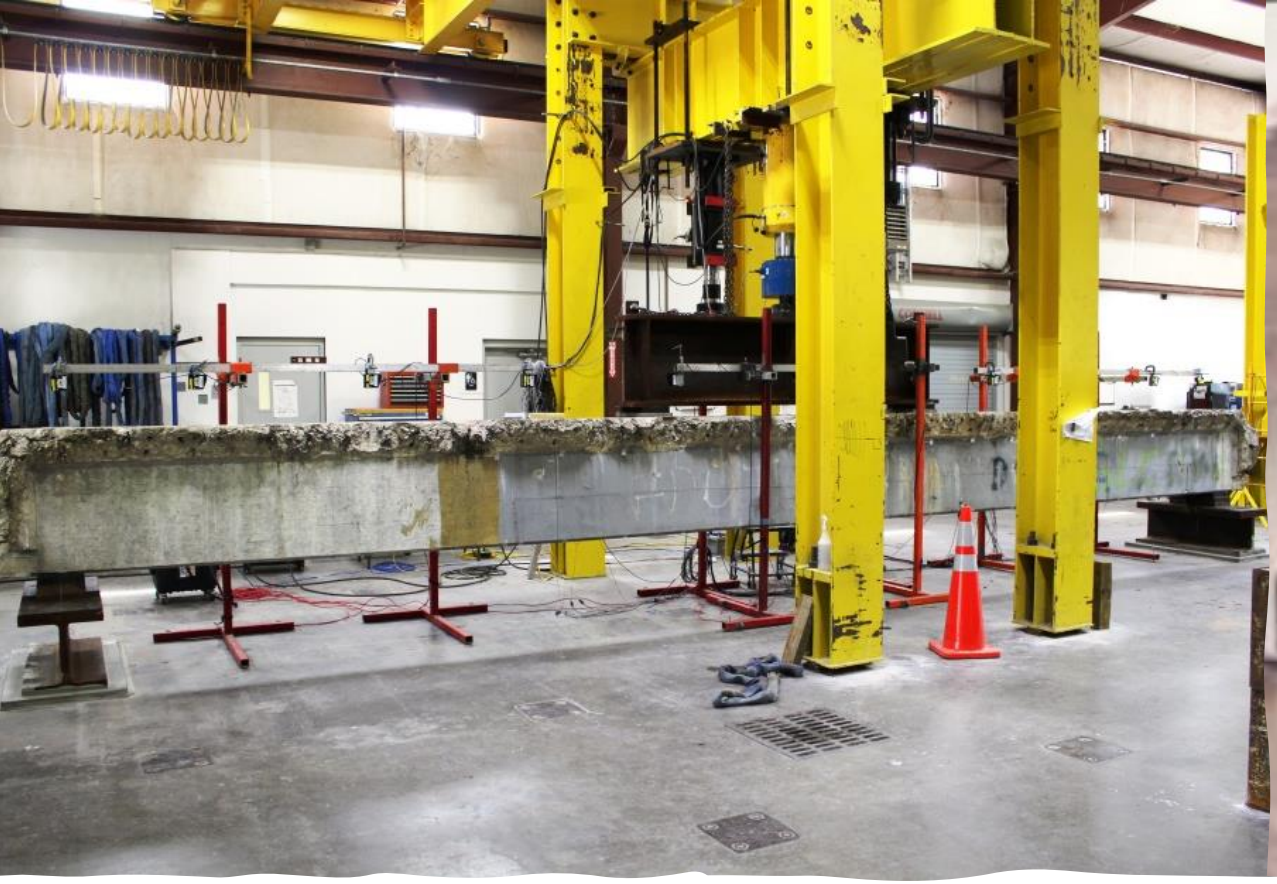
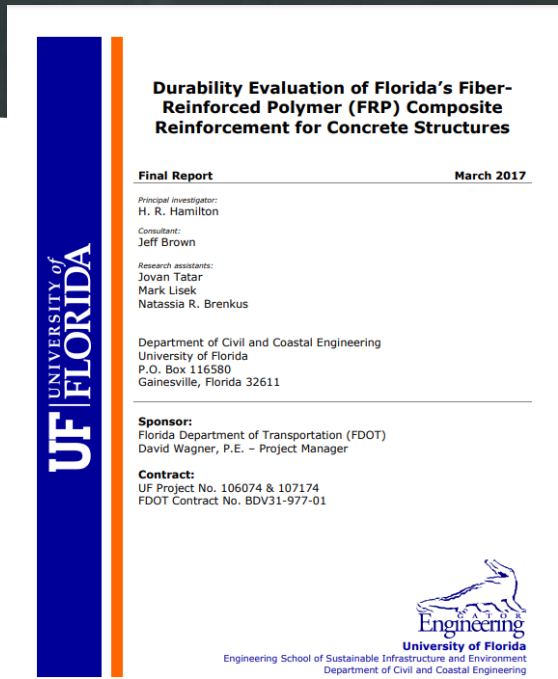


How long does it last…

Band-aid or long-term solution?

Inspection methods?



UF UNIVERSITY of FLORIDA

Durability Evaluation of Florida's Fiber-Reinforced Polymer (FRP) Composite Reinforcement for Concrete Structures

Final Report **March 2017**

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Engineering
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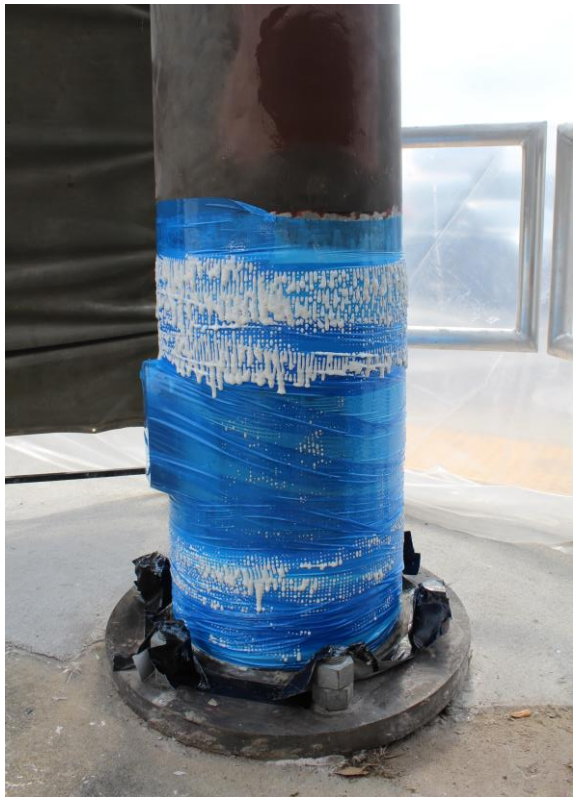


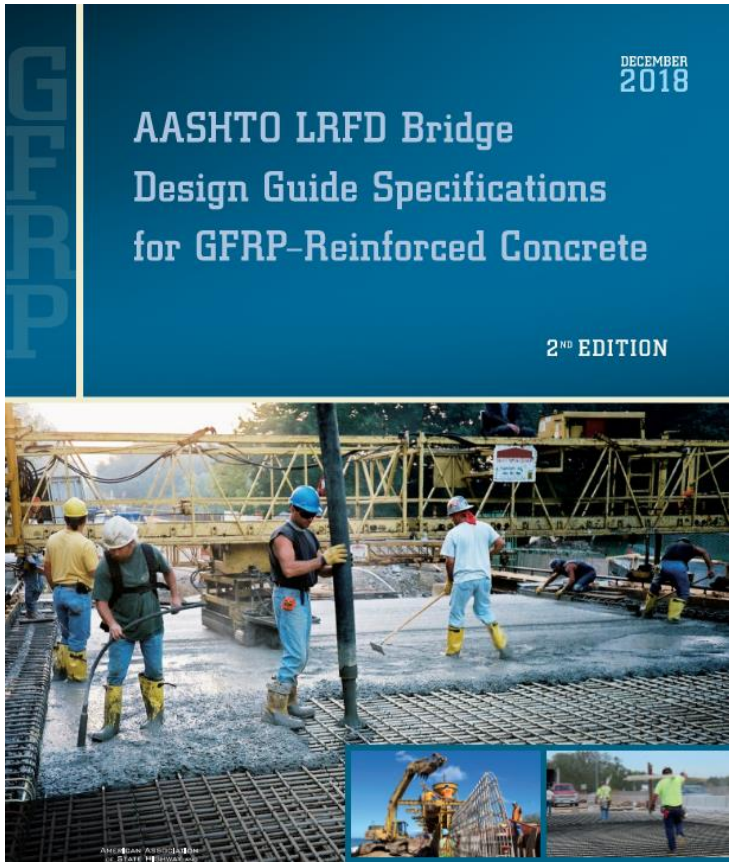
Ancillary Structures…?

Ancillary Structures…

- Very restrictive in application to minimize potential for fatigue concerns
- Replace member when…
  - Global geometry effected
  - Cracking apparent
  - Damage extends to base plate or other weldments
  - Damage level

Action	Dent Depth (% Steel Pole Diameter)
No Repair	<5%
Single-Layer Repair	5% to 20%
Two-Layer Repair	20% to 35%
Replace Pole	>35%

GFRP/BFRP Repairs and Retrofits



Design/Construction Guidance

- GFRP Reinforcement
  - AASHTO GFRP-RC Guide Spec
- FDOT Construction Specifications
  - 400, 415, 450
  - 932, 933
- Technical Special Provisions (TSPs)
- FRP Bar Bending Details
  - Standard Index 415-010
- FRP Approved Producers Listing
  - Per FDOT Materials Manual

Project Examples GFRP/BFRP Bar

Divers placing GFRP rebar mat in forms

Light-weight for easy handling

Bulkhead wall cap GFRP reinforcement in place

Prestressed Sheet Pile System (rebuilt 1970's): Extensive corrosion damage in splash zone

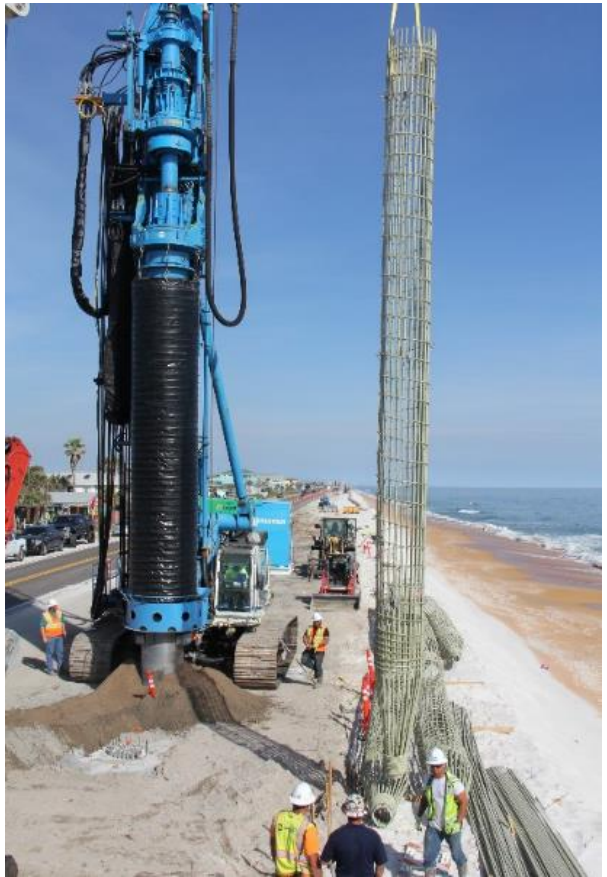
Completed view of North Wall

Bakers Haulover Cut Bridge Rehab

Seawall Cap Repair/Retrofit

Bridge Substructure (Rehab)

Flagler Beach Secant Pile Seawall




SAFETY IS IN YOUR HANDS
Distracted driving was directly responsible for 23,000 deaths and well over a million injuries in the U.S. between 2012 and 2018*. You have a choice every time you get behind the wheel. Plan adequate time to get to your destination. Never use your smartphone or other electronic devices while driving. The choice is yours. Make the safe one.
Always Travel Safely.
PUT IT DOWN
ALERT TODAY
FDOT
ALIVE TOMORROW
*Sourced from National Highway Traffic Safety Administration

Questions

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