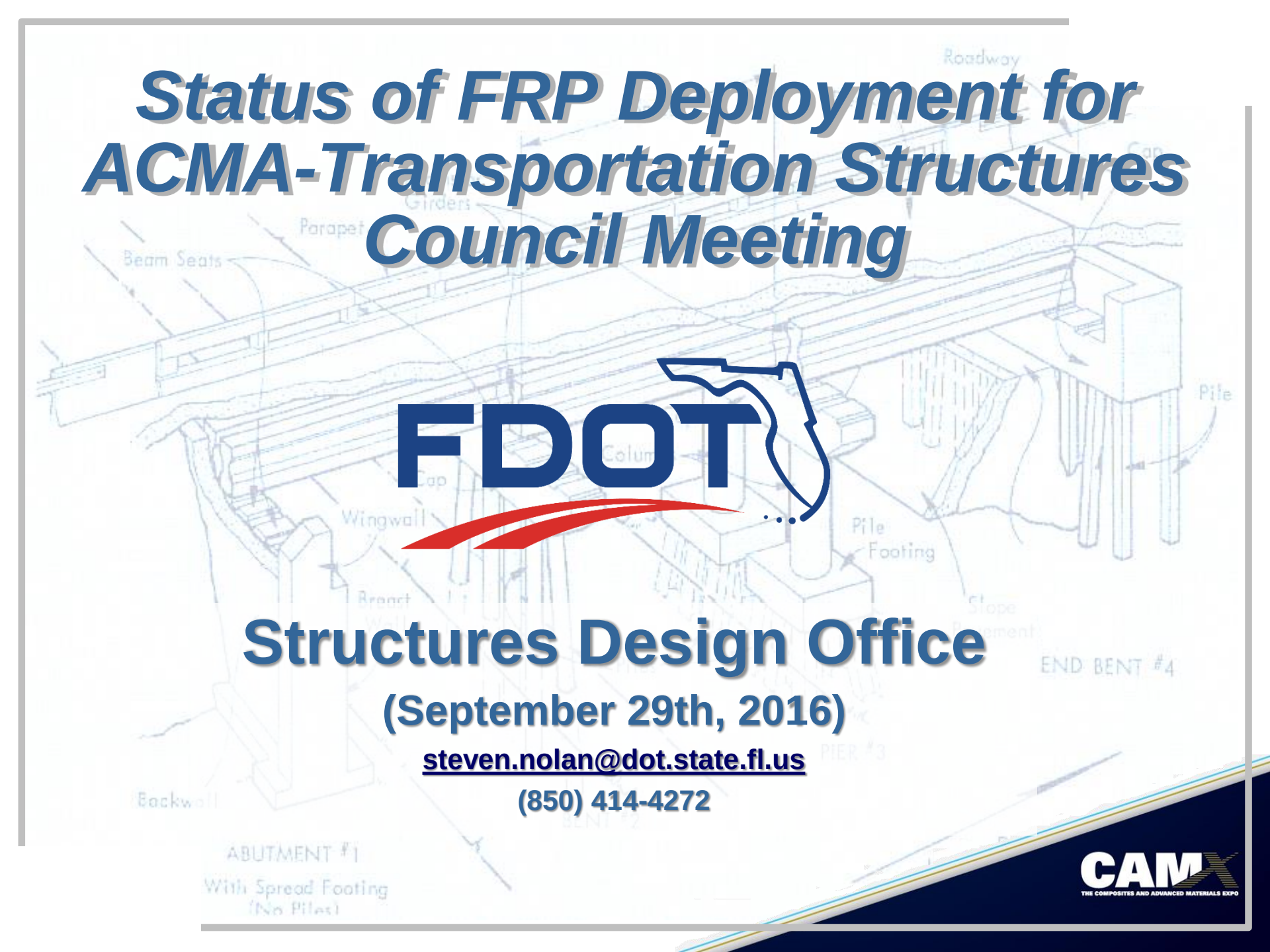
Status of FRP Deployment for ACMA-Transportation Structures Council Meeting



FDOT

Structures Design Office

(September 29th, 2016)

steven.nolan@dot.state.fl.us

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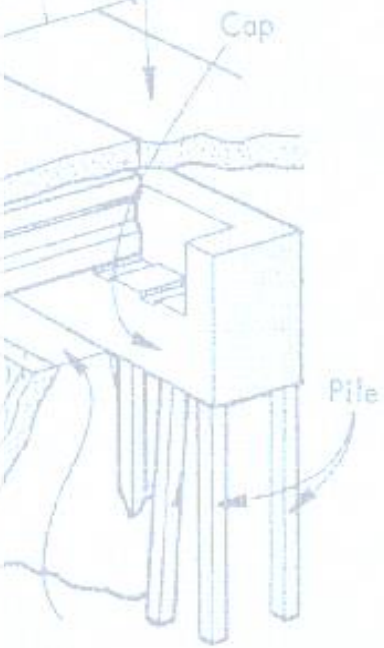
CAMX
THE COMPOSITES AND ADVANCED MATERIALS EXPO

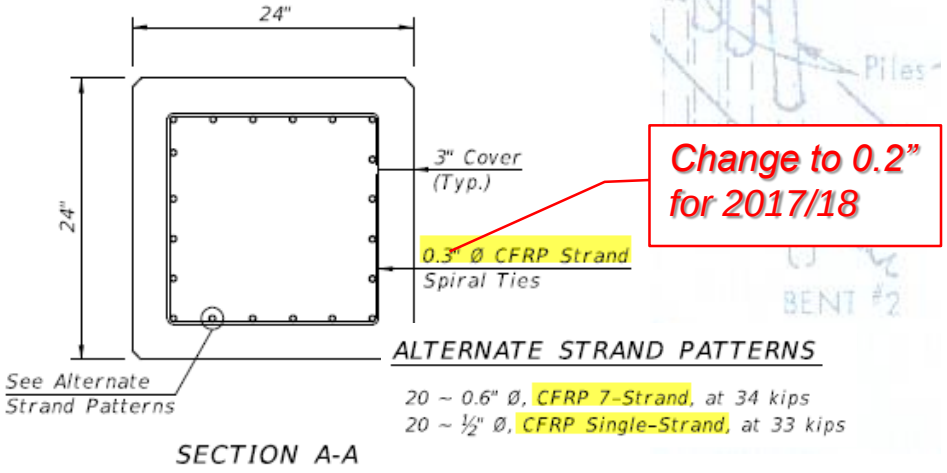
Outline:

- ***Design Standards***
- ***Developmental Design Standards***
- Halls River Bridge Replacement Demonstration Project
- Halls River Bridge FRP Workshop
- Other Projects
- Looking Ahead
- Tech Transfer
- Research
- AASHTO-T6

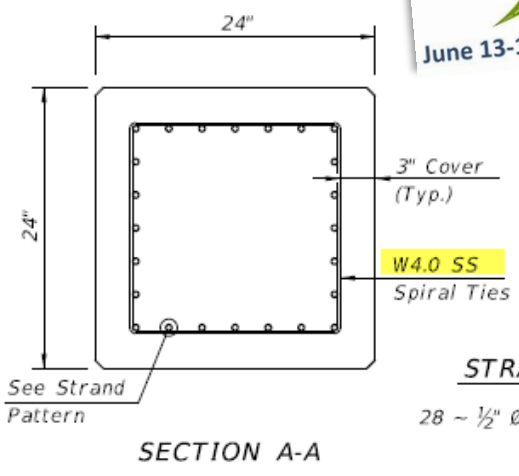


Design Standards: Prestressed Concrete Piles (with CFRP & SS)

- ***Indexes 22600, 20601, 22612, 22614, 22618, 22624, & 20630***
  - ✓ New corrosion resistant piling for intermediate bridge pile bents in Extremely Aggressive Environments (marine)
    - *see **Structures Design Bulletin 15-10** for more information and*
    - ***SDG** Table 3.5.1-1 for application.*
  - ✓ Carbon FRP strands (single or 7-strand) & spiral reinforcing or Stainless Steel strand (7-wire) and spiral reinforcing *(at contractor's/producer's option)*



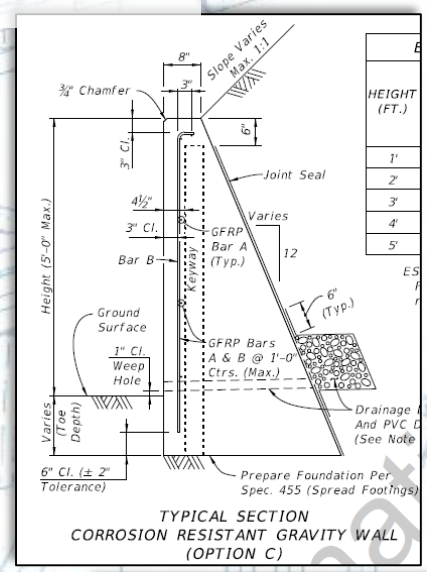
Change to 0.2" for 2017/18

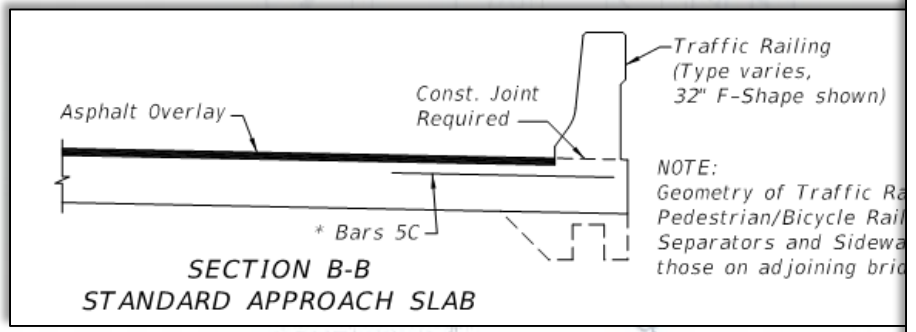


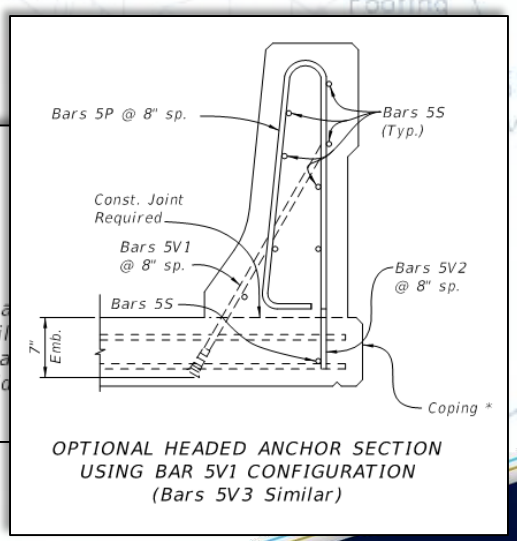
2016 Design Training EXPO
June 13-15, 2016 Daytona Beach, FL

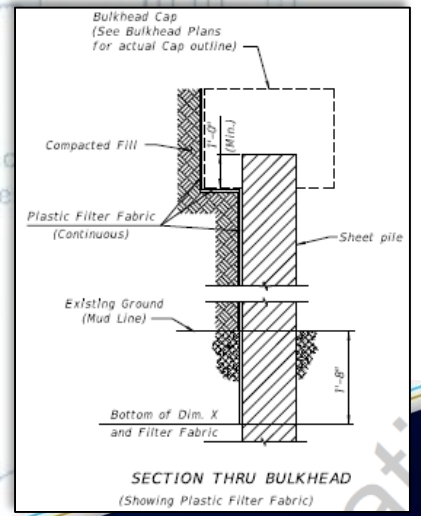
Recently Published FRP-RC ***DDS***'s

- ***Index D6011c:*** Gravity Wall – Option C (GFRP Reinforced)
- ***Index D22420 series:*** Traffic Railing (32" F Shape – GFRP Reinforced)
- ***Index D22440 series:*** Precast Concrete CFRP/GFRP Sheet Pile Wall
- ***Index D22900 series:*** Approach Slabs (GFRP Reinforced)

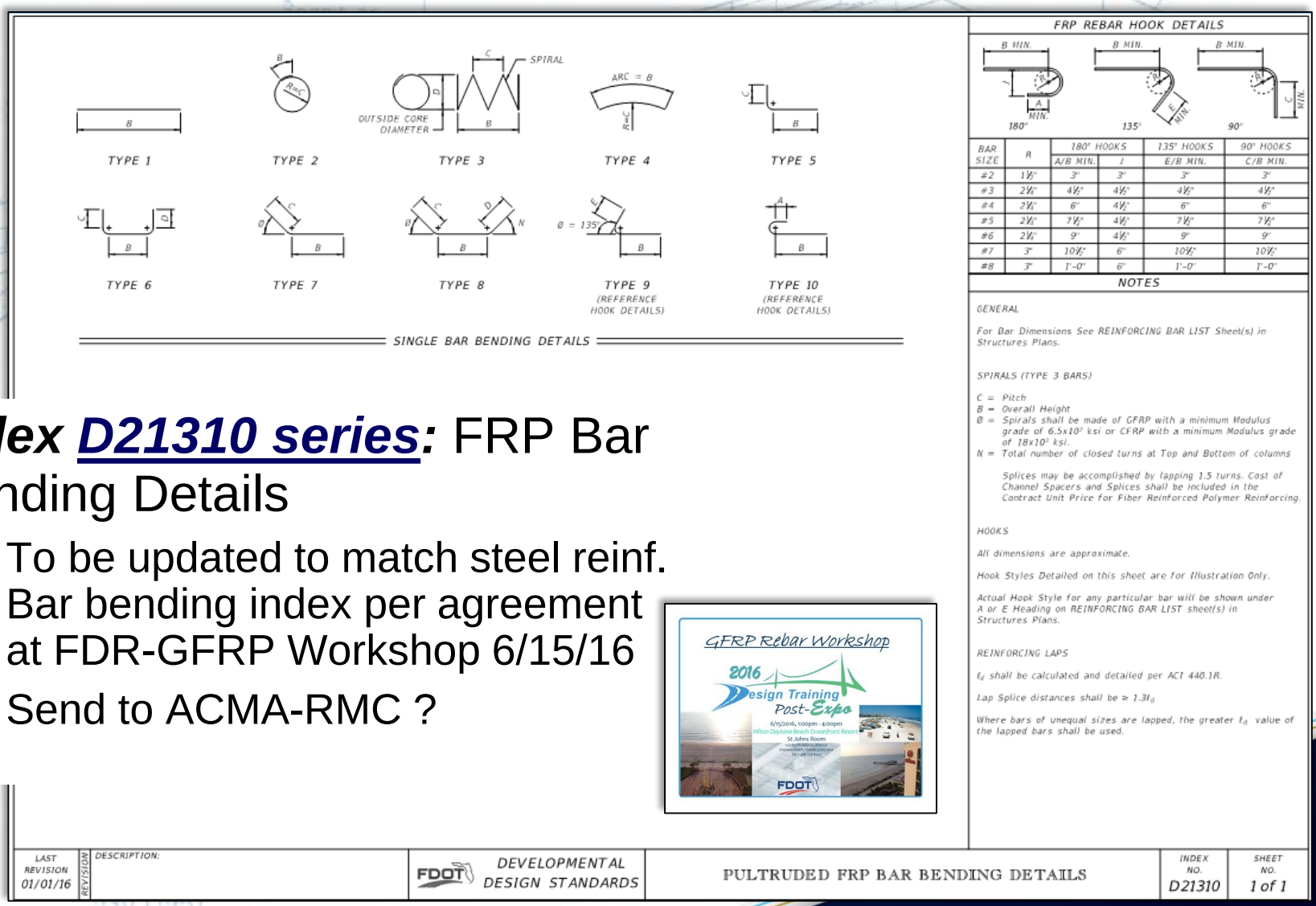








FRP-RC ***DDS***'s to be Revised…



- ***Index D21310 series:*** FRP Bar Bending Details
  - ✓ To be updated to match steel reinf. Bar bending index per agreement at FDR-GFRP Workshop 6/15/16
  - ✓ Send to ACMA-RMC ?

Halls River Bridge Replacement Demonstration Project

DDS's in this project:

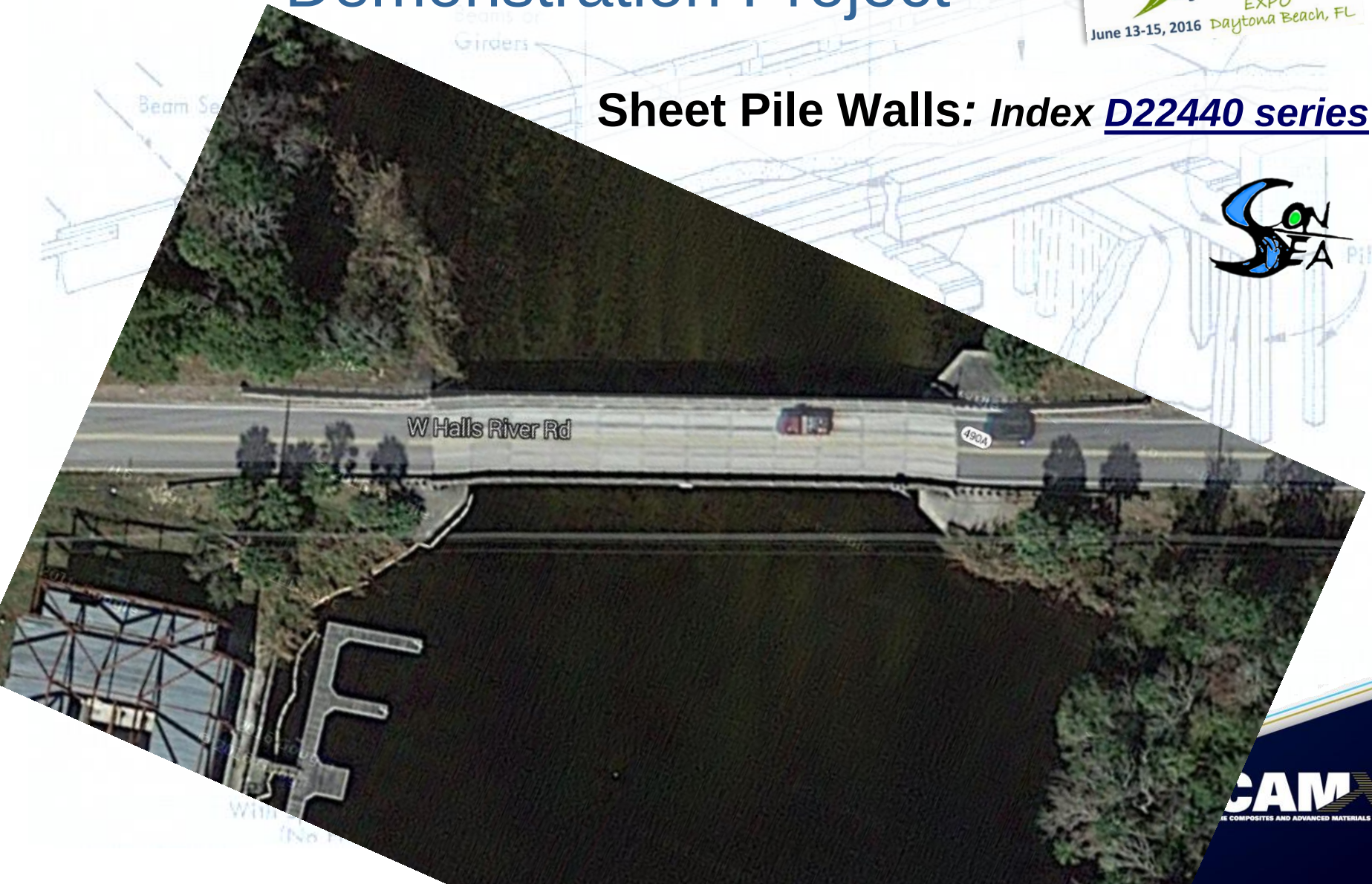
- ✓ ***Index D21310*** – FRP Bar Bending Details;
- ✓ ***Index D22420*** – GFRP reinforced 32" F-Shape Traffic Railing;
- ✓ ***Index D22440*** – Precast Concrete CFRP/GFRP Sheet Pile Wall:
  - CFRP strands 3.5" cover / GFRP Stirrups 3" cover (Type A).
  - Steel strands 5" cover / GFRP Stirrups 2" cover (Type H).
- ✓ ***Index D22618 series*** – 18" Square CFRP Prestressed Concrete Piles (no HSSS strand option);
- ✓ ***Index D22900*** – GFRP reinforced Approach Slab;

- Also includes:
  - ✓ Hybrid Composite Beams (superstructure)
  - ✓ GFRP-RC Bridge Deck and Pile Bent Caps

Halls River Bridge Replacement Demonstration Project

2016 Design Training EXPO
June 13-15, 2016 Daytona Beach, FL

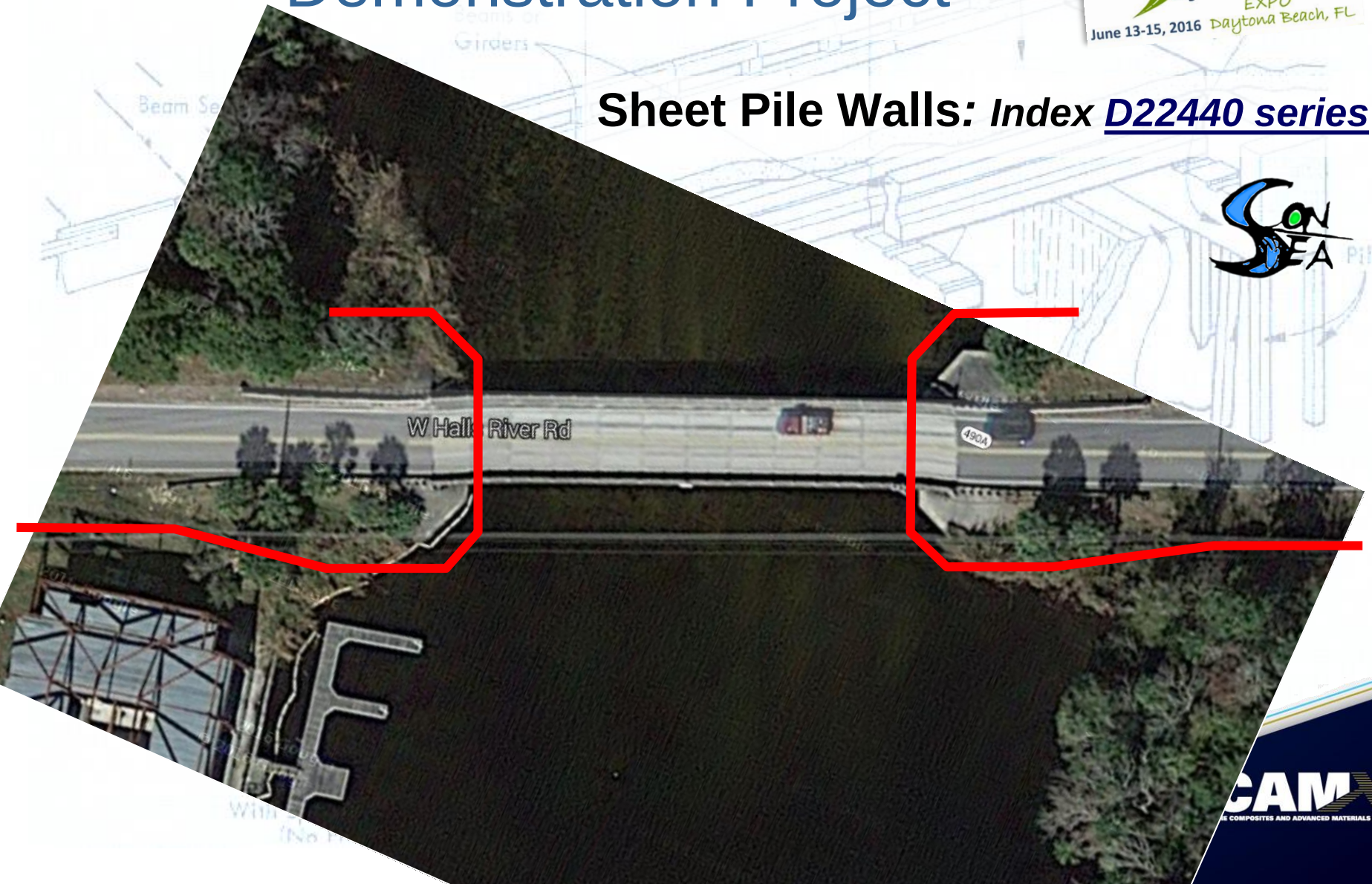
Sheet Pile Walls: *Index D22440 series*



Halls River Bridge Replacement Demonstration Project

2016 Design Training EXPO
June 13-15, 2016 Daytona Beach, FL

Sheet Pile Walls*: Index D22440 series*



Halls River Bridge Replacement Demonstration Project

2016 Design Training EXPO
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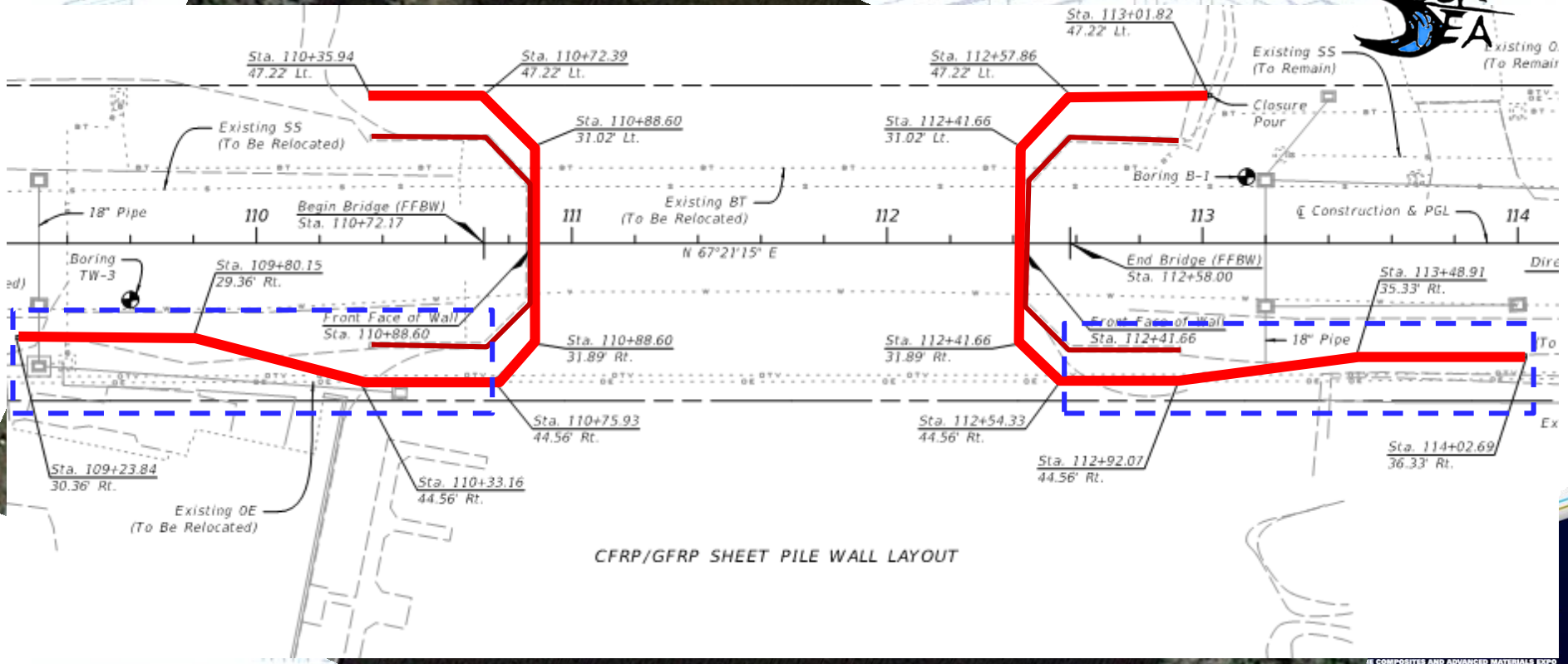
Sheet Pile Walls: *Index D22440 series*



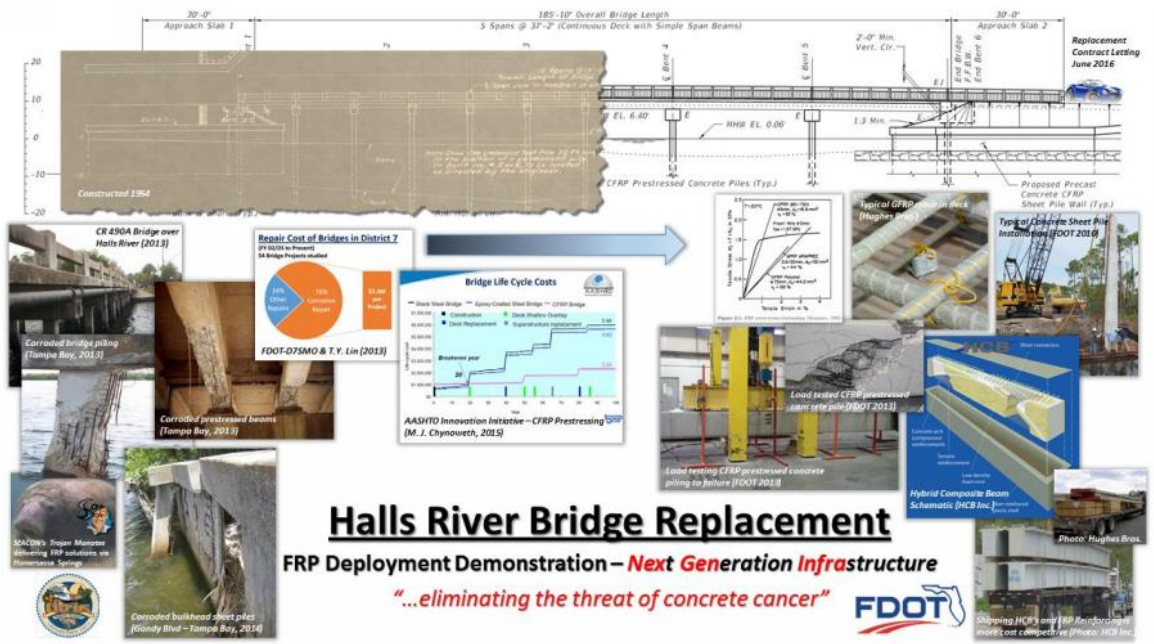
CFRP/GFRP SHEET PILE WALL LAYOUT

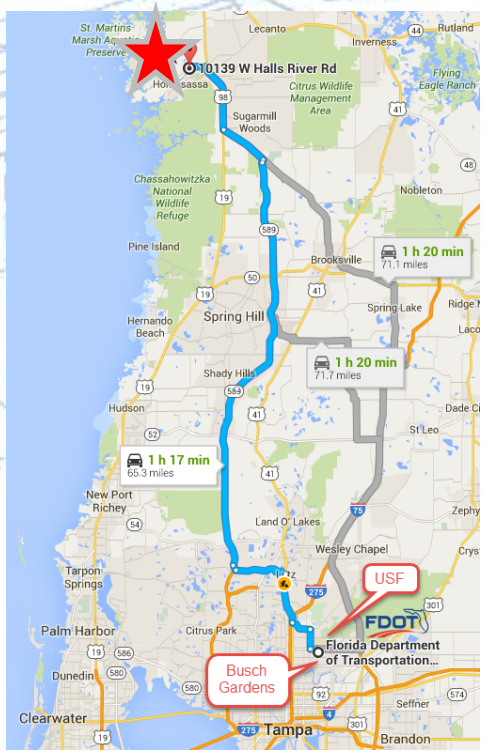
Halls River Bridge FRP Workshop

FDOT – Halls River Bridge FRP Workshop Outline *(Draft)*

Date: May 3rd - 4th 2017

Location: FDOT - District 7 HQ, *Auditorium*
11201 North Malcom McKinley Drive
Tampa, Florida 33612





PRELIMINARY AGENDA

5/3/2017 – Wednesday 1:00 pm to 5:00 pm, D7-HQ Presentations

http://www.dot.state.fl.us/structures/innovation/2017-HallsRiverFRPWorkshopOutline.pdf

(Possible webinar live streaming for wider participation?)

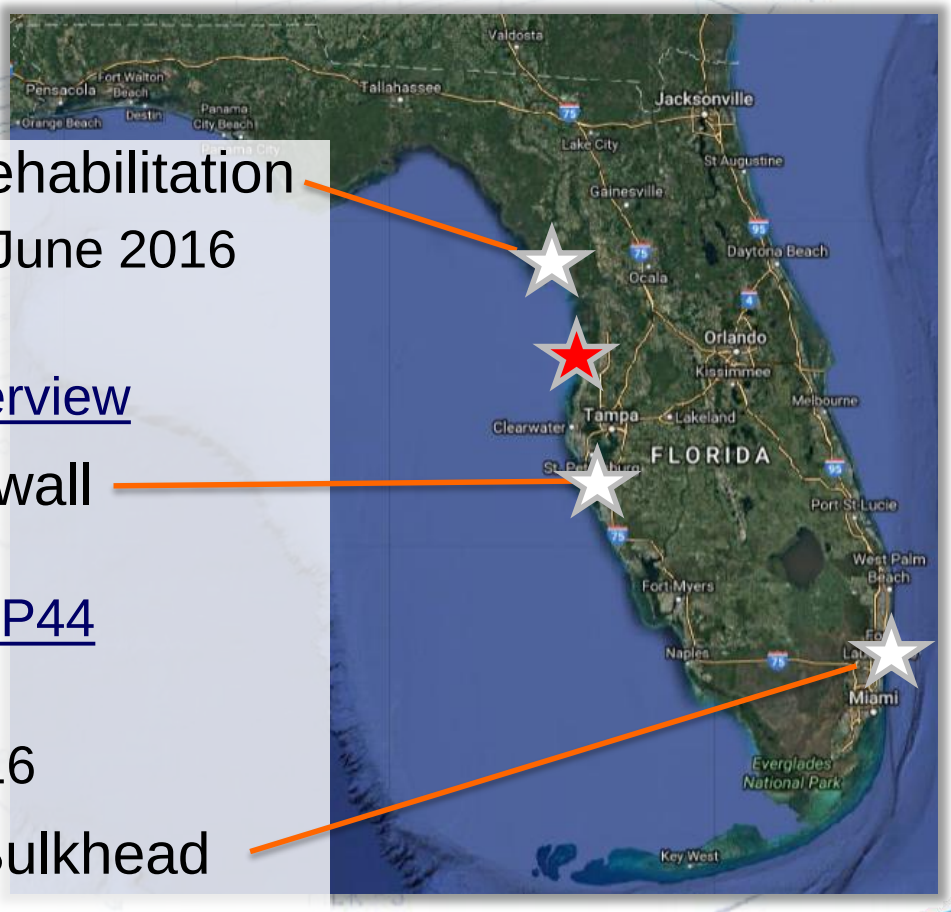
CAMX
THE COMPOSITES AND ADVANCED MATERIALS EXPO

Other Projects

i. Cedar Key SR24 Bulkhead Rehabilitation
   - Construction completed June 2016
   - (FPID 432194-1-52-01)
   - Construction Project Overview

ii. Skyway South Rest Area Seawall Rehabilitation
   - Design-Build contract E1P44
   - (FPID 438528-1-52-01)
   - Advertisement 04/11/2016

iii. Bakers Haulover Cut Bridge Bulkhead Rehabilitation
   - Letting 6/15/2016
   - (FPID 432194-1-52-01)

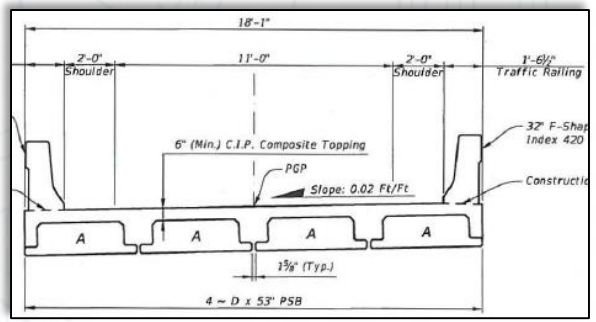


Looking Ahead

Future standards under consideration:

- ***Index D20700 series*** – Precast Intermediate Bent Cap;
  - GFRP Option in Mathcad Design Program

- ***Index D20450G series*** – FSB's with GFRP Stirrups:
  - Option 1 – 2.5" minimum cover to steel strands
  - Option 2 – 3.5" Minimum cover to steel strands
  - Option 3 – CFRP/SS strands 2.5" cover



- ***Index D22440 series*** – Non-Prestressed Concrete Sheet Piles – GFRP Reinforced (under analysis).

Technology Transfer (T^2)

NCHRP Report 768 (2014):

10 key components provide practitioners with a "roadmap" through a guided T^2 process:

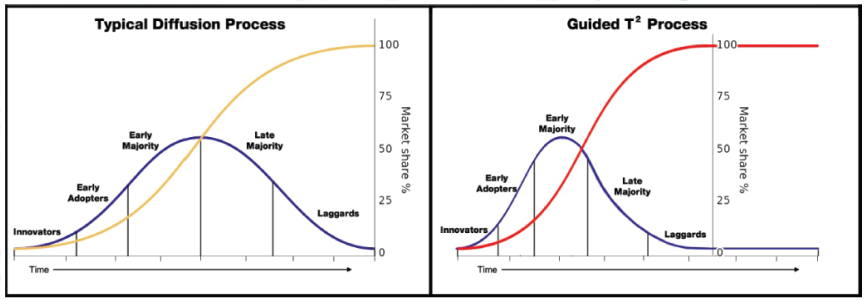
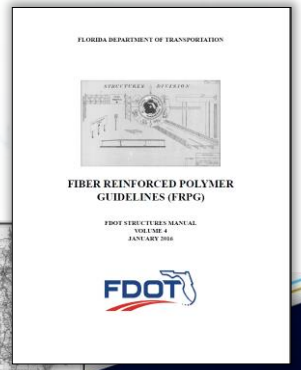


Figure 1-2. Conceptual representation of the intent of guided T².

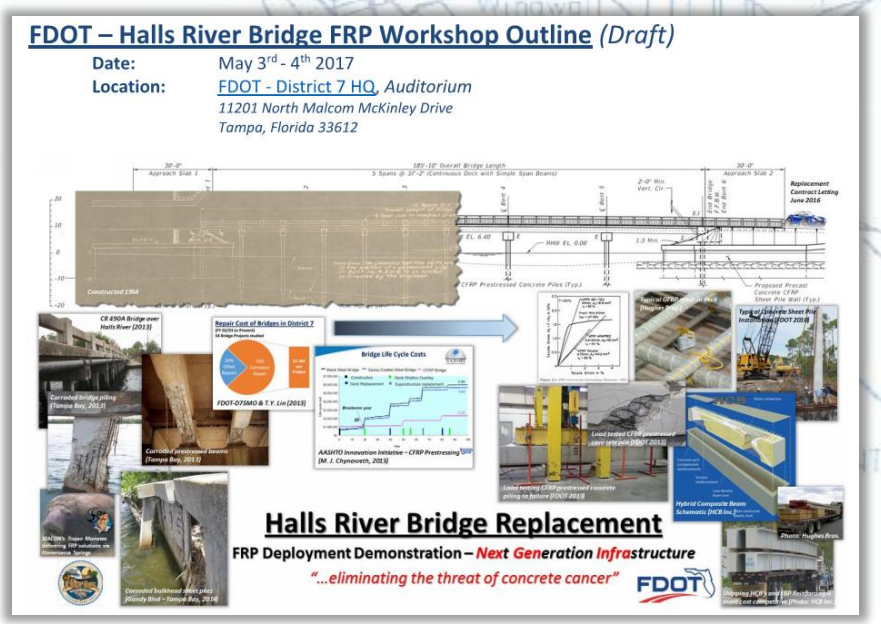
1. Address societal and legal issues;
2. Have an effective champion; (Rick Vallier-Structures / Chase Knight-Materials)
3. Engage decision makers;
   - FDOT-FHWA Corrosion-Resistant Rebar Seminar – 07/17/12;
   - FRP Rebar Industry-FDOT Workshop – 06/15/16;
   - ACMA-Transportation Structures Council - CAMX 9/29/16;
4. Develop a T^2 plan; (Developmental Design Standards Reports, Roadmap for FRP Deployment...)
5. Identify, inform, and engage stakeholders; (***Invitation to Innovation***, FDOT-SRC Research Update webinars, FDOT Design Training Expo, …)
6. Identify and secure resources; (***FRPG***, Developmental Specs. & ***DDS***)
7. Conduct demonstrations/showcases; (Halls River Bridge, Haulover Cut Rehab. - 2017)
8. Educate, inform, and provide technical assistance;
   - FTBA/FDOT Construction Conference - Feb. 2017;
   - Halls River Workshop – May 2017;
   - FDOT Design Expo – June 2017;
9. Evaluate progress; (***SEACON***, FDOT Monitoring Project 430021-1-62-03)
10. Reach [wider] deployment decision;

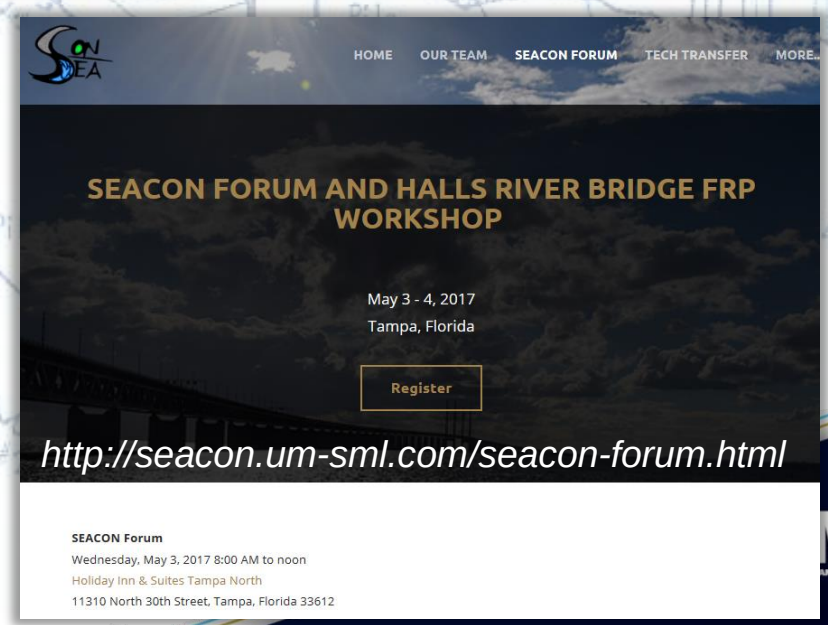
AASHTO Innovation Initiative



AMX SITES AND ADVANCED MATERIALS EXPO

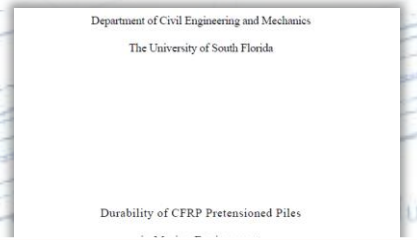
Technology Transfer Opportunities

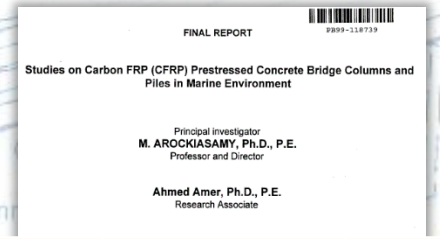


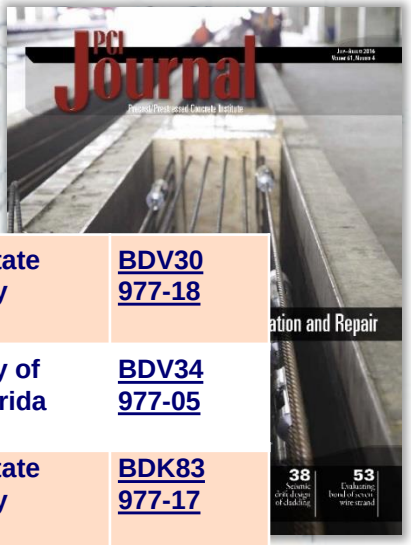


FDOT FRP-RC Research

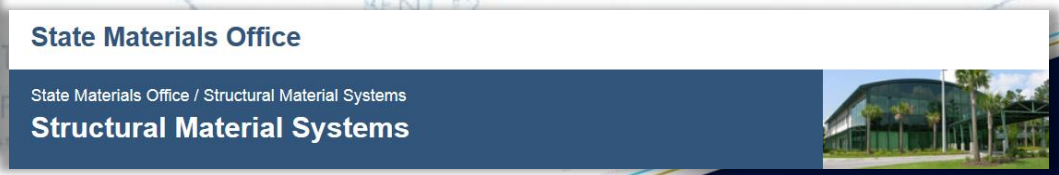
- Service Life Enhancement thru Durability:
  - ✓ The composites research at the SRC has been constant since the late 80's early 90's. Large focus initially was on repair and retrofit, and continues, but attention is now shifting towards new construction *(see examples below).*





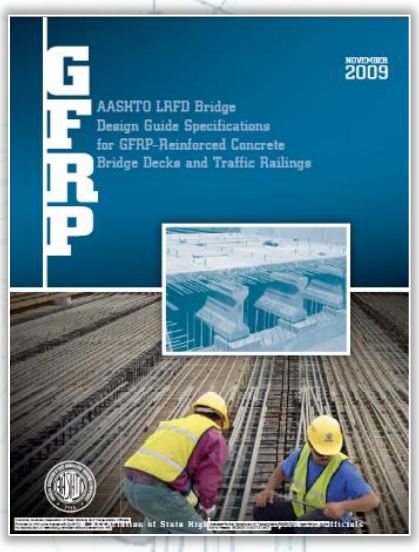


6/30/2018	Performance Evaluation of GFRP Reinforcing Bars Embedded in Concrete Under Aggressive Environments	R. Kampmann	Florida State University	BDV30 977-18
3/31/2018	Degradation Mechanisms and Service Life Estimation of FRP Concrete Reinforcements	A. El Safty	University of North Florida	BDV34 977-05
4/16/2014	Investigation of Carbon Fiber Composite Cables (CFCC) in Prestressed Concrete Piles	M. Roddenberry, P. Mtenga	Florida State University	BDK83 977-17
11/30/1998	Studies on Carbon FRP (CFRP) Prestressed Concrete Bridge Columns and Piles in Marine Environment	M Arockiasamy	Florida Atlantic University	B-9076
8/1/1995	Durability of CFRP Pretensioned Piles in Marine Environment Volume II	R. Sen	University of South Florida	0510642



AASHTO-SCOBS T6 subcommittee

- Update of GFRP Guide Specification
  - ✓ White Paper circulated by Dr. Nanni
- T-6 is currently working on a strategic plan (the primary objective is to support the overall AASHTO SCOBS strategic plan)
- Discussion that the CFRP pretensioning will be getting ready for ballot as a separate Guide Specification.
- NCHRP Research
  - ✓ NCHRP 20-68A Domestic Scan 13-03 – Best Practices in FRP Composites (O'Connor, University of Buffalo) *should be published very soon.*
  - ✓ NCHRP 47-12 (Synthesis) – Use of FRP in Transportation Infrastructure (Dr. Kim, University of Colorado)
  - ✓ NCHRP 12-97 – Guide Specification for the Design of Concrete Bridge Beams Prestressed with CFRP Systems (Dr. Belarbi – University of Houston)
- AASHTO Innovative Initiative (A.I.I.)
  - ✓ Method of Promoting Innovation/Usage (CFRP pre- and post-tensioning currently listed)



Questions ?

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