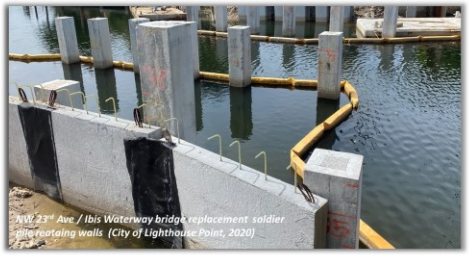
2020 FDOT-FRP Industry 4th RC/PC Workshop

August 4th, 2020

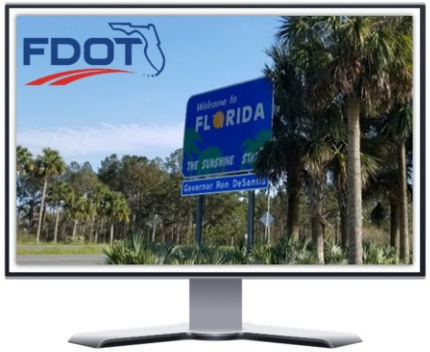
GoToMeeting

Workshop Outline

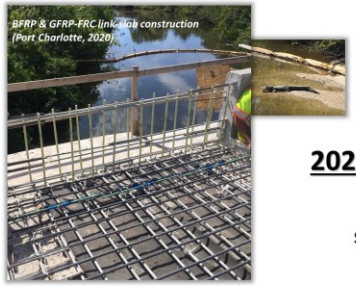


Guiding Principles & Goals

- **S**tewardship
- **C**onfidence
- **C**ompetence
- **C**onsistency
- **C**odification



Previous Participants/Collaborators



2020 FDOT-FRP Rebar Industry 4th Workshop

(online)

Safe Deployment of FRP-RC/PC for Structural Reinforcement of

** August 4, 2020 (9:30am-2:30pm EDT) **

2020 FDOT FRP-RC /PC Workshop – Part B

GoToMeeting (for remote Attendees)

4th FDOT/FRP Industry Reinforced/Prestressed Concrete Workshop (Part A)
Tue, Aug 4, 2020 9:30 AM - 12:00 PM (EDT)
https://global.gotomeeting.com/join/360067229

You can also dial in using your phone. United States: +1 (786) 535-3211
Access Code: 360-067-229

4th FDOT/FRP Industry Reinforced/Prestressed Concrete Workshop (Part B)
Tue, Aug 4, 2020 1:15 PM - 2:45 PM (EDT)
https://global.gotomeeting.com/join/412187349

You can also dial in using your phone. United States: +1 (872) 240-3412
Access Code: 412-187-349

Agenda - Part B

1:15 - 2:15pm FRP Industry Discussion - Strategic Workplan Items and Roadmap Planning
(moderated session)

a. Endurance Limits, Characteristic Curves and Testing (***Strategic Workplan*** Items #1 & #2)
b. Refine FDOT Workplan Priorities for expanded FRP deployment opportunities –
c. Review remaining ***Strategic Workplan*** items:
   3. ~~**Increasing Material Property Qualification Thresholds and Design Limits**~~ **(see Part A)**
   4. **Establishing Consistency**
   5. **Cost Estimating**
      1. OC initiative for ACMA FRP-RMC
      2. FDOT SDG Chapter 9 update
   6. **Bar Bends**
      1. Complex Shapes
      2. FDOT Index D21310
   7. **Minimum Bar Sizes for Design Elements**
   8. **Life-Cycle Cost Guidance**
   9. **Minimum Concrete Class**
   10. **Shear Resistance**
d. Synergies with ***AASHTO COBS T-6*** Strategic Plan to accelerate progress
e. ***EDC-6*** (2021-2022) Any potential for FRP-RC?
f. Establish how FRP Manufacturing Industry can effectively contribute to advancing efforts (a & b)

2:15 - 2:30pm Future Workshops and Action Items *(Nolan)*

a. Action Item Summary
b. Future Workshop opportunities and suggestions:
   i. 5th FDOT-FRP RC/PC Industry Workshop (dates & location/delivery format)
   ii. FRP-RC/PC Designer Training *(August 2020)*
   iii. 3rd International Workshop on FRP-RC, University of Sherbrooke *(August 2021)*
   iv. TRB 2020 Workshop ABK10/AFF80 *(January 2022)*

c. Closing Statements

FRP Industry Discussion - *Strategic Workplan* Items and Roadmap Planning

a. Endurance Limits, Characteristic Curves and Testing *(SW#1 & #2)*

Discussion Points

- Research Needs Statement available at TRB webpage: https://rns.trb.org/details/dproject.aspx?n=41501
- Highlight to DOT owners the importance of supporting this RNS to AASHTO reps.
- FRP rebar fatigue performance may be better than steel, but design provisions for cyclically loaded structures should support this
- Creep rupture refinement of design limits is likely a high priority

FRP Industry Discussion - *Strategic Workplan* Items and Roadmap Planning

b. Refine FDOT Workplan Priorities for expanded FRP deployment opportunities

Discussion Points

- No changes to priorities proposed

FRP Industry Discussion – Reviewing Remaining ***Strategic Workplan*** Items (c)

3. Increasing Material Property Qualification Thresholds and Design Limits

Discussion Points

- See **Part A** discussion

FRP Industry Discussion – Reviewing Remaining ***Strategic Workplan*** Items (c)

4. Establishing Consistency

Discussion Points

- No discussion, but designer training being offered by FDOT on August 10th and September 9th.

FRP Industry Discussion – Reviewing Remaining ***Strategic Workplan*** Items (c)

5. Cost Estimating
   i. OC initiative for ACMA FRP-RMC
   ii. FDOT ***SDG*** Chapter 9 update

Discussion Points

- Small project unit rates are very high due to the project level testing cost included in the unit rates per FDOT specifications.

FRP Industry Discussion – Reviewing Remaining ***Strategic Workplan*** Items (c)

6. Bar Bends
   i. Complex Shapes

   ii. FDOT current ***Index D21310*** is moving to ***Index 455-010*** (FY 2021)

Discussion Points

- Support standardizing the bar bends and maybe coding system proposed by DG.
- BM: do DOTs include additional "stock bars" to avoid unforeseen shortage and resulting delays – SN: no, the actual plan quantity is provided in the plans and paid at that quantity unless there are overruns or field changes required.

FRP Industry Discussion – Reviewing Remaining ***Strategic Workplan*** Items (c)

7. Minimum Bar Sizes for Design Elements

Discussion Points

- SN: #3 bars may be more efficient than #4 or #5 especially for crack control when closer spacing is used. Traditional design practice has discarded the use of #3's partially due to the easy of damage/bending during installation, but FRP has twice the strength of yielding a steel bar, and will deflect under loading, so this may not be a major concern.
- Additional support points may be needed for walking surfaces.

FRP Industry Discussion – Reviewing Remaining ***Strategic Workplan*** Items (c)

8. Life-Cycle Cost Guidance

Discussion Points

- SN: A Bridge Development Report (BDR) stage proposal has been development by FDOT-SDO for extremely aggressive environments. This will be distributed to ACMA-FRC rebar council *(JB: for distribution)* for review and comment.

FRP Industry Discussion – Reviewing Remaining ***Strategic Workplan*** Items (c)

9. Minimum Concrete Class

Discussion Points

- SN: This concept may not be worth pursuing since the higher strength concrete has a higher modulus of elasticity and increased shear contribution. These both combine to improve the efficiency of the GFRP reinforcing and reduce quantities.
- May still be relevant for bridge FDOT deck concrete to allow use of Class II instead of Class IV to minimize the chances of shrinkage cracking resulting from higher cement contents.

FRP Industry Discussion – Reviewing Remaining ***Strategic Workplan*** Items (c)

10. Shear Resistance

Discussion Points

- SN: Current AASHTO/ACI 440 simplified methods are very conservative, given the transverse rebar strain limits of 0.4% for GFRP design ~ 30 ksi. High strength rebar (100 ksi) has a higher strain limit at yield?
- BB: CSA does not allow the use of the simplified method for GFRP-RC, must use the general method.

FRP Industry Discussion – Roadmap Planning

d. Synergies with ***AASHTO COBS T-6*** Strategic Plan to accelerate progress

Discussion Points

- Not discussed by there are opportunities.

FRP Industry Discussion – Roadmap Planning

e. ***FHWA EDC-6*** (2021-2022) proposals closed on January 21, 2020.

Any potential for FRP-RC/PC for ***EDC-7***?

Discussion Points

- Consider this collectively and coordinate for a refined resubmittal of the EDC-5 proposal.
- Address FHWA concerns expressed to T-6 chair regarding inspection, coding and load rating issues.

FRP Industry Discussion – Roadmap Planning

e. (cont.)
FRP-RC/PC for ***EDC-7***?

Discussion Points

FHWA's EDC-5 proposal concerns:

- How do we inspect it?
- How do we maintain it?
- How do we load rate it?
- How do we repair it?
- In short, the engineering is the easy part. The difficult part?...training the appropriate personnel:
- To identify when variations in construction practice will have a detrimental effect on performance and how to respond appropriately
- To know what to look for during an inspection and associating an appropriate level of reaction to the findings
- How to consider the deterioration of the material or a change in the material properties over time on a load rating
- When a repair is needed and how to do it
- How to identify when the useful service life is approaching

FRP Industry Discussion – Roadmap Planning

f. Establish how FRP manufacturing industry can immediately contribute to advancing efforts for:
   a) Endurance Limits
   b) Expanded Deployment Opportunities

Discussion Points

- Continue collaborative engagement using TRB, CAMX, ACI, BEI events.

Future Workshops and Action Items

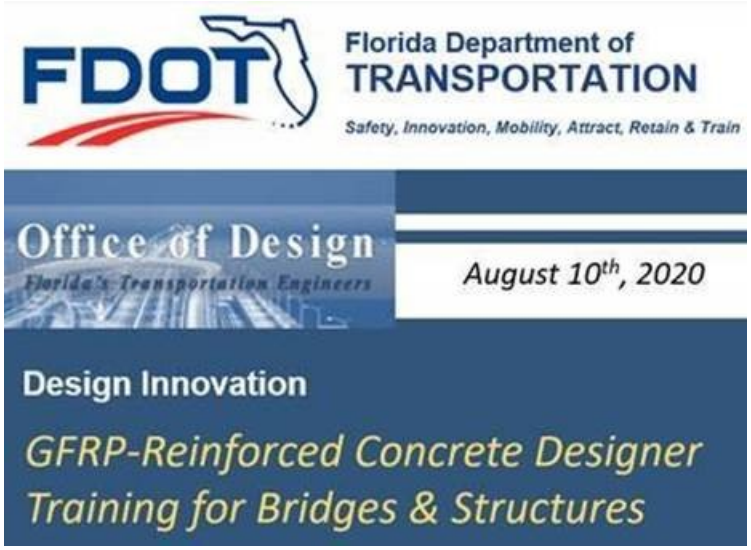
a. Action Item Summary

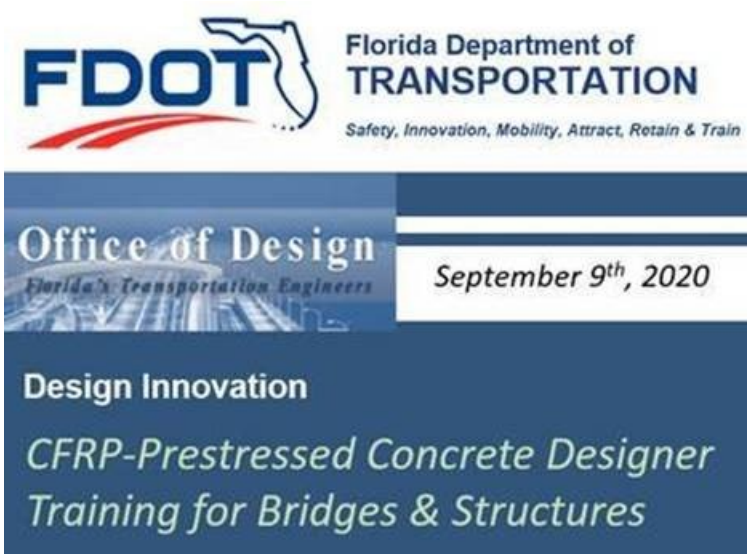
1. *Nolan to distribute internal Spec 932-3 proposal for GFRP bars (probably less than #9) to increase mechanical properties with Ef = 8.7 ksi and corresponding strength increase ~ 125-145 ksi. Bent bars would be Ef = 7250 ksi. The follow up with Industry formal review in a few months*
2. *Nolan to distribute FRP Rebar Bending Standards (Index 415-010) to Gremel;*
3. *Gremel to provide draft language to Nolan;*
4. *FDOT Rebar Program for building FRP Rebar list in Plans (similar to steel) is in development for end of 2020. Nolan will distribute to Busel for Industry review when ready.*
5. *All: Feedback on the format for future Workshop (online vs. face-to-face)*
6. *Presentations to be collated and distributed to attendees and uploaded to FRP-Design Innovation webpage under the Technology Transfer Section: https://www.fdot.gov/structures/innovation/FRP.shtm#link7*

Future Workshops and Action Items

FDOT GFRP-RC Designer Training for Bridges & Structures (August 10, 2020) - Webinar Registration Link

FDOT CFRP-PC Designer Training for Bridges & Structures (September 9, 2020) - Webinar Registration Link





Future Workshops and Action Items

a. Action Item Summary

b. Future Workshop opportunities and suggestions:

i. 5th **FDOT**-FRP RC/PC Industry Workshop (dates & location/delivery format) - *TBD*

ii. **FDOT** FRP-RC/PC Designer Training *(Aug & Sept 2020)*

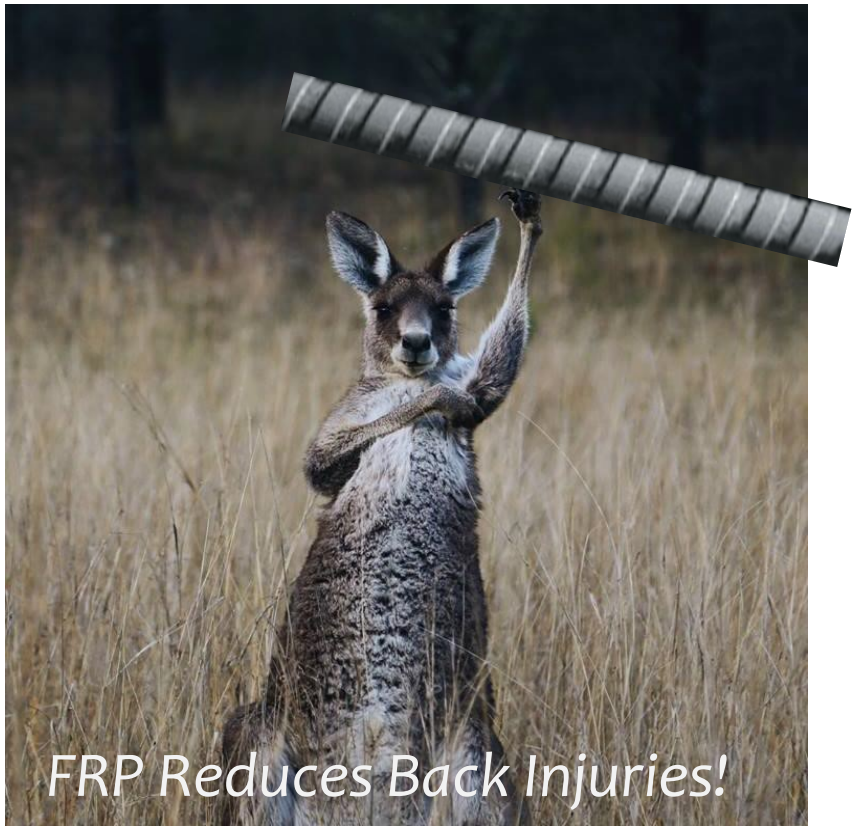
iii. **TRB** webinar proposed *"Advanced Structural Materials - FRP Implementation Successes & Needs"* on behalf of Standing Committee AKB10 & AKB30 *(Winter 2020 ?)*

iv. **3rd International Workshop on FRP Bars in Concrete Structures**, University of Sherbrooke *(August 2021)* *preceding http://acmbs2020.ca/*

v. TRBAM 2022 Workshop? ABK10/AFF80 *(January 2022)*

c. Closing Statements

Adjourn - Thanks for tuning in !



NO text.

NO call.

NOTHING

is worth losing a life over.

PUT IT DOWN

IT'S THE LAW

Put It Down!!