

Request for Research Funding for FY 2022-2023

SPR Subpart B Project: STR-23-02

Requesting Office	CO Structures	Priority	2 of 4
Proposed Title	Fiber-Reinforced Concrete Traffic Railings, Phase II		
Justification	<p>FRC provides enhanced shrinkage control, ductility and toughness over conventional steel reinforced concrete. Use of FRC for slip-formed concrete traffic railings could reduce construction costs by eliminating second stage reinforcing and allow immediate slip forming after deck curing.</p> <p>The Fiber-Reinforced Concrete Traffic Railings for Impact Loading (BDV31 977-72) project was recently completed. During the project, the PI evaluated the impact performance of FRC traffic railings with an FRC mix design developed during the project. The research, from a structural perspective, performed very well based on comparisons to conventional traffic railings. The casting of the test specimens for the Phase I project was performed with conventional forming means and not slip forming. The fiber addition to the ready-mix concrete was performed using a lab mixer and not within the ready-mix truck. The FRC mix design, however, was developed with slip forming in mind.</p> <p>The objective of this research is to evaluate the slip forming methodology with the developed mix design using a ready-mix company for the whole mixing operation. It would be planned to coordinate with an existing FDOT construction project that is using a slip forming machine and cast some mockup traffic railings using the developed mix design. The constructability and fiber dispersion would be evaluated based on the outcome of the mockup(s).</p>		
Impact	<p>This outcome of this proposed research would be to significantly reduce the amount of conventional reinforcement in the current standardized traffic railing. The reinforcement extending from the deck would be maintained, although the length or placement may be modified. All other tied reinforcement would be eliminated, with fiber reinforcement used instead. This will result in reduced cost and improved appearance of traffic railings due to smaller crack sizes and less staining. There will be less potential for geometric conflicts when utility conduits and pullboxes are present. There will also be less potential for geometric conflicts with installation of anchor bolts for attaching railings and signs.</p>		
Affected Offices	CO Structures (Joshua Turley, Andre Pavlov), CO Roadway (Derwood Sheppard)		
Existing Work	<p>ACI Committee 544 (2008). <i>Guide for Specifying, Proportioning, and Production of Fiber-Reinforced Concrete</i>. ACI544.3R-08, ACI Committee 544 Report, ACI: Farmington Hills, MI, USA.</p> <p>Wang, K., Shah, S. P., and Voigt, T. (2008). <i>Self-Consolidating Concrete for Slip-Form Construction: Properties and Test Methods</i>. Proceedings of Advances in Civil Engineering Materials—The 50-Year Teach and Research Anniversary of Professor Sun Wei, pp. 161-172.</p> <p>Zayed, T., Sharifi, M. R., Baci, S., and Amer, M. (2008). <i>Slip-Form Application to Concrete Structures</i>. Journal of Construction Engineering and Management, 134 (3), pp. 157-168.</p>		
Keywords Used In Existing Work Search (Cannot leave blank)	fiber-reinforced concrete slip form, fiber-reinforced concrete traffic railing		
Related Contracts (Give contract numbers)	<p>BDV31-977-72, Fiber-Reinforced Concrete Traffic Railings for Impact Loading</p> <p>BDV31-977-110, Development of GFRP Reinforced Single Slope Bridge Rail</p>		
Funding Request	\$300,000	Anticipated Duration	3 years
Project Manager	Christina Freeman	Contracting Method	Direct contract with university (UF)
Equipment	N/A		

Urgency	2	This project scored second in a rating of research ideas by FDOT's Central and District Structures Design Offices.
Implementability	2	With the success of phase 1 of the Fiber-Reinforced Concrete Traffic Railings project, this project has high likelihood for implementation. Barriers to implementation would be any difficulties encountered during construction with development of the fiber-reinforced concrete mix which can be used with a slip forming machine.
<p>Project Benefits (Succinct, complete explanation)</p> <p>If successful, implementation of this idea will result in substantially reduced tied reinforcement for bridge traffic railings. That will result in faster construction schedules and associated safety improvements.</p>		
Project Benefits (Select all that apply and explain)	Quantifiable Benefits (units, dollars, etc...if applicable)	Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits
<input type="radio"/> Materials Enhancement		
<input type="radio"/> Materials Savings		
<input type="radio"/> Time Savings		There will be less time required at construction sites for tying the reinforcing bar for railings. Therefore, time savings are expected which will positively impact project schedules and the traveling public.
<input type="radio"/> Lives Saved/Injuries Prevented		Improved safety is associated with faster construction.
<input type="radio"/> Other (Explain)		There should be cost reductions due to the elimination of most of the upper reinforcing.

*Comments should explain and support urgency, financial benefit, and implementability scores