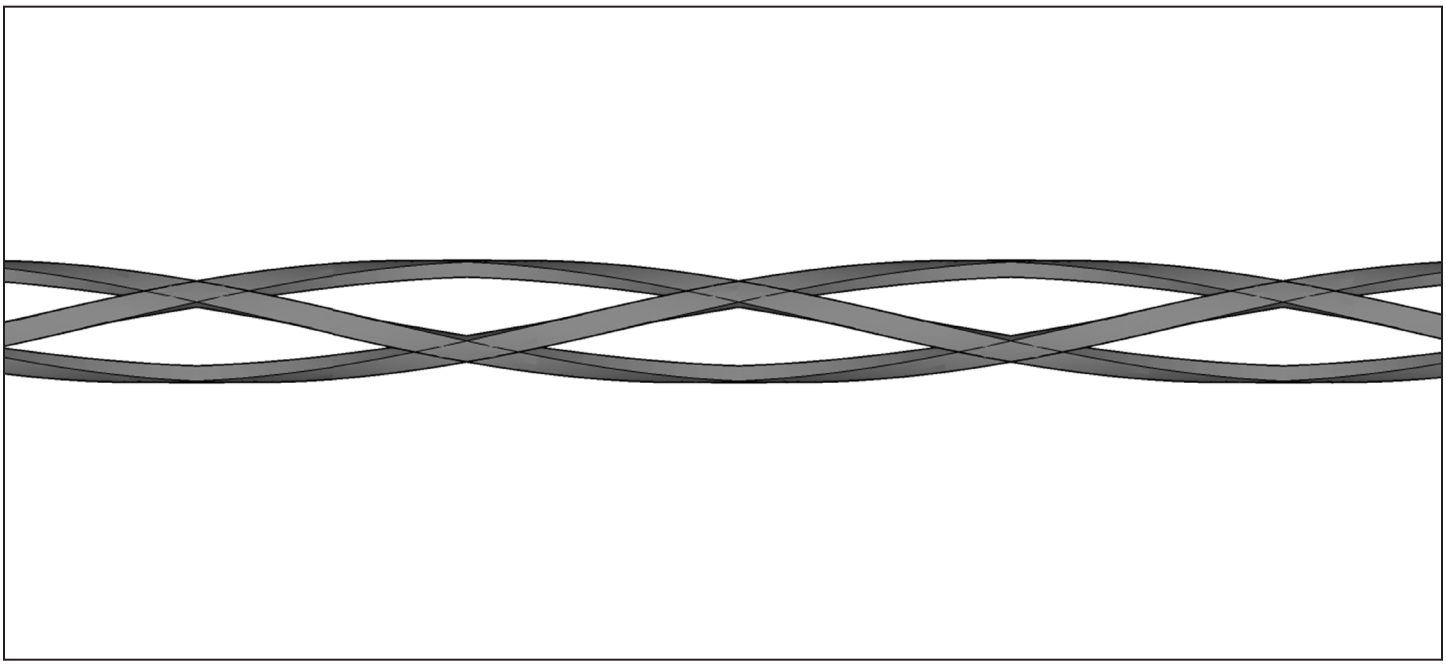
MOUNTAIN-PLAINS CONSORTIUM

PROJECT BRIEF | MPC 16-304 | January 2016

Evaluation of New Reactive FRP Reinforcement Assemblies for Reinforced Concrete Transportation Structures



the ISSUE

Corrosion of steel rebar is the leading source of deterioration of concrete transportation structures. Fiber reinforced polymer composites (FRP) are potentially a more durable alternative, but the unique properties of FRP mean that simply replacing steel bar with FRP bar may not realize the full benefits of FRP.

the RESEARCH

In this exploratory study, two alternative reinforcement geometries were designed, fabricated and tested in small concrete beams. The alternative reinforcements made use of helical and wave geometries intended to induce compression in the neighboring concrete when the FRP reinforcement experienced tension due to flexural loading. The testing compared the performance of the beams with the alternative FRP reinforcement geometries to beams with straight FRP bars of approximately equal cross-sectional area.

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A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

Colorado State University
North Dakota State University
South Dakota State University
University of Colorado Denver
University of Denver
University of Utah
Utah State University
University of Wyoming

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Project Title

Evaluation of New Reactive FRP Reinforcement Assemblies for Reinforced Concrete Transportation Structures

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the FINDINGS

The conclusions are limited by the small sample size and weaker-than-desired concrete in the beams. The wave style of reinforcement was found to be ineffective due to the tight dimensions of the wave. However, the helical reinforcement geometries showed comparable, and perhaps enhanced, flexural and shear performance when compared to the beams with straight FRP bars. The helical geometries also did not show the pull-out failure of the reinforcement, and since they were assembled as a unit, they were simpler to place in the beams and could lead to savings in construction time.

the IMPACT

This project contributes to a body of research seeking the best ways to take advantage of FRP to enhance the longevity of transportation infrastructure. By exploring alternatives that are distinct from the classic straight bar used for steel reinforcement, we may find ways that take better advantage of the unique properties of FRP and reduce or eliminate the drawbacks of FRP reinforcement such as its lower bond strength and brittle nature.

For more information on this project, download the entire report at http://www.ugpti.org/resources/reports/details.php?id=841

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7938 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.