MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 17-325 (project 456) | June 2017

Performance of Steel Girders Repaired with Advanced Composite Sheets in a Corrosive Environment

the ISSUE

The aging of constructed civil structures is an emerging problem. The research discusses a state-of-the-art repair method to enhance the longevity of deteriorated steel bridges. The report also includes practical design recommendations.

the RESEARCH

Corrosion damage to steel girders is one of the most significant problems affecting the service life of existing bridges. The application of carbon fiber reinforced polymer (CFRP) composites to repair damaged steel girders is a promising technique offering an attractive alternative to conventional repair methods (e.g., steel-plating). The performance of CFRP-repaired girders controls the longevity of the superstructure system. A technically unknown issue is the propagation mechanism of corrosion damage in CFRP-repaired steel girders and their performance with respect to the degree of corrosion. The proposed research addresses this scientific challenge through a multi-physics approach in conjunction with chemical kinetics and mechanical bond degradation. The research will also fulfill the need of bridge engineers who want to adopt the state-of-the-art repair technique.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

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

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North Dakota State University
South Dakota State University
University of Colorado Denver
University of Denver
University of Utah
Utah State University
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Project Title

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the **FINDINGS**

The consequences of corrosion damage are physically and chemically characterized, including electric potential, mass loss, corrosion current density, corrosion rate, load-carrying capacity, interfacial strain development, failure mode, and infrared spectroscopy. Design recommendations are proposed to facilitate the use of CFRP-strengthening techniques based on the fact that the accelerated test protocol reasonably represented the deterioration mechanism of constructed steel bridges, which is a typical assumption in durability research, and thus the model is intended to guide practitioners rather than to accurately quantify the extent of corrosion damage.

the **IMPACT**

This research provides new experimental data required to understand the corrosion-induced deterioration mechanism of CFRP-strengthened steel girders and suggests design guidelines for practitioners. The approaches used influence multiple disciplines such as corrosion science, structural engineering, chemistry, and interface physics.

For more information on this project, download the entire report at http://www.ugpti.org/resources/reports/details.php?id=876

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.