MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-570 (project 580) | October 2024

Implementation of Precast Concrete Segments for Electrified Roadway

the ISSUE

Maintaining a sufficient charge during travel duration along with the time required to recharge the vehicle are major concerns for electric vehicle (EV) owners. This project focuses on in-motion, inductive power transfer (IPT) embedded in roadways to ensure charge duration and replace stationary charging units for EVs. To develop full-scale embedded IPT systems, researchers must learn how to best construct the precast concrete panels that will be used and understand how they will perform under loading and environmental stresses.

the RESEARCH

This research focused on the constructability and performance of a dynamic wireless charging system embedded in precast concrete panels. Full-sized concrete panels were constructed, embedded with electrical coils, and subjected to two testing phases. The testing included 1) thermal testing and 2) repeated cyclic loads and statically applied loads. Following the studies, finite element models were created. Modeling and analysis were performed using commercially available ANSYS software.

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
University of Wyoming

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Project Title

Implementation of Precast Concrete Segments for Electrified Roadway

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Owens-Corning Infrastructure Solutions

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the FINDINGS

- The thermal strains in the concrete for one or two hours of continuous coil operation did not cause observable damage to the structure.
- Steel rebar reinforcement, located under the inductive coils, caused increased power losses because the metal interfered with the IPT system.
- From the experiment, Panel 1 (reinforced with glass fiber reinforced polymer) had a flexural load capacity of 51,500 lbs., while Panel 2 (steel rebar) had a capacity of 43,700 lbs. There was a 15% difference. The modeling and experimental results agreed.
- Regarding the crack pattern, the GFRP panel performed well under the applied load by gradually distributing the concrete cracking at the tension face.

the IMPACT

This research was some of the earliest near full-scale testing performed on concrete panels. The combination of thermal testing and mechanical testing made this study time consuming and potentially useful for further research.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1232

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.