Research Project Name: Development and Deployment of Titanium Alloy Bars for Strengthening and Cathodic Protection of Corrosion Damaged Transportation Infrastructure

Improving the Durability and Extending the Life of Transportation Infrastructure

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Project Partners:
Perryman Company, Houston, PA

Research Project Funding:
Federal: 120,000. Match: 120,000. OSU

Project Start Date: 10/1/2023 Project End Date: 5/31/2025

Project Description:

This project will develop and demonstrate a new concept for strengthening and preserving corrosion-damaged coastal transportation infrastructure. A system of titanium alloy bars (TiABs) combined with a surface coating and bonding system will be developed. The TiABs provide immediate strengthening and then are integrated into an impressed current cathodic protection system to provide long-term durability of corrosion-damaged reinforced concrete structures. This multi-functional material application is novel for civil infrastructure applications. The research will develop a mixed metal oxide (MMO) coating for the TiABs that will enable them to be used effectively in an ICCP system over long timescales. No prior MMO system has been used at the scale required for civil infrastructure. The system will be demonstrated on conventional reinforced concrete beams and on AASHTO Type III prestressed concrete girders that were widely used in past bridge applications. These members, when located in environments subjected to salt intrusion such as in coastal environments are susceptible to corrosion and resulting loss of strength. Results will be a field applicable system with design guidelines for allowing implementation into rehabilitation and preservation practices.

(**US DOT Priorities:** The proposed project supports the following *US DOT strategic goals* and *research priorities*: *Safety* – by making transportation infrastructure safer for all people using Data-Driven Systems to strengthen and preserve existing surface transportation infrastructure; *Economic Strength and Global Competitiveness* – by creating and preserving *Resilient Supply Chains* reliant on existing infrastructure*;* and *Transformation* **-** by creating a *New and Novel Technology* for materials that can be deployed to serve everyone today and in decades to come.

Outputs: The results of this work will include new materials and methods for surface treatment of titanium alloy bars so that they can be used to both strengthen deficient and corroded infrastructure and function as the anode in a cathodic protection system to ensure long-term functionality and durability of the system. The products will include the development of proprietary materials and processes for the surface coating system. The work will include partnerships with material suppliers, surface treatment producers, designers from engineering firms, and state transportation agencies.
Outcomes/Impacts: The work will develop a new product for rehabilitation of infrastructure (titanium alloy bars compatible with impressed current cathodic protection systems (ICCP)). The new surface coating materials and processes would warrant patents. The system would provide a novel system for engineers to change current practices whereby strengthening and ICCP are treated as separate actions rather than integrated. Implementation of the system can both strengthen and preserve transportation infrastructure assets across the country that are subjected to corrosion induced deterioration.
Final Research Report: URL to final Report will be provided upon completion.