

Corrosion management system of regional reinforced concrete (RC) bridges

Development of a methodology for characterization, monitoring and controlling corrosion in reinforced concrete (RC) bridges

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Our approach involves corrosion characterization in laboratory scale RC samples, quantification of damage based on different corrosion conditions with different corrosion control technologies, and integration of proposed models of the environmental conditions effect on corrosion of RC. Finally, a methodology is included for assessing the component performance and reliability following the performance observed and characterized for different control actions. The corrosion assessment models include deterministic approach and localized probabilistic approach strategies in a system management tool for use by owner agencies in addressing vulnerable structures in aggressive environments. The proposed research consists of three technical tasks and implementations task. The final goal is to validate the methodology with the proposed tools for monitoring and modeling for the corrosion assessment

The main goal of this research is to develop a comprehensive and effective management system of corrosion-damaged RC structural elements. The management system will encompass several components: (i) model, characterization and methodologies for conducting corrosion assessment as well as in-depth corrosion control characterization for both uniform and local corrosion processes, (ii) methodologies for monitoring the component performance following the repair or control action, (iii) experiment-based and data driven probabilistic models of corroding RC structures.

Status Update

The preliminary framework is based on corrosion assessment by considering the damage evolution as the main threat. The loss of capacity is considered to be attributed mainly to corrosion in this corrosion management set of steps. A flow diagram is proposed to follow up with the implementation and further research in this topic. The proposed framework can be converted in a procedure or methodology including the laboratory characterization (Figure1).

Background

Civil infrastructure assets, including buildings, transportation networks, energy grids and networks, and water-sewer systems, are critical functional components of day to day life activity in a modern society. The durability and reliability of these civil infrastructures are largely affected by corrosion-induced structural deterioration. In addition to continual use and increasing traffic demands, natural environmental conditions set degradation due to corrosion damage as a critical condition to durable and reliable infrastructures. Therefore, in order to improve the durability of the bridge infrastructures affected by corrosion in the most efficient manor, we propose a procedure/methodology to manage integrity of corroding RC bridges which is resulted by corrosion assessment by assuming different initial RC systems (including control actions).



Figure 1. laboratory experiments

The initial plan included a visit to perform monitoring of several parameters that will help to validate the current proposed model and also the performance of different bridges. **Figure 2** shows the bridge containing Galvanized rebar as a reinforcement.

Project Summary



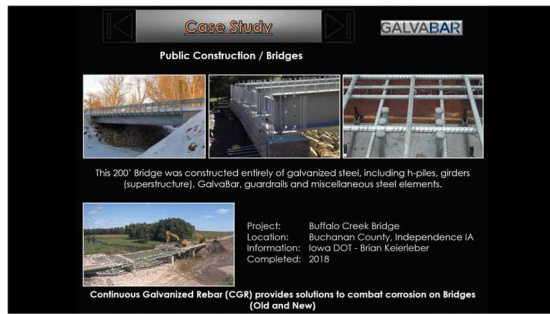


Figure 2. Field demonstration

Impacts

This concept is in response to the deterioration of concrete infrastructure due to reinforcing steel corrosion that has been recognized for several decades as a major technical and economic challenge in the United States and around the world. The durability of these infrastructure assets are negatively affected by corrosion-induced deterioration. In addition to increasing traffic demands, natural environmental conditions cause degradation due to corrosion damage as a critical barrier to durable and reliable concrete structures. Therefore, in order to improve the durability of the bridge components affected by corrosive environments in the most efficient manor, we propose to develop a procedure to manage corrosion RC bridges. It is apparent that Departments of Transportation (DOTs) can benefit greatly from a research project to develop an effective management system for corrosion damaged reinforced concrete bridge element, such as columns.

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

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