



# RESEARCH PROJECT CAPSULE [ 12-3C ]

September 2012

TECHNOLOGY TRANSFER PROGRAM

## Investigation of Best Practices for Maintenance of Concrete Bridge Railings

### JUST THE FACTS:

*Start Date:*  
July 1, 2012

*Duration:*  
12 months

*End Date:*  
June 30, 2013

*Funding:*  
State

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Sponsored jointly by the Louisiana  
Department of Transportation and  
Development and Louisiana State  
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### POINTS OF INTEREST:

*Problem Addressed / Objective of  
Research / Methodology Used  
Implementation Potential*

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### PROBLEM

Mildew growth and darkening of concrete bridge railings and structures have negative impacts on their aesthetic value and durability. Darkening and stains are created by growth of biofilms such as algae, cyanobacteria, and fungi. As fungi grow, the metabolic process produces pigments staining the concrete. Furthermore, several species of fungi or bacteria excrete organic acids, degrading the concrete. These organic acids produce calcium complexes, which can separate from the concrete matrix, reducing the material weight, the porosity, and the permeability of the structure. In addition, concrete, which has a high roughness and macro-porosity, also has a high bio-receptivity. The environmental conditions near bridge railings and structures, such as dampness, warmth, sunlight, and carbon from vehicle pollution, are ideal for microorganism colonization and growth. Other researchers reported that the use of highly-absorptive low durability coarse aggregates should be avoided in Portland Cement Concrete (PCC) for bridge railing applications.

Cleaning and maintenance of concrete bridge railings is costly, dangerous, and must compete with limited funds, which are being stressed by increasing demand from high bridge deterioration rates, and increased traffic loads. A maintenance workforce in Louisiana has recently started to pressure-wash bridge railings but this process is costly, tedious, and dangerous due to lane closure and traffic control. Unfortunately, without preventive strategies, this process must be repeated regularly as the microbial communities responsible for the mildew easily grow back. As a result, many preventive strategies are on the market and being developed to reduce the bio-receptivity of concrete or biological activity. These strategies include water repellants, biocides, and mixtures of the two. The use of a coating with hydrophobic properties, such as titanium dioxide (TiO<sub>2</sub>), may also allow the concrete surface to self-clean in the presence of rain. Therefore, a comprehensive review of best practices employed or evaluated by highway agencies to maintain bridge railings or to enhance the resistance of concrete structures to mildew growth is critically needed. This review should include both mechanical and chemical methods.

### OBJECTIVE

The primary objective of this research is to conduct a comprehensive review of research projects and to survey the best practices employed or evaluated for cleaning and maintaining concrete bridge railings and structures. The goal of this review is to identify possible preventive maintenance or construction materials that will enhance the resistance of these structures to mildew growth and, in turn, reducing labor, costs, and traveling time delays. Based on this review, the research team will identify and summarize current cleaning methods, predicted cleaning schedules, and preventive measures to rehabilitate and preserve these structures. This review will serve as a baseline for future research projects on this topic as identified by the results of the synthesis.

## METHODOLOGY

This project will require the collection of data from a variety of sources including agencies' guidelines on bridge railings maintenance and preservation procedures, completed and on-going research, contractors, available products, and experience of bridge maintenance engineers or inspectors. The research team will thoroughly review existing literature, guidelines, and specifications adopted by state agencies in order to determine the best practices for concrete bridge railings maintenance and preventive procedures.

## IMPLEMENTATION POTENTIAL

The results of this research can be applied to the maintenance and preservation of concrete bridge railings in Louisiana. The findings will be reported as the advantages and disadvantages of different technologies currently being used. This research will impact the state of practice currently adopted by the Department to maintain and preserve bridge railings. The knowledge generated from this research will be disseminated and transferred to the industry through a mid-year meeting with the Project Review Committee and preparation of a synthesis that documents the results of the review. This review will serve as a base line for future research projects on this topic, as identified by the results of the synthesis.