



Transportation Consortium of South Central States

Key Points

Project Number:

18CNMSU01

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Funds Requested to UTC:

\$90,000

Funding Source(s):

Tran-SET

New Mexico State University

Total Project Cost:

\$198,000

UHPC Shear Keys in Concrete Bridge Superstructures

Brief Project Description

This study will develop technology and procedures that will allow ultra-high performance concrete (UHPC) produced with local materials to be used in shear keys between precast concrete girders in bridge superstructures.

Problem Statement

Shear keys are used between bridge superstructure elements to provide load transfer from one girder to an adjacent girder. Shear keys are produced by forming recessed keys into the sides of precast girders so that when the girders are placed on site, the recessed areas in adjacent girders align to form a void that can be grouted full to achieve interlock between the girders. In service, shear keys often deteriorate in a manner that starts with loss of bond between the grout and the superstructure elements. Once bond is lost, water can seep into the previously bonded area and cause degradation through freezing and thawing, leaching, or other mechanisms.

Repair of deteriorated shear keys requires chipping open portions of the shear key and removal of the original grouting material. New grout should be introduced in a manner that successfully re-seals the joint by establishing a strong bond with the girders. While new construction and rehabilitation projects generally utilize non-shrink grout mixtures, this study will investigate the use of ultra-high performance concrete (UHPC) produced with local materials to fill shear keys between girders. UHPC has been shown to have exceptional durability and strength properties that have the potential to greatly extend the service lives of shear keys in bridge superstructures.

Objectives

This study consists of a comprehensive literature review to identify best practices for traditional grouting materials that might also be used for UHPC grouts to ensure a strong durable bond between the UHPC and the substrate material. It is crucial that this bond be able to withstand stresses and deformation caused by shrinkage of the UHPC, thermal expansion and contraction of the grout material, and movements caused by loads applied to the bridge. Laboratory experiments will be conducted to verify that the



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practices identified are effective at maintaining the bond between a UHPC grout and precast, pre-stressed girders. Design recommendations (a user's manual) for field implementation of the technology will also be developed.

Intended Implementation of Research

In addition to the technical aspects of this study, efforts will be made to address education, outreach, workforce development, and technology transfer. To address these issues, the following tasks will also be performed:

- Presenting the findings at national conferences, such as TRB, and publication in archival journals to provide the most lasting impact of the research.
- Presenting the findings at regional conferences that might be co-hosted by Tran- SET or institutions affiliated with Tran-SET.
- Publication of the bi-annual and final reports on Tran-SET's archival website.
- Development and dissemination of presentation slides that can be used for education or workforce development activities.
- Meetings with personnel from the Research Bureau and the Bridge Design Bureau of New Mexico DOT (NMDOT).
- Incorporating the research results into regular course offerings at New Mexico State University (such as capstone design courses) to ensure that graduates have state of the art knowledge in their field.

Anticipated Impacts/Benefits of Implementation

This project is expected to produce meaningful contributions by developing new technology that facilitates use of UHPC in shear keys between superstructure elements. This technology has the potential to increase durability of both new and rehabilitated shear keys and reduce lifetime maintenance costs for bridges.

Weblinks:

<http://transet.lsu.edu/research/research-in-progress/>

<https://rip.trb.org/View/1505432>