

Flexural Strength and Fatigue of Steel Fiber Reinforced Concrete

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Problem

Since the construction of the Luling Bridge in St. Charles Parish in 1983, various wearing surface systems for its orthotropic steel deck have been studied and constructed. This experimentation has shown that asphalt systems have a short service life of about 10 years.

A 4-inch concrete test section was installed in 1999 using steel reinforced concrete, and, although the concrete has developed some cracks, it is still serviceable. This fall, a thinner concrete deck without steel reinforcing bars will be constructed using

high-performance concrete and steel fibers.

LTRC's Concrete Testing Laboratory has conducted some preliminary testing to verify the proposed steel fiber reinforced concrete (SFRC) mixture designs to be used in the new test section of the Luling Bridge. However, these tests have been limited to flexural strength and chloride ion penetration.

Objective

This research will serve as a support study for the Luling Bridge



SFRC application on the Luling Bridge deck (9/26/2004)

deck test section (State Project No. 450-37-0020) by evaluating the proposed SFRC mixture. Researchers will document the properties and performance of this material for future projects.

Additionally, LTRC personnel will monitor a demonstration of maturity meters that an outside testing facility will install in this concrete deck. LTRC will compare the testing facility's data with results from their own research.

Description

After a detailed literature review, researchers will design the test factorial and prepare the SFRC test samples. The construction project's concrete supplier will provide the concrete. The samples will then be tested for flexure strength, flexural toughness, freeze/thaw resistance, compressive strength, and concrete abrasion resistance. Cyclic load testing will further evaluate the SFRC's performance.

Using statistical methods, researchers will analyze the test results to monitor any variation between samples and batches. These methods will include, but are not limited to, those recommended by the *ACI Manual of Concrete Practice 214R: Evaluation of Strength Test Results of Concrete*.

Implementation Potential

Because this study will provide a better understanding of SFRC performance and behavior, DOTD can use these results to make more informed decisions in selecting the final wearing surface material for the Luling Bridge and future test sections.

Furthermore, this study's findings can aid in the selection of bridge deck materials for future bridge designs. SFRC could also be used in other applications like pavement overlays and prestressed members, among others. In addition, these research results could also form the basis for the development of SFRC testing procedures for the DOTD's QC/QA program.