Research Project

06-2ST

Capsule

LTRC

Technology Transfer Program

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Elimination of Deck Joints Using a Corrosion-Resistant FRP Approach

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LTRC

Louisiana Transportation Research Center

Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

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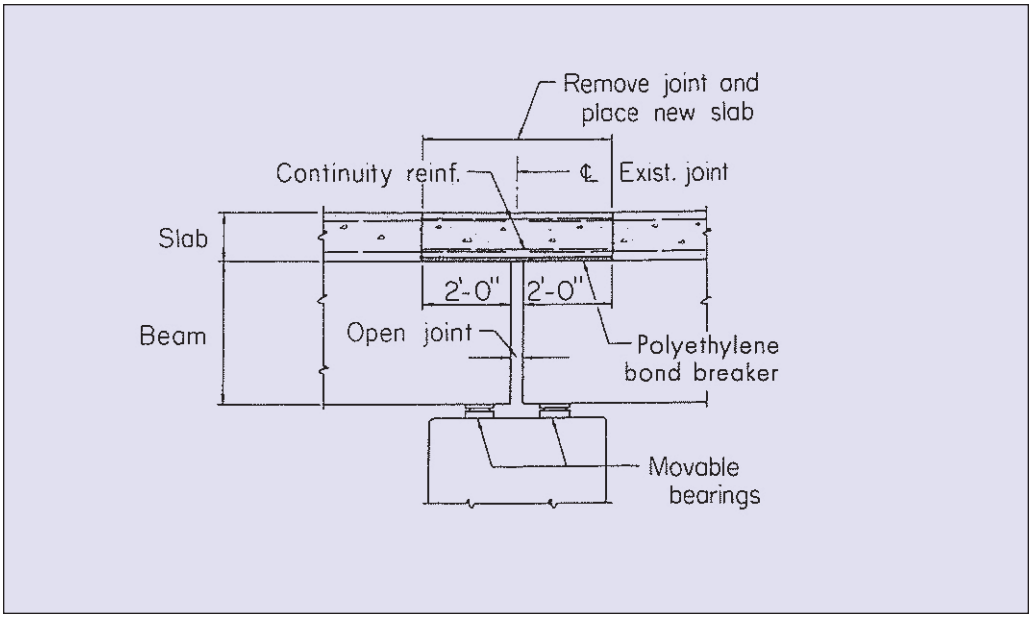
Problem

Many of the thousands of bridges in this country are constructed as simple spans. This construction system requires the use of expansion joints over piers. These are known to create short- and long-term problems including debris accumulation that prevents the joints from functioning properly, and leaks (water and chemicals) that lead to the deterioration of the supporting girders, and, in many cases, the piers. These problems, and others, lead to massive direct and indirect costs. The former is related to bridge maintenance while the latter pertains to drivers' vehicles. Therefore, the number of expansion joints over bridge piers needs to be reduced, or totally eliminated.

Objectives

The objective of this research is to develop and evaluate a new technique using the advancements in materials and current technology. This new technique will eliminate joints in bridge decks without changing the design of the bridge. Expansion joints will be replaced by a link slab that joins decks of adjacent spans without imposing any continuity in the bridge girders. The link slab will be subjected



Conversion of simple spans to continuous spans

to tensile forces due to the negative moment that is developed at the location of the joint. FRP reinforcement will be used to carry the tension forces. FRP reinforcement is chosen because of its corrosion resistance, which has been proven superior to steel reinforcement.

Description

First, a literature review will examine ongoing research and other states' current practices for eliminating bridge deck joints.

Next, the findings of this review will be used to develop a detail for the elimination of deck expansion joints over piers. The detailed plan will introduce both the new system and an instrumentation plan for such a system. The proposed research will evaluate the effects of shrinkage and temperature on the new system. Researchers will perform analytical and experimental studies to determine the effects of bond, embedment length, and abrasion resistance on the new system. Structural capacity testing will also be performed.

After the researchers submit detailed plans for the new system to the Project Review Committee, they will implement the system in the field. DOTD's Bridge Maintenance section will select the structure and number of joints. The researchers will perform the material tests on the FRP products to confirm the manufacturers' characteristics and properties. An instrumentation system will be designed and installed to measure strain, temperature change, and temperature gradient in the link slab, and stress and failure in the FRP grid. The information gathered from monitoring/testing will then be used to calibrate the calculation model to improve the prediction.

The researchers will collect and analyze the data from the new system. Then they will conduct an engineering economic analysis to quantify the advantages of the new system using the life-cycle cost analysis. The evaluation will be based on the reduced structural damage, improved ride quality, and enhanced structural durability.

Implementation Potential

The results from this research will be implemented in the design and construction of bridge decks built in Louisiana, with implementation possible in other states as well. Bridge construction and maintenance costs would be reduced.