RESEARCH PROJECT CAPSULE [15-3ST]

March 2016

TECHNOLOGY TRANSFER PROGRAM

Rehabilitation of Deteriorated Timber Piles using Fiber Reinforced Polymer (FRP) Composites

JUST THE FACTS:

Start Date:
November 2, 2015

Duration:
24 months

End Date:
November 2, 2017

Funding:
TT-Fed/TT-Reg

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

POINTS OF INTEREST:

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

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PROBLEM

Timber bridge piles are highly susceptible to decay in the vicinity of the waterline, and replacement of these piles typically requires cutting out the damaged section and replacing with new wood. Using fiber reinforced polymer (FRP) wraps to reinforce the decayed area with filler materials to arrest future decay can be a cost-effective and long-lasting method for repair of timber piles.

The installation methods and design guidelines for deteriorated piles to be strengthened through repairs using FRP wraps are severely lacking. Installation methods must be formalized to provide a robust load transfer mechanism to solid wood above and below the area of decay. In-situ repair and rehabilitation methods must be developed to fill voids left by decay, ensuring these areas are structurally sound while minimizing further decay and maximizing durability.

OBJECTIVE

Design guidelines for load capacity and service life improvements are needed for full implementation of timber pile repairs using FRP wraps. Repairs with FRP must be cost-competitive compared to traditional repair techniques. The research team proposes to provide a cost-effective and durable solution to timber pile repair in Louisiana.

The objectives of this research project are to determine the best materials and in-situ rehabilitation techniques to be used for repair of timber piles using FRP wraps, and to develop a simplified design methodology for the rehabilitation.

METHODOLOGY

The key to developing engineering guidelines for the repairing of timber piles with FRP is a thorough understanding of the axial load-carrying capacity and the failure modes for the pile. A series of tests will be performed to determine how to provide the required load-carrying capacity.

Fillers need to be included in the rehabilitation of timber piles to replace the wood lost to decay, to fill gaps between the FRP wrap and the uneven external surface of the pile, and to discourage future decay. A test program will be employed to evaluate selected materials for void penetration and bond.

A simplified design methodology will be developed for using FRP wraps in the repair of timber piles. To enable DOTD personnel to make proper design, material, and construction decisions regarding FRP wraps for repair of timber piles, a guide document will be prepared that summarizes the final recommendations of the project. Workshops are planned for training personnel on appropriate design, installation, and inspection techniques.

IMPLEMENTATION POTENTIAL

There is a great need for cost-effective methods to repair timber bridges. The primary deliverables for this project (design methodology and guide document) are the basis for implementation of the recommended timber repairs. Technology transfer is integrated into this proposal through workshops to provide personnel with instructions on the methods and techniques generated in this study.

(a) Mechanical damage *(b) Debris damage* *(c) Fire damage* *(d) Weathering/UV damage*

Figure 1
Several forms of timber deterioration
(Bigelow et al., 2007)