Techniques for Rapid Repair and Strengthening Using Composite Technologies: Missouri Perspective

Investigators: Dr. John J. Myers, P.E., Missouri University of Science and Technology

Dr. Antonio Nanni, P.E., University of Miami

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National University Transportation Center (NUTC) at Missouri S&T

MISSOURI S&T University of Science & Technology

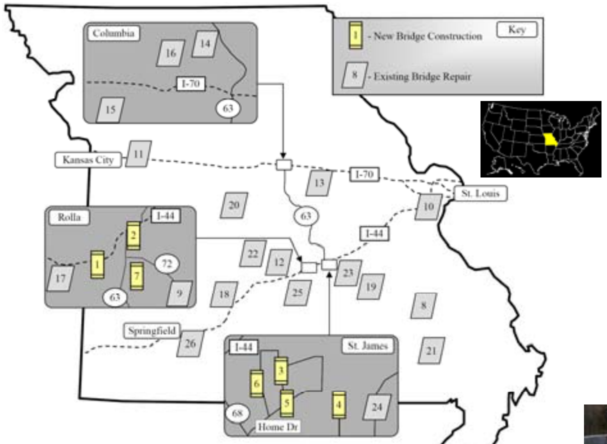
The research initiative conducted over the past decade in Missouri resulted in numerous demonstration projects and case studies to examine alternative rapid repair strengthening systems. These projects serve as a test bed to implement and study the long-term performance of these non-corrosive materials and develop/examine non-destructive testing devices.

Objectives:

Fiber-reinforced polymer (FRP) technology continues to make strides in both new construction applications and strengthening applications of structurally deficient bridges in the United States primarily due to its corrosion resistance, high strength to weight ratio and in many cases rapid installation processes.

This provides an overview of composites usage over the past decade in the State of Missouri, USA for repair and strengthening. These techniques include external strengthening applications of structurally deficient bridges using techniques such as manual wet lay-up systems, pre-cured plate and strip systems, near surface mounted systems, and mechanically fastened systems.

Utilization of Non-Corrosive Materials in Missouri: Location Map



Strengthening System Options:

FRP for Manual Lay-Up

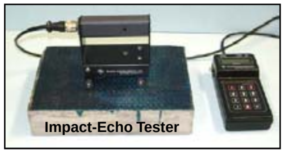
Pre-cured Laminate FRP Installation

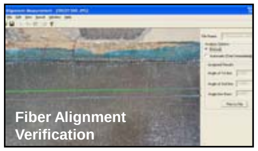
Near Surface Mounted (NSM) Bar Installation

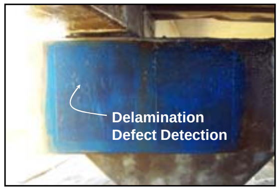
Steel Reinforced Polymer (SRP) Installation

Mechanically Fastened (MF FRP) Systems

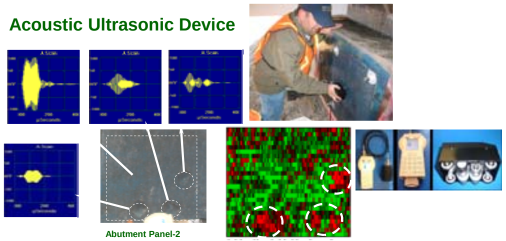
NDT Device Development for FRP:







Acoustic Ultrasonic Device



Microwave Technology

Advantages:

Advantages of FRP Reinforcement

High longitudinal tensile strength (varies with sign and direction of loading relative to fibers)

Corrosion resistance (not dependent on a coating)

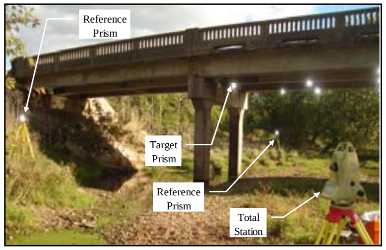
Nonmagnetic

High fatigue endurance (varies with type of reinforcing fiber)

Lightweight (about 1/5 to 1/4 the density of steel)

Low thermal and electric conductivity (for glass and aramid fibers

In-situ Load Testing:



Case Studies:

Bridge Y-298, Pulaski Co., MO
System: Manual Wet-Layup

Bridge P-962, Dallas Co., MO
System: Manual Wet-Layup, SRP

Bridge P-596, Morgan Co., MO
System: NSMR, Manual Wet-Layup

Bridge T-530, Crawford Co., MO
System: Manual Wet-Layup, Plates

Bridge X-495, Iron Co., MO
System: Manual Wet-Layup

Credits / References:

Program Contributing Faculty at Missouri S&T: Prof. G. Chen, Prof. G. Galecki, Prof. N. Maerz, Prof. S. Watkins, and Prof. R. Zoughi.

Website Technical Report Location: Http://utc.mst.edu

Center for Transportation Infrastructure and Safety CTIS
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