UTC RESEARCH PROJECT DESCRIPTION

PROJECT NUMBER: 04210

PROJECT TITLE:
Low Cost Thermoplastic Wrap to Enhance the Bridge Safety

PRINCIPAL INVESTIGATORS:
Nasim Uddin, P.E., Ph.D.
Assistant Professor
Department of Civil and Environmental Engineering
The University of Alabama at Birmingham
Telephone: (205) 934-8432; Fax: (205) 934-9855
Email: nuddin@eng.uab.edu

Co-Principal Investigator:
Associate Professor
Department of Material Science and Engineering
The University of Alabama at Birmingham
Telephone: 205-934-9199
E-mail: uvaidya@eng.uab.edu

PROJECT OBJECTIVE:
The overall objective of this work is to pioneer the new and promising thermoplastics (TP) technology to reduce the vulnerability of bridges to dynamic loads that deliver immense energy to the structure in a short time, e.g., impact from unknown threats such as heavy truck collisions, blasts or earthquakes. Basic proof-of-concept tests were already conducted to investigate the feasibility of the idea. The results confirmed that TP components can provide significant impact strength and stiffening to prevent or delay pier failure. This method has a potential for progressive failure, instead of the catastrophic fracture mode of present structures. The proposed work will include (a) investigating influential parameters affecting column/TP interface behavior, and (b) development of design and repair guidelines for optimum and safe uses of the proposed stiffening/strengthening technique.

PROJECT ABSTRACT:
There are presently no known efforts to use thermoplastic composites for damage containment in civil structures such as bridges because of perceptions of high cost and expensive manufacture. Recent work on thermoplastic composites for bridge piers has shown significant potential to produce cost-effective solutions for protective enclosures for bridge members. This project, an essential step towards the final goal, will examine the influential parameters and viable details of a novel design concept where thermoplastic composite protective enclosures are applied to bridge piers, to protect them from significant damage due to impact loads. The work is new and open to significant development. Hence it provides an opportunity to develop a novel versatile, cost-efficient method of providing structural retrofitting for the impact/earthquake/blast protection of bridges.
PROJECT TASK DESCRIPTIONS:
Task 1 – Scaled Model Tests of Piers
Task 2 – Analytical Study
Task 3 – Behavioral and Design Recommendations
Task 4 - Final report

MILESTONES AND DATES:
· Task 1, Jan 1 – March 1, 2004
· Task 2, Feb15 – Sept 30
· Task 3, April 15 – December 15
· Task 4, Dec 1 – Dec 31, 2004

TOTAL BUDGET:
Twelve month project; UTCA $50,000; total budget $100,000 (matching funds by Greenville Products Group Inc., Greenville, Alabama)

STUDENT INVOLVEMENT:
One graduate student will work on this project.

RELATIONSHIP TO OTHER RESEARCH PROJECTS:
This project is a continuation of UTCA project 03229. It does not tie into any other UTCA projects.

TECHNOLOGY TRANSFER ACTIVITIES:
The results from this project have the potential for publication in a number of scholarly journals. Knowledge transfer will also be enhanced through technical reports, and disseminating information about smart material and structure technology through enhanced documentation and on-site laboratory demonstration to industry and engineering professionals. ALDOT will be given a seminar in the middle and end of the project.

POTENTIAL BENEFITS OF THE PROJECT:
The project will complement the new initiatives currently being developed for homeland security. The program is consistent with current DOT and DOD initiatives on integrity evaluation of affordable advanced materials and structures. Advanced materials are a priority area amongst almost all federal agencies and relevant industries. The work is new and open to significant development. Hence collaborative and consortia activities can be developed to further the proposed concepts.

TRB KEYWORDS:
Bridge, Vulnerability Reduction, Thermoplastic Composite, Rehabilitation, FRP