UTC RESEARCH PROJECT DESCRIPTION

PROJECT NUMBER:
06217

PROJECT TITLE:
Strengthening Steel Bridge Girders Using CFRP

PRINCIPAL INVESTIGATOR:
Principal Investigator:
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PROJECT OBJECTIVE:
The main objective of this study is to strengthen steel bridges through the use of CFRP (Carbon Fiber-Reinforced Polymer) plates placed at the bottom flanges of the girders. Increasing the capacity of bridges is of importance and urgency especially after the devastating effects of the recent hurricane Katrina that struck the Gulf Coast where the assumed loads used for designing many structures were exceeded. The use of CFRP plates will also help in rehabilitation of steel bridges.

PROJECT ABSTRACT:
The study will involve the development of analytical model for simulating the steel bridge behavior strengthened with CFRP plates and laboratory experimental tests of steel I-beams strengthened by CFRP. The finite element analysis will carried out using the ABAQUS software which will incorporate the nonlinear behavior of concrete, steel yielding, and rupture of CFRP plates. Analysis results will be compared to experimental data. Based on the findings, design considerations are suggested for the repair and/or strengthening of steel bridges reinforced by the using CFRP plates.

PROJECT TASK DESCRIPTIONS:
Task 1 - Literature review on steel bridge rehabilitation and analysis.
Task 2 - Develop 3-D finite element models to analyze steel beams strengthened by CFRP plates.
Task 3 - Perform experimental testing of steel I-beams reinforced by CFRP plates.
Task 4 - Model a full scale bridge strengthened with CFRP.
Task 5 - Final report

MILESTONES AND DATES:
Task 1: Jan 1 - Mar 1, 2006
Task 2; Feb 1 - Jun 30
Task 3: May 1 - Augt 30
Task 4: Jul 1 – Oct 30  
Task 5: Oct 1 – Dec 31, 2005

TOTAL BUDGET:  
Twelve month project: UTCA funds $47,398; total budget $94,796

STUDENT INVOLVEMENT:  
One graduate student will be recruited, along with one undergraduate student.

RELATIONSHIP TO OTHER RESEARCH PROJECTS:  
No other UTCA projects have been conducted on this topic.

TECHNOLOGY TRANSFER ACTIVITIES:  
Plans include actively marketing the results from Phase I of this project, to secure additional funding/co-funding for Phase II of the project involving field-testing of the CFRP plates on an actual bridge and testing for improvements. As a part of this project, at the end of Year 1, a seminar/workshop will be given at ALDOT facilities in Montgomery, Alabama, describing the results of this project. Plans also include presenting the results from this study at a regional or national conference.

POTENTIAL BENEFITS OF THE PROJECT:  
The benefits of this research are
1) A comparison and a comprehensive understanding of current design and construction practices of bridge rehabilitation and strengthening.
2) The work will assist policy makers, the transit industry, and the public in evaluating and implementing improved design and construction technologies.
3) Cost savings would be realized due to adoption of new technologies.
4) An additional benefit is that this project will enhance the interaction with the industry and the Departments of Transportation since the project has practical implications

TRB KEYWORDS:  
Bridges, Rehabilitation, FRP, Bridge Strengthening, Safety