PROJECT NUMBER:  
01221

PROJECT TITLE:  
Feasibility Study on Dynamic Bridge Load Rating

PRINCIPAL INVESTIGATORS:  
Dr. Shen-En Chen, P.E.  
Department of Civil and Environmental Engineering,  
The University of Alabama at Birmingham  
Telephone: (205)-934-8433  
Fax: (205)-934-9855  
schen@eng.uab.edu

Dr. Norbert Delatte, P.E.  
Department of Civil and Environmental Engineering  
The University of Alabama at Birmingham  
Telephone: (205) 934-8436  
Fax: (205) 934-9855  
ndelatte@eng.uab.edu

Dr. B.J. Stephens, P.E.  
Department of Mechanical Engineering  
The University of Alabama at Birmingham  
Telephone: (205) 934-8468  
Fax: (205) 934-9855  
bstephen@eng.uab.edu

PROJECT OBJECTIVE:  
The main objective of this research is to conduct a feasibility study on using ambient vibration measurements to quantify bridge load capacity, as an evaluation measure for safety of bridges under load. Specific objectives include investigating the state of the art of dynamic testing of bridges and evaluating actual field ambient vibrations on selected bridges.

PROJECT ABSTRACT:  
Full-scale load tests are sometimes used to determine the actual load capacity of bridges that have questionable or deficient load capacity. However, load tests, whether dynamic or static, require temporary shut down of the bridges and disrupt traffic. Additionally, they are not cost effective. This proposal will study whether field measurements of bridge vibration under regular traffic can be used to retrieve useful information to complement existing load tests and analyses to improve bridge load rating. The proposed works includes literature reviews, laboratory tests on bridge models and full-field vibration measurements on actual bridges. The intended outcome of this research is a
testing methodology that can be used to accurately monitor bridge performance with minimum traffic interruption.

PROJECT TASK DESCRIPTIONS:
Task 1: Conduct a literature search on the state-of-the-art in bridge dynamic testing.
Task 2: Interview bridge vibration experts to learn from their collective experiences.
Task 3: Collaborate with State bridge engineers to determine appropriate bridges for vibration measurements and testing.
Task 4: Conduct laboratory studies on a bridge model to establish testing procedures and a signal-processing algorithm.
Task 5: Concurrent with ALDOT bridge testing, conduct vibration measurements.
Task 6: Conduct ambient vibration measurements during normal traffic flow.
Task 7: Propose a load capacity determination algorithm and testing methodology.
Task 8: Write a final report.

MILESTONES AND DATES:
Project start, Jan 2001
Tasks 1-2, Jan - May 30
Tasks 3-4, Apr 1 - Jun 30
Tasks 5-6, Oct 30
Tasks 7-8, Nov 1 – Dec 25
Submit final report Dec 25 2001

BUDGET:
One-year project; UTCA $53,132; total budget $106,256.

STUDENT INVOLVEMENT:
One Master’s level graduate student and one undergraduate student will be hired to work on this project. This research will become the graduate student’s Master’s thesis. This project will provide a research opportunity to the undergraduate student. To promote diversity, a minority student will be given priority to both positions.

RELATIONSHIP TO OTHER RESEARCH PROJECTS:
The proposed research closely tied to other UTCA projects that may involve in Bridge Management System (BMS) and bridge safety issues.

TECHNOLOGY TRANSFER ACTIVITIES:
The success of this course may further extended to include other transportation systems and applications. Potential journal and technical note publications will be pursued. The results of this research will be presented at the International Modal Analysis Conference or equivalent conferences. A Master’s thesis will be accomplished from this research.

POTENTIAL BENEFITS OF THE PROJECT:
The long-term benefits of this project will be to improve safety and management of the infrastructure of Alabama. However, the results of vibration measurements on the
selected bridges can directly benefit state DOT maintenance engineers by validating their strain measurements during their bridge load tests. Other long-term benefits of this project include making the transportation research in the areas of structural rehabilitation and inspection more competitive in the national level. The modal testing technology developed can also be extended to protective designs and studies of bridges, such as tornado or strong wind effects, etc.

TRB KEYWORDS:
Bridge safety, BMS, Bridge Management Systems, load rating, load tests, bridge rating.