UTCA Bridge Conference - July 23, 2004

UTCA will present a one-day conference to showcase the results of completed and ongoing bridge projects. Participants will hear lectures and get hands-on demonstrations of project results as well as have chance to ask questions and interact with the researchers. The event is scheduled for July 23, 2004, and will be held at the Holiday Inn Homewood. Fee: $45.00, CEU credits .7, Lunch provided. For additional information or to register for this conference, visit our website at www.eng.uab.edu/epd and look under UTCA Technology Transfer Programs.

2nd Annual UTCA Research Symposium - November 15, 2004

The first annual UTCA Research Symposium included 22 presentations from UTCA project investigators and 9 presentations from students. Over 100 attendees from, local governments, consulting firms, universities, and ALDOT attended. The 2nd Annual UTCA Research Symposium will be presented on November 15, 2004, and will be held at the Holiday Inn Homewood with a new set of presentations showcasing the latest projects and results coming out of the UTCA. Fee: $45.00, CEU credits .7, Lunch provided. For additional information or to register for this conference, visit our website at www.eng.uab.edu/epd and look under UTCA Technology Transfer Programs.

UPCOMING EVENT

UTCA Tech Transfer is teaming up with the Alabama T² Center at Auburn University to help the Alabama Section of the Institute of Transportation Engineers (ALSITE) deliver its Access Management short course to ALDOT employees throughout the State. Look for future announcements from UTCA and Auburn University's Alabama T² Center.

Special Needs: Please contact UAB School of Engineering Professional Development at (205) 934.8994 at least two weeks prior to the program start date so that proper consideration may be given to any special needs.

UAB PROFESSIONAL DEVELOPMENT

The University of Alabama at Birmingham
School of Engineering
BEC 253
1530 3rd Avenue South
Birmingham AL 35294-4461

The Signal is intended to serve as a briefing on UTCA sponsored projects and provide information on technology transfer and outreach activities.

If you want to be removed from our mailing list, please fax this page that shows your name and address to 205.934.8472. You can add names by faxing them to the same number.

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Research Briefs and Technology Transfer News

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UTCA Bridge Overview

Since 1999, the UTCA has sponsored more than 20 bridge-related projects. These projects have ranged from investigating the most current bridge designs and materials to developing betters ways of testing and rating bridges. Researchers from all three UTCA campuses have lent their expertise to these projects.

The UTCA Technology Transfer Program is planning an all day conference on bridge research on July 23, 2004. In preparation, this issue of The *Signal* is highlighting some of the bridge research at UTCA. For more information and full reports on UTCA Bridge Research and other projects please visit: http://utca.eng.ua.edu/projects.

Evaluating Structural Damage Using Multimedia Technology

UTCA Report Number 02303
PRINCIPAL INVESTIGATOR: *Dr. Houssam A. Toutanji*

The advent of multimedia technology provides an excellent opportunity for the development of tools to train engineers on the various practices used by the Alabama Department of Transportation (ALDOT) for assessing and repairing different structures. This project focused on providing guidelines for conducting concrete bridge inspections for ALDOT and evaluating and understanding the various maintenance procedures available. A self- training tool was developed in the form of a multimedia CD-ROM. This module provides quick access to detailed information on the assessment and repair procedures currently used by the Alabama Department of Transportation. The module contains two main sections namely inspection and maintenance. The inspection part of this module provides information that is necessary to conduct a bridge inspection for ALDOT using their coded forms such as the BI-5 and BI-6. The maintenance part of the module gives detailed information about bridge repair procedures used by ALDOT.

Development of a Statewide Bridge Database and Data Retrieval System

UTCA Report Number 02403
PRINCIPAL INVESTIGATOR: *Andrew J. Graettinger*

ALDOT has amassed significant quantities of data related to bridges constructed within the state. These include subsurface drilling records and geologic information, construction records, and design drawings. Collectively, this information could be used beneficially in developing projects that are planned for a bridge. The difficulty in using this historical information is that most of these records are available only in paper copies that are archived at remote locations. In such a format, it is very difficult for project personnel to access and to utilize this valuable information. This project investigated whether an electronic system could be devised to store and retrieve the information. This project will improve the extent and type of data available to bridge planners, designers, and maintainers.

Development of Standardized Bridge Systems

UTCA Report Number 02306
Principal Investigator: Vijaya Gopu

More than a quarter of the nearly 600,000 bridges in the United States are either structurally deficient - since they cannot support their design loads - or functionally obsolete because of being overburdened for their current traffic. The billions of dollars spent on repairs by the various state and federal agencies have not alleviated the overall problem. It is not uncommon in parts of Alabama - and other parts of the country -to find school buses being driven extra distances to avoid a bridge which has been declared structurally deficient. The problem is serious and counties are grappling with issues of safety. Counties need better tools, in particular, to manage their bridge systems. These tools range from better and rapid bridge rating, funding decision methodologies, and methods for rapid design and construction/replacement of bridges. The research focused on development of standardized bridge systems that can be utilized for rapid design and replacement/construction of bridges. The standardized systems include concrete, pre-stressed-concrete, steel and timber systems that can be utilized for a variety of short to intermediate crossings. The systems provide for different load ratings to enable the bridge designer to select the most economical system for a particular application. The standardized bridge systems will be made available in an electronic format to permit quick screening of alternate systems. The availability of these standardized systems will significantly enhance the capabilities of the bridge design professionals at the state, regional and local levels.

UTCA Projects and Website

If you would like to learn more about UTCA, please visit our website. You can request a copy of any UTCA reports by visiting the website: http://utca.eng.ua.edu/ or call UTCA at (205) 348-9925. If you are interested in or have questions about our tech transfer activities, please feel free to contact us at (205) 934-8462.

Stability of Curved Bridges During Construction

UTCA Report Number 03228
PRINCIPAL INVESTIGATOR: *James S. Davidson, Ph.D.*

Nationwide, over 30% of all steel-superstructure bridges constructed today are curved. However, the design and construction of curved bridges is far more complicated and problematic than that of the typical straight bridge. Curved girders are inherently unstable and improvements are needed in design, fabrication, transporting, and erection procedures. The overall objective of this project is to investigate stability issues associated with the construction of curved bridges by (1) synthesizing state-of-the-art practice, (2) identifying construction stability research needs through contact with the Alabama Department of Transportation, prominent researchers, and industry, and (3) conducting fundamental stability research that will improve curved bridge design and construction methodology.

A Distributed Strain Sensor for Bridge Monitoring

UTCA Report Number 02304
PRINCIPAL INVESTIGATOR: *Mark W. Lin, Ph.D.*

On-line monitoring and assessment of the integrity condition of bridge structural systems and components can provide vital information to improve decision-making in bridge system management. It has been shown that Electrical Time Domain Reflectometry (ETDR) distributed strain sensors possess great potential for practical application of on-line health monitoring of large concrete structures. In this project, the effectiveness of using various types of interface adhesive bonds between the embedded ETDR sensor and the host concrete materials was investigated to improve signal response of the sensor. The application of the bonding agent between the host concrete and the embedded sensor provided remarkable improvement in transferring force from the host concrete materials to the embedded sensor. Of the five different types of adhesive tested, Anchor Cement yielded the best result.

Feasibility Study on Dynamic Bridge Load Rating

UTCA Report Number 01221
PRINCIPAL INVESTIGATORS: *Dr. Shen-En Chen, P.E., Norbert Delatte, P.E., and Dr. B.J. Stephens, P.E.*

The main goal of this research was to conduct a feasibility study on using ambient vibration measurements to quantify bridge load capacity, and to estimate the remaining useful life as an additional safety measure for bridges. This research studied how field measurements of bridge vibration under regular traffic may be used to retrieve useful information to complement existing load tests and analysis to improve bridge load ratings. In this research, a load capacity prediction technique using ambient vibration measurements has been proposed. This method assumed that the bridge behaves like an elastic spring, where the load capacity of the structure represented the spring stiffness. For a simple bridge with a predominantly bending deformation, the vibration frequency could be used to predict the bridge capacity via inversion. The results of this preliminary study, which developed an ambient, vibration-based bridge rating method for small county bridges, have been presented. The results indicated that the method could be developed into a reliable technique to predict the remaining capacity of a bridge.

Web-Enabled Bridge Sufficiency Calculator

UTCA Report Number 04111
PRINCIPAL INVESTIGATORS: *Alisha Malloy, Ph.D., David P. Hale, Ph.D., Shane Sharpe, Ph.D.*

Effective bridge maintenance management is dependent upon reliable information regarding structural and functional sufficiency of the state's bridges anytime - anywhere. This project will put bridge information at the fingertips of county/city engineers and bridge inspectors by developing a new web enabled tool for bridge data input, bridge sufficiency rating calculation, and accessing existing bridge information parameters through ALDOT's Bridge Maintenance Management Portal. The project explicitly addresses the 2003-04 UTCA Annual Research/Training Plan with respect to County Issues, Bridge System Projects by (1) investigating management of funding for bridge replacement, and (2) developing a management system for rapid bridge rating.

Hot Topics

From the prospective of impact on the user, the work of David Hale and Shane Sharpe for ALDOT (projects 03416 - 03419) will produce a technology-enabled tool to review/evaluate/model data and display it in GIS on several types of maps. They expect to have pavement, bridge, construction, and other types of data in the system. For example, the ALDOT Director may meet with a county engineer. He can turn to his computer, make a couple of relatively simple queries, and bring up a map showing (for example) bridge conditions throughout the county, then he can model the bridge condition for 20 years right before the engineer's eyes. Or, he can compare the county situation to statewide conditions.

Scheduled UTCA Outreach Activities

Introduction to Traffic Signal Design - May 19, 2004

This course provides a fundamental introduction to traffic signal design and timing concepts as well as specific guidelines for designing signals in the State of Alabama. The course is geared toward design engineers with limited or no traffic signal experience but may also benefit signal technicians, persons responsible for maintaining municipal signal systems, or those just wishing to gain a better understanding of signal design and operation. The 4-hour morning session covers basic concepts of signal operation including signal types, phasing, timing, and hardware. The 3.5 hour afternoon session covers design concepts and specific guidelines for developing signal plans for ALDOT. The event is scheduled for May 19, 2004, 1055 Bldg. Rm 108, UAB Campus, Birmingham AL, Registration Fee: $175.00, CEU credits .75. To register for this program please call 205.934.8994 or register on-line at www.eng.uab.edu/epd. Instructor: Andrew Sullivan, P.E.

Course Content:

Fundamental Concepts - Important terms and definitions, signal types, principles of operation, timing parameters, controller fundamentals, and signal hardware.

Signal Timing Concepts - Cycle length, phase sequences, splits, clearance intervals, and signal timing optimization.

Actuated Controllers - Full and semi-actuated controllers, passage times, volume-density operation, and vehicle detection.

Design Guidelines - Basic design concepts, ALDOT design standards, elements of a signal layout sheet, and safety considerations.