Focus on Research

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"Focus on Research updates engineers and technicians on items of interest upcoming in active TxDOT research projects."

TTI Evaluates Superheavy Load Impact on State Highway System

TxDOT is issuing permits for movement of superheavy trucks (greater than 250,000 pounds) over the highway system on an ever-increasing basis. To minimize damage to pavements, the movers are equipped with several hundred tires, but the load per tire is still in the range of 8,000 to 10,000 pounds each. Thus, the potential for pavement damage remains.

Research Study 0-1335, ***Movement of Superheavy Loads over the State Highway System***, is developing a methodology to evaluate the effect of superheavy loads on pavements. This methodology should make use of nondestructive tests prior to, as well as instrumentation during, superheavy load movements. The ultimate aim of the methodology is to provide a means for evaluating pavement structural capacity prior to the movement of all superheavy loads. To date, researchers have monitored five superheavy load movements at three sites.

Area 2 —Technical Panel Chairman: Mike Murphy, P.E., Design Division
Researcher: Emmanuel Fernando, TTI

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Wind Load Effects on Texas Highway Structures Studied

Current design procedures for determining wind load effects on highway signs, luminaires, and traffic signal installations are based for the most part on outdated information and guidelines. In recent times, some TxDOT traffic signal mast arms have failed, or had to be removed, because of excessive wind load vibrations.

In response to this problem, Research Study 0-1303, ***Wind Load Effects on Signs, Luminaires, and Traffic Signal Structures***, seeks to update and revise wind load criteria by modifying Texas wind speed data to reflect current knowledge.

A central objective of this project is to develop—through engineering laboratory testing—procedures for mitigating the structural vibrations that can cause fatigue failures. Possible strategies include stiffening the structures, modifying their shape, and/or increasing their damping ability.

The benefit to TxDOT will be reduced occurrence of fatigue failure and other wind-load-related problems affecting highway structures. Implementation plans include standardizing design for highway signs, luminaires, and traffic signal structures based on revised wind loading criteria.

The project runs September 1991 through August 1994.

Area 4—Technical Panel Chairman: Timothy Bradberry, P.E., Design Division
Researchers: Drs. Kishor Mehta and Frank Wagner, Texas Tech

Texas Department of Transportation

Office of Research and Technology Transfer, in cooperation with the FHWA

Researchers to Update Manual on Lane Control Devices

Overhead freeway lane control signals (LCS) are currently being installed in several major metropolitan areas in Texas. The purpose of these signals is to graphically report in real time the status of the freeway on a lane-by-lane basis. Recent research has identified several issues that bear directly on TxDOT's design, installation, and operation efforts regarding these signals. These issues include special LCS visibility requirements unique to the Texas freeway driving environment, lack of guidance regarding optimum LCS placement, and the use of symbols not covered in the ***Manual on Uniform Traffic Control Devices*** (MUTCD).

In addressing these issues, Study 0-1498, ***Visibility, Spacing, and Operational Issues of Freeway Lane Control Signals in Texas***, will attempt to:

1. identify the extent, causes, and potential countermeasures for freeway LCS visibility limitations in Texas;

2. determine spacing and location guidelines for freeway LCS in Texas;

3. conduct operational studies to assess the effect of the freeway LCS (including the non-standard yellow diagonal and downward arrows) on driver behavior, operations, and safety; and

4. develop recommendations for the operation of freeway LCS, including possible changes to the MUTCD.

Expected benefits of Study 0-1498 include more uniformity of LCS systems across the state, improved driver understanding, greater use of these systems, and more cost-effective design, installation, and operation of LCS systems.

Through interim and final research reports, this study will disseminate its results and recommendations throughout the department. Study 0-1498 may also recommend that changes be made to the existing department purchase specifications of freeway lane control signals, as well as to the MUTCD.

Area 3 — Technical Panel Chairman: Ray Derr, P.E., Traffic Operations Division
Researcher: G. L. Ullman, TTI

Study Examines Segmental Box Girder Bridge Problems

Since the early 1970s, segmental box girder bridges have been successfully built in urban areas, in environmentally sensitive areas, and in locations where it is desirable to construct an attractive bridge system rapidly. However, these bridge types continue to demonstrate susceptibility to various kinds of structural defects, including post-tensioned substructure cracking, temporary post-tensioning anchor blister cracking, excessive joint thickness, stress key spalling, and end diaphragm cracking. Project 0-1404, ***Instrumentation of Precast Segmental Box Girder Bridges on U.S. 183 in Austin***, will address these problems by examining the scheduled U.S. 183 segmental box girder bridge construction project in Austin, Texas. Using that field study site, the project team will undertake the following:

- identify major design uncertainties and areas where field verification of assumptions are necessary in the U.S. 183 segmental box girders;
- refine and improve available instrumentation systems and devices;
- prepare special provisions for the forthcoming bridge construction job to alert contractors of possible field studies and associated schedule delays;
- instrument selected segments, spans, and substructure units;
- interpret field measurements; and
- develop proposed changes to the AASHTO Interim Design and Construction Provisions for Segmental Box Girder Construction.

Through this project, the research team hopes to provide TxDOT with improved state-of-the-art design and construction of segmental box girder bridges. The results of the project will be used to verify bridge design criteria and to set design and construction standards for future segmental bridge projects by TxDOT. By eliminating the uncertainty that has characterized much segmental box girder construction, this study should go a long way toward reducing field problems, field changes, maintenance costs, and repair costs. Ultimately, improved design criteria will lead to better and less expensive bridge designs. The project runs from September 1993 through August 1996.

Area 4—Technical Panel Chairman: Thomas Rummel, P.E., Design Division
Researcher: Dr. John Breen, CTR

Research Area Titles

Area A: "Administrative Policy"

Area 1: "Planning, Economics, Environment and Transit"

Area 2: "Materials, Construction, Maintenance and Pavement Design"

Area 3: "Traffic Operations, Geometric Design and Right-of-Way"

Area 4: "Structural Design"

Pavement Design Procedures Tested

One of the top priorities of TxDOT's Pavement Design Section is to incorporate the falling weight deflectometer (FWD) into the flexible pavement design procedure. Although engineers can use the MODULUS backcalculation program as part of the FWD design procedure, improving and field testing existing pavement design procedures (FPS-19) is an area that needs further investigation.

In Project 7-1987, ***Pavement Design Support***, the study group will work with district staff to perform a full pavement evaluation and rehabilitation design. Specifically, the study will:

- use the FWD, Dynaflect, coring, lab testing, and possibly other nondestructive testing procedures to document pavement conditions;
- use MODULUS, FPS, and other mechanistic design procedures to evaluate the structure and to recommend design modifications;
- develop with district staff a rehabilitation plan that could include milling, recycling, overlay thickness, etc.; and
- compare FPS-11 and FPS-19 results.

Study 7-1987 began September 1, 1993, and will last 2 years. Using the project study findings, the research team will update the programs and develop a series of manuals that identify the required inputs for both the MODULUS and FPS-19 programs.

Area 2—Technical Panel Chairman: Andrew Wimsatt, P.E., Design Division Researcher: Tom Scullion, P.E., TTI

Guidelines for Better Incident Management Focus of Study

Incident management seeks to restore traffic operations disrupted by highway accidents. Especially critical when such incidents involve large trucks with potentially hazardous cargoes, incident management should use all human and electronic/mechanical resources available; ideally, it should comprise a systematic process for detecting incidents, identifying the extent of the incident, determining appropriate response requirements, and providing necessary aid to motorists involved. Thus, proper guidelines for handling traffic are required to minimize congestion, delay, fuel consumption, and other adverse impacts. Project 0-1345, ***Development of Guidelines for Traffic Management in Response to Major Freeway Incidents***, is currently developing a statewide, uniform response plan to assist local jurisdictions in optimizing incident management strategies on urban and rural freeways.

The results of Project 0-1345 will be used to provide detailed response plans for the following:

1. establishing cooperation between the jurisdictions and agencies involved;
2. removing vehicles rapidly;
3. determining when a major rerouting of traffic is required;
4. establishing detour routes and strategies;
5. determining general and specific equipment needs; and
6. determining proper use of equipment, material, and personnel (with special emphasis on large, heavy truck incidents involving potentially hazardous cargoes).

The response plan developed in this project will provide the framework for the development of uniform strategies for major incidents by traffic management teams statewide. The project started in September 1992 and will continue through August 1994.

Area 3—Technical Panel Chairman: Ray Derr, P.E., Traffic Operations Division Researchers: W. McCasland and M. Ogden, TTI

Policies for Encouraging Greater Use of High-Occupancy Vehicles Investigated

Most urban areas in Texas continue to experience traffic congestion, deteriorating air quality, and decreasing mobility. In response, many transportation planners are beginning to view high-occupancy vehicles—rail, bus, carpool, and vanpools—as possible solutions to many of these problems.

The objective of Study 0-1361, ***Parking Policies to Support the Use of High-Occupancy Vehicles (HOV) in Texas***, is to assess the role a variety of supporting policies and programs may play in encouraging greater use of high-occupancy commute modes in Texas cities. In addition, the project will identify the approaches that appear most appropriate for use in Texas, along with the techniques for implementing, monitoring, and evaluating selected strategies.

The results of this research study can be implemented immediately by TxDOT, transit agencies, metropolitan planning organizations (MPOs), cities, private businesses, and by other groups. The findings will be of use to

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Study Evaluates Texas Highways Service Levels

While TxDOT Administrative Circular No. 5-92 defines the Texas highway system's level-of-service guidelines, highway condition rating methods used to establish the current level of service have not been developed. TxDOT staff need an economical, reliable, and objective method to rate each component not currently rated. In addition, a method is needed to determine the percentage of the highway system presently at acceptable levels (as distinct from ratings of individual components).

The objectives of Study 7-1968, ***Measuring and Evaluating Levels of Service of the Texas Highway System***, are (1) to develop economical, reliable, and objective methods to rate each component not currently being rated, and (2) to develop a consistent method to determine the percentage of the highway system presently at acceptable levels. Methods for integrating this information into the current maintenance management process will also be investigated.

The implementation of these methods will provide TxDOT with consistent and defensible guidance in planning and performing highway maintenance activities within the constraints of available funding. In addition, the methods should improve communications about and consistency of maintenance planning and maintenance performance. Finally, such methods should help allocate maintenance resources efficiently.

The project, which got underway in January 1993 and will run through August 1994, will develop methods to complete the ratings and to define the percentage of the highway system presently at acceptable levels. Optimum data collection methods will also be investigated. The study will provide guidance on needed personnel expertise, personal manpower, training, and equipment.

Area 1—Technical Panel Chairman: Bob Blackwell, P.E., Traffic Operations Division Researcher: Dr. R. E. Smith, TTI

High-Occupancy Vehicle Policies

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TxDOT in providing guidance to MPOs and cities attempting to encourage greater use of all high-occupancy commute modes; also useful will be the project's recommendations as to how MPOs and cities can meet specific provisions of both the Clean Air Act and ISTEA.

The project, which started September 1, 1993, will continue through August 31, 1995.

Area 1—Technical Panel Chairman: Alvin R. Luedecke, Jr., P.E., Transportation Planning and Programming Division Researchers: James E. Jarrett and Linda L. Golden, CTR

Focus on Research

*The purpose of **Focus on Research** is to update engineers and technicians on items of interest in active upcoming projects. The contents of the various articles do not necessarily reflect the official views of the FHWA or TxDOT.*

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