Focus on Research

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

Study Assesses the Benefits of Transportation Expenditures

TxDOT needs to make legislators and the general public more aware of the economic significance of transportation in the Texas economy. Past research has shown that highway improvements benefit a locality's economy and quality of life, and that they can ultimately attract new and established businesses to the area.

Study 0-1320 is developing information, in several different ways, that shows the economic significance of transportation expenditures in the Texas economy, at state, district, and project levels. The results should provide at least general guidance on the types of projects that provide the highest returns and have the most positive impact on economic growth and industrial location decisions.

TxDOT can provide this information to the legislature and to the public to demonstrate the importance of the Texas highway and transportation system in the state's economic development. In public hearings and in other forums, this information will be useful in explaining to the people of Texas the benefits of highway expenditures. Study 0-1320 began in August 1992 and will end in August 1995.

Area 1 — Technical Panel Chairman: Cornell Waggonner, P.E., Tyler District
Researcher: William F. McFarland, TTI

In This Issue

Erosion Control Methods Guidelines Studied

TxDOT has recently become more active in environmental issues. One issue is temporary erosion control measures on construction projects. Few guidelines exist for the proper design, construction, and maintenance of various erosion control measures. Department and university personnel created Research Study 0-1379 to meet three aspects concerning this subject:

- selection, through a formal program of research, of the most efficient and cost-effective erosion control materials for use by TxDOT;
- a timely and fair evaluation program for the manufacturers and vendors of erosion control materials to meet TxDOT's mandate for fair bidding practices; and
- appropriate guidelines, design aids, educational materials, and standards for the selection, design, application, and installation of erosion control measures.

Study 0-1379 began September 1, 1993, and will last one year.

Area 2 — Technical Panel Chairman: Tom Mangrem, P.E., El Paso District
Researcher: Sally Godfrey, TTI

Texas Department of Transportation

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

El Paso District Studies Service Level Improvement Measures

Increasing traffic volumes in east El Paso (north of IH-10), together with the need for an east-west high volume roadway other than the interstate, creates an immediate need for improving Montana Avenue between Paisano Drive and Loop 375. The ideal facility would not only increase traffic capacity and improve the level of service; it would also complement land-use characteristics. Transportation professionals know that high-density development along major urban roadways requires thorough investigation to determine the best use of facility types and access locations in order to balance improved service with the preservation of land-use characteristics.

The prime objective of Research Study 7-1942—the Montana Avenue Feasibility Study—is to develop a series of recommended improvement measures for Montana Avenue between Paisano Drive and Loop 375. Other objectives include the following:

- achieve desired Level of Service C or minimum Level of Service D under service conditions;
- identify the best type or combination facilities such as one-way pairs of super streets or freeway design concepts for the area traffic needs and provide needed rationale for supporting these recommendations;
- identify and describe preparatory projects within the corridor that will help reduce congestion during construction of the facility.

Study 7-1942 is providing an opportunity to apply recently developed techniques and methods for regional arterial street concept design. The research team will share with departmental personnel the experience and methods developed through several regional arterial studies, creating a true technology transfer activity. Planning and design engineers will use the study recommendations to examine transportation, social, economic, and environmental implications of the design concepts, together with constructability review before preparing design documents.

Additionally, the application of regional arterial concepts will provide a highly innovative set of Montana Avenue improvement measures. Study 7-1942 ends in November 1993.

Area 1 — Technical Panel Chairman: Chuck Berry, P.E., El Paso District
Researchers: Dr. Clyde E. Lee and William V. Ward, CTR

TxDOT Develops Small Sign Supports

In the past, TxDOT has expended considerable effort in the development of safe and cost-effective small sign supports. Although this work has resulted in several satisfactory designs, TxDOT personnel and researchers expect further modifications and development of new concepts to offer significant improvements in cost and motorist safety.

The work plan divides Study 7-1971, "Development, Analysis, and Testing of New Small Sign Supports," into three major tasks. The first is to analyze and test a new thin-wall tube support bracket for use with the standard thin-wall tube-type sign support. U- and T-post supports of this nature will serve as an alternative for standard Type B and Type D-1 supports, respectively, as detailed in standard sheet SMD (1-1). The new thin-wall supports will eliminate field cutting and welding and, therefore, reduce material and labor costs associated with installation. The Brownwood District has installed this new type experimentally.

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Maintenance Sections to Automate Data Collection

Maintenance crews complete a daily activity report form to document work completed and equipment and material used. Recently, pen display pads or electronic clipboards have become available commercially and can possibly overcome the shortcomings of paper form data entry for maintenance crews. Field data is entered directly into the pen display pad, and the data is uploaded to a personal computer (PC) automatically. Input ranges or options can be preset to reduce entry errors. In the future, field data could be transferred in real time to the maintenance databases via telecommunication links. Also, data could be retrieved from these databases to aid decisions in the field.

Research Study 7-1991 began September 1, 1993, and will last for one year. The researcher is determining the most suitable version of this system with approval from TxDOT. With this information, three districts will be selected as candidates for the implementation of pen display pad technology in maintenance activity data acquisition. Two maintenance sections will be selected from each district. For each section, two pads and one PC will be set up and monitored by the researcher. Finally, a detailed cost-effective analysis will be carried out to compare the merits of the pen display pad against the existing paper form for data collection.

Area 2 — Technical Panel Chairman: Joseph Matesic, P.E., Construction and Maintenance Division
Researcher: Paul Chan, TTI

CTR Studying Revised Bridge Design Procedures

Previous research regarding design thickness of bridge slabs has suggested two areas where engineers need more information:

- *Punching Shear Resistance* — Punching shear usually controls the strength of a bridge deck. Engineers do not know all the effects of fatigue deterioration on the punching shear resistance of bridge deck slabs, so researchers need to investigate punching shear in relation to fatigue.
- *Effects of multiple-axle/short-wheelbase heavy loads* — After flexural cracking, compressive membrane action significantly increases the flexural strength of bridge decks. However, this membrane action is much less effective when a series of closely spaced axles load the slabs. Such loading can significantly increase the flexural stresses in bridge decks, which could require an increase in the design thickness. Since legislation now routinely allows these heavier loads with short wheelbases (such as mobile cranes) to move across Texas bridges, this problem is becoming more critical. Researchers postulate that multiple heavy axles at a 4-foot spacing may create a yield line leading to potential fatigue failure in the reinforcement.

To study the problem, researchers will subject precast specimen deck slabs to a series of rolling loads of constant magnitude to determine fatigue effects. The results will be plotted and analyzed as S-N curves. Specimen slabs will also be statically loaded to determine the flexural strength. Researchers will examine rolling versus fixed load application as well as the effect of arching action (present due to the nature of the test frame apparatus).

Expected benefits for TxDOT include new guidelines for specifying the required thickness of bridge deck slabs as a function of traffic loading and the effects of fatigue loading. This research also should produce results that will allow the Department to determine the effect of oversize loads on bridge deck life expectancy.

Provided the results of the study are practical and acceptable to the Design Division, implementation will take the form of a revised procedure for bridge deck design and possibly a TxDOT training course. Study 0-1305 started in 1991 and ends in August 1994.

NOTE: CTR needs several more 6- to 7-foot precast deck panels to include in the fatigue testing. Call Dr. Richard Klingner at (512) 471-4577 or (512) 471-7259.

Area 4 — Technical Panel Chairman: Carlos Dominguez, P.E., El Paso District

Researchers: Drs. Richard E. Klingner and Ned H. Burns, CTR

Increasing Railroad Crossing Safety

Although significant progress has been made towards improving safety at railroad highway grade crossings, the number of serious injuries and fatalities at these locations continues to be a major concern. In 1989 alone, 798 people were killed and 2,588 hurt in 5,776 crashes at U.S. grade crossings.

Approximately 10 percent of these fatalities, injuries, and crashes occurred at Texas grade crossings. One proven method of improving safety at passive crossings has been the installation of active warning devices; however, based on the current funding level of $12 million per year for installation of these devices in Texas, it would take approximately 70 years to signalize the 9,153 passive crossings in the state.

The objective of "Methods To Enhance Safety Of Passive Warning Devices At Railroad/Highway Grade Crossings," Study 0-1273, is to develop passive warning devices that are more effective and less expensive than the current MUTCD standard crossbuck and advanced warning sign. These improved passive systems will enhance the safety and effectiveness of current passive warning devices and will be less expensive than such active warning devices as flashing light signals or flashing light signals with automatic gates.

Upon completion of the field evaluation, one signing system will be recommended for implementation. Deliverables will include a field reference guide to

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New Small Sign Supports

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The second task involves the development and testing of a smaller omnidirectional slip base for supports with sign areas of less than 16 square feet. Such a design will serve as an alternative to the standard breakaway pipe collar coupling, which offers only marginal safety performance and has proven to be a maintenance problem in the field.

The third is to develop and test a triangular slip base for a two-post sign support system. The objective is to offer safety not only for frontal but also for oblique impacts.

Study 7-1971 began 12 November 1992 and will end in 1994. An interim report will summarize the analytical and crash test results, enabling TxDOT to start developing new standards quickly.

Area 3 — Technical Panel Chairman: Cathy Woods, P.E., Traffic Operations Division

Researchers: Roger Bligh and Dr. Hayes Ross, Jr., TTI

Mailbox Bracket Crash Tests Improve Safety

Nationwide, roadside mailboxes present a significant safety hazard to motorists. TxDOT has been a leader in the design and use of traffic-safe mailbox installations. These innovative safety improvements have greatly reduced the hazard of mailbox installations.

Since implementation of these designs, the former Division of Maintenance and Operations developed a prototype universal mailbox mounting bracket that adjusts to any standard mailbox. This universal mounting bracket requires fewer parts, is easier to install, and is less expensive than the current design.

To get federal approval of the design, TxDOT had to demonstrate that the new bracket has adequate strength to prevent unacceptable mailbox/support system behavior resulting from vehicular impact. Under Study 7-1945, TTI performed a series of 11 crash tests to verify that the newly developed mailbox mounting bracket met national impact safety requirements as specified in NCHRP Report 230. Researchers found that the new mailbox mounting bracket successfully met the NCHRP criteria.

The study ended 31 August 1993. TxDOT will develop new standards and begin use of the new bracket. Because TxDOT designed the mounting bracket, manufacture and use of the new system will not be restricted to any single source entity.

Area 4 — Technical Panel Chairman: Ken Boehme, P.E., Maintenance and Operations
Researcher: Dr. Hayes Ross, Jr., TTI

Increasing Railroad Crossing Safety

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assist highway personnel in the selection and application of appropriate traffic control measures at passive highway/railroad grade crossings. The reference field guide addresses the following:

- Potential problems at both passive and active crossings;
- Possible improvements for each of the problems identified;
- Key grade crossing reference documents, organizations, and individuals;
- Implementation/application of standard and enhanced passive warning devices; and
- Use and application of active warning devices.

Area 3 — Technical Panel Chairman: Darin K. Kosmak, P.E., Design Division
Researcher: Dr. Dan Fambro, TTI

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.*

Contact Kathleen M. Jones (512) 465-7947, Office of Research and Technology Transfer, P.O. Box 5051, Austin, TX 78763-5051, if you need more detailed information on any one of these projects.

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