Focus on Research

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

UH Study To Draft Specs for Use of Recycled Materials in Embankments

Solid waste disposal has become a national problem. While the use of recycled materials in embankments offers TxDOT a strategy for safely disposing of solid waste, such usage will become widespread only if there is a better understanding of the material's behavior, durability, and chemical stability under various loading and environmental conditions.

Project 0-1351, *Recycled Materials in Embankments, Except Glass,* will conduct experiments to substantiate the results documented in the literature. The experiments will be conducted in two steps: The first will involve engineering and environmental issues; the second will involve the development of specifications. The specifications will be performance based, performance with limited tests, or material based.

This research will yield draft specifications for the use of waste/recycled materials in embankment construction projects. A study report will also provide an overview of waste material use in embankment applications. Finally, the researchers will develop a database on recycled materials in embankments. To implement study results, the researchers will schedule several workshops. This project started in October 1994 and will end in August 1995.

Area 2 — PD: Craig Clark, P.E., SAT
Researchers: Drs. Cumaraswamy Vipulanandan and Michael O'Neill, UH

Plastic Drums in Work Zones Evaluated

Because work zone safety is a major concern for TxDOT, it is important that traffic control devices used by the agency in work zones meet certain safety performance standards and specifications. Study 7-2924, *Evaluation of Plastic Drum Specifications,* is testing plastic drums submitted by various manufacturers to determine if the drums conform to the proposed specifications. In addition, the researchers will conduct full-scale crash tests on plastic drums meeting the proposed specification, and will analyze the test results and recommend modifications to the specification as needed.

The availability of better plastic drums will improve work zone safety. The researcher may also recommend modifying current plastic drum specifications. This project runs from May 1994 through August 1995.

Area 4 — PD: Lewis Rhodes, P.E., TRF
Researcher: Dr. King Mak, P.E., TTI

In This Issue

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"

Texas Department of Transportation

Research and Technology Transfer Office, in cooperation with the FHWA

Congestion Management Focus of TTI Study

Traffic congestion adversely affects air quality and roadway operations in many of Texas' urban areas. To minimize these problems, the Texas Department of Transportation (TxDOT) has funded and implemented many highway congestion relief projects throughout the state, either by providing more capacity or by managing demand. Such projects include roadway widening, transit upgrades, intersection improvements, signal timing/progression, motorist assistance/incident detection and response programs, and park-and-ride lots. In the Dallas District alone, $5 million has been spent over the last two years on bottleneck projects and traffic light synchronization.

Yet while highway congestion relief projects undoubtedly provide significant short-range benefits, there exists no uniform method for quantifying the actual operations and emissions reductions obtained through these projects. Connected with this is TxDOT's need to meet legislative mandates (e.g., the 1990 Clean Air Act Amendments and the Intermodal Surface Transportation Efficiency Act of 1991) to quantify the air quality benefits that accrue to nonattainment areas from all congestion-reduction measures.

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In Study 0-1358, *Congestion Management and Air Quality Benefits of Transportation Improvements,* the researchers will

- review studies that relate levels of vehicle emissions to such traffic characteristics as volume, idle time, and speed for various transportation improvements;
- collect and analyze existing transportation data of before-and-after conditions for various transportation improvements;
- quantify the changes in congestion and hydrocarbon/carbon monoxide emissions that result from the implementation of transportation improvement projects; and
- develop guidelines for estimating the operational improvements and emissions reduction benefits associated with both approved and proposed projects.

To achieve these objectives, the researchers will create a methodology that predicts the congestion and emissions reduction obtained through transportation improvement projects. The methodology will then be used to establish uniform guidelines for estimating these benefits for proposed transportation projects.

By increasing the number of congestion relief projects, these guidelines should provide travel-time savings to motorists in Texas' urban areas. A collateral benefit is improved air quality: When congestion is reduced, vehicles can maintain the more uniform speeds associated with free-flow operation. This in turn reduces the amount of fuel consumed and reduces vehicle emissions of volatile organic compounds and carbon monoxide. This study started in September 1993 and will terminate in August 1995.

Area 1 — PD: Wayne Young, ENV
Researchers: Drs. Carol Walters, George Dresser, Jason Crawford, and Mark Middleton, TTI

CTR Updating Code for Prestressed Concrete Column Reinforcement

Tests of conventionally reinforced concrete columns conducted approximately 65 years ago led to a code minimum reinforcing ratio (i.e., area of steel divided by gross area of concrete) of 1 percent. This minimum was intended to prevent passive yielding — that is, the yielding of vertical steel resulting from the transfer of load from the concrete under a sustained load. However, these tests were originally performed with materials of relatively low strength (228 MPa [33 ksi] steel and 17 MPa [2.50 ksi] concrete vs. today's modern reinforcing steel of 414–517 MPa [60–75 ksi] and concrete of 28–69 MPa [4–10 ksi]). It is therefore likely that the code recommendations based on these early tests are no longer valid for high strength materials.

The issue of reinforcing requirements in concrete columns is examined in Project 0-1473, *Minimum Mild Reinforcing Requirements for Conventionally Reinforced and Prestressed Concrete Columns.* In this new project, the researchers plan to:

- analytically model the behavior of reinforced and post-tensioned bridge piers to identify approximate minimum reinforcing limits to aid in developing other testing programs;
- experimentally examine creep behavior of lightly reinforced piers and post-tensioned piers with supplementary mild steel reinforcements; and
- develop minimum reinforcing provisions for adoption by AASHTO.

The results of this study can be used by the department to reduce the amount of longitudinal reinforcement used in many bridge piers constructed in Texas, with such reduction resulting in substantial economic savings over the long term. In addition, the project findings should answer questions regarding how much mild reinforcement should be used in post-tensioned piers.

To implement study findings, the researchers will develop design provisions suitable for adoption by AASHTO and other code- and specification-writing bodies. This project got underway in September 1994 and is scheduled to terminate in August 1997.

Area 4 — PD: David McDonald, P.E., DES
Researchers: Drs. Michael E. Kreger and Ned H. Burns, CTR

Texas Traffic Control Systems Subject of Joint Study

One way of reducing urban freeway congestion is to integrate the highway systems' total operation — that is, to coordinate the operations of freeway main lanes and on/off ramps, frontage road interchanges, and parallel arterial street intersections. Such an integrated system will also improve incident management, which, again, will reduce congestion. Fortunately for Texas, many coordinated control strategies can now be implemented on the state's highways by taking advantage of computerized freeway ramp control and arterial traffic management systems already in place.

The objective of Project 0-1468, *Integrated Arterial and Freeway Operation Control Strategies for IVHS Advanced Traffic Management Systems,* is to assist the Texas Department of Transportation control traffic congestion through the integration of freeways, frontage roads, and arterial street corridors. Specifically, the researchers in this joint study will

- identify the integration problem of all traffic control elements within a freeway corridor;
- develop a conceptual design for integrated freeway-arterial street control systems;
- simulate and analyze a selected model;
- select a site for developing an integrated control system; and
- develop a freeway traffic control methodology for integrating frontage road interchange controls and arterial street signal controls.

The findings of this study will be used by the department to design and implement integrated freeway corridor traffic control systems. Solutions to traffic control integration problems will provide a basis for integrating existing uncoordinated freeway and arterial systems. The results can also be used to develop standard specifications that are applicable to freeway corridors throughout the state. Overall, the research will provide a method by which to reduce freeway corridor congestion costs. This project got underway in September 1994 and is scheduled to end in August 1996.

Area 3 — PD: Abed A. Abukar, P.E., FTW
Researchers: Drs. Randy Machemehl, P.E., and Hani Mahmassani, P.E., CTR, and Dr. James Williams, P.E., UTA

Researchers Assessing Benefits of Telecommuting

Reducing travel demand is a desirable goal for state transportation agencies seeking to comply with the Clean Air Act Amendment. Telecommuting — the use of modern telecommunication networks by which employees work from home or at designated neighborhood satellites for all or part of the workweek — is attracting attention as a way of reducing travel demand. Research has confirmed that telecom-muting can reduce commuting trips without reducing productivity and without leading to a marked increase in other trips. Given its zero-cost feature in terms of highway infrastructure, telecommuting can be an effective option, not only as a way of complying with clean air requirements, but also as a strategy for reducing congestion and its related costs. Accordingly, it should be considered in connection with long-term infrastructure investment needs. Yet, while pilot projects are underway in California, Hawaii, Washington, Virginia, and in Minnesota, telecommuting remains limited in Texas.

The objectives of Study 0-1446, *Potential of Telecommuting for Travel Demand Management,* are to explore the potential and significance of telecommuting as a travel reduction measure and to recommend means to elevate telecommuting to levels that lead to perceptible impacts on traffic congestion and air quality compliance. To achieve these objectives, the researchers will:

- review on-going telecommuting activities in Texas and in other states;
- compile a synthesis of documented advantages and concerns;
- evaluate the effectiveness of alternative commuting programs; and
- estimate the potential for telecommuting in the state's major cities, based on a systematic consideration of telecommuting impact on travel behavior and the adoption of telecommuting by firms in different sectors of the economy.

The findings of this study will benefit TxDOT and other state agencies, as well as metropolitan planning organizations (MPOs) and private sector employers. By realistically assessing the benefits of telecommuting by firms in different sectors of the economy and in different metropolitan areas in Texas, the study will allow TxDOT to guide MPOs and other groups. Further, the research will identify the transportation impacts of telecommuting programs — including those impacts related to reducing traffic congestion and traffic-generated air pollution. Finally, the study will identify specific policies and programs that TxDOT could pursue to encourage greater use of telecommuting by public agencies and private businesses. This study got underway in September 1994 and is scheduled to end in August 1996.

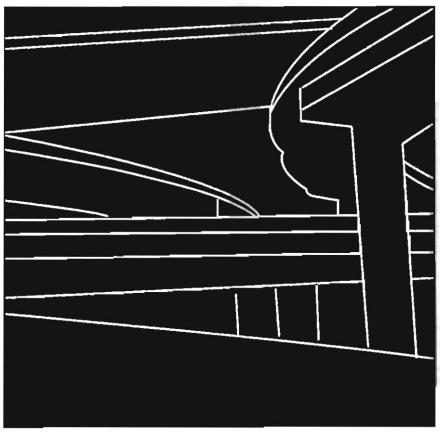
Area A— PD: Carol Nixon, P.E., HOU
Researcher: Dr. Katy Turnbull, TTI

TxDOT Addresses Highway Operations Improvements

Following several decades of over-capacity usage, many of the highways constructed in Texas 20 to 40 years ago have today developed safety and operational problems. At the same time, highway operations research in the state has remained fragmented, with solutions to operational problems often limited to expensive redesign and reconstruction. In the absence of a clear-cut strategy for improving highway operations, TxDOT began the process of assembling a coordinated program of highway operations research. The program envisioned will assist the districts and TxDOT's Traffic Operations Division in effectively implementing operational improvements.

The expected results will improve highway operations by providing a more cost-effective operation and better motorist satisfaction.

Such program development has been the thrust of Project 0-1232, *Urban Highway Operations Research and Implementation Program.* This project, which concluded recently, fulfilled a number of objectives. Among other tasks, it developed an



Urban Highway Operations Research Program, drafted a Texas Highway Operations Manual, defined the issues that affect the implementation of highway operational improvements (including institutional issues), and investigated important specific research studies identified by the study's Advisory Committee. The expected results will improve highway operations by providing a more cost-effective operation and better motorist satisfaction.

To implement study findings, the researchers developed the *Texas Highway Operations Manual,* a support document that covers a range of operational issues related to the planning, design, construction, maintenance, and management of highways. It also shows how "various highway factors can be combined to provide the best possible operations under the prevailing conditions."

This research effort was structured so that a continual and harmonious interaction existed between the research team, the urban districts, and the Austin divisions. This assured that districts and divisions had immediate access to study findings, as well as a high level of confidence in the procedures developed.

This project ran from September 1989 to August 1994.

Area 3 — PD: Gary Trietch, P.E., TRF
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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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