



Research Digest

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In this Issue:
TxDOT Reports

Table of Contents

Item 1. Feasibility Report and Plan of Action for Development of a New, Hydraulically Efficient Bridge Rail (<i>CTR 5492-2</i>)	1
Item 2. Guide to the Economic Value of Texas Ports (<i>CTR 5538-P1</i>)	1
Item 3. Horizontal Cracking Mechanism in CRCP (<i>CTR 5549-2</i>)	2
Item 4. Guidelines for Incorporating a Bus Rapid Transit Scenario into the Analysis of Texas Highway Corridors (<i>CTR 5668-1</i>)	2
Item 5. Financing Tools for Rural Small Urban Area Projects (<i>CTR 6034-1</i>)	3
Item 6. Implementation of Advance Warning of End of Green System (AWEGS): Implementation Report (<i>TTI 5113-01-1</i>)	3
Item 7. Crash Testing and Evaluation of TxDOT Burn Ban Signs (<i>TTI 5210-5</i>)	4
Item 8. Dynamic Testing of the T223 Bridge Rail (<i>TTI 5210-8</i>)	4
Item 9. Horizontal Curve Designing Workshop (<i>TTI 5439-01-P1</i>)	5
Item 10. Studies to Determine the Operational Effects of Shoulder and Centerline Rumble Strips on Two-Lane Undivided Roadways (<i>TTI 5577-1</i>)	5
Item 11. Cable Median Barrier Maintenance Manual (<i>TTI 5609-P1</i>)	6
Item 12. Capacity and Road User Cost Analysis of Selected Freeway Work Zones in Texas (<i>TTI 5619-1</i>)	6
Item 13. Development of a Traffic Signal Operations Handbook (<i>TTI 5629-1</i>)	7
Item 14. Implementation Guide for Monitoring Work Zone Safety and Mobility Impacts (<i>TTI 5771-P1</i>)	7
Item 15. Using Cement Paste Rheology to Predict Concrete Mix Design Problems: Technical Report (<i>TTI 5820-1</i>)	8
Item 16. Analysis of Roadside Safety Devices for Use on Very High-Speed Roadways (<i>TTI 6071-1</i>)	8
Item 17. Coordination and Safety Procedures for Mail Delivery on Roadways without Shoulders: Technical Report (<i>TTI 6076-1</i>)	9
Item 18. Impacts of Current and Future Demographic Change on Transportation Planning in Texas: Final Technical Report (<i>UTSA 5392-2</i>)	9



Research Digest

Item 1

Feasibility Report and Plan of Action for Development of a New, Hydraulically Efficient Bridge Rail

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)

CTR 5492-2 • 2009

This research program addresses issues associated with the hydraulic effects of bridge rails on floodwater levels upstream of bridge structures. The hydraulics of bridge rails and traffic barrier systems are not well understood, especially with regard to rail/barrier systems in series and the submergence of structures. The hydraulics of bridge rails is an important issue for TxDOT bridge rehabilitation projects with potentially significant cost implications. This research project is designed to address issues associated with the hydraulic performance of bridge rails and traffic barriers, and to provide guidance on how different rail/barrier systems can be included in floodplain hydraulics models.

Full-text PDF of this report is available for free download from

http://www.utexas.edu/research/ctr/pdf_reports/0_5492_2.pdf

Item 2

Guide to the Economic Value of Texas Ports

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)

CTR 5538-P1 • 2008

When policymakers make public investments, they are frequently interested in the economic impacts associated with their actions. Stakeholders are usually interested in a policy's economic impact. Common ways of measuring economic impact are the quantity of jobs, sales, and tax receipts associated with an activity. These metrics are often reported as evidence that the welfare of a community will be (or is being) enhanced by a policy decision. This guide summarizes the findings of a CTR/TTI study team investigating the value of Texas ports for the Texas Department of Transportation found in Technical Report 0-5538-1, An Analysis of the Value of Texas Seaports in an Environment of Increasing Global Trade. The methods used to derive data reported in this document are detailed in that report, together with more substantive discussions and data on associated topics.

Full-text PDF of this report is available for free download from

http://www.utexas.edu/research/ctr/pdf_reports/0_5538_P1.pdf



Research Digest

Item 3

Horizontal Cracking Mechanism in CRCP

*UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 5549-2 • 2009*

The purpose of this study is to identify the mechanism of horizontal cracking in continuously reinforced concrete pavement (CRCP). To this end, a numerical model to predict the risk of horizontal cracking in CRCP was developed. Material properties and steel design were considered in the numerical analysis and their effects on the risk of horizontal cracking were investigated. Based on numerical analysis results, laboratory testing was also conducted in order to simulate the horizontal cracking in transverse crack interface in CRCP. A horizontal cracking frame was developed and the mechanism of horizontal cracking was experimentally investigated. Longitudinal steel plays a significant role in developing horizontal cracks in CRCP. Significant stress of concrete develops near longitudinal steel because of steel restraint. It indicates that the horizontal crack perpendicular to maximum stress of concrete can occur near the steel. The horizontal cracks initiate from the transverse crack interface and propagate along the longitudinal steel. The effects of rebar temperature at the concrete placement and the water-to-cement ratio on the concrete rebar bond strength were also investigated experimentally.

Full-text PDF of this report is available for free download from
www.utexas.edu/research/ctr/pdf_reports/0_5549_2.pdf

Item 4

Guidelines for Incorporating a Bus Rapid Transit Scenario into the Analysis of Texas Highway Corridors

*UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 5668-1 • 2009*

Many corridors in the Texas State highway system are facing increasing congestion while having severe right-of-way limitations. The best form of congestion relief may not be additional highway lanes and/or grade separations. The best solution may be the introduction of a higher capacity transit system. Bus Rapid Transit (BRT) has been increasingly regarded as a cost-effective solution for improving mobility and alleviating congestion in urban transportation networks. Our research was aimed at providing TxDOT with comprehensive guidelines for planning and designing BRT that allows development of a BRT scenario in the traditional alternatives analysis. Specifically, this research developed a decision procedure to help TxDOT engineers/MPO planners decide the role of BRT as an integral part of existing/future transportation systems. The research team included identification and evaluation of analysis tools and methods for measuring the effectiveness/impact of BRT. Design criteria was developed for BRT concepts, including possible street re-alignment, geometric considerations, right-of-way acquisition, signal preemption, dedicated/shared busways on major state arterials, as well as integration of BRT into existing and future managed lanes (HOT/HOV). A BRT planning and design case study for El Paso, Texas and Austin, Texas was completed.

CDROM included contains project 5668-P1, "Bus Rapid Transit (BRT) Application Guidebook".

Full-text PDF of this report is available for free download from
http://www.utexas.edu/research/ctr/pdf_reports/0_5668_1.pdf



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Item 5

Financing Tools for Rural Small Urban Area Projects

*UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6034-1 • 2009*

This research examined financing tools that are applicable to rural and small urban area projects undertaken by the Texas Department of Transportation. It documents district experience with some of these tools and lessons learned. Pass-Through Tolling Agreements (PTA) have been popular recently, so case studies of their use in Texas were examined in detail. It was found that districts lack planning tools to conduct proper cost and benefit analyses for partnership projects.

Full-text PDF of this report is available for free download from
http://www.utexas.edu/research/ctr/pdf_reports/0_6034_1.pdf

Item 6

Implementation of Advance Warning of End of Green System (AWEGS): Implementation Report

*TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 5113-01-1 • 2008*

The objective of this implementation project was to implement four AWEGS across Texas at intersections appropriate for the installation of AWEGS. After a survey across Texas, four sites were chosen in the Atlanta District, Pharr District, Odessa District, and San Antonio District. The AWEGS design plans were prepared for these four sites and submitted to the districts. These plans were prepared for an intersection with high-speed approaches having the required dilemma zone detection design. The Atlanta District implementation was typical of the earlier implementation and used the TS2 TS 1 conversion panel. However the remaining implementations were configured for using enhanced BIUs. AWEGS software was also modified to account for rail preemption as the site in Odessa District was being preempted by between 15 to 25 trains per day. Finally the implementation in San Antonio District was redesigned to use radar detection for both dilemma zone and advance detection. AWEGS at the Atlanta, Pharr, and Odessa Districts have been implemented and an evaluation of the system showed that AWEGS was performing satisfactorily at all sites. TTI researchers are awaiting the San Antonio District to install the radar detectors to implement the system there.

Full-text PDF of this report is available for free download from
<http://tti.tamu.edu/documents/5-5113-01-1.pdf>



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Item 7

Crash Testing and Evaluation of TxDOT Burn Ban Signs

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5210-5 • 2009

Texas counties expressed a desire to the Texas Department of Transportation (TxDOT) to post advisory signs on the roadside to alert motorists when a burn ban is in effect. For obvious economic reasons, the preferred method of implementation is to append the burn ban notification signs to existing sign support structures already installed along Texas highways.

In support of this request, TxDOT sponsored this project to evaluate the impact performance of a Texas slip base sign support system with a lightweight, composite burn ban sign appended to the support below the primary sign at a mounting height less than 7 ft. The impact performance of the burn ban sign support configurations was evaluated through full-scale crash testing. The crash testing was performed in accordance with the requirements of NCHRP Report 350. The configuration selected for testing incorporated a 24 inch × 24 inch × 0.080 inch thick aluminum confirmation sign mounted at a height of 7 ft, with the burn ban signs mounted below.

Based on the satisfactory test results reported herein, the practice of appending a burn ban sign to an existing slip base sign support system is considered suitable for implementation.

Full-text PDF of this report is available for free download from

<http://tti.tamu.edu/documents/0-5210-5.pdf>

Item 8

Dynamic Testing of the T223 Bridge Rail

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5210-8 • 2009

The TxDOT T203 bridge rail is often used on bridges where asphalt overlays reduce the effective height of the bridge rail. This reduction in height due to asphalt overlays is undesirable. For this project, several geometric features were changed to improve the strength and crash performance of the T203 rail. These features include increasing the rail height to 32 inches, increasing the size and strength of the rail, and increasing the thickness of the post. In addition, the width of the post was reduced to 4 ft and the openings between the posts were increased to 6 ft. Orientation, placement, and frequency of reinforcing steel in the rail, post, and deck were also evaluated to determine if impact damage to the deck can be reduced. These proposed changes to the T203 rail led to the development of the TxDOT Type T223 bridge rail design, which is reported herein. The objective of this project was to evaluate the strength of the new TxDOT Type T223 Bridge Rail design with respect to different reinforcing steel details in the deck, rail, and posts. The strength of the new TxDOT Type T223 bridge rail was evaluated using dynamic bogie testing. These tests were performed at the ends/joint (two tests) and at mid-span locations (two tests). Reinforcing steel details varied at each test location to determine the preferred placement and orientation of reinforcing steel for the TxDOT Type T223 bridge rail and supporting deck to minimize deck damage during a design impact event.

Full-text PDF of this report is available for free download from

<http://tti.tamu.edu/documents/0-5210-8.pdf>



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Item 9

Horizontal Curve Designing Workshop

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5439-01-P1 • 2009

This handbook is intended for engineers and technicians responsible for evaluating and maintaining curve signing and delineation devices pertaining to horizontal curves on rural highways.

Full-text PDF of this report is available for free download from

<http://tti.tamu.edu/documents/5-5439-01-P1.pdf>

Item 10

Studies to Determine the Operational Effects of Shoulder and Centerline Rumble Strips on Two-Lane Undivided Roadways

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5577-1 • 2009

This report describes the methodology and results of analyses performed to (1) evaluate the impact of shoulder rumble strips (SRS) and centerline rumble strips (CRS) on the placement of vehicles in the travel lane of two-lane, undivided roadways and (2) determine the minimum shoulder width required for drivers to correct errant vehicle trajectories once alerted by passing over SRS. Field studies indicated that CRS on two-lane, undivided roadways with lane widths as narrow as 10 ft do not adversely impact the lateral placement of the vehicle in the travel lane. In fact, at locations with smaller shoulder widths (1 to 2 ft) drivers positioned the center of their vehicles closer to the center of the lane. Similar effects were found at locations with both edgeline rumble strips (ERS) and CRS. The impact of SRS located within 7 to 9 inches of the edgeline on the lateral placement of vehicles in the travel lane was less clear. However, it does appear that SRS located near the edgeline may shift vehicle travel paths closer to the centerline. In contrast, SRS located 35 inches from the edgeline did not seem to impact the lateral placement of vehicles in the travel lane. In addition, lateral offsets that position the center of 16-inch SRS in the middle of the shoulders at least 4-ft wide should provide enough remaining shoulder width for the 85th percentile distracted driver to correct their errant vehicle trajectory before leaving the paved roadway surface. Additional findings from all of the studies and detailed recommendations are discussed in the report.

Full-text PDF of this report is available for free download from

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Item 11

Cable Median Barrier Maintenance Manual

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5609-P1 • 2008

This Cable Barrier Maintenance Manual was developed as part of the 0-5609 In-Service Evaluation of Cable Median Barrier Performance research project. The intended audience for the manual is TxDOT maintenance personnel responsible for the repair and general maintenance of cable barrier systems installed in their section. The manual provides maintenance personnel with general guidance regarding the maintenance and repair of cable barrier systems based on information collected in state and national surveys. Text boxes labeled with the “Guidance” term highlight important recommendations. High-tension cable barrier systems are produced by approved manufacturers and each have unique designs and maintenance needs. For barrier-specific maintenance and repair procedures, TxDOT maintenance personnel should use the manufacturer’s manuals.

Full-text PDF of this report is available for free download from

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Item 12

Capacity and Road User Cost Analysis of Selected Freeway Work Zones in Texas

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5619-1 • 2009

This research was developed to produce usable and meaningful estimates for work zone capacities under a variety of roadway and traffic conditions, work zone configurations, and lane closure scenarios within Texas. Using data collected at eighteen work zone sites, the research presents updated guidance for expected capacities of various freeway work zone lane closure configurations. In addition, models used to evaluate traffic conditions in work zones were evaluated and recommendations for their use were made. Finally, recommendations concerning road user cost analysis for freeway construction projects are included.

Full-text PDF of this report is available for free download from

<http://tti.tamu.edu/documents/0-5619-1.pdf>



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Item 13

Development of a Traffic Signal Operations Handbook

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5629-1 • 2009

The Texas Department of Transportation (TxDOT) operates thousands of traffic signals, both in rural areas and small cities. TxDOT's operation of these signals has served the state well over the years. However, regional differences in signal timing and detection design practice have evolved. These differences create operational inconsistencies and, possibly, sub-optimal performance. Good signal timing practices developed in some areas are not well documented or otherwise communicated to other areas. A comprehensive signal timing resource guide is needed to promote uniform, effective signal operation on a statewide basis. This document summarizes the research conducted and the conclusions reached during the development of a Traffic Signal Operations Handbook. The handbook provides guidelines for timing traffic control signals at intersections that operate in isolation or as part of a coordinated signal system. The research conducted included a review of the literature, a survey of TxDOT engineers, an evaluation of alternative signal controller settings and detection designs. A spreadsheet was developed to accompany the Handbook. This spreadsheet automates several tasks involved in the development of a signal timing plan and is intended to facilitate implementation of the Handbook guidance.

Full-text PDF of this report is available for free download from

<http://tti.tamu.edu/documents/0-5629-1.pdf>

Item 14

Implementation Guide for Monitoring Work Zone Safety and Mobility Impacts

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5771-P1 • 2009

This implementation guide describes the conceptual framework, data requirements, and computational procedures for determining the safety and mobility impacts of work zones in Texas. Researchers designed the framework and procedures to assist district-level personnel who have responsibility for work zone safety and mobility impact reviews of significant projects as required by Texas Department of Transportation (TxDOT) policy. In this guide, researchers describe the types of impact monitoring and analysis that can occur as part of ongoing project activities and those that can be performed during post-project reviews. Analysis procedures are presented to assist in determining which projects should be targeted for regular reviews of crash data during the project, as well as the increase in crash frequency that is indicative of unusual safety concerns that should be investigated further through field observations. Researchers also present analysis procedures to guide district personnel in determining the queue lengths, individual vehicle delays, and total vehicle-hours of delay that are created during temporary lane closures in a project.

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Research Digest

Item 15

Using Cement Paste Rheology to Predict Concrete Mix Design Problems: Technical Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 5820-1 • 2009

The complex interaction between cement and chemical/mineral admixtures in concrete mixture sometimes leads to unpredictable concrete performance in the field, which is generally defined as concrete incompatibilities. Cement paste rheology measurements instead of traditional workability tests can have a great potential to detect those incompatibilities in concrete before the concrete is placed to avoid setting time, workability, and curing-related issues, which sometimes leads to severe early-age cracking especially in severe weather conditions. The objective of the present study was to examine the applicability of the Superpave Dynamic Shear Rheometer (DSR) to measure cement paste rheology in one hand and identify cement and mineral/chemical admixtures incompatibilities base on cement paste rheological behavior on the other hand. Based on the extensive laboratory investigation, it is observed that DSR in modified form can measure cement paste rheology with permissible repeatability and sensitivity and has a great potential to identify cement and mineral/chemical admixture incompatibilities. The heat of hydration data from isothermal calorimeter test and setting time results for the studied mixtures have strongly supported the rheology-based observations. A procedure to formulate rheology-based acceptance criteria based on detailed work covering a wide range of incompatibilities and validation through implementation efforts is warranted. This will ultimately help concrete procedures and district laboratories to detect problematic combinations of concrete ingredients during the mixture design process. The researchers also investigated the feasibility of the mini slump cone test as an alternative or supporting tool for the rheology test.

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Item 16

Analysis of Roadside Safety Devices for Use on Very High-Speed Roadways

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6071-1 • 2009

The Texas Department of Transportation (TxDOT) is embarking on a multi-decade effort to expand the state's transportation system. TxDOT has expressed an interest in using very high design speeds (above 80 mph) for some of these facilities to promote faster and more efficient travel within the state.

Currently, roadside safety hardware is tested at a speed of 62 mph. This impact speed was derived from crash data collected on roads with design speeds up to 70 mph. The ability of existing roadside safety features to accommodate more severe, higher energy impacts is not known.

The objective of this research is to develop roadside safety hardware suitable for use on very highspeed highways. Finite element simulations are used to evaluate the impact performance of selected roadside safety devices subjected to very high-speed impacts. Systems analyzed include single slope concrete barrier, modified thrie-beam guardrail, box beam guardrail, and slip-base sign supports. Design modifications to some of these systems are recommended for further consideration.

Full-text PDF of this report is available for free download from

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Research Digest

Item 17

Coordination and Safety Procedures for Mail Delivery on Roadways without Shoulders: Technical Report
TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6076-1 • 2009

This research utilized interviews, focus groups, and surveys of U.S. Postal Service (USPS) and Texas Department of Transportation (TxDOT) employees to determine safety and coordination issues related to mail delivery on rural, two-lane highways without shoulders. Numerous crashes involving letter carriers have prompted this effort to identify ways to reduce the exposure of rural letter carriers on these types of highways, as well as to recommend innovative ways to improve coordination between the two agencies. This report contains the results and recommendations from that effort. Researchers addressed the following specific issues: - mailbox placement design standards; - mailbox turnout design criteria; - U.S. Postal Service efforts to improve safety for their rural letter carriers; - Texas Rural Letter Carriers' Association input on ways to improve safety for their members; and - current TxDOT practices related to mailbox installation, turnout design, and coordination efforts with the U.S. Postal Service. This report includes data findings from the various studies and recommendations for improving safety for rural letter carriers, as well as ways for TxDOT and the USPS to improve coordination efforts.

Full-text PDF of this report is available for free download from
<http://tti.tamu.edu/documents/0-6076-1.pdf>

Item 18

Impacts of Current and Future Demographic Change on Transportation Planning in Texas: Final Technical Report
UNIVERSITY OF TEXAS AT SAN ANTONIO (UTSA). DEPARTMENT OF CIVIL ENGINEERING.
UTSA 5392-2 • 2008

This report provides an overview of the project objectives and methods and summarizes key findings about the demographic trends impacting Texas transportation. In addition, this report summarizes key findings concerning the use of demographic data at TxDOT and related agencies and provides a technical guidebook for the One-Stop Demographic Data Analysis Tool created as part of this study.

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