

# Research Digest

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## *Item 1*

**Implementing the Ultra-High Pressure Water Cutter for Roadway Maintenance Applications. Final Report**  
TEXAS TECH UNIVERSITY. CENTER FOR MULTIDISCIPLINARY RESEARCH IN TRANSPORTATION (TECHMRT)  
*TechMRT 5230-01-2 • 2013*

The implementation research project described herein was designed to conduct a systematic evaluation of the ultra high pressure (UHP) water cutter as a pavement preservation tool for treatment of flushed, seal-coat surfaced pavements in Texas. Relative to treatment effectiveness, comparison of pre- and post-treatment data from multiple sets of friction and texture tests collected from 14 sites located in four climatic regions in Texas indicates that the UHP water cutting treatment achieved an average increase in pavement texture of about 200 percent, and an average increase in friction of about 135 percent. Treatment durability was evaluated in terms of the survivability and life expectancy of pavement texture and friction values achieved at treatment. Relative to survivability, pavement texture and friction values were at or above the desirable threshold for seven of 13 sites upon completion of monitoring, and values were at or above the maintenance threshold for 12 of 13 sites. Relative to life expectancy, predictive models indicate that the improvement in pavement texture and friction achieved by UHP water cutting will last one or more years at 90 percent of the test sites, and for 40 percent of the test sites, the treatment may last four or more years. Relative to production considerations associated with the UHP water cutter treatment process, a direct comparison of unit cost data for UPH water cutting versus the unit costs of other maintenance functions currently used to treat flushed pavements in Texas indicates that UHP water cutting can provide cost savings of 25 percent to 77 percent, typically 41 percent. Overall, the findings from this implementation study offer a reasonably positive view about UHP water cutting as a roadway maintenance tool for Texas roads.

This report is available for free download (23 MB):

[http://www.depts.ttu.edu/techmrtweb/Reports/Complete%20Reports/5-5230-01-2%20\(2\).pdf](http://www.depts.ttu.edu/techmrtweb/Reports/Complete%20Reports/5-5230-01-2%20(2).pdf)

## *Item 2*

**Structural Performance of Texas U-Beams at Prestress Transfer and Under Shear-Critical Loads**  
UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 5831-2 • 2013*

The Texas U-Beam standard designs were released in the 1990's and have been used increasingly in bridges across the state since. While prototypes of the 54-in. deep prestressed concrete beam were built during the design phase, no full-scale load tests were performed. This study of the U-Beam had five goals: (i) determine the magnitude and location of stresses induced in reinforcing bars in the end region of the beam at prestress transfer, (ii) measure concrete curing temperatures in square and skewed end blocks, (iii) establish the vertical shear capacity of the standard section, (iv) evaluate interaction between behavior at prestress transfer and performance under shear-critical loads, and (v) identify design and detailing improvements and make recommendations. Eight full-scale Texas U54 prestressed concrete beams were fabricated to achieve these goals. Load tests on the first four of these beams resulted in a failure along the bottom flange-to-web interface of the beam. These failures occurred at loads well below the calculated shear capacity. Given the horizontal sliding observed, the failure mode was called horizontal shear. The next two beams were fabricated to test three modifications to the end-region design, two of which were deemed successful. The final two beam sections tested contained the recommended new standard reinforcement and concrete geometry. A method to evaluate the horizontal shear demand on and capacity of the bottom flange-to-web interface of prestressed concrete beams was developed. The calculations were formulated using the theories of beam bending and shear friction. This method was calibrated and verified using the U-Beam test data and results of shear tests in the literature. This dissertation contains the specifics of the beams tested and the data collected, and provides the details of recommended changes to the Texas U-Beam standard drawings.

This report is available for free download (8.3 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-5831-2.pdf>

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## **Item 3**

### **Developing a Testing Device for Total Pavements Acceptance. Final Report**

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 6005-3 • 2013*

During the fourth year of Project 0-6005, construction of the Total Pavement Acceptance Device (TPAD) was completed. The TPAD is a multi-function pavement evaluation device used to profile continuously along pavements at speeds in the range of 2 to 5 mph. The test functions include those associated with a Rolling Dynamic Deflectometer (RDD), ground penetrating radar (GPR), Distance Measurement Instrument (DMI), high-precision differential GPS, surface temperature and digital video imaging of the pavement, and right-of-way conditions. The towing frame system used to position and pull the RDD rolling sensors was developed and installed on the TPAD. The towing frame system minimizes the transmission of vibrations from the TPAD mobile platform and loading system to the rolling sensors, and allows for the incorporation of three rolling sensors (front, center, and rear) on the TPAD. The front and rear rolling sensors have 12.5-in. diameter wheels and a 90-lb hold-down weight while the center rolling sensor has 9.5-in. diameter wheels and a 40-lb hold-down weight. Initial deflection measurements using the new towing frame/sensor cart arrangement were performed at the TxDOT Flight Services Facility (FSF). Based on these tests, it is recommended that most deflection profiling be done with the center and rear rolling sensors at a testing speed of 2 mph. Three case studies with the TPAD were performed at a testing speed of 2 mph: on US 297 near Wichita Falls, at TxDOT FSF, on US 290 near Houston. The pavements at the three sites are continuously reinforced concrete pavement (CRCP), jointed concrete pavement (JCP), and full-depth, hot-mix asphalt (HMA), respectively. The TPAD proved durable during the testing period and provided valuable information for all three types of pavements.

This report is available for free download (3.7 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6005-3.pdf>

## **Item 4**

### **Swelling of Highly Plastic Clays under Centrifuge Loading**

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 6048-01-P2 • 2013*

This document provides step-by-step testing procedures from Project 5-6048-01. "The goal of this project is to use centrifuge technology to properly characterize the swelling potential of expansive clays." --Research Project 0-6048 PSR.

This report is available for free download (312 KB):

<http://library.ctr.utexas.edu/ctr-publications/5-6048-01-P2.pdf>

## **Item 5**

### **Project Evaluation Toolkit (PET) for Abstracted Networks**

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 6235-01-1 • 2013*

This report summarizes the research completed for TxDOT Project No. 5-6235-01 and discusses the implications and future applications of the work. This project extended the capabilities of the Project Evaluation Toolkit (PET), while introducing the software to a large network of potential users across the state of Texas.

This report is available for free download (764 KB):

<http://library.ctr.utexas.edu/ctr-publications/5-6235-01-1.pdf>

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## *Item 6*

### **Webinar Presentations for TxDOT Implementation Project 5-6386-01: Implementation of New Pavement Performance Prediction Models in PMIS**

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)  
*TTI 6386-01-P1 • 2013*

This disc contains 4 Microsoft PowerPoint presentations.

This report is available for free download (25.9 MB):

<http://tti.tamu.edu/documents/5-6386-01-P1.zip>

## *Item 7*

### **Non-Destructive Evaluation of In-Service Concrete Structures Affected by Alkali-Silica Reaction (ASR) or Delayed Ettringite Formation (DEF). Final Report, Part I**

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 6491-1 pt.1 • 2013*

Alkali-silica reaction (ASR) and delayed ettringite formation (DEF) are expansive reactions that can lead to the premature deterioration of concrete structures. Both have been implicated in the deterioration of numerous structures around the world, including many transportation structures in Texas. Research on various aspects of ASR has been conducted since the late 1930s and has led to the identification of the mechanism of the reaction and subsequent expansion, as well as measures to prevent its occurrence in new construction. It consists of a reaction between alkali hydroxides in the pore solution and certain forms of silica in aggregate particles; with sufficient moisture, the product of the reaction swells and leads to expansion and cracking of the concrete. Eliminating any one of these components will prevent deleterious effects.

This report is available for free download (5.2 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6491-1.pdf>

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## **Item 8**

### **Evaluation of Concrete Structures Affected by Alkali-Silica Reaction and Delayed Ettringite Formation. Part 2**

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)  
*TTI 6491-1 pt.2 • 2013*

This report details the results of a comprehensive research project aimed at evaluating the potential use of non-destructive testing (NDT) to assess structures affected by ASR and/or DEF. This project was a collaborative effort between the University of Texas at Austin and Texas A&M University (TAMU). The results presented in this report are those obtained by the team at TAMU. Available data on the performance of large-scale samples exhibiting alkali-silica reaction (ASR) and/or delayed ettringite formation (DEF) are presented, and the analysis of these data shows that steel-concrete bond is affected by ASR/DEF. Multiple techniques for assessing the steel-concrete interface are presented, and the impact-echo method is selected for further study. A small-scale laboratory experiment using impact-echo shows that this technique has the potential to detect ASR/DEF-induced defects at the steel-concrete interface. The application of impact-echo to large-scale samples with ASR yields inconclusive results, and further work is needed to determine if impact-echo can be used to assess the steel-concrete interface of ASR/DEF-affected field structures.

This report is available for free download (7 MB):

<http://tti.tamu.edu/documents/0-6491-1.pdf>

## **Item 9**

### **RTI Special Studies for TxDOT Administration in FY 2012**

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 6581-CT-4 • 2013*

This research project was established by TxDOT's Research and Technology Implementation Office to address special studies required by the department's Administration during FY 2012. Three tasks were completed and are documented.

This report is available for free download (3.6 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6581-CT-4.pdf>

## **Item 10**

### **Assessment of TxDOT Staffing for Project Development and Construction, and Project Backlog Analysis**

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 6581-CT-5 • 2013*

The objective of the work documented in this report was to examine full-time-equivalent (FTE) staffing needs for TxDOT project development and construction, and analyze needs for backlogging projects, i.e., preparing construction plans in advance and keeping them at the ready for possible construction funding in the future. As TxDOT developed its long-term project development plans (PDP-2012 and PDP-2013), the research team provided support to the respective TxDOT task forces. In fiscal year (FY) 2011, the research team examined FTE needs for TxDOT project development and construction, and began to analyze needs for backlogging projects. In FY 2012 this work was continued to complete analyses requested by TxDOT as a result of additional complexities identified during development of PDP-2012, and to address changes in funding enacted by the 82nd Texas Legislature.

This report is available for free download (3.8 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6581-CT-5.pdf>

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## **Item 11**

**Developing a Fundamental Understanding of the Chemistry of Warm Mix Additives. Training Materials**  
UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 6591-P2 • 2012*

This document contains a group of slides used to present information about TxDOT Project 6591.

This report is available for free download (4.6 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6591-P2.pdf>

## **Item 12**

**Evaluation of Skid Measurements Used by TxDOT: Technical Report**  
TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)  
*TTI 6619-1 • 2013*

Accurate estimates of wet roadway friction are critical to the safety of the traveling public, project selection, and for managing the wet weather accident reduction program. Currently, Texas is the only state that uses a one-channel, torque-type wheel transducer to measure the drag force. The Texas Department of Transportation (TxDOT) uses the measured horizontal drag force and the computed value of the dynamic vertical wheel load to determine the skid number from its ASTM E274 friction measurement system. This research project evaluated TxDOT's existing method for measuring pavement surface friction. Given the differences found in skid measurements from tests conducted to compare one- and two-channel locked-wheel skid systems, researchers investigated options for improving TxDOT's current friction measurement method, particularly on nontangent sections where inertial loading effects were found to be most pronounced. Measuring the dynamic vertical test wheel load was the primary focus of this investigation. In addition, researchers investigated improvements that could enhance the overall operation of the TxDOT skid measurement systems and reduce maintenance costs. Researchers recommend that TxDOT convert its current fleet of one-channel locked-wheel skid trailers to two-channel systems that provide direct measurement of vertical load and consider purchasing at least one fixed-slip system to support project-level forensic investigations.

This report is available for free download (4.9 MB):

<http://tti.tamu.edu/documents/0-6619-1.pdf>

## **Item 13**

**Mixture Design Procedure for Flexible Base**  
TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)  
*TTI 6621-P1 • 2013*

This procedure document supplements Report 0-6621-1. "The goals of this project are to develop a flexible base specification that reduces TxDOT's burden for sampling and testing, reduces time and space burdens on producers for maintaining TxDOT-only stockpiles, and maintains or improves the quality of the base. To facilitate accomplishing these goals, this project developed a draft quality control/quality assurance (QC/QA) specification for flexible base." --TxDOT Research Report 0-6621-1 abstract

This report is available for free download (354 KB):

<http://tti.tamu.edu/documents/0-6621-P1.pdf>

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## ***Item 14***

### **Worker Safety in Very Short Duration Work Zone Operations: State of Practice and Risk Management Process**

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

*CTR 6640-1 • 2013*

Very short duration maintenance operations (VSDOs) last for 15 minutes or less and usually involve operations such as removing an object from the roadway (either on the pavement or adjacent shoulder) or pothole patching. These activities have the potential to interrupt traffic flow and can pose a safety risk for both workers and drivers. Specific guidance for VSDOs is undocumented and workers tend to use their own judgment in making critical time sensitive decisions. Identifying risk factors in VSDOs helps maintenance workers better judge the immediate conditions and make more informed decisions on whether to conduct an operation as a VSDO or not. This study sought to define a VSDO and identify typical VSDOs. In addition, this study identified risk factors that maintenance workers may face during VSDOs. Moreover, this study prepared a list of technologies and methods for minimizing risk to workers in VSDOs. This study also presented a risk management process that enables maintenance workers to identify work zone hazards for VSDOs and improve their judgment about work zone conditions and hazards. Multiple scenarios illustrating the risks were presented, and related safety recommendations were also discussed.

This report is available for free download (2.1 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6640-1.pdf>

## ***Item 15***

### **Studies to Assess the Impact of Nighttime Work Zone Lighting on Motorists**

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

*TTI 6641-1 • 2013*

This report describes the methodology and results of analyses performed to assess the impact of work zone lighting on motorists. Field studies were conducted to provide insight into how drivers' eyes react to typical temporary work zone lighting configurations in Texas compared to standard lighting situations (i.e., no lighting and standard fixed lighting). Researchers also conducted closed-course studies to evaluate the impact of various work zone lighting scenarios upon the ability of drivers to detect low-contrast objects (e.g., debris) and workers. The findings from these studies, as well as information from a literature review and review of other state agency specifications, were used to develop work zone lighting guidelines for nighttime operations that considered both worker and motorist needs.

This report is available for free download (1.2 MB):

<http://tti.tamu.edu/documents/0-6641-1.pdf>

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## ***Item 16***

### **Guidance for Effective Use of Pylons for Lane Separation on Preferential Lanes and Freeway Ramps**

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

*TTI 6643-1 • 2013*

Flexible pylons are gaining popularity as traffic channelizing devices in a variety of applications. The flexible pylons are less rigid (as compared to concrete barriers) enabling easier access for emergency vehicles and provide more positive control than pavement markings for channelizing traffic. In general there are also concerns with the effectiveness of flexible pylons when used as channelizing devices. Motorists frequently strike flexible pylons, which can increase maintenance costs for agencies. In addition, broken pylons may create safety concerns to motorists. While some standards exist to test durability of pylons, there is a lack of guidelines for implementation of pylons. This project identifies factors that influence the effectiveness of pylon implementations and develop guidance to effectively implement pylons on high speed facilities. This report documents the task of the first year of research including: a state-of-practice review, vendor survey, agency survey, case studies, and a synthesis of information.

This report is available for free download (15 MB):

<http://tti.tamu.edu/documents/0-6643-1.pdf>

## ***Item 17***

### **Development of Guidelines for Operationally Effective Raised Medians and the Use of Alternative Movements on Urban Roadways**

TEXAS SOUTHERN UNIVERSITY (TSU). DEPARTMENT OF TRANSPORTATION STUDIES

*TSU 6644-1 • 2013*

The development of raised medians is an important access management technique commonly used in urban settings. It can be used to control or restrict mid-block left turns, U-turns or crossing maneuvers for implementing of alternative left-turn/U-turn movements. The objective of this research project was to develop guidelines for operationally effective raised medians and the use of alternative movements on urban roadways. To fulfill this goal, the researchers (1) reviewed and synthesized national and peer states' practices, (2) conducted survey of traffic engineers, (3) conducted field studies, (4) analyzed the design issues relating to raised medians and alternative movements through simulation studies, and (5) developed guidelines for future implementation of raised medians and representative alternative movements in Texas. The results of this study provide recommendations on some critical design issues in the use of raised medians, including median widths, median left-turn lane lengths, placement of median openings, and the use of directional median openings. In addition, a set of implementation-oriented guidelines regarding the applicability, geometric design, and access management of three typical types of alternative movements, including restricted crossing U-turn (RCUT), median U-turn (MUT) and continuous flow intersection (CFI), were developed.

This report is available for free download (13.4 MB):

<http://tti.tamu.edu/documents/0-6644-1.pdf>

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## ***Item 18***

### **Investigating Regional Dynamic Traffic Assignment Modeling for Improved Bottleneck Analysis. Final Report**

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)  
*CTR 6657-1 • 2013*

This research employed dynamic traffic assignment (DTA) modeling to study the network-wide impact of bottleneck alleviation measures taken by TxDOT on MoPac Expressway in downtown Austin. The measures led to a small improvement in MoPac travel conditions and no major route-switching behaviors were found due to the new geometric reconfiguration on MoPac. The study discussed the benefits and challenges of incorporating DTA into the traditional four-step planning process and provided guidelines to move forward in this direction. A decision-making framework to choose from potential future improvements projects was also developed.

This report is available for free download (2.6 MB):  
<http://library.ctr.utexas.edu/ctr-publications/0-6657-1.pdf>

## ***Item 19***

### **Initial Review of Rapid Moisture Measurement for Roadway Base and Subgrade**

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)  
*TTI 6676-1 • 2013*

This project searched available moisture-measurement technologies using gravimetric, dielectric, electrical conductivity, and suction-based methods, as potential replacements for the nuclear gauge to provide rapid moisture measurement on field construction projects. Such testing is critical for acceptance of field compaction, and could become more critical as states look toward mechanistic-based acceptance. The first phase of this project, presented in this report, carried out test method development, pilot testing, and then initial deployment of the most promising devices. These activities confirmed the utility of existing direct heat and microwave oven tests, revealed promising results with an electrical-impedance based field test, and resulted in draft test procedure development with a portable dielectric-based device and a moisture analyzer. Several procedures evaluated only test the passing No. 4 fraction; reliably predicting the moisture content on the full gradation from the passing No. 4 measurement remains a topic needing further investigation. Future work on this project will deploy the most promising devices on a number of construction projects representing a spectrum of materials, where the devices on a number of construction projects representing a spectrum of materials, where the devices will be evaluated for bias, precision, and sensitivity. Additionally, this project identified and pilot tested a microwave resonance-based device that may enable rapid field moisture measurement with a high level of testing coverage. Future work on this project will continue development work with applying this device to windrows and processed construction materials.

This report is available for free download (3.2 MB):  
<http://tti.tamu.edu/documents/0-6676-1.pdf>

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## *Item 20*

### **Improving DMS 9210 Requirements for Limestone Rock Asphalt. Year One Interim Report**

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

*TTI 6686-1 • 2013*

Limestone Rock Asphalt (LRA) mixtures have been produced and placed for several decades using specification requirements currently listed under DMS 9210. Several Districts have had placement issues and premature failures at the beginning of 2010. These issues and failures have been attributed to material properties. Requirements for DMS 9210 have not changed for several years and need to be evaluated to possibly produce a higher quality material to reduce the occurrence of premature failures and to minimize placement issues. The objectives of the study are to (1) Evaluate specification requirements of Item 330 and DMS 9210, (2) Conduct field evaluations and lab testing to determine workability and acceptability as stockpile material for use as needed in pavement maintenance, and (3) Consider improvements to the specification requirements to ensure an acceptable and workable stockpile material for up to 6 months. Twenty eight test patches were constructed around the state but none of the performance problems seen in 2010 were observed in the test sections. A review of production data indicates that one of the suppliers made some significant changes to the flux oil content during the time when the 2010 performance problems were noted. Tests have been identified in this Year One study which may be better indicators of LRA field performance. These tests are being fully explored in Year Two to determine their sensitivity to flux oil content and type.

This report is available for free download (3.5 MB):

<http://tti.tamu.edu/documents/0-6686-1.pdf>

## *Item 21*

### **The Dynamics of U.S.-Asian-South American Waterborne Trade and the Panama Canal Expansion: Their Anticipated Impacts on Texas Ports and the State's Economy**

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

*CTR 6690-1 • 2013*

This report examines noteworthy aspects of US-Asian and US-Latin American trade, particularly the present and likely future roles of Texas ports and the Panama Canal. The purpose is to identify opportunities and challenges faced by the State of Texas and its ports in competing for international trade. The role of Texas ports within the larger US economy is examined, and developments in the Texas energy sector noted. The research team collected information from and conducted selected interviews with Texas port officials and individuals involved with various modes of transportation, such as ocean carriers, the Panama Canal Authority, shippers, consultants, international organizations, research institutes, and the like. The report addresses the Texas Department of Transportation's (TxDOT) role in maintaining functional, economically healthy ports and responding to the canal's expansion.

This report is available for free download (1.41 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6690-1.pdf>

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## **Item 22**

### **Guidebook, Managing Operating Costs for Rural and Small Urban Public Transit Systems**

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)  
*TTI 6694-P3 • 2013*

"This guidebook is a resource for rural and small urban transit agency managers to use in better understanding, predicting, and managing operational costs. Doing so can improve efficiency, effectiveness, and sustainability of public transit in the community served. The guide is a framework for assessing current transit agency operating costs and tools to predict future costs and is presented in three parts." --p.1

This report is available for free download (10 MB):

<http://tti.tamu.edu/documents/0-6694-P3.pdf>

## **Item 23**

### **Worker Safety During Operations with Mobile Attenuators**

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)  
*TTI 6707-1 • 2013*

While most transportation agencies are very familiar with truck-mounted attenuators, trailer-mounted attenuators are increasing in popularity. There is a concern for the level of protection that attenuators provide for workers when they are mounted on trailers compared to trucks. This research evaluated and compared the level of protection provided to workers by truck-mounted and trailer-mounted attenuators. No crash testing was conducted; instead, the researchers used existing crash test report data for the comparison. The researchers found that the use of heavier support vehicles for these mobile attenuators provided better protection for workers and recommend that TxDOT maintains the current policy of requiring 20,000 lb support vehicles, regardless of attenuator type. In addition, the researchers found that the concern of trailer-mounted attenuators swinging around may not be justified, given that post-impact trajectories of the impacting vehicles are similar to those reported during truck-mounted attenuator impact testing.

This report is available for free download (3 MB):

<http://tti.tamu.edu/documents/0-6707-1.pdf>

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## *Item 24*

### **A Web-Based Pavement Performance and Maintenance Management and GIS Mapping System for Easy Access to Pavement Condition Information: Final Report**

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

*CTR 9035-01-P1 • 2013*

State Departments of Transportation, including the Texas Department of Transportation (TxDOT), have long been moving towards the development and implementation of pavement management systems that would enable monitoring of the performance of their roadways, as well as assist transportation officials with maintenance budget allocation and planning decisions. Various past attempts focused on using the available performance databases as well as state-of-the-art concepts for the development of such systems. Texas's unique characteristics, the most predominant of which is the vast size of the managed pavement network—79,696 centerline miles of highways including 49,829 bridges—have made some of the decision support models and/or algorithms a challenge to implement. This report presents a new approach to the development of such a decision-support system with its focus on maintenance management for TxDOT. The new system is web-based and provides functional capabilities that allow transportation officials and engineers to make informed decisions regarding their budget planning and budget allocation for pavement maintenance management, fully utilizing available historical data. The developed system has been successfully pilot-tested in TxDOT's Dallas District.

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