Research Digest

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In this Issue:

TxDOT Reports

Table of Contents

Item 1

Traffic Control Device Evaluation Program. Simulator Evaluation of Sponsored Changeable Message Signs and In-Situ Evaluation of Rumble Strip Alternatives

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

TTI 1001-14-2 • 2016

This report describes two research activities. One research study tested the effects of adding commercial logos acknowledging sponsorship to Changeable Message Signs. A driving simulator study was conducted using test signs with travel times and safety message both with and without logos, while complying with the Texas Manuals on Uniform Traffic Control Devices guidance regarding overall message length and phase timing. Measures of performance included eye gaze duration and last look distance as well as driving performance measures of speed limit compliance and lane maintenance. Forty-two drivers in old and young age groups participated int he study. Another research study evaluated various rumble strip alternatives that have been used on various roadways in Texas. In this study, vehicles were instrumented with specialized equipment to measure the sound and vibration of various rumble strip alternatives. The vehicles were driven at various speeds during the testing. The primary measure of effectiveness was the change in vibration and sound from the control condition of driving in the lane.
(x, 109 pages)

CONTENTS

This report is available for free download (5.3 MB):
http://tti.tamu.edu/documents/9-1001-14-2.pdf

Item 2

MASH TL-3 Crash Testing and Evaluation of the TxDOT T631 Bridge Rail

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 1002-12-12 • 2016

The Texas Type T631 bridge rail was developed as a low-cost, flexible bridge rail system for TL-2 applications. Many of the failures used for the system tested at MxRSF for TL-3 were incorporated into the design developed for this project for *MASH* TL-2 application. The TxDOT Type T631 bridge rail was designed, developed, and evaluated under *MASH* TL-2. The objective of this research was to evaluated the impact performance of the new TxDOT Type T631 bridge rail to *MASH* TL-3. The TxDOT Type T631 bridge rail was intended to serve as a low-cost replacement for the TxDOT Type T6 bridge rail for *MASH* TL-2 applications. The crash testing was performed in accordance with the requirements of *MASH* TL-3. The TxDOT T631 Bridge Rail performed acceptably for *MASH* TL-3.
(xi, 153 pages)

This report is available for free download (11.7 MB):
http://tti.tamu.edu/documents/9-1002-12-12.pdf

Item 3

MASH Test 3-11 of the TxDOT T222 Bridge Rail

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 1002-12-13 • 2016

The objective of this research was to evaluate the impact performance of the TxDOT Type T222 Bridge Rail according to the *Manual for Assessing Safety Hardware* (*MASH*) TL-3. The crash testing was performed in accordance with the requirements of *MASH* TL-3. This report describes the TxDOT T222 Bridge Rail, documents the performance of the rail system according to *MASH* TL-3 specifications, and presents recommendations regarding implementation and future work.

The TxDOT T222 Bridge Rail contained and redirected the 2270P vehicle. The vehicle did not penetrate, under ride, or override the installation. Maximum dynamic deflection during the test was 2.1 inches. No detached elements, fragments, or other debris was present to penetrate or to show potential for penetrating the occupant compartment, or to present hazard to others. Maximum occupant compartment deformation was 4.0 inches in the kick panel are near the right front passenger's feet. the 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 7 degrees and 12 degrees, respectively. Occupant risk factors were within the limits specified in *MASH*. The vehicle exited within the exit box criteria. The TxDOT T222 Bridge Rail performed acceptably for *MASH* test 3-11. This barrier is recommended for implementation on new construction, retrofit applications, and in temporary applications in construction work zones.
(ix, 65 pages)

This report is available for free download (9.7 MB):
http://tti.tamu.edu/documents/9-1002-12-13.pdf

Item 4

Crash Test and Evaluation of 3-ft Mounting Height Sign Support System

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 1002-15-1 • 2016

The Texas Department of Transportation (TxDOT) and other transportation agencies continue to research potential countermeasure for mitigating wrong-way crashes. Because many drivers involved in wrong-way crashes are impaired, some highway safety engineers are proponents of using low-mounting height signs to communicate "Wrong Way" or "Do Not Enter" messages to these drivers. The *Manual on Uniform Traffic Control Devices* (MUTCD) has a provision for the use of a 3-ft sign mounting height. However, as with other sign support systems, any low-mounting height sign support system should meet impact performance criteria prior to its implementation on the national highway system. The purpose of this research was to evaluate the impact performance of a 3-ft × 3-ft aluminum sign panel mounted at a reduced mounting height of 3 ft from the bottom of the panel to grade. The sign panel is supported by a wedge anchor system.

To evaluate the impact performance of the sign support system, two crash tests were performed under American Association of State Highway and Transportation Officials' (AASHTO) *Manual for Assessing Safety Hardware* (*MASH*) evaluation criteria. These were *MASH* Tests 3-60 and 3-61, which consist of a 2425-lb passenger car impacting the sign support system at nominal speeds of 19 mi/h and 62 mi/h, respectively. In both tests, the 3-ft mounting height sign support system performed acceptably and met all relevant *MASH* evaluation criteria. *MASH* Test 3-62, which involves a 5000-lb pickup truck impacting the support structure at a speed of 62 mi/h, was not performed. The reduced mounting height of the sign support system eliminates any secondary contact between the sign support system and the windshield of the pickup truck.
(x, 58 pages)

This report is available for free download (6.2 MB):
http://tti.tamu.edu/documents/9-1002-15-1.pdf

Item 5

Crash Test and Evaluation of a Temporary Wood Sign Support System for Large Guide Signs

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 1002-15-4 • 2016

The objective of this research task was to evaluate the impact performance of a temporary wood sign support system for large guide signs. It was desired to use existing TxDOT sign hardware in the design to the extent possible. The full-scale crash testing followed the procedures recommended in the American Association of State Highway and Transportation Officials' (AASHTO) *Manual for Assessing Safety Hardware* (*MASH*). In *MASH* Test 3-60, the Temporary Wood Sign Support System for Large Guide Signs readily activated by fracturing in various designed locations. The fractured posts did not penetrate or show potential for penetrating the occupant compartment, and did not present hazard to others in the area. The sign panel came to rest on the roof of the vehicle with resulting occupant compartment deformation of 2.5 inches. Occupant risk factors were within the limits specified in *MASH*. In *MASH* Test 3-61, the TxDOT Large Temporary Wood Sign Support readily activated by fracturing in various designed locations. The fractured posts did not penetrate or show potential for penetrating the occupant compartment, and did not present hazard to others in the area. No occupant deformation or intrusion occurred. Occupant risk factors were within the preferred limits specified in *MASH*. The Temporary Wood Sign Support System for Large Guide Signs performed acceptably for *MASH* Tests 3-60 and 3-61. Accompanying wind load charts and foundation embedment depths were developed and presented for all acceptable temporary wood support sizes deemed crashworthy based on the tests performed under this project and previous research efforts. These design charts and tables can be used to develop standard detail sheets to aid designers in the selection of appropriate support details for a given sign.
(xi, 70 pages)

CONTENTS

This report is available for free download (8.9 MB):
http://tti.tamu.edu/documents/9-1002-15-4.pdf

Item 6

Continued Implementation of High Performance Thin Overlays in Texas Districts, Odessa District Workshop

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

TTI 5598-05-WS1 • 2016

CONTENTS

- 5598-05 Odessa District Presentations [PDF]
- Odessa PFC [PDF, "Construction and Monitoring of the Fine PFC Section for Odessa"]
- Odessa TOM C and TOM F Designs [PDF, "APPENDIX B Mix Designs Developed under 5598-05 for Odessa District"]

Workshop materials are available for free download (1.8 MB ZIP file):

http://tti.tamu.edu/documents/5-5598-05-WS1.zip

Item 7

Guidelines on Design and Construction of High Performance Thin HMA Overlays

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

TTI 5598-05-WS2 • 2016

Workshop slides for the workshop "Guidelines on the Use and Inspection of Thin Surface Mixes in TxDOT's Maintenance and Pavement Preservation Programs," held April 2016
(125 unnumbered pages)

Workshop materials are available for free download (7.4 MB):
http://tti.tamu.edu/documents/5-5598-05-WS2.pdf

Item 8

Inspection Guide for Column Splice Regions Affected by Premature Concrete Deterioration

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 5722-P2 • 2016

This guideline aims to help bridge inspectors and engineers to identify and assess the capability of reinforced concrete column splice regions affected by varying degrees of premature concrete deterioration due to alkali-silica reaction (ASR) and delayed ettringite formation (DEF). To assess the structural behavior of bridge column splices that are influenced by ASR/DEF, research engineers conducted a comprehensive experimental program over an eight-year period.The program consisted of the design, construction, curing, exposure, testing, and assessment of 16 large-scale column specimens with a lap splice region typical of TxDOT practice for the bar size being used and conservative by code standards. The report presents a summary of the results on testing of 10 specimens that were structurally load-tested in the four-point load test setup; all but the last two specimens were tested in the three-point load test setup. Researchers will periodically inspect six more specimens that are being stored at the exposure site indefinitely under outdoor exposure conditions.
(vii, 31 pages)

CONTENTS

This report is available for free download (3.2 MB):
http://tti.tamu.edu/documents/0-5722-P2.pdf

Item 9

TPADana 2.0: Draft User's Manual of TPAD Data Analysis Software

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6005-01-P1 • 2016

The Total Pavement Acceptance Device (TPAD) is a continuous pavement deflection test device. Since the device is designed for total acceptance of pavements, the researchers have combined the deflection testing with Ground Penetrating Radar (GPR), digital video, and Global Positioning System (GPS) technologies. Texas Department of Transportation (TxDOT) will use the final system for testing both new pavements and those scheduled for rehabilitation. Since the release of the RDDana 1.0 software about three years ago, Texas A&M Transportation Institute (TTI) made several changes to the original RDDana 1.0 software based on the users' comments. TTI added new features, fixed small bugs, and made the current software more stable and easier to use. After all the updates, the researchers propose to rename the RDDana software to TPADana, and define this new software as version 2.0. This draft user's manual describes the data processing system, and used the data collected in a 2012 survey of US 287 in the Wichita Falls District. The executable load module for this software and the associated data from US 287 are supplied with the manual.
(v, 46 pages)

This manual is available for free download (3.5 MB):
http://tti.tamu.edu/documents/5-6005-01-P1.pdf

Item 10

Spreadsheet-Based Engine Data Analysis Tool. User's Guide

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6626-P1 • 2016

The concept of preventive maintenance is very important in the effective management and deployment of vehicle fleets. The Texas Department of Transportation (TxDOT) operates a large fleet of over 17,000 pieces of on-road and off-road equipment. Newer engines and vehicles are equipped with on-board diagnostic systems that can provide data on engine operation -- including engine speed and throttle position (an indication of load value). There is the possibility of tracking these parameters to refine predictions for when equipment maintenance should be performed. Project 0-6626 aimed to provide a proof of concept for this idea by developing an algorithm that can be used to recommend appropriate oil change intervals based on engine data collected through on-board diagnostic systems. This product is a spreadsheet-based analysis tool developed as part of Project 0-6626, which can be used for logging, analyzing, and characterizing engine data for heavy-duty fleet of vehicles in the TxDOT fleet of the selected test vehicle type.
(ix, 14 pages; 26 MB)

• Accompanying CD-ROM contains "Excel Spreadsheet Data Analysis Tool and Example Data Log"

CONTENTS

This report and accompanying CD-ROM contents are available for free download (1.5 MB; 432 KB ZIP file):
http://tti.tamu.edu/documents/0-6626-P1.pdf

http://tti.tamu.edu/documents/0-6626-P1-CD.zip

Item 11

Executive Plan Summary, An ITS Strategic Plan for Texas

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6672-3 • 2016

The TxDOT Intelligent Transportation System (ITS) Strategic Plan supports the goals and objectives of the TxDOT agency Strategic Plan. It has the same four goals as the TxDOT Strategic Plan: (1) Maintain a safe system; (2) Address congestion; (3) Connect Texas communities; and (4) Become a best-in-class state agency. This report outlines key objectives that fall under each of the four plan goals.
(3 pages)

This report is available for free download (149 KB):
http://tti.tamu.edu/documents/0-6672-3.pdf

Item 12
ITS Strategic Plan for Texas

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6672-P1 • 2016

This purpose of this research was to provide a framework to guide the development and deployment of an integrated statewide program for Intelligent Transportation Systems (ITS). ITS is a critical component of the transportation infrastructure that helps ensure the system operates in the most efficient way possible every day and night, and during all types of situations and weather conditions.
(viii, 15 pages)

This report is available for free download (1.8 MB):
http://tti.tamu.edu/documents/0-6672-P1.pdf

Item 13
Identifying Best Practices for Managing Operating Costs for Rural and Small Urban Transportation Systems: Technical Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6694-1 • 2016

Rural and small urban transit providers across the United States face fiscal challenges caused by the growing gap between the cost of providing transit service and available federal, state, and local funding. In Texas, the fiscal challenges facing rural and small urban transit providers are compounded by an increasing population and growth in urbanization in some counties and declining population with increasing demand for transit service for an aging population in other counties. The research report examines the drivers of operating costs, approaches to containing costs, transit agency priorities for tools needed to better contain costs, and methodology used to develop the guidebook and workshop.
(x,74 pages)

CONTENTS

This report is available for free download (2.57 MB):
http://tti.tamu.edu/documents/0-6694-1.pdf

Item 14

Maintaining Project Consistency with Transportation Plans throughout the Project Life Cycle with an Emphasis on Maintaining Air Quality Conformity. Technical Report

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

TTI 6758-1 • 2016

Federal and state transportation planning statutory and regulatory laws require transportation projects to be consistent with transportation plans and improvement programs before a federal action can be taken on a project requiring one. Significant delays in project delivery can occur if the federal funding is withheld when projects are found to be inconsistent with transportation plans and improvement programs. This issue is especially critical for projects in nonattainment and maintenance areas because an inconsistent project might trigger a conformity failure or delayed determination for the entire plan and/or program.

The researchers found that the main challenges leading to project inconsistencies are insufficient communication over the changes to projects' design concept and scope, cost, and estimated letting date. The research team developed a Project Consistency Guidebook (PCG), a Supplementary Information Document (SID), and a project consistency checklist. The guidebook explains how project planning and development interact with the regional and project level air quality conformity process, and details procedures and tools that TxDOT and Texas Metropolitan Planning Organizations can use to understand and maintain project level conformity and project consistency with applicable transportation plans and programs. The SID provides an overview of the subjects relevant to project consistency. The project consistency checklist serves as a guide to keep track of the changes to a project.
(xii, 88 pages)

CONTENTS

This report is available for free download (2.7 MB):
http://tti.tamu.edu/documents/0-6758-1.pdf

Item 15

Maximizing Mitigation Benefits: Research to Support a Mitigation Cost Framework. Final Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6762-01-1 • 2016

Tracking environmental costs in the project development process has been a challenging task for state departments of transportation (DOTs). Previous research identified the need to accurately track and subsequently estimate project costs resulting from environmental mitigation requiirements. There is currently no single source or management system for capturing and/or estimating the Texas Department of Transportation's (TxDOT's) project-related mitigation costs statewide. The purpose of this continuation project was to determine types of mitigation costs for TxDOT projects and identify the funding sources, mechanisms, and processes for acquiring funding and administering payment, as well as conduct a synthesis of mitigation cost tracking and estimating at select state DOTs.
(x, 51 pages)

CONTENTS

This report is available for free download (1.6 MB):
http://tti.tamu.edu/documents/0-6762-01-1.pdf

Item 16

Recommended RAP/RAS Performance Prediction Program: Tx-Recycol

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6823-P1 • 2016

Tx-Recycol is an asphalt overlay design program tailored for asphalt mixes containing Reclaimed Asphalt Pavement (RAP) and Reclaimed Asphalt Shingles (RAS). It predicts asphalt overlay performance in terms of both rutting and cracking. Tx-Recycol can help pavement engineers to design best asphalt mixes with RAP and RAS suitable for the specific pavement conditions including traffic, climate, overlay thickness, and existing pavement conditions.
(183 MB)

This program is available for free download (42.9 MB):
http://tti.tamu.edu/documents/0-6823-P1.zip

Item 17

NEPA Assignment Training PowerPoints and Quizzes

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6866-P1 • 2016

"The objective of these training materials is to provide National Environmental Policy Act (NEPA) Assignment information to all professionals involved in the NEPA process. This training is not intended to be a replication of existing NEPA training that TxDOT conducts, nor is it a training on performing NEPA documentation. Rather, the information is intended to provide an overview of the responsibilities and duties under NEPA assignment, followed by a quiz. TxDOT staff helped identify six groups to receive the training: (1) Consultants, (2) Engineers, (3) Environmental Specialists, (4) Local Government Staff, (5) Elected Officials, (6) Management.

"Six PowerPoints were developed specifically for these groups. The PowerPoints contain sections that outline an introductory review of NEPA and an explanation of how NEPA Assignment has changed the general responsibilities held by these six groups. An overview of what to expect and develop for different project classifications lays the foundation for project delivery of Categorical Exclusions (CEs), Environmental Assessments (EAs), and Environmental Impact Statement (EISs). Major aspects of implementing the NEPA process across all project classifications are outlined, such as project initiation and quality assurance and control. Finally, real-world examples are used to illustrate how important each person's role is to the larger NEPA process under assignment, and to provide examples of where and how mistakes can take place. Also provided here are five quizzes (for all but the elected official group), which similarly use examples from practice to assess the user's understanding of the material." --Introduction (200 pages)

CONTENTS

Training materials are available for free download (909 KB):
http://library.ctr.utexas.edu/ctr-publications/0-6866-P1.pdf

Item 18

Sediment and Erosion Control Laboratory Facility Expansion

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 9048-01 report • 2016

The Sediment and Erosion Control Laboratory (SEC Lab), formerly the Hydraulics, Sedimentation, and Erosion Control Laboratory, is operated by the Texas A&M Transportation Institute's Environment and Planning Program. Performance evaluation programs for sediment and erosion control products, materials, devices and techniques are conducted at the SEC Lab to produce and maintain the Texas Department of Transportation's (TxDOT) Approved Products List (APL). By 2012, the existing facility was operating at full capacity with a waiting list of over 18 months. Expansion of the facility includes an indoor rainfall simulator that houses three 8 ft. x 40 ft. soil-fill test bed, a covered soil storage/bed preparation area, and a covered preparation area between the existing and new buildings, and a sediment retention device flume. The expansion of the SEC Lab provides additional performance evaluation and research capacity to better serve TxDOT's needs and enable a more robust and comprehensive research program.
(viii, 6 pages)

This report is available for free download (834 KB):
http://tti.tamu.edu/documents/5-9048-01.pdf

Item 19

Installation of Dynamic Travel Time Signs and Efforts to Obtain and Test a Graphical Route Information Panel (GRIP) Sign in Austin

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 9049-03-7 • 2016

Graphic Route Information Panel (GRIP) signs use a combination of text, colors, and representative maps of the roadway system to convey real-time roadway congestion location and severity information. The intent of this project was to facilitate the fabrication, installation, and onset of operations of three dynamic travel time signs and one GRIP sign on Interstate 35 (I-35) near Austin, Texas. Unfortunately, FHWA rejected the request-to-experiment with a GRIP sign. This report documents the efforts made and accomplishments achieved under this project.
(viii, 16 pages)

This report is available for free download (6.6 MB):
http://tti.tamu.edu/documents/5-9049-03-7.pdf

Item 20

Construction and Installation of Travel Time Signs on I-35 in Austin

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

TTI 9049-05-1 • 2016

Dynamic travel time signs (DTTS) provide current travel times to a specific destination via one or more routes. These signs aid motorists in making route choice decisions en route. Through this project, three DTTS were fabricated and installed on I-35 in Austin, TX. Two signs were located southbound on overhead sign bridges at global positioning system coordinates 30.745981, -97.636638 and at 30.515859, -97.687471. The third sign was located northbound at coordinates 30.02644, -97.851073.
(viii, 9 pages)

CONTENTS

This report is available for free download (3.8 MB):
http://tti.tamu.edu/documents/5-9049-05-1.pdf