Research Digest

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TxDOT Research Publications

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Research Digest

Item 1

A Systemic Approach to Project Selection for Highway Widening

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

TTI IAC 58-6XXIA002 • 2016

This report presents the application of a proposed systemic approach to project selection for highway widening with a focus on reducing single-vehicle run-off-road (SVROR) and opposite-direction (head-on) crashes. The main focus is related to crashes occurring on two-lane rural highways with a total paved width less than 24 ft and traffic volume equal to 400 or more vehicles per day in the Texas Department of Transportation (TxDOT) roadway network. This report is divided into two sections. The first section covers the literature review on highway pavement widening, while the second section presents the analysis results on project selection. The analytical process of this report is based on the one initially documented in the report titled Developing Methodology for Identifying, Evaluating, and Prioritizing Systemic Improvements.
(35 pages)

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This report is available for free download (1.3 MB):
http://ftp.dot.state.tx.us/pub/txdot-info/trf/hsip/widening-memo.pdf

Item 2

Transportation Pooled Fund Project: Energy Sector Developments

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

TTI 1530-P1 • 2016

A PDF of slides used in a presentation about the Energy Sector Developments Transportation Pooled Fund project.
(10 pages)

This presentation is available for free download (837 KB):
http://tti.tamu.edu/documents/9-1530-P1.pdf

Item 3

Statewide Implementation of the Total Pavement Acceptance Device (TPAD). Final Report

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

CTR 6005-01-1 • 2016

Construction and development of the Total Pavement Acceptance Device (TPAD) was completed at the end of August 2012 through TxDOT Research Project 0-6005-01. The TPAD is a multi-function pavement evaluation device used to profile continuously along pavements at speeds in the range of 2 to 3 mph. The multi-function features of the TPAD include (1) rolling dynamic deflectometer (RDD), (2) ground-penetrating radar (GPR), (3) distance measurement instrument, (4) high-precision differential global positioning system (GPS), (5) pavement surface temperature measurement, and (6) digital video imaging of the pavement surface and right-of-way conditions. TxDOT implementation Project 5-6005-01 was begun in mid-January 2013 and ended on August 31, 2014. The objective of the project was to implement the statewide use of the TPAD for project-level studies of the structural condition of pavements. During the 20-month period of Project 5-6005-01, the Center for Transportation Research (CTR) at The University of Texas at Austin (UT) and the Texas A&M Transportation Institute (TTI) alternately stored, maintained, and operated the TPAD and TPAD hauler. Personnel at each institute performed TPAD demonstration projects when specific TxDOT districts made requests. Ten TPAD demonstrations and eleven TPAD-level studies in eight districts were performed. The TPAD has been successfully used to evaluate the remaining life of current pavement, to help District engineers select optimum rehabilitation schemes, and to identify problematic areas over a wide range of pavements, such as hot mix asphalt, jointed concrete pavement, continuously reinforced concrete pavement, and composite pavement. In addition, the RDD functionality was improved during the project by replacing the sole air-pressure control system for the rolling sensors with three separate air-pressure control systems (one for each of the sensors), as well as by modifying and improving the towing frame used to position and raise/lower the rolling sensors.
(41 pages)

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This report is available for free download (3.2 MB):
http://library.ctr.utexas.edu/ctr-publications/5-6005-01-1.pdf

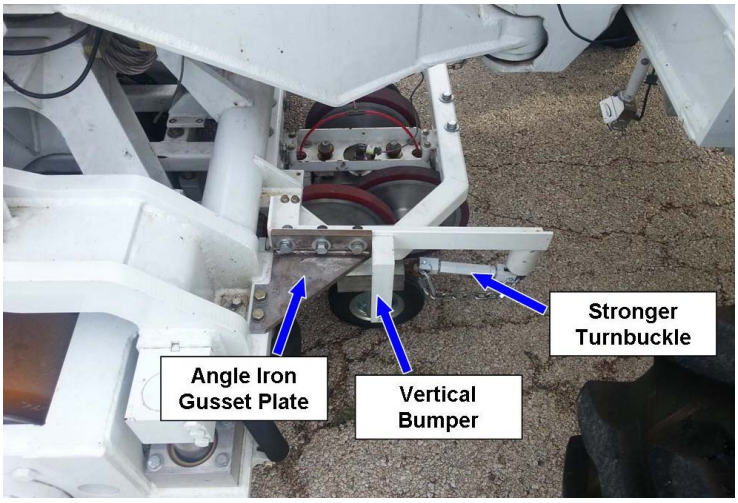
Item 4

Updates to RDD Control Systems and Rolling Sensors

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6005-01-P2 • 2016

This document discusses the improvements made to the RDD system on the TPAD. This work was performed from January 2013 to August 2014. The first improvement involved the air pressure control system on the rolling sensors. The second improvement involved modifications to the towing frame used to position and raise/lower the rolling sensors.
(2 pages)

This report is available for free download (201 KB):
http://library.ctr.utexas.edu/ctr-publications/5-6005-01-p2.pdf



Item 5

Continuous Prestressed Concrete Girder Bridges. Volume 2, Analysis, Testing, and Recommendations

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

TTI 6651-2 • 2016

The Texas Department of Transportation designs typical highway bridge structures as simple span systems using standard precast, pretensioned girders. Spans are limited to about 150 ft due to weight and length restrictions on transporting the precast girder units from the prestressing plant to the bridge site. Such bridge construction, while economical from an initial cost point-of-view, may become somewhat limiting when longer spans are needed. This project focused on developing additional economical design alternatives for longer span bridges with main spans ranging from 150–300 ft, using continuous precast, prestressed concrete bridge structures with in-span splices. Phase 1 of this study focused on evaluating the current state-of-the-art and practice relevant to continuous precast concrete girder bridges and recommending suitable continuity connections for typical Texas bridge girders; the findings are documented in the Volume 1 project report. This report summarizes Phase 2 of the research including detailed design examples for shored and partially shored construction, results of a parametric design study, and results of an experimental program that tested a full-scale girder containing three splice connections. The parametric design study indicated that for bridges spanning from 150–300 ft, continuous precast, prestressed concrete girder bridges with in-span splices can provide an economical alternative to steel girder bridges and segmental concrete box girder construction. The tested splice connections performed well under service level loads. However, the lack of continuity of the pretensioning through the splice connection region had a significant impact on the behavior at higher loads approaching ultimate conditions. Improved connection behavior at ultimate conditions is expected through enhanced connection details. Recommendations for design of continuous spliced precast girders, along with several detailing suggestions are discussed in the report.
(271 pages)

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This report is available for free download (10.8 MB):
http://tti.tamu.edu/documents/0-6651-2.pdf

Item 6

Briefing Sheets on Safety and Operations of Rural Two-Lane Highways

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

TTI 6806-TTI-P1 • 2016

The safety and operations of Texas rural two-lane highways are being affected by increased traffic associated with the energy sector, including the unique characteristics of heavy trucks. Researchers reviewed existing conditions on select rural two-lane highways along with recent literature to develop the following two-page briefing sheets.
(16 pages)

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This report is available for free download (1.6 MB):
http://tti.tamu.edu/documents/0-6806-TTI-P1.pdf

Item 7

Performance evaluation and specification of trackless tack

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

TTI 6814-1 • 2016

Several trackless tack products have come to market in Texas; however, there are currently no specifications to ensure the products have trackless properties and adequate bond strength. The objectives of this project were to (1) evaluate the tracking resistance of different trackless tacks, (2) evaluate bond strength and other construction parameters of different trackless tacks, (3) construct test sections in the field to evaluate performance, and (4) develop test procedures and specifications for trackless tack.

For tracking resistance, a track-free time test and a dynamic shear rheometer (DSR) tackiness test both distinguished between trackless tack and conventional tack. The DSR test further distinguished among stiff-residue and soft-residue trackless tacks. For bond strength of laboratory samples, all samples had acceptable bonding, but stiff-residue trackless tack had the highest bond energy, followed by soft-residue trackless tack, conventional tack, and then no tack. Higher ambient and hot mix asphalt (HMA) compaction temperatures improved bonding. Bonded trackless tack samples were resistant to fatigue cracking and cold temperature delamination. Bond strengths from field samples were considerably lower (15–95 psi) than for lab-molded samples (100–200 psi) and varied among different overlay projects. This was likely due to different project conditions (e.g., pavement surfaces, HMA overlay designs, compaction temperatures). In most cases tack rate did not affect the bond strength.

The researchers recommend adopting the DSR tackiness test and track-free time test to qualify trackless tack materials. The researchers also recommend adopting the shear bond strength test. Draft test methods and a trackless tack material specification are provided.
(vii, 129 pages)

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This report is available for free download (3.3 MB):
http://tti.tamu.edu/documents/0-6814-1.pdf

Item 8

Selection and Design of Quiet Pavement Surfaces

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6819-1 • 2016

This report provides guidelines for the selection and design of quieter pavement surfaces. The focus is on reducing noise at the tire-pavement interface, although the use of quieter pavement surfaces in conjunction with other noise abatement options, such as noise barriers, is also addressed as a case study. A comprehensive literature review is included that outlines the current state of the art in designing quieter pavements and all relevant contributing factors in terms of surface macrotexture, porosity, and resilience. An extensive pavement-noise database was compiled containing a large number and variety of different pavement surfaces used in Texas. In the effort to develop laboratory procedures for designing quieter surfaces, this database was analyzed to identify all relevant design parameters influencing noise. A laboratory test and design procedure to measure and evaluate noise was developed and correlated against design parameters for asphalt and concrete surfaces. Field testing of different asphalt and concrete surfaces was completed, including noise measurements using the on-board sound intensity test method as well as field measurements of surface macrotexture and permeability. The case study documents the design and use of a noise barrier in conjunction with low-noise surfaces to address noise complaints from residents residing along a busy stretch of IH30 near Dallas. Products of this research include detailed laboratory test procedures for measuring noise generated by surface materials and a set of guidelines developed to provide the Districts with recommendations to assist in selecting appropriate candidate projects for low-noise surfaces and for designing surfaces to provide long-term noise reductions.
(161 pages)

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This report is available for free download (11.5 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6819-1.pdf

Item 9

Test Data, Demonstration Videos, and Transceivers

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6838-P1 • 2016

"This report describes various test data, demonstrations, and transceivers created and used during the demonstration phase of Project 0-6838. Researchers at Southwest Research Institute (SwRI) and UT Austin's Center for Transportation Research (CTR) demonstrated the connected-vehicle (CV) applications detailed in this publication utilizing state-of-the-art dedicated short-range communication (DSRC) radios, which were loaded with SwRI-built custom application software in compliance with the USDOT's Connected Vehicle Program and applicable standards. They also demonstrated roadside equipment (RSE) performance along Loop 410. This equipment along Loop 410 had been installed previously by the TxDOT San Antonio District and SwRI to develop and demonstrate advanced signage systems, and was used here to help highlight the capability of the system to support multiple parallel applications simultaneously. The demonstrations performed at the J.J. Pickle Research Center show the portability of the system and ease of configuration and installation in new locations. The CV demonstrations were presented with the context of how they could be utilized by TxDOT and integrated into their existing traffic management centers and standard operations. The CTR researchers investigated the possibility of using inexpensive CV retrofits for traffic monitoring without relying on traditional GPS systems."
(28 pages)

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This report and supplemental data files are available for free download:
http://library.ctr.utexas.edu/ctr-publications/0-6838-p1.pdf (2.1 MB)

http://library.ctr.utexas.edu/ctr-publications/0-6838-p1-files-matlab.zip (27.3 KB)

Item 10

Implications of Connected and Automated Vehicles on the Safety and Operations of Roadway Networks: A Final Report

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

CTR 6849-1 • 2016

Advances in vehicle automation and communication can dramatically reduce the economic and comprehensive costs of U.S. crashes. This report quantifies in detail the crash-related gains of various vehicle automation and connectivity features and anticipates their near-term and long-range impacts on car crashes in Texas. It also documents the best practices for the Texas Department of Transportation (TxDOT) and other agencies to most cost-effectively facilitate Texans' adoption and use of top technologies. This study estimated the adoption of connected and autonomous vehicle (CAV) technologies over the long term through the use of two surveys. The study also reviewed CAVs' impacts on safety, and estimated crash count and crash cost reductions via various CAV technologies. Finally, the report presents a benefit-cost (B-C) analysis that identifies top design and system management strategies for departments of transportation to follow, in the transition to new technologies and travel choices. This work provides practical recommendations emphasizing safety to assist TxDOT in optimally planning for these new technologies using a holistic and qualitative approach.
(xvi, 189 pages, 113 unnumbered pages)

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This report is available for free download (5.7 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6849-1.pdf

Item 11

Best Practices Guidebook for Preparing Texas for Connected and Automated Vehicles

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

CTR 6849-P1 • 2016

"Connected and automated vehicles (CAVs) are destined to change how the Texas transportation system operates. TxDOT is responsible for the nation's most extensive state-level network, and it is essential to explore the potential impacts of CAVs on the design, maintenance, and operation of the transportation system. Research into CAVs' mobility, environmental, legal, and safety implications for the state of Texas was conducted by UT Austin's Center for Transportation Research (CTR). This document, Best Practices Guidebook for Preparing Texas for Connected and Automated Vehicles, presents the main points of CTR's research on CAVs and develops practice recommendations, emphasizing safety, to assist TxDOT in optimally planning for these new technologies using a holistic and qualitative approach."
(38 pages)

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This report is available for free download (410 KB):
http://library.ctr.utexas.edu/ctr-publications/0-6849-p1.pdf

Item 12

A Literature Review of Freshwater Mussel Survey and Relocation Guidelines

TEXAS A & M UNIVERSITY. INSTITUTE OF RENEWABLE NATURAL RESOURCES

6865 report • 2016

"This report summarizes the results of a literature review on sampling guidelines and methodologies for freshwater mussels (Family: Unionidae), identifies research needs based on that review and provides recommendations for when and how to conduct mussel surveys and relocations. This report pertains to persons planning bridge construction projects, but can be adapted for other instream activities."
(47 pages)

This report is available for free download (1.7 MB):
http://library.ctr.utexas.edu/hostedpdfs/0-6865.pdf

Item 13

International Center for Partnered Pavement Preservation (ICP3): First Year Progress Report

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

CTR 6878-1 • 2016

The Accelerating Innovation in Partnered Pavement Preservation project was initiated to promote and streamline research in the area of pavement preservation and to optimize the use of TxDOT's research and implementation resources by fostering cooperation and collaboration with the US DOT Center for Highway Pavement Preservation (CHPP). CHPP is a research and innovation partnership lead by Michigan State University which members include: The University of Texas at Austin, The University of Illinois at Urbana-Champaign, The University of Minnesota, The University of Hawaii at Manoa and North Carolina A&T University. This preliminary progress report summarizes the work performed during the first five months of the project, from April to August 2015. During this period two task orders were developed and the corresponding work was planned and initiated. This report also presents the initial findings of these two task orders. The two task orders are: 1) Determination of Field Performance of Thin Overlays Relative to Alternative Preservation Techniques and 2) Quantification of Highway Pavement Surface Micro- and Macro-Texture.

(x, 50 pages)

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This report is available for free download (843 KB):
http://library.ctr.utexas.edu/ctr-publications/0-6878-1.pdf

Item 14

Cross-Border ITS Systems with Traffic Management Centers: Technical Report

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

TTI 6879-1 • 2016

The Traffic Management Centers (TMCs) in Texas play a vital role in managing traffic operations in many of major metropolitan areas. TMCs have deployed extensive detection, monitoring, and communication infrastructure to allow TxDOT [Texas Department of Transportation] operators to manage incidents and reduce collisions; provide traveler information through roadside assets; provide traffic status to broadcast media; and support work zone monitoring and construction information. Currently there is no cross-border TMC or traveler data exchange along the Texas/Mexico border to inform the traveling public of the traffic conditions on the other side of the border, so travelers do not have information on traveling conditions between border sister-cities. Researchers evaluated the current state of the practice and future plans in Mexico to advance intelligent transportation systems, and developed a framework and an action plan for TxDOT to lead the deployment of cross-border TMCs and share data to improve the traffic conditions along the Texas/Mexico border and adjacent border cities.
(164 Pages)

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This report is available for free download (7.5 MB):
http://tti.tamu.edu/documents/0-6879-1.pdf