

Research Digest

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TxDOT Research Publications

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Item 1

Oil and Gas Energy Developments and Changes in Pavement Conditions in Texas. Final Report

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

TTI • 2015

The Texas Legislature asked the Texas A&M Transportation Institute (TTI) to update [TxDOT Research Project 0-6498] completed in late 2011 documenting locations and trends of oil and gas energy developments in the state. The Texas Legislature also asked TTI to correlate oil and gas developments with changes in pavement condition data over the last few years.

(108 pages)

CONTENTS

- Executive Summary
- Chapter 1. Introduction
- Chapter 2. Oil and Gas Well and Hydrocarbon Production Data
- Chapter 3. Pavement Condition Data
- Chapter 4. Data from Counties and Cities
- Chapter 5. Analysis and Trends
- Chapter 6. Findings
- References
- Appendix. Sample Tables

This report is available for free download (6.3 MB):

<http://tti.tamu.edu/documents/PRC-14-35F.pdf>

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Item 2

Lone Star LTAP Peer Exchange

TEXAS ENGINEERING EXTENSION SERVICE (TEEX)

575-13 Peer Exchange • 2014

"On April 7-9, 2014, Local Technical Assistance Program (LTAP) center directors from Arkansas, Connecticut, Michigan, Minnesota, Nebraska, Texas, West Virginia, and Wisconsin met in San Antonio, Texas, to discuss two key topics: marketing LTAP center services and obtaining/developing curriculum for LTAP center use. Also supporting the discussion were representatives from the Texas Department of Transportation and the Federal Highway Administration. Independent facilitation staff from the Texas A&M Engineering Extension Service, which also operates the Texas Lone Star LTAP Center, conducted the meeting. The final results of the meeting were prioritized lists of best practices that the center directors identified as key to greater success in each of the topic areas. In the area of marketing LTAP center services, all of the centers experienced a high volume of service requests and a variety of expectations. Solutions centered on close affiliation with elected officials, cooperation with industry associations, and effective use of advisory committees. In the area of obtaining/developing curriculum, the problem centered on identification and funding of the needed curriculum. Solutions included partnering with industry associations and each other, as well as exploring new delivery technologies. These problems and recommended solutions apply not only to the centers represented at the peer exchange, but also to LTAP centers nationwide that may be experiencing similar problems."

(84 pages)

CONTENTS

- Chapter 1. Introduction
- Chapter 2. Process Methodology
- Chapter 3. Discussion Topics
- Chapter 4. Recommendations
- Chapter 5. Next Steps/Conclusions
- Appendix A. Facilitation Techniques
- Appendix B. Inventory Of Potential Topics
- Appendix C. Logistics and Travel
- Appendix D. Event PowerPoint Slides
- Appendix E. Participant Biographies
- Appendix F. Photographs

This report is available for free download (3.2 MB):

<https://teex.org/documentsresources/LTAP%20Peer%20Exchange%20Report%20May%202014.pdf>

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Item 3

Automated Distress Surveys: Analysis of Network Level Data (Phase III)

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6663-3 • 2015

The first two phases of this research study provided a project-level assessment of the accuracy and precision of the automated 3D system developed by the Texas Department of Transportation (TxDOT), and state-of-the-practice commercially available automated systems for the high-speed measurement of pavement surface distresses, rutting, texture and cross slope. The third phase of this study had the objective of extending the automated systems' evaluation with a focus on network-level processes and applications. For this purpose, TxDOT initiated a pilot study with two pavement distress data collection vendors to collect full network-level semi-automated data (as per TxDOT Pavement Management Information System [PMIS] specifications) on the entire network in the Bryan and Houston districts, in conjunction with the PMIS Fiscal Year 2014 data collection season. The two districts selected for the pilot study represent highway characteristics from rural, urban, and metropolitan areas in the state of Texas. The two vendors that collected semi-automated data for the pilot study were Fugro-Roadware and Pathway Services. Fugro's data collection was performed using two Automatic Road Analyzer survey vans equipped with the INO Laser Crack Measurement System and Pathway Services' data collection was performed using two PathRunner Data Collections Vehicles equipped with Pathway 3D Systems. The comparative analyses were conducted on the PMIS aggregated scores (including Ride Score, Distress Score, and Condition Score) as well as on individual distress ratings for instances of alligator cracking, longitudinal cracking, rutting, spalling, punchouts, and failures. Each type of comparison was further analyzed by breaking down the collected highway network into different experimental factors, such as the highway system and pavement surface type. In addition, this report includes an analysis of the automated systems' production rates. (xiv, 57 pages)

This report is available for free download (2.5 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6663-3.pdf>

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Item 4

Equipment Replacement/Retention Decision Making: Final Report

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

UT Tyler 6693-1 • 2015

The TxDOT vehicle fleet is a fundamental part of the departmental infrastructure, enabling many activities essential to accomplishing the daily departmental operations. Maintenance of a robust vehicle fleet is essential but costly. On one hand, reductions in fleet costs are potentially beneficial to the department as a whole and thereby beneficial to the taxpayers of the State of Texas. On the other hand, not being able to respond adequately under disaster/emergency conditions is unacceptable and therefore maintaining a fleet robust enough to capably respond in a multi-event contingency is also critical. TxDOT's new equipment replacement optimization software (TERM2) produced through project 0-6412 "Equipment Replacement Optimization" (ERO) by our research team can optimize the equipment retain/replace decision process, potentially resulting in substantial cost savings. Much of the current TERM2 research work and result findings can be seen from Fan et al. (2011a, 2011b). The technical objectives of this project are to (1) Investigate how to estimate costs to the department of NOT replacing equipment when it should be replaced; (2) Identify methods to estimate downtime costs coupled with TxDOT's current rightsizing efforts; (3) Review the use and development of advanced optimization techniques; (4) Recommend feasible ways to model the future uncertain purchase costs due to technology changes; (5) Review Texas's Emergency Management Strategy and support concept and list levels of commitment to the DEM and DPS; (6) Identify reasonable and likely simultaneous disaster/emergency event scenarios in Texas (if reasonably available, list equipment commitments for several historical simultaneous emergencies); (7) Review and describe how other state Departments of Transportation (DOTs) and major metropolitan governments provision their fleets to handle multiple disasters. To accomplish this project, the research team has addressed the above issues and implemented in the TERM2 software and conducted a comprehensive review of the state of the art and state of the practice of equipment replacement/retention decisions based on future uncertain purchase costs, unavailability of funds, and disaster preparedness and a new TERM2 software has been developed with enhanced functionalities.

(xvi, 188 pages)

CONTENTS

- Chapter 1. Introduction
- Chapter 2. Literature Review
- Chapter 3. Investigating Future Uncertain Purchase Costs
- Chapter 4. Cost of Delaying Replacing Equipment
- Chapter 5. Improving Downtime, O&M Costs, and Mileage Forecasting
- Chapter 6. Survey of Fleet Management Practices During Emergency Situations
- Chapter 7. Data Analysis of Fleet Usage for TxDOT during Multiple Emergency Events
- Chapter 8. Summary and Conclusions
- References
- Appendix A: Robust Statistical Estimating and Forecasting Models Used to Investigate the Future Uncertain Purchase Costs Due to Technology Changes and the Down Time Costs Coupled with TxDOT's Current Rightsizing Efforts (0-6693-P1)
- Appendix B: Survey of Fleet Management with Respect to Multiple Disasters Scenarios
- Appendix C: Equipment Replacement Decision Making: Challenges and Opportunities

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

<http://library.ctr.utexas.edu/ctr-publications/0-6693-1.pdf>

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Item 5

Forecasting Models to Investigate Future Uncertain Purchase Costs due to Technology Changes, and Estimate Down Time Costs and Operating and Maintenance Costs

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6693-P1 • 2015

"The purpose of this task was to investigate future uncertain purchase costs due to technology changes and recommend feasible ways to model the future purchase costs given the historical data... The research team explored the use of both linear and nonlinear statistical modeling techniques, as well as strategies involving fixed increases to the forecasted purchase costs based on the inflation rate, to develop the best possible forecasts due to technology changes and other uncertainties. After a feasible (and potentially most desirable) way to model the future uncertain purchase costs was identified, it was incorporated into the TERM2 equipment replacement optimization software. In addition to developing models for estimating future uncertain purchase costs, the research team also explored the potential of emerging vehicle fuel technologies and their possible impacts on future purchase costs."
(vii, 53 pages)

CONTENTS

- Chapter 1. Forecasting Models to Investigate Future Uncertain Purchase Costs due to Technology Changes
- Chapter 2. U.S. Energy Scenario and Potential Future Directions
- Chapter 3. Estimating Down Time and Related O&M Costs
- Chapter 4. Estimating O&M Costs
- References

This report is available for free download (748 KB):

<http://library.ctr.utexas.edu/ctr-publications/0-6693-P1.pdf>

Item 6

0-6693, Equipment Replacement/Retention Decision Making

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT). RESEARCH AND TECHNOLOGY IMPLEMENTATION (RTI)
UT Tyler 6693 PSR • 2015

"Maintenance of a robust vehicle fleet is essential but costly. Reductions in fleet costs are potentially beneficial to the department as a whole and thereby beneficial to Texas taxpayers. Currently, TxDOT owns and maintains an active vehicle fleet of approximately 17,000 units and annually replaces approximately 10 percent of its fleet. In monetary terms, TxDOT has a fleet valued at approximately \$500,000,000, with an annual turnover of about \$50,000,000. Any methodology that can improve TxDOT's replacement procedures can potentially save millions of dollars. Also critical is being able to respond adequately under disaster/emergency conditions, which requires maintaining a fleet robust enough to capably respond in a multi-event contingency... In this regard, the increment of equipment above and beyond the day-to-day "right size" quantities must also be clearly established... "
(2 pages)

This report is available for free download (555 KB):

<http://library.ctr.utexas.edu/ctr-publications/psr/0-6693-s.pdf>

Research Digest

Item 7

Development of Rapid, Cement-based Repair Materials for Transportation Structures. Final Report UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)

CTR 6723-1 • 2015

The state of Texas has been plagued by various durability-related issues in recent years, including deterioration from alkali-silica reaction (ASR), delayed ettringite formation (DEF), corrosion of reinforcing steel, and volume changes (plastic shrinkage, drying shrinkage, thermal effects, etc.), just to name a few. These durability-related issues, coupled with other factors that contribute to reductions in service life (e.g., service loads, defects, vehicle impact, etc.), have resulted in the need to repair concrete structures and to do so in a timely, efficient fashion, with minimal disruption to the traveling public. Thus, the need for rapid, cement-based repair materials has emerged, especially in highly congested urban areas. This project included a comprehensive laboratory-based program, as well as a significant field component, aimed at addressing this critical infrastructure need. The goals of the research project were to evaluate a range of rapid repair materials and to provide recommendations on the most efficient, economical, and durable repair materials and methodologies. (xxii, 266 pages) color illus.

CONTENTS

- Chapter 1. Introduction and Scope
- Chapter 2. Literature Review of Rapid-Repair Materials
- Chapter 3. Materials
- Chapter 4. Phase I Initial Screening Program
- Chapter 5. Engineering Properties
- Chapter 6. Early-Age Volume Change
- Chapter 7. Calorimetry
- Chapter 8. Field Testing
- Chapter 9. Freezing-and-Thawing Cycles and Salt Scaling Resistance
- Chapter 10. Alkali-Silica Reaction
- Chapter 11. Sulfate Attack
- Chapter 12. Permeability and Corrosion
- Chapter 13. Conclusions
- References
- Appendix A: Compressive Strength Curves
- Appendix B: Accepted Mixture Proportions from Phase I
- Appendix C: Isothermal Calorimetry Mixture Tables
- Appendix D: Isothermal Calorimetry Plots
- Appendix E: Field Performance
- Appendix F: Salt Scaling Images from ASTM C 672

This report is available for free download:

<http://library.ctr.utexas.edu/ctr-publications/0-6723-1.pdf>

http://library.ctr.utexas.edu/ctr-publications/0-6723-1_appx.pdf

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Item 8

Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas. Student Manual

UNIVERSITY OF TEXAS AT EL PASO. CENTER FOR TRANSPORTATION INFRASTRUCTURE SYSTEMS

UTEP 6740-01, P1-P3 • 2015

This research product contains a printout out of PowerPoint slides associated with the "Implementation of Intelligent Compaction Technology for Improving Compaction Quality of Soil and Base in Texas" training. (54 pages)

CONTENTS

- Training Module A. Fundamental Concepts of IC Technology
- Training Module B. IC Roller Retrofit Kit Installation and Calibration
- Training Module C. GPS Installation & Calibration
- Training Module D. IC Roller/Retrofit Kit Operation & Maintenance
- Training Module E. IC Data Analysis & Report
- Training Module F. TXDOT IC Specification and Projects
- Training Module G. Overview of VisionLink
- Training Module H. Overview of VEDA

This report is available for free download (4.2 MB):

http://library.ctr.utexas.edu/hostedpdfs/5-6740-01_student.pdf

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Item 9

Evaluation of Existing Smartphone Applications and Data Needs for Travel Surveys

UNIVERSITY OF NORTH TEXAS. CENTER FOR ECONOMIC DEVELOPMENT AND RESEARCH (CEDR)

UNT 6767-1 • 2015

Current and reliable data on traffic movements play a key role in transportation planning, modeling, and air quality analysis. Traditional travel surveys conducted via paper-and-pencil or computer-aided are costly, time consuming, and labor intensive for survey conductors; and place significant burden to the survey participants. Furthermore the accuracy and completeness are susceptible to participants' after-fact memory. On the other hand, smartphones are an integral part of daily life for many people in the world today. According to the Pew Internet & American Life Project's survey, in May 2011, 83% of U.S. adults have a cell phone and 42% of them own a smartphone. Many people today interact with their cell phones constantly to some degree through checking messages or emails, playing games, and talking. Smartphone applications have a great potential to lower the costs, reduce the burden, and increase the accuracy and completeness of travel surveys. This project evaluated existing smartphone applications for conducting travel surveys. The project compiled a list of the pioneering smartphone travel survey efforts and lessons learned, compared them, and analyzed their applicability to serve TxDOT survey needs. The project identified and installed a list of smartphone travel survey applications to thoroughly evaluate and compare their capabilities. The project summarized and classified the data elements collected by TxDOT surveys and built a prototype smartphone household survey app to validate that all the survey data can be collected using smartphones. The project discussed the opportunities and challenges in fully realizing the potential of using smartphone applications for travel surveys.

(x, 77 pages)

CONTENTS

- Overview
- Review of Smartphone Travel Survey Efforts
- Texas Travel Survey Practice
- Evaluating Existing Applications
- Classification of Data Elements in TxDOT Travel Survey
- The Opportunities and Challenges of Smartphone Mobility Household Travel Surveys in Texas
- References

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

<http://tti.tamu.edu/documents/0-6767-1.pdf>

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Item 10

0-6767, Evaluation of Existing Smartphone Applications and Data Needs for Travel Survey

UNIVERSITY OF NORTH TEXAS. CENTER FOR ECONOMIC DEVELOPMENT AND RESEARCH (CEDR)

UNT 6767 PSR • 2015

Current and reliable data on traffic movements play a key role in transportation planning, modeling, and air quality analysis. Traditional travel surveys conducted via paper or computer are costly, time consuming, and labor intensive for survey conductors; and place a significant burden on the survey participants. Furthermore, accuracy and completeness are susceptible to participants' after-fact memory. To address this issue, this project evaluated existing smartphone applications for conducting travel surveys.
(2 pages)

This report is available for free download (473 KB):

<http://tti.tamu.edu/documents/0-6767-S.pdf>

Item 11

University Handbook, 2016

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT)

• 2015

"TxDOT's Cooperative Research and Implementation Program is managed by the Research and Technology Implementation Office (RTI). The Program provides for TxDOT to contract with Texas state-supported institutions of higher education, through a competitive process, to improve Texas transportation... This handbook, TxDOT's Research Manual, and the Cooperative Research and Implementation Agreement (CRIA) outline the program policies and provide an overview of TxDOT's technical research program. This handbook provides the framework and policies under which related procedures are developed. This handbook establishes the procedures that implement the policies expressed in the Research Manual. By signing a CRIA, each university, or university system, agrees to TxDOT procedures. This handbook presents those procedures to universities active in TxDOT's research program."
(85 pages)

CONTENTS

- Chapter 1. Introduction [TxDOT Research Program; Conduct; Using this Handbook; RTI Program Overview]
- Chapter 2. Requests for Proposals (RFP)
- Chapter 3. Proposal Requirements
- Chapter 4. Proposal Agreements
- Chapter 5. Managing the Project
- Chapter 6. Deliverables
- Chapter 7. University Costs

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

http://library.ctr.utexas.edu/hostedpdfs/txdot/rTI/rTI-univhandbook_2016.pdf

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Item 12

University Handbook, 2016. Appendix

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT)

• 2015

CONTENTS

- Appendix A: Deliverable Base Project Agreements. Chapter 3, Proposal Requirements
- Appendix B: Deliverable Base Project Agreements. Chapter 4, Project Agreements
- Appendix C: Deliverable Base Project Agreements. Chapter 5, Managing the Project
- Appendix D: Deliverable Base Project Agreements. Chapter 7, University Costs

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