Research Digest

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New TxDOT Research Publications

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Item 1

Implementation of Centrifuge Testing of Expansive Soils for Pavement Design

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

CTR 6048-03-1 / P1 • 2017

The novel centrifuge-based method for testing of expansive soils from project 5-6048-01 was implemented into use for the determination of the Potential Vertical Rise (PVR) of roadways that sit on expansive subgrades. The centrifuge method was modified to allow for testing of both undisturbed and reconstituted specimens as well as to match the boundary conditions of the state of practice laboratory method, ASTM D4546. The test was used to expand the expansive soils database through a number of sites east of the Balcones Fault Zone in Central Texas in order to give designers a better understanding of the characteristics of soils in the region and to compare against results from Tex-124-E. The test was further used to test field specimens from various sites to illustrate the need for either uncontaminated bulk specimens or undisturbed specimens and to develop a new method for sites with limited testing. Instrumentation and monitoring of the heave at field sites were used to validate the testing method by showing similar moisture content changes in the field section as in laboratory specimens as well as showing a field site in which Tex-124-E misidentifies a site that sits on a non-expansive subgrade. The project provided a new method to calculate the PVR of a site using real data, expanded the database of soils to include new soils and look at heterogeneity between soil horizons, and analyzed field results to validate the results from laboratory experiments.
(242 pages)

- "Appendix A presents 5-6048-03-P1, Spreadsheet with Data of Swelling Curves for Clays in TxDOT Austin District"

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This report is available for free download (26.3 MB):
http://library.ctr.utexas.edu/ctr-publications/5-6048-03-1.pdf

Item 2

Implementation Project [on] Strengthening a Continuous Steel Girder Bridge in Lakeport, Texas with Post-Installed Shear Connectors. Phase 1, Bridge Strengthening Design and Load Testing

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

CTR 6719-01-1 • 2017

In Implementation Project 5-6719, a non-composite continuous steel girder bridge located in Lakeport, Texas will be strengthened using techniques developed in TxDOT Research Project 0-6719. This strengthening technique involves the use of post-installed shear connectors in positive moment regions and the allowance of limited flexural yielding in negative moment regions. This Implementation Project is intended to demonstrate the strengthening technique, evaluate potential difficulties in design and construction and suggest solutions, and evaluate structural effectiveness and cost effectiveness of this bridge strengthening technique. Phase I of the Implementation Project includes selection of a non-composite continuous girder bridge in Texas for strengthening, detailed design of the strengthening system, detailed finite element analysis of the un-strengthened and strengthened bridge designs, and field load testing of the un-strengthened bridge to obtain baseline data on the behavior of the existing bridge for later comparison with field load testing data for the strengthened bridge. Phase II will include monitoring construction operations during the installation of post-installed shear connectors, collecting information on construction costs and difficulties, and field load testing of the bridge after strengthening is completed, to verify the effectiveness of the strengthening system.
(127 pages)

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This report is available for free download (2.6 MB):
http://library.ctr.utexas.edu/ctr-publications/5-6719-01-1.pdf

Item 3

TxDOT Wildland Fire Management Training

TEXAS TECH UNIVERSITY. CENTER FOR MULTIDISCIPLINARY RESEARCH IN TRANSPORTATION (TECHMRT)

TechMRT 6735-01-1 • 2016

In 2011, the Texas Tech Center for Multidisciplinary Research in Transportation (TechMRT) was contracted by the Texas Department of Transportation (TxDOT) to analyze best practices for the department in responding to wildfires. This project (0-6735) was adapted into an implementation project in order to provide a training workshop for TxDOT employees on wildland fire management. The target audience of this workshop was TxDOT Directors of Operations (DOOs), Directors of Maintenance (DOMs), Area Engineers (AEs), maintenance managers, maintenance supervisors, assistants, and crew chiefs. A total of nine workshops were held beginning in March, 2014 and ending in June, 2014. Workshops were conducted in Lubbock, Alpine, San Antonio, Houston, Corpus Christi, Dallas, Fort Worth, and Brownwood. At least 557 TxDOT employees attended the workshops. During the course of these nine training workshops, evaluation sheets were distributed. The TechMRT project team received 527 total evaluations, and the responses were tallied and analyzed. Respondents were asked to indicate whether they strongly disagreed, disagreed, had no comment on, agreed, or strongly agreed with a number of different responses. Nine responses related to the general instruction and efficacy of the training workshops. Five responses related specifically to learning objectives that the project team wanted the attendants to master during the workshops. To evaluate the efficacy of the workshops, numerical values were assigned to each possible rating for every question, ranging from 1 for a strong disagreement to 5 for a strong agreement. Overall, every question received a rating between 4.22 and 4.49. These results indicate that the majority of students either agreed or strongly agreed with the efficacy of the workshops and felt they were equipped with new skills and a better understanding of their roles in wildland fire management. (49 pages in various pagings)

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This report is available for free download (1.6 MB):
http://library.ctr.utexas.edu/hostedPDFs/texastech/5-6735-01-1.pdf

Item 4

Implementation of LRFD Geotechnical Design for Deep Foundations Using Texas Cone Penetrometer (TCP) Test

TEXAS TECH UNIVERSITY. CENTER FOR MULTIDISCIPLINARY RESEARCH IN TRANSPORTATION (TECHMRT)

TechMRT 6788-01-1 • 2016

This study provides resistance factors (f) for design of deep foundations to implement Load and Resistance Factor Design (LRFD) for bridge foundations using Texas Cone Penetrometer (TCP) Test data. Initial efforts were made to determine resistance factors using Davisson's criterion in Research Project 0-6788: Reliability Based Deep Foundation Design Using Texas Cone Penetrometer (TCP) Test, completed on 8/31/2014. In this study, additional LRFD reliability analyses were performed using 5%, and 10% relative settlement criteria to determine ultimate capacities. The resistance factors obtained using Davisson, 5%, and 10% criteria were 0.30, 0.32, and 0.31, respectively, for total capacity of driven piles in soils with target reliability index (b) of 3.0. Similarly, the resistance factors obtained using Davisson, 5%, and 10% criteria were 0.38, 0.40, and 0.39, respectively, for total capacity of drilled shafts in soils with b of 3.0. These resistance factors reflect TCP blow counts not corrected for hammer efficiency. Based on the size and scope of the dataset, literature review, and statistical analyses, it is recommended that resistance factors from Davisson and 5% criteria be used for driven piles in soils (f = 0.44 and 0.30 with b of 2.33 and 3.0, respectively) and drilled shafts (f = 0.54 and 0.40 with b of 2.33 and 3.0, respectively) in soils, respectively. It is considered that these values are suitable for implementation for small projects. For large projects, it is recommend consideration of determining ultimate capacity from static or dynamic load tests in accordance with AASHTO policy which will yield higher resistance factors.
(vi, 29 pages)

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This report is available for free download (1.8 MB):
http://library.ctr.utexas.edu/hostedPDFs/texastech/5-6788-01-1.pdf

Item 5

Improved Overlay Tester for Fatigue Cracking Resistance of Asphalt Mixtures

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

UTEP 6815-1 • 2017

Premature cracking of the asphalt concrete (AC) layer in flexible pavement is one of the major concerns of the pavement community. Over the past decade, AC mixes have been designed using the Hamburg wheel-tracking device to improve their rutting potential that might have impacted the cracking resistance and flexibility of the AC mixes. Several highway agencies have either implemented or considered implementing performance tests to predict the cracking potential of AC mixes in the laboratory setting. One such test, the Overlay Tester (OT) test, measures the number of cycles to failure of the AC specimens by simulating the opening and closing of the cracks induced by daily temperature variations and high tensile strain generated by the traffic load. The OT test is routinely used by the Texas Department of Transportation (TxDOT) to screen mixes with well and poor crack resistant potential. The variability of the number of cycles to failure that is used as the performance index is expressed as a major concern in reliably characterizing the cracking potential of the AC mixes. The performance of the OT, in general, and the number of cycles to failure, in particular, were evaluated in this study.

The consistency of the number of cycles to failure and potential parameters that can be measured from the OT were comprehensively investigated with two different AC mix types. Fundamentally, the cracking potential of an AC mix can be characterized in two stages: a) crack initiation and b) crack propagation. An alternative cracking methodology and performance indices were implemented for the OT considering these two stages. The consistency and repeatability of the proposed performance indices, critical fracture energy and crack progression rate, seem to be better than the acceptable repeatability level defined as a coefficient of variation (COV) of less than 20%. The proposed cracking methodology and preliminary failure limits seem to characterize and discriminate satisfactorily the cracking resistance of several AC mix types commonly used in Texas. A parametric study was conducted on key variables (e.g., glue type and gluing method) considered in the current OT specifications (Tex-247-F) using synthetic specimens. The results of this parametric study were then used to improve the specimen preparation and testing processes. The improved OT test method was preliminarily validated with OT tests on field cores from pavement sections with known field performance. Given its promise in this study, the improved OT test method is recommended as a routine test during the mix-design process of AC mixes.
(xiv, 162 pages)

This report is available for free download (6.44 MB):
http://library.ctr.utexas.edu/hostedpdfs/utep/0-6815-1.pdf

Item 6

Partial Depth Precast Concrete Deck Panels on Curved Bridges: Finite Element Analytical Model of PCPs

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

CTR 6816-P1 • 2017

A number of full-scale tests have been carried out in the laboratory focused on the shear performance of simulated precast concrete deck panels (PCP). Shear tests were carried out to simulate the type of loading that will be applied to the deck panels as they are engaged as a bracing element. As part of the research study, two different finite element models were developed to improve the understanding of the behavior of the concrete deck panels as well as the members that are to be braced by the deck panels. The two models consist of a detailed model as well as a simple model. The purpose of the detailed model is for studying the impact of details on local stress concentrations in the panels so as to understand the potential for cracking or crushing of the concrete in isolated regions. The purpose of the simple model is to represent the stiffness and strength of the concrete deck panel for parametric studies are larger girder/bridge systems. Both of these finite element analytical models represent the most recent PCP/connection system tested in the shear frame and were developed using the commercial software program Abaqus/CAE 6.13-1.
(22 pages)

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This report is available for free download (1 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6816-p1.pdf

Item 7

Bringing Smart Transport to Texans: Ensuring the Benefits of a Connected and Autonomous Transport System in Texas. Final Report

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

CTR 6838-2 • [2017]

"This project develops and demonstrates a variety of smart-transport technologies, policies, and practices for highways and freeways using connected autonomous vehicles (CAVs), smartphones, roadside equipment, and related technologies. The intent is to maximize the benefit of these technologies in terms of improved driver safety, reduced congestion, and agency cost savings. For example, in a well-implemented system, advanced CAV technologies may reduce current crash costs by at least $390 billion per year. A poorly implemented system could significantly detract from or reverse these benefits. The project's Phase 1, documented in this report, showcased DSRC-instrumented vehicles for wrong-way driving alerts, vehicle guidance, and road-surface condition monitoring demonstrations. It developed algorithms for more accurate vehicle-position information and real-time traffic flow monitoring. It delivered statewide and national forecasts of fleet evolution, consumer preferences, and Texans' opinions of CAV policies and technologies. It also simulated various strategies for smart ramp merges and smart intersection and network operations, under thousands of case settings, with calculated delay reductions. It anticipated emissions savings from more thoughtful automated driving and crash savings from more conflict-aware driving. It also analyzed the benefits of shared autonomous vehicle transit. Recommendations are provided for guiding TxDOT as technologies increasingly become available to the public, estimated to impact the U. S. economy by as much as $1.3 trillion per year. Recommendations focus on the need for increasing TxDOT in-house expertise, simulating new systems, developing policy, and updating design manuals."
(xxiv, 375 pages; 15.7 MB)

• Accompanying CD-ROM contains "Bringing Smart Transport to Texans: Appendices to Final Report"

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- Appendix I. Expert Survey Questionnaire
- Appendix J. Expert Interview Questions
- Appendix K. Case Law and Statutes

This report and its appendices are available for free download:

http://library.ctr.utexas.edu/ctr-publications/0-6838-2.pdf (8.7 MB)

http://library.ctr.utexas.edu/ctr-publications/0-6838-2-appx.pdf (15.7 MB)

Item 8

Putting Price Tags on International Trade Use of State Infrastructure: Final Report

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

CTR 6844-1 • 2017

As a major gateway to the entire U.S. for international trade both through seaports and land ports of entry, Texas pays the bills for the construction and maintenance of the infrastructure required to move the freight which benefits other parts of the country. Moreover, with the expansion of the Panama Canal and the land bridge from the Mexican port of Lazaro Cardenas to Texas, it is likely that international trade through Texas ports of entry will continue to grow, and continue to impact transportation infrastructure in Texas. In this sense, the effective and efficient management of this infrastructure has been at the forefront of discussions. However, there are no local studies that examine the current asset value of major freight corridors to move international trade in Texas; in other word, there is a need to develop a methodological process which can be used to put "price tags" on international trade use of Texas' transportation infrastructure. This research proposes a novel utility-based asset valuation framework that can consider loss in potential benefits if the infrastructure fails, as well as its construction and maintenance costs. As the result, the price tag assigned to the freight corridors was significantly different than its replacement cost, which is one of most frequently used asset valuation methods to estimate the value of transportation assets. The price tag was estimated at $366 billion, while the replacement cost was only $160 billion. The difference indicates that a failure to include the functionality and the utilization aspects of transportation assets can result in distorting their true values, by underestimating or overestimating the values.

This research study is critical to TxDOT as the research findings provide TxDOT with a comprehensive asset value of the freight corridors, which is essential to maintain the freight corridors with high condition standards for the potential trade growth.
(149 pages)

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This report is available for free download (4.3 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6844-1.pdf

Item 9

Guidelines on CV Networking Information Flow Optimization for Texas

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6845-1 • 2017

Recognizing the fundamental role of information flow in future transportation applications, the research team investigated the quality and security of information flow in the connected vehicle (CV) environment. The research team identified key challenges and their potential solutions. Concerning information quality, the team conducted comparative analysis of two major enabling technologies for V2V (vehicle-to-vehicle) and V2I (vehicle-to-infrastructure) communication, namely LTE (Long-Term Evolution) and DSRC (dedicated short-range communication). Their technology standards, performance, and cost are analyzed. To facilitate the analysis, the team developed separate tools to simulate network information flow and estimate the deployment costs. Concerning information security, the team provided a critical review of potential attacks on CVs and limitations of existing DSRC standards to address these threats. The team developed a strategy based on game theory to tackle a wide range of potential attacks on CVs. Also identified were open issues that remain unsolved by existing technologies and security protocols.
(86 pages)

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This report is available for free download (5.4 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6845-1.pdf

Item 10

Workshop Materials [for TxDOT Project 0-6845: Connected Vehicle Problems, Challenges and Major Technologies]

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

CTR 6845-P1 • 2017

This document includes the presentation slides for a workshop covering Tasks 1 & 2 of Project 0-6845, as well as presentation slides for a November 29, 2016 workshop covering Tasks 3 & 4 of Project 0-6845.
(54 pages)

CONTENTS

- Connected Vehicle Problems, Challenges, and Major Technologies / TxDOT Project Manager: Darrin Jensen Research Supervisor: Chandra Bhat Researchers: Chang-Sik Choi, Jeffrey Andrews, Lakshay Narula, Todd Humphreys, Robert Heath, Jia Li
- Secure Perception in Connected Vehicles / Lakshay Narula, Todd E. Humphreys

This report is available for free download (2.5 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6845-P1.pdf

Item 11

An Assessment of Autonomous Vehicles: Traffic Impacts and Infrastructure Needs, Final Report

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

CTR 6847-1 • 2017

The project began by understanding the current state of practice and trends. NHTSA's four-level taxonomy for automated vehicles was used to classify smart driving technologies and infrastructure needs. The project used surveys to analyze and gain an understanding of the U.S. general public's perception towards such technologies and their willingness to adopt such technologies. Respondents were asked several anticipatory questions including their technology preferences (buying/selling their vehicles or simply adding new technologies to their current vehicles), and their comfort with and willingness to pay for connected and autonomous vehicles (CAVs). The team found that advanced automation technologies are not yet popular. This research report also describes the potential crash, congestion, and other impacts of CAVs in Texas, and provides initial monetary estimates of those impacts, at various levels of market penetration. Our findings indicate that CAVs will lead to increased vehicle miles traveled (VMT) because, essentially, drivers experience falling travel time burdens. Their values of travel time that make using a vehicle "costly" tend to decrease because they are more comfortable heading to more distant locations and those unable to drive themselves, such as the handicapped, can now safely travel.
(182 pages)

This report is available for free download (2 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6847-1.pdf

Item 12

Best Practices for Modifying Transportation Design, Planning, and Project Evaluation in Texas

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6847-P1 • 2017

"Connected and automated vehicles (CAVs) in Texas are about to significantly change how the Texas transportation system works. The Texas Department of Transportation (TxDOT) maintains the most widespread state-level transportation network, and it is important to expect, understand, and respond to the increasing number of CAVs that are expected within the next few decades. The UT Austin Center for Transportation Research (CTR) has conducted research into the effects of CAV market penetration. This research informs the changes and responses that are expected when concerning the design and planning of future projects, as well as evaluating the effectiveness of projects... This guidebook is a desktop guide for TxDOT staff to facilitate an understanding of CAV technologies and the current trends in development and deployment. The overview should aid in anticipating the evolution of the Texas fleet and its use under various market (price, technology, demographics, and land use) scenarios; and provide implementation recommendations to mitigate safety and other impacts, over the short, medium, and long term. Where possible, the guidebook identifies potential best practices for TxDOT and other agencies to cost-effectively facilitate Texans' adoption and use of the top safety and mobility technologies."
(58 pages)

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This report is available for free download (532 KB):
http://library.ctr.utexas.edu/ctr-publications/0-6847-P1.pdf

Item 13

A Proposal for Revising TxDOT Ride Specification to Account for Ride Quality Improvement

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

CTR 6853-1 • 2017

The objectives of this project were to i) develop a rational and financially justifiable pay adjustment system that incorporates "new" versus "old" ride quality and ii) evaluate the existing techniques to measure ride quality using Surface Test Type B or inertial profilers on short projects. To achieve these objectives, the researchers conducted an extensive review of ride specifications from other states, focusing on common ride measuring devices and roughness indices, and payment adjustment systems. A survey of past studies was also conducted that focused on the relationship between pre- and post-construction roughness and pavement performance, evaluating the need for incorporating the improvement in ride quality into the pay adjustment system. A comprehensive database was developed integrating SiteManager, Design and Construction Information System (DCIS), and Pavement Management Information System (PMIS) databases. The ride quality data was extracted from a total of 565 asphalt projects constructed from 2001 to 2011. Statistical analyses were applied to establish a pay adjustment scheme based on the gain in pavement life due to the ride improvement relative to ride quality prior to the project construction. As a result, a performance-based pay adjustment system was proposed that incentivizes or penalizes pavement projects according to the combination of change in the ride quality and post-construction ride quality.

In terms of roughness measurement on short projects, the research team administered a survey questionnaire with specific and direct questions and in-person interviews designed to obtain insight into the practical issues associated with operating inertial profilers on short projects. A field experiment was also carried out to investigate the feasibility of using inertial profilers to measure roughness on short projects. The results of the field experiment and the survey revealed that an inertial profiler operated by an experienced driver could be used to measure the roughness on short projects, provided that sufficient data is collected for stabilization and initialization of the algorithms before that target section.
(80 pages)

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This report is available for free download (1.9 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6853-1.pdf

Item 14

0-6853-P1, Workshop Material; 0-6853-P2, Instructor's Guide; 0-6853-P3, Student's Guide

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6853-P1 / P2 / P3 • 2017

This research product contains presentation slides for workshops conducted for the TxDOT Research Project 0-6853, "Improvements to Ride Specifications."
(105 pages)

CONTENTS

- 0-6853-P1 and P2: Workshop Material (P1) and Instructor's Guide (P2)
- 0-6853-P3: Student's Guide

This report is available for free download (4.3 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6853-p1p2p3.pdf

Item 15

NEPA Assignment at TxDOT: Analysis, Review, and Training Modules

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6866-1 • 2017

Under the Surface Transportation Project Delivery Program created by SAFETEA-LU and continued under MAP-21, federal transportation law has authorized delegating the National Environmental Policy Act (NEPA) review and approval processes to state Departments of Transportation. The Texas Department of Transportation (TxDOT) is the second state DOT to assume this responsibility. The research assists the Environmental Affairs Division of TxDOT with the interpretation of the roles and responsibilities outlined in its current MOU with FHWA. The report includes an analysis of FHWA's audit findings for the California Department of Transportation's implementation of NEPA Assignment, and makes recommendations for performance measures. The report identifies risks for MOU noncompliance through a case law review of NEPA and has developed a series of training power points for different groups involved in NEPA documentation.
(344 pages)

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- Chapter 1. Introduction
- Chapter 2. The Memorandum of Understanding
- Chapter 3. Selected Audit Findings
- Chapter 4. Performance Measures
- Chapter 5. NEPA Case Law Review
- Chapter 6. NEPA Assignment Training Modules
- Chapter 7. Conclusions and Recommendations
- References
- Appendix A. Caltrans Interagency Relationship Survey
- Appendix B. Caltrans Audit Findings
- Appendix C. NEPA Training Modules

This report is available for free download (3.6 MB):
http://library.ctr.utexas.edu/ctr-publications/0-6866-1.pdf

Item 16

Integrating Underground Freight Transportation into Existing Intermodal Systems

UNIVERSITY OF TEXAS AT ARLINGTON. CENTER FOR TRANSPORTATION INFRASTRUCTURE SYSTEMS (CTIS)

UTA 6870-1 • [2017]

The Texas transportation system is critical to the United States economy. According to a report prepared for TxDOT, NAFTA tonnage on Texas highways and railroads is expected to increase by nearly 207 percent from 2003 to 2030. Truck tonnage will grow by 251 percent while rail tonnage is forecasted to increase 118 percent. The number of trucks carrying NAFTA goods will increase by 263 percent and the number of rail units will grow by 195 percent. This will have a profound impact on the Texas highway and rail systems. Additionally, larger ships will arrive in the Port of Houston due to Panama Canal expansion. Therefore, increasing the capacity of the freight transportation system in Texas is a must, but increased land development and population growth make the possibility of building new roads, widening existing roads, and building new railroad tracks very difficult if not impossible. Underground freight transportation (UFT) is a class of automated transportation systems in which vehicles carry freight through pipelines and tunnels between terminals Being able to use a part of the underground space of the existing highways, will greatly facilitate the construction of such pipelines and tunnels and reduce their construction costs. By considering planning and design, construction methods, cost analysis, environmental impacts, financing means, and the stakeholder committee input, this project examines the use of UFT in three proposed routes in Texas, specifically, the Port of Houston to City of Lancaster (near Dallas), Port of Houston to a distribution center within 15 miles of the Port's point of origin, and the border crossing with Mexico in Laredo. This project has shown that underground freight transportation is financially viable, feasible, greener, cost-effective, and can become an important part of intermodal freight mobility in Texas. (xxxvi, 221 pages)

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This report is available for free download (7.2 MB):
http://library.ctr.utexas.edu/hostedpdfs/uta/0-6870-1.pdf

Item 17

Communications and Radar-Supported Transportation Operations and Planning. Final Report

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

CTR 6877-1 • 2017

This project designs a conceptual framework to harness and mature wireless technology to improve transportation safety, with a focus on frontal collision warning/collision avoidance (CW/CA) systems. The framework identifies components of the technology and its capabilities, and how these components can be integrated to improve transportation safety.
(161 pages)

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