

Research Digest

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In this Issue:

Southwest Region University Transportation Center (SWUTC)

Table of Contents

| | | |
|-----------------|--|----|
| Item 1. | 2012 Household Travel Survey Symposium: Conference Summary and Final Report | 1 |
| Item 2. | Automated Vehicles: Policy Implications Scoping Study | 2 |
| Item 3. | Comparison of Fatigue Analysis Approaches for Hot-Mix Asphalt to Ensure a State of Good Repair | 3 |
| Item 4. | Compendium of Student Papers: 2013 Undergraduate Transportation Scholars Program | 3 |
| Item 5. | Decision-Support Framework for Quantifying the Most Economical Incentive/Disincentive Dollar Amounts for Critical Highway Pavement Rehabilitation Projects | 4 |
| Item 6. | Developing the Sediment and Erosion Control Laboratory to Become a Hands-on Training and Education Center | 5 |
| Item 7. | Empirical Measurement of Travelers' Value of Reliability | 6 |
| Item 8. | An Examination of Severe Environmental Justice Zones: A Houston, Texas Case Study | 7 |
| Item 9. | Exploring Sustainable Transportation for Texas Southern University | 7 |
| Item 10. | Game Theory and Traffic Assignment | 8 |
| Item 11. | Left-Turn Lanes at Unsignalized Median Openings | 8 |
| Item 12. | Multivariate Analysis of Freeway Speed and Headway Data | 9 |
| Item 13. | Public-Private Partnerships in Transportation Infrastructure: Survey of Experiences and Perceptions | 9 |
| Item 14. | Real Time Freeway Incident Detection | 10 |
| Item 15. | Revolutionizing Our Roadways: The Challenges and Benefits of Making Automated Vehicles a Reality | 10 |
| Item 16. | State and Regional Tools for Coordinating Housing and Transportation | 11 |
| Item 17. | Sustainability of Bridge Foundations Using Electrical Resistivity Imaging and Induced Polarization to Support Transportation Safety | 12 |
| Item 18. | A Transportation Corridor Analysis Toolkit | 13 |
| Item 19. | Transportation Revenue Impacts from a Changing Light-Duty Vehicle Fleet | 13 |
| Item 20. | U in the Driver Seat: A Peer-to-Peer Pilot Program for Decreasing Car Crashes by College Students | 14 |
| Item 21. | Use of Directional Median Openings on Urban Roadways | 14 |
| Item 22. | Wetting Characteristics of Asphalt Binders at Mixing Temperatures | 15 |

Research Digest

Item 1

2012 Household Travel Survey Symposium: Conference Summary and Final Report

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/13/600451-00017-1 • 2013

The SWUTC Travel Survey Symposium was held in Dallas on November 8 and 9. More than 70 travel survey professionals attended this event from across the United States, from Florida to Alaska, with one attendee from the City of Calgary (Canada), representing an almost equal mix of agency, consultant, and academic researchers. The symposium started with a poster session, featuring research from 22 related efforts. An opening session followed that included a Texas welcome from Mr. Michael Morris, Executive Director of NCTCOG and a key note speech from Dr. Kermit Wies of the Chicago Metropolitan Agency for Planning. Attendees were encouraged to think outside the box and consider all users of travel survey data as their customers. The symposium was divided into two parts. The discussion groups on Thursday focused on identifying lessons learned and opportunities to advance methods and sampling approaches, as well as considering all uses of the survey data. The day ended with attendees presenting their versions of the “travel survey of the future”—incorporating new technologies, known and on the horizon. Friday, the focus of the symposium discussion turned to identifying what can be implemented now and establishing a research agenda to move us toward the newly identified survey designs.

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<http://swutc.tamu.edu/publications/technicalreports/600451-00017-1.pdf>

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Item 2

Automated Vehicles: Policy Implications Scoping Study

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/14/600451-00029-2 • 2014

Automated vehicles are an emerging technology with the potential to greatly change and disrupt the American transportation system, but may also have significant benefits. This study sought to understand how automated vehicles will change the transportation system, identify implications on state and local transportation providers, determine future research needs, and understand emerging policy issues.

To accomplish these ends, the research team performed an in-depth literature review. Following this review, the research team interviewed expert personnel from automated vehicle manufacturers, suppliers, and developers; and state and local transportation agency representatives. These interviews informed the research process and provided insight into the future needs of transportation providers in the face of automated vehicles.

CONTENTS

- Executive Summary
- 1.0 Introduction
- 2.0 Classifying Automated Vehicles
- 3.0 The Status of Automated Vehicles
- 4.0 Governmental Responses
- 5.0 Economic and Societal Effects
- 6.0 Interviews
- 7.0 Findings
- 8.0 Research Needs
- 9.0 Bibliography
- 10.0 Appendix

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Item 3

Comparison of Fatigue Analysis Approaches for Hot-Mix Asphalt to Ensure a State of Good Repair

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/13/600451-00012-1 • 2013

Fatigue cracking is a primary form of distress in hot-mix asphalt. The long-term nature of fatigue due to repeated loading and aging and its required tie to pavement structure present challenges in terms of evaluating mixture resistance. This project focused on comparing stiffness and fatigue life output from two recently developed approaches that use repeated direct tension tests: the Modified Calibrated Mechanistic with Surface Energy (CMSE*) approach and the Push-Pull Viscoelastic Continuum Damage (PP-VECD) approach.

The CMSE* and the PP-VECD approaches were applied to both laboratory and field specimens for two mixtures, one from SH 24 in the Paris (PAR) District and one from US 277 in the Laredo (LRD) District of the Texas Department of Transportation, and the results were compared. Both approaches can be used to characterize mixture fatigue resistance with relatively low variability. Based on stiffness, both approaches predict better resistance (lower stiffness) for the PAR mixture based on laboratory results but that the mixtures would have equivalent resistance based on field results for the CMSE* approach. There was also good agreement between laboratory and field specimens for the LRD mixture.

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<http://swutc.tamu.edu/publications/technicalreports/600451-00012-1.pdf>

Item 4

Compendium of Student Papers: 2013 Undergraduate Transportation Scholars Program

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/13/600451-00003-2 • 2013

This report is a compilation of research papers written by students participating in the 2013 Undergraduate Transportation Scholars Program. The 10-week summer program, now in its 23rd year, provides undergraduate students in Civil Engineering the opportunity to learn about transportation engineering through participating in sponsored transportation research projects. The program design allows students to interact directly with a Texas A&M University faculty member or Texas Transportation Institute researcher in developing a research proposal, conducting valid research, and documenting the research results through oral presentations and research papers.

CONTENTS

- Validation of Computer Vision for Structural Vibration Studies / Daniel Bartilson
- Evaluating Driver Response to Prototype Traffic Control Devices at Access Points / Adrian Contreras
- Evaluation of Apparent Capacities through Freeway Lane Closures / Kevin Mackan
- Operational Effects of Chevrons on Horizontal Curves Using Speed and Energy Differentials and Speed Profiles / Mark Membreño
- Preliminary Development of a Trip Generation Manual for Texas / Parker C. Moore

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Item 5

Decision-Support Framework for Quantifying the Most Economical Incentive/Disincentive Dollar Amounts for Critical Highway Pavement Rehabilitation Projects

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/13/600451-00016-1 • 2013

One innovative way of reducing construction duration is to reward contractors with an early completion incentive bonus and levy fines for delays. Although use of Incentive/Disincentive (I/D) is increasingly common, State Transportation Agencies (STAs) often struggle to select the most appropriate I/D rates due largely to the lack of the proper analytical methods. There is an immediate need to develop a holistic framework that is more general and applicable to a variety of transportation projects for the determination of optimal I/D rates. The main objectives of this study were to create a new decision-support analytical framework of optimal I/D and test whether it can reasonably and realistically determine and justify the most economical I/D dollar amounts. This study blends existing schedule and traffic simulation techniques with a stochastic analysis by accounting for the integration of project schedule, Contractor's Additional Cost (CAC) of acceleration, and total savings to motorists and to the agency. STAs can arrive at an optimal I/D rate by employing a seven-stage methodology proposed in this study. These steps include two adjustment algorithms that are factored on the concepts of level-of-service and net present value. The study results revealed a strong tradeoff effect between schedule and cost, suggesting that CAC growth rate can be analyzed by how the CAC interacts with the agency's specified schedule goal. The robustness of the proposed seven-stage methodology was validated with two case studies performed on real-world construction projects. This research work provides research communities and industry practitioners with the first holistic view to determine the most economical and realistic I/D dollar amounts for a given project—an optimal value that allows the agency to stay within budget while at the same time effectively motivating contractors to use their ingenuity to complete the projects earlier. It can help agency engineers and decision makers make better-informed decisions and allocate more realistic incentives, which will result in more favorable cost-benefit ratios and better use of public funds. It will significantly reduce the agency's expenses in the time and effort required for determining I/D rates.

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Item 6

Developing the Sediment and Erosion Control Laboratory to Become a Hands-on Training and Education Center

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/13/161306-1 • 2013

The Sedimentation and Erosion Control (SEC) Laboratory has an established reputation as a renowned soil erosion research facility in the United States since its inception in 1990. During the past two decades, the lab has expanded its original performance evaluation task to cutting-edge stormwater research, as well as professional training development. The researchers affiliated with the SEC Lab have also developed numerous training courses. In the market of continuing education industry, a popular business is to provide courses on soil erosion and Low Impact Development (LID) subjects. As the growing demand on these topics, there are more and more continuing education programs starting to set up training courses on this topic. However, those programs rarely can provide hands-on training. Therefore, the opportunity arises where Texas A&M Transportation Institute can depend on the SEC Lab for hands-on exercises to be integrated in professional training, continuing education and high-impact learning experiences for current TAMU students, regional municipalities, and other professionals in the design and construction industries. Considering SEC Lab has never developed a master plan and the demand of continuing education, the research proposed a master plan for the lab and developed a pilot LID course. Tasks conducted include: cases review, SWOT (strength, weakness, opportunity and challenge) analysis, course module development, conceptual plan design, model build, propagation, and final master plan.

This report is available for free download (24 MB):

<http://swutc.tamu.edu/publications/technicalreports/161306-1.pdf>

Item 7

Empirical Measurement of Travelers' Value of Reliability

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
TTI SWUTC/14/161304-1 • 2014

Time and reliability are two fundamental factors influencing travel behavior and demand. The concept of the value of time (VOT) has been extensively studied, and estimates of VOT have been obtained from surveys and empirical data. On the other hand, although the importance of value of reliability (VOR) is appreciated, research related to VOR is still in its early stages. The VOR has been estimated using surveys but has almost never been estimated using empirical data.

This research used empirical data to take an initial step toward understanding the importance of travel time reliability. Katy Freeway travelers face a daily choice between reliable tolled lanes and less reliable but untolled lanes. An extensive dataset of Katy Freeway travel was used to examine the influence of time, reliability, and toll on lane-choice behavior. Lane choice was estimated using multinomial logit models. Basic models, including only travel time and toll, yielded reasonable results. Models included VOTs of \$2.60/hour, \$8.63/hour, and \$10.71/hour for off-peak, shoulder, and peak-period travelers, respectively.

However, adding a managed-lane (ML) alternative specific coefficient to these models resulted in positive coefficients for the toll variable and negative VOTs. Similarly, adding reliability to the models resulted in counter-intuitive results. Researchers concluded that additional research on how travelers perceive the reliability and time savings on MLs is needed because modeling real-world choices of MLs using the standard definitions of reliability and time savings led to counter-intuitive results.

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Item 8

An Examination of Severe Environmental Justice Zones: A Houston, Texas Case Study

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/14/600451-00046-1 • 2014

Declining federal subsidies are limiting transportation capacity at the regional and local levels. At the same time, federally funded agencies must comply with Executive Order (EO) 12898, which augments Title VI of the Civil Rights Act of 1964. The EO states that agencies are to identify burdens and benefits to vulnerable populations. Prior to the 2010, demographic and socioeconomic data collected from the decennial census, the American Community Survey (ACS) and the United States Department of Health and Human Services were used to classify environmental justice zones. In the 2010 decennial census, the U.S. Census Bureau eliminated the long-form, which reduced the data available to perform adequate environmental justice analyses. Currently, metropolitan planning organizations (MPOs) use the ACS which provides limited data. MPOs must now develop innovative strategies to determine environmental justice zones. In previous work, a methodology for identifying EJZs in the Houston TMA was created for the MPO. This methodology analyzed the level of transportation investment in severe census tracts. The methodology included a three-tier process. First, the EJZs and non-EJZs were identified based on the distribution of variables throughout the census tracts. Of the 1,066 tracts within the Houston transportation management area (TMA), there was usable data for 1,062 tracts. About 356 (34%) were classified as EJ Zones. Among EJ tracts, 209 (20%) were low EJ, 107 (10%) were medium EJ, 32 (3%) were high EJ, and 8 (1%) were extreme EJ tracts. For purposes of this study, only these eight extreme EJ zones are discussed in more detail. The second tier analysis developed community profiles for these extreme EJZs. In the third tier, transportation mobility accessibility options were described for the extreme EJZs, including an automobile versus public transit comparison. The study found that one of the EJ areas had the best travel times and good access to transit and light rail. This was primarily due to its close proximity to the CBD. Study areas located the farthest from the CBD reported higher car ownership.

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Item 9

Exploring Sustainable Transportation for Texas Southern University

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/14/600451-00042-1 • 2014

Texas Southern University is a commuter campus with students, faculty, and staff traveling from the Greater Houston area to the university. Over the past few years, the TSU campus has made marked improvements to move towards a “greener” more sustainable campus with less impervious coverage. Despite this commitment, the campus still has not addressed how the university will decrease its carbon footprint and change the way people arrive at the campus. Adopting a multi-faceted approach to commuting where faculty, staff, and students have the sustainable commuting options: i.e. rideshare, transit, drive, and bicycle, as viable alternatives to get to the university. The literature and practices currently in use show these strategies are already working well at other campuses and could prove success at TSU as well.

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Item 10

Game Theory and Traffic Assignment

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/13/600451-00065-1 • 2013

Traffic assignment is used to determine the number of users on roadway links in a network. While this problem has been widely studied in transportation literature, its use of the concept of equilibrium has attracted considerable interest in the field of game theory. The approaches used in both transportation and game theory disciplines are explored, and the similarities and dissimilarities between them are studied. In particular, treatment of multiple equilibrium solutions using equilibrium refinements and learning algorithms which convergence to equilibria under incomplete information and/or bounded rationality of players are discussed in detail.

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Item 11

Left-Turn Lanes at Unsignalized Median Openings

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/14/600451-00044-1 • 2014

Due to the frequent presence of median openings in urban arterial settings, the requirements for the deceleration and storage of turning vehicles (e.g. AASHTO Green Book) often exceed the available length between two adjacent openings which leaves traffic engineers having to decide whether left-turn lanes, shorter than the standards, can be used or not. The goal of this research is to investigate the minimum required length for the left-turn lanes at the unsignalized median openings, and study the safety and operational impacts of such left-turn lanes with substandard lengths. To achieve this goal, researchers will: 1) synthesize existing related research; 2) develop models for storage lengths at unsignalized median openings; 3) develop models for estimating the delays caused by substandard deceleration lengths and the resulting excessive deceleration on main travel lanes; and 4) analyze safety impacts of substandard median left-turn lanes.

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Item 12

Multivariate Analysis of Freeway Speed and Headway Data

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/13/600451-00020-1 • 2013

The knowledge of speed and headway distributions is essential in microscopic traffic flow studies because speed and headway are both fundamental microscopic characteristics of traffic flow. For microscopic simulation models, one key process is the generation of entry vehicle speeds and vehicle arrival times. It is helpful to find desirable mathematical distributions to model individual speed and headway values, because the individual vehicle speed and arrival time in microscopic simulations are usually generated based on some form of mathematical models. Traditionally, distributions for speed and headway are investigated separately and independent of each other. However, this traditional approach ignores the possible dependence between speed and headway. To address this issue, the research presents a methodology to construct bivariate distributions to describe the characteristics of speed and headway. Based on the investigation of freeway speed and headway data measured from the loop detector data on IH-35 in Austin, it is shown that there exists a weak dependence between speed and headway. The research first proposes skew-t mixture models to capture the heterogeneity in speed distribution. Finite mixture of skew-t distributions can significantly improve the goodness of fit of speed data. To develop a bivariate distribution to capture the dependence and describe the characteristics of speed and headway, this study proposes a Farlie-Gumbel Morgenstern (FGM) approach to construct a bivariate distribution to simultaneously describe the characteristics of speed and headway. The bivariate model can provide a satisfactory fit to the multimodal speed and headway distribution. Overall, the proposed methodologies in this research can be used to generate more accurate vehicle speeds and vehicle arrival times by considering their dependence on each other when developing microscopic traffic simulation models.

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Item 13

Public-Private Partnerships in Transportation Infrastructure: Survey of Experiences and Perceptions

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/13/600451-00072-1 • 2013

The use of public-private partnerships (PPPs) for transportation infrastructure delivery has increased in the U.S. However, concerns about and opposition to these agreements exist due to a variety of factors. This paper explores the perceptions that a variety of PPP stakeholders have about PPP usage to deliver transportation infrastructure in the U.S., including stakeholders from fields at times overlooked in PPP literature but that are key to these transactions, such as professionals in legal, banking and finance, and concessionaire organizations. The paper reports the results of a survey taken by 101 professionals, with responses classified based on different aspects of the respondents' backgrounds. Results indicate that stakeholders' perceptions about benefits, barriers, and valuation of PPPs vary—at times greatly—depending upon the respondent's work type, location, and especially whether they had previous experience with PPPs. While this is not surprising, in some cases, such variations in perceptions were unexpected in both type and magnitude. It is understandable that some misperceptions still exist among PPP stakeholders due to various reasons, yet some responses showed deep misunderstandings, fears, or unrealistic expectations about PPPs. The fact that respondents were targeted because of their assumed familiarity with these transactions is worrisome and it indicates the need to educate decision-makers, staff, and the general public about what PPPs really are, why they are needed, and what they can and cannot do.

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Item 14

Real Time Freeway Incident Detection

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/14/600451-00083-1 • 2014

The US Department of Transportation (US-DOT) estimates that over half of all congestion events are caused by highway incidents rather than by rush-hour traffic in big cities. Real-time incident detection on freeways is an important part of any modern traffic control center operation because it offers an opportunity to maximize road system performance. An effective incident detection and management operation cannot prevent incidents, however, it can diminish the impacts of non-recurring congestion problems. The main purpose of real-time incident detection is to reduce delay and the number of secondary accidents, and to improve safety and travel information during unusual traffic conditions. The purpose of this project is to evaluate two recently developed automatic incident detection algorithms. The majority of automatic incident detection algorithms are focused on identifying traffic incident patterns but may not adequately investigate possible similarities in patterns observed under incident-free conditions. When traffic demand exceeds road capacity, the traffic speed decreases significantly and the traffic enters a highly unstable regime often referred to as “stop-and-go” conditions. The most challenging part of real-time incident detection is recognition of traffic pattern changes when incidents happen during stop-and-go conditions. This work describes a case study evaluation of two recently evolved incident detection methods using data from the Dallas, TX traffic control center.

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Item 15

Revolutionizing Our Roadways: The Challenges and Benefits of Making Automated Vehicles a Reality

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC 600451-00029-2 • 2014

CONTENTS

- 1.0 Automated Vehicles: The Future Is Near
- 2.0 An Overview of Automated Vehicles
- 3.0 Asking the Experts
- 4.0 Where to go from Here
- Resources

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Item 16

State and Regional Tools for Coordinating Housing and Transportation

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

SWUTC/14/600451-00107-1 • 2014

Federal, state, and local governments spend billions on transportation infrastructure and affordable housing subsidies, but rarely with complete coordination. States and regional entities are pivotal in shaping transportation and housing systems. State agencies not only spend state-generated revenue but also frequently determine how federal resources are allocated. The largest federal subsidy for affordable, rental housing is the low-income housing tax credit program, but states largely determine the allocation of these credits. With increasing attention on the need to combine affordable housing with mobility options, this report examines which states have incorporated transit proximity into their allocation of low-income housing tax credits. In addition, the report also reviews to what extent low-income residential patterns are included in federally required, regional transportation planning. We find that most states address transportation in their allocation of low-income housing tax credits, with the most common transportation criterion being proximity to transit (e.g., whether a development was .25 or .5 miles from transit). Across metropolitan areas, our scan of regional plan documents revealed inconsistent consideration of the residential locations of low-income households. In both policy areas, we thus observe some attention to the relationship between housing location (for low-income households) and transportation systems. The steps toward integration are still new, without documented efficacy, and even with initial progress and attention across spheres, integration challenges may remain.

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Item 17

Sustainability of Bridge Foundations Using Electrical Resistivity Imaging and Induced Polarization to Support Transportation Safety

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/14/600451-00028-1 • 2014

As of September 2007, there were 67,240 U.S. bridges in the National Bridge Inventory classified as having unknown foundations (FHWA 2008). The bridges spanning rivers are of critical importance due to the risks of potential scour. In fact, it is estimated that 60 percent of all bridge collapses are due to scour (Parola et al. 1997). Not only are these failures costly, they can be deadly for the traveling public. On April 5, 1987, 10 people were killed in New York when a pier collapsed on the Schoharie Creek Bridge causing two spans of the deck to fall into the creek. Several other fatal collapses have occurred since the Schoharie Creek Bridge failure. Detecting scour is only part of the assessment that must take place to determine risk of failure and knowing the foundation depth is a critical component of the assessment.

This research explored the feasibility and effectiveness of induced polarization (IP) and electrical resistivity imaging (ERI), near surface geophysical methods, for determining the depth of unknown foundations. With budget cuts and deteriorating infrastructure, there is a need to seek alternative solutions for nondestructive structural integrity testing that are more robust to limit bridge failures that hinder transportation safety. The existing methods for unknown bridge foundations in the literature are often hindered by the type of foundation or require the use of a borehole, making them very costly. As a result, only a few states are working to identify the depth of unknown bridge foundations around them. In order to solve this national problem, a new and effective method needs to be investigated with full scale bridge testing and disseminated nationwide. In this work, an experimental study was conducted at a National Geotechnical Experimentation Site (NGES) to identify key parameters for the testing design and setup in order to obtain optimal surveys of bridge foundations. The conclusions of the NGES investigations were used to plan the field surveys on four bridges with known foundations. The outcomes of the four bridges showed that IP and ERI can be used in concert with one another to estimate the type and depth of bridge foundations. The results of the field surveys were used to create a probability of non-exceedance curve for future predictions of unknown bridge foundations using the methods described in this research. Finally, the probability of exceedance curve was used to validate the method with testing on a foundation unknown at the time of testing, and the use of IP and ERI were extended to other subsurface infrastructure when a gas line was imaged

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Item 18

A Transportation Corridor Analysis Toolkit

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
CTR SWUTC/13/600451-00066-1 • 2013

The Moving Ahead for Progress in the 21st Century Act includes a number of provisions advocating improving the condition and performance of the national freight network through targeted investments and policies by the Department of Transportation and state agencies. Critical to this network are freight corridors which serve as major trade gateways connecting multiple cities and regions. However, transportation planners and policy makers are limited by the number of tools available to assess the performance and condition of these corridors. Most current tools and models require data which is either unavailable, outdated or insufficient for analysis. To address this need, a truck-rail intermodal toolkit was developed for multimodal corridor analysis and enables planners and other stakeholders examine freight movement along corridors based on mode and route characteristics. The toolkit includes techniques to acquire data for simulating line-haul movements, and models to evaluate multiple freight movement scenarios along corridors. Example analyses examining truck and rail movements along 5 mode-competitive corridors are presented in addition to a case study of the Gulf Coast Megaregion. The methodology described herein can be used in other multistate corridors and serve as an initial assessment of the condition and performance of the national freight network.

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Item 19

Transportation Revenue Impacts from a Changing Light-Duty Vehicle Fleet

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
CTR SWUTC/13/600451-00073-1 • 2013

Advanced fuel economies in both traditional internal combustion engine vehicles (ICEs) and electric vehicles (EVs) have a strong influence on transportation revenue by reducing fuel consumption per vehicle and ultimately drawing down the amount of fuel tax revenue received. It is expected that more ICE vehicles with advanced fuel economies and EVs, especially gasoline hybrid EVs, will enter the roadway in coming years, and fuel tax revenues and the Highway Trust Fund will increasingly become more affected. This study estimates the impact that increased sales of advanced ICEs and EVs will have on future fuel tax revenues by drawing on industry estimates of future EV and ICE market shares and anticipates future fleet mix and fuel economy for both vehicle technologies. An estimation process overview is provided and assumptions are described.

Fuel tax revenue amounts that would be expected from future light vehicle fleets with increased shares of EVs are compared to equivalently sized fleets composed of all ICEs, and future fleet mixes are estimated. Results show that as more EVs enter the light vehicle fleet, greater revenue losses are expected, and total losses from years 2011 through 2050 depend on fleet composition and fuel economy of both vehicle types. It is found that the amount of fuel taxes paid by ICE drivers each year remain greater than fuel taxes paid by EV drivers even with advances in the average ICE vehicle fuel economy. Finally, a review of alternative revenue generation methods that states are employing to cover fuel tax revenue gaps is given.

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

<http://swutc.tamu.edu/publications/technicalreports/600451-00073-1.pdf>

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Item 20

U in the Driver Seat: A Peer-to-Peer Pilot Program for Decreasing Car Crashes by College Students

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/13/600451-00015-1 / SWUTC/14/600451-00015-1 • 2013

The goal of this project was to build a peer-to-peer (P2P) model, U in the Driver Seat, targeted toward the college-aged audience at two college campuses. Researchers performed the following tasks: conducted pre- and post-assessments of driving risk awareness and self-reported driving behavior, performed field observations of seat belt use and driver's use of electronic device(s), established a leadership team at each campus, provided safety messages and promotional items to the team, provided ideas for project/safety messaging activities to the team, and assisted the teams in establishing a student-run designated driver program. Objectives of the study included: gaining a better understanding of risk awareness and attitudes toward driving dangers, measuring success of P2P messaging and activities for a college-aged audience, increasing understanding of safety messaging and design elements effective with this age group, and improving the program model.

This report is available for free download (1.9 MB):

<http://swutc.tamu.edu/publications/technicalreports/600451-00015-1.pdf>

Item 21

Use of Directional Median Openings on Urban Roadways

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/14/161342-1 • 2014

Over the past decades, many states and local transportation agencies have installed directional median openings on divided roadways to improve arterial safety and operational performance. A directional opening is normally used to restrict crossing and left-turn movements from minor streets to help avoid potential conflicts. A series of potential benefits may be achieved by installing directional-median openings, including reduced crash rates, increased traffic capacity, and better operational performance. However, the benefits of directional median openings depend largely on proper implementation and on various factors, including geometric, traffic control, environmental conditions, and the type and placement of the downstream U-turn provisions. The goal of this research is to investigate the safety impacts of installing directional openings on median-divided urban roadways. To achieve this goal, the research : 1) synthesized existing related research; 2) compared the safety performance of directional median openings and full median openings, at subject opening locations and downstream U-turn locations; and 3) analyzed the contributing factors to the crashes occurred at the downstream U-turn locations of a directional median opening.

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Item 22

Wetting Characteristics of Asphalt Binders at Mixing Temperatures

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

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Conventional hot mix asphalt (HMA) is produced by heating the aggregate and the asphalt binder to elevated temperatures that are typically in the range of 150C to 160C. These temperatures ensure that the viscosity of the asphalt binder is low enough to effectively coat the aggregate particles. During the past decade, warm mix asphalt (WMA) has been introduced to reduce the mixing temperatures by approximately 30C compared to HMA. Workability at these reduced temperatures is typically achieved by the use of chemical additives in the asphalt binder or by foaming the asphalt binder using small percentages of water. The use of WMA is associated with advantages such as reduced emissions during mixture production, extended paving season and reduced aging in the asphalt binder. In case of the WMA and the HMA, one of the important physical properties that dictates the quality of coating is the surface tension of the asphalt binder at mixing temperatures. In this study, the surface tension of different liquid asphalt binders was measured at typical mixing temperatures. The effect of binder type, temperature, and chemical additives used to produce WMA on the surface tension of the binder was evaluated. Three different binders with and without three different chemical additives were used in this study. The dynamic surface tension was measured using four different rates of surface formation and at several different temperatures within the range of 140C and 170C. Results show that the surface tension of asphalt binder depends on the rate of surface formation, temperature and source of the asphalt binder. Dynamic surface tension of asphalt binders suggests that asphalt binders behave similar to surfactants. The addition of chemical warm mix additives did not significantly reduce the surface tension of the binder compared to the control.

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