



Research Digest

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Southwest Region University Transportation Center (SWUTC)

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Item 1

An Alternative Transportation Fuels Update: A Case Study of the Developing E85 Industry

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/11/167360-1 • 2011

As the United States imports more than half of its oil and overall consumption continues to climb, the 1992 Energy Policy Act established the goal of having “alternative fuels” replace at least ten percent of petroleum fuels used in the transportation sector by 2000, and at least thirty percent by 2010. Currently, alternative fuels consumed in Alternative Fuel Vehicle (AFVs) account for less than one percent of total consumption of gasoline. This paper examines how alternative fuel E85 can be used to reverse that trend. In addition, this research paper will take a look at some of the ongoing government decisions concerning the use of the alternative fuel E85, and will discuss what policy makers might hold for the future in terms of the supply and demand of alternative fuels in the United States. This case study will be useful to all stakeholders involved in the transportation industry, including, but not limited to the government, policy makers, automakers, motorists, and researchers, eager to find a just balance with both a better transportation system and a healthy and clean environment.

This report is available for free download (406 KB):

<http://swutc.tamu.edu/publications/technicalreports/167360-1.pdf>

Item 2

Compendium of Student Papers: 2011 Undergraduate Transportation Engineering Fellows Program

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/11/476660-00003-4 • 2012

This report is a compilation of research papers written by students participating in the 2011 Undergraduate Transportation Scholars Program. The 10-week summer program, now in its 21st 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.

The papers in this compendium report on the following topics, respectively: 1) evaluating the impact of nighttime work zone lighting characteristics on motorists; 2) late night roadway visibility; 3) investigation of the use and pricing of the I-15 express lanes in San Diego; 4) intercity passenger rail access to airports: a case study at the Milwaukee airport; 5) development of a background complexity assessment tool; 6) identifying pavement preservation treatments suitable for performance-related specifications; and 7) arsenic content and retroreflectivity of glass beads used in pavement markings.

CONTENTS

- Evaluating the Impact of Nighttime Work Zone Lighting Characteristics on Motorists / Felicia J. Desorcie
- Late Night Roadway Visibility / Ruoxin Jiang
- Investigation of the Use and Pricing of the I-15 Express Lanes in San Diego / Pete Kelly
- Intercity Passenger Rail Access to Airports: A Case Study at the Milwaukee Airport / Shawn Larson
- Development of a Background Complexity Assessment Tool / Marcus Rasulo
- Identifying Pavement Preservation Treatments Suitable for Performance-Related Specifications / Joshua Rivera
- Arsenic Content and Retroreflectivity of Glass Beads Used in Pavement Markings / Hidi Marie Wood

This report is available for free download (7.7 MB):

<http://swutc.tamu.edu/publications/technicalreports/compendiums/476660-00003-4.pdf>

Item 3

The Design of a Comprehensive Microsimulator of Household Vehicle Fleet Composition, Utilization, and Evolution

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
CTR SWUTC/12/161120-1 • 2012

The report describes a comprehensive vehicle fleet composition, utilization, and evolution simulator that can be used to forecast household vehicle ownership and mileage by type of vehicle over time. The components of the simulator are developed in this research effort using detailed revealed and stated preference data on household vehicle fleet composition, utilization, and planned transactions collected for a large sample of households in California. Results of the model development effort show that the simulator holds promise as a tool for simulating vehicular choice processes in the context of activity-based travel microsimulation model systems.

This report is available for free download (343 KB):

<http://swutc.tamu.edu/publications/technicalreports/161120-1.pdf>

Item 4

Developing Infrastructure for Interconnecting Transportation Network and Electric Grid

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
TTI SWUTC/11/161006-1 • 2011

"This report formulates and develops models and solution approaches for plug-in electric vehicle (PEV) charging station installation. The models are formulated in the form of bilevel programming and stochastic programming problems, while a meta-heuristic method, genetic algorithm, and Monte Carlo bounding techniques are used to solve the problems. Demand for PEVs is increasing with the growing concerns about environment pollution, energy resources, and the economy. However, battery capacity in PEVs is still limited and represents one of the key barriers to a more widespread adoption of PEVs. It is expected that drivers who have long-distance commutes hesitate to replace their internal combustion engine vehicles with PEVs due to range anxiety. To address this concern, PEV infrastructure can be developed to provide re-fully status when they are needed.

"This report is primarily focused on the development of mathematical models that can be used to support decisions regarding a charging station location and installation problem. The major parts of developing the models included identification of the problem, development of mathematical models in the form of bilevel and stochastic programming problems, and development of a solution approach using a meta-heuristic method. PEV parking building problem was formulated as a bilevel programming problem in order to consider interaction between transportation flow and a manager decisions, while the charging station installation problem was formulated as a stochastic programming problem in order to consider uncertainty in parameters. In order to find the best-quality solution, a genetic algorithm method was used because the formulation problems are NP-hard. In addition, the Monte Carlo bounding method was used to solve the stochastic program with continuous distributions." --p. v

This report is available for free download (6.1 MB):

<http://swutc.tamu.edu/publications/technicalreports/161006-1.pdf>

Item 5

Development and Validation of a Testing Protocol for Carbon Sequestration Using a Controlled Environment

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/12/476660-00028-1 • 2012

Carbon footprints, carbon credits and associated carbon sequestration techniques are rapidly becoming part of how environmental mitigation business is conducted, not only in Texas but globally. Terrestrial carbon sequestration is the general term used for the capture and long-term storage of carbon dioxide. For a transportation facility, this occurs through the natural processes of the roadside vegetation and soil. Texas has a state-maintained highway system of approximately 80,000 linear miles of roadway with more than 1.1 million acres of right-of-way, not including the street systems of cities, towns and local communities. The majority of these roadways have supporting vegetation within their rights-of-way that usually consists of various combinations of grasses, shrubs and trees. Roadside carbon sequestration measurement practices typically rely on modeling and in-situ measurements. This project conducted initial testing to develop a method for quantifying plant and soil carbon sequestration capabilities under the controlled conditions of the Texas Transportation Institute's Environmental and Emissions Research Facility (EERF). Plants and soil were subjected to heavy-duty truck emissions over a six week period. Samples were analyzed for changes in carbon and nitrogen content over time. Due to the plant injury that occurred during testing, the sequestration capabilities of these plant materials and soils were inconclusive. A comparison of samples taken over the course of the study indicated that the desired results may have been accomplished had the initial exposure in the EERF been reduced to a more moderate level. Modifications to this technique for future research on specific soils and plant materials may help identify plant and soil combinations to maximize roadside carbon sequestration.

This report is available for free download (4.4 MB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00028-1.pdf>

Item 6

Development of Warrants for Installation of Dual Right-Turn Lanes at Signalized Intersections

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/12/161141-1 • 2012

Right-turn lanes provide space for the deceleration and storage of right-turn vehicles, and separate turning vehicles from through movements. Dual right-turn lanes are increasingly used at urban intersections primarily for two reasons: (1) to accommodate high right-turn demands and avoid turn-pocket overflows, and/or (2) to prevent right-turn vehicles that exit from a nearby upstream freeway off-ramp (on the left of the roadway) from abruptly changing too many lanes toward the right-turn lane at the intersection. In addition, a number of other factors may affect the decisions on the installation of dual right-turn lanes. However, warrants for dual right lane installation are almost non-existent, leaving traffic engineers to rely on engineering judgment. This research aims to develop warrants for installation of dual right-turn lanes at signalized intersections. Both the operational and safety benefits/costs were analyzed by surveying traffic engineers and by conducting traffic simulation-based analysis. Microscopic traffic simulation model, VISSIM, was used to quantify the operation benefits and Surrogate Safety Assessment Model (SSAM) developed by Siemens was used to analyze the safety gains due to installation of dual right-turn lanes.

This report is available for free download (2.2 MB):

<http://swutc.tamu.edu/publications/technicalreports/161141-1.pdf>



Item 7

The Economic Efficiency of Allowing Longer Combination Vehicles in Texas

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/11/476660-00077-1 • 2011

This paper shows the economic efficiency of allowing longer combination vehicles in Texas. First, an overview of the truck size and weight policies is explained, with an emphasis on those that affect Texas. Next, LCV operations in other countries are described. Then, an LCV scenario for Texas is chosen, with specific routes and vehicle types. Operational costs for these vehicles are calculated on a cost per mile and cost per ton (or cubic yard) mile. The LCV scenario and the current truck base case are analyzed to find the number of truck trips, the number of mile, and the cost per mile for the chosen routes. These are then compared to estimate the change if LCVs were allowed in Texas.

This report is available for free download (1.7 MB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00077-1.pdf>

Item 8

Equity Evaluation of Vehicle Miles Traveled Fees in Texas

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/12/161105-1 • 2012

The Texas state gas tax has been 20.0 cents per gallon since 1991, and the federal gas tax has been 18.4 cents per gallon since 1993. The gas tax is not only stagnant, but depreciating in value due to inflation. One proposed alternative to the gas tax is the creation of a vehicle miles traveled (VMT) fee; with equity being a crucial issue to consider. This research used 2009 National Household Travel Survey (NHTS) Texas data to consider the equity impacts surrounding four VMT fee scenarios. Data were filtered and weighted to reflect results representative of Texas vehicle-owning households in 2008. Each scenario was run both statically and dynamically under the assumption that the VMT fee would replace the state gas tax. Results indicate that all of the VMT fee scenarios are essentially as equally vertically equitable as the current state gas tax system.

This report is available for free download (1.4 MB):

<http://swutc.tamu.edu/publications/technicalreports/161105-1.pdf>

Item 9

Evaluating the Effect of Street Network Connectivity on First/Last Mile Transit Performance

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/11/161106-1 • 2011

This study defines a novel connectivity indicator (CI) to predict transit performance by identifying the role that street network connectivity plays in influencing the service quality of demand responsive feeder transit services. This new CI definition is dependent upon the expected shortest path between any two nodes in the network, includes spatial features and transit demand distribution information, and is easy to calculate for any given service area. Simulation analyses over a range of networks are conducted to validate the new definition. Results show a desirable monotonic relationship between transit performance and the proposed CI, whose values are directly proportional and therefore good predictors of the transit performance, outperforming other available indicators typically used by planners. This study also presents a methodology to identify and locate critical links in a grid street network system of any size for feeder transit services. A critical link can be defined as that link that when eliminated from or appended to an existing network would cause the largest change in the network connectivity and consequently transit performance. Easily computable formulas are provided and validated by simulation analyses. Useful insights indicate a monotonic decrease in link criticality as we depart from the centrally located links to those located at boundaries.

This report is available for free download (781 KB):

<http://swutc.tamu.edu/publications/technicalreports/161106-1.pdf>

Item 10

Evaluation of Mobile Source Greenhouse Gas Emissions for Assessment of Traffic Management Strategies

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/11/161142-1 • 2011

In recent years, there has been an increasing interest in investigating the air quality benefits of traffic management strategies in light of challenges associated with the global warming and climate change. However, there has been a lack of systematic effort to study the impact of a specific traffic management strategy on mobile source Greenhouse Gas (GHG) emissions. This research is intended to evaluate mobile source GHG emissions for traffic management strategies, in which a Portable Emission Measurement System (PEMS) is used to collect the vehicle's real-world emission and activity data, and a Vehicle Specific Power (VSP) based modeling approach is used as the basis for emission estimation. Three traffic management strategies are selected in this research, including High Occupancy Vehicle (HOV) lane, traffic signal coordination plan, and Electronic Toll Collection (ETC). In the HOV lane scenario, CO₂ emission factors produced by the testing vehicle using HOV lane and the corresponding mixed flow lane are compared. In the evaluation of traffic signal coordination, total CO₂ emissions produced under the existing coordinated signal timing and the emulated non-coordinated signal timing along the same designed testing route are compared. In the study about ETC, total CO₂ emissions produced by the testing vehicle around an ETC station and a Manual Toll Collection (MTC) station located on the same toll road segment are estimated and compared. The results demonstrated that HOV lane, well-coordinated signal timing, and ETC are all effective measures to reduce mobile source GHG emissions, although the level of effectiveness is shown to be different for different strategies.

This report is available for free download (1.7 MB):

<http://swutc.tamu.edu/publications/technicalreports/161142-1.pdf>

Item 11

Getting the Parking Right for Transit-Oriented Development

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/12/161027-1 • 2012

Increasingly MPOs in Texas are incorporating Transit-Oriented Development (TOD) or similar concepts into their long-range plans for the purpose of achieving sustainable transportation. One major challenge to implementing these TOD-type strategies is parking. The conventional parking policies likely produce excessive parking, undermining the expected community benefits of TOD and could even cause the TOD initiative to fail. Getting the parking right is essential to ensure the desirable form and functionality of TOD. There are few studies of the topic on Texas cities. The main objective of this study is to report the state-of-the-knowledge on parking regulations and practice influencing the planning, design, and implementation of TOD. The report first offers a narrative review of the published works on TOD-Parking. Based on the review findings it then presents a matrix of best parking practices for TOD. Finally, the report provides an annotated bibliography of TOD-Parking studies. Appendix 1 assembles parking regulations and practice policies in selected cities in the Austin-Round Rock Metropolitan Statistical Area.

This report is available for free download (1.7 MB):

<http://swutc.tamu.edu/publications/technicalreports/161027-1.pdf>

Item 12

High Speed Rail: A Study of International Best Practices and Identification of Opportunities in the U.S.

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/11/476660-00071-1 • 2011

In the United States, passenger rail has always been less competitive than in other parts of the world due to a number of factors. Many argue that in order for a passenger rail network to be successful major changes in service improvement have to be implemented to make it more desirable to the user. High-speed rail can offer such service improvement.

With the current administration's allocation of \$8 billion in its stimulus package for the development of high-speed rail corridors and a number of regions being interested in venturing into such projects it is important that we understand the factors and regulatory structure that needs to exist in order for passenger railroad to be successful. This study aims to review how foreign countries have developed and their railroad systems to identify key factors that have contributed to its successful implementation. An evaluation of the factors, such as organization structure, operation, administration, development and type of funding, that are common to each of these projects will be used as performance measures to identify potential locations and opportunities for high speed rail projects in the U.S. Southwest region.

This report is available for free download (3.9 MB):

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Item 13

How Fast is a Fast Train?: Comparing Attitudes and Preferences for Improved Passenger Rail Service among Urban Areas in the South Central High-Speed Rail Corridor

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/11/161003-1 • 2011

High-speed passenger rail is seen by many in the U.S. transportation policy and planning communities as an ideal solution for fast, safe, and resource-efficient mobility in high-demand intercity corridors between 100 and 500 miles in total endpoint-to-endpoint length. As the nation moves forward with a significant investment to improve its intercity passenger rail system, a number of planning and policy barriers still exist, making it difficult to fully realize the anticipated benefits of high-speed passenger rail. Using data from an Internet-based survey of residents in three communities in Central Texas—Waco, Temple, and Hillsboro—this research project examined the potential impacts of new intercity passenger rail service on small- or medium-sized communities located in the intermediate area between two larger urban areas that form the endpoints of a federally designated intercity high-speed rail corridor. Responses from more than 1,000 surveyed residents found that residents' attitudes toward new intercity passenger rail service are generally favorable and that trains could be used instead of automobiles for some intercity trips. The project's findings provide a foundation for later investment-grade ridership studies in the corridor and have potential applications in planning for intercity passenger rail and transportation policy development.

This report is available for free download (1.4 MB):

<http://swutc.tamu.edu/publications/technicalreports/161003-1.pdf>

Item 14

Investigate Existing Non-Intrusive (NII) Technologies for Port Cargo Inspections

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/11/161042-1 • 2011

The quantity of cargo handled by United States ports has increased significantly in recent years. Based on 2004 data, almost 2.7 billion tons of cargo passed through the ports in one year. To protect the U.S., all of this cargo must be inspected by U.S. Customs Border Protection (CBP) officials in the most effective manner possible. Existing non-intrusive inspection (NII) technologies have significant strengths, but they also have some weaknesses, such as a low detection rate and a long inspection time. Fortunately, there are newer and more advanced technologies that can be used to inspect cargo with higher accuracy and less delay. The goal of this research was to identify the most effective and efficient combination of NII technologies for inspecting cargo arriving at U.S. ports. For this purpose, a discrete-event simulation model was developed to simulate the cargo inspection procedure. By simulating the operations of different combinations of NII technologies, the effectiveness and efficiency of the various combinations were evaluated. This information was used to provide recommendations about the most effective and efficient combinations of NII technologies for detecting a wide range of contraband. The results of this research are helpful in making decisions concerning the appropriate choices of NII technologies for use in inspecting cargo that is entering U.S. ports.

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Item 15

An Investigation of the Effects of Reading and Writing Text-Based Messages While Driving

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/11/476660-00024-1 • 2011

Previous research, using driving simulation, crash data, and naturalistic methods, has begun to shed light on the dangers of texting while driving. Perhaps because of the dangers, no published work has experimentally investigated the dangers of texting while driving using an actual vehicle. Additionally, previous research does not clearly differentiate the dangers associated with reading and writing text messages. To address these issues, 42 participants drove an instrumented research vehicle on a closed driving course. Participants drove under a control, text reading, and text writing condition. Baseline text reading and writing data were also collected outside of the research vehicle.

Results indicated that impairment associated with texting while driving may be greater than previously thought. Principally, when reading or writing texts, drivers exhibited reductions in reaction time that were nearly twice as great as previously thought. Drivers also exhibited nearly identical impairment in the reading and writing conditions, suggesting that both reading and writing text messages may be equally dangerous. These results have immediate implications for improving our understanding of the dangers of texting while driving and may be useful for future public policy discussions.

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

<http://swutc.tamu.edu/publications/technicalreports/476660-00024-1.pdf>

Item 16

Laboratory Evaluation of Friction Loss and Compactability of Asphalt Mixtures

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/12/476660-00025-1 • 2012

"This study aimed to develop prediction models for friction loss and laboratory compaction of asphalt mixtures. In addition, the study evaluated the effect of compaction level and compaction method of skid resistance and the internal structure of asphalt mixtures. The predictive model for friction loss was developed based on parameters that describe aggregate texture and angularity before and after polishing, aggregate gradation, and polishing cycles in the laboratory. Squared-shape slabs of asphalt mixtures were prepared in the laboratory using a linear kneading compactor and polished using a wheel-polishing device. The frictional characteristics were measured after different intervals of polishing cycles. Mixtures with coarser aggregate gradation were found to have better skid resistance than those with fine aggregate gradation. The friction loss model was found to correlate very well with the experimental measurements.

The predictive model for laboratory compaction of asphalt mixtures was developed based on parameters that describe aggregate shape characteristics, aggregate gradation, binder content, and binder properties at compaction temperatures. The researchers executed intensive laboratory experiments to quantify the effect of these parameters on the compaction of asphalt mixture in the laboratory. Two models that describe slope and intercept of the laboratory compaction curves of asphalt mixtures were developed. These models showed strong correlations between the predicted values and the measured ones. These models provide essential inputs to quantify the compaction effort needed to compact asphalt mixtures.

In the last phase of this study, the researchers evaluated the effect of compaction level and compaction method on skid resistance and internal structure of asphalt pavements. The vibratory roller was found to yield a smoother surface than the static roller. In addition, the results confirmed that the vibratory roller was more effective in reducing the air voids than the static roller. Moreover, the test sections compacted using the vibratory roller had more uniform air void distribution compared to the test sections compacted using the static roller.

This report is available for free download (6.8 MB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00025-1.pdf>

Item 17

Managing Commodity Risks in Highway Contracts: Quantifying Premiums, Accounting for Correlations Among Risk Factors, and Designing Optimal Price-adjustment Contracts

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/11/161104-1 • 2011

It is a well-known fact that macro-economic conditions, such as prices of commodities (e.g. oil, cement and steel) affect the cost of construction projects. In a volatile market environment, highway agencies often pass such risk to contractors using fixed-price contracts. In turn, the contractors respond by adding premiums in bid prices. If the contractors overprice the risk, the price of fixed-price contract could exceed the price of the contract with adjustment clauses. Consequently, highway agencies have opportunity to design a contract that not only reduces the future risk of exposure, but also reduces the initial contract price.

The main goal of this report is to investigate the impact of commodity price risk on construction cost and the optimal risk hedging of such risks using price adjustment clauses. More specifically, the objective of the report is to develop models that can help highway agencies manage commodity price risks. In this report, weighted least square regression model is used to estimate the risk premium; both univariate and vector time series models are estimated and applied to simulate changes in commodity prices over time, including the effect of correlation; while genetic algorithm is used as a solution approach to a multi-objective optimization formulation. The data set used in this report consists of TxDOT bidding data, market-based data including New York Mercantile Exchange (NYMEX) future options data, and Engineering News-Record (ENR) material cost index data. The results of this report suggest that the optimal risk mitigation actions are conditional on owners' risk preferences, correlation among the prices of commodities, and volatility of the market.

This report is available for free download (1.8 MB):

<http://swutc.tamu.edu/publications/technicalreports/161104-1.pdf>

Item 18

Megaregion Freight Movements: A Case Study of the Texas Triangle

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/11/476660-00075-1 • 2011

U.S. population growth is predicted to substantially increase over the next 40 years, particularly in areas with large regional economies forecasted to contain over two-thirds of the national economic activity. In Texas, population growth from 2000 to 2040 is predicted to increase around 72% and produce a diverse population of some 36 million. This will comprise 12% rural and 88% urban, much of it in the 26 metropolitan areas. These population and economic estimates stimulated the exploration of appropriate planning strategies to address the needs of serving such growth, including a macro approach encapsulated in the term megaregions. Although some planners are skeptical about whether this concept enhances traditional planning, it does merit examination in the freight transportation sector, which tends to get less emphasis in community and regional planning. Texas has at least one megaregion, and the largest—The Texas Triangle, comprising Dallas/Fort Worth-San Antonio-Houston—generates over 60% of the gross state product. The project will consider the Texas Triangle with an emphasis on maintaining efficient future freight movement and will offer multimodal solutions to moving freight to, between, and within the metropolitan economies of the megaregion to 2050.

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

<http://swutc.tamu.edu/publications/technicalreports/476660-00075-1.pdf>

Item 19

Operational and Vehicular Strategies for Reducing Fuel Consumption and GHG Emissions from Trucking

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/11/476660-00072-1 • 2011

Reducing fuel consumption and greenhouse gas emissions is becoming increasingly important in the United States, and new legislation can be expected in the near future that will affect trucks either directly or indirectly. This work is a qualitative examination of operational strategies for reducing fuel consumption from freight trucking, and also compares them with vehicular strategies. A focus is placed on who implements, benefits from, and pays for each strategy, and what type of trucking each strategy is applicable to.

This report is available for free download (800 KB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00072-1.pdf>

Item 20

Opportunities and Challenges for High-Speed Rail Corridors in Texas

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/11/476660-00076-1 • 2011

Texas features a growing economy and population. The state boasts a large and well-developed network of roads, freight railroads, and air facilities, which make the state a vital link in the movement of people and goods. However, as the state continues to grow in population and economic significance, these systems are straining to meet state, national, and even global needs. It is increasingly obvious to residents and state officials that Texas should consider implementing alternative modes of transport, including development of passenger rail, for which Texas currently lags behind many of its peer states. Passenger rail provides quantifiable benefits in displacing less energy-efficient and higher pollutant-emitting air and automobile modes while generating potential positive economic impacts and enhancing consumer choice and multimodalism. Conveniently, renewed national interest in rail has invigorated research measuring the applicability of passenger rail services to many different regions of the United States, with the possibility that future national transportation visions will include passenger rail as an essential element.

This thesis seeks to clarify the potential for passenger rail specifically in Texas through comparison and contrast with other regions and nations in the midst of new national-level knowledge and the changing transportation opportunities and challenges facing the state. Some of the ideal characteristics of successful international passenger systems exist in Texas, including optimal city spacing and a well-established rail network, which have fuelled ongoing interest demonstrated by various system proposals for high-speed intercity transportation in Texas over the last four decades. Despite these characteristics, the state presents a number of barriers to rail transport rooted in low transit use coupled with generally lower density and ambivalent support from politicians and residents when officials present realities of eminent domain and land use changes. However, with revitalized national rail interest and new federal rail planning requirements, the state may yet be able to work through these challenges to exploit the opportunities the state possesses.

This report is available for free download (6.8 MB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00076-1.pdf>

Item 21

Performance Measures for Metropolitan Planning Organizations

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/12/161004-1 • 2012

Performance measurement is a topic of increasing importance to transportation agencies, as issues with funding shortfalls and concerns about transportation system efficiency lead to a shift in how transportation decision making is carried out. In addition to the increased emphasis on performance-based management and accountability, the role of the metropolitan planning organization (MPO) has also gained much significance. MPOs are unique in their role in bridging the gap between various stakeholders in the transportation planning process, and in the expertise and input they provide for transportation decision making. Thus, MPOs play a very important coordinating role in the transportation planning process. However, individual MPOs differ vastly from one another and often do not have the authority to raise revenue or allocate funds. MPOs often lack the resources to identify and use performance measures. By the use of proper performance measures, MPOs can help guide the local transportation planning process toward achieving higher-level transportation goals. The aim of this project is to consolidate available knowledge and provide guidance to transportation agencies, specifically MPOs, to help them incorporate performance measurement relating to transportation planning and operations. This research includes a survey of agency practices and agency needs, development of guidance on effective performance measurement and allied issues of strategic planning, goal setting, and data collection.

This report is available for free download (993 KB):

<http://swutc.tamu.edu/publications/technicalreports/161004-1.pdf>

Item 22

Potential Connected Vehicle Applications to Enhance Mobility, Safety, and Environmental Security

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/12/161103-1 • 2012

The connected vehicle research initiative is the core of the U.S. Department of Transportation's intelligent transportation system research program. The initiative is beginning to gain momentum in the research community because of the development of a promising wireless communications technology—dedicated short-range communications. Connected vehicle technology has the potential to transform the transportation industry and significantly improve the quality of life of drivers. This study aims to explore the potential uses of connected vehicle technology in real-world settings.

Researchers first conducted a comprehensive review of the state-of-the-art connected-vehicle research and technologies. Once researchers had a thorough understanding of the technology, they focused on selecting and developing the near-term practical applications that use connected vehicle technology. The research team then sought expert opinions from the Texas Transportation Institute working group during two brainstorming sessions, which produced two lists of potential applications and prioritized the applications based on deployment feasibility. In particular, a total of five applications were selected for development of the full concept of operations, including two in safety, two in mobility, and one in environmental security. These applications address various problems, including wrong-way driving and unprotected-grade-crossing crashes (safety); work-zone merge efficiency and safety, and freeway speed harmonization (mobility); and slippery-pavement-related crashes (environmental security).

This report is available for free download (3.5 MB):

<http://swutc.tamu.edu/publications/technicalreports/161103-1.pdf>

Item 23

Predicting Damage in Concrete Due to Expansive Aggregates: Modeling to Enable Sustainable Material Design

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/12/476660-00027-1 • 2012

A poroelastic model is developed that can predict stress and strain distributions and, thus, ostensibly damage likelihood in concrete under freezing conditions caused by aggregates with undesirable combinations of geometry and constitutive properties. Sensitivity of the stress distributions to the aggregate and matrix constitutive parameters are assessed to allow improved concrete design. The proposed model does not account for the viscoelastic stress relaxation and may over-predict the stress results. The model is evaluated experimentally through acoustic emission analysis under freeze-thaw cyclic loading, which reveals that air-entrained concrete may undergo durability cracking (D-cracking) if deleterious materials are present. It is determined that high-porosity, low-permeability aggregates with fine pore structure are the most vulnerable to D-cracking in non-air-entrained concrete, and the destructive tensile stress is generated at the aggregate boundary by the Mandel-Cryer effect. On the other hand, low-porosity, high-permeability aggregates relax the pore liquid pressure rapidly and prove to be beneficial for the non-air-entrained concrete. Reduction in aggregate size is found to be effective in quickly relaxing the tensile tangential stress, which eventually helps mitigate D-cracking of concrete. The difference between the coefficients of thermal expansion of the coarse aggregate and the matrix in which they are embedded should not be too high since it may cause tensile stress at the aggregate boundary or interfacial transition zone. Low water-to-cement mass ratio and addition of pozzolans help increase the bulk modulus, reduce the porosity of the porous body, and improve durability. It is also observed that increase in cooling rate decreases concrete durability under freezing temperatures through the reduction in time available to relax pore pressure buildup and the related tangential stresses in the aggregate and matrix.

This report is available for free download (2.6 MB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00027-1.pdf>

Item 24

Predicting the Market Potential of Plug-in Electric Vehicles Using Multiday GPS Data

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/11/161123-1 • 2011

Detailed GPS data for a year's worth of travel by 255 households from the Seattle area were used to investigate how plug-in electric vehicle types may affect adoption rates and use levels. The results suggest that a battery-electric vehicle (BEV) with 100 miles of range should meet the needs of 50% of one-vehicle households and 80% of multiple-vehicle households, if those households fully charge their BEVs just once a day and are willing to use a different vehicle or mode of transport just 4 days a year or less (to serve daily travel distances above 100 miles). Moreover, the average one-vehicle household in the Seattle region relies on its vehicle for 23 miles per day and should be able to electrify close to 80% of its miles using a plug-in hybrid electric vehicle (PHEV) with 40-mile all-electric-range. Households owning two or more vehicles can electrify 50 to 70% of their household miles using a PHEV40, depending on how they assign the vehicle across their drivers each day. Cost comparisons between the average single-vehicle household owning a Chevrolet Cruze (regular gasoline vehicle) versus a Chevrolet Volt PHEV suggest that when gas prices are \$3.50 per gallon and electricity rates at the U.S. average of 11.2 ct per kWh, the Volt will save the household \$535 per year in operating costs. Similarly, the Toyota Prius PHEV, when compared to the Toyota Corolla, will provide an annual savings of \$538 per year.

This report is available for free download (756 KB):

<http://swutc.tamu.edu/publications/technicalreports/161123-1.pdf>



Item 25

Prioritization of Highway Maintenance Functions Using Multi-Attribute Decision Making with Fuzzy Pairwise Comparison

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/11/161128-1 • 2011

As is the case for most of the Departments of Transportation in the U.S., the Texas Department of Transportation has been experiencing fluctuations of budget for maintaining and preserving its highway infrastructure over the recent years. If the maintenance budget shortfall lasts for an extended period of time, the condition of the highway network would be harmed directly or indirectly since some maintenance work would be deferred or cancelled. Thus, in order to control and minimize the risk caused by maintenance budget reductions, it is important for highway agencies to adjust their maintenance and rehabilitation policies to accommodate budget fluctuations.

This report presents a methodological framework that helps highway agencies quantify the risks to highway networks, and revise the highway routine maintenance work plans to minimize the impact of budget fluctuations. The proposed methodology aims to assist highway agencies in prioritizing and selecting maintenance functions according to the risk of not performing a specific maintenance activity. Also, this methodology considers the subjective nature of decision makers' assessments, allowing different levels of confidence and different attitudes toward risk to be captured as the uncertainty and imprecision involved in the decision making process. In the case study, the proposed methodology is tested with a set of data obtained from the Texas Department of Transportation. The result is compared with the outcome obtained from the crisp Analytical Hierarchy Process using the same set of data. The outcomes from the two methodologies are very close, validating the effectiveness of prioritizing highway maintenance functions using Multi-Attribute Analysis with Fuzzy Pairwise Comparison.

This report is available for free download (438 KB):

<http://swutc.tamu.edu/publications/technicalreports/161128-1.pdf>

Item 26

Reviewing, Analyzing and Updating Marketing Strategies to Increase Public Transit Ridership

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/12/476660-00050-1 • 2012

Ridership in the United States has been fluctuating over the last decade. With fuel prices increasing, urban and suburban communities growing and global warming and environmental impact getting special attention, it is important to increase our knowledge of best marketing practices to attract riders to public transit as a better alternative to the use of their own car. Houston METRO is adding roughly 30 miles of light rail, offering new quick line bus routes and in general improving efficiency and reducing costs. But in order to move people out of their cars for all or some of their travel, a deeper analysis of the decision variables and a strategy to promote public transit is required.

This report is available for free download (631 KB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00050-1.pdf>

Item 27

Senior Automobile Crashes and Fatalities in Texas: Are Older Texas Drivers Safe?

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/11/476660-00049-1 • 2011

Many factors can contribute to a senior being involved in a traffic accident, i.e. poor vision, declining health, roadway hazards, and declining driving skills, etc. Throughout the US, laws are being enacted to ensure that seniors can continue driving without harming themselves or the general public. Katie's Law (H.B. 84) represents an attempt to make roadways safer for senior drivers in Texas. Katie's Law requires that elderly persons age 79 and over must renew their licenses in person at Department of Safety offices. This study examines data from Texas Department of Transportation's (TxDOT's) accident records during 2003-2008, to determine if enacting Katie's law resulted in a decrease in senior fatalities. Finally, the study ends by looking at additional senior friendly transportation initiatives.

This report is available for free download (241 KB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00049-1.pdf>

Item 28

Taxiway Aircraft Traffic Analysis at George Bush Intercontinental Airport

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TTI SWUTC/11/476660-00029-1 • 2011

Serving one of the largest metropolitan areas in the United States, the George Bush Intercontinental Airport (IAH) is among the 10 airports with the longest average taxi-out and taxi-in times. The first part of this report assesses the congestion at IAH by analyzing taxi times and flight data during different hours of the day. The capacity of IAH is investigated by examining the number of departing flights on the ground. It reveals that IAH is operating close to the capacity most of the time. Since increasing airport capacity can mitigate the congestion, the second part of this report develops a surface operation model based on the analyzed results to achieve this aim. A mixed integer programming formulation is proposed to optimize the total taxi times by finding the optimal taxi routes and the related schedules. Afterwards, the model is applied to a sample from real data.

This report is available for free download (278 KB):

<http://swutc.tamu.edu/publications/technicalreports/476660-00029-1.pdf>

Item 29

Testing Information to Improve Communication with Communities and Decision Makers

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

TSU SWUTC/11/473700-00055-1 • 2011

This work focuses on important concepts in making information available to decision makers and the public, specifically focused on the Transportation Industry. The emphasis is on the PowerPoint presentation and enhancing the message through this medium. Critical elements include adhering to the assigned time limit, incorporating animation, font size, including images, techniques, and preparation. While much information is available on-line about presentations, audiences at too many transportation meetings view substandard presentations, which likely negatively affect understanding and decision-making. Blending available information, focus group feedback and observations yield a foundation for transportation planners in improving presentations to constituents.

This report is available for free download (2 MB):

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Item 30

Understanding Emerging Commuting Trends in a Weekly Travel Decision Frame: Implications for Mega Region Transportation Planning

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR SWUTC/11/161127-1 • 2011

National transportation statistics have shown the rise of long-distance, trans-regional commute (LDC/TRC) in the US. Four societal factors contribute to the trend: increase in dual earner households, advance in information and communications technologies, new concept of arranging work time weekly, and people's changing attitude towards travel. In the field of urban transportation planning, commuting has been studied in individual metropolitan areas in a one-day time frame. LDC/TRC traverse multiple metros and the commuting behavior cannot be better understood without going beyond the one-day convention. Studying LDC/TRC corresponds to the growing interest worldwide in planning for megaregions. Up to date, the phenomenon of weekly commuting has been explored only by a few European researchers in the fields of geography and sociology.

This study analyzed LDC/TRC using national datasets available in the US. They are American Travel Survey, National Household Travel Survey, and Census Transportation Planning Package. Further detailed analyses were conducted for the Texas Triangle megaregion. The national travel surveys are helpful in portraying large pictures of LDC/TRC but limited in offering insights into LDC/TRC behavior. Based on the preliminary study, the next phase of the study will conduct qualitative research by interviewing selected LDC/TRC individuals in the Texas Triangle megaregion.

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