



# Research Digest

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## *Item 1*

### **Freight Data Needs at the Metropolitan Level and the Suitability of Intelligent Transportation Systems in Supplying MPOs with the Needed Freight Data**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC-04-167247-1 • 2005

Many Metropolitan Planning Organizations (MPOs) have identified the lack of robust and accurate freight data as a major constraint in conducting meaningful freight planning. An in-depth literature review was conducted that covered (1) the most relevant freight issues faced by MPOs, (2) the state-of-the-art methodologies used in urban travel demand forecasting to integrate the passenger and freight components, (3) primary and secondary freight data sources and their strengths and limitations for supporting urban planning activities, and (4) the full spectrum of Intelligent Transportation Systems (ITS) technologies that are considered rich sources of freight data. A Freight Data Needs Survey was administered to U.S. MPOs to assess urban freight data needs given the demographic characteristics of the region, the freight issues MPOs have to deal with, the state-of-the-practice in integrating the freight component into the urban travel demand models (TDMs), freight collection activities at the metropolitan region, the level of deployment of ITS technologies, and the use of archived ITS data to support urban planning activities. Special emphasis was given to cargo data, freight transportation modes data, and terminal/intermodal transfer facilities data because they provide valuable insight into urban freight movements. The results of the survey revealed that, although two-thirds of the responding MPOs are conducting freight planning, only 26% of them have integrated both the passenger and freight components into their TDMs. Among the responding MPOs, 49% to 94% indicated a need for origin-destination patterns, routing details, shipment details, and commodity type information, while cargo data availability varied from 6% to 46%. The percentage of respondents who indicated a need for highway/truck data, rail data, air data, and water data varied between 51% and 100%, while transportation mode data availability ranged between 0% and 40%. Finally, the percentage of respondents who indicated a need for terminal/intermodal transfer facilities data varied between 82% and 97%, while the availability of this data varied from 3% to 18%. These figures point to the substantial need for freight data, especially among the small, mid-size, and mid-large MPOs. It is thus obvious that effective freight planning and wholly informed decisions are still largely limited by a lack of reliable data. Given a lack of funding sources, primary data collection is also not an option for many small to mid-large MPOs. For the future, these MPOs will have to explore innovative and cost effective means to gather an understanding of freight movements. This study showed that data collected by electronic means such as those provided by ITS can be invaluable to urban freight planning.

Full-text PDF of this report is available for free download at <http://swutc.tamu.edu/Reports/167247-1.pdf>



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## **Item 2**

### **Experience with Flex Route Transit Service in Texas**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC-05-167148-1 • 2005

Flex-route and feeder bus services are solutions that more public transit providers may find advantageous to explore as they try to serve increasingly spread-out and suburban populations while maintaining cost-effective operations. This study examined the experiences of The T, VIA, DART, and other selected transit agencies in Texas who have operated flex-route bus services, examining their objectives for operating the service, experiences, and lessons learned.

Full-text PDF of this report is available for free download at <http://swutc.tamu.edu/Reports/167148-1.pdf>

## **Item 3**

### **Framework for Developing Integrated ITS Solutions to Improve Traffic Operations**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC-05-167248-1 • 2005

The overall objective of this study is to assist transportation agencies in developing appropriate ITS strategies to improve traffic operations. This report summarizes the effort in applying innovative methods for ITS planning and ITS evaluation. First, the authors present a study using FHWA ITS Planning Process Version 2.1 to develop appropriate ITS strategies to accommodate local needs. A case study was performed in Austin, Texas to illustrate the whole procedure. The results indicate that by incorporating the National ITS Architecture and IDAS, the FHWA ITS Planning Process could be more applicable to the regional ITS planning. Next, a multicriteria decision analysis method is presented for ITS alternative comparison and selection. The multicriteria approach developed in this study can be applied to identify the best ITS alternative among several candidates. An iterative ELECTRE-I procedure was employed to compare various ITS alternatives and identify the best one. With a case study in Austin, TX, the approach was illustrated and its applicability was proven. Finally, recommendations for further research activities are given at the end of the report.

Full-text PDF of this report is available for free download at <http://swutc.tamu.edu/Reports/167248-1.pdf>

## **Item 4**

### **Analysis of Texas Speed Limit Laws and Fatality Accident Rates**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC-05-167320-1 • 2005

Safety on Texas' interstate highways receives constant media attention. From issues such as truck safety and seat belt requirements, the highways remain a focal point of scrutiny and federal funds. As vehicle miles traveled (VMT) continue to increase, there is little hope that Texans will be giving up their sport utility vehicles anytime soon. Therefore, the attention must be towards strategies to establish policies that enhance safety while not hindering mobility. This project seeks to determine if the increase in speed limits from 1996 to 1999 resulted in an increase in fatal accidents in Texas. The data focused on a select set of variables and the data from Texas will be compared to nationwide figures in order to determine if there were any similarities in the number of fatal accidents.

Full-text PDF of this report is available for free download at <http://swutc.tamu.edu/Reports/167320-1.pdf>



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## **Item 5**

### **An Assessment of Criteria Used for Transit Friendly Decision-Making** *SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER* SWUTC/05/167322-1 • 2005

A great deal of attention is being focused on creating more livable communities, as well as implementing smart growth, transit-oriented and generally more sustainable communities. As a result, planners are focusing more attention on multimodal transportation solutions. Regional goals mention the critical nature of planning and implementing environmentally sensitive systems that allow residents a choice in travel mode. A preliminary review of the decision-making criteria used by many local governments, however, shows project selection criteria largely reflective of measures that tend to favor highway-oriented benefits, such as increasing travel speeds. In addition, goals supporting increased non-motorized travel options, increased transit and more environmentally sensitive projects are often less measurable and more related to the nebulous "quality of life" factors. When benefits, such as air quality are measurable, the advantages may be localized and seem insignificant on a regional basis. This research examines transportation decision-making to determine whether criteria have been broadened to include a more balanced view of transportation, allowing pedestrian and transit options to be assessed based on their full benefits. The study reviews criteria with a focus on identifying non-highway criteria among six selected Metropolitan Planning Organizations (MPOs).

Full-text PDF of this report is available for free download at <http://swutc.tamu.edu/Reports/167322-1.pdf>

## **Item 6**

### **The Effect of the New Security Paradigm on Port Infrastructure Development and Finances** *SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER* SWUTC/05/167454-1 • 2005

Nine public ports account for 88% of all waterborne international trade in the State of Texas. Following September 11, 2001, these ports were required to implement new and additional security measures intended to deter terrorist attacks. This research project provides an overview of the financial aspects of port infrastructure development, the implementation of new security measures, and the relationship between them at these nine Texas ports. The history of the Port Security Grant Program through August 2005 is summarized to provide an understanding of the context in which ports are making financial decisions. This report also describes the financial performance of the ports during the study period (FY 1994 - FY 2004). It examines the funding approaches used to finance asset acquisition and construction, and analyzes both the profitability of Texas ports in general terms and the potential effect of new security-related expenses on port finances. The use of security fees to recoup some of the security costs is explored, as are other potential "financing" mechanisms. Finally, several conclusions and policy concerns that surfaced during the conduct of this research are presented. The information presented in this report was obtained through examination of public financial data, interviews with key executives at the port authorities, investigation of government sources, and through media reports.

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## *Item 7*

### **The Impact of U.S.-China Trade on Multimodal Transportation Systems and the Economies of Texas and Mexico**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*  
SWUTC/05/167551-1 • 2005

This report examines the dynamics of U.S.-China trade, its implications for the economies of Texas and Mexico, and the role of trans-Pacific transportation supply chains. Part I of the report discusses the emergence of China as a major U.S. trading partner, the extent to which China has become a direct competitor with Mexico in terms of exports to the United States, and opportunities and challenges that this competition poses to the economic growth prospects of Texas. Part II addresses transportation infrastructure and logistics within China, trans-Pacific ocean shipping lines and their scheduled services, U.S. West Coast ports and connecting land-bridge rail services, and alternative routes via the Panama Canal, Mexico's West Coast ports, and the Suez Canal. Two appendices contain information on trends in U.S. international trade and trans-Pacific maritime routes and services.

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## *Item 8*

### **Compendium of Student Papers: 2005 Undergraduate Transportation Engineering Fellows Program**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*  
SWUTC/05/473700-00003-10 • 2005

This report is a compilation of research papers written by students participating in the 2005 Undergraduate Transportation Engineering Fellows Program. The ten-week summer program, now in its fifteenth year, provides undergraduate students in civil engineering the opportunity to learn about transportation engineering through participation in sponsored transportation research projects. The program design allows students to interact directly with Texas A&M University faculty members and Texas Transportation Institute researchers 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) a managed lanes traffic and toll revenue study for the San Antonio Northeast Corridor; 2) an investigation between tire hits on raised pavement markers and traffic volume; 3) an analysis of age and education characteristics in the comprehension of changeable message signs; 4) an analysis of reading time and comprehension of AMBER alert messages presented on simulated changeable message signs; 5) an analysis of noises from vehicle tire interactions with rumble strips; 6) a study of driver understanding of innovative diagrammatic guide sign formats; 7) the development of a conceptual model to evaluate the performance of on-premise business signs; and 8) the development of a transportation performance monitoring plan for the Texas Medical Center in Houston, Texas.

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## **Item 9**

### **Mexican Truck Idling Emissions at the El Paso - Ciudad Juarez Border Location**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC/05/473700-00033-1 • 2005

This project was co-sponsored by the Southwest University Transportation Center (SWUTC) and Region 6 of the United States Environmental Protection Agency (EPA), and the Border Environment Cooperation Commission. The overall goal of the project was to develop a methodology and to apply this methodology to estimate emissions produced by trucks from Mexico crossing the El Paso-Ciudad Juarez border locations. The specific objectives of the study were to develop a: 1. border crossing fleet profile - profile of the make, model, and year of trucks crossing the two main border bridges; 2. border crossing travel profile - profiles of the drive cycles (acceleration, deceleration, cruising, idling, and creep idling) of trucks crossing the two main border bridges; and 3. border crossing emissions profile - estimates of idling emissions and driving emissions of trucks crossing the two main border bridges. TTI used portable emissions measurement system (PEMS) equipment along with Tapered Element Oscillating Micro-balance (TEOM) equipment operated by Oak Ridge National Laboratory to measure the truck emissions. The project provided good insight into the fleet, travel, and emissions characteristics of trucks crossing the El Paso-Ciudad Juarez border locations.

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## **Item 10**

### **The Integration of GIS and Transportation Modeling: A State-of-the-Practice Review**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC/05/473700-00043-1 • 2005

One of the factors that continuously affect the quality of life and the desirability of metropolitan areas as a place to live and work is an effective local transportation system. As individuals, businesses and government search for ways to relieve congestion and reduce travel time, the role of geographic information systems (GIS) in relation to transportation planning, analyzing, evaluating, and planning of transportation networks and systems becomes more critical. A powerful relationship exists between GIS and transportation modeling systems. State departments of transportation (DOTs) and metropolitan planning organizations (MPOs) have begun to utilize Environmental Systems Research Institute's (ESRI) ArcInfo, ArcView, and Intergraph's GeoMedia Suite with transportation models; however, these activities have not been documented together in a single source. The purpose of this report is to document the active use of GIS for transportation (GIS-T) (if any) at the 50 state Departments of Transportation and Metropolitan Planning Organizations.

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## ***Item 11***

### **Developing a Diagnostic System for Air Brakes Used in Commercial Vehicles**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC/06/167141-1 • 2006

The safe operation of vehicles on roads depends amongst other things, on a properly functioning brake system. Air brake systems are widely used in commercial vehicles such as trucks, tractor-trailers and buses. In these brake systems, compressed air is used as the energy-transmitting medium to actuate the foundation brakes mounted on the axles. In this report, a model-based diagnostic system for air brakes is presented. This diagnostic system is based on a nonlinear model for predicting the pressure transients in the brake chamber that correlates the brake chamber pressure to the treadle valve (brake application valve) plunger displacement and the pressure of the air supplied to the brake system. Leaks and “out-of-adjustment” of push rods are two prominent defects that affect the performance of the air brake system. Diagnostic schemes that will monitor the brake system for these two defects are presented. These schemes are corroborated with experimental data obtained from the brake testing facility constructed at Texas A&M University.

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## ***Item 12***

### **Background Development And Concept Of Operations For A Real-Time Performance Measurement Monitoring System**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC/06/167147-1 • 2006

Recognition and response to incidents on a freeway is a vital function of freeway management. When an incident occurs, an established response mechanism seeks to return the freeway to normal conditions as rapidly as possible. The state-of-the-practice in current systems focuses on identification of the incident and rapid implementation of the established recovery plan. This is one example of an operational strategy used to monitor and improve conditions on the roadways. What is missing from these systems is systematic feedback on how the plan actually worked and a consistent basis for refining the plan to achieve better results, if possible. The use of a feedback system provides a quantitative basis for assessing the impacts of various operational strategies. That basis is known in other disciplines as system performance measures. While performance measures have been applied in transportation, the area of transportation operations has lagged behind in implementation. This research proposes an experimental design for a real-time performance measures system as well as a concept of operations for utilizing the information.

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## ***Item 13***

### **Driver Perceptions of Risk: Potential Approaches to Improving Driver Safety**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC/06/167451-1 • 2006

This research study examined driver perceptions of the reasons for and the risks associated with certain aggressive or negligent driving behaviors, including illegal turns, disregard of stoplights or stop signs, and improper lane usage. A literature search, interviews with DPS officers and “defensive driving” instructors, driver focus groups, and driver surveys in two Texas cities were employed to determine drivers’ perceptions of the risks of selected traffic violations, factors that encourage or discourage unsafe driving behaviors, and how a change in perceived risk may affect future driver behavior.

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## *Item 14*

### **Predicting Truck Tire Pressure Effects Upon Pavement Performance**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC/06/167864-1 • 2006

Truck tire inflation pressures have steadily increased in the recent decades. A most apparent effect of the increased tire pressure would be reduction in the tire-pavement contact area, which may in turn result in an increase in the tire-pavement contact stress and then more damaging effects to the pavement. This study uses a Monte Carlo simulation based mechanistic-empirical method to identify and quantify the tire pressure effects on flexible pavement performance. In this study, measured non-uniform tire-pavement contact stress data for different tire load and inflation pressure conditions and for three popular tire/axle configurations were input to the finite element program ANSYS to compute immediate pavement responses for various asphalt pavement structures. Typical computation results from the finite element program were compared with the results of the linear elastic multilayer program CIRCLY using the traditional tire model in which tire-pavement contact stress is assumed uniformly distributed over a circular contact area and equal to tire inflation pressure. The effects of tire inflation pressure on pavement performance were initially analyzed by inputting the typical computation results into pavement distress transfer functions and variability in loading, pavement or environment conditions was not considered. Critical pavement responses responsible for pavement distresses in bottom-up cracking and rutting were determined. A quick solution method for the prediction of critical pavement responses was developed using regression models that relate critical pavement responses with tire loading and pavement structural conditions. And finally a Monte Carlo simulation based C++ program was developed to predict the effects of increased truck tire pressure on selected pavement structures with variability in loading, pavement, and environment conditions included. The research study found the traditional tire model and the associated linear elastic multi-layer program tended to overestimate horizontal tensile strains at the bottom of the asphalt concrete layer and underestimate vertical compressive strains at the top of the subgrade layer. The quick solution models developed in this study could predict pavement responses in a good accuracy and be used to replace the time-consuming finite element models. The Monte Carlo simulation program found increased pavement fatigue cracking and rutting would be expected when average tire pressure was increased.

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## *Item 15*

### **Modeling the Interaction Between Passenger Cars and Trucks**

*SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER*

SWUTC/06/473700-00015-1 • 2006

The topic of this research was the use of distributed computing to improve how the interaction between passenger cars and trucks is modeled. The two focus areas were the development of a methodology to combine microscopic traffic simulation programs with driving simulator programs, and the application of a prototype distributed traffic simulation to study the impact of the length of an impeding vehicle on passing. The methodology was motivated by the need to provide an easier way to create calibrated traffic flows in driving simulations and the need to capture vehicle behavior within microscopic traffic simulations. The original design for the prototype was to establish a two-way, real time exchange of vehicle data, however problems were encountered that imposed limitations on its development and subsequent use. The passing study was motivated by the possible changes in federal truck size and weight regulations and the current inconsistency between the passing sight distance criteria for the design of two lane highways and the marking of no-passing zones. Test drivers made passing maneuvers around impeding vehicles that differed in length and speed. The main effects of the impeding vehicle length were found to be significant for the time and distance in the left lane, and the start and end gap distances. Passing equations were formulated based on the mechanics of the passing maneuver and included behavior variables for calibration. Through a sensitivity analysis, it was shown that increases in vehicle speeds, vehicle length, and gap distance increased the distance traveled in the left lane, while increases in the speed difference and speed gain decreased the distance traveled in the left lane. The passing equations were calibrated using the current AASHTO values and used to predict the impact of increased vehicle lengths on the time and distance in the left lane. The passing equations are valuable for evaluating passing sight distance criteria and observed passing behavior.

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