Research Digest

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Southwest Region University Transportation Center (SWUTC) Reports

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Research Digest

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Integration and Consolidation of Border Freight Transportation Data for Planning Applications and Characterization of NAFTA Truck Loads for Aiding in Transportation Infrastructure Management: Second Year

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
SWUTC/08/0-5339-2 • 2008

The quantity of truck transportation handled in Texas increased dramatically in the 1990s especially after the full implementation of the North American Free Trade Agreement (NAFTA). Accurate information on truck volumes and truck characteristics is critical to the transportation planning and transportation operation activities performed by the Texas Department of Transportation (TxDOT) and other agencies responsible for the freeway and roadway system in the state of Texas. Information for freight transportation planning, in particular truck-related data, is expensive and difficult to collect, but various agencies located at the Texas-Mexico border already gather information that is used for operation or statistical purposes.

The objectives in the second year were to (a) collect data from a statistical sample of Mexican carriers – those that have applied to operate beyond the current commercial zones once the border opens – on the size of the Mexican companies, the types of operations, and equipment currently used and anticipated to be used for cross-border movements, and (b) to collect and analyze weigh-in motion data from Texas and Mexico in order to establish their main characteristics as they affect pavement performance.

Full-text PDF of this report is available for free download from
http://swutc.tamu.edu/publications/technicalreports/0-5339-2.pdf

Item 2

Transportation Infrastructure and Quality of Life for Disadvantage Populations: A Pilot Study of El Cenizo Colonia in Texas

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
SWUTC/08/167162-1 • 2008

This research is a pilot study aimed to identify environmental characteristics in colonias that are related to infrastructure and safety, access to goods and services, and quality of life. A secondary objective consisted of evaluating a variety of tools that could be used to identify and assess these environmental characteristics. El Cenizo in Webb County, Texas, was selected as our study colonia after preliminary visits and investigations. A multi-disciplinary approach framed this study, considering the transportation, urban design and planning, public health, and socioeconomic dimensions as potential determinants of the residents' mobility behaviors, environmental perception, and quality of life. Three instruments were developed to collect data for this research: 1) a survey, 2) an activity diary or travel diary, and 3) environmental audit instruments. Additionally, this study also included a small sub-group study testing the usability of wearable Global Positioning Systems (GPS) units as a research tool to capture spatial-behavioral data, combined with travel diary. First, the study has generated valuable data on transportation and mobility behaviors where almost no information is available. Second, the multidisciplinary approach has allowed a comprehensive approach towards a better understanding of the current needs of colonias, especially those related to pedestrians. Some of them could be easily addressed with direct short-term interventions while other require more long-term plans. Third, the assessment of new research tools offers useful insights for future research in the context of similar low-income marginalized communities.

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http://swutc.tamu.edu/publications/technicalreports/167162-1.pdf

Item 3

On the Move! Exploring Transportation Career Horizons

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
SWUTC/08/167164-1 • 2008

A recent Southwest University Transportation Center (SWUTC) project entitled Go! Girl! provided standing room only participation for the career workshops and activities it presented. The number of agencies, schools and universities offering support for the program and requesting a program in their area could not be accommodated in the time frame of a one-year grant. The need for middle school programs that explore career activities became increasingly evident as the project progressed.

The concept for On the Move! originated from success of Go Girl!. The team wanted to examine if the same type of program could be applied for both boys and girls and whether those activities would be received with the same enthusiasm. The goal of On the Move! was to create one day events that encouraged students' interest in STEM areas and transportation careers. It was also important that the event could be easily replicated for future use.

A total of eight separate events were piloted to diverse audiences across Texas. Each event created using a slightly different approach for sparking students' interest in STEM. All of the events were produced at a cost of less than $1,000 and all of the events were well attended and well received. A total of 1,175 students participated in the initial On the Move! outreach events and over 3,400 other students were reached through On the Move! career fair and science night events. Almost all of these events have continued to be replicated through other funding sources.

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http://swutc.tamu.edu/publications/technicalreports/167164-1.pdf

Item 4

Loss Modeling for Pricing Catastrophic Bonds

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
SWUTC/08/167172-1 • 2008

In the research, a loss estimation framework is presented that directly relates seismic hazard to seismic response to damage and hence to losses. A Performance-Based Earthquake Engineering (PBEE) approach towards assessing the seismic vulnerability of structures relating an intensity measure (IM) to its associated engineering demand parameter (EDP) is used to define the demand model. An empirically calibrated tripartite loss model in the form of a power curve with upper and lower cut-offs is developed and used in conjunction with the previously defined demand model in order to estimate loss ratios. The loss model is calibrated and validated for different types of bridges and buildings. Loss ratios for various damage states take into account epistemic uncertainty as well as an effect for price surge following a major hazardous event. The loss model is then transformed to provide a composite seismic hazard-loss relationship which is used to estimate financial losses from expected structural losses.

The seismic hazard-loss model is then used to assess the expected spread, that is the interest rate deviation above the risk-free (prime) rate in order to price two types of CAT bonds: indemnity CAT bonds and parametric CAT bonds.

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http://swutc.tamu.edu/publications/technicalreports/167172-1.pdf

Item 5

A Comprehensive Assessment of Children's Activity and Travel Patterns

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

SWUTC/08/167270-1 • 2008

This report provides a comprehensive review of previous research on children's activity engagement and travel by focusing on the dimensions characterizing children's activity-travel patterns and the factors affecting these dimensions. In addition, an empirical analysis is undertaken of the post-school out-of home activity-location engagement patterns of children aged 5 to 17 years. Specifically, this research effort utilizes a multinomial logit model to analyze children's post-school location patterns, and employs a multiple discrete-continuous extreme value (MDCEV) model to study the propensity of children to participate in, and allocate time to, multiple activity episode purpose-location types during the afterschool period. Finally, the paper identifies the need and opportunities for further research in the field of children's travel behavior analysis.

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http://swutc.tamu.edu/publications/technicalreports/167270-1.pdf

Item 6

An Assessment of Transit Ridership: Increased Suburban to Urban Public Transportation Options in Houston, Texas

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

SWUTC/08/473700-00053-1 • 2008

Suburban development is occurring near urban areas across America. Often these communities are separated by large masses of land with no linkage to the urban core. Referred to as urban sprawl, this type of development causes a challenge for transportation planners in providing adequate public transportation services to suburban communities. This research applied a transit needs index to assess whether there might be demand for public transportation options between selected Houston suburban counties and the urban core. The research found that several neighborhoods within three selected suburban counties received a high rating on the index and are good candidates for public transportation.

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http://swutc.tamu.edu/publications/technicalreports/473700-00053-1.pdf

Item 7

Characteristics of Drayage Operations at the Port of Houston

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
SWUTC/08/473700-00075-1 • 2008

Port drayage, defined as a container truck pickup to or from a seaport terminal with both the trip origin and destination in the same urban area, is a critical yet comparatively understudied link in the intermodal supply chain. Because port dray trucks operate primarily in urban environments, they can have a significant impact on congestion and air quality. The primary goal of this study is to identify key dray industry characteristics at the Port of Houston Authority (POHA) to help planners prepare for increasing container volumes while maintaining profitability and mitigating societal costs. The report gives the results of interviews with dray managers and a survey of 103 port drivers at the Port of Houston Barbours Cut container terminal on demographics, working conditions, truck characteristics, route characteristics and port operations. The results of the study are then compared against the existing literature, most of which comes from the Los Angeles area. Substantial variation is shown in the age and mileage of trucks. While only a minority of drivers was unsatisfied with overall terminal efficiency, many had suggestions on ways in which efficiency could be improved. The industry is found to be relatively stable despite the increasing demands placed by high container growth rates which have created a shortage of drivers at some locations. Lastly, the report examines methods in which the dray fleet could be modernized through air quality improvement grants.

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Item 8

Measuring the Marginal Cost of Congestion

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
SWUTC/08/473700-00088-1 • 2008

This study attempted to estimate the effect of additional vehicles joining the traffic stream when it is near capacity. The study used data from highways I-35, I-45 in Texas and I-80 in California aggregated at different time intervals. Various macroscopic traffic flow models, Catastrophe model and the bottleneck model were studied in order to identify models that best represent the speed-flow relation for the traffic data over complete range of flow.

The Catastrophe model and the bottleneck model did not fit the data well, while three macroscopic models, the Modified HCM, Newell-Franklin and Van Aerde model were found to fit the data well. Using congestion pricing theory the optimum toll rates were calculated for each of these three models. The optimum toll rates were then compared with the toll rates on some of the existing variably priced toll roads in the US. The optimum toll rates estimated using Modified HCM, Newell-Franklin and Van Aerde model were $0.65, $0.81 and $0.97 per mile assuming the value of travel time savings as $20/hr for the near capacity flow. These toll rates were found to be lower when compared with the maximum toll rates on three of the existing variable toll facilities which charge about $1/mile during the hours of extreme congestion.

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http://swutc.tamu.edu/publications/technicalreports/473700-00088-1.pdf

Item 9

Analysis and Assessment of Microbial BioFilm-Mediated Concrete Deterioration

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

SWUTC/08/476660-00008-1 • 2008

Inspections of bridge substructures in Texas identified surface deterioration of reinforced concrete columns on bridges continuously exposed water. Initial hypothesis were that the surface deterioration was a result of the acidity of the water in which the columns were exposed. However, evaluation of the water acidity indicated that the surrounding waters were only very slightly acidic and near neutral. Discussions between engineers from the Texas Department of Transportation (TxDOT) and researchers at Texas A&M University and the Texas Transportation Institute (TTI) hypothesized that the damage could be a result of microbial attack. Microbial attack is often identified as an acid attack because some microbes can produce sulfuric acid. This research investigated whether microbes were present at areas on the bridge that were exhibiting attack, determined if there was a correlation between degree of damage and number of microbes present, determined if these microbes were acid producing microbes, and identified the microbes present at the field sites. Results indicate that microbes are present at the bridge columns experiencing surface deterioration, that the number of microbes present is directly correlated with the degree of damage, and that these microbes are acid producing. The research identified five genera: these included Bacillus, Brachybacterium, Flavobacterium, Lysinibacillus and Thiomonas. The group with the largest numbers of representatives was Bacillus, which was composed of 17 strains. The second largest group was identified as Thiomonas perometabolis, which consisted of seven strains. The researchers concluded that the damage to the concrete bridge columns is microbial attack. Because some bridge structures are exhibiting significant microbial attack of the concrete cover and because the long-term performance of the columns (and hence bridges) are most sensitive to concrete cover, further research is needed on how to prevent and mitigate this attack.

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Item 10

Southwest Region University Transportation Center Annual Report 2008

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

SWUTC Annual Report 2008 • 2008

SWUTC is a consortium of three universities. These three universities (Texas A&M University, Texas Southern University, and the University of Texas at Austin) that comprise the SWUTC have grown both as members of our consortium and as individual universities each with a robust transportation program.

Successful students are primary "products" of our research and education programs. During the year, 140 students (undergraduate and graduate) participated in the research and educational programs of the SWUTC's consortium universities.

The faculty is the heartbeat of the SWUTC enterprise … vital, steady, and strong. Teaching and research efforts at all three universities have been the key to our enterprise's success for two decades. Inside this report, please find the numerous mentions of award-winning faculty member activities at each of the three universities and their affiliated research centers. Dynamic new professors and professional researchers, along with the "greybeards", populate our SWUTC faculty, both teaching and research. Cutting edge research and innovative classroom excellence are routine outcomes in SWUTC.

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