Research Digest

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Item 1

Assessment of Event Egress for Houston's Reliant Stadium, A Synthesis Report of Purpose and Need

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
TSU 2015-600451-00049-1 • 2015

Attendance at large arena events is increasing, as the seats are added, and ground level activities such as tailgating attract visitors not attending the game. Access is somewhat staggered as people choose their arrival times differently. However, the egress is far more concentrated with visitors largely attempting to leave simultaneously. The prevailing approach is to place police officers, who communicate via radio, at proximate exit locations. Further complicating the egress are those who arrive by public transportation and are transported by scheduled train cycles or queued buses. Once filled, users wait for the next cycle. Given advances in technology from the perspective of handheld devices and traffic management software, it is timely to reexamine protocol and strategies to determine whether an opportunity exists to facilitate or streamline egress, specifically looking at NRG Stadium in Houston. This work convened stakeholders familiar with NRG stadium in Houston, Texas to detail concepts to potentially improve egress, particularly in consideration of Super Bowl XLIX to be held at NRG in 2017.
(x, 22 pages)

This report is available for free download (990 KB):
http://swutc.tamu.edu/publications/technicalreports/600451-00049-1.pdf

Item 2

Gulf Coast Megaregion Evacuation Traffic Simulation Modeling and Analysis

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
2015-600451-00101-1 • 2015

This paper describes a project to develop a micro-level traffic simulation for a megaregion. To accomplish this, a mass evacuation event was modeled using a traffic demand generation process that created a spatial and temporal distribution of departure times, origins, and destinations based on past hurricane scenarios. A megaregion-scale simulation was required to assess this event because only at this level can traffic from multiple cities, over several days, with route assignments in multiple and overlapping directions be analyzed. Among the findings of the research was that it is possible to scale-up and adapt existing models to reflect a simultaneous multi-city evacuation covering a megaregion. The movements generated by the demand and operational models were both logical and meaningful and they were able to capture the key elements of the system, including the traffic progression over vast spaces and long time durations. They were also adequate to demonstrate benefits of proactive traffic management strategies and the effect of increased and decreased advanced warning times. The project also revealed numerous limitations of existing modeling and computational processing capabilities. The knowledge and results gained from this research can be adaptable and transferable for the evaluation of other locations with different road networks, populations, transportation resources, and hazard threats. Models such as this can be modified to represent anticipated growth and development within large regions and can be used to evaluate the interrelationships between behavioral response and regional transportation management strategies.
(34 pages)

This report is available for free download (802 KB):
http://swutc.tamu.edu/publications/technicalreports/600451-00101-1.pdf

Item 3

Assessment of Vehicle Performance in Harsh Environments Using LSU Driving Simulator and Numerical Simulations

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

2015-600451-00112-1 • 2015

With the economic booming development of coastal areas, the importance of the traffic planning becomes obvious not only in a hurricane evacuation but also in the daily transportation. Vehicle performance on the freeway during harsh environments is critical to the success of the planning process. The present study aims to study the effect of harsh environments on the driving behavior and vehicle performance. The driving simulator installed in Louisiana State University was used to investigate the driver's behavior and vehicle performance in different adverse conditions such as strong crosswinds, wet road surface, and curving. Modified parameters of the driving simulator were determined to reproduce the real wind loadings according to the vehicle velocity and wind velocity, through the manipulation of appropriate software. While the vehicle performance was recorded in terms of lane offset, vehicle velocity, and heading error, the driver's reaction was measured in the form of the reaction time, steering angle, and the time of pressing on brake and gas pedal, respectively. The results illustrate that a higher wind speed leads to more variance of lane offset and heading error. The rainy weather/wet road surface does have an effect on the vehicle velocity in a strong wind environment. The findings of this study demonstrate the valuable use of a driving simulator to represent different hazardous driving conditions and to develop a statistic model to predict and estimate the driver's behavior and vehicle performance.

(68 pages)

This report is available for free download (4.8 MB):

http://swutc.tamu.edu/publications/technicalreports/600451-00112-1.pdf

Item 4

The Opportunities and Tensions of Historic Preservation and Transit Oriented Development

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
U-NOLA 2015-600451-00116-1 • 2015

In recent years, there has been much research on Transit Oriented Development (TOD) in the United States and abroad. There has been decades of study of historic preservation, both in the United States and internationally. Yet the intersection of TOD and historic preservation has received scant attention. This project cross-references data on TOD and historic preservation, examines case studies of where TOD and historic preservation intersect and recommends policy and tools for preservation in TODs.
(118 pages)

CONTENTS

- Introduction
- Literature Review
- Methodology
- Quantitative Findings using Georgraphic Information Systems
- Summary of Expert Team Project Meetings
- Case Studies
- Appendix A. State-Level Historic Property Database Availability
- Appendix B. A Guide to Facilitate Historic Preservation through Transit Oriented Development / Created by Merritt C. Becker Jr. University of New Orleans Transportation Institute, John Renne et al.

This report is available for free download (4.7 MB):
http://swutc.tamu.edu/publications/technicalreports/600451-00116-1.pdf

Item 5

High Speed Rail Distribution Study

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)
TSU 2016-600451-00050-1 • 2016

The Texas Central Partners are in the process of developing a high speed rail line connecting Houston and Dallas, Texas. Ultimately, plans are for 8 car trains that accommodate 200 people per vehicle scheduled every 30 minutes. In addition, Texas Department of Transportation (TxDOT) and officials in Austin, Houston and San Antonio are investigating intercity (interregional) rail to provide frequent rail service linking those cities. After arriving, passengers will need disbursement throughout the cities from the rail terminal station. The menu of options includes passenger pick-up (private by a friend or relative or purchased through a provider), taxi/limousine, rental car or public transportation. This research investigates the distribution patterns of northeastern cities with a history of intercity ground transportation as well as distribution patterns from a Houston area airport to assess the potential modal choices of passengers disembarking from intercity rail systems in Texas. In addition, a gravity formula is applied to several employment/activity locations to anticipate patrons' distribution choices. The research focuses on the proposed location for the high speed rail terminal.
(18 pages)

This report is available for free download (362 KB):
http://swutc.tamu.edu/publications/technicalreports/600451-00050-1.pdf

Item 6

Quantification of Infrastructure Consumption under Different Axle Configurations and Wheel Loads

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR 2016-600451-00071-1 • 2016

Recent developments in the energy sector in Texas, in particular oil, gas and wind energy, have resulted in increased volumes of traffic generated in areas such as the Barnett Shale, Eagle Ford Shale, Permian Basin, the Texas Panhandle, and others. In the case of oil and gas, the development and operation of a well site requires significant number of truck movements (including oversize/overweight loads) that accelerate the deterioration of the surface transportation network of the state faster that what was designed for. This unanticipated and accelerated deterioration of the road network imposes additional burden on already insufficient maintenance and rehabilitation budgets that affect most state highway agencies in the United States. The energy sector contributes immensely to the economic competitiveness of the State of Texas and the Southwest Region of the United States, but, under the present situation, the Texas Department of Transportation (TxDOT) does not have the necessary resources to keep up with reconstruction, rehabilitation or maintenance of the system to keep it safe for the general public. A solution has to be worked out to address this immediate problem.
(xiv, 44 pages)

This report is available for free download (2.2 MB):
http://swutc.tamu.edu/publications/technicalreports/600451-00071-1.pdf

Item 7

The Contribution of Micro- and Macro-texture to the Skid Resistance of Flexible Pavement

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR 2016-600451-00085-1 • 2016

Skid resistance is an important characteristic of the pavement surface to reduce the number of road accidents. The mechanisms involved in the activation of the frictional force required for a safe braking of the vehicle depend on both the macro- and the micro-texture of the pavement surface. The state-of-the-practice methodologies commonly used for measuring pavement texture at highway speeds only account for the macro-texture, which alone might not be sufficient to effectively characterize skid resistance. This study explored different ways to characterize the micro-texture of pavement surfaces with the main objective of quantifying the effect of accounting for both the micro and the macro components of the texture, rather than just the macro-texture, on the prediction of skid resistance.

The friction and texture data analyzed in this study were collected from an experiment conducted on in-service flexible pavement surfaces. Surface friction was measured using a British Pendulum Tester whereas texture data was collected using a Circular Track Meter and a Laser Texture Scanner. The surface micro-texture was characterized by different texture parameters calculated in both the spectral and the spatial domain. The impact of incorporating the micro-texture on the prediction of skid resistance was evaluated by analyzing a series of models specified by each of the proposed parameters. The results of the analyses show a significant improvement in predicting the surface friction when accounting for both components of the surface texture, as opposed to only the macro-texture. Furthermore, the parameters calculated on the frequency domain led to a better prediction power.
(x, 40 pages)

CONTENTS

- Chapter 1. Introduction
- Chapter 2. Background
- Chapter 3. Texture and friction data collection
- Chapter 4. Characterization and processing of micro-texture data
- Chapter 5. Analyses of micro-texture data
- Chapter 6. Summary and Conclusion
- References

This report is available for free download (1.7 MB):
http://swutc.tamu.edu/publications/technicalreports/600451-00085-1.pdf

Item 8

Boundary Conditions Estimation on a Road Network Using Compressed Sensing

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

CTR 2016-600451-00090-1 • 2016

This report presents a new boundary condition estimation framework for transportation networks in which the state is modeled by a first order scalar conservation law. Using an equivalent formulation based on Hamilton-Jacobi equation, we pose the problem of estimating the boundary conditions of the system on a network, as a Mixed Integer Linear Program (MILP). We show that this framework can handle various types of traffic flow measurements, including floating car data or flow measurements. To regularize the solutions, we propose a compressed sensing approach in which the objective is to minimize the variations over time (in the L1 norm sense) of the boundary flows of the network. We show that this additional requirement can be integrated in the original MILP formulation, and can be solved efficiently for small to medium scale problems.
(29 pages)

CONTENTS

- Introduction
- Model Definition
- Affine initial, boundary and internal conditions
- Constraints arising from model and measurement data
- Boundary flow estimation on a single highway link
- Generalization to Highway Networks
- Application of the boundary estimation framework on highway networks
- Conclusion

This report is available for free download (530 KB):
http://swutc.tamu.edu/publications/technicalreports/600451-00090-1.pdf

Item 9

Analysis of Evacuation Clearance Time under Megaregion Disaster Threats

SOUTHWEST REGION UNIVERSITY TRANSPORTATION CENTER (SWUTC)

2016-600451-00114-1 • 2016

The significance and continuous growth of urbanized areas throughout the world has led to the emergence of the global phenomenon of megaregions. Megaregions often share common historical, cultural, environmental, and topographic/geologic systems as well as close economic ties, facilitated by transportation linkages that connect the movement of people and freight. Another characteristic that megaregions also often share are threats from naturally-occurring and manmade disasters. This paper describes a project to better understand, prepare for, and respond to catastrophic disasters in megaregions In the research, a mass evacuation of the United States Gulf Coast megaregion was modeled based on past hurricane scenarios in the area. The results of the analyses revealed how operational characteristics of the megaregion road network vary and how strategies such as temporally-phased evacuations and regional contraflow operations are able increase overall system effectiveness. The results of the simulations also showed numerous limitations of the network as well as existing modeling and computational processing capabilities to create such simulations.
(44 pages)

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http://swutc.tamu.edu/publications/technicalreports/600451-00114-1.pdf