University Transportation Research Center - Region 2

Final Report

Adaptive Evacuation Transportation Planning Under Uncertainty

Performing Organization: State University of New York (SUNY)

July 2018

Sponsor:
University Transportation Research Center - Region 2

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The Region 2 University Transportation Research Center (UTRC) is one of ten original University Transportation Centers established in 1987 by the U.S. Congress. These Centers were established with the recognition that transportation plays a key role in the nation's economy and the quality of life of its citizens. University faculty members provide a critical link in resolving our national and regional transportation problems while training the professionals who address our transportation systems and their customers on a daily basis.

The UTRC was established in order to support research, education and the transfer of technology in the field of transportation. The theme of the Center is "Planning and Managing Regional Transportation Systems in a Changing World." Presently, under the direction of Dr. Camille Kamga, the UTRC represents USDOT Region II, including New York, New Jersey, Puerto Rico and the U.S. Virgin Islands. Functioning as a consortium of twelve major Universities throughout the region, UTRC is located at the CUNY Institute for Transportation Systems at The City College of New York, the lead institution of the consortium. The Center, through its consortium, an Agency-Industry Council and its Director and Staff, supports research, education, and technology transfer under its theme. UTRC's three main goals are:

Research

The research program objectives are (1) to develop a theme based transportation research program that is responsive to the needs of regional transportation organizations and stakeholders, and (2) to conduct that program in cooperation with the partners. The program includes both studies that are identified with research partners of projects targeted to the theme, and targeted, short-term projects. The program develops competitive proposals, which are evaluated to insure the mostresponsive UTRC team conducts the work. The research program is responsive to the UTRC theme: "Planning and Managing Regional Transportation Systems in a Changing World." The complex transportation system of transit and infrastructure, and the rapidly changing environment impacts the nation's largest city and metropolitan area. The New York/New Jersey Metropolitan has over 19 million people, 600,000 businesses and 9 million workers. The Region's intermodal and multimodal systems must serve all customers and stakeholders within the region and globally.Under the current grant, the new research projects and the ongoing research projects concentrate the program efforts on the categories of Transportation Systems Performance and Information Infrastructure to provide needed services to the New Jersey Department of Transportation, New York City Department of Transportation, New York Metropolitan Transportation Council , New York State Department of Transportation, and the New York State Energy and Research Development Authorityand others, all while enhancing the center's theme.

Education and Workforce Development

The modern professional must combine the technical skills of engineering and planning with knowledge of economics, environmental science, management, finance, and law as well as negotiation skills, psychology and sociology. And, she/he must be computer literate, wired to the web, and knowledgeable about advances in information technology. UTRC's education and training efforts provide a multidisciplinary program of course work and experiential learning to train students and provide advanced training or retraining of practitioners to plan and manage regional transportation systems. UTRC must meet the need to educate the undergraduate and graduate student with a foundation of transportation fundamentals that allows for solving complex problems in a world much more dynamic than even a decade ago. Simultaneously, the demand for continuing education is growing – either because of professional license requirements or because the workplace demands it – and provides the opportunity to combine State of Practice education with tailored ways of delivering content.

Technology Transfer

UTRC's Technology Transfer Program goes beyond what might be considered "traditional" technology transfer activities. Its main objectives are (1) to increase the awareness and level of information concerning transportation issues facing Region 2; (2) to improve the knowledge base and approach to problem solving of the region's transportation workforce, from those operating the systems to those at the most senior level of managing the system; and by doing so, to improve the overall professional capability of the transportation workforce; (3) to stimulate discussion and debate concerning the integration of new technologies into our culture, our work and our transportation systems; (4) to provide the more traditional but extremely important job of disseminating research and project reports, studies, analysis and use of tools to the education, research and practicing community both nationally and internationally; and (5) to provide unbiased information and testimony to decision-makers concerning regional transportation issues consistent with the UTRC theme.

Project No(s):
UTRC/RF Grant No: 49198-24-28

Project Date: July 2018

Project Title: Adaptive Vehicle Routing for Evacuation under Uncertainty

Project's Website:
http://www.utrc2.org/research/projects/adaptive-vehicle-routing-evacuation

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Sponsor(s):
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15. Supplementary Notes

16. Abstract

The objective of this research project is to deliver a real-time, adaptive evacuation system for cascading events (e.g., hurricanes, following flooding, and following aftershocks). To realize this goal, the PI synthesized the existing information (e.g., flood inundation scenarios, human mobility information such as location-based social media data, U.S. Census Bureau data, past disaster statistics, and relevant weather and land conditions); established theoretically proven experimental models; simulated evacuation plans using the synthesized data sets and models; and conceptualized and presented a new approach. The adaptive evacuation transportation-planning model is anticipated to contribute to substantial improvement in our understanding of natural or man-made hazards and mitigation of their effects. The target disaster type is flooding induced by hurricane and the target region is the New York City area, selected considering the potentially affected population size and the high frequency of hurricane occurrence in that region.

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Project Title: Adaptive Evacuation Transportation Planning Under Uncertainty

Principal Investigator: Sung Hoon Chung

Two conference papers were submitted based on the research for this project as follows:

Kohts, S., Chung, S., Li, Y., Sawant, N. (2016) "Evacuation Planning for Urban Areas Using Public Transit Systems," Proceedings of the 2016 Industrial and Systems Engineering Research Conference

Abstract

Detailed evacuation planning during natural disasters is a critical aspect of managing calamities. Typically, it is assumed that evacuees use personal vehicles to vacate; however, the use of public transportation for evacuation may have advantages, especially in urban areas. Moreover, if everyone utilizes his/her own vehicle to evacuate out of an urban area, it would cause a dangerous amount of congestion. Therefore, this study has considered using public transit systems for evacuation in an urban area. Assuming that there are enough resources to evacuate every individual in need, the objective is to minimize the amount of time it takes to rescue every person.

Link

Evacuation Planning for Urban Areas Using Public Transit Systems

Li, Yinglei & Chung, Sung. (2016). "Specification of Uncertainty Sets for Robust Evacuation Planning"

Abstract

The importance of effective evacuation planning cannot be overemphasized when it comes to hazards and disaster management. The available data about evacuation demand is usually limited in disaster evacuation planning. In this paper, we tackle methodologies on how to select an uncertainty set of evacuation demand even when available data is limited in the context of robust network design models applied to disaster evacuation planning. In particular, we propose two approaches. The first approach enables us to estimate the set of demands, which can be used as the uncertainty set for our robust counterpart of the evacuation model. The second approach makes it possible to estimate the mean demands, after which the uncertainty set can be defined by use of a desired uncertainty level specified by stakeholders. Preliminary results of the evacuation simulation are presented.

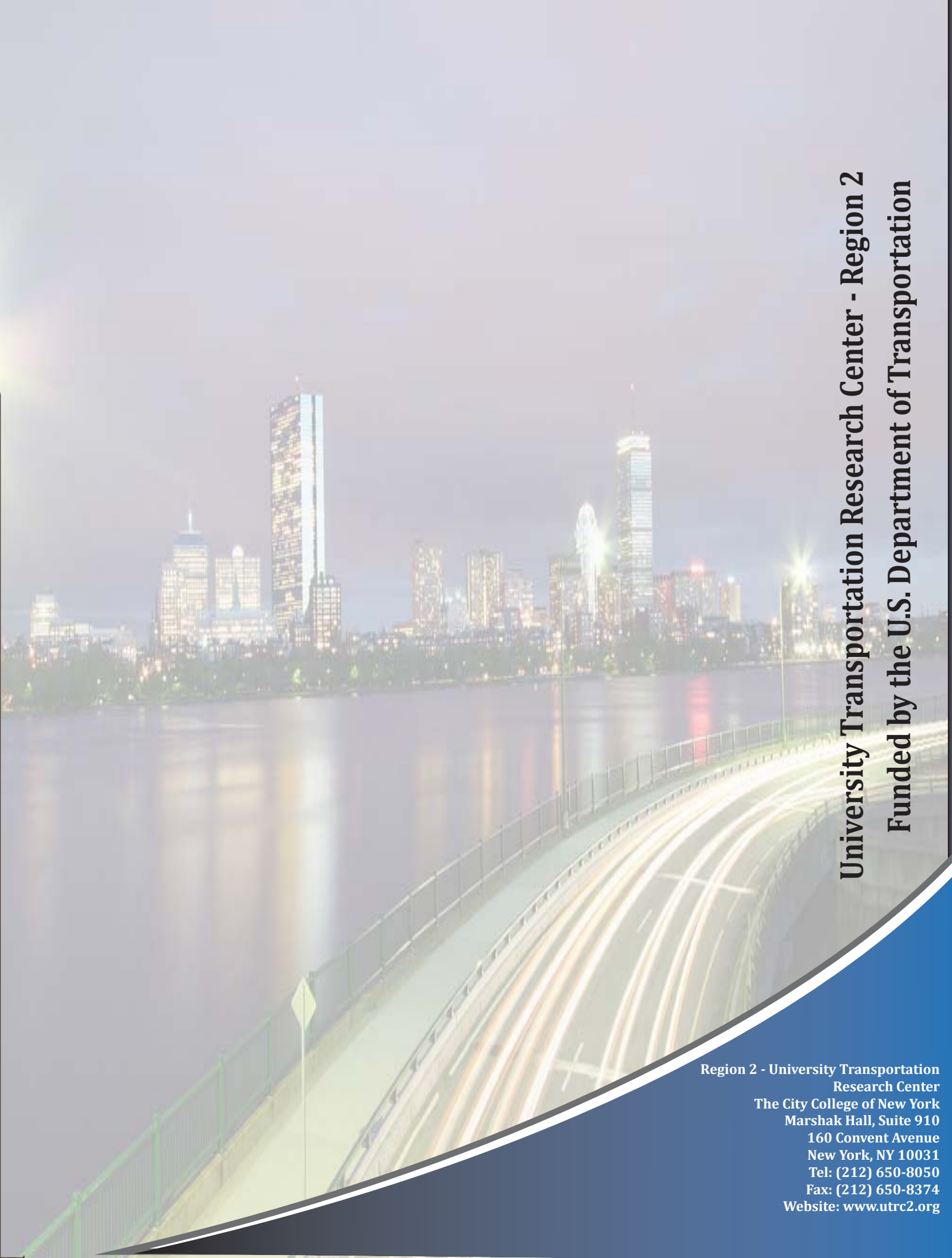
Link

PDF: Specification of Uncertainty Sets for Robust Evacuation Planning [accessed Oct 15 2018].

Sponsors: University Transportation Research Center

Completion Date:

University: SUNY Binghamton



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