

REGION II UNIVERSITY TRANSPORTATION RESEARCH CENTER

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PROGRAM PROGRESS PERFORMANCE REPORT

Submitted to the Office of the Assistant Secretary for Research and Technology

Federal Grant # DTRT12-G-UTC02

Project Title: University Transportation Research Center – Region 2

Name of Grant: University Transportation Center

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Signature_

Penny Eickemeyer, Associate Director for Research, UTRC

CONSORTIUM MEMBERS

City University of New York, Clarkson University, Columbia University, Cornell University, Hofstra University, Manhattan College, New Jersey Institute of Technology, New York Institute of Technology, New York University, Polytechnic Institute of NYU, Rochester Institute of Technology, Rowan University, Rensselaer Polytechnic Institute, Rutgers University*, State University of New York, Stevens Institute of Technology, Syracuse University, The College of New Jersey, University of Puerto Rico

*Member under SAFETEA-LU Legislation

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This report will cover UTRC's three mission areas: Research, Technology Transfer, and Education for activities that occurred under the Grant# DTRT12-G-UTC02 during this reporting period.

1. ACCOMPLISHMENTS

A. Goals and objectives:

- a) Research: To support the USDOT Strategic Goals and to advance the state of practice in planning and management of regional transportation systems; the research program consists of both agency-initiated and faculty-initiated studies
- b) Education and workforce development: To improve the knowledge base and approach to problem solving of the region's transportation workforce
- c) Technology transfer: To increase the awareness and level of information concerning transportation issues facing Region 2 to the education, research and practicing community; disseminate project reports, studies, analysis, and use of tools to the community; and provide unbiased information and testimony to decision-makers concerning regional transportation issues consistent with the UTRC theme.

B. Accomplishments under these goals:

- a) Research
- A new award under the Grant# DTRT12-G-UTC02 was made in October 2014 for the following project:
- Nondestructive Evaluation of Pavement Structural Condition for Rehabilitation Design-Rutgers

Ongoing projects under Grant# DTRT12-G

- Broadband Hybrid Electromagnetic and Piezoelectric Energy Harvesting from Ambient -Stony Brook
- Characterizing Highway Corridor Length to Evaluate Travel Time Reliability using Probe Vehicle Data –TCNJ
- Characterizing and Quantifying the Shrinkage Resistance of Alkali Activated (Cement Free) Concrete -Clarkson
- Development of the Household Activity Pattern Problem as an Activity-Travel Simulator-UB
- Effect of plug in hybrid electric vehicle adoption on gas tax revenue, local pollution, and greenhouse gas emissions-Rowan
- Demonstrations of Urban Outdoor Lighting for Pedestrian Safety and Security-RPI
- Empowering Individuals to Make Environmentally Sustainable and Healthy Transportation Choices in Mega-Cities through a Smartphone App- Queens College
- Evaluation of Public-Private Partnership Contract Types for Roadway Construction, Maintenance, Rehabilitation, and Preservation-UB
- Freight Demand Forecasting in the Context of the Built Environment: An Integrated Land Use-UB
- Impacts of Freight Parking Policies in Urban Areas: the Case of New York City -RPI

- IIMS Staten Island Web and Smartphone Development, Deployment and Evaluation –UB
- Improving Freight System Performance in Metropolitan Areas RPI
- Integration of Bus Stop Count Data with Census data for Improving Bus Service Albany
- Investigating the Network System Effects of Mileage Fee-RPI
- Laser Scanning Aggregates for Real Time Property Identification -Rowan
- Modeling Emissions and Environmental Impacts of Transportation Activities Associated with High Volume Horizontal Hydraulic Fracturing Operations in the Marcellus Shale Formation -RIT
- Modeling Disaster Operations from an Interdisciplinary Perspective in the New York-New Jersey Area -NYU
- Metrics and Performance Response Functions for Assessment of Resilience of Urban Infrastructure System-NJIT
- Nitrogen Dioxide Sequestration Using Demolished Concrete and Its Potential Application in Transportation Infrastructure Development –Stony Brook
- Omitted variable bias in crash data analysis -Rutgers
- Optimizing Work Zones for Highway Maintenance with Floating Car Data (FCD) NJIT
- Panama Canal Expansion and the Economic Impacts on New York and New Jersey States UB
- PPS-AQ and PPS-CMP hosting, maintenance, and technical support Cornell
- Port Resilience: Overcoming Threats to Maritime Infrastructure and Operations from Climate Change-Stevens Institute of Technology
- Real-time Estimation of Transit Origin-Destination Patterns and Delays Using Low-Cost Ubiquitous Advanced Technologies-NYU
- Relationships between public-private financing, speed, and rail infrastructure development
- Requirements, Model and Prototype for a Multi-Utility Locational and Security Information Hub-NJIT
- Robotic Inspection of Bridges –CCNY
- Smarter Multi-modal Traffic Signal Control with Both Floating Sensor Network and Fixed Sensor Network
- Street Standards as Parking Policy: Identifying Residents' Willingness to Pay -NYU
- Suburban Poverty, Public Transit, Economic Opportunities and Social Mobility –NYU
- Techniques for Information Extractions from Compressed GPS Traces Albany
- The Economy of Preventive Maintenance of Concrete Bridges –Syracuse
- The Role of Social Media in Improving the Safety and Efficiency of Traffic Operations during Non-Routine Events such as Incidents and Planned Special Events—RPI
- The Ties that Bind: Developing a Bi-national Transportation-Combined Economic Simulation Model to Assess Security and Policy Implications of US-Canada Border Bridges-UB
- Truck Driver Fatigue Assessment using a Virtual Reality System-Rowan

Completed Projects during this period include:

- Adaptive Traffic Signal Control System (ACS-Lite) for Wolf Road –RPI
- A GIS-based Performance Measurement System for Assessing Transportation Sustainability and Community Livability--UB Assessing Behavior Changes under the Influence of Travel Demand Management Strategies - RPI
- Air Quality Impact of Traffic Congestion in Midtown Manhattan -NYU
- Effectiveness Based Pavement preservation Selection Based on Statistical Analysis of Long term payment performance data
- Impact Analysis of Recreational Transit Services on Local Community Economic Development, Employment and Spending -Rutgers
- Investigation of the Carrs Creek Geofoam –Syracuse
- Landfill Closure with Dredged Materials Desktop Analysis Multiple Sources Development
- National Aviation Security to Cyber-terrorism: An Integrated Framework to Quantify the Economic Impacts of Cyber-terrorist Behavior-UB
- On-Road Energy Harvesting for Traffic Monitoring -Stonybrook
- Real-time Dynamic Pricing for Bicycle Sharing Programs -UB
- Subsurface Imaging of Corrosion in Painted Steel Bridges-NYU
- Support for NYMTC for CMAQ Application and Documentation -CCNY
- The Effects of Public-Private Partnerships on Traffic Safety: Evidence From Mexico-Cornell

Quarterly Reporting

As part of its partnership with regional agencies, UTRC continued its quarterly meeting process with NJDOT and NYSDOT.. UTRC also requires written quarterly progress reports on both agency-initiated and faculty-initiated projects. During this reporting period, these were requested for work completed through Sept. 30, 2014 and December 31, 2014.

As examples of project progress, excerpts from these written reports for several projects are provided below.

Development of the Household Activity Pattern Problem as an Activity-Travel Simulator

The purpose of this project is to develop a framework of an activity-travel microsimulator based on the Household Activity Pattern Problem (HAPP). The structure of the framework is an optimization model that matches both the system and individual household level data. Activity-based travel demand models, which have their theoretical foundation explicitly rooted in the accepted notion that travel is derived from daily activities, offer an attractive, but complex, alternative to the conventional four-step forecasting models.

During the quarter, the literature review was completed, the model's framework was set up, and case studies were tested.

The Economy of Preventive Maintenance of Concrete Bridges

The proposed project will investigate the economy of preventive maintenance for concrete bridges. It is proposed to evaluate a thorough investigation of the cost of various current methods for inspection and maintenance of existing highway concrete bridges and compare those costs to those of the proposed economical preventive maintenance approach. The research report will present recommendations for modification of the current inspection and maintenance methods and implementation of the proposed preventive maintenance approach that is based on quantitative material chemical condition of the bridge.

During this reporting period, tasks one through six have been completed as indicated below.

- Review of current bridge inspection manuals for concrete bridges evaluation
- Identification of various Deterioration Mechanisms
- Extensive presentation of chemical NDTS
- Establish Thresholds for various household compounds
- Required preventative maintenance measures for different levels of harmful compounds found in concrete bridges
- Cost of various activities presented

Effect of plug in hybrid electric vehicle adoption on gas tax revenue, local pollution, and greenhouse gas emissions

During the quarter, a report for tasks 1-3, Current PHEV Market, Electric Generation Report, and Commutes/distance data was developed and preliminary results were presented in a poster session at Big Data and Innovative Solutions for Safe, Efficient and Sustainable Mobility, UTRC Ground Transportation Technology Symposium. New York, New York.

Evaluation of Public-Private Partnership Contract Types for Roadway Construction, Maintenance, Rehabilitation, and Preservation

Following the original plan, the research team has so far:

- Conducted a literature review with respect to Public-Private Partnership (PPP) contracting (e.g., performance-based contracting, cost-plus-time contracting, incentives/disincentives, design-build and its derivatives, warranties, and lane rentals), and has thoroughly examined the PPP state-of-practice.
- Compiled and collated the existing (to the research team) data, and has acquired several
 relevant New York State data elements from the New York State Department of
 Transportation (NYSDOT), such as pavement condition for various NYS's Region 5
 roadway segments, traffic volumes and characteristics, project and contract
 characteristics, accident information, weather information, and so on.

• Started estimating the statistical models which identify relationships between contract types, project characteristics, cost, safety, operations, and asset condition.

So far, the research team has estimated random and fixed parameter linear regression models for the cost savings percentage amount, and random and fixed parameter count data models for the change orders; all by PPP type. All model results so far seem intuitive and are in line with the literature. The models have further been tested as to whether their parameters are transferable between US contracts and those of other countries and regions, and the preliminary results indicate that separate models for the US are warrantied.

Finance, Speed, and Rail Infrastructure Improvement

This study investigates the uses of public-private partnerships (P3's) to finance infrastructure improvements for passenger trains running at "high speed." It answers the following questions: is P3 financing best suited to construction of very high speed (vhs) rail projects or can it also be applied to projects that achieve "higher," but not "very high" speed.

During the quarter the following activities were undertaken:

Collected primary and secondary documents, reports, data, and other relevant resources related to project, began analysis of relationships between finance, infrastructure, and high speed, monitored high speed rail projects in California, Texas and Florida, and conducted phone interviews with officials and journalists involved with "All Aboard Florida," the planned line from Miami to Orlando (and, in future, Tampa).

Impacts of Freight Parking Policies in Urban Areas: The Case of New York City

The project team is currently working on Tasks 1 and 2. More specifically the team has selected the study area in which the case study will take place, conducted an initial field visit including an interview of a large traffic generator located within the study area, and began a survey of policies in place within the study area.

Modeling Disaster Operations from an Interdisciplinary Perspective in the New York-New Jersey Area

The objective of this research is to develop a systematic methodology to understand overall demand, destination type choice, and route choice decisions in the aftermath of a hurricane. It will consider both transportation and social and other relevant factors such as actions of agencies dealing with emergency operations. During this quarter, the following was undertaken:

Analysis of the evacuation behavior, initiation of development of simulation analysis and examination of empirical data during historical hurricanes.

Modeling Emissions and Environmental Impacts of Transportation Activities Associated with High Volume Horizontal Hydraulic Fracturing Operations in the Marcellus Shale Formation

During the quarter, the researchers began re-running the 2011 highest truck volume road segments using EPA 2008 Average In-use Fleet emission rates to serve as a comparison to runs simulating by the research assistant of a fleet of 2007 Model Year (MY)trucks (with substantially lower emissions). The team has also started analyzing the changes comparing the 2007 MY and 2008 EPA emission rates for the areas the GIFT model suggests are experiencing the greatest environmental impacts from hydraulic fracturing truck traffic emissions. This comparison serves as the basis of the next TRB paper we are working on, which we plan to submit August 1, 2015. The PI will present this research at GIS/SIG (a local GIS conference) and has been invited to give a talk at the University of Rochester in February. The team has also been preparing to run county based simulations for truck totals derived from PADOT traffic data. Simulations will be used to help assess the relative contribution of hydraulic fracturing truck traffic emissions to total truck emissions.

Optimizing Work Zones for Highway Maintenance with Floating Car Data (FCD)

Milestone accomplishments on this project include:

Task 1 – Literature Review

• Completed this task and submitted the technical memorandum.

Task 2 – Model Development-

• The improved work zone cost estimation model has been developed.- A preliminary search algorithm has been developed to find the optimal work zone length and schedule.

Task 3 – Site Selection and Data Collection

- The historical and real-time data (i.e. floating car and work zone information) of I-295 direct connection construction project has been collected.
- A data processing algorithm and method was developed to translate the data from various sources into a unified data format appropriate for the model development.

Task 4 – Case Study

• The improved model developed in Task 2 that utilizes FCD collected in Task 3 has been applied for a road maintenance project to optimize work zone length and schedule.

The Ties that Bind: Developing a Bi-national Transportation-Combined Economic Simulation Model to Assess Security and Policy Implications of US-Canada Border Bridges

The objectives of this research are to understand the economic importance of border bridges on the U.S.-Canada economies, especially involving the various US states proximate to the Province of Ontario, and to simulate various the U.S.-Canada border bridge policy and security scenarios. Work continued on developing the model including the construction of a binational highway

network. A paper has been developed and submitted to Research in Transportation and Business Management (RTBM)

Requirements, Model and Prototype for a Multi- Utility Locational and Security Information Hub

This project aims at defining the functional requirements, identifying data sources, developing an integrated data model open to all utility source information, and building a prototype using one and possibly more key utilities for a multi-utility information hub in support of field mark-out activities, that augments on demand intra-utility information sources and inter-utility exchanges, in order to achieve two key objectives:

- a. Improved support for infrastructure projects to keep the networks in a State of good repair, and in response to needed single or multi utility improvements. This is achieved through the provision of an information backbone and an ad-hoc tool for safe-digging processes such as the New Jersey One Call.
- b. Improvement and Modernization of Key Information Technologies for the Location and the securitization of the underground infrastructure systems attached to surface transportation, and the analysis and rating of the safety and security of planned construction and maintenance activities.

The main focus of the requirements has been on the main categories of users capable of providing an input to the accurate location of underground utility pipelines, both pre and post excavation. To that end, a range of users from utilities, excavators and subsurface utility consultants/contractors were interviewed, using a questionnaire tailored to the scope of their work and their contractual obligations and potential liabilities.

Port Resilience: Overcoming threats to maritime infrastructure and operations from climate change

Work continues on Task 1, which is a review of the recent literature on port and supply chain disruptions and their effects on networked infrastructure and maritime enterprise including related literature on supply chain recovery and emergency management during major disruptive events. Findings from Task 1 are being used to develop a conceptual framework that will systematically assist infrastructure owners and others in the maritime transport sector to reestablish business continuity in a post-event environment.

Work under Task 2 has been expanded. In addition, the PI received a local special limited invitation to a TRB-organized workshop was held on November 14, 2014 to further explore the relationship between physical infrastructure and social infrastructure that had been examined during a previous conference in June 2014. The workshop was organized in concert with the DHS Center for Secure Maritime Commerce. The objective of the workshop was to discuss the

resiliency of physical and social infrastructure and to work on documenting activities that strengthen their relationship and increase decision-makers effectiveness during incident response and recovery from natural and human-caused disruptions.

The workshop focused on the urban coastal zone with two expert-led sessions (and included specifically invited participants from both the public and private sectors . The first panel included experts on options for physical infrastructure (structural and non-structural) construction in port and urban environments. The panel examined the potential role of non-traditional green infrastructure (also frequently referred to as living shorelines, ecologically enhanced shorelines, and natural/nature based features, among other epithets) in enhancing the resilience of urban coastal communities. The second panel was composed of experts in organizational consistency, collaboration, and business continuity strategies.

Milestone Accomplishments and Dates: Task 2 is completed. Organizational work and literature searches began in Task 1 will continue into Task 5 as the final report is being compiled. Interviews are anticipated in January and February to assess the value of the proposed resiliency framework formulation.

- b) Education and workforce development
- NYMTC/UTRC September 11th Memorial Program Academic Initiative –The two Year 9 participants began their internships in September 2014
- AITE- The AITE scholarship awardees have begun their studies.
- Professional development in collaboration with the New York State Association of MPOs has begun. The initial course has been selected.
- Year 8 interns presented the results of their research at a Brownbag Seminar held at NYMTC on September 17, 2014. Emily Heard from Columbia University presented, LAYING THE GROUNDWORK FOR COMMUNITY PLANNING-Long Island Community Initiative. Homer Hill from Hunter College/CUNY presented Producing a NYMTC GHG Inventory.

c) Technology Transfer

NJDOT Technology Transfer Presentations
 UTRC and NJDOT sponsored an In-House Lecture Series at the NJDOT Offices at
 Trenton, NJ. During the Fall 2014, four UTRC faculty researchers presented at NJDOT.
 These presentations were very well attended and generated a lot of interest within
 NJDOT for future research in the region.

The following topics were presented during Fall 2014.

DATE	TOPIC	PI(S)	UNIVERSITY
October 17, 2014	Investigation of the Carrs Creek Geofoam Project	Dr. Dawit Negussey	Syracuse University
November 14, 2014	Road Traffic Congestion	Herb Levinson and John Falcocchio	UTRC & NYU Polytechnic Institute
December 11, 2014	Alain Kornhauser	Smart Driving Cars	Princeton University
December 15, 2014	John Bullough	Warning Lights for Maximizing Worker Safety	Rensselaer Polytechnic Institute

- NJDOT Research Showcase
 UTRC PIs and staff attend the 16th Annual NJDOT Research Showcase on October 23,
 2014 and several PIs presented their research.
- THE THIRD CONNECTED AND AUTONOMOUS VEHICLE SYMPOSIUM: SMART CITY MARKET ALIGNMENT FOR ROADWAY TECHNOLOGIES (SMART)

 The UTRC's third annual Connected and Autonomous Vehicle Conference took place at the SUNY Polytechnic Institute on November 5th, 2014. The conference was a big success as the event received support from state and local government. The New York State Department of Transportation Commissioner, Joan McDonald; Congressman Paul Tonko; and Senior Vice President for Cisco's Technology Group, Helder Antunes delivered the keynote addresses at the conference. The conference outlined two plenary sessions; National Connected Vehicle Landscape led by Richard McDonough from NYSDOT and Transitioning Innovation to Commercialization led by Michael Fancher from SUNY Polytechnic Institute. There were four information-rich panels (listed below) featuring presentations from experts in public and private sector.

- 1 University-based Research Assets
- 2 Industry-driven Tech Roadmap
- 3 Government-directed Framework
- 4 Investment Strategies to Enable Success

The keynote addresses and speakers' presentations are available on the conference website. www.connectedvehicleworkshop.com

• GROUND TRANSPORTATION TECHNOLOGY SYMPOSIUM: BIG DATA AND INNOVATIVE SOLUTIONS FOR SAFE, EFFICIENT AND SUSTAINABLE MOBILITY

Following the success of the 2013 GPS Symposium, UTRC hosted another successful conference on Ground Transportation Technology addressing Big Data and Innovative Solutions for Safe, Efficient and Sustainable Mobility on November 19th, 2014 at the New York Institute of Technology. UTRC's distinguished lecturer Matthew W. Daus was the chair of the organizing committee.

Hon. Council Member Ydanis Rodriguez, Chair of the New York City Council's Transportation Committee delivered the introductory remarks and talked about his transportation progressive agenda.

The presenters explored the cutting edge intelligent transportation systems, big data aggregation, and innovative transportation technology solutions to promote efficiency, safety, security and sustainability goals, as well as the impact on broader inter-modal and multimodal transportation considerations.

The event aimed to encourage future and forward thinking innovative concepts and the pragmatic political reality of various movements (such as climate change/environmental policies and safety initiatives for reduced traffic fatalities). Vision Zero was discussed extensively, as well as the use of smartphone apps, black boxes, red light and speed cameras.

The symposium proceedings including presentations, videos, and images are available on the UTRC's website at: http://utrc2.org/ events/ground-transportation- technology symposium. A detailed column summarizing the symposium speeches authored by Mr. Daus can be accessed at the UTRC website at: http://www.utrc2.org/events/ground-transportation-technology-symposium

• UTRC WORKSHOP WITH JAPANESE CIVIL ENGINEERING PROFESSORS DECEMBER 4TH. 2014 AT CCNY

Several UTRC faculty collaborated with civil engineering professors from Japan on December 4, 2014 for a workshop related to traffic congestion and goods distribution after disasters. Jun Sakamoto from Japan's National Institute of Technology, Gifu College, who is spending the year at Queens College-CUNY, reached out to UTRC through Queens College colleagues, Mindy Rhindress, Adjunct Professor of Sociology, and Andy Beveridge, Professor of Sociology, who had previous connections with UTRC. Dr. Sukamoto and three of his

colleagues in Japan were interested in presenting their research and exchanging ideas with UTRC researchers with similar interests. The topics presented during this program included:

- 1. Analysis of traffic animated simulation during downpour disasters using probe car data with GIS application, Motohiro Fujita, Ph.D., Nagoya Institute of Technology.
- 2. Planning of goods distribution in earthquake aftermath, Wisinee Wisetjindawat, Ph.D., Nagoya Institute of Technology
- 3. Possibility of black-spot identification based on probe car data, Jun Sakamoto, Ph.D., National Institute of Technology, Gifu College.
- 4. Cooperation and Collaboration of Land based Logistics Teams to Enhance Supply Chain Resilience, Thomas Wakeman, Ph.D., and Professor, Stevens Institute of Technology.

• UTRC HOSTED A PRESENTATION ON URBAN CONNECTED MOBILITY FOLLOWED BY A PANEL DISCUSSION

UTRC hosted a presentation on December 16, 2014 at the New York Institute of Technology followed by a panel discussion. The presentation speaker was Larry Yermack, a strategic advisor to Cubic Transportation Systems. The panel members included; Richard Hanley (Moderator), Professor at New York City College of Technology, CUNY; Matthew Daus, UTRC Distinguished lecturer; and Candace Brakewood, Assistant Professor at the City College of New York, CUNY.

In his presentation, Larry mentioned that urban transportation systems are being challenged by the multiplicity of providers and complexity of the journey. He presented that it has gotten a lot more complicated to get around major cities and that we are seeing attempts to address these problems by public providers as well as App developers. However, Larry believes that so far, they all fall short of solving the problem. He talked about the vision of connected urban mobility that addresses the problems and is within our grasp. His presentation enabled the audience to imagine the ability to use a phone to plan a journey, check schedules, receive real-time incident data, pay for all of the segments and then receive a single monthly bill for all paid transportation used. The presentation and panel discussion were videotaped and are available on the UTRC's website. http://utrc2.org/events/connected-urbanmobility

• Newsletter publications released

The Fall 2014 UTRC Research News on December 22, 2014.

• Brief video clips of interviews with PIs

UTRC has posted a video briefing of the completed project titled; *Data Collection and Econometric Analysis of the Demand for Nonmotorized Transportation*. The principal Investigator for this project was Dr. Ricardo Daziano from Cornell University. The video is available on the project's website: http://www.utrc2.org/research/projects/data-collection-and-econometric-analysis

• Annual report

UTRC will publish and release the 2014 Annual Report in the first week of February.

C. Opportunities for Training and Development

Our seminars and workshops are designed to educate the transportation community on current issues in policy and best practices as well as foster meaningful discussion on these topics. We also provide funding to the September 11th Memorial Program to select current students to serve in internship positions in regional and local agencies to enhance their educational experience.

C. Dissemination of results:

Nothing to report

D. Plans for next reporting period:

- a) Academic Forum on Financing MTA Capital Program March 5th, 2015 at NYIT (8:00 am to 12:00 pm)
- b) A Possible Book Talk with Andrew Sparberg: "From a Nickel to a Token" about the history of the MTA Transit System (Expected in March or April)
- c) UTRC is organizing the 2015 Annual Conference for the AASHTO Sub-committee on Bridges and Structures that will be held from April 19-24 at the Saratoga, NY For more information, please visit the conference website at: www.bridgemeeting2015.org
- d) UTRC's Winter Research News will be published in March 2015.

2. PRODUCTS

Products this period

Products this period have included newsletters, press releases announcing final reports that were submitted, several papers in professional journals based on UTRC –funded research, short interviews of PIs regarding completed projects.