RESEARCH NEWS

A Publication of the Region 2, University Transportation Research Center *Fall 2005*

UTRC Awards Funds for Five Research Projects

The Region 2, University Transportation Research Center recently announced the successful completion of our 2005 Research Initiatives request-for-proposals. The Initiative was a competitive matching grant program for consortium members in faculty-initiated research programs. After careful evaluation on a competitive basis by University and agency peers, five proposals were selected for accomplishing the program objectives. These objectives were to (1) promote excellent and innovative research projects by university faculty on transportation problems relevant to US DOT Region 2, which includes New York, New Jersey, Puerto Rico and the U.S. Virgin Islands, (2) encourage multi-disciplinary and multi-university approaches to research on these problems, (3) provide practical and workable contributions and solutions to the region's transportation community, and (4) further the education of transportation students by involving them in scholarly research. The summaries of five research projects are featured in this newsletter.

2005 UTRC Research Initiatives Program

Investigate the Relationship Between Truck Movements and the Economic Performance of the New York/ New Jersey Region.

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Problem

The purpose of this project is to investigate the relationship between truck movements and the economic performance of the New York/New Jersey region, and thereby, to test whether truck movements on the I-95 Corridor are a leading indicator of changes in the performance of the New York/New Jersey regional economy.

The economy is susceptible to fluctuations as economic conditions change over time. Economists, forecasters, and others use monthly economic measures to track the performance of the economy, to understand the short-term relationships among different sectors of the economy, and to forecast the performance of the economy, particularly business cycles. To do this they use measures called "indicators", such as employment, manufacturing production, sales, business inventories, and consumer confidence, among other things. In addition to giving information that is valuable in its own right, the indicators often have a relationship to the growth of the economy, measured by Gross Domestic Product (GDP) for the nation, or Gross State Product (GSP) for a state.

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Director's Message

Robert "Buz" Paaswell, Ph.D.
Director & Distinguished Professor

Lessons from the Hurricane

This message is written as we learn about both opportunities gained and opportunities lost from Hurricane Katrina. There were, of course, many transportation lessons to be learned –some for practice, some for research and some for the classroom. For practice, of course, the lessons include knowing where your assets are and how best to deploy them. At a time when everyone was told to drive away, those without cars were left to depend on the resourcefulness or planning of others.

Creating an emergency bus network, of the region's bus fleet, public and private might become a part of future practice. Such a network can be mobilized on short notice, and with good emergency planning be deployed to agreed upon high priority zones for use. Aiding such entire mobilizations will be the improved integration of our high tech communications systems – through telephones, blackberries, computers, and other means to coordinate mass movements. The research questions are staggering, starting with new models of evacuation and of asset deployment under difficult conditions.

Finally, we must add to our transportation courses a realistic component of planning for extreme events –hurricanes, fires, earthquakes as well as terrorism. Such realism must include scenario development, and human behavior as well as the traditional engineering analysis of such events. We have the capacity, within our tremendous academic resources to make real contributions to this clearly needed part of transportation planning – and must put the development of our academic resources to work.

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Until now, freight movements were not included in these indicators. Preliminary work suggests that a freight indicator when used with other economic indicators could produce a better understanding of the current and future course of the economy. The movement of a freight index over time can be compared with other economic measures to understand the relationship of transportation to changes in the regional economy. Leading indicators are especially useful in forecasting turning points in the economy, and are therefore of particular interest to economic decision-makers.

Proposed Approach

The Rutgers team proposes to develop an econometric model to test whether a correlation with a lag effect exists between truck movements on the NJ Turnpike and various economic time series data. It will also assess the feasibility of producing a freight index and publishing this index on an ongoing quarterly basis for the larger New York/New Jersey region. Using an existing model of New Jersey's economy that is provided by the Rutgers Economic Advisory Service (R/ECON), truck movement data will be provided by the NJ Turnpike so that the project team can examine the feasibility and investigate the relationship between truck movements and the performance of the New Jersey economy.

Work Effort

Investigating this relationship and collaborating with the NJ Turnpike will produce a 'first of its kind' project that should advance the understanding and value of freight to our economy. Using a student researcher from the Center for Advanced Transportation and Infrastructure and teaming with an economist will generate new perspectives across disciplines. The work effort will be complete in 12 months and this proposal is offered as the first phase that will result in a determination of the feasibility of the concept.

"Planning and Management of Regional Transportation Systems"

Public Transit in New York City: Keeping Up with the Trend

Dr. Cynthia Chen, Assistant Professor, UTRC
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Dr. Hongmian Gong, Assistant Professor
Department of Geography, Hunter College

The concept of transit development along with the land use development (or called transit-oriented development) has long been accepted in the field as a viable solution to solve transportation related problems such as congestion and air quality problems The hypotheses behind these transit-oriented developments are two: a) because of the close proximity between activities, it is hoped that the need to make trips, especially longer-distance trips, is reduced; and b) for the same reason (because of the close proximity between activities), it is also hoped that people will shift from low-occupancy modes (e.g., automobiles) to high-occupancy modes such as public transit and non-motorized modes (e.g., walking and biking).

The above two hypotheses further assume that *there is no excess travel*, or no longer-than-necessary or more-than-necessary trips will be made. If this were true, then all the hypothesized benefits of transit-oriented developments would indeed be achieved. However, the latter hypothesis can be rejected in some mobility-inclined market segments. Variety seeking and possible positive utilities associated with traveling probably contribute to excess travel.

Therefore, in order for the transit-oriented developments to be successful, it is extremely important to understand how people make travel related choices, especially their mode choices. Understanding in one's travel related choices requires a full understanding of one's daily activity and travel patterns, because of the widely recognized notion "travel as a derived demand", which suggests that people travel to perform activities distributed in space.

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Furthermore, we are at a very special turning point when understanding in the current and potential transit users' needs becomes extremely important. During the last decade, we have started seeing first signs of inward immigration into the city as well as growth of the city cores, after decades of outward migration. Three special market segments have potentially contributed to this important observation: the empty nesters, the young generation X professionals and the new immigrants. Compared to the typical middle-class married couples with young kids (those who most likely prefer living in suburbs), these three groups of people are finding the inner city to be an attractive place to live and are likely to reside in the city. It is those people who will become a very significant proportion of the transit riders for the next 10 years to come.

The objectives of the proposed research are thus two-folds:

1. to analyze the daily activity and travel patterns of the above three special groups in comparison to the control group (middle-class married couples with young kids) in order to understand their activity and travel needs via simple descriptive analysis coupled with statistical tests (e.g., ANOVA analysis), and
2. to quantitatively assess the impact of various factors in the decision making process for mode choice made by people in the different groups described above by applying the mixed logit model and the heterogeneity-accounted logistic model.

These two types of analysis will be done via the utilization of the 1997/1998 household travel survey data, collected by the New York Metropolitan Transportation Council (NYMTC) and New Jersey Transportation Planning Authority (NJTPA), both of which are Metropolitan Planning Organizations (MPOs) for the New York Metropolitan Area.

The proposed project will take one year to complete. Five tasks will be involved, including preparation of the dataset to be used, development of the built environment related variables by GIS/remote sensing tools, descriptive analysis of people's daily activity and travel patterns, model development of people's mode choice decisions, and final report preparation.

Results from the proposed project will significantly advance our understanding in the activity and travel needs of these three very important market segments, which will hopefully lead to important policy construction or modification in the New York City.

Collaborative Exploratory Research: On the Anticipatory Route Guidance Problem

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Dr. Georgia Perakis, Associate Professor
Sloan School of Management
MIT

Transportation is a very important service in modern society. The report from the National Science Foundation workshop on planning, design, management and control of transportation systems states that "the future of the nation and the world depends critically on systems of transportation that are reliable, efficient, safe and environmentally sustainable." In particular, a problem of great importance is traffic congestion. Expanding the traffic network by adding new routes is often not a possibility. Arnott and Small cite that congestion costs $640 per traveler in 39 metropolitan areas of the U.S. only in the year 1994. This brings the total costs due to congestion to $48 billion for that year alone. In general, it is estimated that congestion costs around $100 billion each year to Americans alone in the form of lost productivity.

An important characteristic of traffic congestion is its randomness. Data suggest that roughly 60% of congestion-related delays on urban freeways in the U.S. are due to specific random incidents such as accidents and vehicle breakdowns. Even without such incidents, congestion has a random component due to the variability in demand patterns and in network performance. Because of this randomness, a driver's past experience can be an unreliable basis for predicting the conditions associated with various travel options, and as a result, for making

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good travel choices. Advanced traveler information systems (ATIS) attempt to provide drivers with data intended to help them make better travel decisions. Messages may be available to all drivers (for example by radio or television broadcasts) or only to some: for example, those who pass near a particular infrastructure (such as variable message signs or VMS) or who have special receivers in their vehicles. Drivers, of course, may react to the messages in any way they choose.

Driver information systems may be distinguished on the basis of the type of information they provide in messages. Static systems furnish information those changes only infrequently: for example, locations of and directions to trip attractions such as cultural centers or restaurants. Reactive systems estimate prevailing travel conditions from real-time measurements and provide messages directly based on these estimates: for example, information about current travel times. Predictive or anticipatory systems use real-time measurements to forecast travel conditions in the near-term future (up to a few hours), and present messages based on these predictions. As a result, a trip maker can make a decision based on what conditions are likely to be at network locations at the time he/she will actually be there, rather than on (possibly very different) currently prevailing conditions.

The research we propose will focus on predictive driver information systems that provide messages intended to facilitate drivers' path choice decisions before and during a trip. In general, the messages may inform drivers about anticipated traffic conditions on different available paths, or (based on these conditions) recommend a specific path to follow, or both. Such systems are called route guidance systems. If only a few drivers receive route guidance messages, they may benefit from it by making better path choice decisions. When more drivers receive guidance, on the other hand, their reactions to the guidance may affect traffic conditions significantly.

The key issue in generating guidance messages based on traffic condition forecasts is to ensure that drivers' reactions to the guidance do not invalidate the forecasts that the guidance is based on, and so render the guidance irrelevant or worse. Messages predicting impending congestion on one road, for example, may cause drivers to switch en masse to a parallel road less able to accommodate them, leaving the original road free flowing and producing overall worse traffic conditions than if no guidance had been issued.

Predictive guidance is said to be consistent when the forecasts on which it is based are indeed experienced by drivers after they react to it. Generating consistent guidance is called the Anticipatory Route Guidance (ARG) problem. Some network-level analyses of route guidance systems have assumed that the effect of guidance will be to establish traffic equilibrium conditions. Others have modeled guidance effects via a reduction in the perception error of guided drivers using a stochastic assignment model. These approaches may be appropriate if perfect information is available to drivers at all locations. More generally, however, when a guidance system provides information only at a limited number of network locations, there is no reason to expect that the resulting flow patterns and traffic conditions would correspond to those of conventional network equilibrium. There is even less reason to expect this if, as is likely to be the case in reality, the messages provided by the guidance system are very succinct network condition summaries or path recommendations.

Capital Cost Drivers for Light Rail Transit Projects

This UTRC study. Capital Cost Drivers for Light Rail transit Projects." which is sponsored by the Federal Transit Authority will identify areas where costs are currently growing, where there are consistent cost overruns, and where costs could be cut and through a series of interviews, identify cost drivers, impacts on operations, the potential for standardization, and mitigation strategies. The work will interview consultants and experts who have performed cost capital cost analysis and developed capital cost indexes. The work will include a presentation to the FTA and APTA on the results of the interviews and a final report to document the work.

2005 UTRC Research Initiatives Program

Investigating The Feasibility Of Establishing A Virtual Container Yard To Optimize Empty Container Management In The NY-NJ Region

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Trade imbalances create a substantial problem of empty container handling throughout the US and particularly in port regions and densely populated economic centers, such as the NY-NJ region. The two main aspects of empty container management deal with empty storage accumulation and excessive unproductive empty trips to and from marine terminals and empty depots. The most straight forward and efficient way to minimize unproductive empty trips and associated VMTs and vehicle emissions; and to alleviate marine terminal and depot gate delays, additional road congestion and associated emissions is to maximize chances for direct empty interchange, the so called "street turns". A Virtual Container Yard (VCY) is a mean of developing a shared resource information system to match empty equipment needs through the adoption of next generation internet and new technology information platforms (e.x., Virtual Private Networks VPNs and ebXML). The project will examine the feasibility of developing and operating a Virtual Container Yard to serve the freight and maritime community in the NY-NJ region. Definition of user requirements and potential business and institutional impediments in successfully establishing the system will be identified. To support user requirements production and solutions, and to address potential impediments, literature dealing with local, US and International experience in applying web-based shared information systems will be critically reviewed. Subsequently, the conceptual architecture, specifications and functionalities of the system will be developed based on latest e-business collaborative solutions, systems and protocols. Special attention will be given to systems security architecture to make the application robust and attractive to potential partners. Proprietary products either dealing directly with street-turn matching or with wide range matching applications will be critically evaluated in view of the developed user requirements.

Financial and economic evaluation, potential funding alternatives and investment recovery strategies to ensure successful development and long term viability of systems' operation, will be presented. Systems governance structure and potential partnership will be investigated and proposed to serve the purpose of long term sustainability of the system. Finally, a staged application timeline and implementation plan will be produced, to cater for an intermediate pilot demonstration phase, necessary to draw experiences leading to proper full scale application. The project will provide for an integrated support product to enhance setting up a Virtual Container Yard system application in the NY-NJ region.

UTRC Participates on the Advisory Panel for the Connecticut Transportation Institute

UTRC researchers Herbert Levinson and Robert Baker, are advising the Connecticut Transportation Institute and the Connecticut Department of Transportation on the ConnDOT study, "Alternatives to Sand/Salt Mixtures for Winter Highway Maintenance." The study will look at the need to use abrasives and recommend new approaches to dealing with snow and ice removal. The Connecticut DOT maintains 5700 miles of local roads and 21,000 miles of State and Interstate roads with AADT of 2,000-170,000. ConnDOT uses approximately 1 million cubic yards of sand/abrasives each year. The study will test the effectiveness of the abrasives and look for alternatives. The study will also look at ITS Technologies and the potential for weather stations throughout the state.

Deformation of Cohesionless Fill due to Cyclic Loading

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In an on-going research project with the NJDOT, we have instrumented an integral bridge and have been gathering data every two hours for the past two years. We found that there is a significant pressure built-up in the soil behind the abutment.

We have identified at least four mechanisms responsible for the increase in the pressure: 1) strain ratcheting (or the plastic accumulation of strain) due to the cyclic loading of the soil; 2) a flow of the sand particles during the daily and seasonal cyclic loading; 3) the presence of frozen ground; and 4) possible failure of a soil wedge during the active pressure periods of the winter months which may be shifting the equilibrium position during every season.

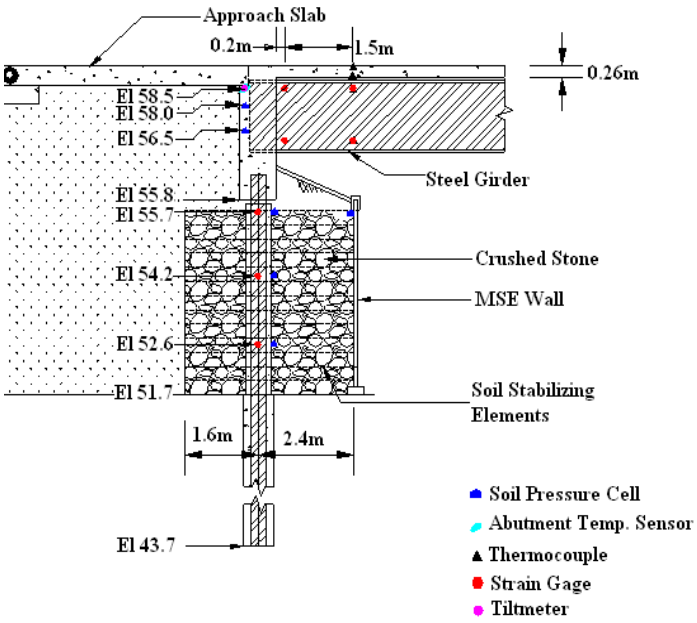
In order to recommend design parameters for the correct pressure distribution and magnitude, we must understand the pressure development mechanisms. This is of vast and immediate importance to the design community, considering that the construction of integral abutments is becoming widespread.

In this research effort, we aim to put forward a feasible mechanism for the pressure increase. Namely, we will investigate 1) well-developed theories on strain ratcheting and particle flow of granular materials under cyclic loading, and 2) the different wedge-failure theories on the development of active and passive pressures. We will investigate how the available theories fit our data and propose design parameters for the pressure distribution behind integral abutments.

The research approach will be:

- Study applicable theories, choose the theory that most closely answers the question on the pressure distribution and magnitude of integral abutments and check the theory with our data.
- Separate the different mechanisms responsible for the pressure built-up. We have data that will help us quantify the different affects on the development of the pressure. For example, data at the beginning of the measurements does not show the accumulated plastic strain. Data right after a freeze period shows very high pressures that dissipate with higher temperatures. (Note that one would expect the passive pressure to be the greatest at the highest temperatures).
- Identify the role of skew in the development of pressure. Data taken at the East and West part of the abutment can be used to quantify the effect of skew.
- Recommend design parameters for the safe evaluation of pressure behind integral abutments

A report on the research will be made available at the conclusion of the work.



UTRC Study "Speed Project Closeouts and Streamline Local Financing" Saves Dollars for NYSDOT

Neville Parker, Ph.D., Camille Kamga, and Robert Baker, City College of New York
John E. Osborn P.C., Attorneys and Counselors at Law, NYC, NY

The project closeout phase is the last phase in a construction project life cycle. Project closeout begins when substantial completion is achieved and the owner finally accepts the project after the architect or engineer concludes that the project meets the goals established. Project closeout can be further slowed when State Departments of Transportation include improvements for local governments as part of construction projects. In general, upon completion of such projects, the local agency is responsible for ensuring that all work has been accomplished in accordance with the approved agreement with the State DOT, including any approved changes. Any deficiencies on the project must be corrected and re-inspected before acceptance.

This study has identified the general causes of numerous issues that slow or prevent project closeout and recommends actions that address these causes. With a flow diagram of a generic procedure for public closeout as a point of departure, NYSDOT's current procedure was diagramed . Then, having identified "time of the essence" as an inherent flaw in the NYSDOT process that prevented it from determining the point at which it was entitled to treat a contractor as having waived its rights to the final retainage amount, and armed with reviews of relevant sections of the Court of Claims Act, State Finance Law, the State Highway Law and case law, it was determined that two years should be set as the legal "time of the essence" limit for settling closeout claims. Following upon this, NYSDOT's current procedure was modified and recommended for adoption and implementation. Three draft letters of notification and instruction to contractors were recommended for adoption.

The NYSDOT estimated that the study has saved and redirected several million dollars in unspent construction funds which can now to applied to other projects.

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