Semi-Annual Program Progress Performance Report
for the
Mid-Atlantic Universities Transportation Center
The Pennsylvania State University
201 Transportation Research Building
University Park, PA 16802

July 1 – December 31, 2012

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INTRODUCTION

The Mid-Atlantic Universities Transportation Center (MAUTC) is comprised of six universities—Morgan State University, The Pennsylvania State University (Penn State)(lead),University of Maryland, University of Virginia, Virginia Polytechnic and State University (Virginia Tech), and West Virginia University—and is located in Federal Region 3. MAUTC has served as the Region 3 regional UTC since the program's inception in 1987.

In the past, MAUTC primarily served as a conduit of research funding for its member institutions. Each institution conducted its own program of activities—research, education, and technology transfer—to respond to the priorities of the U.S. Department of Transportation's strategic goals as well as the institutions' state departments of transportation, which were the primary sources of matching funds, and other in-state stakeholders.

ACCOMPLISHMENTS

Major Goals:

MAUTC is organized as a single entity serving multiple, non-university stakeholders who are part of the transportation enterprise of the mid-Atlantic region. Each member institution received $300,000 (base funds) to be used for any purpose eligible under the grant, including research, student support, workforce development, technology transfer and administrative costs. The remaining funds are distributed, through a competitive proposal process, among the following programmatic areas:

Pooled Research Funds ($1,500,000)

Under the previous grant, DTRT07-G-0003, MAUTC began to move toward a more collaborative approach for conducting research. A portion of Penn State's funds was escrowed for pooled research projects to encourage member institutions to conduct joint research that would address regional transportation issues. Each member institution participated in at least one regional proposal.

The pooled research program will build on the success of the earlier "regional program."Advanced or applied research that is performed by multiple universities or funded by multiple sponsors will be eligible for funding. Any combination of universities and public and/or private matching funds are eligible. Public sector stakeholders, i.e. the Region 3 state DOTs, are given the right of first refusal for use of the federal funds in this program area. Proposals will be solicited quarterly by the MAUTC Project Selection Committee, comprised of representatives of each of the MAUTC universities and from the DOTs in the states that are home to the MAUTC universities.

Accomplishments:

Requests for proposals are issued quarterly. During the current reporting period, July 1 – December 31, 2012, seven collaborative research proposals were submitted for review, and three were selected by the project selection committee for funding. To date, 15 proposals have been submitted and seven have been funded. Of the $1,500,000 allotted for collaborative research, $1,059,917 has been awarded with a match commitment of $1,067,498 from the region's state DOTs and the Center's universities.

- Needs, Barriers and Analysis Methods for integrated Urban Freight Transportation – UMD (lead), MSU and WVU

  A reliable system for the flow of goods is critical to the U.S. economy and to our quality of life. However, this activity is adversely affected by congested conditions and scarcity of suitable spaces for loading and unloading vehicles and contributes to urban congestion, emissions, energy use and safety hazards.

  The proposed study seeks to help policy makers, planners, and other practitioners to identify and assess alternatives for ensuring efficient and reliable freight movement by trucks in large urban areas while minimizing the negative impacts such as congestion, air pollution, safety, etc., of freight deliveries. A set of alternatives called urban delivery integration (UDI) strategies will be analyzed. These include (1) improved routing and scheduling efficiency, (2) consolidation of goods for multiple shippers and customers on common vehicles, and (3) restrictions of deliveries to relatively uncongested periods.

- Smart Concrete Bridge Girders Using Shape Memory Alloys – UVA (lead) and PSU

  With the increasing demands for high structural performance, the use of "smart material" have been considered in different engineering disciplines due to the appealing characteristics of these materials such as efficiency, self-actuation, adaptability, self-monitoring and self-healing, and decision making. Recently, shape memory alloys (SMAs) have received considerable attention as a class of smart materials that can be employed in bridge engineering applications [1]. SMAs have the ability to regain their original shape after being deformed up to 6-8% strain. This shape recovery is a result of an underlying reversible solid-solid phase transformation, which can be induced by either a stress or a temperature change. Several researchers have investigated the use of heat-induced SMAs to prestress concrete [2-4]. However, the previous studies have been focused on thermally activating NiTi SMA tendons by electrical heating and have been mostly at the theoretical and laboratory study levels. This proposed work is an original investigation including thermo-mechanical characterization aimed at designing an optimized NiTiNb SMA (PSU) that can be activated using hydration heat and evaluating the performance of self post-tensioned concrete (UVA).

  The research goal of this project is to investigate the development of self post-tensioned bridge girders by activating the shape memory effect of SMAs using the heat of hydration of grout. Using NiTiNb SMAs as post-tensioning tendon instead of conventional steel

tendons will not only address the critical problem of corrosion-induced deterioration, but also will greatly simplify the construction and enable adjusting the pre-stress level as needed during the service life of concrete bridge structures. The use of self post-tensioned SMA tendons in concrete girders will increase overall sustainability of bridge structures by (i) minimizing the susceptibility of post-tensioning tendons to corrosion; (ii) enabling the adjustment of pre-stressing force during service life; and (iii) simplifying the tendon installation.

- A Feasibility Study of Bridge Deck Deicing Using Geothermal Energy, PSU (lead) and VT

  The proposed study aims to investigate the feasibility of a ground-coupled bridge deck deicing system that utilizes heat energy harvested from the ground using circulation loops integrated in the deep foundations supporting the bridge or embedded within the approach embankment. The proposed system is different from ground-source heat pump systems used for heating and cooling of buildings because it utilizes a circulation pump rather than a heat pump. The warm fluid extracted from the ground will be circulated through a tubing system embedded within concrete bridge deck. This technology will help in reducing the use of salts and deicing chemicals. As a result, it will be possible to reduce bridge deck deterioration and offset the detrimental effects and environmental hazards caused by these chemicals.

  In the proposed research, we will investigate the operational principles, identify key design parameters and develop a proof-of-concept testing and analysis approach that will eventually transform the ground-source deicing concept to a ready-to-use technology. Experiments will be performed on model-scale instrumented bridge deck and model heat-exchanger piles to investigate heat transfer within different components of the ground-coupled bridge deck system. Heat transfer within ground and concrete bridge deck will be quantified through numerical simulations under a variety of design and operational conditions. A preliminary cost analysis will be performed to investigate the economic feasibility of the proposed technology. The knowledge and experience gained from this research will allow us to develop preliminary guidelines and strategic plans for future real-life implementation of the proposed alternative bridge deck deicing technology.

Workforce Development/Student Support ($600,000)

Developing the next generation of transportation professionals is a critical component of MAUTC's mission. Each member institution may submit a proposal to provide direct support to university students, graduate or undergraduate, or to fund activities that encourage pre-college or pre-engineering college students, especially those from underrepresented or disadvantaged groups, to students in science, technology, engineering, and mathematics (STEM) fields and consider transportation a career, improve the content knowledge and professional skills of the STEM teacher workforce, or improve the transportation-related resources available for learning STEM subjects.

In November, three doctoral students were selected to receive funding for research projects. White papers or research reports will be submitted at the conclusion of their projects.

- Karim Fadhlou, Virginia Tech, is studying moving bottlenecks, which occurs when a slow-moving vehicle's speed is limited, causing others to attempt to pass it, by proposing a model for the estimation of the passing rate past the moving bottleneck. An example of frequently-occurring moving bottlenecks are when large trucks traveling I-81 and I-77 in the mid-Atlantic region are slowed below the speed limit of the traffic stream due to climbing a hill.

  The expected benefits of this research would be to (a) develop an analytical model that can be used to estimate the flow passing a moving bottleneck without the need to gather field data or run microscope traffic simulations software; (b) allow departments of transportation within the Mid-Atlantic region to estimate the queues forming upstream of a slow moving truck and compute the traffic stream delay associated with slow moving vehicles using a simple analytic procedures; and (c) allow DOTs to integrate these procedures in their travel time prediction algorithms to capture the impact of trucks on freeway travel times.

- Reza Faturechi, University of Maryland, is working to develop tools to evaluate the surface transportation infrastructure's ability to cope with deterioration and randomly arising events that affect system sustainability. The effort will build on an existing systems modeling-based resilience framework that quantifies the ability of transportation and other infrastructure systems to recover from disaster events. The existing capability considers the possibility of only one possible sporadic event actually occurring. The revised framework will account for multiple intermittent events occurring randomly over time. This work will aid in filling the need for quantification methodologies to assess disaster/disruption readiness of transportation infrastructure systems to cope with damage. Mr. Faturechi is a senior doctoral student and selected member of the College of Engineering's Future Faculty Program at the University of Maryland.

- Mark Franz, University of Maryland, is developing a decision tool for traffic safety and operation practitioners to use when considering the deployment of a variable speed limit (VSL) system in recurrent congestion applications. The decision tool will assist traffic experts in deciding where VSL may be effective and how to most effectively design field deployment of the VSL system. Ultimately, this research has the potential to assist traffic engineers in improving the efficiency and safety of a highway plagued by recurrent congestion.

Workforce Development/Professional Development ($300,000)

The development of tomorrow's transportation workforce is critical to maintain and improve the safety and efficiency of our transportation system. As much as 50 percent of the transportation workforce is due to retire in the next several years, which will create a large knowledge gap that must be filled.

These funds are available for activities that will help to further develop the knowledge, skills, and abilities of the transportation professionals for both personal development and career advancement. Activities may include, but are not limited to, on-site or distance education in the form of conferences, short courses, webinars, seminar series, tutorials, communities of practice, individual consultation, and technical assistance.

- Development of Digital Instructional Modules for Transportation Professionals: Overviewing the Fundamentals of How to Obtain Soil Properties in Practice, UVA

  Researchers will record a series of digital instructional lab modules that overview the application, specific ASTM procedures, and data processing required for the most commonly performed geotechnical tests. Transportation professionals will be able to use the online lab modules as a reference to learn how to conduct, interpret, and apply geotechnical lab tests used in practice to determine engineering soil properties. The modules will be produced and distributed through the Virginia Transportation Training Academy for use by transportation professionals. Additionally, the on-line modules will be available for use by other MAUTC universities or state DOTs that wish to offer these modules as reference tools within their own transportation design community.

Implementation and Tech Transfer ($350,000)

These funds will be available to help fund conferences, workshops, webinars, etc. to further the adoption of new-to-the-user products or procedures by the transportation community.

There are no new projects to report.

The next review for proposals to be funded from the collaborative funds will be held June 1. Faculty will continue to seek opportunities to collaborate with other universities and other partners.

Base Funds

Each of the Center universities has solicited proposals and is working with their respective departments of transportation to select projects. Faculty are also reaching out to others within the Center to find common interests for collaborative proposals.

The following projects began during the current reporting period:

- Urban and Suburban Safety Performance Functions, Phase II, Penn State

The objective of this project is the development and implementation of state specific Safety Performance Functions (SPFs) for differing functional classes in Washington State. These SPFs will be used by all safety professionals and those responsible for safety assessment in Washington State. To achieve this objective, the following will occur: (1) an assessment of the current practice, (2) literature review of national and state practice, (3) development of SPFs by functional class, (4) development of SPFs implementation procedures for the differing tools and office (e.g. HSM, SafetyAnalyst, IHSDM, etc.), and (5) recommendation for subsequent SPFs development.

- Construction Practices in Karst Topography

  In 2011, the "perfect [snow] storm" hit the Washington, DC commuting area during the evening peak period causing some drivers to spend 13 hours on the road. While it is widely acknowledged that severe weather reduces speeds and capacities, their importance cannot be determined without knowing how many drivers will be affected. Predicting the winter weather demand involves understanding the complexities associated with the decision to travel at a particular time. In particular, school closures, work place policies, storm characteristics, and road conditions influence driver's trip decisions in winter events. This study explores these influences and complexities. The goal is to examine winter weather effects on demand and estimate demand models. Toward this goal, this study involves collecting original data on citizens' travel decisions during snow storms and the dependence of these decisions on the above influential factors; identifying school and employer policies with respect to early closures during snow events; and developing snow storm related demand models.

- Next Generation Traffic Management Centers, University of Virginia

  Traffic management centers (TMCs) are critical to providing mobility to millions of people travelling on high-volume road. In Virginia, as with most regions of the United States, TMCs were aggressively deployed in the period of late 1990's – early 2000's. Thus, most TMCs use technology of this time period. Recent advances in technology may provide improvements in TMCs in terms of function and cost. The purpose of this project is to assess the current state of the traffic management center as well as a look at what the TMC may be able to implement to further improve operations and accomplish their goals. The primary focus is on new technology as well as an evaluation of business philosophy and the decision-making process used by TMCs. The project will conclude with recommendations for potential areas of improvement and the feasibility of implementation of those recommendations.

- Performance Evaluation of Damage-Integrated Girder Bridges

  Within the bridge community, there is a divide between the parties in design and preservation. Designers primarily focus on static conditions at the time of construction with limited consideration of future conditions related to maintenance, whereas preservation professionals emphasize on maintenance and repair practices with limited

focus on design behavior and system performance. Similar to the concept of immediate depreciation of a new vehicle purchase, bridges in-service begin to degrade after they are placed in service, albeit at a lower rate. Current maintenance practices are not sufficient to predict the exact consequential effects that are imposed on the performance and serviceability of bridge system under the influence of routine degradation conditions. As a result, the main objective of this research is to establish a framework to integrate different sources of damage mechanisms into the measure of system performance, based on which serviceability and remaining service life of deteriorated superstructures can be effectively evaluated. The corresponding investigation of this research program will be conducted on a numerical analysis platform with association of limited experimental database for validation of the proposed models and conceptual methodology. In future, the proposed framework can be developed into a performance-based assessment tool that can be widely implemented by transportation agencies.

- Intelligent Transit Signal Priority, University of Virginia

  Existing transit signal priority strategies rely on either extending existing green or early return to green to accommodate buses. However, field experience has shown that buses are not always able to make the green times provided by either extended green or early return to green, causing additional delays to general vehicular traffic. This is, in part, because of inaccuracy in bus arrival time estimation due to unexpected heavy queues. In addition, it has been also reported that transit signal priority (TSP) often causes disruptions in traffic signal progression along the major corridor if improperly implemented. The main purpose of this project is to investigate the status of transit signal priority in Virginia, and to explore opportunities to improve TSP through connected vehicle technology.

- Forensic Analysis of Decommissioned Bridges, University of Virginia

  A limiting factor in current bridge management programs is a lack of detailed knowledge of bridge deterioration mechanisms and processes. The current state of the art is to predict future condition using statistical forecasting models based upon historical observations. This approach is limited in that the historical observations are subjective visual observations assigned to categorical condition states. Physical and chemical processes are not measured and deterioration processes are not modeled at the basic level. While this is adequate for routine bridge maintenance and management it does little to add to fundamental knowledge of the processes that, in the end, limit the useful service life of a bridge. Normal practice is to demolish and dispose of a bridge that is to be replaced, with no attempt to extract useful knowledge from the decommissioned bridge. This project is based upon the hypothesis that bridges which have been in service for extended periods will have deteriorated and that detailed forensic analysis of such bridges can provide fundamental knowledge of the deterioration mechanisms that limit bridge service. The extent, severity, and sequence of deterioration mechanisms or processes such as fatigue, overloading, weathering, and corrosion will be documented and measured. This will undoubtedly require innovative methods and thinking to be efficient and successful. This is an initial step in a project which will submit a much larger proposal to

the National Science Foundation. This project will consider this problem in detail and propose how to perform detailed forensic autopsies on several bridges each year (out of the several thousand bridges that are decommissioned each year) and to add to the fundamental science and knowledge of bridge engineering.

- Assessment of Splash and Spray Potential of Experimental Quiet Pavement Surfaces, Virginia Tech

  Splash and spray potential is one of the less studied pavement functional characteristics, although it can have significant impact on travel safety and comfort. Research suggests that it contributes to a small, but measureable, proportion of road traffic accidents, provides considerable nuisance to motorists, and can generate negative environmental impact to the vegetation adjacent the roadside. This project will: (1) develop splash and spray measurement equipment, and (2) test innovative "quiet pavements" to determine if they also provide additional benefits with regards to this new emerging functional pavement performance parameter. The project is leveraged by the significant data being collected for the *Virginia Quiet Pavement Initiative*.

  The project will develop capabilities for testing splash and spray in the state and compare the splash and spray potential of VDOT traditional and innovative pavement surfaces. The innovative aspects of the project include: (1) it allows for the incorporation of an additional functional performance measurement into the asset management process, (2) it will help design pavements that provide safer and more comfortable ride to the citizens of the state, and (3) it will contribute to consolidating VDOT's and VTTI's leadership in the area of pavement surface characteristics.

- Development of Bayesian Multi-state Travel Time Reliability Models, Virginia Tech

  The reliability of travel time is a key performance index of transportation system and has been a major transportation research area. Reliability is one of the four key focus areas of the Strategic Highway Research Plan (SHRP2). Travel time is affected by multiple factors such as traffic condition, weather, incidents etc. Many of these factors are random in nature and stochastic modes should be used in modeling the uncertainty associated with travel time. Traditionally, uni-mode distributions have been adopted for travel time reliability modeling and the log-normal distribution has been the most popular model. In recent years, the multi-state travel time reliability model has been proven to be a superior alternative by providing substantial improved data fitting, scientifically sound interpretation, as well as close relationship with the underline traffic flow characteristics.

  The majority of the current stochastic models, however, focus primarily on provide the best fitting for the travel time data. Limited researches have been conducted to link travel time uncertainty with traffic conditions and other external factors. Part of the reason is that traditionally used uni-mode distributions lack the flexibility to accommodate variation in travel time, let alone the complex interaction with external factors. On contrast, the multi-state model used a two-level structure to represent 1) the probability of encountering a traffic delay, and 2) the distribution characteristics of travel time in both delay or non-delay conditions. Previous studies have shown that the parameters of the

multi-state model are directly related to the time of day. The results fit the intuition that the probability of encountering traffic delay is much higher during peak hours. However, previous studies are exploratory in nature and had not quantitatively evaluated the relationship between traffic conditions and parameters of the multi-state models. To establish quantitative relationship between traffic condition and the key parameters of multi-state models, i.e., the probability of encountering delay and the distribution parameters for each travel time state, will significantly increase our understanding of the relationship between traffic condition and travel time.

The results of this study will benefit congestion management for traffic management authorities as well travel time prediction for individual travelers.

- Alternative Intersections Comparative Analysis, Virginia Tech

  The purpose of this project is to develop a guidebook for the analysis of alternative intersection designs, to be used by consulting engineers performing comparative analysis, during the preliminary engineering phase of a project. Intersection designs supported by FHWA to be included in the proposed guidebook include the displaced left-turn intersection, the median u-turn intersection, the restricted crossing u-turn intersection, the quadrant roadway intersection, the jug handle intersection, and the modern roundabout. The proposed guidebook will be divided into three sections: an overview of the various design alternatives, including literature review and documentation of where and how they have been implemented; a synthesis of analysis guidelines for these designs, specifically examining Federal recommendations and any existing State recommendations; and a proscribed analysis methodology for conducting comparative analysis of these design alternatives in preliminary engineering.

- Effects of Major Transportation Incidents and Disruptive Events, Virginia Tech

  During the last five years, the Northern Virginia transportation system has experienced several major incidents and disruptive events including a Metrorail train collision, an earthquake, and a collapsed crane. The magnitudes and sources of these incidents are different from the more common vehicle collisions. This study will compare and contrast the impacts of the three major events with the more common vehicle collisions in terms of demand changes, network performance, and the applicability of congestion mitigation strategies. The overall goal of this project is to better understand the similarities and differences between extraordinary disruptive events and more common incidents and the traffic mitigation strategies that are effective in these situations. The associated objectives include (1) identifying similarities and difference among the major incidents and major and more common incidents; (2) determining the network performance under major incident and disruptive event conditions; (3) determining the network performance under more common incident conditions; and (4) identifying and evaluating traffic mitigation strategies for applicability to the different event conditions. The study's outcomes will help VDOT and other departments of transportation plan for unusual events of different types and evaluate the benefits of implementing traffic mitigation strategies in the different scenarios.

- Investigate Attractiveness of Toll Roads, Virginia Tech

  With the increasing congestion and pollution problems, tolling is becoming an intermediate reasonable solution to shift demands and divert traffic when building extra roads is not a viable alternative. There are multiple tolling strategies: fixed toll, toll rate by travel mileage, variable toll, high-occupancy-toll (charging solo drivers when they use a HOV lane), etc. It is important to compare these different tolling plans beforehand, such that planning agencies will have an accurate prediction of traffic volumes, revenue, and cost of each individual tolling plan to make knowledgeable decisions on different alternatives. The factors that will impact on traffic volume diversion should be studied and the correlation among these factors need be modeled. The goal of this research is to develop a model to predict the percentage of traffic volume selecting toll roads over free roads in response to tolls to avoid congestion. The results of this research can be used to estimate the revenue and the resulting changes of traffic volumes on affected roads.

- Developing a Real-time Energy and Environmental Monitoring System, Virginia Tech

  This study will develop a real-time monitoring system that can continuously evaluate energy and environmental impacts on transportation facilities using real-time traffic data. It is anticipated that the proposed development will have many practical and methodological implications to local transportation planners and traffic engineers.

- Winter Weather Demand Considerations, Virginia Tech

  In 2011, the “perfect [snow] storm” hit the Washington, DC commuting area during the evening peak period causing some drivers to spend 13 hours on the road. While it is widely acknowledged that severe weather reduces speeds and capacities, their importance cannot be determined without knowing how many drivers will be affected. Predicting the winter weather demand involves understanding the complexities associated with the decision to travel at a particular time. In particular, school closures, work place policies, storm characteristics, and road conditions influence driver's trip decisions in winter events. This study explores these influences and complexities. The goal is to examine winter weather effects on demand and estimate demand models. Toward this goal, this study involves collecting original data on citizens' travel decisions during snow storms and the dependence of these decisions on the above influential factors; identifying school and employer policies with respect to early closures during snow events; and developing snow storm related demand models.

Proposals will continue to be solicited at each university for projects to be funded from their base funds.

PRODUCTS

Publications and presentations are the standard method by which faculty, researchers and students disseminate the knowledge garnered through their research. In addition, MAUTC will

use social networking sites such as Facebook, LinkedIn, and Twitter to communicate research activities and findings.

Publications and Presentations

Submitted:

Gheitasi, A. and Harris, D.K., "System Reserve Capacity of Redundant Composite Steel Girder Bridges", ASCE – *Journal of Bridge Engineering* (*Submitted 2012*).

Venkittaraman, A. and Banerjee, S. (2013). "Seismic Resilience of Highway Bridges", Abstract submitted to the College of Engineering Research Symposium, The Pennsylvania State University, University Park, Pennsylvania.
Accepted:

Lijie, T., and Flintsch, G. W., "Use of Precipitation Records in Drainage Design of Porous Asphalt Surface Layer," presentation 13-2720, 92nd Annual Meeting of the Transportation Research Board, Washington, DC, January 2013

McGhee, K. K. de Leon Izeppi, E.D., Flintsch, G. W. Mogrovejo, D. E., "Virginia Quiet Pavement Demonstration Projects: Initial Functional Assessment," paper 13-3150, 92nd Annual Meeting of the Transportation Research Board, Washington, DC, January 2013

Miller-Hooks, Elise, Reza Faturechi, Lei Feng and Shabtai Isaac, "Emergency Shelter Design for Geographic and Building Environments Using Stochastic and Robust Optimization," to be presented at the *International Conference on Stochastic Programming*, Bergamo, Italy, July 2013.

Venkittaraman, A. and Banerjee, S. (2013). "Seismic Retrofit of Bridges to Enhance Disaster Resilience of Highway Transportation Systems", accepted. Abstract will appear in the proceedings of 2013 Structures Congress, May 2-4, Pittsburgh, Pennsylvania.

Venkittaraman, A. and Banerjee, S. (2013). "Seismic Hazard Mitigation through Risk- and Resilience-Based Optimization:, accepted. Will appear in the proceeds of ICOSSAR 2013: 11th International Conference on Structural Safety and Reliability, June 16-20, New York, New York.

Presented/Published:

Miller-Hooks, E., R. Faturechi, L. Feng, and S. Isaac. "Robust Shelter Location in Geographic and Building Environments," presented at the annual meeting of the *Institute for Operations Research and the Management Sciences (INFORMS),* Phoenix, October 2012.

Sangster, John, "Expanding our Geometric Toolbox for Intersection Design", Virginia-section ITE Fall Meeting, Wintergreen, Virginia. URL:
https://www.youtube.com/watch?v=jCWXLz6e_9o

Sangster, John, “Can we live with traffic?”, TedXVirginia Tech, November 10, 2012

Other

Website for the Conference on Agent Based Modeling in Transportation Planning and Operation, www.cpe.vt.edu/abmconf/index.html

Mid-Atlantic Universities Transportation Center, www.mautc.psu.edu

Virginia Tech has developed and is testing smart phone applications for travel behavior and health survey data collection on both iOS and Android operating systems.

A GroupTweet account has recently been established for Center members to disseminate breaking news in research, education, and technology transfer activities. @MAUTC

PARTICIPANTS AND COLLABORATORS

The Pennsylvania State University
University Park, Pennsylvania
Provides financial and in-kind support, facilities, conducting collaborative research with Virginia Tech, Morgan State, University of Virginia, West Virginia University, Virginia Tech

Morgan State University
Baltimore, Maryland
Provides financial and in-kind support, facilities, conduct collaborative research with University of Virginia, Virginia Tech, Penn State, University of Maryland, West Virginia University

University of Maryland
College Park, Maryland
Provides financial and in-kind support, facilities, conducting collaborative research with Morgan State University, West Virginia University

University of Virginia
Charlottesville, Virginia
Provides financial and in-kind support, facilities, conduct collaborative research with Morgan State University, Penn State

Virginia Polytechnic and State University
Blacksburg, Virginia
Provides financial and in-kind support, facilities, conduct collaborative research with Penn State, Morgan State University

West Virginia University
Morgantown, West Virginia
Provides financial and in-kind support, facilities, conduct collaborative research with Penn State, University of Maryland, Morgan State University

Maryland State Highway Administration
Provides financial support and member, Project Selection Committee for Collaborative Projects

Pennsylvania Department of Transportation
Harrisburg, Pennsylvania
Serves on the Project Selection Committee for Collaborative Projects

Virginia Department of Transportation
Charlottesville, Virginia
Provides financial support and member, Project Selection Committee for Collaborative Projects

West Virginia Department of Highways
Morgantown, West Virginia
Member, Project Selection Committee for Collaborative Projects

Preston County Schools
Kingwood, West Virginia
Collaborated on a proposal with West Virginia University

EdVenture Group
Morgantown, West Virginia
Collaborated on a proposal with West Virginia University

IMPACT

The MAUTC program provides financial support and research opportunities for graduate students primarily in civil engineering and mechanical engineering, but also in curricula such as industrial engineering, statistics, communications, and logistics to name a few. Their involvement in research expands their learning experience well beyond the classroom.

Eight undergraduate students and 33 graduate students are currently involved in projects.

It is too soon to report on impacts of projects.

CHANGES/PROBLEMS

In the previous PPPR, the University of Maryland incorrectly reported the following projects as being part of the MAUTC program:

- Magnetic Signature Processing for Anonymous Vehicle Identification
- Dynamic Discreet Choice Model for Railway Ticket Cancelation and Exchange Behavior
- Improved methods for Planning and Operating Public Transportation Services with Mixed Fleets

A Modified Capacitated Arc Routing Problem (MCARP) for the Resource Effectiveness of Highway Infrastructure Inspection and Scheduling (IIS), was canceled approximately10 months

into the project. The principal investigator was prohibited from working on federally funded projects due to irregularities in the principal investigator's administration of non-MAUTC project funds.

Changes to the MAUTC program are not anticipated at this date.