



Program Progress Performance Report (PPPR) No. 1 – Urban Mobility & Equity Center

Submitted to: U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

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Project Title: Urban Mobility & Equity Center

Morgan State University (Lead Institution)
Virginia Polytechnic Institute and State University
University of Maryland

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Recipient Organization: Morgan State University
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or Account Number, if any: 522949

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Reporting Period End Date: June 30, 2017
Report Term: Bi-annual. This report covers Nov. 30, 2016, to May 31, 2017.

Signature:

1. ACCOMPLISHMENTS

UMEC has completed on time every deliverable required by the grant to date, including a website, a directory of key personnel and an approved data management plan.

1.1 What are the major goals and objectives?

The Urban Mobility & Equity Center (UMEC) at Morgan State University's National Transportation Center (NTC) develops research to improve urban mobility of people and goods; bolster the scientific foundation and identify equity and environmental implications for urban mobility policy.

UMEC provides utilizable technical assistance and nurtures the next generation of transportation professionals through educational and community outreach projects and programs. UMEC is developing a public interest research and technical assistance program, designed to undertake problem-solving projects on city-wide and community levels, such as employment access and economic development. This will entail UMEC-affiliated faculty interacting with community residents periodically to explore concerns and collaborate with faculty at partner universities to provide expertise. Faculty and students would engage in public interest research with residents' cooperation in order to foster solutions.

In addition, the UMEC partner universities, through innovative projects and programs, generate interest in the field of transportation and facilitate exchange of information. Projects include a number of internship opportunities, engagement programs with area secondary school students and teachers, and project development with regional highway administrative bodies to connect these transportation organizations with the desired training and technical assistance.

1.2 What was accomplished under these goals?

- Research themes have been established. UMEC supports research centered on three themes:
 - ◆ Transit, paratransit, and freight planning and operations to improve mobility, access and cost efficiency;
 - ◆ Buyer acceptance, affordability and government promotion of connected and automated vehicles;
 - ◆ Distribution of transportation costs and benefits, including equity of user fees and taxes that fund infrastructure and services.
- Grants have been awarded from base funds at each university for six core research projects, which begin this summer:

Project Name	Principle Investigator(s)	University	Subject Areas
Development of Multimodal Traffic Signal Control	Dr. Hesham Rakha	Virginia Tech	Traffic Signal Control
		Virginia	

	Dr. Kyoung-ho Ahn	Tech	
Traffic State Prediction: A Traveler Equity and Multi-model Perspective	Dr. Hesham Rakha	Virginia Tech	Multimodal Transportation System, Transit Passenger Demand Prediction, Bike Share System, Travel Time Prediction
Optimized Development of Urban Transportation Networks	Dr. Paul Schonfeld	University of Maryland	Transportation Network Evaluation, Traffic In Road Networks, Project Scheduling, Optimization, Economic Analysis
Understanding Access to Grocery Stores in Food Deserts in Baltimore City	Dr. Celeste Chavis	Morgan State University	Food deserts, Access to Transportation, Public Transportation
	Anita Jones, M.S.	Morgan State University	
Optimizing Small-Sized Automated Transit Operations and Its Applications	Dr. Young-Jae Lee	Morgan State University	Automated Vehicles, Transit, Ridesharing
Dynamic Vehicle Routing with Route Guidance for Urban Pickup and Delivery	Dr. Ali Haghani	University of Maryland	Freight Mobility, Logistics

- Competitively awarded grants have been solicited and proposals will be submitted to UMEC for selection on July 7, 2017. UMEC has created a process for evaluating proposals that included the establishment of an [advisory board](#); Board members and other technical experts serve as peer-evaluators.
- UMEC helped sponsor a Bike Equity Forum, held at Morgan State University on April 24, 2017. Melody Hoffman from the University of Minnesota presented “Bike Lanes are White Lanes” and Charles Brown of Rutgers University presented “One Barrier Too Many: Understanding What It Means to Bicycle in Black and Latino Communities.”
- Dr. Andrew Farkas provided assistance to the Maryland Energy Administration, which testified on the Clean Cars Act of 2017 to the Maryland legislature. His involvement as a technical expert supported the administration’s efforts to make the bill’s financial incentives for electric vehicle purchases more equitable. The bill was enacted.

- Faculty and NTC staff assisted Morgan State and the Maryland Transit Administration in planning the routing of BaltimoreLink Silver Line, a bus line that for the first time directly links Morgan State and nearby residential communities with downtown and other educational institutions.

1.3 What opportunities for training and professional development has the program provided?

- Morgan State University offers transportation-related degrees at the bachelor's, master's and doctoral level, as well as a post-baccalaureate transportation certificate in three schools – the School of Engineering, School of Architecture and Planning, and the School of Graduate Studies. In 2014-2015, Morgan awarded 42 Bachelor of Science transportation-related degrees; 39 Master of Science and Master of Engineering degrees and 7 D.Eng. and Ph.Ds. Virginia Tech is well known for its transportation programs. In 2014-2015, Virginia Tech awarded 15 Bachelor of Science transportation-related degrees, 7 Master of Science degrees and 5 Ph.Ds.
- The University of Maryland is equally renowned for its program, and in 2014-2015 it awarded 170 bachelor's degrees that involved transportation-related courses; 28 Master of Science degrees and 19 Ph.Ds.
- UMEC has developed with support from the Maryland State Highway Administration an innovative educational program for middle school students, the Middle School Summer Transportation Initiative, which introduces them to the transportation field to spark their interest. Seventeen students will participate in the inaugural four-week program this July that includes hands-on activities such as building a model bridge and field trips.



Middle school students and their families arrive for orientation for the first Middle School Summer Transportation Initiative.

The new middle school program is an outgrowth of an existing, highly successful

workforce development program, the Summer Transportation Institute (STI). STI is a month-long pre-collegiate program that gives 20 high school students unprecedented levels of experience with transportation planning professionals, technology, and preparation for entering university. Additionally, the two-week Teacher Transportation Institute (TTI) exposes teachers and administrators such as guidance counselors to transportation concepts that they can use in STEM-based lessons. They earn continuing education credits for their participation. Both STI and TTI were established under previous grants, and UMEC funds will enable them to continue their mission in the future.

- The NTC and UMEC have a relationship with the Maryland Department of Transportation (MDOT) to continue two internship programs: undergraduate-level summer internships with the State Highway Administration and full-year, graduate-level internships at the administrative subdivisions of MDOT.
 - ◆ This year's SHA summer interns are: Destiny Copeland, Venita Russell, Ayomiposi Akinyemi, Amirah Fields, Wayne Johnson, Adrianna Rhoden, and Anthony Lovelace.
 - ◆ Final selection of the 2017-2018 MDOT/MSU Graduate School interns will be completed by the end of June; orientation is July 11, 2017.



Morgan State University graduate students visited the Maryland Department of Transportation to learn more about the agencies involved in the MDOT/MSU Graduate School Internship Program.

1.4 How have the results been disseminated? If so, in what ways?

Researchers receiving UMEC funding are encouraged to publish their results in journals, present at conferences and create webinars; professional editing services are available to them.

- The UMEC website, www.morgan.edu/umec, details the agency's mission, research and offerings. All ongoing research is listed, and completed research reports will be available on the site. Social media will be used to request proposals and disseminate the research findings. Content of interest to transportation professionals, researchers, policy makers and students is posted on

the UMEC Facebook page, www.facebook.com/urbanmobilityandequitycenter, and our Twitter feed, www.twitter.com/UMECresearch.

- The creation of UMEC was featured in a Baltimore Sun special section entitled Education focusing on higher education. (Page 6.)
<http://marketplace.baltimoresun.com/baltimore-md-features/special-section/Education/04-09-2017/page-1#>
- A data management plan has been produced and all original research and research methods will be archived in a manner that is searchable.
- A newsletter, *The UMEC Report*, is being developed and will be distributed via email later this summer to transportation professionals, researchers, community organizations and government officials. An annual report will be created, which will be distributed and posted on our website.
- Press releases will be developed for appropriate media when research and/or results are newsworthy, and fact sheets will be developed to facilitate technology transfer.

1.5 What do you plan to do during the next reporting period to accomplish the goals and objectives?

- UMEC plans to fund four or five competitively selected research projects that will consist of collaborative, advanced or applied research to solve mobility challenges and lead to public policy recommendations or new tools/innovations.
- We will have successfully completed the summer programs at Morgan.
- Our SHA internships will have been completed.
- We will finalize our technology transfer plan.
- For the project **Traffic State Prediction: A Traveler Equity and Multi-modal Perspective**, data reduction of APC data and mobile APP data from BT4U will be accomplished, and prediction models for transit passenger demand will be developed.
- The project **Optimized Development of Urban Transportation Networks** will develop methods for selecting and scheduling interrelated improvements in transportation networks.

2. PRODUCTS

2.1 Publications, Conference papers, presentations

- With regard to the project **Traffic State Prediction: A Traveler Equity and Multi-modal Perspective**, two conference papers which describe the data processing and modeling were submitted to the 5th IEEE international conference on models and technologies for intelligent transportation systems, June 26-28, 2017, Napoli, Italy.
 - ◆ “Bike Share Travel Time Modeling” 5th IEEE international conference on models and technologies for intelligent transportation systems, June 26-28, 2017, Napoli, Italy
 - ◆ “Modeling Bike Sharing Availability using Machine Learning” 5th IEEE international conference on models and technologies for intelligent

transportation systems, June 26-28, 2017, Napoli, Italy

- The bike-sharing portion of **Traffic State Prediction: A Traveler Equity and Multi-modal Perspective** will be published in a chapter book entitled “Data Analytics Applications for Smart Cities” (Taylor & Francis).

2.2 Websites or other internet sites

www.morgan.edu/umec

www.facebook.com/urbanmobilityandequitycenter

www.twitter.com/UMECresearch

2.3 Technologies or techniques

- The project **Development of Multimodal Traffic Signal Control** will develop a novel multi-modal traffic control system that integrates connected and automated vehicle applications and will work on the development of an integrated CV simulation platform.

2.4 Inventions, patent applications or licenses

Nothing to report.

2.5 Other products such as databases, physical collections, audio or video products, software or NetWare, model education aids, curricula, instructions, equipment

Nothing to report.

3. PARTICIPANTS & COLLABORATING ORGANIZATIONS

3.1 What organizations have been involved as partners?

Morgan State University (lead)

- Financial Support
- In-Kind support
- Facilities
- Collaborative Research
- Personnel exchanges

Virginia Tech, Blacksburg, Virginia

- Financial Support
- In-Kind support
- Facilities
- Collaborative Research
- Personnel exchanges

University of Maryland

- Financial Support
- In-Kind support
- Facilities
- Collaborative Research
- Personnel exchanges

3.2 Have other collaborators or contacts been involved?

Not at this time.

4. IMPACT

4.1 What is the impact on the development of the principle disciplines of the program?

Research conducted through UMEC is expected to not only expand the body of knowledge but to create tools such as predictive methods, algorithms, and analysis of how people really use transportation that will serve future researchers.

- The project **Development of Multimodal Traffic Signal Control** will impact the teaching and development of traffic engineering courses.
- Real-world implementation of the models and algorithms proposed in the project **Dynamic Vehicle Routing with Route Guidance for Urban Pickup and Delivery** has the potential impact of reducing congestion and improving freight delivery reliability which in turn benefits the society by reducing congestion delays, vehicle emissions, environmental pollution, and increasing customer satisfaction.
- By better satisfying the desired objectives and constraints, methods developed in the project **Optimized Development of Urban Transportation Networks** will help improve the effectiveness, safety, sustainability and affordability of transportation systems, which in turn improve prosperity and quality of life. Equity across regions and societal groups will also be achievable by specifying appropriate constraints when using the proposed methods.

4.2 What is the impact on other disciplines?

- The project **Development of Multimodal Traffic Signal Control** will incorporate a multidisciplinary approach across operational research, computer science, urban planning, and air quality engineering.
- Dynamic vehicle routing problem is among the most challenging operations research problems. The project **Dynamic Vehicle Routing with Route Guidance for Urban Pickup and Delivery** intends to advance the state-of-the-art in other disciplines such as Operations Research and Business Management.
- The project **Optimizing Small-Sized Automated Transit Operations and Its Implications** will examine the optimal operation of small-sized automated transit vehicles as a flexible ride-sharing operation and as a feeder service for mass transit so that users' travel behaviors and modal choices in the future can be predicted. This will have implications for urban planning, economics and business and marketing.
- Applications of the method developed in the project **Optimized Development of Urban Transportation Networks** are not limited to the transportation domain. This project intends to advance the state-of-the-art in other disciplines such as Project Management and Engineering Economics.

4.3 What is the impact on the development of transportation workforce development?

- Several participants in the MDOT/MSU graduate school internship program have been hired by the agencies for which they interned; one participant from last summer's program was hired during the internship. Although we do not track students after the Summer Transportation Institute, several have chosen to come to Morgan; one who will be a freshman this year is planning to major in Transportation Studies.
- The project Development of Multimodal Traffic Signal Control engages under-represented minority students by providing opportunities for research in the transportation engineering fields; helping to improve the performance and skills of students; and assisting to develop and disseminate their educational materials and provide assistantships.
- The project Dynamic Vehicle Routing with Route Guidance for Urban Pickup and Delivery can educate both undergraduate and graduate students interested in freight and logistics research. Students will be academically better prepared for their careers in freight transportation.
- The project Optimized Development of Urban Transportation Networks can educate both undergraduate and graduate students interested in transportation infrastructure development. Students will be academically better prepared for their careers in civil infrastructure development.

4.4 What is the impact on physical, institutional and information resources at the university and/or other partner institutions?

Nothing to report.

4.5 What is the impact on technology transfer?

- We have met with the staff at the Office of Technology Transfer and are developing a technology transfer strategy that incorporates documenting benefits.
- Freight carriers can save their vehicle operating costs by adopting methods and algorithms developed in the project Dynamic Vehicle Routing with Route Guidance for Urban Pickup and Delivery. Therefore, such technologies can be implemented.
- The project Optimized Development of Urban Transportation Networks can improve existing methods used for determining transportation network expansion projects. This project is expected to yield greatly improved methods for developing transportation networks. The methods will include appropriately integrated components for evaluating candidate projects, selecting them and scheduling their implementation, while satisfying constraints regarding budgets and construction times.
- The project Optimizing Small-Sized Automated Transit Operations and Its Applications will develop an optimal automated small transit routing algorithm. The algorithm also will be adapted to the transit user information system for a flexible transit service.

4.6 What is the impact on society beyond science and technology?

Successful transportation systems are a hallmark of a successful society. The efficient movement of people and goods is a cornerstone of a healthy economy, and

it is critical to ensure that everyone has access to transportation that facilitates employment, education and economic growth. These research projects will establish ways to improve that efficiency in a manner that is sustainable and equitable.

- Optimizing freight vehicle routes can reduce congestion delays and energy use.
- Understanding how people in food deserts access groceries will lead to recommendations to increase access, helping municipalities to reduce food deserts, which in turn could improve diet and health in minority and low-income communities.
- Before procuring and operating automated transit vehicles, it is extremely important to determine what future transit customers want and expect from them.

5. CHANGES/PROBLEMS

5.1. Changes in approach and reason for change?

Nothing to report.

5.2 Actual or anticipated problems or delays and actions or plans to resolve them

Nothing to report.

5.3 Changes that have a significant impact on expenditures

Nothing to report.

5.4 Significant changes in use or care of animals, human subjects and/or biohazards

Nothing to report.

5.5 Change of primary performance site location from that originally proposed

Nothing to report.

5.6 Additional information regarding products or impacts

Nothing to report.

6. SPECIAL REPORTING REQUIREMENTS

There are no special reporting requirements at this time.