2010 – 2011
Annual Report

The Pennsylvania State University ▪ University of Maryland
▪ University of Virginia
▪ Virginia Polytechnic Institute & State University
▪ West Virginia University

Table of Contents

Page

MAUTC Theme 1

Management Structure 1

MAUTC Funding and Expenditures 2

University Descriptions 3

Research 7

Education 23

Technology Transfer 23

Faculty and Researchers 25

Figures

1. MAUTC Expenditures by Source 2

2. MAUTC Expenditures by Activity 2

3. Sample Car-following Data from the 100-car Dataset 7

4. Framework of Proposed Driverless Intersection Control System 9

5. Conceptual Diagram of Proposed Eco-cruise Control System 11

6. Trend in Bicycle Share of All Trips and Bicycle Share of Regular Communities in Washington, D.C. and Adjacent Jurisdictions 12

7. Share of Bike Trips by Sociodemographic Indicators in the Washington, D.C., Region Compared to the U.S. National Averages for Urbanized Areas, 2008-2009 12

8. Simulation Network Showing Incident Locations and Dispatch Stations 13

9. Comparison between Correction Methods under Random Error Scenarios 14

10. Forecast of the MA(2) Model 15

11. Comparison between Estimated Flows and Observed Flows 15

12. Multi-car Accident on I-68 16

13. Fog Conditions 16

14. Teenage Driver........17
15. School Zone Area........18
16. Revenue Optimization Considerations........19
17. Raw Travel Data Recording for a Sample Long Distance Trip........20

THEME

MAUTC's theme, *Technology for Integrated Transportation Systems Operation and Performance,* recognizes the critical link between technology and management of our transportation infrastructure, and it provides for a multidisciplinary approach to many critical transportation issues facing the Mid-Atlantic Region. MAUTC's research, education, and technology transfer programs focus on the integration of knowledge and expertise in transportation operations, organizational management, and infrastructure management. The theme clearly reflects the strengths of the five universities of MAUTC and the interests of the faculty and state agencies that support much of the research conducted by MAUTC.

The distinctive elements of MAUTC's theme include the following:

- Design and implementation of research and educational programs that apply advanced technologies for information acquisition, analysis, and application to the management of the transportation system.
- Multidisciplinary approach to research, education, and technology transfer activities.
- Emphasis on the operations and management of the transportation system.
- Multimodal mission that addresses passenger and freight transportation, highway, transit, and intermodal facilities.

MANAGEMENT STRUCTURE

Penn State has been the lead university and grantee for the University Transportation Centers (UTC) Program since 1986. MAUTC is administered through the Thomas D. Larson Pennsylvania Transportation Institute (Institute).

The MAUTC executive director and principal investigator, Dr. Martin T. Pietrucha, delegates day-to-day responsibility for MAUTC partner activities to each partner university:

- University of Maryland
- University of Virginia
- Virginia Polytechnic Institute and State University and
- West Virginia University

Dr. Paul Jovanis, professor, civil engineering, and director of the Transportation Operations Program, represents the Institute's faculty interests in MAUTC activities.

Ms. Janice Dauber, MAUTC coordinator, is responsible for MAUTC's technology transfer activities, publicity, and report preparation.

Ms. Lisa O'Hara, staff assistant, provides clerical support for the overall MAUTC administrative effort as well as for Penn State's MAUTC projects and programs. Additional Institute staff support MAUTC as needed.

FUNDING and EXPENDITURES

MAUTC meets the U.S. Department of Transportation's 1:1 match requirement through state and local agencies, private companies, and universities. Maryland, Pennsylvania, Virginia, and West Virginia departments of transportation provide the majority of matching funds. (See figures 1 and 2.)

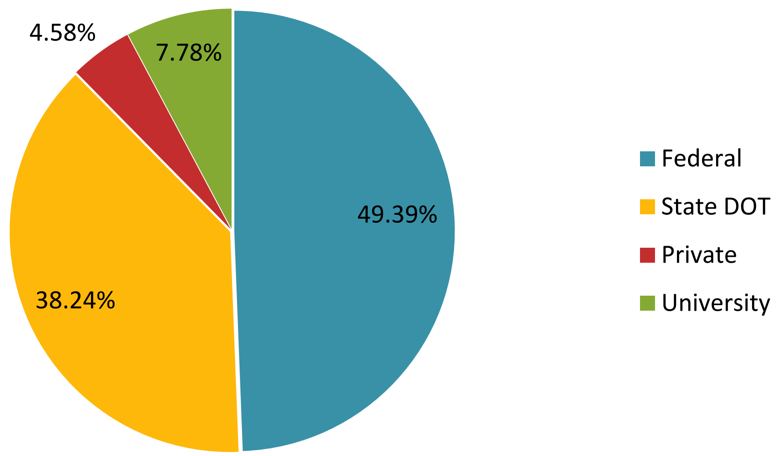


Figure 1: Expenditures by Funding Source

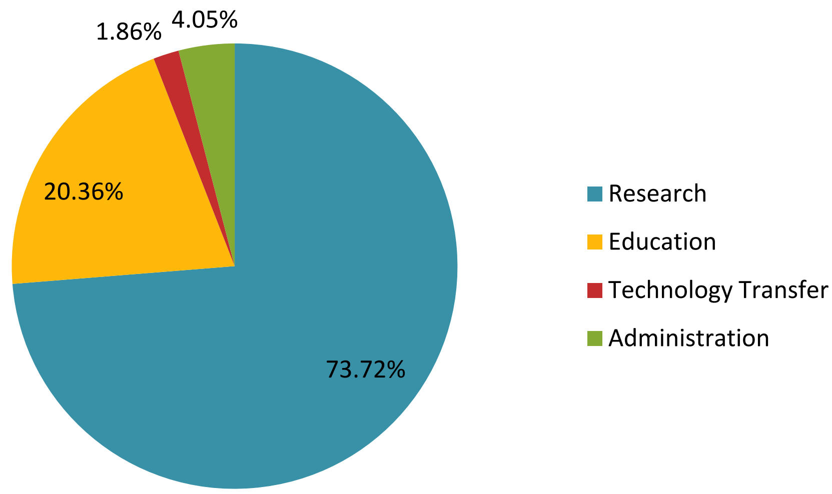


Figure 2: Expenditures by Activity

The Pennsylvania State University

The Thomas D. Larson Pennsylvania Transportation Institute at Penn State is the University's transportation research center, a major multidisciplinary unit within Penn State's College of Engineering. Since its inception in 1968, the Larson Institute has maintained a threefold mission of research, education, and service. In pursuit of this mission, the institute aspires to conduct innovative and relevant research addressing current and future transportation needs, to promote continuing education for transportation professionals, to provide significant interdisciplinary educational and research opportunities for undergraduate and graduate students, and to disseminate research results within and beyond the transportation field. The Institute maintains a vigorous commitment to encouraging women students to pursue careers in engineering and to involving women engineers in its education, research and outreach initiatives.

The Larson Institute is the locus for transportation-related research conducted by Penn State faculty from more than 14 colleges and research centers. Many of these faculty hold joint appointments with the Institute and Penn State's academic colleges and schools; areas of specialization include civil, computer, electrical, industrial, and mechanical engineering as well as agriculture, information sciences and technology, supply chain management, architectural engineering, economics, geography, psychology, and statistics. Through its multidisciplinary structure and supportive research environment, the institute provides a unique focal point of collaboration for faculty from many different areas of the University.

The Institute's energies are directed toward solving problems in three major areas of transportation research: transportation operations; transportation infrastructure; and vehicle systems and safety. Students directly involved in the research, education and technology transfer activities at the Larson Institute represent aerospace, architectural, civil, electrical, industrial, mechanical, and nuclear engineering; engineering science and mechanics; materials science; geosciences; physics; psychology; education; supply chain management and business administration.

The Institute has conducted research projects for federal, state, municipal, and industrial sources, including the U.S. Department of Transportation (FHWA, FTA, NCHRP, SHRP, TCRP), U.S. Department of Energy, Department of Defense, National Science Foundation, Pennsylvania Department of Transportation, other state departments of transportation, the Center for Rural Pennsylvania, and a broad range of private-sector entities. The Institute has established an enviable track record of successful on-time delivery of high-quality research products to its public and private-sector sponsors. The Institute's active research contracts are valued at more than $40 million, with over $8 million in annual expenditures.

University of Maryland

The University of Maryland (UMD) became a partner in 2007 when MAUTC re-competed for the Region 3 University Transportation Center. Professor Elise Miller-Hooks serves as MAUTC director for UMD.

UNIVERSITY OF MARYLAND

The University of Maryland transportation research effort benefits from the Intelligent Transportation Systems Laboratories in the state-of-the-art Engineering Research Building. New laboratories for transportation research include:

- Real-time Traffic Management Systems Research and Education Laboratory
- Collaborative Decision-Making Laboratory for Large-Scale Distributed Dynamic Systems
- Traffic Safety and Operations Laboratory and
- Intelligent Transportation Systems Planning Laboratory.

Direct connections exist from the various cameras and sensors installed along the freeway and highway system under the Maryland CHART traffic management center to provide live quasi-continuous feeds to the ITS Laboratories. Access to all archived CHART traffic data is also available through the University of Maryland laboratories. The Collective Decision-Making Laboratory provides unique capability to conduct interactive simulation-based experiments with multi-agent transportation decision systems. The University of Maryland offers transportation-related undergraduate and graduate degrees in civil engineering and mechanical engineering.

University of Virginia

The transportation program at the University of Virginia (UVA) has expanded since its inception in the late 1940s when the University of Virginia School of Engineering and Applied Sciences began an ongoing partnership with Virginia Center for Transportation Innovation and Research (VCTIR), the research branch of the Virginia Department of Transportation. The Center for Transportation Studies (CTS) was established to organize the existing academic program and research activities and to lay the groundwork for future growth.

CTS is located within the civil engineering department on the grounds of UVA. With offices and laboratory facilities located on two floors, including the Smart Travel Labe, CTS also shares the resources, laboratories and library of the VCTIR facility, a 100-employee research complex at UVA. The academic and research programs of CTS are closely associated with VCTIR. Through this partnership, faculty hold joint appointments, VCTIR research scientists teach specialized courses, and graduate student work is supported through a Graduate Research Assistantship Program. The VCTIR also supports the Virginia Technology Transfer Center, the Smart Travel Lab, shared computational facilities, and the largest transportation library in the state of Virginia.

Today CTS oversees a flourishing program that includes education, research, and public service. Its faculty, which span the departments of civil engineering and systems and information engineering at the University, are highly regarded both as teachers and as researchers. They have been the recipients of University teaching awards and include two members of the National Academy of Engineering.

Thanks to the extensive longstanding ties with such organization as VCTIR, MAUTC, as well as the Federal Highway Administration and the Institute of Justice, CTS has a stable, flourishing research program, covering such areas as transportation and land use, traffic simulation, highway safety, freight operations, and traffic operations.

Virginia Polytechnic Institute and State University

The Virginia Tech Transportation Institute (VTTI) is an interdisciplinary, multidisciplinary, university research center of Virginia Tech. VTTI was established in August 1988 in response to the U.S. Department of Transportation's University Transportation Centers Program and in cooperation with the Virginia Department of Transportation (VDOT). VTTI pursues its mission by encouraging research, attracting a multidisciplinary core of researchers, and educating students in the latest transportation technologies through hands-on research and experience. In 1996, the Institute was designated as one of three Federal Highway Administration/Federal Transit Administration Intelligent Transportation Systems (FHWA/FTA ITS) Research Centers of Excellence. In 2005, due to VTTI's continued research leadership, the Institute was designated the National Surface Transportation Safety Center for Excellence (NSTSCE).

The Institute serves as Virginia Tech's largest university-level research center and is dedicated to conducting research to save lives, save time and save money in the transportation field by developing and using state-of-the-art tools, techniques, and technologies to solve transportation challenges. Its cutting-edge research is effecting significant change in public policies in the transportation domain on both the state and national levels.

VTTI's traditional laboratories are housed in two buildings totaling more than 52,000 square feet. Building 1 accommodates the Smart Road Control Center, where researchers monitor and control data collection, weather-generation, lighting, power grids, and roadway surveillance cameras; Building 2 features 22,000 square feet of office and laboratory space. VTTI's vehicle fleet includes 32 vehicles and tractor trailers, many of them uniquely instrumented for specific experiments. VTTI was built at the western end of the Virginia Smart Road, a 2.2-mile, two-lane road that serves as a unique, state-of-the-art, full-scale research facility for pavement research and evaluation of ITS concepts, technologies, and products. The Smart Road is the first facility of its kind to be built from the ground up with its infrastructure incorporated into the roadway. It features weather-making capabilities, a variable lighting test bed, pavement markings/visibility testing sections, on-site data acquisition and road weather information systems capabilities, and a signalized intersection.

The VTTI houses a number of centers. One of these centers is the Center for Sustainable Mobility (CSM) which is directing and managing the MAUTC program at VTTI. The CSM vision is to establish itself as a nationally- and internationally-recognized center in the area of sustainable transportation planning and management with emphasis on mobility, efficiency, energy, environment, and safety. The specific objectives of CSM is to conduct research and educate transportation engineers in the area of sustainable transportation mobility, which entails developing and managing transportation systems and technologies through their "life-cycle assessment" while at the same time reducing their carbon foot print. The CSM is multi-modal in nature and considers various ground modes of transportation including cars, trucks, buses, motorcycles, pedestrians, and rail modes.

The CSM has four groups that focus on four research themes, namely: transportation systems and operations, energy and Green House Gas (GHG) emissions, transportation system safety and driver behavior, and data mining and visualization. The transportation systems and operations theme focuses its research in the area of traffic flow theory, transportation system modeling, driver behavior modeling, traffic control and management, transportation safety, and transportation planning. The energy and environment theme conducts research on energy and environmental issues as they relate to the transportation sector including developing tools to assess the energy and environmental impacts of transportation systems, developing eco-routing systems, developing eco-driving systems, and developing eco-traffic signal control systems. The transportation system safety theme focuses on developing statistical tools to assess the system-wide safety impact of transportation system applications. The traffic data mining and visualization theme conducts research in the area of spatial databases, data mining, data warehousing, and geographic information systems as they relate to Intelligent Transportation Systems (ITS).

West Virginia University

The Staggers Center at West Virginia University (WVU) is a comprehensive transportation research institute that has served regional and national transportation research, education, and technology transfer needs since 1977. The center consists of multi-disciplinary faculty and staff members currently conducting nearly $2 million of research, education, and technology transfer activities. As part of a large university, the Center can bring the necessary expertise to bear on a wide range of contemporary transportation problems. The Staggers Center has five primary research areas:

- Highway Safety
- Transportation Planning and Economics
- Transportation Design and Operations
- Energy and Environmental Impacts and
- Public Transportation

Public service is one of the Center's primary missions in concert with WVU's role as the land grant institution for the state. The Center strives to ensure that benefits of research extend beyond the solving of technical problems. Through the technology transfer center, routine training sessions are held for transportation engineering and maintenance personnel. Faculty and researchers serve as technical and educational support to state agencies, legislature, municipalities, and private citizens. In addition, the research program provides the primary support for graduate students while they pursue their studies, a tremendous investment in the future of transportation engineering.

RESEARCH

Virginia Tech

Modeling Driver Car-following Behavior, Hesham Rakha

Car-following models characterize driver behavior along a roadway as they interact with vehicles ahead of them. Traditionally, car-following models have been both created and calibrated through the use of either loop detector data or vehicle trajectory data created from aerial photography and videography. The data collected from these sources have limitations both in the lack of information available about the drivers and in the length of the car-following events; limited to either instantaneous in the case of loop detector data, or as long as it takes a vehicle to progress across the field of view for an aerial trajectory data. Car-following models continue to become more sophisticated as traffic simulation software programs seek to produce more representative results compared to real-life driving behavior. It is important to probe both the limitations of the existing car-following models, and the limitations of the conventional data gathering techniques.

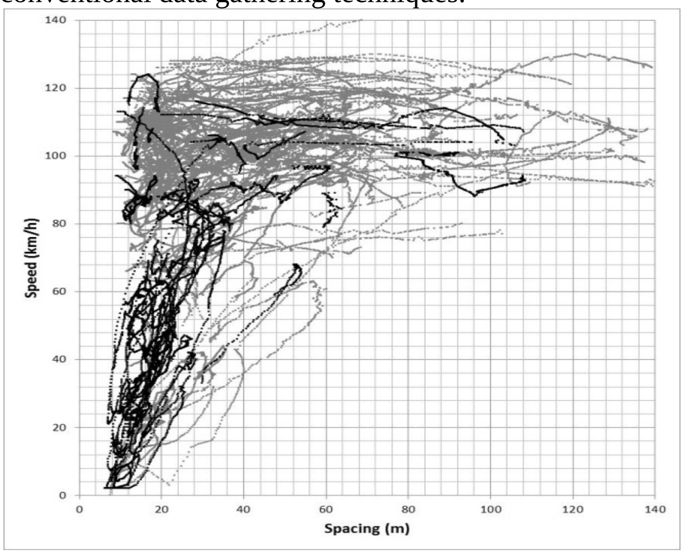


Figure 3: Sample Car-following Data from the 100-car Dataset

This research effort uses the 100-car naturalistic data in an attempt to model driver behavior. The 100-car Naturalistic Driving Study was conducted in the Northern Virginia area with the recording of nearly 43,000 hours of driving data. Initially collected to investigate crash and near-crash events, this study included instrumentation of vehicles to collect and store onboard vehicle diagnostics data, GPS location information, front and rear radar tracking of objects, and synchronized video feeds viewing both the inside and the outside of the vehicle. Additional information collected from drivers includes demographics and personality questionnaires.

The first step in the analysis entailed extracting car-following events from the entire dataset, as illustrated in Figure 3. The initial research investigation is intended to look at driver heterogeneity, both the variability of calibrated parameters between trips for a given driver, and the variability between drivers. Future research for this dataset may include the correlation of personality traits to model parameters, and the impact of the duration of a car-following event on the calibrated model parameters, with comparison to Next-Generation Simulation (NGSIM) data.

Agent-based Modeling of Driver Gap Acceptance Behavior, Hesham Rakha

Transportation engineers attempt to design highway networks to reduce the number of crashes and delay at the same time. Many artificial intelligence labs have suggested the use of fully driverless (autonomous) vehicles that have the capability of sensing the surrounding environment to enhance roadway safety. A driverless vehicle that drives in the traffic stream will have to do everything from obeying the speed limit to staying in its lane, detecting pedestrians, and choosing the best route. Consequently, the automated vehicles should be provided with video cameras, radar sensors, a laser range finder, and detailed maps to navigate the road ahead. The idea of having fully automated vehicles running in streets was inapplicable for many years until recently when a number of research centers succeeded in developing a fully automated vehicle (e.g., Google Driverless cars, October 2010). It is anticipated that in the future most vehicles will be fully automated; thus, the movements of those vehicles will need to be optimized in the network. This research attempts to focus on modeling driverless vehicles at intersections as autonomous agents. The vehicle movements inside the intersections will be optimized using game theory algorithms in order to minimize delay and/or fuel consumption levels.

There are a growing number of agent-based applications in a variety of fields and many transportation systems, including decision support systems, dynamic routing, congestion management, and intelligent traffic control. The use of agents of many different kinds in a variety of fields of computer science and artificial intelligence is increasing rapidly due to their wide applicability. Agent-based modeling (ABM) (or multi-agent modeling) has emerged as a modeling algorithm for modeling complex systems composed of interacting and autonomous units (i.e., driverless vehicles). Agents have behaviors, often described by simple rules, and interact with other agents, which in turn influence their behaviors. The level of an agent's intelligence could vary from having pre-determined roles and responsibilities to a learning entity. Consequently, agent-based modeling will help to maximize the efficiency of moving vehicles through intersections. It is assumed that intersections could be equipped with a dedicated wireless communication system and a protocol for communicating and giving permission to vehicles to pass. In the proposed system, vehicles must traverse intersections according to a set of parameters agreed upon by the vehicle and the intersection controller (decision maker). The vehicle movements through the intersection will be constrained by the vehicles' physical characteristics and weather conditions. The decision of passing or not for each vehicle will be given by the manager (controller) of the intersection based on a game theory algorithm.

A game is simply defined as a conflict in interest among individuals or groups (players). There exists a set of rules that define the terms of exchange of information, the conditions under which the game begins, and the possible legal exchanges in particular conditions. Game theory has been applied in many engineering, economics and biological fields. However, the decision making for driverless vehicle movements at intersections using game theory is considered an innovative idea in the transportation engineering arena. The game theory algorithm of this research is presented as a multi-objective function seeking delay minimization and/ or reducing fuel consumption. The decision maker – intersection manager – is modeled as a player trying to maximize the total benefit (delay and/or fuel consumption) for the entire intersection by giving the appropriate decision (passing or not) to each vehicle. As part of this effort the team has developed a heuristic optimization algorithm for driverless vehicles at un-signalized intersections using a multi-agent system. The proposed system models the driverless vehicles as autonomous agents controlled by the intersection controller (manager agent). The input information of the system consists of vehicles' current location, speed and acceleration in addition to the surrounding environment (weather, intersection characteristics, etc.), as illustrated in 4. The intersection

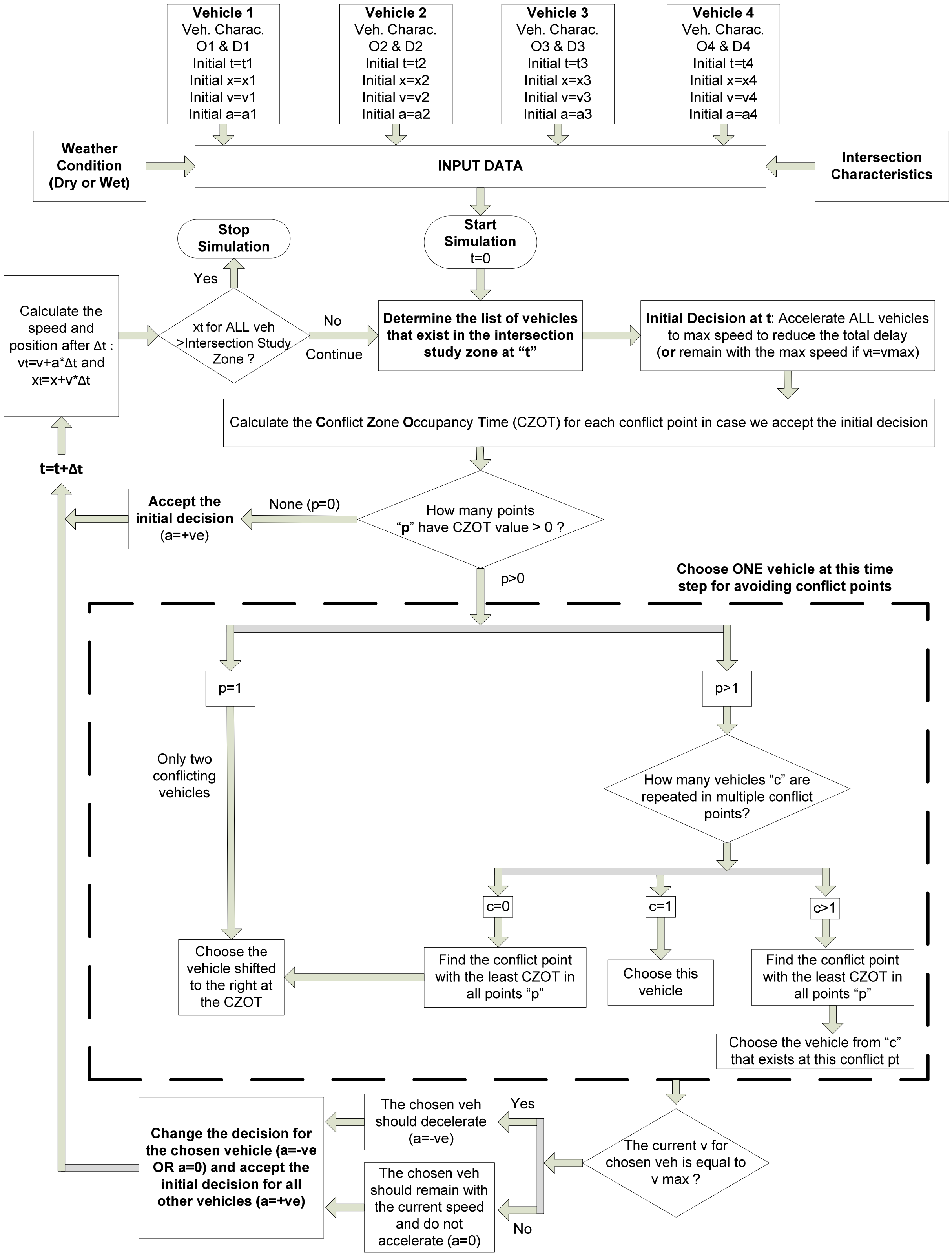


Figure 4: Framework of Proposed Driverless Intersection Control System

controller processes the input information using a built-in simulator, “OSDI” (Optimization Simulator for Driverless vehicles at Intersections). The simulator objective is to optimize the movements of vehicles to reduce the total delay time for the entire intersection and prevent crashes simultaneously. Consequently, the intersection controller uses the simulator output for controlling the speed profile of the driverless vehicles within the intersection study zone. The proposed system is compared to two different intersection control scenarios: an all-way stop control (AWSC) and an intersection manager with built-in OSDI. For both scenarios, it is assumed that there are four driverless vehicles (one vehicle per approach) willing to cross a four-legged un-signalized intersection concurrently. The results, using Monte Carlo simulation, show that the proposed system reduces the total delay by 35 seconds on average compared to traditional AWSC. This research is considered as a first step in developing an unmanned vehicle technology OSDI system.

Tools to Support Greenhouse Gas Emissions Reduction - A Regional Effort, Hesham Rakha and Elise Miller-Hooks

The U.S. transportation sector is one of the largest contributors of greenhouse gases (GHG) emissions, accounting for almost 28 percent of national emissions. Growing awareness of the impact of anthropogenic GHG emissions and climate change has brought critical attention towards developing strategies to identify their sources and estimate and reduce their magnitude. These strategies include establishing emissions reduction policies and methods of policy implementation. However, it is the availability of specific tools that holds a significant and unique potential to support emissions reduction in the transportation sector.

Researchers from the University of Maryland and Virginia Tech, with support from the Mid-Atlantic Universities Transportation Center, Maryland State Highway Administration and NAVTEQ, are engaged in a regional effort to develop tools to support GHG emissions reduction in transportation globally. Their work seeks to bridge gaps in emission analysis and adopts a comprehensive approach to developing these emissions reduction support tools.

To help support emissions reductions in the U.S. from on-road vehicles, such as cars, motorcycles, light and heavy trucks, and buses, the project team developed the Virginia Tech Comprehensive Power-based Fuel Model (VT-CPFM), a model to help quantify the fuel consumption levels of vehicles, and develop in-vehicle technologies to reduce a vehicle’s fuel consumption level. The VT-CPFM was developed to overcome two significant deficiencies in current fuel consumption models. First, the model produces a control system that does not result in bang-bang control. Second, the model can be easily calibrated using publicly available data without the need for field data collection.

To address the impact of roadway grades on vehicle fuel consumption and CO_2 emission rates, the VT-CPFM was used to develop a predictive eco-cruise system. This predictive eco-cruise control system minimizes vehicle fuel consumption levels utilizing roadway topographic information. The predictive eco-cruise control system consists of three components: a fuel consumption model, a powertrain model, and an optimization algorithm, as illustrated in Figure 5. The developed system generates an optimal vehicle control plan using roadway grade information to vary the vehicle speed within a preset speed window in a fuel-saving manner. The developed system was tested by simulating a vehicle trip on both real and synthetic roadway profiles and comparing this to conventional cruise control system performance using ten top-selling vehicles. Fuel savings relative to a conventional cruise control system is in the range of 30 to 60 percent. This corresponds to approximately a 6.9 percent reduction in the total U.S. oil consumption, assuming a daily consumption of 20 million barrels.

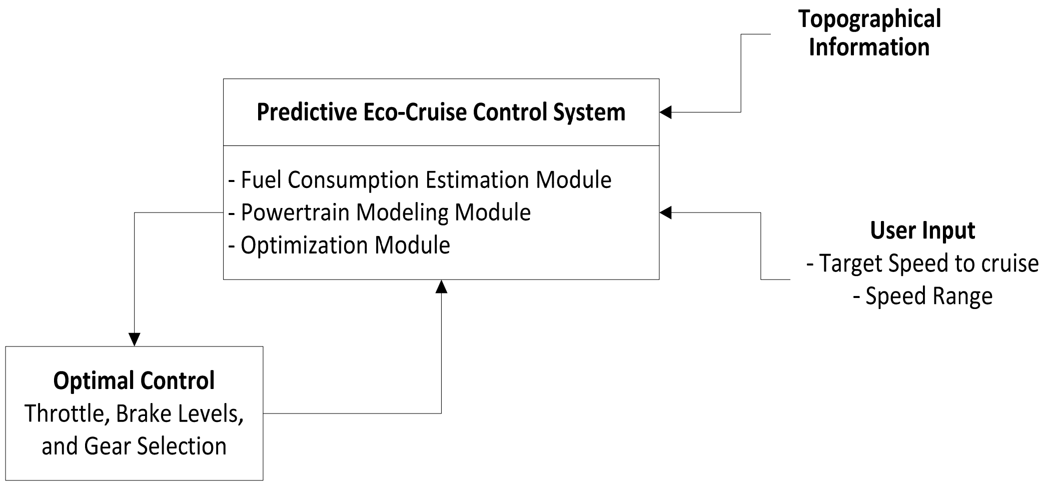


Figure 5: Conceptual Diagram of Proposed Eco-cruise Control System

Additionally, eco-routing algorithms are being developed. Routing strategies produced by these algorithms were assessed using a stochastic, multi-class, dynamic traffic assignment and simulation framework. It was found that a savings in fuel consumption of approximately 15 percent was achieved.

Determinants of Bicycle Use in the Washington Metropolitan Area, Ralph Buehler

Governments in the United States promote cycling as a healthy and sustainable mode of transport. For the last 20 years, cycling levels have been increasing in U.S. cities. Cycling levels and growth in bike use vary widely across jurisdictions and neighborhoods. This project documents cycling trends and policies in Washington, D.C. and adjacent inner ring jurisdictions. The goal is to gain a better understanding of determinants of bicycle use in a bike-friendly metropolitan area. Data for this analysis originate from the Metropolitan Washington Council of Government household travel surveys (1994 and 2008), the U.S. Census (1990 and 2000), the American Community Survey (2009), and information provided by local jurisdictions.

There is significant variability in cycling levels in the Washington D.C. area. The share of trips by bicycle ranges from 0.3% and 0.4% in suburban Fairfax and Prince George's County to 1.5% and 1.1% in the cities of Washington D.C. and Alexandria. With the exception of Fairfax County, all jurisdictions witnessed growth in cycling levels over the last 20 years. Cycling levels almost doubled in Alexandria—from 0.6% of all trips in 1994 to 1.1% of all trips in 2008. Cycling also increased in Washington (1.3% to 1.5%), Arlington (0.5% to 0.8%), and the counties of Montgomery (0.4% to 0.6%) and Prince George's (0.2% to 0.4%). The share of trips by bike declined slightly in Fairfax County (0.5% to 0.3%). Compared to the national average, cyclists in Washington, D.C. are more likely female (33% in D.C. vs. 25% nationally), between 25 and 64 years old (67% vs. 46%), in the highest income quartile (41% vs. 26%), and white (88% vs. 82%). Moreover, 41% of bike trips in the Washington, D.C. area are for the commute compared to 17% nationwide. Given the commute orientation of cycling in D.C., the share of regular bike commuters is higher than the share of all trips by bike. Fairfax and Prince George's counties have the lowest share of regular bike commuters (0.5% and 0.6%), while Alexandria and Washington, D.C. have the highest share of cyclists among commuters (2.7% and 3.3%).

Similar to cycling levels, the supply of bike infrastructure (e.g., bike lanes, paths, bike lockers) varies widely across jurisdictions. Initial results of three sets of logistic regressions estimating (1) the likelihood to cycle at least once during a week, (2) cycling daily, and (3) regularly commuting to work by bicycle indicate that 25- to 40-year-olds, whites, men, those in households with fewer cars and more bikes, and those living in urban clusters and close to bike lanes are more likely to cycle. Trips are more likely made by bike for distances shorter than 2 miles and for the commute. Commuters are more likely to cycle to work if their work place provides showers, secure bike parking, and changing rooms with lockers for clothes.

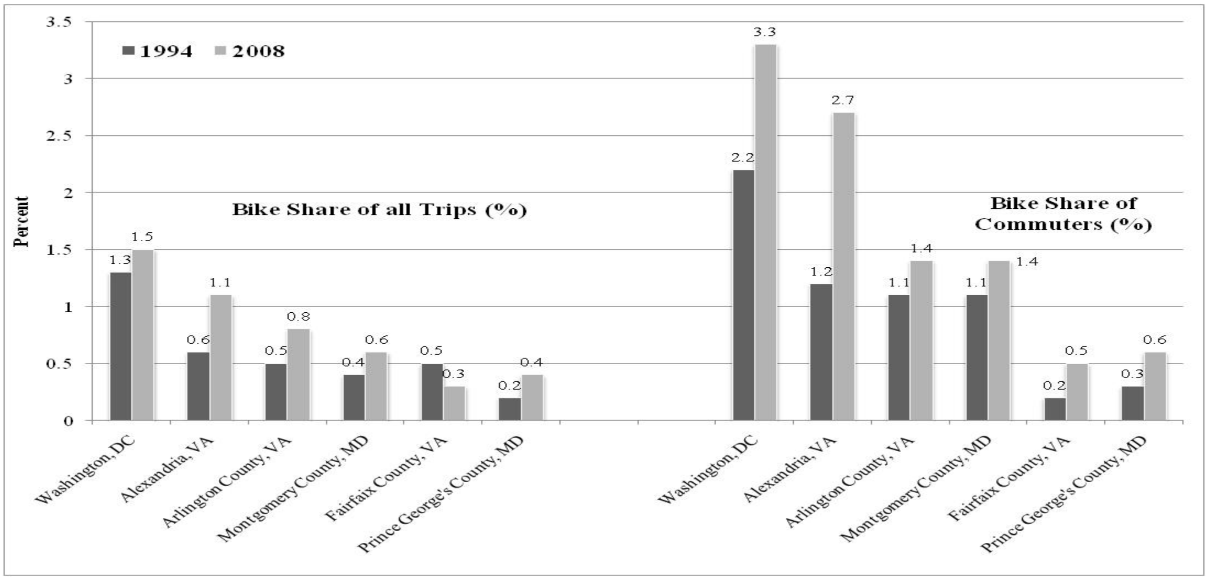


Figure 6: Trend in bicycle share of all trips and bicycle share of regular commuters in Washington, D.C. and adjacent jurisdictions, 1994-2008 (Source: MWCOG Travel Surveys 1994 and 2008)

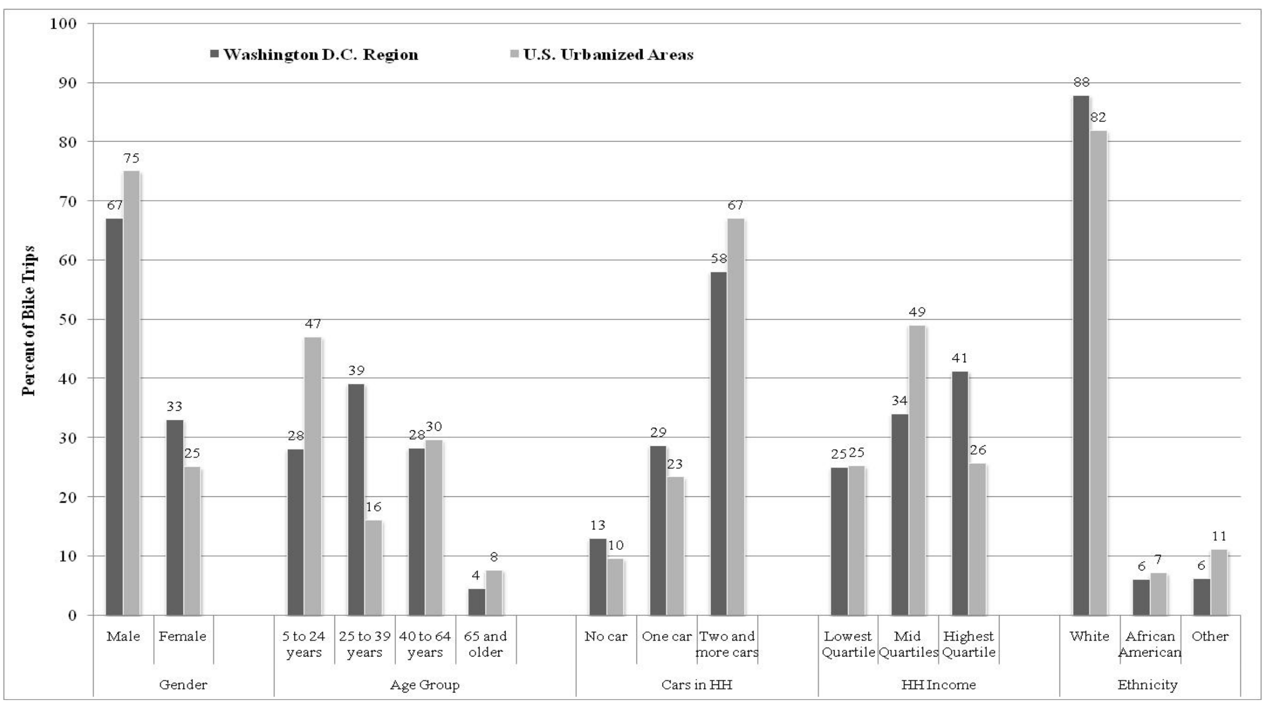


Figure 7: Share of bike trips by sociodemographic indicators in the Washington, D.C. region compared to the U.S. national averages for urbanized areas, 2008/2009 (Source: MWCOG Travel Survey 2008 and NHTS 2009)

Congestion-based Emergency Vehicle Preemption Technique

Emergency Vehicle Preemption (EVP) has been enabling faster emergency response in communities until congestion and gridlock prevent emergency vehicles from reaching the preemptive detection range at equipped signalized intersections. This condition prevents movement of non-emergency vehicles, which would otherwise move from the right of way allowing emergency vehicles to proceed. Limited research has been done on the use of intelligent preemption control, which has the ability to use real-time traffic information to minimize emergency vehicle delays. The control technique employed in this study uses vehicular queue-based offsets to adjust preemption time at downstream intersections along a response route. Use of microscopic simulation has shown potential reduction in delays approaching 13 percent with respect to traditional preemption techniques during peak-hours on an urban corridor.

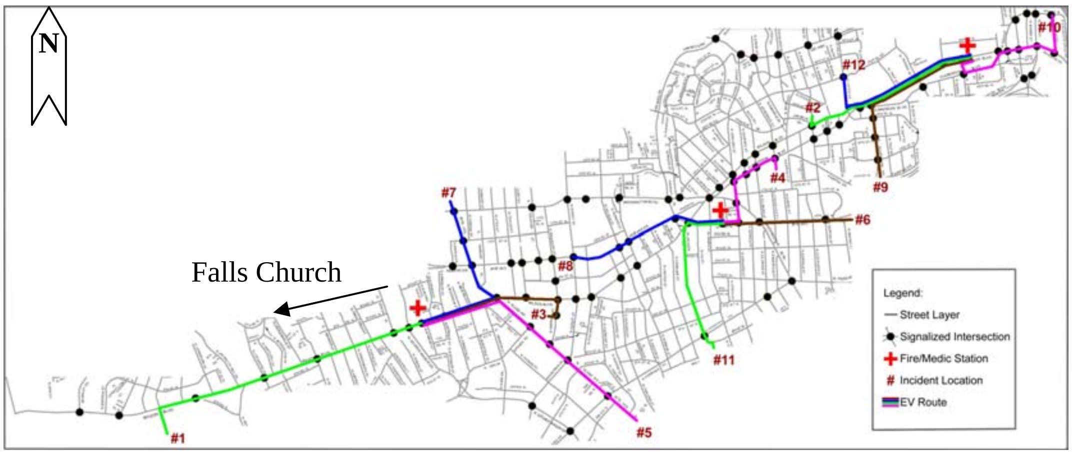


Figure 8: Simulation Network (Arlington, VA) showing incident locations and dispatch stations.

Real-time Estimation of Origin-Destination Matrices for I-66

Dynamic origin-destination (OD) matrices are essential inputs for Advanced Traffic Information and Management Systems. Accurate estimates of time-varying OD demands can greatly enhance on-line traffic management systems in terms of operational efficiency, especially for use in management strategies based on Dynamic Traffic Assignment (DTA). Inductive loop detectors provide one source of real-time traffic data that can be used to estimate OD matrices; however, detectors malfunction on occasion. In the first phase of estimating OD matrices, we explored four temporal and spatial correction procedures to impute the flows for different combinations of malfunctioned detectors under non-incident conditions. We used detector data from I-66 as our test bed.

Among the four procedures, a new spatial approach and a modified version of another were proposed. The proposed method incorporates lane use percentages through kernel regression (KR). The modified spatial approach exploits the relationship between individual detector flow and station flow using linear regression (LR). The other two approaches are temporal correction (TC) and lane distribution correction (LD) (proposed by Smith and Conklin, 2002). To comprehensively compare the correction procedures, systematic and random-error evaluations were conducted. The results of the systematic evaluation suggest that temporal correction provides superior performance and the linear regression approach is of competitive performance. The results of the random-error evaluation indicate that the temporal correction procedure performs better at all error levels and the spatial approaches may produce inaccurate results under light traffic conditions, especially when the estimates are based on zero flow readings.

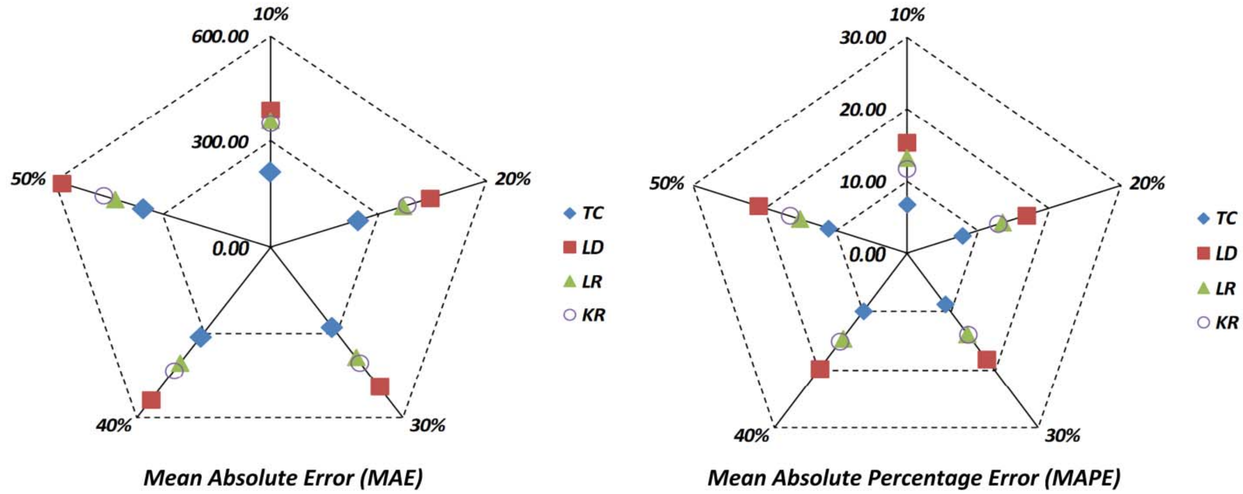


Figure 9: Comparison between Correction Methods under Random Error Scenarios

The results of the study are for a specific detector station that has five lanes, one of which is an exit lane. This configuration is different from numerous previous studies and may have a significant impact on the performance of the spatial correction procedures. The choice of correction procedures should be determined from multiple aspects. First, correction methods need to be calibrated according to location-specific characteristics. Second, the error types and magnitudes associated with the dataset should be considered. Finally, the traffic conditions should be taken into consideration.

The second phase used the data set corrected with the temporal technique and the Box-Jenkins auto-regressive integrated moving average time-series framework to model station flow series. We developed a MA(2) model that produced a mean absolute percentage error of 7%, but different models are required for each station and time period. However, once the models are fitted, they can be used to forecast hourly traffic flows.

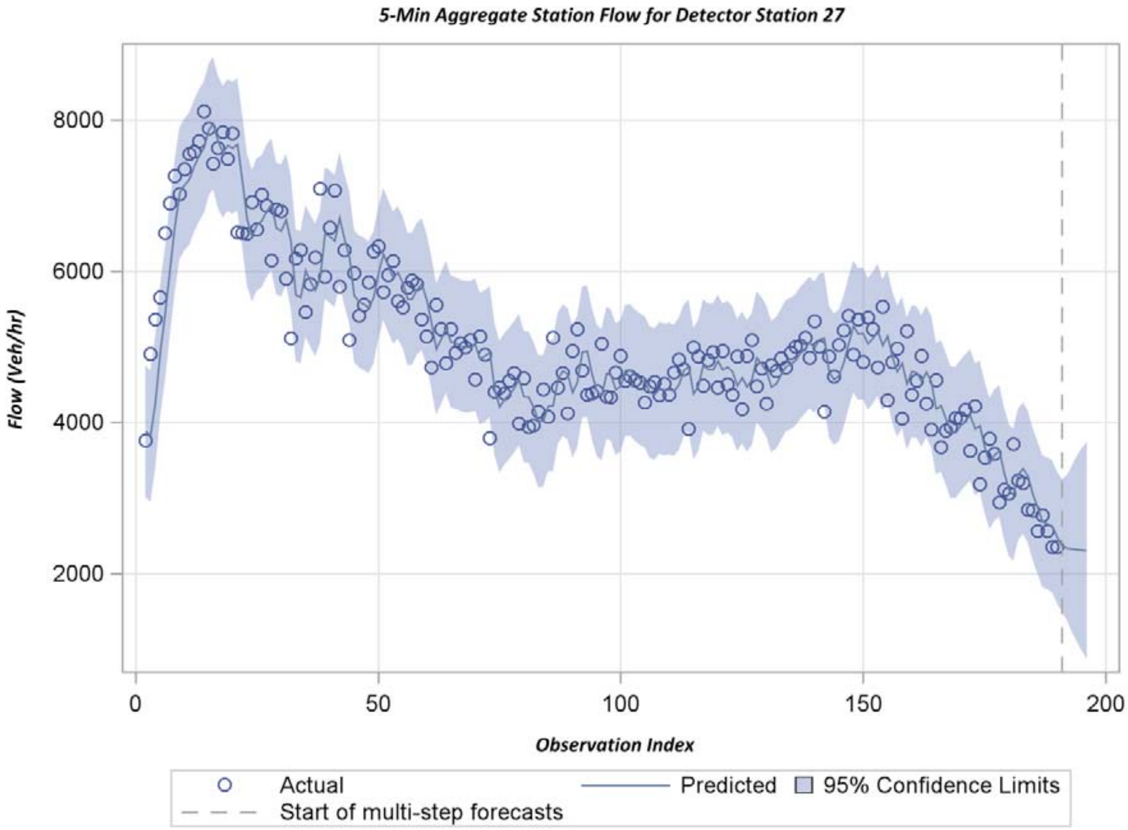


Figure 10: Forecast of the MA(2) Model

In the third phase, we used the traffic flows modeled by the Box-Jenkins technique in combination with QueensOD to develop dynamic OD matrices. Generally, the relative errors (MAPE) are around 10% with a few higher exceptions (see Figure 11).

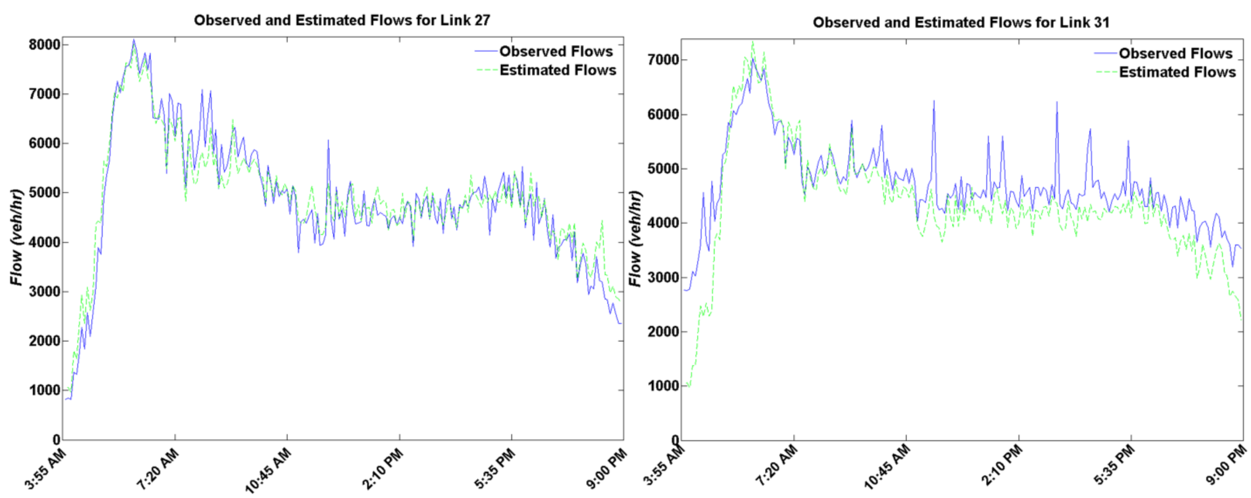


Figure 11: Comparison between Estimated Flows and Observed Flows

Reference: Smith, B., & Conklin, J. (2002). Use of local lane distribution patterns to estimate missing data values from traffic monitoring systems. *Transportation Research Record, 1811*, 50-56.

West Virginia University

Fog detection Equipment for Interstate and State Highways, David Martinelli

Sudden reduction in visibility in highways due to fog, smoke and rain often lead to increased crash levels (Abdel Aty et al., 2010). The effect of fog on driver safety and crashes has been heavily studied in the United Kingdom. Moore and Cooper, 1972, found that even though traffic is reduced by 20 percent under foggy conditions, the total number of crashes leading to injuries increased by 16 percent. Crashes occurring under foggy conditions frequently involve multiple vehicles (Summer et al., 1977). A classic example of this was the multi-vehicle accident that occurred on Interstate 68 near Big Savage Mountain in May 2003 (SWA, 2003).

Figure 12: Multi-car Accident on I-68

Driving conditions and visibility can deteriorate extremely rapidly under fog instances. Fog detection systems help identify conditions of limited visibility and forewarn the drivers before they encounter the fog. Active fog detection systems, such as using sensors to collect information about weather, visibility and traffic conditions, can be used in combination with simple motorist warning systems such as signs warning motorists that the freeway section is susceptible to heavy fog or advanced ITS systems such as Dynamic Message Signs which provide warning messages or advisory information on recommended speeds. In addition, there are several passive systems which help warn and delineate traffic, such as delineators, reflectors, striping, etc.

Active and passive fog detection and warning systems have been deployed in various states across the country. They vary significantly in terms of sophistication, deployment, and cost. For example, the fog detection system in St. Albans, W.Va., costs less than $100,000, whereas the fog detection system deployed in Mobile, Ala., costs $6.5 million (SWA, 2003). There have been a number of fog detection and warning systems deployed in recent times. It is crucial to identify the correct system in order to minimize driver injuries due to fog-related crashes.

Researchers at West Virginia University are conducting a detailed literature review to identify active and passive systems or products used for fog detection and with motorist warning systems. Several systems have been deployed in the United States. A list of possible products or systems that may be suitable for the State of West Virginia will be compiled based on the results of the literature review.

Figure 13: Fog Conditions

The study will also summarize the components and factors that cause the development of fog such as moisture, dew points range, etc. Discussion with the National Weather Service and other groups will take place early to develop parameters and to determine what fog-predicting information or warning systems are available. Researchers will also investigate which parameters are used by other agencies (such as the U.S. Army

Corps of Engineers) to see what programs and considerations they use in incorporating fog in their processes. The analysis of fog will be evaluated also to see if it is ever considered in the environmental approval process and route determination for projects. The work will also identify critical fog-prone areas in West Virginia.

The scope of the work involves the following:

- Determine the elements that develop fog. Contact other agencies (USACE, National Weather Service, etc.) to learn what models they use for prediction and warning.
- Complete a literature search of the subject and determine what other state DOTs do concerning the problem. The first part of the literature search will be to determine what process West Virginia currently uses in evaluating fog potential areas.
- Develop a best management practices sheet for where to install active or passive fog detection or delineation systems.
- Analyze relevancy of what's being done in other states to West Virginia.
- Present relevant data on types of fogs prevalent in West Virginia and fog-prone areas.
- Evaluate the potential for fog detection systems as a component to the ITS.
- Conduct a benefit-cost analysis.
- Summarize the findings of the research in a report.

Analysis of Graduated Driver Licensing Program in West Virginia

The purpose of this research is to determine the effectiveness of the Graduated Driver Licensing (GDL) program in West Virginia towards improving the safety of younger drivers. GDL aims to reduce teen driver crashes by gradually exposing them to regular driving risks in a staged manner. According to the Insurance Institute for Highway Safety (IIHS), an optimal GDL system involves three stages: (1) Learner, (2) Intermediate, and (3) Full Privilege. During the learner period, driving is conducted with minimum supervision. In the intermediate stage, supervised driving is conducted for "high-risk" situations. A driver's license with full privileges is made available after successful completion of the first two stages. The move towards the GDL began in the United States in the 1990s and currently all states have some form of the three-stage GDL system (IIHS, 2010).

To date, several research efforts have focused on determining the impact of GDL on reducing teenage crashes and fatalities (Mandic and Ridgeway, 2010; McKnight et al., 2002; Morissey et al., 2006). Several studies have focused on correlating the level of strictness of the policies with the reduction in teenage crash involvement. However, different states have adopted different policies corresponding to varying level of strictness of the GDL policies. There is a limited number of studies focusing on the perspective, knowledge and opinion of high school students, parents of high school students, and police officers on GDL policy. There has been no such study conducted for the State of West Virginia.

Figure 14: Teenage Driver

A detailed literature review of past studies on the impact of GDL will be conducted to clearly ascertain the benefits of the program and to critically review past research affecting the safety of younger drivers. A clear explanation of the details associated with West Virginia's GDL program will be developed. A survey of high school students, police officers, and parents will be conducted to understand how well

West Virginia's GDL policy is understood, complied with, and enforced. Researchers will also look at enforcement used in others states.

An Evaluation of School Zone Traffic Control Strategies

The objective of this proposal is to analyze traffic safety and congestion problems in school zones in West Virginia, review current warrants and laws in West Virginia and other states relevant to school zones, and conduct traffic engineering studies to evaluate the effectiveness of traffic management strategies.

Fewer school-age children walk or bike to school today than in the past. Parents are predisposed to drive their children to school due to many factors, including distance from home and unsafe travel environments. Arrival and departure practices at some schools consist of parents dropping off or picking up students at the same time school buses are attempting to use the same access facilities. This situation can be further complicated by school-age pedestrians and young bicycle riders trying to cross through this setting using the same roadways, driveways, and parking lots. The collective traffic pattern is more complex and vulnerable than standard intersections and roadways of equal traffic volume.

Traffic control in school zones and approaching school zones, sometimes requested by parents, teachers, and other citizens, may be unnecessary and costly and may tend to lessen the respect for controls that are warranted. Further, speed limits at school zones may not adequately incorporate the many access features that may vary from school to school. For example, as small schools consolidate to larger ones, they are often located off of high-speed highways, creating a type of traffic problem not captured by the existing school zone warrants and guidelines.

Figure 15: School Zone Area

The researchers will look at some of the policies in place and where they might not be keeping up with development trends. Congestion reduction is not a primary mission of schools, and there is no larger policy framework to motivate change or site schools in ways that make alternative modes of transportation feasible. The lack of disincentives for driving, such as regulating drop-offs at K-8 schools or charging and managing parking at high schools, may limit the potential of trip reduction programs.

The research team will:

- Conduct an assessment of the traffic safety and efficiency problem around schools in W.Va.
- Conduct a comprehensive literature review.
- Select school zones for conducting traffic engineering studies and identify a set of traffic management solutions.
- Analyze the results of speed studies conducted by the WVDOH on select school zone locations.
- Make recommendation regarding guidelines and policies relevant to school zones and summarize the study results in a final report.

University of Maryland

Market Segmentation in Railway Revenue Optimization Problems, Cinzia Cirillo

The railway is considered the most energy-efficient mode of transportation, and its role is becoming increasingly important around the world with ever growing concerns about the global energy crisis and climate change. Implementing a Revenue Management (RM) strategy for railway is expected to contribute to a significant lessening of this environmental burden by making better use of existing railway infrastructure. The attempt toward a better understanding of passenger behavior in the RM environment has produced a new research area. Choice based RM offers the possibility to incorporate a behavioral framework into RM modeling systems.

In the context of behavioral models for RM, we propose advanced discrete choice models for variable pricing strategies. The analysis is based on ticket reservation; these data are readily available from ticket sales but do not contain any socio-economic information. In order to overcome this limitation, advanced modeling techniques are developed and implemented. The empirical analysis shows that the proposed demand modeling approaches can be successfully applied to recover random heterogeneity when limited socio-demographic information is available. The results on passenger choice behavior can be used to support revenue management policy such as fare pricing optimization.

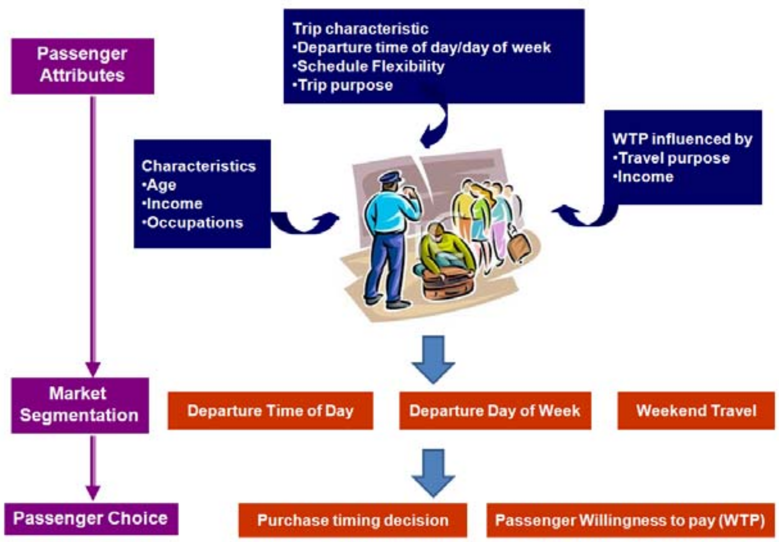


Figure 16: Revenue Optimization Considerations

Innovative Data Collection and Modeling Methods for Long-Distance Passenger Travel Demand Analysis, Lei Zhang

The lack of a capable long-distance passenger travel analysis tool in the U.S. is in sharp contrast with important emerging needs for analyzing various national transportation policies related to long-distance passenger travel. Previous studies have identified two major issues with the development of long-distance passenger travel analysis tools in the U.S.: (1) Lack of recent data and high data collection cost; and (2) Lack of information on the cost-effectiveness of various methodological options. The objective of this proposed research project is to explore innovative data collection and modeling methods for long-distance passenger travel analysis. These methods have not been extensively studied or even considered in previous research, but have the potential to advance the state of the art and the state of the practice on long-distance passenger travel analysis.

In this research project, we explore the feasibility of developing travel data collection applications based on GPS-enable smart-phones. This method offers several important advantages for long- (and short-) distance travel data collection. First of all, it does not require stand-alone GPS data loggers or data communication devices, and therefore significantly reduces cost and simplifies subject recruitment. Second, the data collection tool can be seamlessly integrated into smart phone operations through software applications without requiring direct communications between data collectors and the subjects. Third, the smart phone applications can also serve as an input channel through which subjects, motivated by certain incentives (e.g. monetary rewards, valuable information), may provide travel information not automatically supplied by the GPS positioning system. Successful utilization of GPS-based data also relies on efficient data post-processing methods that produce information such as activity locations, travel routes, trip length, trip start and end times, trip purpose, and travel mode. Therefore, this research will also develop data post-processing methods based on GPS raw data, GIS land use data, and machine learning algorithms.

Figure 17: Raw Travel Data Recording for a Sample Long Distance Trip

Risk Mapping and Other Tools for Securing Public Transit Systems, Elise Miller-Hooks

A mixed-integer, multi-stage program was developed that seeks to effectively secure a transit system where risk is considered to be dynamic and varies over time. A time-varying risk measure reflects the unique nature of transit systems, where accumulation of passengers at transfer facilities, stations and transit vehicles increases the vulnerability of transit users and system in the face of adverse events. Accumulation of passengers at stations can be caused by operational characteristics, service network topology, delays, and capacity limitations. A risk map is created that visually presents the time-varying risk of transit assets that allows transit operators to respond to fluctuations by repositioning security assets to better match current and anticipated conditions. The optimization model uses the risk measure to generate distribution plans to maximize covered risk. The volume-dependent risk measure and subsequent deployment of security assets are developed for the transit system in Washington, D.C., demonstrating the variable nature of risk under five scenarios. These scenarios, designed on past events, replicate the operational conditions of the transit system for the morning rush hour period and show the improvements in security coverage through deployment of assets.

The Pennsylvania State University

Large Scale Evacuation Transportation Systems: Robust Models and Real Time Operations, Tao Yao

Large-scale transportation systems are critical elements in emergency evacuation management. Recent developments in new technology, i.e., information and communication technology, and social science, i.e., new paradigms for modeling social behavior, have brought new opportunities and challenges to planning and operating a large-scale transportation system. In particular, the increasing complexity and uncertainty of such transportation systems heighten the need for tractable optimization methods and for complicated real-time decision support tools to manage potential extreme events.

This project will improve the understanding of evacuation transportation management, producing results that will be translated into educational materials that cover broad fields including transportation engineering, emergency management, social science, and operations research.

Evaluation of the Use of Registration Stickers, Philip Garvey

The issuance of motor vehicle license plate registration stickers is a costly and potentially flawed component of the vehicle registration renewal process. The Commonwealth of Pennsylvania currently maintains an inventory of approximately 30 million such stickers. Widespread reporting of sticker theft, especially in larger metropolitan areas, led to the Philadelphia Vehicle Registration Sticker Pilot Program, which was an attempt to address so called "plate clipping" where the corner of the plate containing the sticker is cut off and plate theft. This problem occurs in many states.

Researchers evaluated the potential costs and benefits, financial and law-enforcement related, of doing away with license plate registration stickers as part of the registration renewal process for Pennsylvania. A comprehensive literature review, a survey of U.S. and Canadian licensing agencies, a cost/benefit analysis of eliminating license plate stickers, and an assessment of related law enforcement issues and public information and education (PI&E) campaigns conducted by other agencies that have stopped using license plate registration stickers was conducted. The research resulted in a set of options and recommendations for Pennsylvania and an evaluation plan. The recommendations favored elimination of a sticker registration program based on simplicity, cost savings, elimination of potential sticker theft, and positive reports from similarly adapted programs.

Using Coal Fly Ash and Recycled Glass in Developing Green Concrete Materials, Farshad Rajabipour

The environmental impact of Portland cement concrete production has motivated researchers and the construction industry to evaluate alternative technologies for incorporating recycled cementing materials and recycled aggregates in concrete such as pulverized glass as sand or pozzolan. There is an abundance of recycled glass bottles that may be used as an additive to Portland cement along with fly ash to develop durable and environmentally positive concretes than can be used for various transportation applications.

In this project, recycled glass will be used as aggregate and several types of coal fly ash will be used to replace up to 50 percent of Portland cement in concrete. The advantage of using fly ash in concrete mitigates the deleterious alkali-silica reaction (ASR) which causes water absorption, swelling, and cracking in the concrete.

Researchers will investigate the mechanism of ASR mitigation by fly ash to optimize the use of fly ash without negatively affecting the strength and durability of concrete. The results will then be used in developing mixture proportions for concretes containing recycled glass sand that have desirable strength, workability, and durability.

Development of Guidelines for Use of High Percent Reclaimed Asphalt Pavement (RAP) in Warm Mix Asphalt, Mansour Solaimanian

Since its introduction to the United States in early 2000, warm mix asphalt (WMA) has been rapidly gaining popularity. Several states have implemented this technology for a number of their construction projects in lieu of hot mix asphalt (HMA) within the last several years. WMA is friendlier to the environment compared to HMA and is in accordance with green highway initiatives. WMA reduces energy consumption and emissions and can extend the construction season for cold regions due to placing and compacting the mix at a lower temperature.

Parallel to the success of WMA is the success of using recycled asphalt materials (RAP) in pavement construction thereby reducing costs and increasing environmental benefits. Typically, up to 15 percent of RAP is used in asphalt construction.

This research focuses on evaluating the feasibility of using high RAP content in WMA and determining engineering properties and performance of WMA pavements containing a high percentage of RAP. Guidelines and draft specifications for use of high percentage RAP in WAM will be developed.

Evaluation of Special Surface Treatment Using Accelerated Testing, Angelica Palomino

The objective of this study was to evaluate the affect of a specialty polymer-modified cement coating on aging and performance characteristics of asphalt binder and asphalt concrete through laboratory investigation. Asphalt binder is a critical component of asphalt concrete, which is used to construct asphalt pavements (roadways). The coating material is a relatively new ultra thin surfacing system for asphalt pavements. This coating was designed to extend pavement life by providing an ultra thin protective coating, which is believed to simultaneously seal existing cracks, provide a protective barrier against tire wear and chemical attack, reduce aging due to ultraviolet (UV) light exposure, and reduce temperature fluctuations in the underlying asphalt.

This work included a limited literature review and controlled laboratory testing of a series of asphalt binder and concrete specimens with and without the polymer-modified cement coating. The laboratory testing required preparation and testing materials at different aging levels. Aging was achieved through three techniques: heat, pressure and UV exposure. The heat and pressure techniques are traditional methods for aging asphalt materials, while UV aging is a non-standard aging technique. A UV chamber was specially designed and constructed for this project. The mechanical testing completed for asphalt concrete was with the Model Mobile Load Simulator (MMLS3) on the coated and uncoated pavement slabs. The MMLS3 applies repeated simulated traffic loads using a tracked wheel system.

The results of this study show that (1) the coating significantly reduced the level of aging induced through the pressure technique, (2) no significant difference was found in stiffness between the asphalt binders aged under UV for 14 days versus those aged under UV for 28 days, (3) no significant difference was found in the binder stiffness for the same levels of UV aging between coated and uncoated binders, and (4) the coating appears to reduce the overall rutting when applied to an asphalt concrete slab for the same number of MMLS3 traffic load cycles. One important insight gained in this study is that the time periods for UV aging used in this study (maximum of 28 days) were inadequate to produce measurable aging effects.

EDUCATION

The five universities comprising MAUTC offer more than 50 transportation-related graduate degree programs ranging from civil engineering to systems engineering to supply chain and information systems. In academic year 2010/2011, there were 91 students enrolled in transportation-related master's programs and 105 students enrolled in transportation-related doctoral programs. Most of these students , along with 82 undergraduate students, participated in transportation research activities, which enrich their classroom experience.

MAUTC Student of the Year

Figure 18: Ahmed Amer

Ahmed Amer is a Ph.D. candidate at the Charles E. Via, Jr. Department of Civil and Environmental Engineering, Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, and also a Graduate Research Assistant with the Center for Sustainable Mobility, Virginia Tech Transportation Institute. Mr. Amer has been receiving financial support from the MAUTC program since his enrollment in January 2007. Since then, he completed his required coursework successfully with a cumulative GPA of 4.0. Mr. Amer is working on modeling driver behavior at signalized intersections for the development of safe and efficient traffic signal timings under the supervision of Professor Hesham Rakha. As part of his research, he conducted a large data collection experiment on the Virginia Smart Road, where he led a team of ten research assistants to conduct experiments on 30 test subjects over a six month period. This study involved 180 two-hour driving sessions. He has four peer-reviewed papers published and another two papers accepted for presentation/publication.

Mr. Amer received his B.S. (with honors) and his M.S. degrees in civil engineering from Cairo University, Egypt, in 2001 and 2006, respectively. During his academic career, Mr. Amer won several awards and prizes for his outstanding academic and research performance. He is also an active member of the Alliance of Transportation Engineering Students (ATES) at Virginia Tech, in addition to serving as the Treasurer of an Egyptian Student Organization at Virginia Tech (Egypt Friends).

TECHNOLOGY TRANSFER

Transportation Engineering and Safety Conference

Penn State's 16th Annual Transportation Engineering and Safety Conference offered 29 sessions in four broad areas: safety, operations, design and planning. In addition, six pre-conference workshops provided more in-depth discussion of the current state of Pennsylvania highway occupancy permits, disability accessibility, traffic calming techniques in Pennsylvania, project development training and the the highway safety manual's guide to two-lane rural highways.

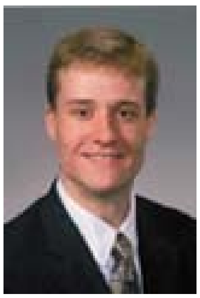
Susan B. Herbel, principal, Cambridge Systematics, Inc., was the keynote speaker. Dr. Herbel spoke about the need for safety workforce development. For the first time since the 1950s, highway fatalities are decreasing. There are many reasons for this such as reduced miles driven, increased use of safety belts, better young driver education, etc. But beyond those often cited reasons are national initiatives such as the Highway Safety Improvement Program, Strategic Highway Safety Plans and the High Risk Rural Roads Program. There is a great deal more work to be done to improve the nation's highway safety. Dr. Herbel recommended a road safety management approach that is science-based, has a safe system perspective and looks at accidents versus crashes. A trained and diverse workforce, career advancement opportunities for transportation engineers, and a national alliance to promote science-based road safety training and education opportunities would all be beneficial in continuing the trend of fewer highway fatalities.

Major sponsors of the conference included the Mid-Atlantic Universities Transportation Center, Penn State's College of Engineering, Jacobs Engineering Group, PBWorld, and Michael Baker Corporation.

The Pennsylvania State University

Joel R. Anstrom, Ph.D.
Director, Hybrid and Hydrogen Vehicle Research Center and DOE Graduate Automotive Technology Education Center

Research Interests: Modeling of electric, hybrid electric, and fuel cell vehicles for efficiency and dynamic handling



Sean Brennan, Ph.D.
Assistant Professor, Mechanical and Nuclear Engineering

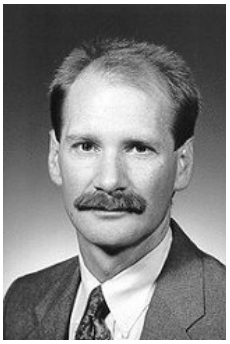
Research Interests: vehicle dynamics and automation, mechatronics and embedded systems, modeling and control of dynamically similar systems

Eric T. Donnell, Ph.D., P.E.
Assistant Professor, Civil Engineering

Research Interests: Geometric design of highways and streets, highway safety, roadside design and management, traffic engineering

Hosam Fathy, Ph.D.
Assistant Professor, Mechanical Engineering

Research Interests: Model reduction, stochastic estimation, and optimal control theories, with application to battery health-conscious hybrid vehicle power management and online vehicle inertia estimation for adaptive safety applications.



Jeffrey A. Laman, Ph.D, P.E.
Associate Professor, Civil Engineering

Research Interests: Bridge monitoring, bridge dynamics, bridge analysis and load distribution, substructures and foundations, integral abutment bridges, bridge load models, fatigue loading, steel structure design, weigh-in-motion, optical fiber sensors

Daniel G. Linzell, Ph.D, P.E.
Associate Professor of Civil Engineering

Research Areas: Bridge engineering, curved and skewed bridges, construction design and analysis, force protection, advanced materials and structures, steel structures, advanced finite element analysis, field testing, structural health monitoring, large-scale laboratory testing

Angelica Palomino, Ph.D.
Assistant Professor, Civil Engineering

Research Interests: Soil modification for the development of engineered soil materials, clay particle surface modification, clay particle-based nanofabrics – intercalated particles, engineered soil fabrics manufactured through pore fluid chemistry and/or electric field manipulation, iIon exchange and removal from clay slurries

Martin T. Pietrucha, Ph.D.
Director, Science Technology and Society Program
Associate Professor, Civil Engineering Chair, Transportation Engineering and Safety Conference

Research Interests: Highway safety, ergonomics, highway traffic operations, traffic impact analysis, highway design, older drivers, and pedestrians

Zoltan Rado, Ph.D.
Research Associate, Larson Transportation Institute

Research Interests: Vehicle dynamics, vehicle surface interaction, surface characteristics, friction, braking, crash safety

Farshad Rajabipour, Ph.D.
Assistant Professor, Civil and Environmental Engineering

Research Interests: Sustainable infrastructure, concrete materials

Venky Shankar, Ph.D, P.E.
Associate Professor of Civil Engineering

Research Interests: Transportation Planning and Programming, Access Management, Travel Demand Modeling, Traffic Flow Modeling, ITS Evaluation, Traffic Safety, Design Policy, Freight Planning, Pedestrian and Bicycle Safety, Infrastructure Pricing, Environmental Issues in Transportation, Urban Simulation

Barry Sheetz,

Research Interests: Chemistry and mineralogy of cementitious systems for waste management, environmental restoration and infrastructure applications

Mansour Solaimanian, Ph.D, P.E.
Director, Northeast Center of Excellence for Pavement Technology
Senior Research Associate, Larson Transportation Institute

Research Interests: Pavement Materials, Pavement Instrumentation, Asphalt Pavement Construction, Testing and Characterization of Asphaltic Materials, Finite Element Modeling of Asphalt, Concrete Behavior, Moisture Damage in Asphalt, Recycled Materials in Pavements

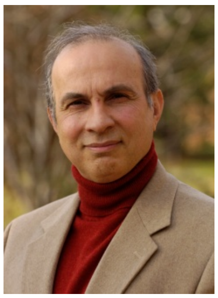
Tao Yao, Ph.D.
Assistant Professor, Industrial Engineering

Research Interests: Transportation network modeling and analysis: stochastic and robust optimization; congestion mitigation: pricing, auction, derivatives, mechanism design; evacuation and emergency management; infrastructure management; transportation operations and planning

University of Maryland

Cinzia Cirillo, Ph.D.
Assistant Professor, Civil Engineering

Research Interests: Discrete choice analysis, advanced demand modeling, activity based models, revealed and stated preference surveys, large scale model systems, and value of time studies



Ali Haghani, Ph.D.
Professor and Chairman, Department of Civil and Environmental Engineering

Research Interests:
Large scale network optimization, emergency preparedness and response, logistics and freight transportation analysis, public and private sector fleet management, traffic control and optimization, transit operations, port operations and water transportation

Elise Miller-Hooks, Ph.D.
Associate Professor, Civil and Environmental Engineering

Research Interests: Stochastic and Dynamic Network Algorithms, Optimization and Mathematical Modeling in Transportation, Routing and Scheduling, Hazardous Materials Transport, Intermodal Goods Transport, Regional and Building Evacuation, Emergency Preparedness, Response and Recovery, Collaborative and Multi-objective Decision-Making, Concurrent Flow Lane Operations, Freeway Service Patrols

Gang Len Chang, Ph.D. Professor of Civil Engineering

Research Interests: Network Traffic control, Freeway traffic management and operations, Real-time traffic simulation, Dynamic urban systems

Paul Schoenfeld, Ph.D. Professor of Civil Engineering

Research Interests: Transportation Engineering

Lei Zhang, Ph.D.
Assistant Professor

Research Interests: Transportation and urban systems analysis, Land use and transportation planning, Transportation economics and policy, Innovative pricing and financing, Infrastructure project and policy evaluation, Traveler information systems, Mathematical and agent-based simulation models with applications in ITS, demand forecasting, and network dynamics.

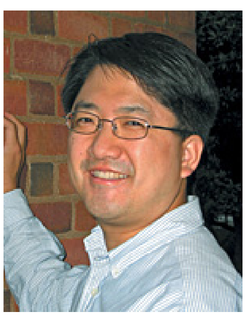
University of Virginia

Michael J. Demetsky, Ph.D.
Professor of Civil Engineering
Director, Center for Transportation Studies

Research Interests: Intermodal freight transportation planning and operations, evaluation of ITS deployments, decision support systems for transportation systems management, performance analysis of transportation systems

Brian L. Smith, Ph.D.
Chair and Professor of Civil Engineering
Director, Smart Travel Laboratory

Research Interests: Intelligent Transportation Systems, particularly in advanced transportation management; statistical modeling, traffic flow theory, software engineering, simulation, data mining, geographic information systems, and artificial intelligence

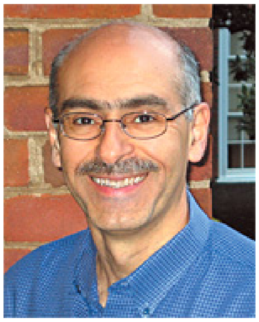


Byungkyu (Brian) Park, Ph.D.
Associate Professor of Civil Engineering

Research Interests: Stochastic Optimization of Traffic Signal Timing Plan, ITS Evaluation Using Simulation Model, Travel Time Estimation, and Traffic Flow Theory

Steven B. Chase, Research Professor of Civil Engineering

Research Interests: Nondestructive Evaluation of Civil Infrastructure, Sustainable Infrastructure Engineering, Infrastructure Asset Management



Saeed Eslambolchi
Director of Research Administration, Center for Transportation Studies

Virginia Polytechnic Institute and State University

Kyoungho Ahn, Ph.D.
Senior Research Associate

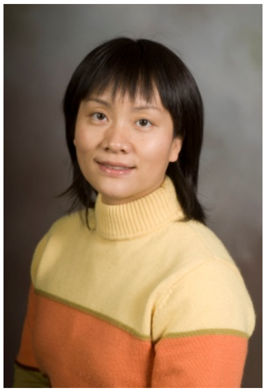
Research Interests: Transportation environmental modeling, traffic flow theory, and traffic modeling and simulation. He is also knowledgeable in the areas of operations research, urban planning, and transportation planning.

Ahmed Amer, Ph.D.
Research Associate

Research Interests:
Intelligent transportation systems, traffic modeling and simulation, driver behavior and safety modeling, agent-based modeling, statistical analysis, urban transportation planning

Ralph Buehler, Ph.D.
Assistant Professor Urban Affairs and Planning

Research Interests:
(1) the connection between policy, urban form, land use, socio-economic factors and travel behavior; (2) the link between active travel (walking, cycling, public transport) and public health and energy use; (3) the relationship between sustainable transport and transport policy; (4) international comparative research



Jianhe Du, Ph.D.
Research Associate

Research Interests: Intelligent transportation systems and optimization, GIS in transportation, and safety modeling

Ihab El-Shawarby, Ph.D.
Senior Research Associate

Research Interests: Operations research, Intelligent transportation systems, transportation modeling and simulation, driver behavior and performance evaluation, transportation environmental modeling, field data collection and field data analysis

Kathleen L. Hancock, PE, PhD
Co-Director, Center for Geospatial Information Technology and Associate Professor

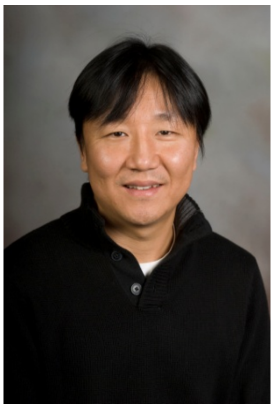
Research Interests: Geospatial solutions to transportation problems, freight operations and planning, transportation safety

Shinya Kikuchi, Ph.D. PE
Professor

Research Interests: Transportation Systems Analysis, Urban Public Transportation, Transportation Planning, Uncertainty Analysis

Pamela Murray-Tuite, Ph.D.
Assistant Professor

Research Interests: Evacuation Modeling; Network Analysis and Design; Transportation Systems Analysis; Risk and Security Analysis; Transportation Resilience Analysis; Reliability Analysis; Transportation Planning; Behavior Modeling; Infrastructure Interdependency Modeling and Analysis; Location Analysis; Mathematical Modeling and Optimization; Traffic Flow Analysis; Simulation



Sangjun Park, Ph.D.
Research Associate

Research Interests: Traffic flow theory, traffic modeling and simulation, traffic operations, and transportation energy and environmental modeling

Hesham A. Rakha, Ph.D.
Director, Center for Sustainable Mobility
Professor, Charles E. Via, Jr. Department of Civil and Environmental Engineering

Research Interests: Traffic flow theory, traffic modeling and simulation, intelligent transportation systems, traffic control, energy and environmental modeling, and safety modeling

Shereef A. Sadek, Ph.D.
Research Associate

Research Interests: Traffic Modeling, Transport phenomena, Computational Fluid Dynamics, Numerical Methods

West Virginia University

David M. Martinelli, Ph.D., P.E.
Chairman and Professor, Department of Civil and Environmental Engineering

Research Interests: Structural dynamics, finite element modeling, pavement dynamics, measurements and instrumentation, digital signal processing, mechanical design, and intelligent structures

Avinash Unnikrishnan, Assistant Professor, Civil and Environmental Engineering

Research Interests: Transportation network modeling and planning, freight and logistics, network equilibrium models, traffic operations