

2007 – 2008 Annual Report



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

2007/2008 Annual Report

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MAUTC THEME

MAUTC's theme, *Advanced Technologies in Transportation Operations and Management*, 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 four 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 1968. MAUTC is administered through the Thomas D. Larson Pennsylvania Transportation Institute (LTI). The MAUTC director and principal investigator, Dr. John M. Mason, Jr., 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. Martin T. Pietrucha, assistant professor, civil engineering, and director, Transportation Operations Program, represents LTI's faculty interests in MAUTC activities.

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

Ms. Sara (Sally) Gannon, staff assistant, provides clerical support for the overall MAUTC administrative effort as well as for Penn State's MAUTC projects and programs. Additional LTI staff support MAUTC as needed.

MAUTC 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. The UTC Program helps these states leverage their research dollars.

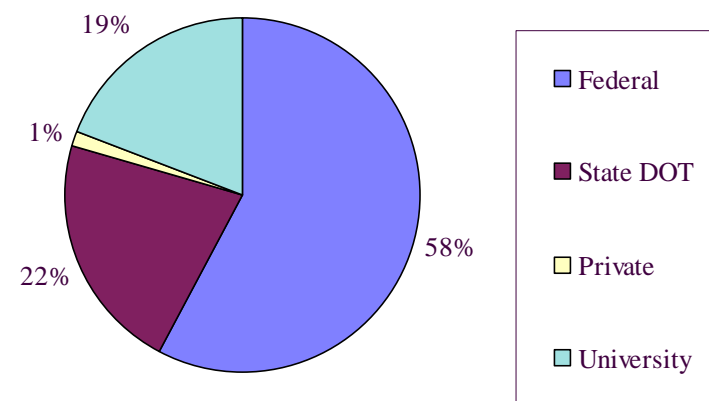


Figure 1. 2007/08 Sources of Total Expenditures

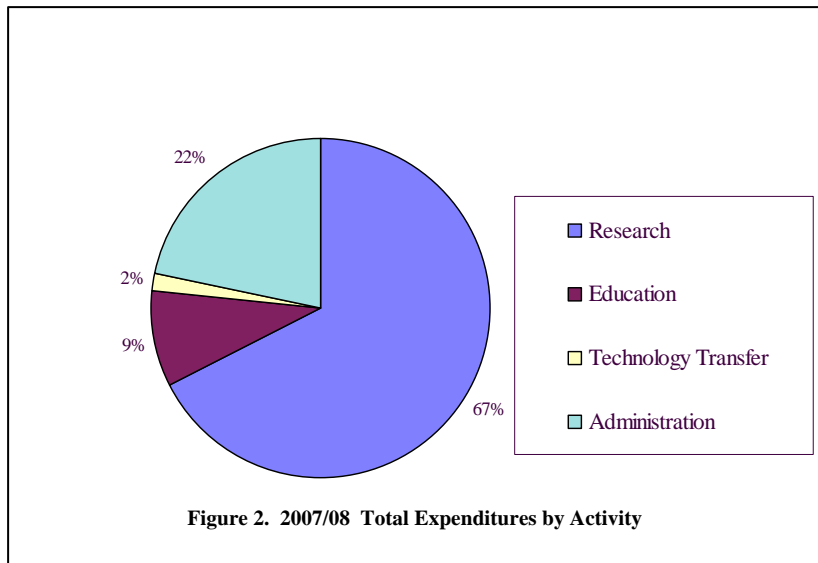


Figure 2. 2007/08 Total Expenditures by Activity

THE CENTER

The Mid-Atlantic Universities Transportation Center is comprised of five universities:

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

The Pennsylvania State University

The Thomas D. Larson Pennsylvania Transportation Institute is one of the nation's leading university transportation centers. Since its first days in 1968, LTI has pursued a mission of interdisciplinary research that today



Figure 2. Pennsylvania Transportation Institute

involves laboratories, departments, and colleges throughout Penn State and numerous state, federal, and private collaborators. LTI supports University faculty and students by

providing interdisciplinary educational and research opportunities that complement and enhance the University's undergraduate and graduate education programs.

LTI 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.

Three programs comprise the Institute: Transportation Infrastructure Program, the Transportation Operations Program, and Vehicles Systems and Safety Program. Faculty, researchers, and students from all three programs contribute to and benefit from the research projects funded under the auspices of MAUTC.

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.

The University of Maryland transportation research effort benefits from the new Intelligent Transportation Systems



Laboratories in the recently completed 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 Collaborative 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 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 Transportation Research Council (VTRC), 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.

The Center is located within the Civil Engineering Department on the grounds of the University of Virginia. With offices and laboratory facilities located on two floors, including the Smart Travel Lab, the Center also shares the resources, laboratories and library of the VTRC facility, a 100-employee research complex at the University of Virginia. The academic and research programs of the Center are closely associated with the Virginia Transportation Research Council. Through this partnership, faculty hold joint appointments, VTRC research scientists teach specialized courses, and graduate student work is supported through a Graduate Research Assistantship Program. The Research Council 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 the Center 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 organizations as VTRC, MAUTC, as well as the Federal Highway Administration and the Institute of Justice, the center 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

Virginia Technology and Transportation Institute 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. 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. The institute is both an FHWA/FTA ITS Research Center of Excellence and a Mid-Atlantic Universities Transportation Center.

VTTI is housed in a 30,000-square-foot building located in Blacksburg, Virginia. It was built at the western end of Virginia's Smart Road, a road designed specifically for testing new transportation technology. The building accommodates the Smart Road Control Center, where researchers monitor and control data collection, weather-generation, lighting, power grids, and roadway surveillance cameras. The building is equipped with office and laboratory space for VTTI, VDOT's Christiansburg Residency, and companies that contract for use of the facility. Additionally, it holds a fully staffed garage and shop for experimental vehicles.

VTTI is used by more than 90 researchers and faculty. In addition, approximately 80 students have access to the facility as well as its laboratories and equipment.

West Virginia University Harley O. Staggers National Transportation Center

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 includes nearly 20 core 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 virtually any client's problem. The Staggers Center has five primary research areas: Infrastructure Management, Planning and Economics, Transportation Design and Operations, Energy and Environmental Impacts, and Transportation Structures.

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.

MAUTC Student of the Year

Mason Gemar earned his Master of Science degree in Civil Engineering from Penn State in May 2007. At the Thomas D. Larson Pennsylvania Transportation Institute, Mason was the lead student on a PennDOT/MAUTC research project to evaluate the operational effects of wide edge lines applied to horizontal curves on two-lane rural highways. In addition, Mason was instrumental in estimating negative binomial regression models of crash occurrence and developing crash severity distributions at interchange locations in Minnesota on an NCHRP project.



In 2003, Mason graduated from Iowa State University with a B. S. in Civil Engineering. While an undergraduate student, he worked as a lab assistant at the Center for Transportation Research and Education (CTRE) where he conducted research for the Iowa Pavement Management Program (IPMP) and aided studies for the Iowa Traffic Safety Data Service (ITSDS).

Prior to graduate school, Mason was employed by HNTB, in Overland Park, Kansas. Mason is currently employed by HDR, in Austin, Texas.

RESEARCH

The Pennsylvania State University

PennDOT/MAUTC Partnership

The PennDOT/MAUTC Partnership, initiated in 2005, continues to provide a framework to conduct mutually beneficial research and to develop

tomorrow's workforce by providing graduate students an opportunity to conduct research for the Commonwealth.

Sixteen projects have been initiated as of the close of FY 07/08 with a total contract value of \$2.7 million. Students work directly on transportation issues affecting the Commonwealth to understand the challenges faced by state DOT on a daily basis.

Effectiveness of Speed Minders in Reducing Driving Speeds on Rural Highways in Pennsylvania, PSU-2006-07



Researchers at Penn State conducted this project to determine the affect of placing speed minders at speed transition zones between rural highways and local communities.

Previous studies have been conducted on the effectiveness of speed minders, but most research has focused on their deployment in work zones and on highways with wide-ranging weather conditions.

PennDOT has been deploying speed minders for one-week periods in community transition zones where speeds transition from 45 to 55 mph to 25 to 35 mph. The research team found that deploying the speed minders for two-week periods could extend their effectiveness in maintaining safe roadway speeds in the transition zones. Final report: <http://www.pti.psu.edu/mautc/docs/PSU-2007-06.html>

Principal Investigator: Dr. Eric Donnell

Evaluating Performance of Limestone Prone to Polishing, PSU-2007-02

Several roads in Pennsylvania constructed according to standard design and construction techniques and paved with Portland cement concrete have

shown a serious decrease in skid resistance. This study, recommended by a task force, is investigating prior research and literature available in the U.S., and developing test matrices to evaluate the effects of blended aggregate materials, mortar fraction and aggregate concentrations and aggregate size for the evaluation of long-term pavement surface performance. The results will help abate deterioration of surface characteristics and skid resistance of Portland Cement concrete pavements.

Statewide Crash Analysis and Forecasting, PSU-2006-08

The frequency of vehicle crashes and resultant injuries and fatalities for each vehicle mile traveled has diminished considerably as both vehicles and roadways have become safer. Still, no level above zero is acceptable, so agencies like the Pennsylvania Department of Transportation are constantly vigilant for ways to further decrease the likelihood of crashes, particularly in high-risk locations.

Penn State researchers analyzed existing PennDOT data in order to produce products that could be used in PennDOT's Crash Data Analysis and Retrieval Tool (C-DART). The team identified "Sites with Promise" (SwiPs), which are road segments with a crash risk above the mean for comparable segments. Using SwiPs, PennDOT can identify road sections that have an elevated risk of a crash and have the greatest potential for safety improvements, and invest limited resources where they will have the greatest benefit. Final report: www.pti.psu.edu/mautc/docs/PSU-2006-08.html

Principal Investigator: Dr. Paul Jovanis

The Effects of On-premise Sign Lighting Level on Nighttime Sign Legibility and Traffic Safety, PSU-2006-09

Drivers and pedestrians often rely on on-premise signs to locate commercial businesses. During the day, most signs have adequate illumination to be able to read the signs at a reasonable distance. But at night it becomes more difficult, which can cause traffic congestion, erratic driving, and vehicle and

pedestrian accidents. Determining the appropriate level of sign lighting is important to optimize the effectiveness of the sign and to ensure driver and pedestrian safety. Final report: <http://www.pti.psu.edu/mautc/docs/PSU-2006-09.html>

Principal Investigator: Dr. Martin T. Pietrucha

University of Virginia

System Operations Data Integrity Assessment, UVA-2006-04

Large quantities of traffic data from many sources are collected daily and archived for use in a variety of applications. But how can practitioners be confident of the quality and validity of that data when coming from a wide range of intelligent transportation systems?

This may be addressed through two basic and important value-added services of a traffic data archive: (1) Data screening checks the feasibility (i.e. is the data reasonable?) and usability of the data already collected, and (2) the health of the detection system is continuously monitored to support proactive maintenance of the sensor infrastructure. This research effort focused on developing a methodology to tailor these functions for specific archives. The report presents the methodology, as well as examples of its application in the Regional Integrated Transportation Information System (RITIS) of the Washington, D.C. area.

Principal Investigator: Dr. Brian Smith

Integration of Stochastic Traffic Signal Optimization Method and Software in the Loop Simulation, UVA-2006-03

Traffic signal timing optimization and control are one of the most cost-effective ways of improving urban arterial network congestions. Actuated traffic signal control system is designed to provide green times where they are needed and it uses pre-specified gap-out time to determine early termination of current phase green time. However, the effectiveness of its signal state decisions is limited by its dependence on aggregated vehicle information from fixed point sensors located near the stop bar or upstream

at signalized intersections. With the emerging wireless location technology (WLT), individual vehicle information (e.g., speed, location, etc.) is expected to be utilized for traffic signal control applications. A recent study evaluated a dynamic gap-out feature that terminates existing green without elapsing gap-out time if no vehicles would arrive within the gap-out time. Even though the timing plan was not optimized under the dynamic gap-out feature, the study showed $\approx 20\%$ delay savings over regular gap-out at a two one way street intersection. Final report: www.pti.psu.edu/mautc/docs/UVA-2006-03.html

Principal Investigator: Dr. Brian Park

Virginia Polytechnic Institute and State University

Evaluation of Strategies to Increase Transportation System Resilience to Congestion Caused by Incidents, VPI-2006-03

Recurrent and non-recurrent congestion costs motorists time and money and can cause significant safety problems. This research project focused on evaluating four strategies to reduce non-recurrent congestion caused by incidents: opening a high vehicle occupancy vehicle lane to all traffic, using variable speed limits to smooth traffic flow, diverting traffic by en route rerouting and by variable message signs (VMS).

Opening the HOV lane to all travelers and re-routing traffic using VMS proved to be the most effective methods to reduce incident-related congestion. These strategies could also be applied to work-zone and special event routing. Final report: www.pti.psu.edu/mautc/docs/VPI-2006-03.html

Principal Investigator: Dr. Pamela Murray-Tuite

Characterizing Driver Behavior at the Onset of a Yellow Phase Transition, VPI-2006-06

Researchers at Virginia Tech Transportation Institute investigated whether a warning system for potential red-light violators could be effective in reducing the number of straight crossing-path crashes at signalized intersections. Specifically, the researchers wanted to determine if an

adequate number of drivers would react positively to a warning and therefore be able to avoid collision with a motorist running a red light.

Results of the experiments were positive—most drivers will brake quickly enough when given a warning. However, further research needs to be conducted that takes into account other vehicles being on the road, which could result in rear-end collisions. Final report: www.pti.psu.edu/mautc/docs/VPI-2006-04.html

Principal Investigator: Dr. Hesham Rakha

West Virginia University

Economic Externalities of Relative Accident Rates Between SUV vs. Passenger Cars, WVU-2006-02

Researchers at West Virginia investigated whether the behaviors of SUV drivers, rather than the attributes of the sport utility vehicle (SUV), posed increased safety risks on drivers of passenger cars. Many drivers perceive these vehicles as safer due to their weight, size, and higher driver seating, which may lead to taking more risks such as driving faster in poor weather conditions, speeding, and rolling stops at intersections.

Using FARS data, the researchers compared data from fatal crashes between two passenger cars, passenger/SUV, and two SUV. Overall, there has been a decrease in fatal crashes between two passenger cars, a significant increase in fatal crashes between passenger/SUV and no significant change in fatal crashes between two SUV. Researchers concluded that SUV pose a higher risk on passenger cars than on SUV, and that it may be due to the Peltzman Effect, where there is a trade off between increased safety features and increased risky behavior. Final report: <http://www.pti.psu.edu/mautc/docs/WVU-2006-02.html>

Principal Investigator: Dr. David Martinelli

Faculty and Researchers

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



Ghassan Chehab, Ph.D.

Assistant Professor of Civil Engineering Affiliate, Materials Research Institute

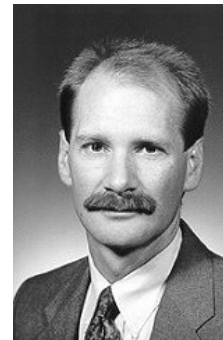
Research Interests: Pavement engineering and materials of construction, advanced characterization of asphalt concrete, laboratory and accelerated pavement testing, pavement design, and management non-destructive testing



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



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.

Director, Transportation Infrastructure Program 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



John M. Mason, Jr., Ph.D., P.E.
 Associate Dean for Graduate Studies, Research and Outreach
 Director, MAUTC
 Director, LTI

Research Interests: Highway engineering, traffic engineering, and roadway safety for surface transportation vehicles (automobiles and large trucks). Research includes operational effects of highway geometrics, safe driving characteristics, traffic data collection methods



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



Andrea J. Schokker, Ph.D.
 Assistant Professor and Henderson Chair, Department of Civil and Environmental Engineering

Research Interests: Design and materials-related improvements in prestressed concrete, durability and corrosion of concrete structures, cement grouts for post-tensioning applications



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

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

University of Virginia



Michael J. Demetsky, Ph.D.
Chair & Professor of Civil Engineering

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



Nicholas J. Garber, Ph.D., P.E.
Henry L. Kinnier Professor of Civil Engineering

Research Interests: Traffic operations and highway safety, intelligent transportation systems, speed management on high-speed roads, work zone safety, large truck safety



Lester A. Hoel, D. Eng., P.E.
L.A. Lacy Distinguished Professor of Engineering
Director, Center for Transportation Studies

Research Interests: Management, planning and design of surface transportation infrastructure with emphasis on highway and transit systems



Brian L. Smith, Ph.D.
Associate 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, PhD.
Assistant 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



Hesham A. Rakha, Ph.D.
Leader, Transportation Systems and Engineering

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



Saeed Eslambolchi
Director of Research Administration, Center for Transportation Studies



Ihab El-Shawarby, Ph.D.
Research Scholar

Research Interests: Operations research, optimization, modeling and simulation

Virginia Polytechnic Institute and State University



Kyoungho Ahn, Ph.D.
Senior Research Scientist

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



Alejandra Medina, Ph.D.
Senior Research Associate

Research Interests: Network traffic modeling, traffic simulation, identification of driver errors, pavements, and infrastructure management



Mazan Arafeh, D.Eng.
Senior Research Associate

Research Interests: Travel time analysis, automatic vehicle identification tag readers, interstate planning, truck management, and traffic evacuation strategies. Specific projects include “The Reliability of Trip Travel Estimations,” an ITS implementation project, and the I-81 Planning Study sponsored by the Virginia Department of Transportation (VDOT)



Samir N. Shoukry, Ph.D.
Professor, Departments of Civil and Environmental Engineering and Mechanical and Aerospace Engineering

Research Interests: Application of advanced technologies in transportation, pavement modeling and evaluation, transportation systems analysis, and transportation planning and economics

West Virginia University



L. James French, Ph.D., P.E.
Research Assistant Professor

Research Interests: Traffic engineering, highway design, and intelligent transportation systems



David M. Martinelli, Ph.D., P.E.
Chairman and Associate 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