2005 – 2006 Annual Report

Advanced Technology in Transportation Operations and Management

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

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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 Pennsylvania Transportation Institute (PTI). 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 Virginia, Virginia Polytechnic Institute and State University, and West Virginia University.
Other administrative staff include:

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

Ms. Susan Thompson, staff assistant, accepted a new position at Penn State in September 2005.

Ms. Sara (Sally) Gannon, staff assistant, joined PTI in November 2005 and provides clerical support for the overall MAUTC administrative effort as well as for Penn State's MAUTC projects and programs. Additional PTI staff support MAUTC as needed.

MAUTC FUNDING

MAUTC meets the U.S. Department of Transportation's 1:1 match requirement through state and local agencies, private companies, and universities. Pennsylvania, Virginia, and West Virginia departments of transportation provide the majority of matching funds. The UTC Program helps these states leverage their research dollars.

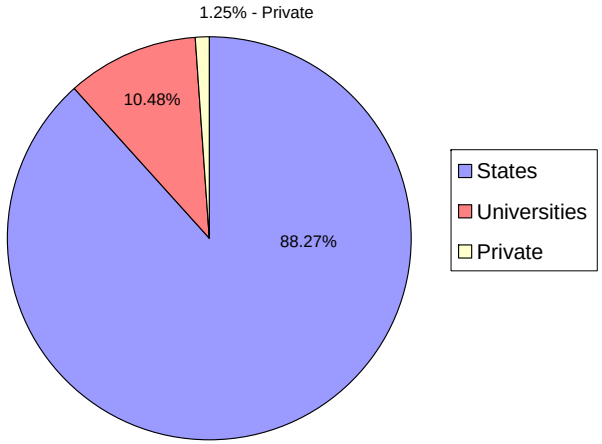

Figure 1. 2005/06 Sources of Matching Funds

THE CENTER

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

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

The Pennsylvania State University

The Pennsylvania Transportation Institute is one of the nation's leading university transportation centers. Since its first days in 1968, PTI has pursued a mission of interdisciplinary research that today involves laboratories, departments, and colleges throughout Penn State and numerous state, federal, and private collaborators. PTI supports University faculty and students by providing interdisciplinary educational and research opportunities that complement and enhance the University's undergraduate and graduate education programs.

Figure 2. Pennsylvania Transportation Institute

PTI 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 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.

Figure 3. VTTI's Smart Road

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

Figure 4. WVU's People Mover

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.

Success Stories

THE PENNSYLVANIA STATE UNIVERSITY

Technologies for Improving Bridge Construction/Ongoing PennDOT Research
Prediction of Movement and Stresses in Curved and Skewed Bridges, PSU-2005-01, and Field Monitoring of Integral Abutment Bridges, PSU-2004-07

Roadway bridges in Pennsylvania are tasked to do much more than carry traffic from one point to another; they must also be responsive to widely fluctuating temperature changes from winter to summer. Two types of popularly used bridges are receiving close scrutiny in related studies at Penn State.

The early success of integral abutment bridges in the Commonwealth has led to the application of this design to increasingly longer spans. However, with uncertainties in the prediction of long- and short-term behavior of all spans of these bridges and a number of design principles warranting real-world validation, PennDOT engaged researchers at Penn State to conduct a comprehensive field monitoring program to determine the actual response of this bridge type to thermal loads.

Under the direction of project PI Jeff Laman, four bridges in the I-99 corridor were instrumented extensively, including piles, backwall, girders and slab using over 3 miles of cable and 64 instruments. Direct student involvement in this work also reaped educational dividends. Documented structure behaviors were compared to Penn State numerical models and to PennDOT design methodology specifications.

"In general the observed behaviors follow the Penn State numerical models fairly well," said Laman, "and the original design models/assumptions do not match observed behavior."

These findings will be examined in greater detail in follow-on work, which will include collecting data over annual temperature cycles and evaluating observed behavior as compared to specification and standard practice.

Another bridge type that has seen rapidly increasing use nationwide is the curved and skewed bridge. Because certain aspects of the behavior of these structures during construction and while in service still are not well understood, PennDOT authorized a study examining the effects of design, fabrication, and construction on the geometry and load distribution in a curved or skewed bridge system. The construction of both curved and skewed bridges in the I-99 Advanced Technology Test Bed provides a unique opportunity to investigate curved and skewed structures not only during their construction, but also while in service. In this case construction data collected will be used to assess the accuracy of three different numerical models.

Figure 5. Bridge Construction on I-99

"Penn State is one of the few institutions where field data measuring the construction response of bridge structures is collected," said project PI Dan Linzell, "and collection of curved and skewed bridge data during construction is even more unique." Engineering students were heavily involved in establishing the system for remote data acquisition on two such bridges in the I-99 corridor. "Students did all of the work under my advisement – undergraduate, MEng, M.S. and Ph.D.," said Linzell. "They prepared and placed instrumentation and data-acquisition systems, collected and reduced data, prepared and ran computer models. From their work, information on how to design and construct these structures safely and more efficiently is being obtained."

How well the numerical models predict bridge behavior depends on the complexity of the models, said Linzell. "Some do quite well – within 10% or less for some parameters, others not as well – within 30% for some parameters. Work has shown the sensitivity of modeling decisions on accuracy."

PennDOT has expressed interest in continuing to fund this investigation. "My goal with all of this," said Linzell, "is to develop a design for construction manual for PennDOT and the rest of the country that will provide quantitative information for both bridge engineers and contractors that will guide the construction process, prevent accidents and provide finished structures that behave as anticipated."

Principal Investigator: Dr. Jeffrey Laman (PSU-2004-07)
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Principal Investigator: Dr. Daniel Linzell (PSU-2005-01)
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Safety Evaluation of Wider Edge Lines on Curves, PSU-2005-03

Ever notice the painted edgelines on the side of the highway as you're driving, especially at night? The Pennsylvania Department of Transportation and other state transportation agencies are required to provide edgeline delineation on two-lane arterials where traffic volumes exceed 6,000 vehicles per day and the pavement width is at least 20 feet. Other combinations of pavement width and traffic volume may also warrant edgeline delineation. While the standard edgeline width is 4 inches, an edgeline width of 8 inches can provide greater emphasis for motorists. In a recent study, experiment participants said they felt that wider edgelines on horizontal curves provided improved guidance, especially during nighttime driving conditions. But an earlier study performed in Virginia in the 1980s found no practical difference in driving behavior when comparing roadway sections with 4-inch and 8-inch wide edgelines. Is there really an increased effectiveness associated with wider edgelines that would justify their use? A PennDOT project underway at Penn State is set to find out.

Figure 6. Graduate students place piezoelectric sensors in the lane.

Is this work unique? Project PI Eric Donnell said the work is not only unique in Pennsylvania, but on a broader scale. "This study will evaluate several pilot installations of the wide edgeline treatment along horizontal curves," said Donnell. "PennDOT currently uses only 4-inch-wide edgelines to delineate the limits of a travel lane on rural, two-lane highways. This research will evaluate how driver behavior – as measured by speed, lateral vehicle position, encroachment frequency, and speed change location with respect to the beginning of a horizontal curve – changes after applying an 8-inch edgeline on horizontal curves."

Donnell said the study is using before-and-after observation and includes control sites. The project team has completed the after-period data collection phase and has begun analyzing the data. The project is expected to be completed in November 2006.

Under Donnell's guidance an M.S. candidate and Ph.D. candidate working on the project have worked cooperatively to collect the field data, develop an analysis database, and assist with data analysis and report preparation. "The graduate students have been gaining hands-on experience with a wide variety of field data collection procedures and data analysis methods learned in various statistics courses at Penn State."

Donnell said future research should include a safety evaluation of the wide edgeline application, measured based on the frequency and severity of run-off-road crashes on horizontal curves.

Principal Investigator: Dr. Eric T. Donnell
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***Transportation Engineering and Safety Conference,* PSU-2004-08**

Figure 7. Allen D. Biehler, Pennsylvania Secretary of Transportation

Allen D. Biehler, Secretary of Transportation for the Commonwealth of Pennsylvania, delivered the keynote address to more than 500 transportation professionals attending the 12th annual Transportation Engineering and Safety Conference.

Mr. Biehler presented PennDOT's emerging policies and initiatives and the challenges the agency faces in balancing quality of life, land use, economic development and fiscal responsibility issues as it strives to improve Pennsylvania's transportation system.

Five pre-conference workshops were offered ranging from QuickZone software training to PennDOT's Access Management Model Ordinances. The technical workshops provide in-depth technical information or hands-on activities to participants.

Several new session topics were introduced this year: Special Event Traffic Control, Bridge Barriers and Transitions, and ADA Issues in Transportation Engineering.

Conference Chair: Martin T. Pietrucha
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VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Modeling the Capacity of Freeway Weaving Sections, VPI-2004-01

The freeway weaving analysis procedures in the HCM 2000 are based on research conducted in the early 1970s through the early 1980s. Subsequent research has shown that the method's ability to predict the operation of a weaving section is limited. Consequently, this research effort utilizes the INTEGRATION microscopic traffic simulation software to estimate the capacity of weaving sections.

The study identified 18 common configurations of Type B weaving sections to develop analytical models. The developed models were compared to the 2000 HCM procedures. The results demonstrated that the 2000 HCM procedures suffer from a number of drawbacks:

1. The procedures can only consider relatively long weaving sections (150 m or longer).
2. The HCM procedures fail to capture the impact of the distribution of weaving flows between freeway and on-ramp on the capacity of weaving sections.
3. Capacity estimation from the HCM procedures is considerably different from field estimates.

The proposed models were found to estimate capacity to within 11 percent of the simulated data and were consistent with field observations. Models are being developed to estimate the capacity of Type A and Type C weaving sections.

Principal Investigator: Dr. Hesham Rakha
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Addressing I-81 Transportation Issues, VPI-R-01

Figure 8. I-81 in Virginia, Mileposts 118 to 143

Vehicle dynamics models have been developed for the modeling of heavy truck motion along grade roadway sections. These models account for the effects of pavement, vehicle tires, and vehicle characteristics on vehicle acceleration behavior. The models were validated against field data that were gathered along the Smart Road test facility. Furthermore, these vehicle dynamics models have

been incorporated within the INTEGRATION microscopic traffic simulation software.

The Virginia Department of Transportation (VDOT) is redesigning the entire I-81 corridor within Virginia. The vehicle dynamics models that were developed as part of MAUTC are key components to the objective evaluation of alternative design scenarios. One of the most highly traveled sections of I-81 in Virginia (between mileposts 118 and 143) was modeled using the INTEGRATION software, as illustrated in Figure 2. Three scenarios were modeled as follows:

- Base case: This included a base case do-nothing scenario for the existing network, with two climbing-lane sections at mileposts 128 and 119 in the southbound direction. In addition, this scenario included distributor lanes at the 118 exit.
- Truck Lane Scenario: This scenario captured the geometric configuration that incorporates a two-lane express truck lane. This includes two truck lanes in each direction, additional lanes at some locations, and a flyover at milepost 132 from the truck express lanes to the general purpose lanes.
- General Widening Scenario: This scenario included a proposed truck climbing lane between mileposts 128 and 122 in the southbound direction of travel with additional lanes in order to maintain a level-of-service (LOS) C over the entire section. The *Highway Capacity Manual* defines the operational conditions of a roadway by introducing the concept of levels of service.
- LOS is used as a qualitative measure that characterizes the operational conditions within a traffic stream. Levels of service are characterized in terms of two factors that include average travel speeds and service volumes. The HCM defines six levels of service that range from A to F, with the level of service A representing the best operating conditions and level of service F representing the worst operating conditions. Roadways are typically designed for an LOS of B or C.

The results demonstrated that the addition of traffic and truck climbing lanes without the separation of trucks and cars provided significant benefits in terms of traffic and truck delay, while the separation of trucks and cars provided optimum benefits in terms of delay, energy and environmental impacts. The results of the study have been submitted to VDOT and will be instrumental in the design alternative of I-81.

Principal Investigator: Dr. Hesham Rakha
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WEST VIRGINIA UNIVERSITY

New Dowel Bar Design "Shokbar" Leads to Longer Lasting Transverse Joints, WVU-R-17 and WVU-2000-05

Through MAUTC funding of two projects, "Identification of Critical Stress Concentration Around Dowel Bars and Evaluation of Load Transfer Efficiency (LTE) Measures," West Virginia University researchers were able to quantify the field performance of the new dowel design, which they developed as a result of the first project. The field measurements of the load transfer efficiency indicated the superiority of the "Shokbar" design over the traditional dowel in maintaining a high level of LTE over a four-year period of monitoring. Additionally, the Shokbar design was shown to reduce the contact stresses in the concrete surrounding the dowels by 60 percent and allow for uniform opening of transverse joints along the project. As a result, the new Shokbar design will provide a solution for nationwide problems in concrete pavements such as transverse joint deterioration, joint faulting and spalling as well as mid-slab early age cracks that appear prematurely after only a few months of opening to traffic. These problems were seen in Pennsylvania, Iowa, North Carolina and Illinois and are documented in the Long-Term Pavement Performance (LTPP) Program.

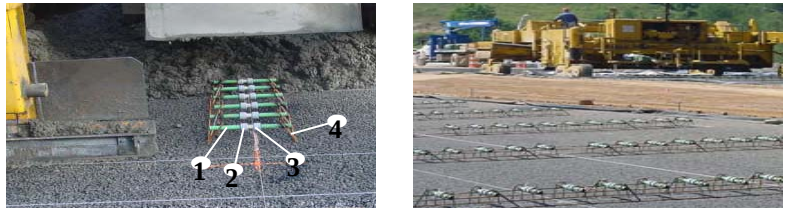

Figure 9. Installation of Modified Dowels on Robert C. Byrd's Highway

MAUTC researchers employed advanced computer modeling techniques and state-of-the-art sensor technology for long-term structural monitoring to study the structural behavior of concrete slabs fitted either with traditional dowel bars or with the new Shokbar design. The new dowel design has been under field-testing since 2001 with the support from West Virginia Department of Transportation and MAUTC.

Principal Investigator: Dr. Samir N. Shoukry
304-293-3111 sshoukry@wvu.edu

Communication Strategies for State DOTs, WVU-2003-01

West Virginia University partnered with Ohio University and the Ohio Department of Transportation to investigate communications strategies and activities of state DOT research programs. The results of this research have produced a picture of how DOTs nationwide are engaging and serving constituents while offering a comprehensive examination of Ohio constituencies and their perceptions regarding transportation research. As a result, a communication plan has been developed that will benefit not only the Ohio DOT but will also provide a communications model that other state DOTs could emulate.

This research unites transportation engineering and public relations expertise to assess, establish and recommend communication mechanisms that better inform, and thus better serve, transportation research constituents, thereby reinforcing ODOT's valued customer focus. In addition, the information gathered from this study allows for the development of a comprehensive two-way communication strategy that makes efficient and effective use of communication resources and increases constituents' awareness of the research contributions to the state DOT missions.

The research was extremely well received by ODOT and caught the interest and attention of high-level officials in AASHTO and TRB. The Research Activities Committee of AASHTO invited the co-investigators to present the project findings at its national meeting in Mystic, Connecticut. Later, the Education and Training Committee of TRB invited the co-investigators to present the work at their committee meeting at the TRB annual meeting. The Transportation Research Record also published a paper summarizing the project.

Principal Investigator: Dr. David N. Martinelli
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Appendix A: Research Project Status List

RESEARCH

New Projects (FY 05/06)

PSU-2005-05 Preliminary Assessment of Acid Producing Rock on Future PennDOT Construction, Barry E. Scheetz

PSU-2005-04 Hardened Air in Concrete Roadway Pavements and Structures, Barry E. Scheetz

PSU-2005-03 Safety Evaluation of Wider Edge Lines on Curves, Eric T. Donnell

PSU-2005-02 Advanced Road Safety and Weather Warning System (ARSAWWS), Paul P. Jovanis

PSU-2005-01 Prediction of Movement and Stresses in Curved and Skewed Bridges, Daniel G. Linzell

VPI-2005-01 Study the Impact of Inclement Weather on Traffic Stream Behavior, Hesham Rakha

Ongoing Projects

PSU-2004-03 Hydrogen Fueling Infrastructure, Joel R. Anstrom

PSU-2004-05 Development of a Database to Evaluate Median Safety in the Presence of Interchange Entrance Ramps, Eric T. Donnell

PSU-2004-07 Field Monitoring of Integral Abutment Bridges, Jeffrey T. Laman

PSU-R-01 Center for Intelligent Transportation Systems Research, Michael L. Patten

UVA-2004-02 Surface/Air Transportation System Interface Innovation, Brian L. Smith/Lester A. Hoel

UVA-2004-03 Evaluation of Procedures to Estimate Trip Generation for Generalized Land Uses, Michael J. Demetsky

UVA-2004-04 Identifying the Impact of Truck Lane Restriction Strategies on Traffic Flow and Safety Using Simulation, Nicholas J. Garber

VPI-2001-01 Developing a Fully Instrumented Test Facility, Hesham Rakha

VPI-R-01 Addressing I-81 Transportation Issues, Hesham Rakha

VPI-R-14 Addressing Urban Network and State Transportation Issues, Hesham Rakha

WVU-2003-03 Work Zone Speed Control, Ronald W. Eck

Completed Projects

PSU-2004-02 Susquehanna Segmental Bridge Project, Andrea J. Schokker

PSU-2004-01 Susquehanna Valley Rural Health Partnership (SVRHP) Transportation Study, Michael L. Patten

PSU-2003-01 Intelligent City, Konstadinos G. Goulias

PSU-2000-02 Advanced Traffic Laboratory for Automated Systems (ATLAS), Ageliki Elefteriadou

PSU-2002-08 Time Use, Telecommunications, and Technology Interactions, Konstadinos G. Goulias

PSU-2002-04 Analysis of the Great Lakes/St. Lawrence Navigation System's Role in U.S. and International Trade, Evelyn A. Thomchick, Gary L. Gittings

PSU-2002-06 Moving Activity-Based Approaches to Practice, Konstadinos G. Goulias

PSU-2002-10 Legibility of Internally vs. Externally Illuminated On-Premise Signs, Philip M. Garvey

PSU-2000-01 Pennsylvania Statewide Long-Range Transportation Plan (Penn Plan), Konstadinos G. Goulias

PSU-2001-01 Centre County Simulation, Konstadinos G. Goulias

PSU-2001-02 ITS Evaluation, Konstadinos G. Goulias

PSU-2000-04 OPTIPATH Lab, Elise Miller-Hooks

PSU-2000-06 E-Commerce and Transportation, Konstadinos G. Goulias

PSU-2000-07 Evaluation of Pennsylvania Turnpike ATIS, Konstadinos G. Goulias

PSU-R-05 Strategic Plan for the Implementation of Intelligent Transportation Systems in Pennsylvania, John M. Mason

PSU-R-06 Roadside Vegetation Management, Larry J. Kuhns

PSU-R-07 Climate Survey Development and Organizational Assessment, Robert J. Vance

PSU-R-15 Support of the ITS Statewide Steering Committee, John M. Mason

PSU-R-26 Intelligent Transportation Systems Research and Development Fellowship Program at PSU, Konstadinos G. Goulias

PSU-R-27 Pennsylvania Quality Initiative: Synthesis of Customer Satisfaction and Information Requirement, James H. Miller

PSU-R-70 Probing Motorists' Perceptions of Highway Quality, James H. Miller

PSU-R-71 Increasing the Pool of Highway Construction Subcontractors and Construction Personnel, James H. Miller

PSU-R-72 Construction and Materials Training and Education Plan, John A. Anderson

UP-2001-01 Technology Innovation to Reduce Conflicts between Rail Freight and Passenger Transportation (Former Title: Freight Transportation Trends, Policy Options, and Technology Innovations), Edward K. Morlok

UP-2000-04 Real-World Vehicle Routing and Scheduling Problems, Zhi-Long Chen

UP-R-09 Transportation and Logistics Network Research Program, Edward K. Morlok

UVA-2004-01 Evaluation of Red Light Camera Enforcement in Virginia, Nicholas J. Garber

UVA-2003-01 Supply Chain Models for Freight Transportation Planning, Michael J. Demetsky

UVA-2002-02 Development of Counter Measures to Security Risks from Air Cargo Transport, Michael J. Demetsky

UVA-2002-03 Effects of Light Rail Transit on Traffic Congestion, Lester A. Hoel

UVA-2002-04 The Effect of Land Use Planning on University Transportation Systems (Former Title: Factors that Affect the Modal Split in College/University Towns), Lester A. Hoel

UVA-2002-05 Using an Accessibility Measure to Identify Areas with Potential for Walking and Cycling Travel, Lester A. Hoel

UVA-2002-06 Estimating the Supply and Demand for Commercial Heavy Truck Parking on Interstate Highways, A Case Study of I-81 in Virginia, Phase II, Nicholas J. Garber

UVA-2002-07 Guidelines for Left-Turn Lanes at Signalized and Unsignalized Intersections, Nicholas J. Garber

UVA-2001-01 Carbon Monoxide Production in Response to Increased Reforestation and Traffic in Eastern United States (Former Title: Aerosol and Oxidation Production Arising from Urban and Rural Traffic), Jose D. Fuentes

UVA-2001-02 Development of a Freight Flow Prediction Method for Statewide Planning, Michael J. Demetsky

UVA-2001-03 HOV Corridor Evaluation and Improvement (Former Title: Study on The HOV/HOT/General Purpose Lane Efficiency Comparison Methodology), Lester A. Hoel

UVA-2001-04 Transit Demand Forecasting for Research Parks, Michael J. Demetsky

UVA-2001-06 Investigating the Application of a GIS Database to Address Statewide Freight Transportation Planning, Michael J. Demetsky

UVA-2000-01 Finite Element Evaluation of the Structural Integrity of Composite Concrete-Steel Bridge Decks (Formerly UVA-R-40, Reliability-Based Monitoring of Bridge Structures for Bridge Management), C. E. Orozco

UVA-2000-02 A Methodology for Oversized Vehicle Trip Scheduling: A Case Study in the Hampton Roads Area (Former Title: Oversized Vehicle Routing and Scheduling), Lester A. Hoel

UVA-2000-05 Supply and Demand of Parking Facilities for Large Trucks: Phase I (Former Title: Parking Facilities for Large Trucks on Primary Arterial Highways), Nicholas J. Garber

UVA-2000-06 Assessment of Advanced Engine Technology for the Transit Systems (Former Title: Feasibility Study of Alternative Travel Modes and Vehicle Fuels for UVA "Groundswalk"), Michael J. Demetsky

UVA-2000-07 Spatial Analysis Tools for Integrated Transportation Data: Northern Virginia Intelligent Transportation Systems Prototype, Brian L. Smith

UVA-2000-08 Safety Impacts of Differential Speed Limits - Phase I: Effects of Differential Speed Limits on Vehicle Speed and Crash Characteristics Using Hypothesis Tests, Nicholas J. Garber

UVA-2000-09 Crash Characteristics at Work Zones, Nicholas J. Garber

UVA-2000-10 Predicting Crashes from Increased Signalization: Prototype Software for Corridor Planning, Michael J. Demetsky

UVA-2000-11 Safety Impacts of Differential Speed Limits - Phase II: Determining the Safety Effects of Differential Speed Limits on Rural Interstate Highways Using Empirical Bayes Method, Nicholas J. Garber

UVA-R-37 An Investigation of Web-Based Technologies for the Peninsula Transportation District Commission, Brian L. Smith

UVA-R-38 Evaluation of Traveler Diversion Due to En-Route Information (Former Title: Prediction of Traveler Response to En-Route Information, Michael J. Demetsky

UVA-R-41 Evaluating ITS Parking Management Strategies: A Systems Approach (Former Title: ITS Alternatives Analysis: Evaluating Parking Management), Lester A. Hoel

UVA-R-43 Ozone Formation Attributable to Emissions from Rural Interstate Traffic, Michael J. Demetsky

VPI-2004-01 Modeling the Capacity of Freeway Weaving Sections, Hesham Rakha

VPI-2000-02 Characterizing Vehicle Dynamics for the Enhancement of Traffic Simulation Models, Hesham Rakha

VPI-2001-02 MAUTC Scholarship, Hesham Rakha

VPI-2000-03 The Development of TRANSIMS Modeling Capabilities, Antoine G. Hobeika

VPI-2000-04 Electronic Payment Systems, John Collura

VPI-2000-05 Use of Video Surveillance for Rural and State Highway Safety, Antoine G. Hobeika, Hesham Rakha

VPI-2000-07 SUPERPAVE HMA Mixes, Immadeddin Al Qadi

VPI-R-11 Professional Capacity Building in Transportation, Hesham Rakha, John Collura, Alejandra Medina

VPI-R-12 Quantifying the Impact of Average Speed, Speed Variability, Level of Deceleration, and Level of Acceleration on Vehicle Fuel Consumption and Emissions, Hesham Rakha

VPI-R-13 Development of a Macroscopic Model for Evaluating the Impact of Emergency Vehicle Signal Preemption on Traffic, John Collura, Wei Hua Lin

WVU-R-06 Fitting Falling Weight Deflectometer with SASW Measurement Capability, Samir N. Shoukry

WVU-R-07 Evaluation of Backcalculation Algorithms Through Dynamic Modeling of FWD Test, Samir N. Shoukry

WVU-R-17 Identification of Critical Stress Concentration Around Dowel Bars, Samir N. Shoukry

WVU-2000-01 Operational Effects of Highway Geometrics in Mountainous Terrain, L. James French, David R. Martinelli, Ronald W. Eck

WVU-2000-02 Development of Design Vehicles and Characteristics for the HANGUP, L. James French, Ronald W. Eck

WVU-2002-02 Truck Forecasting Related Research, L. James French

WVU-2002-03 Effect of FWD Testing Position on Modulus of Subgrade Reaction, Samir N. Shoukry

WVU-2002-04 Evaluation of Load Transfer Efficiency Measurement, Samir N. Shoukry

WVU-2000-05 Effect of Dowel Bonding Force on Stresses in Concrete Slabs, Samir N. Shoukry

WVU-2003-01 Communications Strategies for State DOT Research Offices, David R. Martinelli

CANCELLED PROJECTS

PSU-2002-07 QUIK Survey, Peter B. Everett

EDUCATION

New Projects

None

Ongoing Projects

UVA-E-05 Transportation Courses in Information Technology for Graduates and Undergraduates, Brian L. Smith

VPI-2000-06 Continuing Education Courses in Transportation Systems and Operations, John Collura, Hesham Rakha

Completed Projects

PSU-2004-06 Professional Traffic Operators Engineers Certification Program Refresher Course and Exam, Eric T. Donnell

MAUTC-E-03 Support Transit Internship Program at PSU, UPENN, and UVA, James H. Miller, Edward K. Morlok, Lester A. Hoel

MAUTC-2000-01 The MAUTC Freight Transportation Partnership, James H. Miller, Michael J. Demetsky, David R. Martinelli, Edward K. Morlok, Thomas W. Dingus

MAUTC-E-01 Transportation Computational Laboratory, Martin T. Pietrucha, Edward K. Morlok, David R. Martinelli, Hesham Rakha, Brian B. Park

MAUTC-E-04 Maintain and Seek New Opportunities for the VDOT Fellowship Program at UVA and VPI, Lester A. Hoel

MAUTC-E-06 Maintenance and Enhancement of Transportation Laboratories, Konstadinos G. Goulias, Thomas W. Dingus, Michael J. Demetsky, Edward K. Morlok, David R. Martinelli

PSU-2002-02 MAUTC Student Research Showcase at TRB Annual Meeting, Konstadinos G. Goulias

PSU-2002-03 2002/2003 Distinguished Lecturer Series, Konstadinos G. Goulias

PSU-2002-05 Graduate Student Theses, Konstadinos G. Goulias

PSU-2002-09 Undergraduate Internship Program, Konstadinos G. Goulias

PSU-E-01 Transportation Engineering and Management (TEaM) Laboratory Maintenance and Enhancement (Survey Center, MANTIS, ATLAS, OPTIPATH, and TEaM), Konstadinos G. Goulias

PSU-E-02 MAUTC Annual TRB Research Showcase, Ann Marie Hutchinson

PSU-R-03 Traffic Engineering Education Plan and Program (Deployment of Study Guides and Development of Additional Study Guides), John A. Anderson

PSU-R-38 Pennsylvania TRAC Careers Center Program at Penn State, James H. Miller, Janice S. Dauber

UP-2000-03 Transportation and Logistics Systems Laboratory and Course Development - Phase 4, Edward K. Morlok

UP-E-01 Undergraduate Research Experience, Edward K. Morlok

UP-E-05 Transportation and Logistics Doctoral Program Support, Edward K. Morlok

UP-E-02 National Summer Internship Program in the Railroad and Transit Industries, Edward K. Morlok

UP-E-04 Transportation and Logistics Systems Laboratory and Course Development - Phase 3, Edward K. Morlok

UVA-E-01 Studies in Transportation Engineering and Planning at UVA, Lester A. Hoel

VPI-E-03 Education Program at the Center for Transportation Research, Hesham Rakha, John Collura

WVU-2000-03 The West Virginia TRAC/TCAP Program of West Virginia University, Crystal May

WVU-2000-04 Graduate Student Assistantships in Transportation, David R. Martinelli

WVU-2001-01 The West Virginia TRAC/TCAP Program of West Virginia University, Crystal May

WVU-2001-02 Graduate Student Assistantships in Transportation, David R. Martinelli

WVU 2001-03 West Virginia Bridge Building Contest, David R. Martinelli

WVU-2002-01 The West Virginia TRAC/TCAP Program of West Virginia University, Crystal May

WVU-2003-02 The West Virginia TRAC/TCAP Program of West Virginia University, Crystal May

WVU-R-16 International Symposium on Use of Nonlinear Finite Element Modeling for Pavement Analysis and Design, Samir N. Shoukry

TECHNOLOGY TRANSFER

New Projects

PSU-2005-06 2006 Transportation Engineering and Safety Conference, Martin T. Pietrucha

Ongoing Projects

PSU-2004-04 Statewide High Performance Concrete Implementation Program, Paul J. Tikalsky

Completed Projects

PSU-2004-08 2005 Transportation Engineering and Safety Conference, Martin T. Pietrucha

PSU-2003-03 2004 Transportation Engineering and Safety Conference, Martin T. Pietrucha

PSU-2003-02 TRANSTEC, Konstadinos G. Goulias

PSU-2002-11 Transportation Engineering and Safety Conference, Konstadinos G. Goulias

PSU-2002-01 Transportation Engineering Safety Conference and Student Showcase, Kevin M. Mahoney

PSU-2000-08 Annual Transportation Engineering and Safety Conference, Kevin M. Mahoney, Eric T. Donnell

Appendix B: MAUTC Publications
1999-2006

REPORTS

ADA-Compliant Passenger Rail Car Designs to Maintain Full Freight Service (including Excess Dimension Load) Clearances and Meet Restrictive Northeastern Passenger Rail Line Vertical Clearances, by E. K. Morlok, University of Pennsylvania, Technical Report, August 2003.

Analysis of the Great Lakes St. Lawrence River Navigation Systems Role in Ocean Container Trade, by E. Thomchik, G. Gittings, J. Spychalski, and C. Cassano, 2003.

Analysis of Thermal Induced Stresses Induced in Dowel Transverse Joints, by S. Shoukry and G. William, West Virginia University, proceedings of the ASCE Airfield Pavement Conference, Chicago, Illinois, 2001, pp. 373-384.

Application of Dynamic Relaxation in Thermo-Elastic Structural Analysis of Highway Pavement Structures, by S. Shoukry, G. William, and M. Riad, Proceedings: Eighth International LS-DYNA User's Conference, Dearborn, Michigan, 2006.

Assessment of Advanced Engine Technology for the University of Virginia Transit System, by J. Lamb and R. Espino, University of Virginia, Final Report, October 2000, 21 pp.

Assessment of the Performance Rigid Pavement Backcalculation Through Finite Element Modeling, by S. Shoukry, G. William, and D. Martinelli, West Virginia University, Proceedings of the SPIE Conference on Nondestructive Evaluation of Bridges and Highways III, Vol. 3587, California, 1999, pp. 146-156.

Bicycle-Friendly Shoulder Rumble Strips, by L. Elefteriadou, M. El-Gindy, D. Torbic, P. Garvey, A. Homan, Z. Jiang, B. Pecheux, and R. Tallon, The Pennsylvania State University, Final Report, March 2000, 117 pp.

Calibration of the Gravity Model for Truck Freight Flow Distribution, by S. Mao and M. Demetsky, University of Virginia, Final Report, August 2002, 53 pp.

Characteristics of Concrete Contact Stresses in Doweled Transverse Joints, by S. Shoukry, G. William, and M. Riad, West Virginia University, The International Journal of Pavement Engineering, Vol. 3, No. 2, 2002, pp. 117-129.

Comparison of Mobile5a, VT-Micro, and CMEM Models for Estimating Hot-Stabilized Light Duty Gasoline Vehicle Emissions, H. Rakha, K. Ahn, and A. Trani, Virginia Polytechnic Institute & State University, accepted for publication in the Canadian Journal of Civil Engineering (CJCE), 2003.

Crash Characteristics at Work Zones, by M. Zhao and N. Garber, University of Virginia, Final Report, May 2001, 62 pp.

Deploying an ITS Warning System for No-passing Zones on Two-lane Rural Roads, by J. El-Zarif, Virginia Polytechnic Institute & State University, Final Report.

A Discrete Optimization Approach for Locating Automatic Vehicle Identification Readers for the Provision of Roadway Travel Times, by H. Sherali, J. Desai, H. Rakha, and I. El-Shawarby, tentatively accepted for publication in Transportation Research Part B: Methodological, 2003.

Dynamic Backcalculation of Pavement Layer Moduli, by S. Shoukry and G. William, West Virginia University, Proceedings: ASNT Spring Conference and 8th Annual Research Symposium, American Society of Nondestructive Testing, Florida, 1999, pp. 43-45.

Dynamic Relaxation: A Technique for Detailed Thermo-Elastic Structural Analysis of Transportation Structures, by S. Shoukry, G. William, M. Riad, and K. McBride, West Virginia University, International Journal of Computational methods in Engineering Science and Mathematics, Vol. 7, No. 4, pp. 303-311.

Effect of Dowel Bar Looseness on Measured Load Transfer Efficiency Using FWD, by S. Shoukry, G. William, and M. Riad, West Virginia University, Proceedings of SPIE Conference on Smart Systems for Bridges and Highways, Vol. 4330, 2001, pp. 505-510.

Effect of Thernal Stresses on Mid-Slab Cracking in Dowel Jointed Concrete Pavements, by S. Shoukry, M. Fahmy, J. Prucz and G. William, West Virginia University, Journal of Structures and Infrastructure Engineering, DOI: 10/1080/15732470500253214.

Efficient Simulation Algorithms for Optimizing the Reliability of Transportation Network System Capacity, by J. Lin and C.H. Chen, University of Pennsylvania, Electrical and Systems Engineering Department, Working Paper, 2003.

Estimating the Supply and Demand for Commercial Heavy Truck Parking on Interstate Highways: A Case Study of I-81 in Virginia, by N. Garber, H. Wang, and D. Charoenphol, University of Virginia, Final Report, October 2002, 66 pp.

Estimating Vehicle Fuel Consumption and Emissions Based on Instantaneous Speed and Acceleration Levels, by K. Ahn, H. Rakha, A. Trani, and M. Van Aerde, Virginia Polytechnic Institute & State University, ASCE Journal of Transportation Engineering, Vol. 128(2), March/April 2002, pp. 182-190.

Evaluating ITS Parking Management Strategies: A Systems Approach, by R. Maccubbin and L. Hoel, University of Virginia, Final Report, May 2000, 93 pp.

Evaluation of the Pennsylvania Turnpike's Advanced Traveler Information System (ATIS) Project, Phase III, by M. Patten, K. Goulias, and O. Pribyl, The Pennsylvania State University, Final Report, July 1, 2003, pp. 154.

Evaluation of Traveler Diversion Due to En-Route Information, by R. Schiesel and M. Demetsky, University of Virginia, Final Report, May 2000, 61 pp.

Finite Element Evaluation of the Structural Integrity of Composite Concrete-Steel Bridge Decks, by S. Roche and C. Orozco, University of Virginia, Final Report, July 2001.

HOV Corridor Evaluation and Improvement, by J. Ma and L. Hoel, University of Virginia, Final Report, April 2002, 60 pp.

Impact of Vehicle Stops on Hot Stabilized Light-Duty Vehicle Energy and Emission Rates, by H. Rakha and Y. Ding, Virginia Polytechnic Institute & State University, ASCE Journal of Transportation Engineering, Vol. 129(1), Jan./Feb. 2003, pp. 1-10.

Instrumentation and Health Monitoring of Star City Bridge, West Virginia, by S. Shoukry, M. Riad, G. William, West Virginia University. Proceedings of 2005 New York City Bridge Conference, Bridge Engineering Association, New York, New York.

The INTEGRATION Modeling Framework for Estimating Mobile Source Emissions, by H. Rakha and K. Ahn, Virginia Polytechnic Institute & State University, accepted for publication in the ASCE Journal of Transportation Engineering, TE-22744, 2003.

Intelligent Transportation Systems Research and Development Fellowship Program at the Pennsylvania State University, by K. Goulias, The Pennsylvania State University, Final Report, August 2000, 13 pp.

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An Investigation of Web-Based Technologies for the Peninsula Transportation District Commission, by B. Revels and B. Smith, University of Virginia, Final Report, May 2000, 70 pp.

Mechanistic Evaluation of the Depth to Bedrock and its Effect on the Response of 3D Finite Element Pavement Model, Pavement Subgrade, Unbound Materials, and Nondestructive Testing, by G. William and S. Shoukry, West Virginia University, 2000 Geotechnical Special Publication, No. 98, ASCE, Denver, Colorado, pp. 73-86.

Methodology for Forecasting Transit Demand at an Urban Research Park, by S. Hkawn N-Sang and M. Demetsky, University of Virginia, Final Report, May 2002, 16 pp.

A Methodology for Oversized Vehicle Trip Scheduling, by C. Xu and L. Hoel, University of Virginia, Final Report, May 2001, 73 pp.

Modeling and Forecasting Vehicular Traffic Flow as a Seasonal Stochastic Time Series Process, by B. Williams and L. Hoel, University of Virginia, Final Report, June 1999, 243 pp.

An Overview of Pennsylvania's Statewide Long-Range Transportation Plan (PennPlan), by K. Goulias, J. Smedley, R. Heaney, P. Everett, G. Dauber, T-G. Kim, and K. Viswanathan, The Pennsylvania State University, Final Report, July 2000, 36 pp.

Ozone Formation Attributable to Emissions form Rural Interstate Traffic, by S. Jones, Jr., M. Demetsky, and J. Fuentes, University of Virginia, Final Report, May 2001, 143 pp.

The Parcel Service Industry in the U.S.: Its Size and Role in Commerce, by E. Morlok, B. Nitzberg, K. Balasubramaniam, and M. Sand, University of Pennsylvania, Final Report, August 1, 2000, 110 pp.

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The Population Biology of the Spotted Salamander, Ambystoma Maculatum, Inhabiting Penn State Erie Wetlands, by P. Silver, A. Campbell, and J. Cooper, Final Report, October 1999, 58 pp.

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Safety Impacts of Differential Speed Limits - Phase I: Determining the Safety Effects of Differential Speed Limits on Rural Interstate Highways Using Empirical Bayes Method, by X. Sun and N. Garber, University of Virginia, Final Report, May 2002, 108 pp.

Safety Impacts of Differential Speed Limits - Phase I: Effects of Differential Speed Limits on Vehicle Speed and Crash Characteristics Using Hypothesis Tests, by B. Yuan and N. Garber, University of Virginia, Final Report, May 2002, 71 pp.

Spatial Analysis Tools for Integrated Transportation Data: Northern Virginia Intelligent Transportation Systems Prototype, by M. Grimes and B. Smith, University of Virginia, Final Report, May 2002.

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Test Plan: Motorist Survey - Evaluation of the Pennsylvania Turnpike Advanced Travelers Information System (ATIS) Project, Phase III, by M. Patten and K. Goulias, The Pennsylvania State University, Final Report, April 2001, 36 pp.

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Transit Demand Forecasting for Research Parks, by S. N-Sang and M. Demetsky, University of Virginia, Final Report, June 31, 2002.

Transportation for Livable Cities, by V. R. Vuchic, University of Pennsylvania, CUPR—Center for Urban Policy Research, Rutgers University, 1999.

PAPERS

Analytical Procedures for Estimating Capacity of Type B Weaving Sections, by H. Rakha and Y. Zhang, Virginia Polytechnic Institute & State University, presented at the 84th Annual Meeting of the Transportation Research Board, Washington D.C., January 2005.

Applications of Automobile Emissions Modeling to Airport System Planning, Transportation Research Circular, by H. Rakha, K. Ahn, and A. Trani, Virginia Polytechnic Institute & State University, presented at the 80th Annual Meeting of the Transportation Research Board Workshop, 2002.

Assessing the Potential of Using Traffic Simulation Model Results for Evaluating Automatic Incident Detection Algorithms, by B. Hellinga, H. Rakha, and M. Van Aerde, Virginia Polytechnic Institute & State University, Intelligent Transportation Systems Safety and Security Conference, Miami, Florida, March 24-25, 2004.

Assessing the Occlusion Effect of Large-Dimension Vehicles on Traffic Signs at Multilane Highways, by A. Al-Kaisy, J. Bhatt, and H. Rakha,Virginia Polytechnic Institute & State University, Journal of Transportation Engineering, Vol. 130 (5), 2004, pp. 648-657.

Bicycle-Friendly Shoulder Rumble Strips, by D. Torbic, M. El-Gindy, L. Elefteriadou, and Z. Jiang, International Journal of Vehicle Design, 2003, Vol. 33, No. 4, pp. 440-466.

Boarding and Alighting Injury Experience with Different Station Platform and Car Entranceway Designs on U.S. Commuter Railroads, by E. Morlok, B. Nitzberg, and L. Lai, University of Pennsylvania, Accident Analysis and Prevention, Vol. 36, No. 2 (2003), pp. 261-271.

Calibration of TRANSYT Traffic Dispersion Model: Issues and Proposed Solutions, by M. Farzaneh and H. Rakha, Virginia Polytechnic Institute & State University, presented at the 84th Annual Meeting of the Transportation Research Board, Washington D.C., January 2005.

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Virginia Polytechnic Institute & State University, Transportation Research Board, 2001.

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Comparison of Delay Estimates at Under-saturated and Over-saturated Pre-timed Signalized Intersections, by F. Dion, H. Rakha, and Y.S. Kang, Virginia Polytechnic Institute & State University, Transportation Research, Part B: Methodological, Vol. 38(2), 2004, pp. 99-122.

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Developing a Decision Support System for Evaluating an Investment in Fare Collection Systems, by P. Ghandforoush, J. Collura, and V. Plotnikov, Journal of Public Transportation, National Urban Transit Institute, in press.

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Field Evaluation Approach for Quantifying Network-wide Efficiency, Energy, and Emission Impacts of Operational-Level Projects, by H-G. Sin, Virginia Polytechnic Institute & State University, Ph.D. Thesis, 2001.

Field Evaluation of Efficiency, Energy, Environmental and Safety Impacts of Traffic Signal Coordination across Jurisdictional Boundaries, by H. Rakha, A. Medina, H. Sin, F. Dion, M. Van Aerde, and J. Jenq, Virginia Polytechnic Institute & State University, Transportation Research Record, No. 1727, 2000, pp. 42-51.

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Finite Element Modeling of Rigid Pavements, by S. Shoukry and G. William, and M. Riad, West Virginia University, CD Proceedings of the 2nd International Symposium on Maintenance and Rehabilitation of Pavements and Technological Control, Aurburn, Alabama, Paper No. 01-120, 2001.

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Annual Transportation Research Board meeting, Washington, D.C., paper 06-1499.

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Invited Remarks on the 20th Anniversary of SEPTA Commuter Rail Service and of the Delaware Valley Association of Railroad Passengers, by E. Morlok, University of Pennsylvania, The Delaware Valley Rail Passenger, March-April 2003, pp. 10-11.

A Level-2 Reformulation-Linearization Technique Bound for the Quadratic Assignment Problem, by P. Hahn, W. Adams, M. Guignard, and W. Hightower, University of Pennsylvania, submitted to the European Journal of Operational Research, 2003.

A Longitudinal Analysis of Awareness and Use for Advanced Traveler Information Systems, by K. Goulias, T. Kim, and O. Pribyl, The Pennsylvania State University, paper presented at the European Commission Workshop on Behavioral Responses to ITS April 1-3, 2003, Eindhoven, the Netherlands.

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