



## **2004 – 2005 Annual Report**

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

## TABLE OF CONTENTS

Theme .....	1
Management Structure .....	1
Funding .....	1
The Center .....	2
Faculty, Researchers, and Staff .....	4
Students .....	8
Research .....	12
Education .....	15
Technology Transfer .....	15
Appendix A: Project Status List .....	16
Appendix B: Publications, 1999-2005 .....	22

## 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 - responsible for MAUTC's technology transfer activities, publicity, and report preparation.

Ms. Susan Thompson, staff assistant - 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.

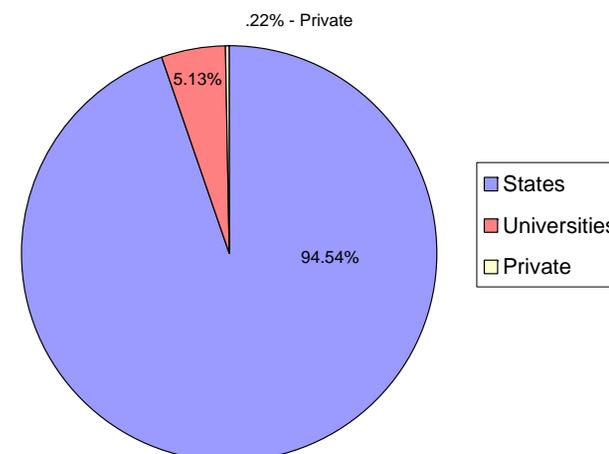


Figure 1. Sources of Matching Funds.

## 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 University of Pennsylvania, a MAUTC partner since 1986, withdrew with the support and concurrence of the consortium members effective July 1, 2005, due to a strategic change in the University's research interests and the impending retirement of Dr. Edward Morlok, director of MAUTC at UPenn. Dr. Morlok announced UPenn's intention to withdraw at the University Transportation Centers review held at the Pennsylvania Transportation Institute in April 2005. UPenn's research was primarily in the area of freight transportation and logistical networks.

### 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.

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.

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.

## Faculty, Researchers and Staff

### 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



**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



**John M. Mason, Jr., Ph.D., P.E.**

Associate Dean for Graduate Studies, Research and Outreach

Director, MAUTC

Director, PTI

**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



**Michael L. Patten, B.S.**

Senior Research Assistant Manager, Center for Intelligent Transportation Systems (CITranS) and the Transportation Survey Research Center at PTI

**Research Interests:** Institutional issues in ITS development and implementation; transportation policy and economics; socio-economic issues in transportation; transportation and land use interactions; survey research methodology



**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, pedestrians



**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



**Paul J. Tikalsky, Ph.D., P.E.**  
Associate Professor, Civil Engineering  
Deputy Director, PTI

**Research Interests:** Structural and material evaluation of buildings and bridges, destructive and nondestructive testing of construction materials, high performance concrete materials



**Nicholas J. Garber, Ph.D., P.E.**  
Professor, Civil Engineering

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



**Janice S. Dauber**  
MAUTC Coordinator

**Susan F. Thompson**  
MAUTC Assistant



**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

## University of Virginia



**Michael J. Demetsky, Ph.D.**  
Professor, Civil Engineering  
President, CUTC

**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.**  
Associate Professor, Transportations Systems 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



**Saeed Eslambolchi**  
Associate Director of Research and Administration  
Center for Transportation Studies

## 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



**Ihab El-Shawarby, Ph.D.**  
Research Scholar

**Research Interests:** Operations research, optimization, modeling and simulation



**Alejandra Medina**  
Senior Research Associate

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



**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



**Mazan Arafah, 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)



**Katie Thacker**, Technical Communicator  
**Machelle Hall**, Budgets and Contracts Coordinator

**Kelly Stanley**, Fiscal Technician  
**Sherri Box**, Communications Manager

**Sherri Cook** (not pictured), Finance Director

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



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

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



**Gergis W. William, Ph.D., P.E.**  
Research Assistant Professor  
Civil and Environmental Engineering

**Research Interests:** Computer simulation, analysis and design of highway bridges and pavements, finite element modeling, concrete pavements, bridge engineering, advanced materials, and structural dynamics

## STUDENTS

### The Pennsylvania State University



**Francis Gross**  
*2004 MAUTC Student of the Year*

Mr. Gross is currently pursuing a Ph.D. in civil engineering in the area of transportation safety. He received an M.S. degree in engineering from Penn State in December 2003 and a B.S. degree in May 2002 from Clarkson University.

His current research is focused on truck safety and empirical Bayes modeling based on Pennsylvania data. Throughout 2004-2005, he has been involved in a driver-fatigue truck safety project sponsored by the Federal Motor Carrier Safety Administration (FMCSA) using binary logistic regression to predict the risk of a crash based on the number of hours driving and different driving patterns. In addition, he has worked with the Transportation Research Board Joint Subcommittee on Transportation Safety Workforce Development to develop a set of safety core competencies and conducted a university-scan to determine the current availability of safety-related programs in the United States. The scan is conducted to outline the fundamental skills and knowledge necessary to function as a transportation safety professional.



**Edwin Salcedo Rueda** holds a B.A. in mathematics engineering with a minor in physics from Saint Vincent College in Latrobe, Pennsylvania, and a B.S. in civil engineering from Penn State. He is a Ph.D. candidate in civil and environmental engineering at Penn State and expects to graduate in May 2007.

His research interests include structural design of concrete structures with emphasis on bridges, durability studies on temporary corrosion protection systems for prestressing strand used in post-tensioned structures, performance testing of grouts used in post-tensioned structures, durability of integral wearing surfaces used on segmental construction, and analysis of the principle tensile stresses at the critical section for shear during construction and service loading of segmental bridges.



**Samrudhdi Suresh** holds a B.E. in civil engineering and is currently pursuing an M.S. degree in civil and environmental engineering at Penn Sate. Ms. Suresh is evaluating high-performance concrete mixes provided by the Pennsylvania Department of Transportation for shrinkage, permeability, coarseness workability, and other parameters using software such as SeeMIX and Life365.



**Sudhakar Sathyanarayanan** holds a Master of Science degree with a major in transportation engineering from Kansas State University, Manhattan, Kansas, and a Bachelor of Technology degree with a major in civil engineering from the National Institute of Technology, Kurukshetra, India First Class.

Mr. Sathyanarayanan is currently conducting research on pavement marking retroreflectivity under the supervision of Dr. Eric Donnell. Mr. Sathyanarayanan is exploring the use of duration models to assess/model the service life of pavement markings and assisting in literature review, data collection, and data analysis efforts pertaining to the pavement marking retroreflectivity project.

Mr. Sathyanarayanan also has an interest in exploring the possibility of designing an automated in-car display system that can supplement warning, advisory and regulatory traffic sign information using an integrated application of geographic positioning systems and .net programming.

## University of Virginia



**Rachel Elizabeth Abel** earned a bachelor's degree in civil engineering from the University of Virginia in spring 2005. She will pursue a master's degree in transportation engineering at the University of Virginia beginning in August 2005. Her focus of research has been on highway safety, specifically the efficacy of photo-red enforcement programs in the Commonwealth of Virginia. As an undergraduate student, Ms. Abel participated in research that aided the Virginia General Assembly in its decision concerning continued use of the photo-red enforcement programs.



**Vikramaditya Repaka** is pursuing a Master of Science degree at the University of Virginia and expects to graduate in May 2006. He is conducting research in the area of sensitivity analysis of accessibility indices of various cities. His advisors are professors Lester A. Hoel and Brian L. Smith. In July 2004 he received a Bachelor of Technology degree in civil engineering from Indian Institute of Technology, Madras, India.



**Rahul Khandelwal** is currently pursuing a Master of Science in transportation and expects to graduate in August 2005 from the University of Virginia, Charlottesville, Virginia. Rahul earned a Bachelor of Technology in civil engineering from the Institute of Technology (BHU), India. He is a graduate research assistant at Virginia Transportation Research Council where he is working with an interdisciplinary team of transportation planners and lawyers to discover the impact of red light cameras on safety in Virginia.



**Cyrus Stevenson Kump** earned a B.S. degree with distinction in civil engineering with a minor in mathematics in 2004 from the Virginia Military Institute (VMI) in Lexington, Virginia. While a student at VMI, he surveyed and created a topographical map for the Lexington Botanical Garden and won first place in the 2004 ASCE Virginia's Conference Concrete Frisbee Competition. He served as a Highway Engineer Co-op Technician for the West Virginia Department of Transportation performing inspection work on various road construction and paving projects for two summers. He is currently a graduate research assistant at the University of Virginia and Virginia Transportation Research Council. Mr. Kump is expected to graduate with a master's degree in transportation in May 2006.



**Qun Liu** received his B.A. degree in civil engineering from Tsinghua University, Beijing, in 1997. After graduation, he joined China State Construction Corporation and gained three years' working experience in construction management. In 2000, he attended National University of Singapore to pursue a master's degree in transportation engineering. During that period, he conducted and published research on arterial travel time estimation and traffic simulation. Upon graduation in 2002, he entered Singapore Technology Corporation and served as a transportation engineer within a project team on the integration of ITS systems in Singapore. From 2003 to 2004 he worked as a research staff at University of Hong Kong with research interests in GIS-Transportation and discrete choice modeling.

In 2004, Mr. Liu was admitted into the transportation program in the Department of Civil Engineering at UVA. Under the guidance of Dr. Nicholas Garber, he is currently conducting research in a project called "Identifying the Impact of Truck Lane Restriction Strategies on Traffic Flow and Safety Using Simulation." His estimated graduation date for an M.S. degree is May 2006.



**Vidya-Charan Tatineni** is a second year graduate student at the University of Virginia. His areas of interest are in logistics and freight modeling. He is currently working on a project titled "Supply Chain Modeling for Freight Transportation Planning" under Professor Michael Demetsky. He received the 2004-2005 George A. Gecowets Graduate Student Award from the Council of Logistics Management. He was the president of the Virginia Student Transportation Association (VSTA), the joint student chapter of ITE and ITS America at the University of Virginia, from January 2004 to December 2004.

Mr. Tatineni is from Vijayawada, India. He received his Bachelor of Technology degree in civil engineering from the Indian Institute of Technology (I.I.T.) in Madras in May 2003. His undergraduate thesis, titled "Traffic Flow Characteristics of Urban Roads," studied the relationships between speed, volume and density on four-lane divided roads in Chennai. At IIT-Madras, he worked as a teaching assistant for an undergraduate course titled "Engineering Design."

## Virginia Polytechnic Institute and State University



**Mohamadreza Farzaneh** received his Ph.D. degree in civil engineering in May 2005. His research areas of interest included traffic flow theory, traffic environmental impacts, applications of intelligent systems in transportation engineering, travel demand modeling, and transportation planning.



**Sangjun Park** is pursuing an M.S. degree in civil engineering and expects to graduate in summer 2005. He has conducted research in environmental issues in the transportation field with a focus on modeling of impacts of transportation activities on energy consumption and emissions.



**Bin Yu** was awarded a Ph.D. in transportation engineering in 2005. His research areas of interest included development and implementation of a truck simulation program, modeling of truck motion along grade sections of road, comparing vehicle performance on road curves, and investigation of WAAS, a method for the collection of road geometry information.



**Huany Yue** has conducted research in the areas of traffic engineering, driver behavior for traffic and environmental modeling and traffic models for buses and high-occupancy vehicle (HOV) lanes. He is a Ph.D. candidate in transportation engineering and plans to complete his studies in December 2005.

**Ahmed Sidky** (photo not available) is pursuing a Ph.D. in computer science as it applies to transportation planning and engineering.



**Yihua Zhang** was awarded a Ph.D. in civil engineering in May 2005 with a concentration in transportation. His research activities included capacity modeling of freeway weaving sections, developing travel time systems with license plate recognition, traffic flow theory and control, traffic modeling, intelligent transportation systems, and transportation safety.

## West Virginia University



**Mourad Y. Riad** is a researcher and Ph.D. candidate since obtaining his master's degree in 2001 at the Department of Civil and Environmental Engineering at West Virginia University. Mr. Riad has demonstrated experience in instrumentation, development, and execution of instrumentation plans, sensory systems, programming data acquisition systems for research projects for long-term monitoring of pavement structures and bridge decks. He previously worked on several research projects funded by the WVDOT and MAUTC.

Mr. Riad is also experienced in 3D finite element modeling of concrete pavements as well as bridges and validation of models response versus laboratory and field experimental data.



**Leonel Medellin, E.I.T.**, is a Ph.D. student in transportation engineering, with expected graduation in May 2006. As a graduate research assistant he has been involved in truck parking and transit equity studies. He has more than seven years of professional experience in heavy construction projects and experience in consulting as a certified Project Manager Professional. His areas of expertise are transportation engineering and project management. His interests include transportation planning and public transportation. He received a B.S. in civil

engineering and an M.S. in construction management from Instituto Tecnológico de Monterrey (ITESM), Monterrey, Mexico.

# RESEARCH

MAUTC research projects are selected on the basis of their ability to provide financial support for students and to support the needs of the state departments of transportation, local transportation agencies, and the Mid-Atlantic Region. U.S. Department of Transportation research priorities are strong considerations when seeking matching funds for projects.

The number of new projects decreased this year, as MAUTC focused on bringing ongoing research projects to completion.

MAUTC has conducted more than 100 projects since the beginning of the current contract, totaling just over \$9 million. The majority of the projects have been in the area of transportation system performance. Appendix A provides a complete listing of all projects.

Subject Area	No. of Projects	Total Budgeted (All Sources)
Transportation System Performance	49	44.23%
Physical Infrastructure	16	18.09%
Information Infrastructure	25	24.70%
Vehicles	2	0.60%
Other	15	12.38%

Table 1: Research Projects by Subject Area.

### Susquehanna Segmental Bridge Project, PSU-2004-02



The Susquehanna Segmental Bridge on the Pennsylvania Turnpike is currently under construction. This bridge is the first major bridge in Pennsylvania to utilize post-tensioned segmental construction. Precast, post-tensioned segmental bridges have the advantage of excellent durability and long service life combined with quick

construction and a pleasing streamlined appearance. Segments for the bridge are precast at a concrete casting yard near the site and then joined together with high-strength steel post-tensioning cables.



This project provides an excellent opportunity to combine the expertise at Penn State with a unique bridge project in Pennsylvania. Dr. Schokker, associate professor of civil engineering at Penn State, helps run the American Segmental Bridge Institute (ASBI) grouting certification program along with Edwin Salcedo, a Ph.D. candidate at Penn State. Dr. Schokker is one of the few faculty in the country working in the area of post-tensioned segmental concrete bridge structures. The Penn State team is working with the Pennsylvania Turnpike through a subcontract with Parsons to ensure that the grouting on the new bridge is state-of-the-art. They are also taking the opportunity to instrument some of the bridge segments to evaluate the actual stress state in the bridge in hopes of making future improvements in design codes and practice.

For further information, contact Andrea Schokker, [ajs19@psu.edu](mailto:ajs19@psu.edu).

### Susquehanna Valley Rural Health Partnership (SVRHP) Transportation Study, PSU-2004-01

The Transportation Survey Research Center at the Pennsylvania Transportation Institute conducted a series of interviews of transportation providers in SVRHP’s service area. SVRHP will use the information gathered to improve services for its clients. The interviews requested information about the providers’ overall operations with a special emphasis on any paratransit services they provided. The respondents were also asked how the Americans with Disabilities Act (ADA) has affected their operations.

Key study findings include:

- Given the low population density and geographic features of SVRHP’s service area, its clients are well served by both paratransit and fixed-route transit.

- Transportation providers in the SVRHP service area participate in all the major paratransit programs.
- The responding paratransit providers carry approximately 530 clients more than 8,500 miles on an average day.
- 50 to 60 percent of paratransit trips are for medical purposes.
- Visits to senior centers and similar groups are very successful in informing potential clients about the availability of these services.

For further information, contact Michael Patten, [mlp2@psu.edu](mailto:mlp2@psu.edu).

### Developing a Fully Instrumented Test Facility, VPI-2001-01

The collaborative efforts of the National Science Foundation, Virginia Department of Transportation (VDOT), and MAUTC researchers at the Virginia Technology and Transportation Institute (VTTI) are transforming Blacksburg, Virginia, into the first instrumented city in North America.

The project, begun in 1999, is designed to support transportation research outside of laboratories and controlled environments by making the entire town of Blacksburg a real-life test facility. Researchers from VTTI have been collecting data from the town to evaluate highly demanded transportation modeling tools aimed at improving roadway safety, traffic flow, and noise and air pollution. The project also tests the latest communication, traffic management, and traveler information systems, which in turn will improve the roadways.

The system infrastructure includes two components. The main component includes a video surveillance system located at 20 of Blacksburg's and Christianburg's signalized intersections. The Traffic Signal Data Acquisition System (TSDAS) acquires and manages traffic signal data from two separately managed traffic signal systems (see Figure 2). The first system is managed by the Town of Blacksburg (TB), which controls traffic signals within the downtown Blacksburg area, and the second system is managed by the Salem District office of VDOT, which controls the remainder of the traffic signals in the Blacksburg and Christianburg area. The system uses a 900 MHz wireless communication system to communicate and transfer data between local controllers and their respective master signal controller. The data are then sent to the VDOT and TB servers, respectively, via a modem connection. The servers at TB and VDOT are programmed to send all necessary and relevant data tables to the VTTI server via the World Wide Web.

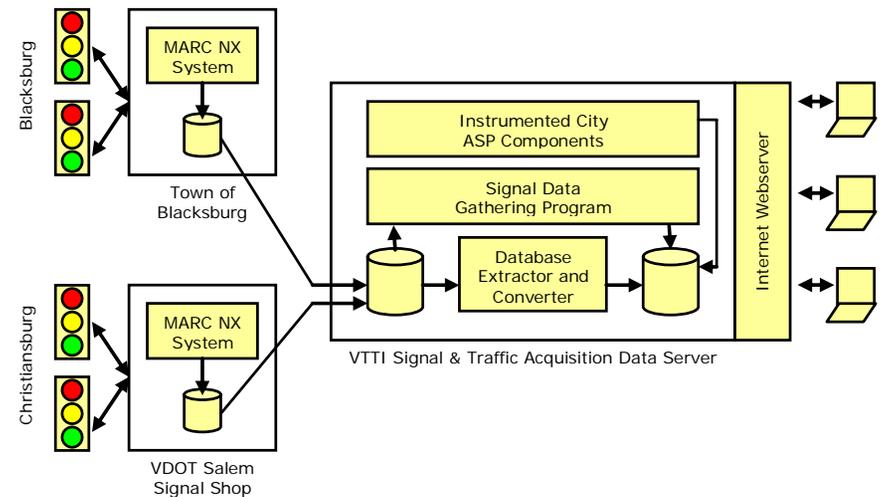


Figure 2. TSDAS System Architecture

The TSDAS system gives researchers the ability to query traffic signals for three distinct types of data:

- *Traffic Data.* The system detector volume and occupancy counts at intervals as short as 15 minutes.
- *Signal Timing Data.* The dial, split, and offset timings for the traffic signals and the actual time each phase within the cycle is activated.
- *Measures of Effectiveness (MOE):* Includes the average volumes, stops, delays and phase utilization.

The second component of the system is a set of infrared cameras that read vehicle license plates. Forty-three cameras are being installed throughout the Blacksburg area and algorithms that encrypt, match, and estimate dynamic roadway travel times will be developed as part of this research project.

For further information, contact Hesham Rakha, [rakha@vtti.vt.edu](mailto:rakha@vtti.vt.edu).

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

A conventional freeway system is composed of three basic components: basic freeway sections, ramp sections, and weaving sections. Freeway weaving sections are formed when a merge area is closely followed by a diverge area or when a one-lane on-ramp is closely followed by a one-lane off-ramp and the two are joined by an auxiliary lane. The weaving sections are further defined as type A, B, or C. Researchers at VTTI are using INTEGRATION

microscopic traffic simulation software to estimate the capacity of weaving sections. The freeway weaving analysis procedures published in the *2000 Highway Capacity Manual* were based on data collected in the early 1970s through the early 1980s.

For further information, contact Hesham Rakha, [rakha@vtti.vt.edu](mailto:rakha@vtti.vt.edu).

### A New Lubricant for Dowel Bars at Transverse Joints, WVU-R-17 and WVU-2000-05

Through the MAUTC funding of two projects, Identification of Critical Stress Concentration around Dowel Bars and Effect of Dowel Bonding Force on Stresses in Concrete Slabs, West Virginia University researchers discovered that lubricating the dowel bars using oil is incapable of eliminating concrete-dowel interfacial friction forces. Laboratory and field testing of dowel bars indicated that such forces would reach 2,500 lb per dowel. These forces resist the slab contraction as its temperature decreases, a reason for a nationwide problem: premature transverse cracks that appear at mid-slab.



MAUTC researchers employed advanced sensor technology in order to measure the strains developed in concrete around the dowel bars from the time of construction to the full curing. They experimented with different viscous coatings such as tectyl and silicon. The silicon coat was observed to be more durable than the tectyl coat, as patches of the tectyl adhere to the surface of concrete at the interface. Applying the silicon coat to the dowel surface reduced the friction coefficient at the concrete dowel interface by 75 percent.

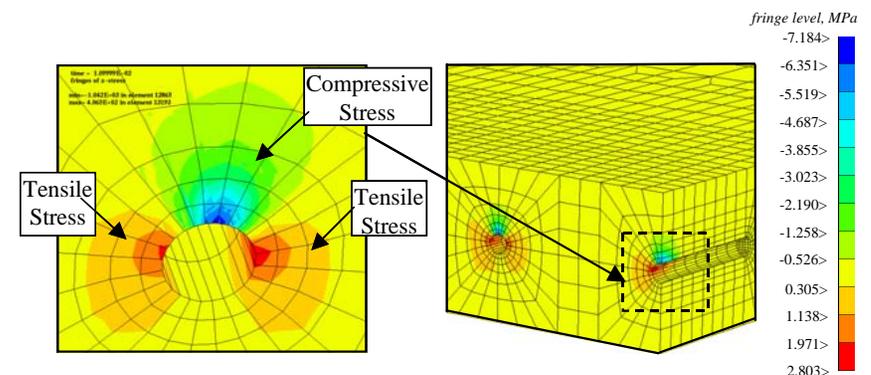
With the support from West Virginia Division of Highways, the long-term performance of silicon-coated dowels is currently under field testing in the instrumented concrete pavement section along Corridor H near Elkins, West Virginia. The new coat was integrated with the shokbar design to

significantly improve the transverse joint performance and help reduce mid-slab stresses to reduce both joint distress and mid-slab cracking.

For further information, contact Samir N. Shoukry, [sshoukry@wvu.edu](mailto:sshoukry@wvu.edu)

### An Innovative Dowel Bar Design “Shokbar,” WVU-R-17 and WVU-2002-04

The MAUTC funding of the WVU-R-17 project, Identification of Critical Stress Concentration Around Dowel Bars enabled West Virginia University researchers to identify the localized high stresses that develop around the dowel bars at transverse joints between slabs of concrete pavement. Such a finding allowed us to develop an innovative dowel design that was pending for patent in 1998. Although the new design was theoretically proven to be effective in reducing such high stresses around the steel dowels, its long-term field performance remained questionable.



Through support from the West Virginia Division of Highways, the new shokbar has been installed on a section of the newly constructed highway designated as Corridor H in West Virginia in 2001. Through the MAUTC funding of the WVU-2002-04 project, Evaluation of Load Transfer Efficiency measurement, the long-term performance of the shokbar was evaluated versus that of the traditional dowel bars. Not only did the shokbar preserve a constant high level of load transfer efficiency, but it allows for a uniform crack opening of transverse joints through the section where it was installed. This uniform opening plays a great role in overcoming the problem of mid-slab cracking.

For further information, contact Samir N. Shoukry, [sshoukry@wvu.edu](mailto:sshoukry@wvu.edu).

## EDUCATION

### Professional Traffic Operations Engineer (PTOE) Refresher Course and Certification Exam, PSU-2004-06

Penn State, in cooperation with the Mid-Atlantic Section of the Institute of Transportation Engineers (MASITE), delivered a one-day Professional Traffic Operations Engineer workshop in Grantville, Pennsylvania, to prepare engineers for the PTOE exam offered on December 7 at Penn State's University Park campus. Eighteen engineers attended the workshop taught by Eric Donnell, assistant professor of civil engineering at Penn State. Forty-six engineers sat for the exam offered by the Institute of Transportation Engineers (ITE).

For further information, contact Janice Dauber, [jdauber@psu.edu](mailto:jdauber@psu.edu).

## TECHNOLOGY TRANSFER

Through technology transfer activities, the knowledge gained by MAUTC researchers is disseminated well beyond the geographic boundaries of the Mid-Atlantic region. Faculty, researchers, and students disseminate their research findings at professional conferences, research showcases, and through professional organizations.

### Transportation Engineering and Safety Conference Marks Tenth Anniversary, PSU-2003-03



Close to 600 transportation professionals, faculty, and students attended the 2004 Transportation Engineering and Safety Conference, December 8-10, 2004, at the Penn Stater Conference Center Hotel on Penn State's University Park campus.

The Honorable Roger A. Madigan, Pennsylvania State Senator and Chair of the Senate Transportation Committee, was the keynote speaker at the plenary session on Wednesday. On Thursday, Daniel Turner, Professor and Director of the University

Transportation Center for Alabama, University of Alabama, delivered the keynote address.

Five pre-conference workshops were offered Wednesday morning: Catch 'em If You Can, Interchange Selection, Intersection Safety, Roadside Design 101, and Roundabouts.

Session topics covered a broad spectrum of topics from Efficient Traffic Flow and Operations to Trends in Tolling to The Importance of Transportation Systems from Local, State, and Federal Government Perspectives.

A poster session Friday morning showcased research conducted by students from the Pennsylvania Transportation Institute. This annual event provides an opportunity for students to demonstrate their knowledge and interests to the larger transportation community.



A technology showcase and reception Wednesday evening provided an opportunity for participants to view the latest in technology products and engineering services from 27 vendors.

## Appendix A: Research Project Status List

### RESEARCH

#### New Projects (FY 04/05)

- PSU-2004-01 Susquehanna Valley Rural Health Partnership (SVRHP) Transportation Study, Michael L. Patten
- PSU-2004-02 Susquehanna Segmental Bridge Project, Andrea J. Schokker
- 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
- UVA-2004-01 Evaluation of Red Light Camera Enforcement in Virginia, Nicholas J. Garber
- 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-2004-01 Modeling the Capacity of Freeway Weaving Sections, Hesham Rakha
- WVU-2003-03 Work Zone Speed Control, Ronald W. Eck

#### Ongoing Projects

- PSU-R-01 Center for Intelligent Transportation Systems Research, Michael L. Patten
- UVA-2003-01 Supply Chain Models for Freight Transportation Planning, Michael J. Demetsky
- VPI-2001-01 Developing a Fully Instrumented Test Facility, Hesham Rakha
- VPI-2000-02 Characterizing Vehicle Dynamics for the Enhancement of Traffic Simulation Models, Hesham Rakha
- VPI-R-01 Addressing I-81 Transportation Issues, Hesham Rakha
- VPI-R-14 Addressing Urban Network and State Transportation Issues, Hesham Rakha

#### Completed Projects

- 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-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-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 and Technology Transfer Projects Status List

### EDUCATION

#### New Projects

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

#### 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

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

## **TECHNOLOGY TRANSFER**

### **New Projects**

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

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

### **Ongoing Projects**

None

### **Completed Projects**

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

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

## Appendix B: MAUTC Publications 1999-2005

### 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. Spsychalski, 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.

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.

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.

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.

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.

Investigating the Application of a GIS Database to Address Statewide Freight Transportation Planning, by B. Shannon and M. Demetsky, University of Virginia, Final Report, April 2002, 34 pp.

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 from 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.

The Pennsylvania Quality Initiative: A Synthesis of Customer Satisfaction and Additional Research Needs, by T. Poister, The Pennsylvania State University, Final Report, October 1999, 44 pp.

Pennsylvania Rail Freight Assistance Program, by G. Gittings, The Pennsylvania State University, Application for Assistance, July 1993, 19 pp.

Pennsylvania Road Safety Audit Pilot Program, by M. Pietrucha and P. Garvey, The Pennsylvania State University, Final Report, March 1999, 38 pp.

Performance Evaluation of Backcalculation Algorithms through 3D Finite Element Modeling of Pavement Structures, by S. Shoukry and G. William, West Virginia University, Journal of Transportation Research Board No. 1655, TRB, National Research Council, 1999, pp. 152-160.

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.

Predicting Crashes from Increased Signalization: Prototype Software for Corridor Planning, by S. Kim, University of Virginia, Final Report, August 2001, 28 pp.

Quantifying the Benefits of Active Incident Management in Rural Areas, by H. Rippeon, J. Miller, and M. Demetsky, University of Virginia, Final Report, May 1999, 32 pp.

Road Quality Thresholds from the Motorist's Perspective, by P. Garvey, M. Pietrucha, R. Ghebrial, The Pennsylvania State University, and T.H. Poister and C. Smith, Final Report, December 2003, 76 pp.

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.

Test Plan: Motor Carrier Focus Groups - 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, 14 pp.

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.

Test Plan: Survey of Transportation System Operators - Evaluation of the Pennsylvania Turnpike Advanced Travelers Information System (ATIS) Project, by M. Patten and K. Goulias, The Pennsylvania State University, Final Report, April 2001, 26 pp.

Test Plan: Truck Driver Survey - Evaluation of the Pennsylvania Turnpike Advanced Travelers Information System (ATIS) Project, by M. Patten and K. Goulias, The Pennsylvania State University, Final Report, April 2001, 25 pp.

3D Finite Element Analysis of Temperature Induced Stresses in Dowel Jointed Concrete Pavements, by G. William and S. Shoukry, West Virginia University, The International Journal of Geomechanics, Vol. 1, No. (3), 2001, pp. 291-307.

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 80<sup>th</sup> 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.

Case Study Evaluation of Throughput, Energy, Environmental and Safety Impacts of Traffic Signal Coordination: Field and Modeling Results, by H. Rakha, A. Medina, H. Sin, F. Dion, M. Van Aerde, and J. Jenq, Virginia Polytechnic Institute & State University, International Road Federation Conference, Paris, June 2001.

Case Study Operational and Safety Evaluation of an Interstate Highway, by A. Medina, S. Lee, and H. Rakha, Virginia Polytechnic Institute & State University, Intelligent Transportation Systems Safety and Security Conference, Miami, March 24-25, 2004.

Comparison and Calibration of FRESIM and INTEGRATION Steady-state Car-following Behavior, by H. Rakha and B. Crowther, Virginia Polytechnic Institute & State University, accepted for publication in Transportation Research: Part A, 2002.

Comparison of Delay Estimates at Undersaturated and Oversaturated Pretimed Signalized Intersections, by F. Dion, H. Rakha, and Y. Kang, Virginia Polytechnic Institute & State University, Transportation Research Board, 2001.

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Comparison of Delay Estimates at Under-saturated and Over-saturated Pretimed 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.

Comparison of Greenshields, Pipes, and Van Aerde Car-following and Traffic Stream Models, by H. Rakha and B. Crowther, Virginia Polytechnic Institute & State University, accepted for publication in the Transportation Research Record, 2002.

Comparison of Web-based Road-Weather Information from Three States, A. Fayish and P. Jovanis, The Pennsylvania State University, Transportation Research Board Annual Meeting, CD, January 2004 (accepted for publication in Transportation Research Record Series).

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