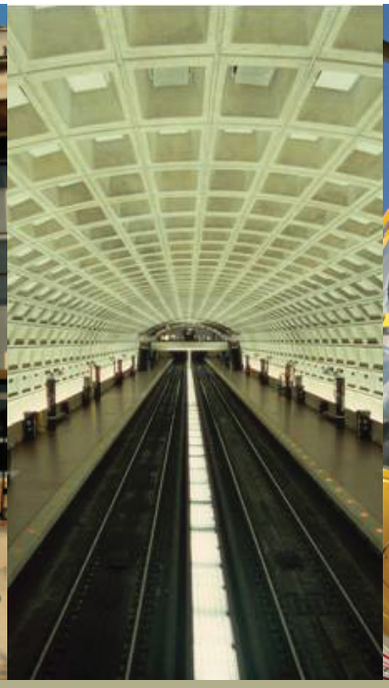

CENTER FOR INTEGRATED TRANSPORTATION SYSTEMS MANAGEMENT

ANNUAL REPORT [2010]

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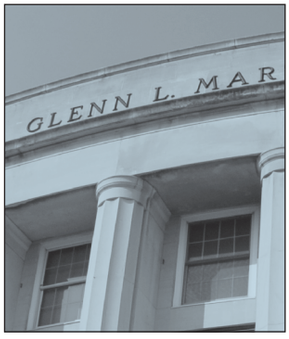


CITSM Center for Integrated Transportation Systems Management

Letter from the Director

The Center for Integrated Transportation Systems Management (CITSM) has completed its second year of operation. In the past two years, the CITSM faculty and researchers have made significant contributions to the state of the art and practice in surface transportation. The research conducted in the center addresses many of the Nation's critical challenges in transportation.

The CITSM research activities in the past two years has been focused on developing new technologies for traffic detection and surveillance, developing new models for improving the efficiency of the transportation systems, developing and using new technologies for real-time travel time prediction, and developing a statewide multi-faceted modeling system intended to support the high level development of transportation policy among others. During this period, the CITSM has funded 23 projects and has supported a cadre of faculty from several departments in the Clark School of Engineering, the School of Architecture, Planning and Preservation, the College of Mathematical and Physical Sciences, and the Center for Smart Growth. CITSM strives to maintain an interdisciplinary research program that best addresses the national transportation research needs within its theme.

On educational front, the CITSM continued to support the Consortium for ITS Training and Education (CITE), a unique organization of universities and industry associations focused on providing comprehensive training and education related to Intelligent Transportation System technology that is delivered in a manner that is flexible and convenient for its students, and the Operations Academy a nationally recognized activity developed and run by members of the CITSM staff to provide senior management training to personnel within State Departments of Transportation. The CITSM is also funding the development and delivery of two new academic courses in intelligent transportation systems, and highway safety to be offered in the next academic year.

Last year the CITSM hosted RITA in their first visit, and Mr. Peter Appel, the RITA Administrator visited us last month. In February 2010, Mr. Philip Tarnoff, the founding director of CITSM, retired from active service at the University. We owe him a debt of gratitude for his vision and leadership over many years of dedicated service the University of Maryland, both as the Director of the Center for Advanced Transportation Technology (CATT) and subsequently as the Director of CITSM. While retired, Mr. Tarnoff is still actively participating in research and development and we greatly benefit from his experience and wisdom. Also, during last year we welcomed two new faculty members to the distinguished cadre of the CITSM faculty and one of our faculty members left the University of Maryland to accept a new position elsewhere.

It has been a very productive year for the CITSM. I invite you to browse through this report and learn about exciting projects that are ongoing at the CITSM. I hope you enjoy reading about the details of our accomplishments in the pages that follow. Thank you for your interest and support of CITSM.

Ali Haghani

Ali Haghani
Director, CITSM/ Professor and Chair, Department of Civil & Environmental Engineering

CITSM People

CURRENT BOARD OF VISITORS

ANNE FERRO
Administrator,
Federal Motor Carrier Safety Administration

ELIZABETH BAKER
Administrator,
NHTSA – Mid-Atlantic Region

GLORIA SHEPHERD
Associate Administrator for Planning,
Environment and Realty, FHWA

RON FREELAND
Executive Secretary,
Maryland Transportation Authority

PAUL WIEDEFELD
Maryland Transit Administrator,
Maryland Transit Administration

JIM WHITE
Executive Director,
Maryland Port Administration

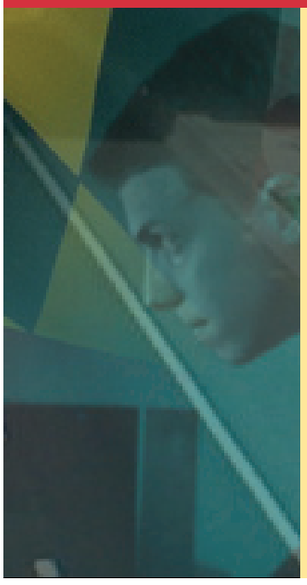
NEIL PEDERSEN
State Highway Administrator,
Maryland State Highway Administration

ED ROWE
Senior Vice President,
Iteris, Inc.

FORMER ADVISORS

JOHN PORCARI
U.S. Deputy Secretary of Transportation

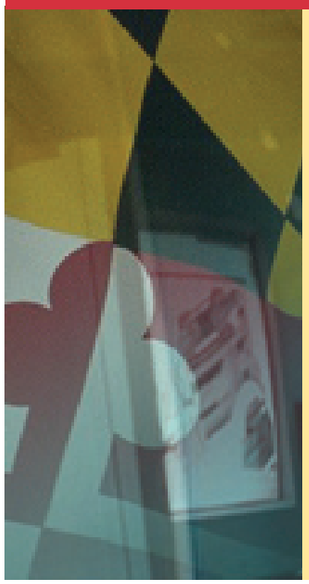
NEW CITSM FACULTY



CATHERINEPLAISANT
Research Scientist
Associate Director of Research,
Human Computer Interaction Lab - http://www.cs.umd.edu/projects/hcil/
Interests: Information visualization, Digital libraries, universal access, image browsing, help, digital humanities, technology for families, or evaluation methodologies.

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

FORMER CITSM FACULTY



KELLY CLIFTON
Assistant Professor
Interests: interactions between land use, transportation, and human behavior

PHIL TARNOFF
Former Director
Interests: Development of advanced technology, Improved processes, and Enhanced organizational structures for the integrated management and operation of transportation facilities and corridors.

CITSM STAFF

ALI HAGHANI
Director

MASOUD HAMEDI
Research Associate

MICHAEL PASZKIEWICZ
Assistant Director

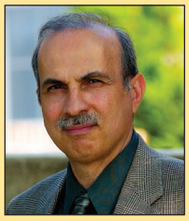
N'KOLA (NIKKI) MORRIS
Accounting Associate

CONTINUING CITSM FACULTY

GANG-LEN CHANG
Professor,
Civil & Environmental Engineering
Interests: Network Traffic control, Freeway traffic management and operations, Real-time traffic simulation, Dynamic urban systems.

CINZIA CIRILLO
Assistant Professor,
Civil & Environmental Engineering
Interests: Discrete choice analysis, Advanced demand modeling, Activity based models, Revealed and Stated preference surveys, Large scale model systems, Value of Time studies.

CHRISTOPHER DAVIS
Professor,
Electrical and Computer Engineering
Interests: Directional wireless communication systems, Communication networks, Sensor networks, Fiber sensors, Biosensors, and Characterization of antennas in the near field.

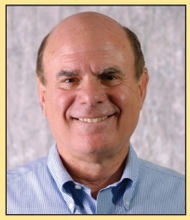


ALI HAGHANI
Professor & Chair,
Civil Engineering Department
Interests: Transportation network modeling, Freight transportation and logistics, Emergency response, Dynamic fleet management, Container transportation, Mass transit operations.

GERRIT-JAN KNAPP
Professor & Director,
National Center for Smart Growth
Interests: Smart Growth and Urban Growth Management, Land Economics and Public Finance, Environmental policy.

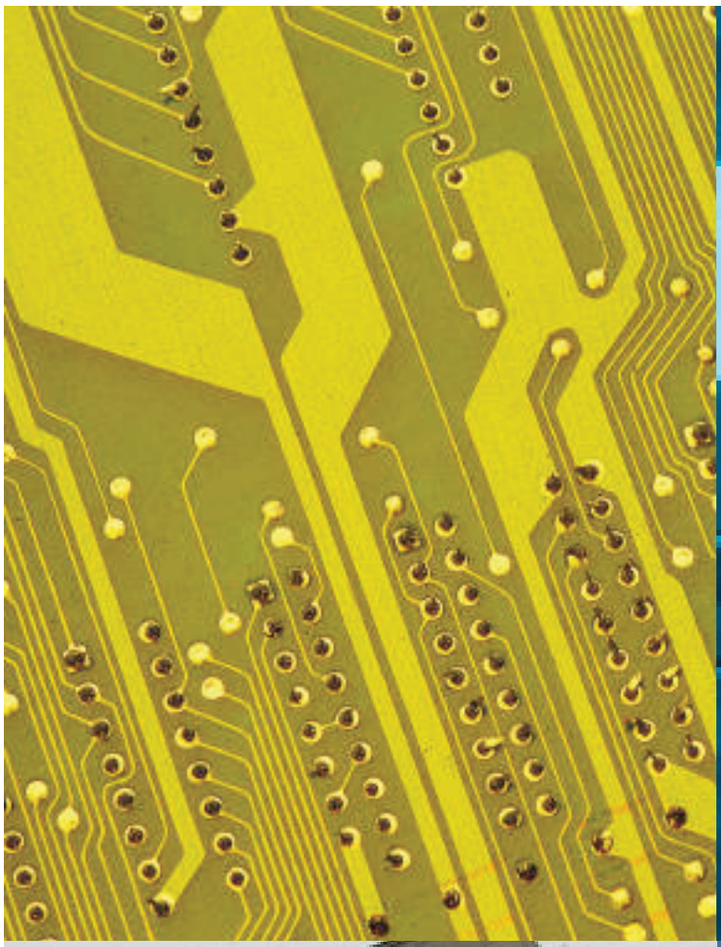
MEHDI KALANTARI KHANDANI
Assistant Research Scientist, Electrical and Computer Engineering
Interests: Communication theory, Internet security and in particular Distributed Denial of Service (DDoS) defense, and modeling and analysis of wireless networks, and Vehicular networking technologies.

ELISE MILLER-HOOKS
Associate Professor,
Civil & Environmental Engineering
Interests: Stochastic and dynamic network algorithms, Optimization and mathematical modeling with applications in transportation, Regional and building evacuation, Emergency preparedness, response and recovery, Transportation infrastructure vulnerability and protection, Routing and scheduling, Hazardous materials routing, Inter-modal goods transport, Collaborative and multi-objective decision-making.

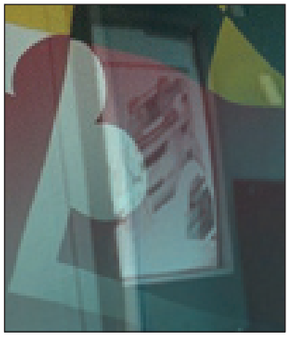


STUART MILNER
Research Professor & Director,
Center for Networking of Infrastructure Sensors
Interests: Scalability of dynamic wireless networks and topology control in hybrid free space optical/RF directional, Wireless networks, Optical wireless sensor networks for critical infrastructure surveillance and broadband optical/RF wireless networks.

PAUL SCHONFELD
Professor,
Civil & Environmental Engineering
Interests: Transportation Engineering.



CITSM Theme



The theme of the CITSM is "Integrated Transportation Systems Management". The Center conducts research and provides education and technology transfer related to this theme. The goal of the Center is to provide improved mobility and reduced congestion for travelers and shippers using the nation's transportation system. The objectives of the Center include the development of advanced technology, improved processes and enhanced organizational structures for the integrated management and operation of existing transportation infrastructure and facilities. Because of the significance of the problems addressed by this theme, parallel research activities are underway within other Universities and their transportation centers. The CITSM activities are coordinated with these other programs such as the work related to mobility in the northeast corridor being conducted by the Institute for Public Administration at the University of Delaware.

Our theme recognizes the likelihood that additions to the capacity of transportation facilities will fail to keep pace with demand, and that the public will increasingly require that existing and planned facilities be managed and operated as efficiently as possible. Current management and operations (M&O) inadequacies reflect inadequate emphasis on this aspect of the transportation system, as well as a shortage of appropriately trained personnel, technological deficiencies, and incompatibilities with existing administrative and political structures. These problems are further compounded by the stove-piping of management functions such that there is little interaction between planners, engineers and operators, and still less interaction between the organizations responsible for the M&O of various transportation modes. These issues are directly addressed by the CITSM theme, which emphasizes a balanced approach to integrated M&O that focuses on education, technology and organizational needs. The Center's activities are further enhanced through the creation of a strong outreach program to ensure that its research successes are implemented by transportation practitioners.

CITSM Scope

The CITSM is concerned with the integrated operation of all modes serving the nation's transportation system, including the institutional issues associated with their management and operation. A balanced multi-modal approach will be used that considers freight and passenger mobility, as well as system operation during periods of both recurring and nonrecurring congestion, including response to major emergencies. The modes included in this theme include highway, transit, rail, and inter-modal interfaces including ports, terminals and airports. The scope of the center is best described in terms of eight overarching topic areas presented below that address both technical and institutional issues. The activities associated with each of the topic areas include research, education and outreach.

- **Transportation System Data Acquisition and Monitoring** – Integration of currently independent information sources, including electronic forms of system monitoring, monitoring of video images, and manual data inputs, is required for the creation of a fully integrated system in which automated vision processing and data fusion techniques can be applied to acquire a comprehensive picture of existing conditions within the transportation system. Knowledge of such conditions can greatly aid in congestion management, emergency response, private or public sector fleet management and other operations within the transportation system.

- **Real-time System Management and Operations** – Existing management and operations focus on the independent needs of incident and emergency management, traffic signal operations, tolling and other demand management strategies, transit operations, and terminal (port and airport) operations. Rarely are these independent activities combined and coordinated in a manner that takes advantage of available capacity and the unique ability of these activities to influence demand. The potential of coordinated operation has been demonstrated by a number of research activities, such as a study performed at the University of Maryland under the Vehicle Infrastructure Integration (VII) project funded by the RITA's ITS Joint Programs Office. This study demonstrated that coordinated operation of facilities offers the potential for reducing vehicle delays by more than 50% in the presence of major incidents. CITSM researchers will focus on the development of processes and decision support tools that will facilitate coordinated system management and operations.

- **Transportation System Safety** – In 2005, there were more than 43,000 transportation system-related fatalities in the U.S. and nearly 1.2 million fatalities worldwide. By most definitions this would be considered a pandemic, with transportation-related accidents ranked as the third leading cause of death, ahead of more highly publicized death causes such as wars (ranked number 8) and HIV (ranked number 10). Victoria, Australia proved that the problem can be effectively addressed, decreasing the fatality rate by 60% in fifteen years, to a rate that is approximately ½ that of the United States. The Victoria success relied on a combination of technology, enforcement and political will. The CITSM research, education and outreach activities are well suited to address this problem by focusing on the political processes that must be energized in order to replicate the Victoria experience. In addition to the obvious benefits of reducing the human cost associated with crashes, improved safety will improve the travel reliability of the system.

- **Transportation Systems Planning** – Consideration of the transportation system as subsystems of networked infrastructure and of the interactions between these subsystems can greatly affect performance. The Center faculty and staff will develop techniques for planning and operating both single-mode systems (such as transit, rail, highway, air) and multi-mode and inter-modal systems (such as inter-modal freight transport systems involving rail, waterways, roadways, ports and terminals) with special attention to potential efficiencies that can be gained through integration and resulting seamless operation. Research projects undertaken within the CITSM will also focus on the development of modeling and other analysis techniques that will permit the extension of system planning to emphasize not only construction of new facilities and expansion of existing facilities, but also changes to operations and interactions between supply and demand that can lead to more efficient use of existing facilities.

- **Management and Operations in Extreme Events** – Human populations are faced with numerous hazards, both natural (e.g. hurricanes, earthquakes, tornados, tsunamis, volcanic eruptions, flooding, mudslides, wildfires) and human-caused, whether accidental (e.g. a hazardous materials release or a nuclear power plant malfunction) or purposeful (e.g. terrorist attack), that have the potential to cause significant devastation. The Center faculty and staff offer a unique range of hands-on knowledge of the issues and procedures associated with emergency preparedness and response. Integrated, coordinated operations are essential in the preparation for such an event and in the decision-making and emergency response that immediately follow.

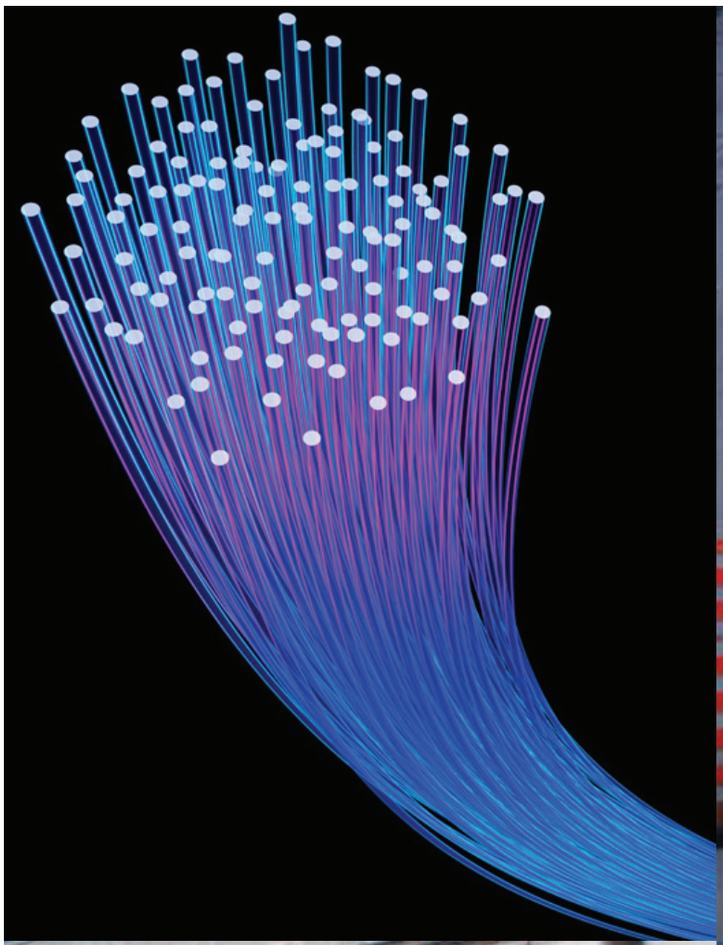
- **Information Dissemination to System Users and Operators (including traveler information)** – One of the most significant shortcomings of today's transportation systems is the absence of integrated information regarding system status. This shortcoming reduces the ability of public agencies to manage the system and prevents travelers, carriers, shippers, and others from making informed decisions regarding the best route, departure time, and mode to use for their intended trip. Existing efforts (e.g. the 511 phone number) are only a first step in providing such information, because their geographic scope is limited and the data are rarely integrated in ways that support informed decision-making. In research conducted within CITSM, integration of data sources and presentation of information in ways that facilitate travel decisions will be emphasized.

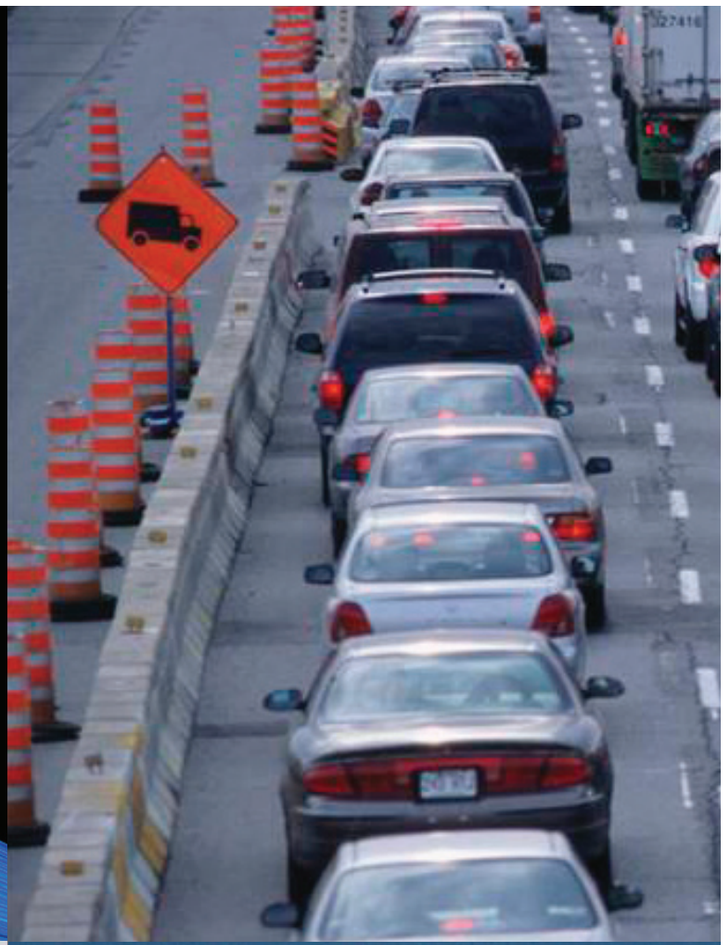
- **Performance Measurement** – The Center's activities will focus on development of performance measures to facilitate integration of transportation management and operations. Center faculty and staff have played a lead role in the development of mobility performance measures locally, regionally and nationally. Their work addresses the entire

spectrum of performance measurement, from the regular assessment of performance of the State of Maryland's traffic management activities to the development of national standards for measuring mobility. Their activities include the development of measures to support planning, engineering, operations and staff management. Such measures are intended for use in communicating with the public, state legislature and regional Metropolitan Planning Organizations (MPOs) in both the Baltimore and Washington, D.C. regions. The focus of research under the CITSM will be on the development of outcome-oriented and system-wide performance measures as opposed to functions related to performance of facilities that fall within the purview of a particular agency.

- **Policy and Institutional Issues** – The challenges that the Center's faculty and staff have faced in their ongoing involvement with regional transportation system management and operations (e.g. CapWIN and RITIS) have highlighted the significance of policy and institutional considerations when attempting to establish an integrated transportation system. Existing institutions are intended to serve the local jurisdictions in which they reside. Little credit is given to politicians who think regionally rather than locally. Parochialism is further promoted by required planning (and funding) processes in which projects are initiated by local jurisdictions. This is often done in a manner that discourages region-wide and system-wide support. Activities undertaken within the Center will study deficiencies that exist in the structure of, and coordination between, the various local, regional and federal transportation agencies and the resulting impact of these deficiencies on system performance. The absence of an integrated strategy has led to, for example, significant insufficiencies in intermodal transport as a result of the current structure of modal-based agencies.

These topics, while varied in nature, are united by the common theme of developing a fully integrated approach to managing and operating available transportation resources. As appropriate, research projects will focus on the development of near-term mitigation strategies for traffic congestion and more basic, exploratory findings whose effects may be experienced further in the future.






RFS

Current Projects

PROTOTYPING A LOW COST AND SCALABLE WIRELESS SENSOR NETWORK FOR TRAFFIC MEASUREMENT

Dr. Mehdi Kalantari Khandani
Electrical and Computer Engineering (CITSM)

In this project, we develop low cost, low profile, and energy self-sufficient sensor modules for different applications of intelligent transportation systems. The proposed sensors harvest the mechanical vibration in street pavement and convert it to electrical energy for operation of sensors. As an important application of this architecture, prototyping and field evaluation will be done for a variation of the proposed sensors that measure quantities such as traffic volume, speed, density, and distribution of vehicle lengths. Compared to the existing solutions, the proposed architecture is economical, easy to install, easy to maintain, and energy self-sufficient. We expect the following outcome for this project: (i) Architectural design, development, and implementation of wireless sensors that harvest their energy from vibration in the road pavements; (ii) Signal processing techniques and algorithms to convert raw data of sensors into quantities such as space mean speed, vehicle length, etc. and, (iii) reports on road evaluation of the developed sensor in field experiments and simulations.

MODELING CAR OWNERSHIP DECISIONS AND VEHICLE AVAILABILITY IN THE STATE OF MARYLAND

Dr. Gerrit-Jan Knaap
Urban Studies & Planning (CITSM, MDSHA & NCSG)

Under a contract with the Maryland State Highway Administration and in cooperation with Parson's Brinkerhoff, the National Center for Smart Growth is building a sketch-level transportation model. That model, which will include the entire states of Maryland and Delaware, the District of Columbia, and parts of Virginia, West Virginia, and Pennsylvania will be used for a variety of purposes, including but not limited to examining the effects of various transportation investments on traffic flows, examining the effects of transportation investments on land use patterns, and examining alternative future development scenarios. The model is expected to play an important role in transportation decision making for years into the future. Among the many policy decisions that must be made in the near future is how to respond to climate change. A recently issued report from the Maryland Climate Commission recommends that emissions associated with vehicle miles traveled be reduced by 25 to 50 percent of 2006 levels by 2020. Interim reduction goals are 10 percent by 2012 and 15 percent reductions by 2015, respectively. Under this project supported by the Maryland University Transportation Center, researchers at the National Center for Smart Growth will enhance the capacity of the transportation model and exercise the model to explore alternative options for meeting these greenhouse gas reduction goals.

INTERMODAL TRANSFER COORDINATION IN LOGISTIC NETWORKS

Dr. Paul Schonfeld
Civil & Environmental Engineering (CITSM)

A model will be developed for integrating and optimizing logistic networks relying on intermodal transfers. It will combine (1) a pre-planning component for optimizing system characteristics such as terminal and vehicle characteristics, routes and schedules, and (2) real-time control algorithms for dealing with service disruptions.

A PROOF-OF-CONCEPT AND DEMONSTRATION OF A HIGH DEFINITION, DIGITAL VIDEO SURVEILLANCE AND WIRELESS TRANSMISSION SYSTEM FOR TRAFFIC MONITORING AND ANALYSIS

Dr. Christopher Davis
Electrical & Computer Engineering;
Dr. Stuart Milner
Civil & Environmental Engineering (CITSM & various industry sources)

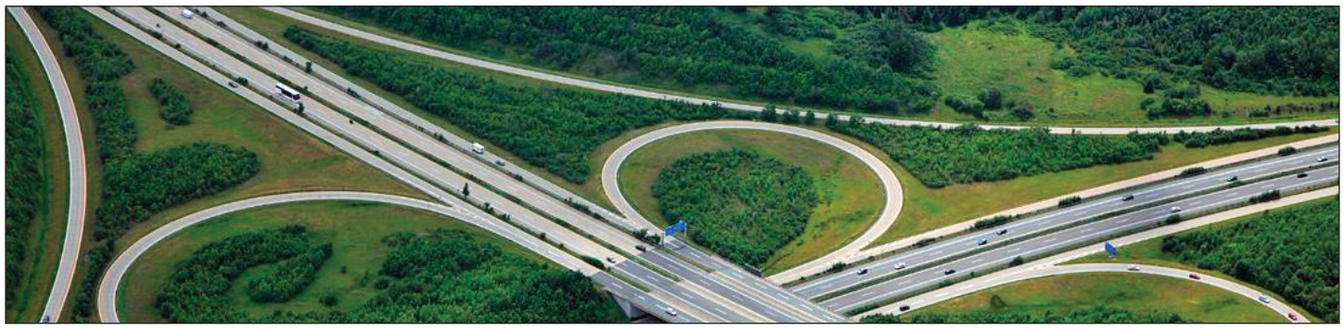
In this applied research project, we plan to conduct a proof-of-concept and demonstration of a high definition (HD), digital video surveillance and wireless transmission system for traffic monitoring and analysis, enabled by rapidly deployable, RF directional wireless links. This system will also provide improved capabilities to emergency responders. The demonstration will consist of HD cameras networked through a 4-node directional wireless network on the University of Maryland campus, and will include the development of real-time “event” detection algorithms specially tailored to our unique combination of HD image capture, wireless transport, and real-time processing. This project will lead to a greater understanding of video technology and image analysis requirements for HD traffic analysis with rapidly deployable advanced wireless systems. It will further allow analysis of gaps between current practice and capability vis-à-vis our HD, high capacity, and deployable wireless image transport system.

DEVELOPMENT OF ADVANCED APPLICATIONS USING BLUETOOTH-GENERATED TRAFFIC FLOW DATA

Dr. Ali Haghani and Mr. Phil Tarnoff
Civil & Environmental Engineering (CITSM)

During the past year, research personnel of the CATT successfully developed and demonstrated a new technology for the collection of travel times and space mean speeds of traffic based on the reception of signals emitted by Bluetooth equipped electronics (PDAs, cell phones, car radios, laptop computers, etc.) located in passing vehicles. Bluetooth is a standards-based, pervasive wireless networking protocol whose use is rapidly expanding throughout the computer electronics industry.

Because of the quality and large sample size of the Bluetooth data sets, this project is focused on research related to the use of this data for advanced analysis of the traffic conditions that existed at the time that the data was collected. This research is intended to address both near-term analytical challenges and long-term applications. In the near term (year one), the research will concentrate on determining the minimum required sample sizes to reliably portray the traffic conditions; identifying and eliminating sample outliers; and developing procedures for distinguishing between motor vehicles and pedestrians in urbanized areas. In the long term (years two and three), the research will concentrate on the development of applications that take advantage of the size and quality of the Bluetooth data. This will include automatic identification of the existence of freeway incidents; use of origin-destination data to evaluate the impact of variable message sign (VMS) (also known as dynamic message sign (DMS) messages on traffic diversions; and predicting the impacts of incidents on travel time.



TRAFFAX TRAFFIC DETECTOR DESIGN AND TESTING

Dr. Ali Haghani, Civil & Environmental Engineering (UMD-MIPS)

The TRAFFAX project is a University partnership with private industry with the goal of developing and commercializing a Bluetooth-based traffic detector technology. The development plan includes three distinct products: a pre-production prototype, a mobile unit, and a permanent installation unit. This proposal directly targets tasks needed for the development of the latter two. The pre-production prototype was manufactured in house and is already under design, unveiled in the summer of 2008. A limited number of pre-production prototypes will be sold to initial customers and used in early demonstrations and initial deployments. The mobile and permanent-mount units will contain the functionality of the pre-production prototype but customized for use in their respective environments. The proposed project targets the specifications, design, assembly of production prototypes, and testing of these two products, as well as smaller research tasks.

ESTIMATING DRIVERS' WILLINGNESS TO PAY FOR HOT LANES ON I-495 IN MARYLAND

Dr. Cinzia Cirillo
Civil & Environmental Engineering (CITSM & NCSG)

A number of new road pricing projects have emerged in the U.S. over the past decade. Currently, 35 of the 50 states have some sort of road pricing project in the planning or implementation stage. One promising approach in implementing road pricing is to convert existing under-utilized high occupancy vehicle (HOV) lanes to high occupancy toll (HOT) lanes. The development of HOT lanes can bring new revenues and pricing incentives to road users by essentially auctioning off space on existing HOV lanes. However, policy makers have always been hesitant to adopt HOT lanes due to insufficient political support. One of the reasons is because it is believed that the HOT lanes will mainly benefit travelers with high incomes due to their high valuation of travel time saving.

In the recent past, the State of Virginia has approved the HOT Lanes Project and has started major infrastructure enhancements to the Beltway (I-495). The project includes two new lanes in each direction from the Springfield Interchange to just north of the Dulles Toll Road and the replacement of more than $260 million in aging infrastructure. This includes replacing more than 50 bridges, overpasses, and major interchanges. HOT lanes will operate as tolled lanes alongside existing highway lanes to provide users with a faster and more reliable travel option. Buses, carpools (HOV-3), motorcycles and emergency vehicles will have free access to HOT lanes. Drivers with fewer than three occupants can choose to pay to access the lanes. Tolls for the HOT lanes will change according to traffic conditions to regulate demand for the lanes and keep them congestion free - even during peak hours. (www.virginiahotlanes.com)

On the Maryland side of the Beltway discussions about HOT lanes as a possible strategy to reduce congestion and collect revenues for other major infrastructure investments is at a much earlier stage. Therefore, with this project we propose to investigate the acceptability of HOT lanes and the willingness to pay for their use from the traveler perspective. In particular, we aim at formulating a model system that simulates individual behavior in response to HOT lanes on I-495 in Maryland. The project will utilize state-of-art and advanced discrete choice models to calculate the number of riders that will be willing to pay to use HOT lanes, the distribution of the willingness to pay and the main factors affecting their choices. Furthermore, our objective is to capture the ability of travelers to change their behavior in response to congestion pricing and their flexibility to accept more sustainable way to access work, shopping and leisure places. Finally the project team intends to establish a continuous dialog with local State agencies in order to adapt our modeling tool to their needs in terms of policy analysis.

DEVELOPMENT AND DEMONSTRATION OF BLUETOOTH-BASED TRAFFIC MONITORING TO ASSESS TRAVEL TIME AND ORIGIN & DESTINATION

Mr. Phil Tarnoff
Civil & Environmental Engineering (CITSM)

The purpose of this project is to develop and deploy Bluetooth data logging devices on roadways to demonstrate its potential to measure travel time and assess origin and destination (O&D) information for ITS operations and HISD planning applications within the Maryland State Highway Administration (SHA). The goal is to fully evaluate the effectiveness of such an approach as a long-term solution for SHA's traffic detection purposes. This task order concentrates on the research and deployment activities as required by the SHA Director, Office of CHART, Highway Information Services Division (HISD) and ITS Development. An interdisciplinary staff of full-time staff engineers and computer scientists, ITS Professionals, faculty, graduate and undergraduate students will support this effort as necessary.

RESILIENCE OF FREIGHT TRANSPORTATION NETWORKS

Dr. Elise Miller-Hooks
Civil & Environmental Engineering (CITSM)

Risks from accidents, weather-induced hazards, and terrorist attacks on freight and passenger transport systems have dramatically increased in recent years. The occurrence of such events can have tremendous impact on system performance, especially intermodal (IM) systems, and can lead to significant economic loss. Even less monumental incidents, such as derailment of cars from tangent track, can lead to network-wide disruptions in service and ensuing delays. A secure and functioning transportation system is of paramount importance to society. To ensure that effective transport services can be provided in a disaster's aftermath enabling society to recover, agencies charged with constructing, managing and operating these systems must invest in measures that prevent or mitigate the effects of disaster incidents. This research effort will result in mathematical tools (i.e. a stochastic, integer program and methodology for its solution) that will explicitly recognize that post-disaster performance of transportation networks depends not only on the inherent capability of the system to absorb externally induced changes, but also on the actions that can be taken in the immediate aftermath of the disaster to restore system performance. Remedial actions that may be taken pre-event, including, for example, adding additional links to the network, ordering spare parts or backup equipment, prepositioning resources in anticipation of potential recovery activities, implementation of advanced technologies, training, and other pre-event actions that can reduce the time required to complete potential recovery activities should they be required post-event will also be considered. Identification of the appropriate pre-event preparatory and post-disaster recovery actions and related investment allocation decisions can play a crucial role in lessening ensuing post-disaster economic and societal loss. Developments from this effort will support rail-based IM system performance measurement, operational decision-making, preparedness planning and immediate post-disaster action. Developed tools will aid infrastructure managers and IM system operators of rail-based IM passenger and freight transport systems in effectively addressing threats from disasters.

TRAFFIC DATA COLLECTION AND ANONYMOUS VEHICLE DETECTION USING WIRELESS SENSOR NETWORKS

Dr. Ali Haghani
Civil & Environmental Engineering (MDSHA)

In this project, we develop low cost, low profile, and energy self sufficient sensor modules for different applications of intelligent transportation systems. The proposed sensors harvest the mechanical vibration in street pavement and convert it to electrical energy for operation of sensors. As an important application of this architecture, prototyping and field evaluation will be done for a variation of the proposed sensors that measure quantities such as traffic volume, speed, density, and distribution of vehicle lengths. Compared to the existing solutions, the proposed architecture is economical, easy to install, easy to maintain, and energy self sufficient. We expect the following outcome for this project: (i) Architectural design, development, and implementation of wireless sensors that harvest their energy from vibration in the road pavements; (ii) Signal processing techniques and algorithms to convert raw data of sensors into quantities such as space mean speed, vehicle length, etc. and, (iii) reports on road evaluation of the developed sensor in field experiments and simulations.

MODELING AND OPTIMIZATION OF SUPPLY CHAIN OPERATIONS DURING EMERGENCY RESPONSE

Abbas Afshar & Dr. Ali Haghani
Civil & Environmental Engineering (CITSM)

The global increase in the number of natural or man made disasters highlights the need for a better planning and operation of the responding agencies. In case of these emergencies various organizations face significant problems of transporting large amounts of many different commodities including food, clothing, medicine, medical supplies, machinery, and personnel from several points of origin to numerous destinations in the disaster areas. The transportation of supplies and relief personnel must be done quickly and efficiently to maximize the survival rate of the affected population and minimize the cost of such operations.

Current research offers a mathematical model that describes the FEMA's supply chain operations in response to natural disasters. The model is able to find the optimal location for temporary facilities and fully consider the flow of relief commodities from sources to the recipients. The model also considers optimal vehicle routings for each vehicle in each transportation mode for the duration of the operations as well as detailed pick-up and drop-off itinerary for each vehicle. The proposed model is tested for numerical case studies which showed the model's ability to help decision makers during the large emergency relief operations.

Also, this research introduces a set of solution techniques and heuristic algorithms to solve the MIP problem for large cases in short times. It is shown in the analysis of numerical results that for large scale problems, commercial solvers are not able to find the optimal solution for proposed model or the running time is so long that it is not practical for disaster response management at the operational level. Two main approaches are followed to develop heuristic solution techniques. First, the model is decomposed into a number of smaller/easier problems and then the results are aggregated. The decomposition can be spatial or temporal or both. In the second approach, the idea is to develop heuristics that find near optimal solutions for the entire model in a short time. Various relaxation techniques are used for this type of heuristics. At the end, the results of the two approaches are compared to each other for different numerical cases.

This research offers a tight lower bound for the MIP problem, in order to evaluate the quality of solutions provided by the heuristic algorithms. It is very important to have a relatively close bound because for the large numerical problems, a theoretical bound is the only benchmark to compare the quality of different heuristics. The proposed lower bound provides the opportunity to try more ambitious heuristics that can potentially be very rewarding.

In addition, a set of real-world-size case studies and simulation experiments are constructed to analyze the model behavior in the large scale disaster response operations. The disaster relief operations can happen in large and disperse geographical areas which requires management tools capable of handling the large scale operations. The dynamic environment after the disaster strike will be best replicated through a set of well-designed simulation experiments that covers a wide range of possible scenarios and test the model's ability to react to variations of data over time.

Finally, in this research major sensitivity analysis is performed on both the model structure and the solution algorithms. The proposed model includes several parameters and variables that can affect the quality of solution as well as the solution time. A major sensitivity analysis on all of the related parameters is essential in order to thoroughly investigate the properties of the model and solution algorithms.

COMPREHENSIVE HIGHWAY CORRIDOR PLANNING WITH SUSTAINABILITY INDICATORS

Dr. Lei Zhang
Civil & Environmental Engineering (MDSHA)

This proposed research project has three main objectives:

1. Define sustainability indicators that are relevant to SHA's Comprehensive Highway Corridors (CHC) program.
2. Develop a high-level planning Model Of Sustainability And Integrated Corridors (MOSAIC) that helps SHA integrate the identified sustainability indicators into the CHC program at the project/corridor level.
3. Provide a guidance document for integrating safety, mobility, and environmental stewardship objectives into SHA's corridor planning process.

EFFECTIVENESS AND EQUITY OF FUTURE TRANSPORTATION FINANCING OPTIONS AT THE FEDERAL AND STATE LEVELS

Dr. Lei Zhang
Civil & Environmental Engineering (CITSM)

It has become evident both at the federal and state levels, that without a significant tax rate increase the gasoline tax – the Highway Trust Fund's primary revenue source – will no longer be a viable method of generating sufficient revenue. According to a report prepared by Cambridge Systematics Inc. (2005), maintaining the nation's current highways and transit systems required approximately $222 billion in 2005, and that amount will increase to $295 billion for 2015. In order to improve the current highways and transit systems, those numbers increase to $271 billion for 2005 and $356 billion for 2015. However, 2005 annual resources only amounted to approximately $180 billion from all levels of government, well short of covering even the maintenance costs. The federal gasoline tax has not increased since 1993. Increased inflation and greater vehicle fuel efficiency have eroded the purchasing power of the gasoline tax revenues. Alternative fuels and fuel efficiency improvement have not completely disrupted tax collection, but it has become clear that an alternative to the gasoline tax is necessary. Recent sharp increases in gasoline prices have resulted in a reduction in total vehicle travel, further hurting the gasoline tax revenue at all levels.

A series of revenue studies have been conducted in recent years with leadership from the National Revenue Commission created under SAFETEA-LU, AASHTO, TRB, and state agencies (McMullen and Zhang 2008, National Revenue Commission 2007, Cambridge Systematics Inc. et. al. 2006, TRB 2006). These studies have all confirmed the revenue gap, and proposed future financing options to close the gap. The following list summarizes the proposed revenue-generating alternatives:

- Increase gas tax steadily in the next several years and then index it to inflation;
- Implement a federal transit ticket surcharge on a per-trip basis;
- Increase vehicle registration and other vehicle-related fees;
- Replace or supplement fuel tax with a mileage-based user fee system;
- Tolling freeways for revenue generation and congestion management;
- Encourage public-private partnerships and leverage private-sector resources;
- Expand specific revenue sources for freight-related transportation needs

While the nation as a whole and many states engage in the debate of sustainable transportation financing options, answers to the following questions will provide critically important input to this debate and help decision-makers forge effective and equitable financing policies:

- What is the true revenue-generating potential of alternative policy portfolios?
- How can revenue goals for maintaining and improving systems be achieved (e.g. how much higher the gas tax needs to be; what should be the rate of vehicle mileage fee)?
- What are the impact of alternative policies on different population segments (e.g. low and high income, urban and rural, different regions, transit users)?
- How will the general public react to the policy scenarios and how to gain their support?

This project will integrate existing datasets (national and regional travel surveys, Highway Performance Monitoring System, etc.) and develop statistical models to answer these important questions. The statistical models estimate how individual households or user groups by geographic location make vehicle ownership (quantity and type) and use (miles driven on each vehicle) adjustments in response to proposed policy scenarios respectively. The overall effectiveness and equity of each financing option will then be evaluated based on model outputs. Similar models have been developed by the P.I. for Oregon, and successfully applied to evaluate the revenue and equity impact of vehicle mileage fees. This proposed project will extend the previous research by considering gas taxes, transit ticket surcharge, vehicle registration fee, distance-based user fee, and tolling at both federal and state levels. Maryland (due to availability of recent surveys and detailed network information) and California (early adoption of fuel-efficient and low-emission vehicles) will be used for state-level case studies. Since there are no clear quantifiable policy proposals regarding public-private partnerships (Zhang 2009) or freight-specific transportation revenue sources, the evaluation of these two financing options are left for future research after the national agenda on these policies is established.

Compared to previous analyses of future transportation financing options, this project is unique and more advanced in several ways. First, demand responses to proposed financing options will be considered in impact analysis. This will be a significant methodological contribution, because a previous study has shown that revenue changes under new funding policies can be overestimated by 11~28% if short-run demand responses are ignored, and by an additional 3~5% if long-run responses are also ignored (Zhang and McMullen 2009). Second, in addition to revenue total estimates, this project will also examine the distributional

effects of future financing options on different population groups. A thorough understanding of the equity issue is necessary for political debates, and for gaining public support. Finally, this project will explore environmentally-friendly (or green) versions of proposed financing options. For instance, a fixed vehicle mileage fee rate for all vehicles has a greener counterpart that incorporates a variable fee structure favoring more fuel-efficient vehicles. A green financing option will not only help reduce energy consumption and pollution emissions, but also improve public support as shown by a recent survey in California (Agrawal 2009).

DISCOVERING AND COMMUNICATING TEMPORAL PATTERNS WITHIN INCIDENT DATA

Dr. Catherine Plaisant
Human Computer Interface Lab (CITSM & HCIL)

While the transportation community emphasizes developing standards for archiving and transmitting raw incident data, little effort has been made to design appropriate visual analytics tools to explore the data, extract meaningful knowledge, and represent results. To improve the integrated management of transportation facilities we believe that novel designs are needed for (1) enabling exploratory search of rich incident data, (2) providing user-controlled visualizations of results, and (3) facilitating cause and effect analysis. Traditional safety and incident analysis has mostly focused on incident attributes data (such as the location and time of the incident or type of vehicle involved). In this project we will focus on exploring temporal aspects that are often overlooked e.g. the length of time there has been water on the road, how long it took for responders and equipment to arrive on scene, the length of time that lanes were blocked or closed, etc.)

By bridging the worlds of databases, user interface design and information visualization, we believe that we can create the next generation of potent visual analytic tools for temporal data exploration of incident data. After 30 years in which SQL was the dominant query framework, we offer a fresh visual approach that promises to impact theory and practice for temporal data exploration, which can in turn help identify both effective countermeasures and improve the integrated management of transportation systems.

FEASIBILITY AND BENEFIT OF ADVANCED FOUR-STEP AND ACTIVITY-BASED TRAVEL DEMAND MODELS FOR MARYLAND

Dr. Lei Zhang
Civil & Environmental Engineering (MDSHA)

This proposed research project has four main objectives:

1. Summarize current and emerging planning and policy issues in Maryland that MSTM needs to address and identify the types of improvements to MSTM which would improve the ability to address these issues.
2. Identify cost-effective approaches for improving MSTM based on SHA's planning and policy analysis needs. In close cooperation with SHA, develop a long-range plan for continual improvement to the MSTM.
3. Obtain a better understanding of the feasibility and benefit of the activity/tour-based approach for travel demand forecasting at SHA;
4. Develop a prototype time-of-day choice model. If SHA plans to improve the time-of-day aspects of the MSTM, this prototype model can be further developed in a subsequent project and incorporated into MSTM to improve model sensitivity with respect to congestion, pricing, and other policies.

Completed Projects

INTEGRATION OF OFF-RAMP AND ARTERIAL SIGNAL CONTROLS TO MINIMIZE THE RECURRENT CONGESTION ON CAPITAL BELTWAY

Dr. Gang-Len Chang,
Civil & Environmental Engineering (CITSM)

INTEGRATING VEHICLE OWNERSHIP DECISIONS INTO THE MARYLAND STATEWIDE TRANSPORTATION MODEL

Dr. Kelly Clifton,
Urban Studies & Planning;
Dr. Cinzia Cirillo,
Civil & Environmental Engineering (CITSM & NCSG)

MODELING VIOLATIONS IN HIGH-OCCUPANCY TOLL LANE STUDIES

Dr. Elise Miller-Hooks,
Civil & Environmental Engineering (CITSM)

DEVELOPMENT OF A REAL-TIME TRAFFIC SIMULATOR FOR I-695, BALTIMORE BELTWAY, FOR TRAFFIC OPERATIONS AND INCIDENT MANAGEMENT

Dr. Gang-Len Chang,
Civil & Environmental Engineering (MDSHA)

DEVELOPMENT AND OPERATIONS OF A TRAVEL TIME PREDICTION SYSTEM WITH VARIABLE MESSAGE SIGNS FOR THE HIGHWAY NETWORK BETWEEN SALISBURY AND OCEAN CITY

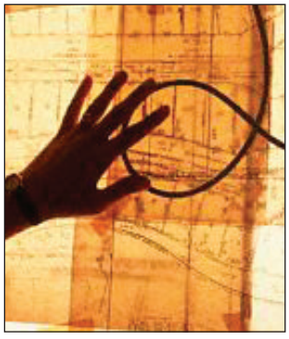
Dr. Gang-Len Chang,
Civil & Environmental Engineering (MDSHA)

AN INTEGRATED COMPUTER SYSTEM FOR ANALYSIS, SELECTION, AND EVALUATION OF UNCONVENTIONAL INTERSECTIONS

Dr. Gang-Len Chang,
Civil & Environmental Engineering (MDSHA)


GLENN L. MARTIN

Current Publications & Presentations



1. Haghani, A., Hamedi, M., Sadabadi, K.F., Young, S., and P. Tarnoff, "**Data Collection of Freeway Travel Time Ground Truth with Bluetooth Sensors**", Transportation Research Record, Journal of the Transportation Research Board, No. 2160, pp. 60-68, 2010.

2. Sadabadi, K.F, and A. Haghani, "**Bluetooth Travel Time Data Collection**", poster presented at NATMEC Conference on Improving Traffic Data Collection, Analysis, and Use, Transportation Research Board, Seattle, Washington, June 21–24, 2010.

3. Young, S.E., and A. Haghani, "**Bluetooth Traffic Monitoring: Technical Attributes and Application Potential**", presented at NATMEC Conference on Improving Traffic Data Collection, Analysis, and Use, Transportation Research Board, Seattle, Washington, June 21–24, 2010.

4. Kaza, N., Knaap, G, and Clifton, K., "**Economic Scenarios and Development Patterns in the Baltimore-Washington Region**", presented at the meetings of the Association of Collegiate Schools of Planning, Crystal City, VA, October 2009.

5. Mishra, Sabyasachee, Fred Ducca, Gerrit-Jan Knaap, and Subrat Mahapatra, Xin Ye, "**An Integrated Land Use-Transportation Model for Analyzing Transportation Impacts in the Maryland-Washington D.C. Region**", presented at the meetings of the Association of Collegiate Schools of Planning, Minneapolis, MN, October 2010.

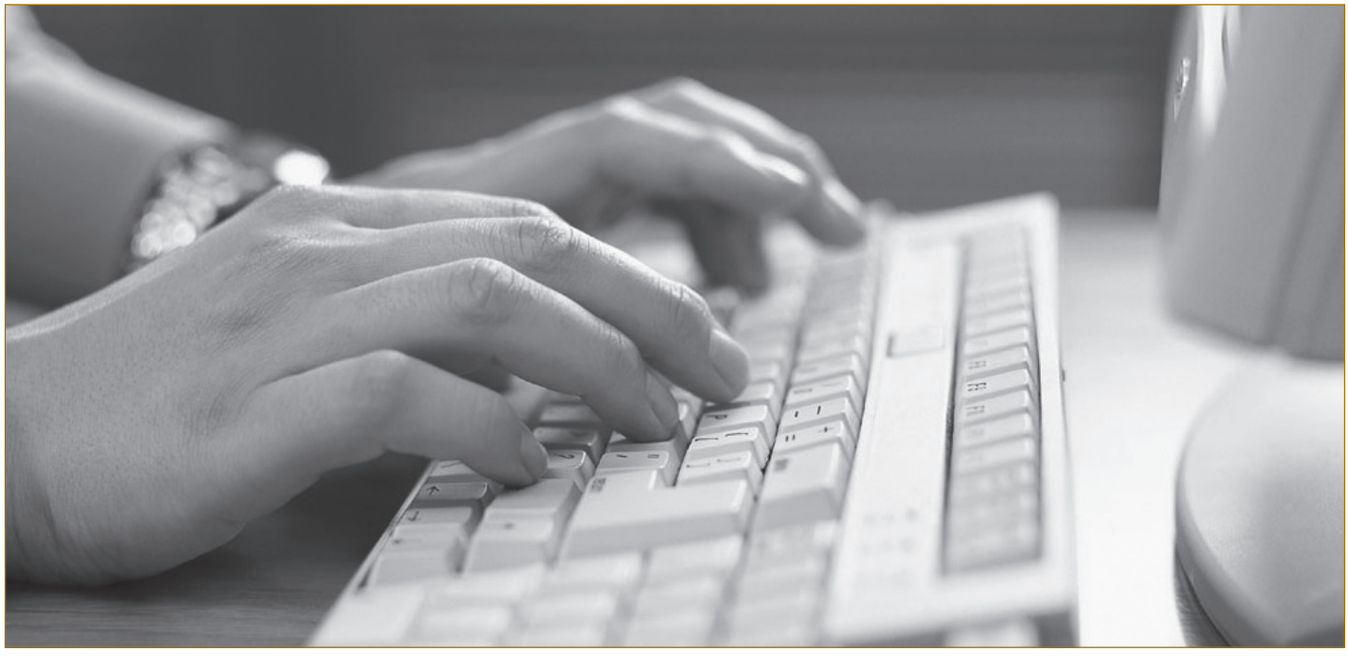
6. Mishra, Sabyachee, Xin Ye, Fred Ducca, and Gerrit Knaap, "**A Functional Integrated Land Use-Transportation Model for Analyzing Transportation Impacts in the Maryland-Washington D.C. Region**", Sustainability: Science, Practice & Policy, under review at.

7. Knaap, Gerrit-Jan., Terry Moore, Arnab Chakraborty, Nikhil Kaza, and Rebecca Lewis, "**Visions, Scenarios, and Development in the Baltimore-Washington Area: Is There a Connection?**" Sustainability: Science, Practice & Policy, under review at.

8. Zhang, L. and Methipara, J. (2010). "**Internalizing Congestion and Environmental Externalities with Green Transportation Financing Policies**", Journal of the Transportation Research Board (under revision for second submission).

9. Robitaille, A, Methipara, J., and Zhang. L (2010). "**Effectiveness and Equity of Vehicle Mileage Fee at the Federal and State Levels**", Journal of the Transportation Research Board (under revision for second submission)

10. Zhang, L. and Methipara, J. (2010). "**Internalizing Congestion and Environmental Externalities with Green Transportation Financing Policies**", to be presented at the 2011 TRB Annual Meeting, Washington, D.C.



11. Robitaille, A, Methipara, J., and Zhang. L (2010). "**Effectiveness and Equity of Vehicle Mileage Fee at the Federal and State Levels**", to be presented at the 2011 TRB Annual Meeting, Washington, DC.

12. Zhang, L., Robitaille, A, and Methipara, J. (2010). "**Effectiveness and Equity of Future Transportation Financing Options in the U.S.**", paper presented at the 12th World Conference on Transport Research, July 11-15, Lisbon, Portugal.

13. Zhang, L. (2010). "**Vehicle Mileage Fee and Congestion Pricing**", invited panel presentation at the 2010 Annual Transportation Research Forum, March 11-13, Washington, DC.

14. Zhang, L., Robitaille, A., and Methipara, J. (2010). "**Effectiveness and Equity of Transportation Financing Options at the Federal and State Levels**" presented at the Fourth International Conference on Financing Surface Transportation in the U.S. May 19-20, New Orleans, LA.

15. Zhang, L., Robitallie, A., and Methipara, J. (2010). "**Internalize Congestion and Environmental Externalities with Variable Distance-based User Charge**", presented at the TRB Conference on Innovations in Pricing, May 11-13, Orlando, FL.

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17. Zhang L. (2009). "**Environmentally-friendly Distance-based User Charge**", paper presented at the 4th International Transport Economics Conference, June 15-16, Minneapolis, MN.

18. S. Milner, J. Llorca, and C. C. Davis. "**Autonomous Reconfiguration and Control in Directional Mobile Ad Hoc Networks**", IEEE Circuit and Systems Magazine, 9,2, 10-26, 2009.

19. J. Llorca, M. Kalantari, S. Milner, C. Davis. "**A Quadratic Optimization Method for Connectivity and Coverage Control in Backbone-based Wireless Networks**", Ad Hoc Networks 7 (2009), pp. 614-621.

20. Jaime Llorca, Stuart D. Milner, and Christopher C. Davis. "**Molecular Inspired Models for Prediction and Control of Directional FSO/RF Wireless Networks**", SPIE Annual Meeting, August 2010.

21. Jaime Llorca, Stuart D. Milner,* and Christopher C. Davis. "**Molecular System Dynamics for Self-Organization in Heterogeneous Wireless Networks**", EURASIP Journal on Wireless Communications and Networking (to be published, 2010, to appear)

22. Markovic, N. and Schonfeld, P. "**Scheduling Under Uncertainty for a Single-hub Intermodal Freight System**," under review at the Transp. Res. Record, Aug. 2010.

23. Chen, C.C. and Schonfeld, P. "**Real-time Dispatching Control to Alleviate Schedule Disruptions at Intermodal Freight Transfer Terminals**," under review at the Transp. Res. Record, Aug. 2010.

24. Markovic, N. and Schonfeld, P. "**Stochastic Scheduling for a Single-terminal Transfer System with Poisson Arrivals**," submitted to Strojniski Vestnik (Slovenian J. of Mechanical Eng.), Aug. 2010.

25. Guerra Gómez, J., Wongsuphasawat, K., Wang, T., Pack, M., Plaisant, C. "**Analyzing Incident Management Event Sequences with Interactive Visualization Technical Report**", under review at http://www.cs.umd.edu/localphp/hcil/tech-reports-search.php?number=2010-17

26. Wongsuphasawat, K., Guerra Gómez, J., Plaisant, C., Wang, T., Taieb-Maimon, M., Shneiderman, B. "**LifeFlow: Visualizing an Overview of Event Sequences Technical Report**", under review at http://www.cs.umd.edu/localphp/hcil/tech-reports-search.php?number=2010-17

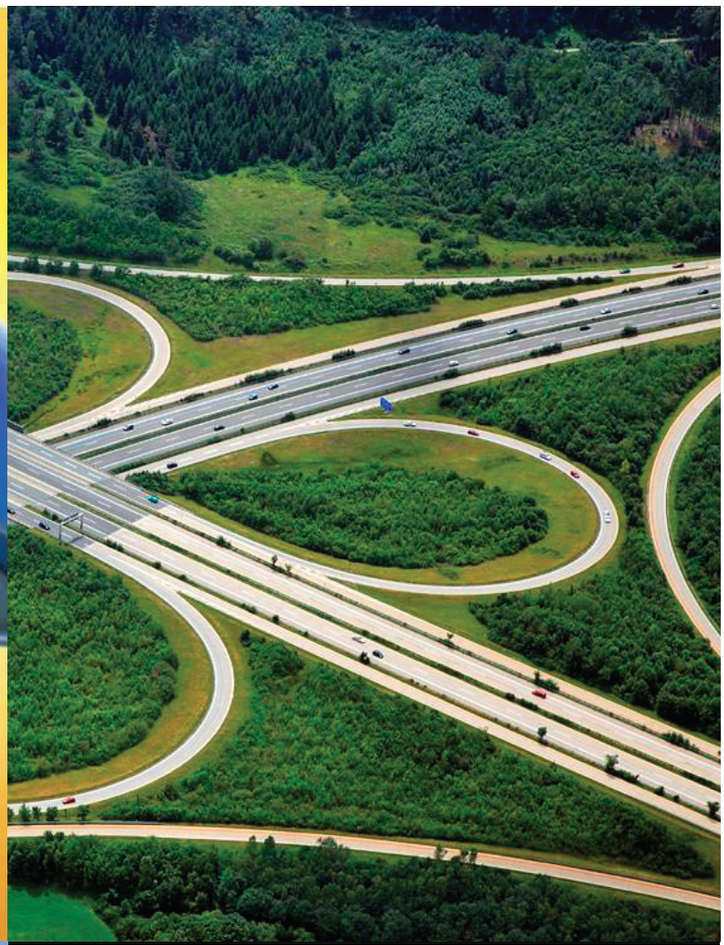
27. Chou, C.-S., E. Miller-Hooks and X. Chen, "**Modeling Violations in Studies of Concurrent Flow Lanes**," Civil and Environmental Engineering Showcase, University of Maryland, Spring 2010.

28. Chou, C.-S. and E. Miller-Hooks. "**Exploiting Capacity of Managed Lanes in Diverting Traffic around an Incident**," in review for publication in Transportation Research Record and presentation at the 90th Annual Meeting of the Transportation Research Board, Washington, D.C., January 2011.

29. Chou, C.-S. and E. Miller-Hooks. "**Safety Implications of Violations in Concurrent Flow Lane Operations**," in review for publication in the Transportation Research Record and presentation at the 90th Annual Meeting of the Transportation Research Board, Washington, D.C., January 2011.

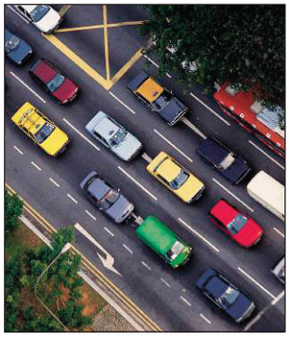
30. Zhang, X., R. Faturechi and E. Miller-Hooks. "**Maximizing Transportation Network Resilience through Optimal Investment in Preparatory and Recovery Actions**," working paper.

31. Faturechi, R., X. Zhang, E. Miller-Hooks, "**Resilience of Freight Transportation Networks**", INFORMS, Austin, November 2010.




GLENN L. MARTIN HALL

Transportation Programs At Maryland



CATT

The Center for Advanced Transportation Technology (CATT) at the University of Maryland, College Park was created in order to respond to the significant changes brought about by increasing use of advanced technologies in the transportation field. A permanent staff of ITS professionals and affiliated faculty of the Department of Civil Engineering supports the CATT. All offer extensive knowledge and experience in the areas of ITS technology, traffic engineering and control, systems analysis, and operations research. CATT provides an organizational umbrella for four major initiatives including CapWIN, CATT Lab, CITE, and MD T^2 Center.

The CATT provides a bridge between the intelligent transportation systems (ITS) community, the information technology community, and other disciplines essential to the successful application of ITS.

CURRENT CATT PROJECTS

RESEARCH

- 3-D, Real-time Traffic Monitoring (Virtual Helicopter)
- 3-D Traffic Data Spatial and Temporal Graphing
- 3-D, Virtual Commute Fly-over
- Automated Small Vehicle Transportation
- Automated TMC Performance Measurement System
- Bluetooth Traffic Monitoring Technology
- Evacuation Planning
- I-270 Analysis, Modeling, and Simulation (AMS)
- Incident Data Extraction Soft ware
- Incident Management Soft ware
- Maryland Transportation Operations Summit (MTOS)
- Performance Measures for Mobility
- Performance Measures for Statewide Congestion
- Regional Performance Measures
- Temporal Event Pattern Recognition
- Timelines for Real-time and Historical Incident Visualization
- Visual Analytics for Transportation Datasets
- Wide-Area, Archived Travel Time & Bottleneck Analysis Tools

EDUCATION

- Consortium for ITS Training and Education (CITE)
- CITE Blended Learning Courses
- Maryland Transportation Technology Transfer (MD T^2) Center
- NCHRP 20-77 Transportation Operations Framework
- Operations Academy
- Road Scholar Program
- Virtual Incident Management Training

DEPLOYMENT ASSISTANCE

- Capital Wireless Information Net (CapWIN)
- CHART Support
- Explore and Visualize Accidents (EVA)
- I-95 Corridor Coalition
- I-95 Corridor Coalition Vehicle Probe Project
- Incident Cluster Explorer
- Maryland Statewide ITS Architecture
- Metropolitan Area Transportation Operations Coordination (MATOC)
- Mobile Traveler Services
- NCHRP 20-7 Guide to Benchmarking Operations Performance
- Regional Integrated Transportation Information System (RITIS)
- State Highway Administration Commercial Vehicle Iinformation System and Network (CVISN) Support
- Traveler Information on the web

CATT Lab

The CATT Lab is supported by an interdisciplinary staff of graduate and undergraduate student researchers, affiliated faculty of the Department of Civil Engineering, and a permanent team of ITS professionals. The CATT Lab's research and development activities provide a bridge between the intelligent transportation systems (ITS) community, the information technology community, and other disciplines essential to the successful application of ITS. Though a complete list of our research initiatives can be seen in the research section of this website, the CATT Lab specializes in:

- data archiving
- data retrieval tools
- data visualization
- 3D modeling and simulation
- traveler information systems
- video image processing
- software development

The primary resource of the CATT Laboratory is the interdisciplinary group of over 45 undergraduate and graduate researchers and talented staff. CATT Lab staff and students have (or are seeking) degrees in Civil Engineering, Computer Engineering, System Engineering, Electrical Engineering, Computer Science, Aerospace Engineering, Mechanical Engineering, Geography & Geographic Information Systems, and Art.

The lab has access to sophisticated process control & sensing software, mathematical software, modeling and simulation software, Geographic Information Systems (GIS) software, and a collection of video detection and sensing hardware. The lab also has over 50 high-end workstations and laptops plus an impressive array of servers and VM-ware machines in its networking and data center. The lab has also established a T^1 connection with the Maryland State Highway Administration's (SHA) Coordinated Highway Action Response Team (CHART) system that enables the lab to monitor CHART databases, live video feeds, Dynamic Message Signs, and incidents. The CATT Lab maintains a CHART operator workstation, and archives CHART databases for real-time simulation and modeling, traveler information systems, traffic prediction algorithms, and for future research initiatives.
http://www.cattlab.umd.edu/

CapWIN

The Capital Wireless Information Net (CapWIN) is a regional coalition of public safety and transportation agencies across Maryland, Virginia, the District of Columbia, and the Federal Government whose mission is to enable and promote interoperable data communications, operational data access, and incident coordination and situational awareness across jurisdictions and disciplines.

The CapWIN program is staffed by the University of Maryland Department of Civil and Environmental Engineering's Center for Advanced Transportation Technology. It operates under the guidance of a Board of Directors made up of representatives from local, state, and Federal first responder agencies across Maryland, Virginia and the District of Columbia.
This multi-disciplinary, multi-jurisdictional effort focuses on first responders in the field and the unique requirements of wireless users. Today, CapWIN has over 5000 registered users from more than 80 public safety, transportation, and emergency services agencies drawn from all levels of government--including regional authorities--operating in the three state jurisdictions.
http://www.capwin.org/

National Center for Smart Growth

The National Center for Smart Growth Research and Education is a non-partisan center for research and leadership training on smart growth and related land use issues in Maryland, in metropolitan regions around the nation, and in Asia and Europe. Located at the University of Maryland in College Park, MD., just eight miles from Washington, D.C., the National Center for Smart Growth was founded in 2000 as a cooperative venture of four University of Maryland schools: Architecture, Planning and Preservation, Public Policy, Agriculture and Natural Resources, and Engineering.

The mission of the Center is to bring the diverse resources of the University of Maryland and a network of national experts to bear on issues related to land use and the environment, transportation and public health, housing and community development, and international urban development. The Center accomplishes this through independent, objective, interdisciplinary research, outreach and education.

In addition to its research efforts, the Center also is partners with Smart Growth America in the Governors' Institute on Community Design, a program designed to assist governors throughout the United States who are interested in issues of land use, development land conservation, community design, or related issues. This project is funded by the National Endowment for the Arts and the U.S. Environmental Protection Agency.

Upon request, the Center also offers smart growth leadership training to federal, state and local government officials as well as to private sector decision-makers. The Center staff and its affiliate faculty offer specialized education and training programs as well as smart growth study tours and workshops. Center staff invites suggestions or ideas for tours, training or workshop programs and is interested in establishing partnership arrangements.
http://www.smartgrowth.umd.edu/

NEXTOR

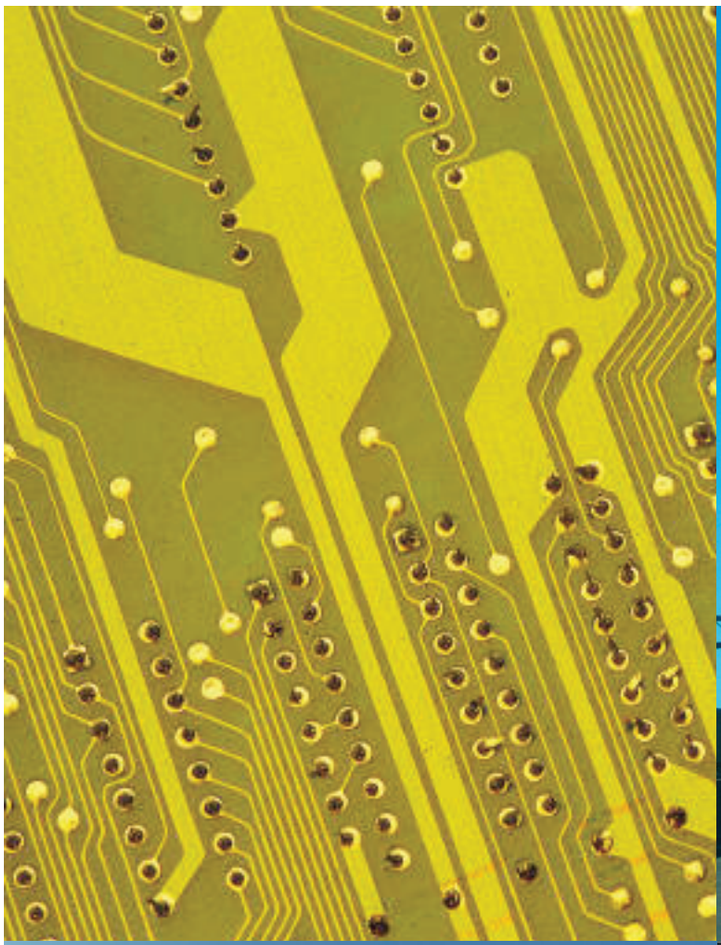
NEXTOR is a Government-Academic-Industry alliance dedicated to the advancement of aviation research and technology. NEXTOR is sponsored by the Federal Aviation Administration (FAA) Office of Technology Development and Operations Planning. In collaboration with the FAA and its industry partners, NEXTOR looks to develop an understanding of how the National Airspace System (NAS) service providers and users will respond to alternative system architectures, operational concepts, investment strategies and finance mechanisms. The knowledge and capabilities gained from this government-sponsored *Research Program* provides critical information to executives and senior government officials on a host of issues ranging from near-term investment choices to long-term strategies. Through its *Knowledge Exchange Program*, NEXTOR researchers, industry members, and government agents present state-of-the art research to the aviation community. The program offers two to three conferences and seminars per year on such subjects as NAS Infrastructure Management, Performance Metrics and the Economic and Social Value of Air Transportation.

In addition, the partnership seeks to increase the breath of aviation operations research knowledge through its *Education Program*. More than 100 graduate students have participated in NEXTOR's research programs since the organization's birth in 1996. Short courses are taught by faculty members and are open to any FAA, federal government, or industry affiliate employee interested in air transportation systems analysis.
http://www.nextor.org/

Center for Networking of Infrastructure Sensors (CNIS)
The CNIS is an interdisciplinary research center at the University of Maryland. CNIS is concerned with sensors, communication, and infrastructure security in the military and civilian domains. The University of Maryland, College Park, has developed a remote, real-time surveillance system to demonstrate the ultra-broadband capability of hybrid Free Space Optical (FSO)/RF links. Our system transmits ultra-high bandwidth, high resolution images from surveillance cameras monitoring regions of interest on campus. Hybrid wireless links transfer live, high resolution, video imagery that can be processed in real time to provide important information about targets of interest in the field of view. Targets of interest can be "events" detected by intelligent image analysis software, moving vehicles, or background changes in the field of view. This requires high quality, both in terms of spatial resolution and in the time domain (frame rate), which demands a large bandwidth. An important feature of our system is that it provides transmission of high-resolution imagery, which requires low latency, high data-rate frame transfer end-to-end over the Internet, with wireless communications in the "last mile." Our system, which includes high resolution, zoomable, tracking cameras, with 1.25Gb/s FSO and 100Mbs 24GHz directional RF links, can remotely process incidents over an internet and execute follow up activity such as tracking in real time. The average data transfer rate for this application is approximately 183Mb/s, corresponding to slightly less than 15% of total available bandwidth.
http://www.cnis.umd.edu/index.htm

Applied Technology and Traffic Analysis Program (ATTAP)
ATTAP is jointly initiated by the Office of Traffic and Safety at the Maryland State Highway Administration and the Traffic Safety and Operations Laboratory at the University of Maryland - College Park. The primary focus of the program is to develop and apply advanced technologies in contending with day-to-day congestion and in improving traffic safety in highway networks. Research projects performed by the program range from basic human behavior study to deployment of real-time control systems for monitoring and guiding emergency evacuations.
http://attap.umd.edu/

Traffic Monitoring System for the Ocean City Region
This project is to design and implement a real-time network traffic monitoring system in the Eastern shore region that includes a set of algorithms for traffic monitoring, travel time prediction, and emergency evacuation.
http://oceancity.umd.edu/



Technology Transfer

CONSORTIUM FOR ITS TRAINING AND EDUCATION (CITE)

The Consortium for ITS Training and Education (CITE) is a unique organization of universities and industry associations focused on providing comprehensive training and education related to Intelligent Transportation System technology that is delivered in a manner that is flexible and convenient for its students. CITE offers over thirty interactive web-based courses to be used both within college curricula and continuing education.

The purpose of the Consortium for ITS Training and Education (CITE) is to create an integrated advanced transportation training and education program. The program, based on a consortium of universities, is open to anyone pursuing a career in advanced transportation. Instruction offered through CITE may include graduate and undergraduate level courses, as well as skill-based training and technology transfer. Courses are delivered either in the form of web-based learning, or using a hybrid format that integrates web-based instruction with instructor led teleconferences.
http://www.citeconsortium.org/index.html

OPERATIONS ACADEMY

As the emphasis on transportation management and operations increases, the demand for personnel with skills in these areas is also increasing. Unless sufficient numbers of personnel with adequate training and experience can be identified, it is unlikely that the State and local transportation agencies will be able to increase their focus on the effective use of existing transportation infrastructure. The Operations Academy is designed to address these needs. It is based on the concept of total immersion in the subject of transportation management and operations, using a mix of classroom instruction, workshops, and analysis of existing systems to ensure the retention of the principles being presented. The academy will provide opportunities to practice and internalize the principles learned which is not possible in traditional classes and short courses.

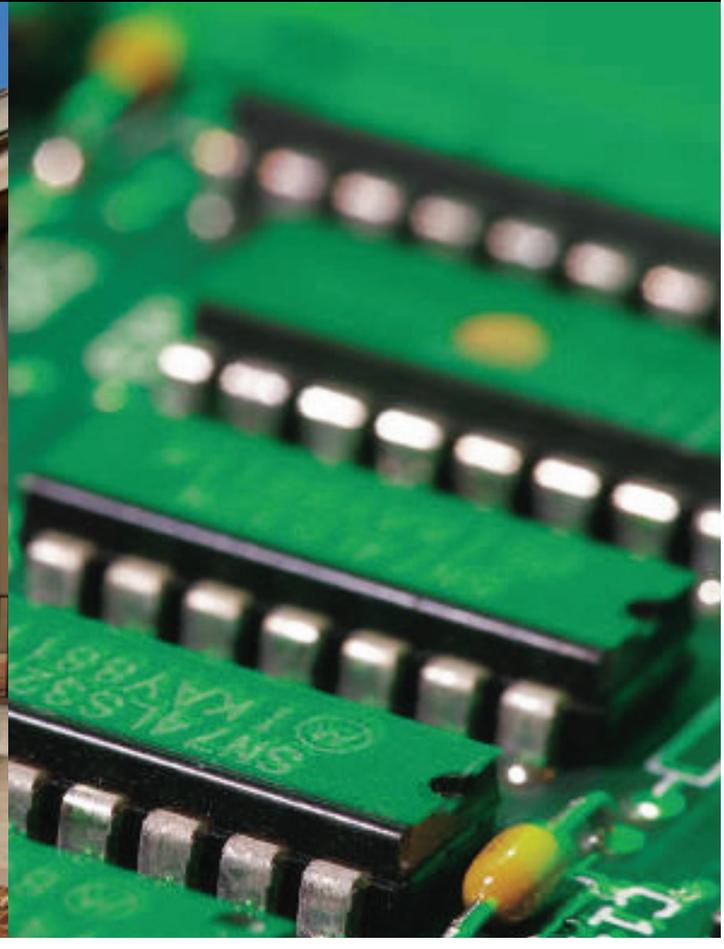
Acceptance for the program is competitive, and requires the nomination of a local, State or Federal transportation agency. It also requires a commitment on the part of those attending the program to satisfy the self-study requirements, and to spend two uninterrupted weeks participating in the Academy's activities. The rewards for participating in this program include national recognition of graduates, certificates of accomplishment, Continuing Education Units (CEUs), and the involvement of supervisors from the participants' home organization. The academy will provide a significant development opportunity to career professionals in transportation management and operations. The development of the Operations Academy was initially funded by the I-95 Corridor Coalition. The Academy receives its funding from student tuition fees, some of which are supported by scholarships awarded by the Federal Highway Administration and the I-95 Corridor Coalition.
http://www.operationsacademy.org/index.html

MDT^2

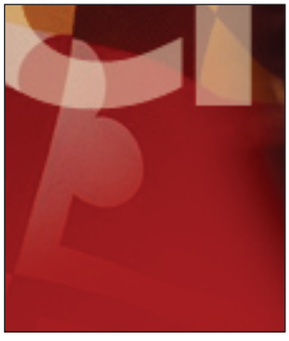
The Maryland Transportation Technology Transfer Center (MD T^2 Center) was established in 1984 at the University of Maryland, College Park. LTAP provides an excellent foundation for T^2 activities in Maryland. Each year, the Center works with the Maryland SHA and the FHWA to develop a work plan that meets the training and technology assistance needs of agencies with transportation responsibilities within the state of Maryland.

Some of the services the Center provides through the LTAP Program include:

- Training Courses and Conferences: The MD T^2 Center organizes more than seventy-five training courses and conferences per year. LTAP funds provide partial support for more than half of these events. Training Catalog: http://www.mdt2center.umd.edu/courses/course-catalog.html
- Media Library: The MD T^2 Center maintains a library of numerous resources on topics of interest to local agencies in Maryland. Visit us online at http://www.mdt2center.umd.edu/library/index.html.
- TechNotes: A quarterly newsletter published by the MD T^2 Center. Download the latest Technotes or browse through past issues at http://www.mdt2center.umd.edu/newsletter/index.html.
- Outreach and Community Service: The MD T^2 Center participates in transportation-related conferences and meetings throughout the state and region. - County Engineers Association of Maryland - The Maryland Municipal League - The Maryland Association of Counties - America Public Works Assn. (DC\MD\VA) Chapter - Roadway Management Conference - ITS Maryland
http://www.mdt2center.umd.edu/



Seminar Series



Intelligent Transportation Systems in the District of Columbia
Speakers: Yanlin Li and Xianding Tao
Dr. Yanlin Li is the ITS Division Manager of the District Department of Transportation. Dr. Xianding Tao is a recent Ph.D. graduate from University of Maryland and currently works in the ITS Division of the District Department of Transportation.

Abstract: Intelligent Transportation Systems (ITS) play an important role to promote traffic operation effectiveness/efficiency and traveler's information services, given the constraints in roadway infrastructure. The District Department of Transportation (DDOT) develops, operates and maintains its ITS to keep the traffic systems operating effectively to meet different goals for the nation's capital. This presentation will provide an overview of the ITS systems in DDOT including traffic signals, dynamic message signs, road weather information systems, traffic detection systems, traffic management center, critical infrastructure protection, highway advisory radio and regional information sharing. It also briefs key knowledge required to get into the ITS community to grow and contribute.

Integrated Land Use and Transportation Model for Analyzing High Speed Rail, Greenhouse Gases, and Sustainable Development in California
Speaker: Dr. Robert A. Johnston
Robert A. Johnston is an Emeritus Professor in the Department of Environmental Science and Policy at the University of California at Davis. He is also a Faculty Researcher at the Institute of Transportation Studies there. He has taught land use planning, energy policy, geographic information systems, and impact assessment courses for 34 years.

His major research project currently is the development of a statewide economic model of land use and transportation. This model will be used to evaluate high-speed rail and other major transportation improvements, as well as policies to reduce greenhouse gases in all sectors. He advises State agencies on greenhouse gas policy. In 2006-07 Professor Johnston was on an NAS committee that issued a book on the state of travel modeling in the U.S. He recently developed a model for projecting energy use and greenhouse gases from general plans.

Abstract: Prof. Bob Johnston will talk about the *Integrated Urban Model* being developed for California. This model projects economic activity and floorspace consumption in about 500 zones and then disaggregates those land uses into 160 million 50m gridcells, to give a fine-resolution map that can be used for impact assessments of noise, runoff, habitats, etc. The land use model is run with the *Statewide Travel Model* every five years, so that changes to the transport system can be evaluated, as well as land use policies, such as compact growth.

Policies to be evaluated include the *High Speed Rail* proposal, various policies to reduce greenhouse gases, and other sustainable development proposals. Impacts of interest to various groups include: Housing affordability, wages, exports, new development footprint, habitat fragmentation, human health, and others. This model set gives measures of economic welfare for households by income class and for employees by occupation and so can be used for equity analysis, as well as economic efficiency.

Passenger Transport Demand Modeling at European Level – Political Background, Methods, and Application Examples

Speaker: Dr. Eckhard Szimba

Eckhard Szimba, Ph.D., is a senior researcher at the Institute for Economic Policy Research (IWW) of the Karlsruhe Institute of Technology (KIT) in Germany. He studied economic engineering at the Universität Karlsruhe (TH) in the period of time 1993-1998, and joined IWW as a researcher in 1998. In 2006 he finished his PhD on the development of a methodology for analysing interdependencies between transport infrastructure projects, which he applied to priority infrastructure projects of the European Union (EU). His PhD was awarded by the European Friedrich List Prize in 2007. Eckhard's research interests are in the field of European transport policy, assessment methodologies, transport demand modelling and information systems. He is also responsible for lectures and courses in transport economics and European transport infrastructure planning. Eckhard has been involved as a researcher in various EU-funded projects, mainly in the field of developing long-term scenarios, passenger transport demand forecasting, impact assessment of transport policies and transport policy information systems. He has also been involved in the development of the European Commission's reference transport model TRANS-TOOLS, and is a member of the TRANS-TOOLS management board.

Abstract: The presentation will tackle different aspects of (passenger) transport demand modelling at strategic European level. In the first part of the presentation, the political need for transport demand modelling at European level will be addressed, by tackling the process of European integration and the development of trans-European networks for transportation. Based on this, the policy requirements transport demand models have to meet will be outlined. The second part of the presentation will give insight in the methods applied for passenger transport demand modelling. Selected methodological aspects will be presented with respect to two models: the long-distance passenger transport demand model VACLAV developed at the Institute for Economic Policy Research (IWW); and the designated reference transport demand and assessment model of the European Union, TRANS-TOOLS. Subsequently, selected application examples of these models will be presented. The presentation will conclude with an overview of the main challenges of passenger transport demand modelling at European scale and an outlook.

Impact of White House Street Closings

Speaker: Fred Ducca

Dr. Fred Ducca, National Center for Smart Growth, has 30 years of experience in travel demand modeling and forecasting. Prior to coming to the University of Maryland he managed the Travel Model Improvement Program for the Federal Highway Administration. This program focused on improving the State of the Art and State of the Practice in travel forecasting. He holds a B.S. in Mathematics from St. Peter's college, an MBA from the Wharton School, University of Pennsylvania and a Ph.D. in City Planning from the University of Pennsylvania.

Abstract: After September 11, street closings around the White House, for Security purposes, caused major rerouting of traffic in downtown D.C. and surrounding areas. The FHWA conducted a study on the effects of these closings on traffic and possible strategies to mitigate the impacts. To do this a model was constructed to simulate the movements of 2 million vehicles in the downtown D.C. area and to account for 20 million moving within the D.C. region. The results were presented to high level decision makers for consideration. This seminar will cover the purpose of the study, the findings and methods for presenting technical findings in a form which non-technical audiences can understand.

Transit Simulation for the White House Area Transportation Study: An Overview of the Analysis Issues, Methodologies, and Results

Speaker: Brian Gardner

- Brian Gardner is currently with the Federal Highway Administration. For the past nearly 20 years, he has worked in a variety of roles including:
- NHI instructor for courses on highway capacity analysis, arterial analysis, congestion management, site impact traffic evaluation, and travel demand forecasting;
- Team member for both the USDOT's crisis management team and FEMA's interagency emergency response team
- Project manager for various staff and contract research projects relating to transport analysis;
- Technical reviewer for highway project forecasts as part of the NEPA and conformity processes;
- Research program coordinator for the Office of Planning and Environment;
- TRANSIMS program manager under SAFETEALU;
- And currently as the team leader for the Planning Methods Team within the Office of Planning.

Brian earned a BSCE and MCE from North Carolina State University.

Abstract: The White House Area Transportation Study was commissioned by Congress to evaluate options to mitigate congestion caused by the street closures in the vicinity of the White House in response to security concerns. The study considered significant construction options to restore the street grid, operations options to reduce congestion impacts, and transit options to restore person capacity through the area. The model framework employed a dynamic router integrated with a large area meso-scale simulation overlayed on the existing MPO trip model.

This presentation focuses on the transit options and will include:

- An overview of the analysis methodologies,
- A summary of the results and various ways to present them;
- A discussion of modeling issues and lessons learned.

Exploratory Advanced Research at Federal Highway Administration

Speaker: David Kuehn

David Kuehn became the first Program Manager for the Federal Highway Administration (FHWA) Exploratory Advanced Research Program. The Program Manager serves as the senior advisor to agency leadership on the communication and coordination of exploratory advanced research activities and fosters partnerships with other Federal agencies, national scientific societies and organizations, and the academic community in support of the Program. The program focuses on longer term and higher risk research with the potential for transformational improvements to the transportation system.

David also served as a national expert on statewide and metropolitan transportation planning, transportation and land use, environmental justice, public involvement, transportation planning and environment, and transportation planning performance measurement for FHWA. David entered federal service as a Presidential Management Fellow.

Before working at the federal level, David worked in local government and as a consultant in southern California. He holds a Masters of Public Administration from the University of Southern California and a B.A from the University of California, Irvine and is a member of the American Institute of Certified Planners (AICP).

Abstract: The transportation industry is facing unprecedented challenges. In order to meet those challenges, the industry needs to engage in high-risk, breakthrough research. Relying only on incremental improvements will not meet future needs. The Federal Highway Administration (FHWA) is building capacity for high-risk, high-impact research by engaging research partnerships across sectors and across disciplines. Federal legislation established an exploratory advanced research (EAR) program that addresses longer term and higher risk breakthrough research with the potential for dramatic long-term improvements to plan, build, renew, and operate safe, congestion-free and environmentally sound transportation systems. The FHWA EAR Program funds exploratory advanced research across the range of issues critical to the transportation industry. Using full and open competition and expert review to identify areas of research focus and assess technical excellence, the FHWA has awarded funding for 29 projects during involving 20 different universities and colleges, 13 private businesses, eight state and local agencies and five federal laboratories including the Turner Fairbank Highway Research Center. Research includes both foundational work that anticipates the questions and future needs in applied research and the application of innovations from other industries to the transportation sector. This presentation will discuss the role of EAR in preparing for the future of transportation and processes FHWA uses for partnerships that are leading the way.

The Role of Information Technology in Improving Transit Systems

Speaker: Nigel Wilson

Dr. Nigel Wilson is a professor in the Department of Civil and Environmental Engineering at the Massachusetts Institute of Technology. He is an internationally renowned expert in public transportation, transportation system design, and new transportation systems.

Abstract: Improving performance of computers and communications technologies are now starting to have a significant impact on the urban public transport industry. Automatic data collection systems including automatic vehicle location systems, automatic passenger counting systems, advanced passenger information systems and electronic fare payment and ticketing systems are becoming ubiquitous in large systems and are having an impact on the quality and availability of information for service and operations planning, controlling the service and measuring the resultant service quality delivered to passengers. While the impacts of these advances are already apparent in many systems, there is the potential for much deeper impact in the future. Technology continues to improve across the board and will offer opportunities to develop and apply more ambitious models to assist in many facets of the performance of public transport systems. Traditional models of the inter-relationships between service planning, operations control and passenger information, for example, have been based largely on the independence of these functions one from another. So the service plan has largely driven both the operations control and passenger information functions in most operating agencies, simplifying these aspects of the system. In the future, public transport systems may be able to take advantage of improved information and better communication between operating personnel, agency managers and passengers which will enable a rethinking of these inter-relationships. This seminar will examine current public transport industry practice in this arena and discuss the potential for future enhancement of these individual public transport agency functions as well as their inter-relationships.

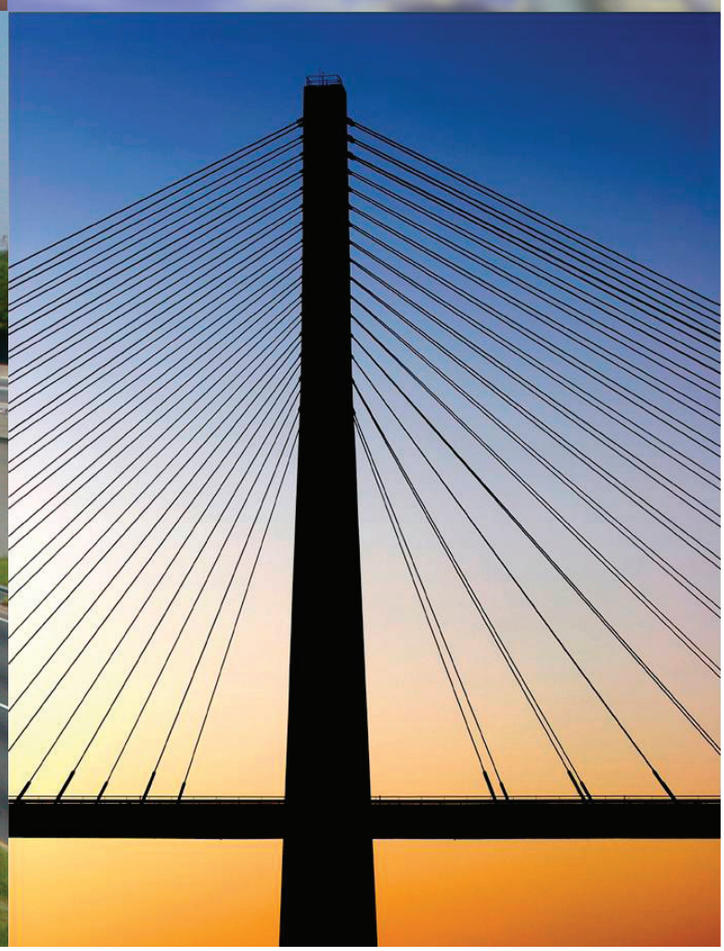
Unexpected Events and Intelligent Transportation Systems

Speaker: Asad J. Khattak

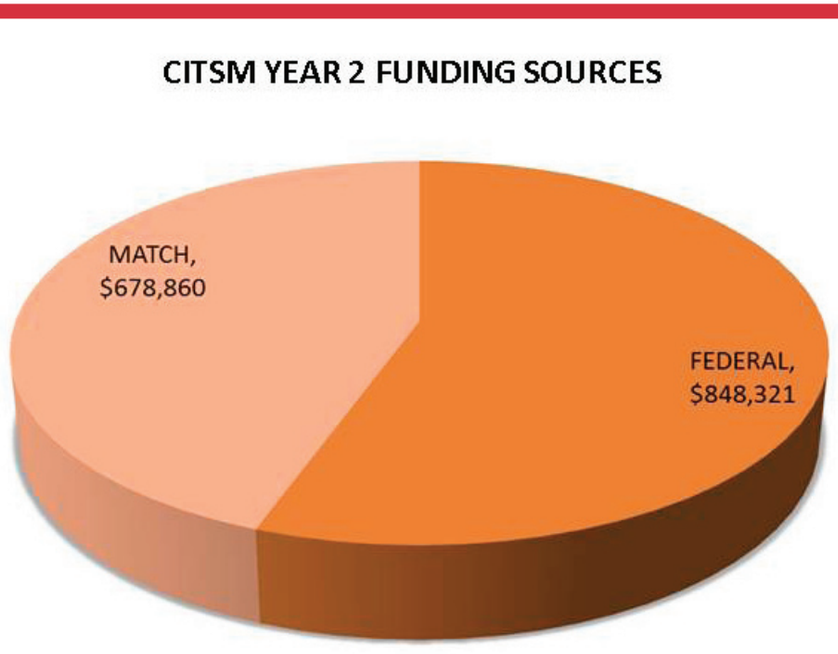
Dr. Asad J. Khattak is Frank Batten endowed chair Professor of Civil Engineering at Old Dominion University, where he teaches and conducts research in transportation. Since Fall 2006, he has developed and directed ODU's Transportation Research Institute and educational programs. Dr. Khattak's research focuses on various types of innovations related to (a) intelligent transportation systems (their planning/operation and behavioral impacts), (b) transportation safety, and (c) sustainable transportation. Dr. Khattak has more than 16 years of research experience and 13 years of teaching experience in the transportation field, after completing his Ph.D in Civil Engineering from Northwestern University in 1991. He has authored 75 scholarly journal articles and 46 technical reports to research sponsors. As a principal- or co-investigator, he has successfully completed 32 sponsored research and educational projects totaling $4.5 million.

Dr. Khattak is Editor for the SCI-indexed Journal of Intelligent Transportation Systems. He is also Associate Editor of SCI-indexed International Journal of Sustainable Transportation. His service to professional organizations is further reflected in active participation in the Council of University Transportation Centers (CUTC) and as a member of the Committee on Intelligent Transportation Systems, Transportation Research Board, National Academies. He co-chairs the TRB Advanced Traveler Information Systems sub-committee.

Abstract: The presentation will attempt to answer a few fundamental questions: How can cities operate transportation systems to better handle uncertainty created by unexpected events? What is the role of technological innovations, specifically, intelligent transportation systems? We will discuss the performance of transportation system under different situations, ranging from relatively normal weather conditions to mandatory evacuations under hurricane conditions. Further, the performance of the system will be examined when one relatively small traffic incident occurs to the occurrence of complex cascading (secondary) incidents. The role of traveler information systems and freeway service patrols in reducing incident-induced congestion will be examined. The presentation will go into the development of various tools that can 1) encourage the diffusion of innovative intelligent transportation systems strategies, and 2) predict incident durations, the chances of secondary incidents, and associated delays. These tools aid in planning and proactively identifying operational strategies to deal with unexpected events.

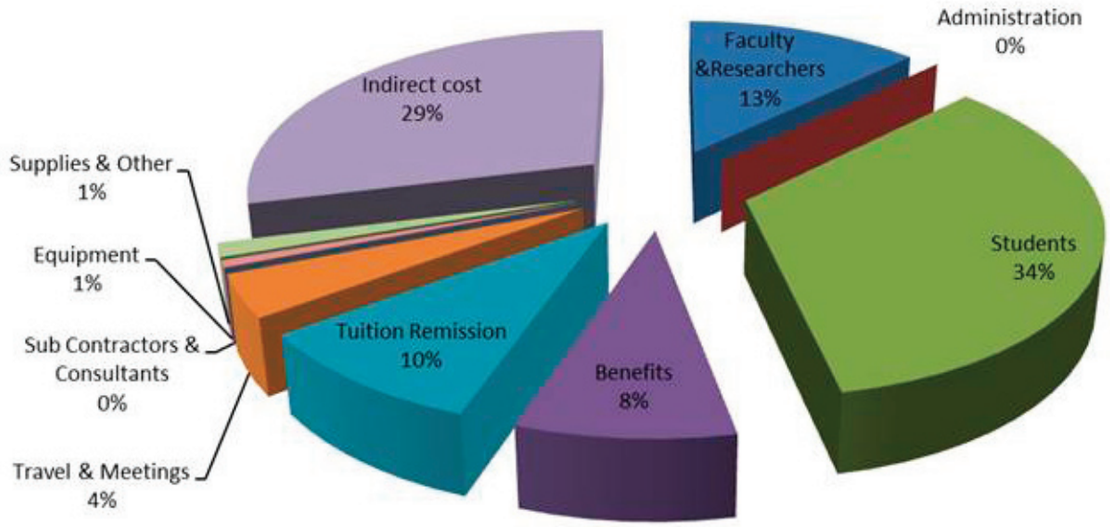


Expenditures

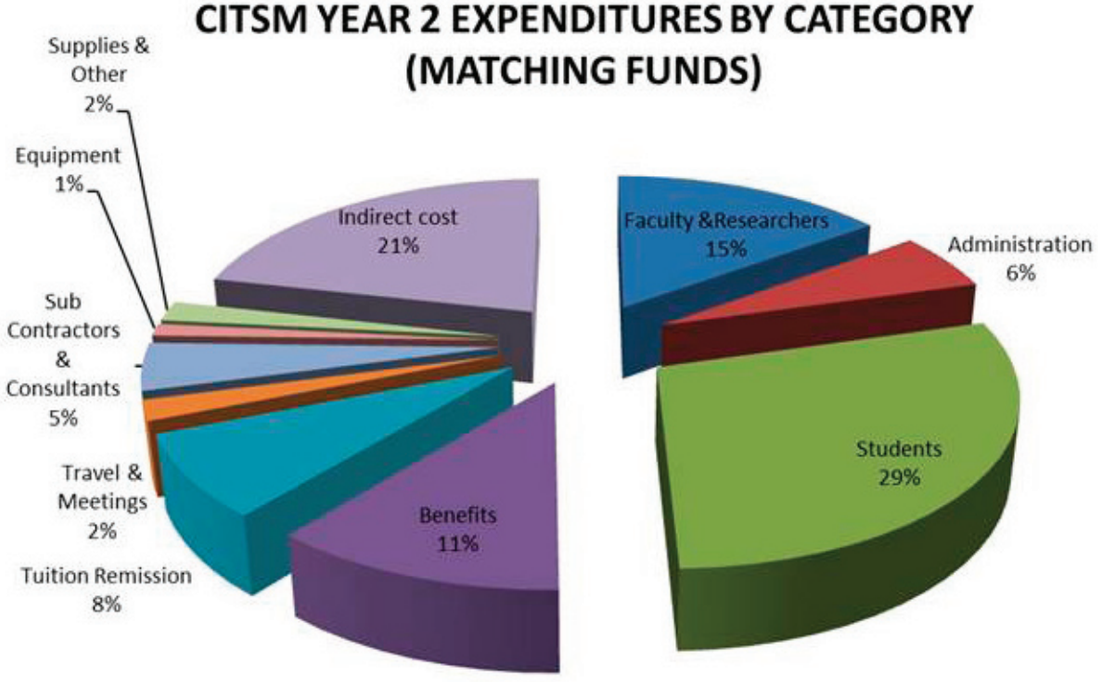


Total Expenditures: $1,527,181

CITSM YEAR 2 EXPENDITURES BY CATEGORY (FEDERAL FUNDS)



CITSM YEAR 2 EXPENDITURES BY CATEGORY (MATCHING FUNDS)



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