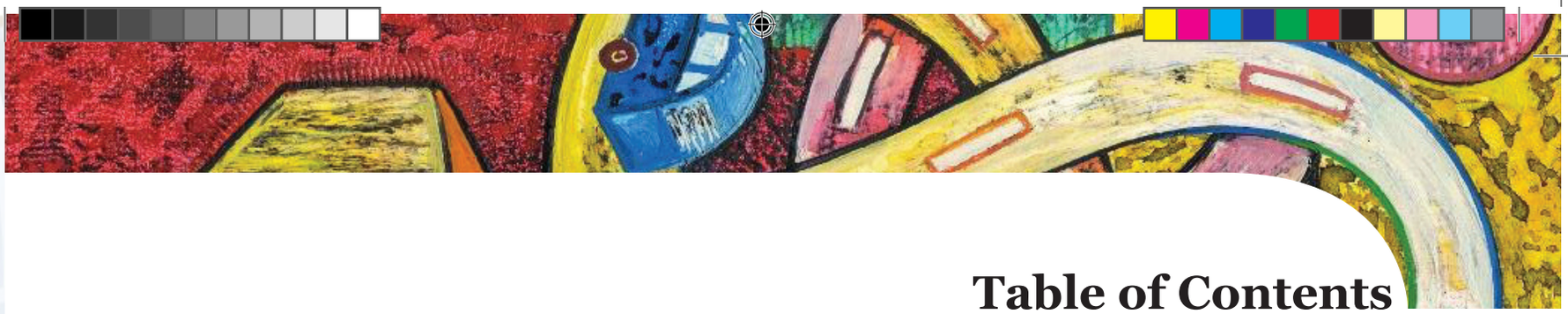
CENTER FOR INTEGRATED TRANSPORTATION SYSTEMS MANAGEMENT

annual report: **2012**



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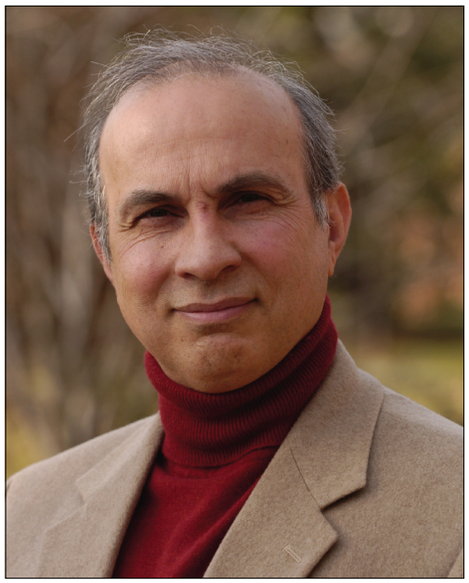
Chapter 1: **Letter From The CITSM Director**

The Center for Integrated Transportation Systems Management (CITSM) has completed its fourth year of operation. It has been yet another 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 ading about the details of our accomplishments in the pages that follow.

The CITSM research activities in the past four 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. This year we added new projects related to public transportation, structures, construction and pricing structure for toll facilities to the rich portfolio of the projects funded by the CITSM. During this period, the CITSM has funded 61 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 Computer, Mathematical and Natural 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.

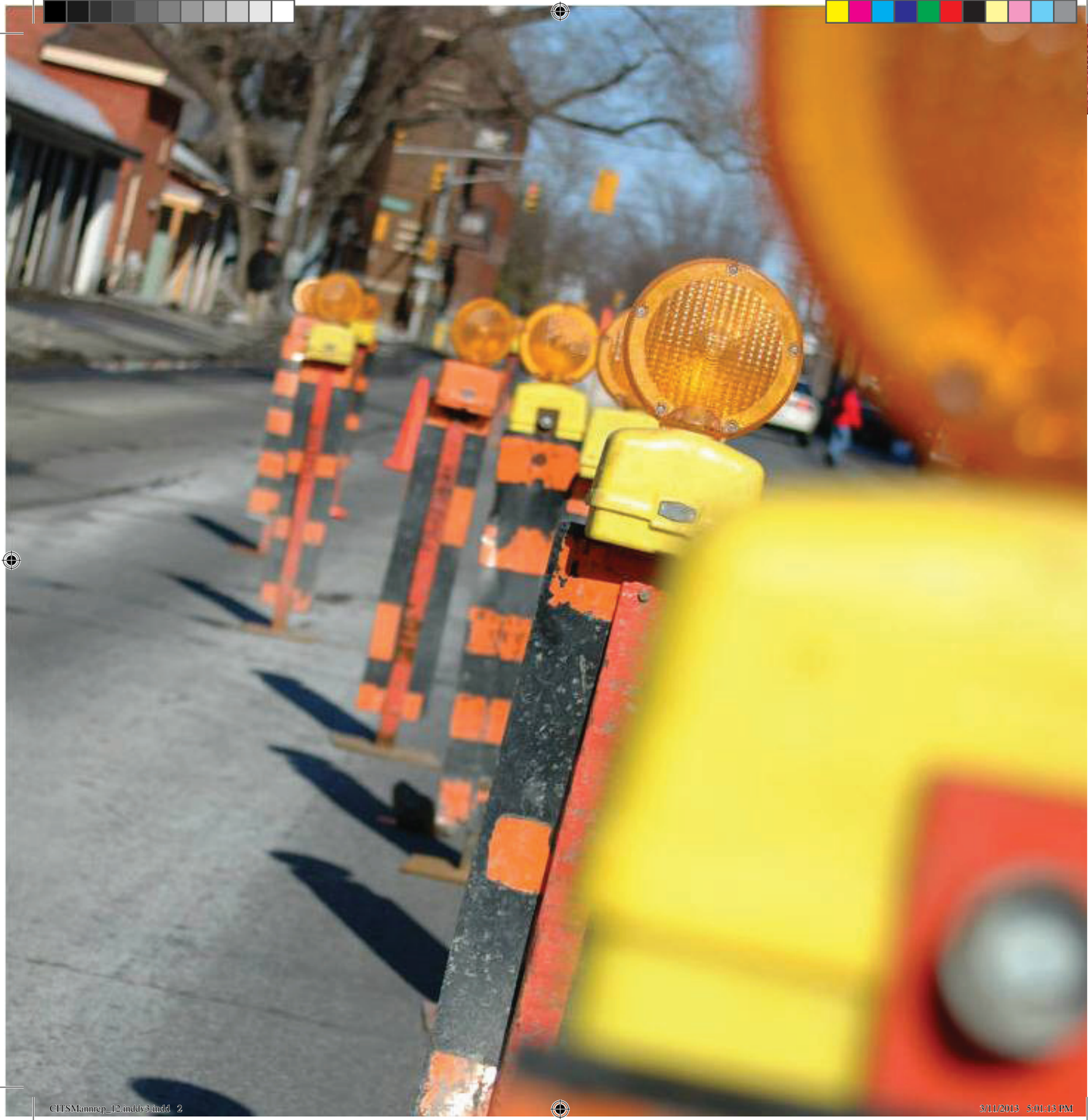
The CITSM continued its support of the Consortium for ITS Training and Education (CITE), a unique organization of universities and industry associations focused on providing comprehensive training and education related to Intelligent Transportation System technology that is delivered in a manner that 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 first academic course on highway safety supported by CITSM was offered in fall 2011. The CITSM faculty are working on the second course on intelligent transportation systems and we intend to offer that course in spring 2013.

During its 4 years of existence, 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 during the past 4 years addressed many of the Nation's critical challenges in transportation. We developed sophisticated new technologies for traffic detection and surveillance as well as complex modeling systems for



addressing the State of Maryland's needs in transportation engineering and planning. Many of the research products of the CITSM have either been used or will be used in the near future at the state level. Technologies we have developed for traffic detection and surveillance and those for truck parking have been deployed in the field and tested and are ready for implementation. We are very proud of the CITSM accomplishments in the past four years and look forward to continue our research work in collaboration with the Maryland State and federal government for years to come.

Ali Haghani



Chapter 2: **CITSM People**


Q. CUI


HIROYUKI ISEKI


G.L. CHANG


C. CIRILLO


C. DAVIS


A. HAGHANI


G.-J. KNAPP

NEW FACULTY

QINGBIN CUI
Assistant Professor,
Civil & Environmental Engineering

INTERESTS

- Infrastructure Finance & Sustainability
- Project Delivery
- Contract Engineering
- Project Complexity
- Global Project Administration

HIROYUKI ISEKI
Assistant Professor
Urban Studies and Planning

INTERESTS

- Transportation economics and finance
- Public transit planning and management
- Travel behavior analysis and modeling
- Regional transportation planning

CONTINUING 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 & 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
- Characterization of Antennas in the Near Field

ALI HAGHANI
Professor & Chair,
Civil & Environmental Engineering

INTERESTS

- Transportation network modeling
- Freight transportation & 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


M. K. KHANDANI


E. MILLER-HOOKS


S. MILLER


C. PLAISANT


P. SCHONFELD


L. ZHANG


P. TARNOFF

MEHDI KALANTARI KHANDANI
Assistant Research Scientist,
Electrical and Computer Engineering

INTERESTS

- Communication theory
- Internet security and, in particular, Distributed Denial of Service (DDoS) Defense
- Modeling and Analysis of Wireless Networks
- 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 Multiobjective Decision-making

STUART MILNER
Research Professor & Director,
Center for Networking of Infrastructure Sensors

INTERESTS

- Scalability of Dynamic Wireless Net works and Topology Control in Hybrid Free Space Optical/RF Directional
- Wireless Networks
- Optical Wireless Sensor Networks for Critical Infrastructure Surveillance
- Broadband optical/RF Wireless Networks

CATHERINE PLAISANT
Research Scientist & Associate Director of Research,
Human Computer Interaction Lab

INTERESTS

- Information Visualization
- Digital Libraries
- Universal Access
- Image Browsing, Help
- Digital Humanities
- Technology for families
- Valuation methodologies

PAUL SCHONFELD
Professor,
Civil & Environmental Engineering

INTEREST

- Transportation Engineering

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 & Policy Evaluation
- Traveler Information Systems
- Mathematical and Agent-based Simulation Models with Applications in ITS
- Demand Forecasting
- Network Dynamics

FORMER FACULTY

PHIL TARNOFF
Former Director

INTERESTS

- Development of Advanced Technology
- Improved Processes
- Enhanced Organizational Structures for the Integrated Management and Operation of Transportation Facilities and Corridors

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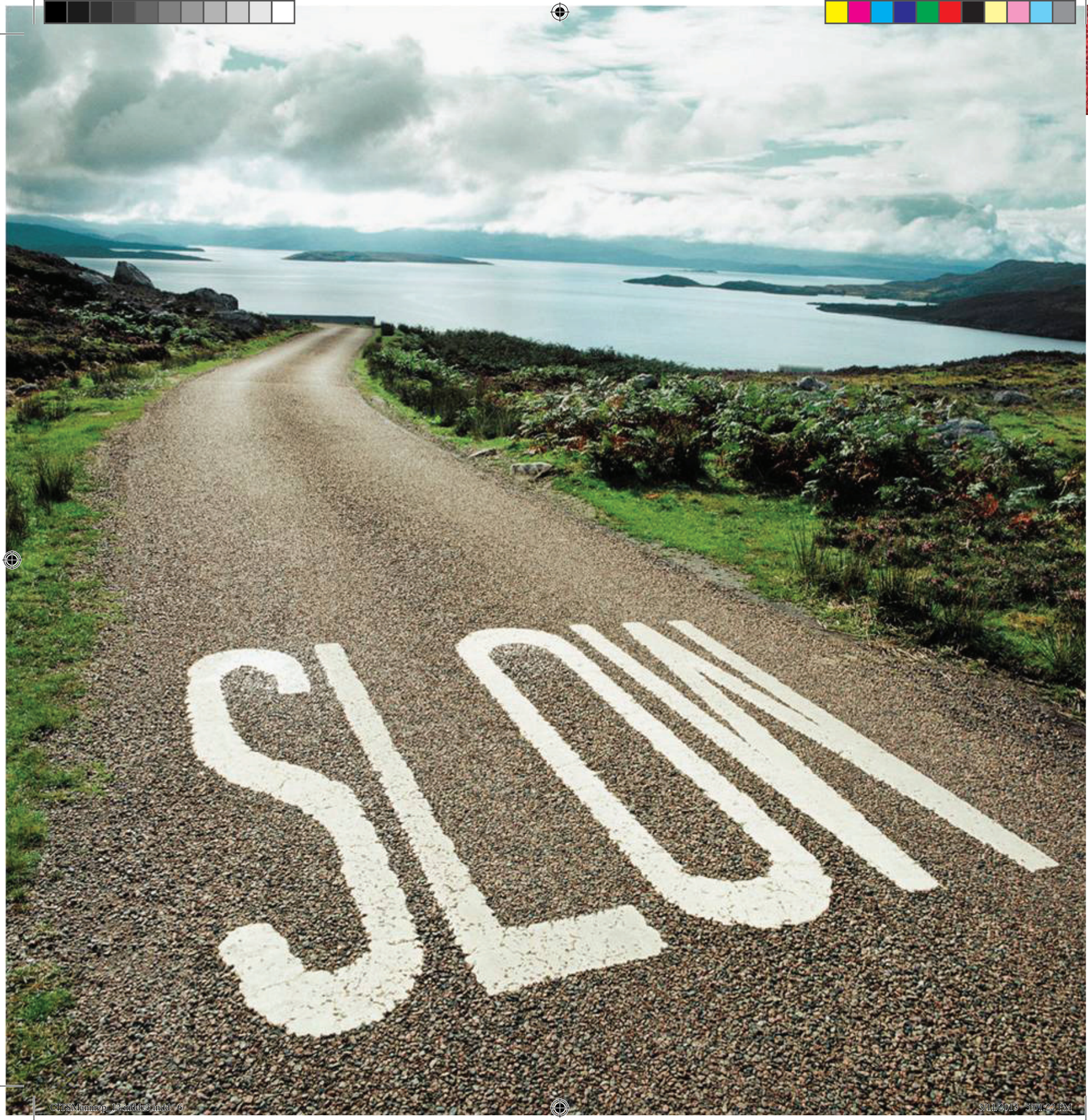
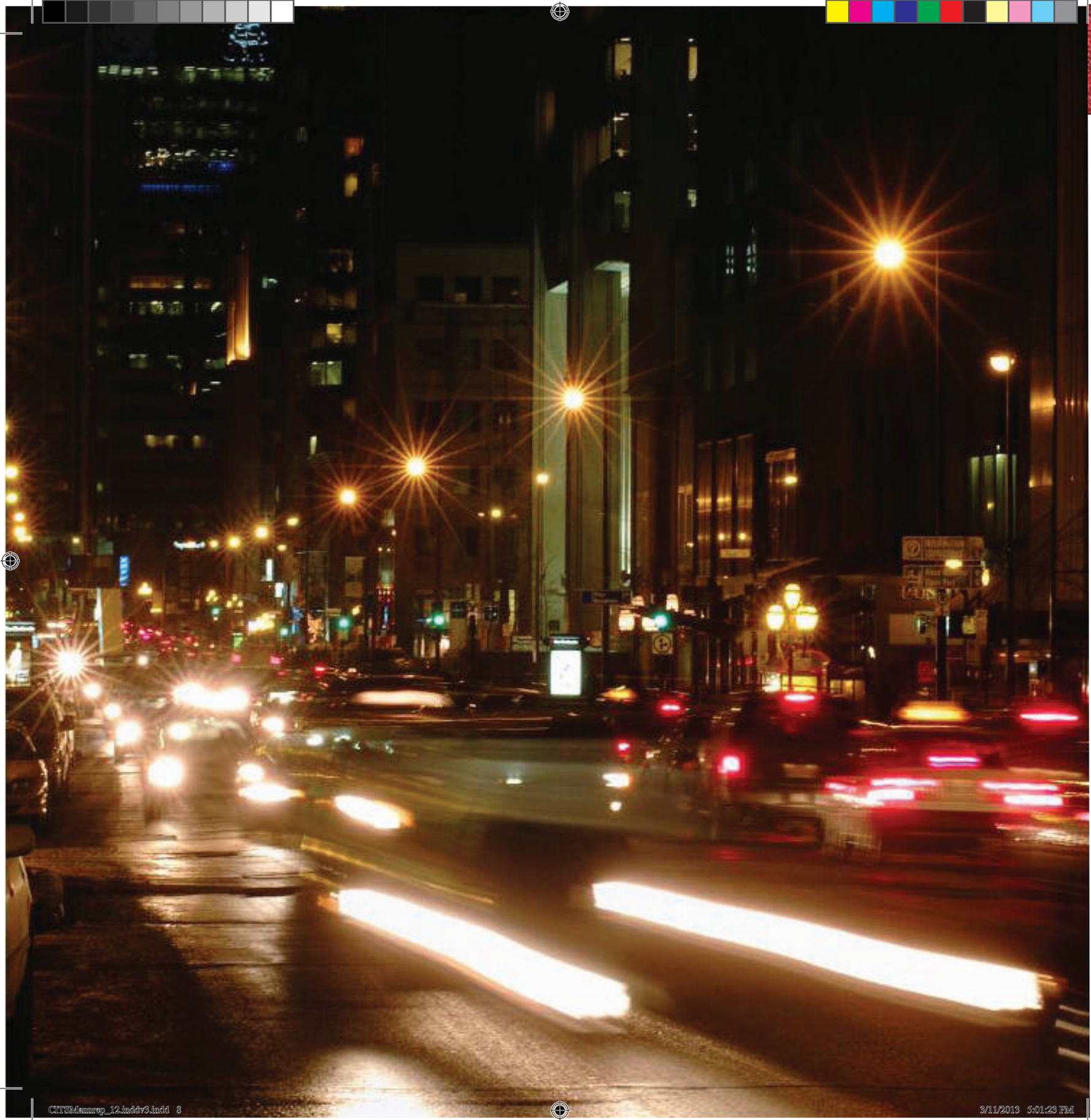


Chapter 3: **CITSM Theme**

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.



Chapter 4: **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 non-recurring 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 US 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.

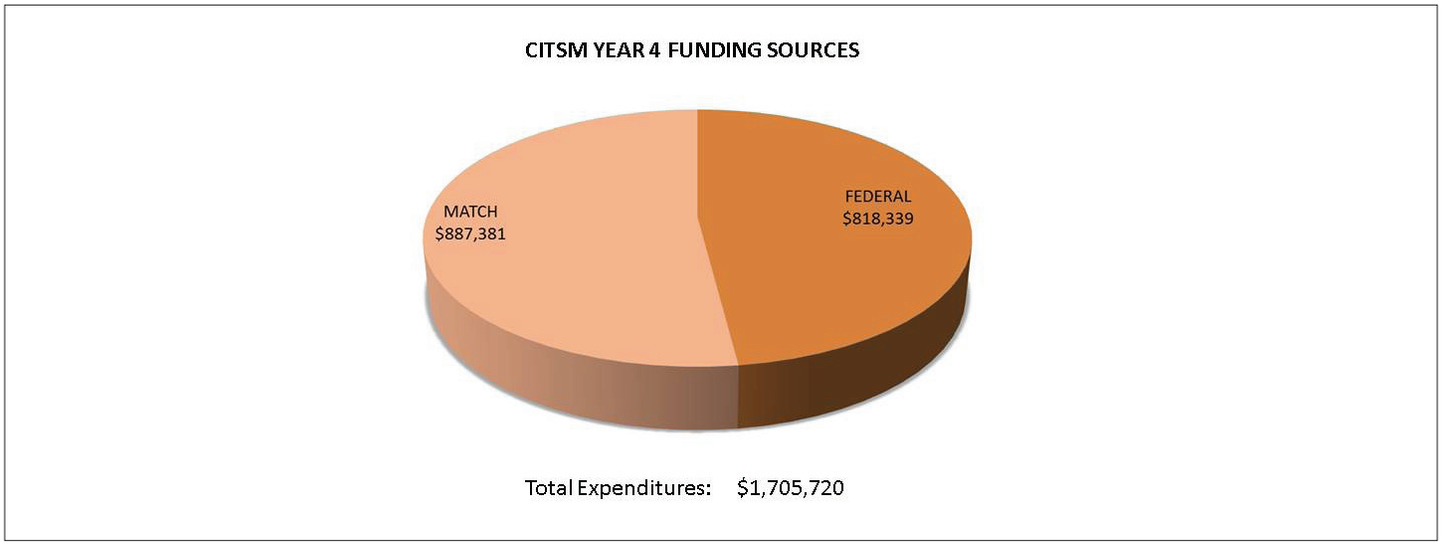
Performance Measurement. The Center's activities will focus on development of performance measures to facilitate integration of transportation management and operations. Center faculty and staff have played

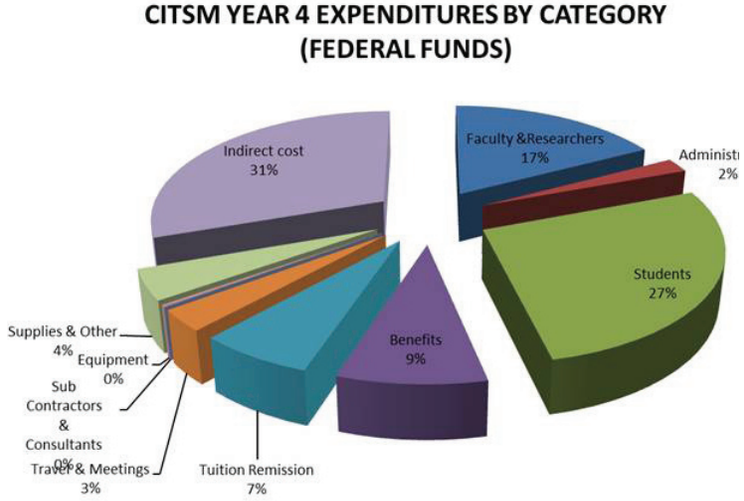
a lead role in the development of mobility performance measures locally, regionally and nationally. Their work addresses the entire spectrum of performance measurement, from the regular assessment of performance of the State of Maryland's traffic management activities to the development of national standards 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.

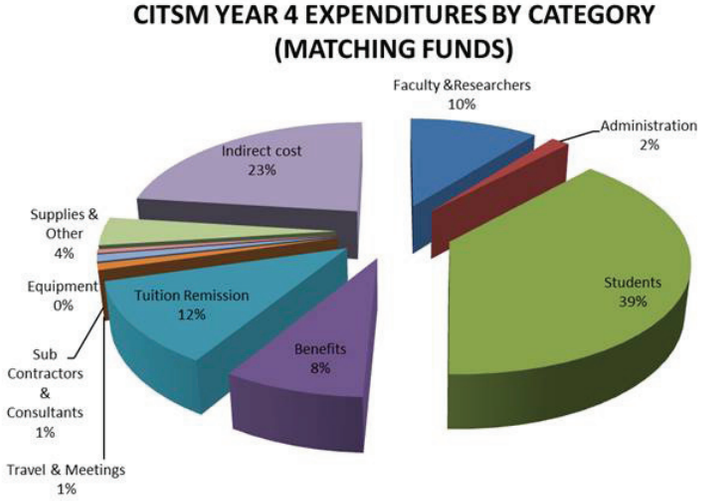
Policy and Institutional Issues. The challenges that the Center's faculty and staff have faced in their ongoing involvement with regional transportation system management and operations (e.g. CapWIN and RITIS) have highlighted the significance of policy and institutional considerations when attempting 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.

Chapter 5: **CITSM Financial**







Chapter 6: **Current Projects**

Dynamic Discrete Choice Models with Application to Car Ownership Modeling

Cinzia Cirillo

Discrete choice models have received widespread acceptance in transport research over the past three decades, being used in travel demand modeling and behavioral analysis; however, their applications have been mainly developed in a static context. The static framework is limited by the assumption that consumers are not affected by past and future states when choosing their preferred alternative in the present. The gap between discrete choice model and dynamics in individual behavior has spurred various developments that are mainly intended to enrich the basic theory by including in the formulation the changes occurring in the system to be modeled.

A significant portion of the literature focusing on the extension of discrete choice models into a dynamic frame can be found in economics and related fields. In dynamic discrete choice structural models, agents are forward looking and maximize expected inter-temporal payoffs; the consumers is aware of the rapidly evolving nature of product attributes within a given period of time and different products are supposed to be available on the market. Changing prices and improving technologies have been the most visible phenomena in a large number of important new durable goods markets. Although sometimes the future effects are not fully known, or depend on factors that have not yet transpired, the person knows that in the future, he will maximize utility among the alternatives that will available at that time. This knowledge enables consumers to choose the alternative in the current period that maximizes his expected utility over the current and future periods.

In this project we propose a dynamic modeling framework for discrete choice and its application to the car ownership problem. It is expected that the obtained predictions will provide a more realistic picture of car user preferences under the rapid evolution of the industry supply and of the fuel prices.

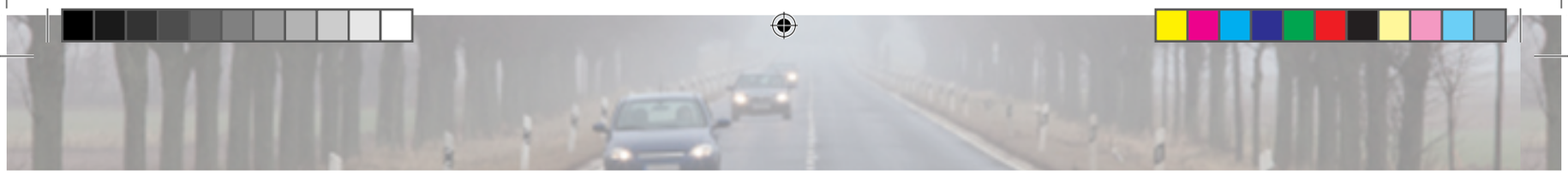
Automated Scalable and Real-Time Truck Parking Information System

Mehdi Kalantari

Overnight truck parking in the United States is a significant problem that is growing worse. Commercial drivers seeking to comply with the Federal Motor Carrier Safety Administration's Hours of Service regulations often park illegally on freeway shoulders and ramps when legal parking is either not available, or the availability of free parking spots in a truck parking facility is not known . Safety is a primary issue that should be considered and one of the priority strategies in the safety area is to reduce the need for trucks to park on high speed highways. So, adequacy of rest area parking is one of the most critical issues today and has gained national importance; however, improved safety and greater operational efficiency might be realized if commercial drivers could be given real-time information on availability of parking at known locations within the general areas where they are traveling.

Posting advance parking information in real-time on upstream of each parking area, using variable road signs, making public-private partnership investments, developing and using ITS and web-based solutions, converting weigh stations near parking facilities into additional parking, allowing overnight parking at malls or large retail chains, and improving communication regarding state truck parking policies are recommendations to address the problem.

Motivated by the use of technology to improve truck parking safety through efficient use of existing parking capacity, we propose and automated real-time parking information system. This proposal involves applied and advanced research in the area of transportation and telecommunication. The proposed solution takes advantage of a low power wireless vehicle detection technology. By using this new technology



the proposed parking monitoring system will be low cost, scalable, energy self sufficient and easy to deploy. Unlike imagery based technologies the system is completely anonymous and thus the privacy of truckers is not compromised.

Agent-based Microsimulation of Long-Distance Passenger Travel Demand

Lei Zhang

The needs for analyzing transportation capital expenditure decisions at the national level in the 1970s led to two U.S. National Transportation Studies (NTS) in 1972 and 1974 respectively. These early national travel studies inventoried existing and planned U.S. transportation systems; and estimated future travel demand, system costs, performance, and broader impacts under alternative funding scenarios. With the completion of major investments on the Interstate Highway System, the development of national-level long-distance passenger travel analysis tools in the U.S. has been stagnate since the 1970s, though there have been continual academic interests in improving the theory and methods for multimodal intercity passenger travel demand analysis with a focus on mode choice.

The lack of a capable long-distance passenger travel analysis tool in the U.S. is in sharp contrast with important emerging needs for analyzing various national transportation policies related to long-distance passenger travel. For instance, it is desirable to systematically design and evaluate national transportation investment strategies, such as reconstructing and expanding the capacity of the Interstate Highway System, providing high-speed rail services along selected corridors, and building the next-generation air transportation system. In addition to these multimodal capacity investment needs for long-distance passenger travel, there are also imperative needs to assess a variety of operational and management strategies at the national level, which could significantly improve transportation efficiency and productivity, support and stimulate economic growth, and produce positive social and environmental impacts. Examples include: (1) congestion pricing on the Interstate and National Highway System; (2) Congestion management at airports; (3) Separation of passenger vehicles and heavy trucks on highway facilities; (4) National transportation financing options such as fuel tax increase and mileage fees; and (5) Substitution between long-distance travel and teleconference/telecommuting.

The objective of this proposed research project is to develop a prototype agent-based microsimulation model of long-distance passenger travel at the U.S. national level.

Mobile Sensor Network for Measuring Activity-Travel Behavior, Transportation System Performance, and Impacts of Social Networking: An Exploratory Analysis

Chang, Zhang, Zhou

So far, research based on mobile GPS platform is still preliminary and its potentials in measuring activity-travel behavior and transportation system performance, and supporting various modeling endeavors have not been adequately explored. For example, two questions that are crucial for travel demand modeling have never been well addressed in previous research. One question is with whom people are traveling. Another equal, if not more, important question about travel behavior in the context of social network is for whom people are traveling. There questions have attracted emerging and substantial interest in travel behavior research community as a growing number of studies start to focus on joint participation in activities and impacts of social network, which has been ignored for a long time partly due to lack of data. A special issue in the Journal of Transpiration has been dedicated to intra-household interactions and group decision-making. A few pilot studies extend this strand of research to investigate individual travel behavior condition upon their social network, including social activity-travel generation, spatial distribution, and information communication. A well developed data collection platform that allows researchers to monitor activity-travel behavior, transportation system performance, and impacts of social networking at the same time would provide a valuable data source and significant benefit future modeling efforts in both transportation planning and operations. The objective of this project is to develop and test a mobile sensor data collection platform that allows researchers to measure detailed activity-travel behavior, transporta-

tion system performance, and aspects of the social network related to travel at the same time based on mobile sensors with built-in GPS and/or other spatially-traceable components.

Adaptive Network Design for the Management of Large Crowds

Elise Miller-Hooks

The proposed research effort will develop behavior-based optimization techniques and solution methodologies to support an Adaptive Crowd Control System (ACCS) envisioned herein. Effective management of pedestrian movement during large public gatherings can provide crucial support toward meeting pedestrian access and safety goals. The ACCS will guide the crowd manager and security personnel toward actions that remain consistent and appropriate with a changing environment and will instruct individuals in the crowd toward efficiently and safely obtaining their goals. Poor execution of crowd management can frustrate the people in a crowd by thwarting their goals. At the extreme, poor crowd management has caused many instances of crowd crushes and fatalities involving high volumes of people in a wide array of circumstances.

A cognitive systems approach will be taken in the design of the ACCS and its components. Conventional approaches for modeling crowds are based on a physical systems modeling approach, where pedestrians are viewed as physical objects that simply react to the environment in accordance with causal physical rules specified in the models. In a cognitive systems approach, both the individuals in the crowd and the crowd manager are users of the system. These systems are assembled for the purpose of supporting the pursuit of goals at both system and individual levels. From an individual user's perspective, the goal may be to reach a particular destination by a given time, while traveling with companions. From the system's perspective, the goal may be to maximize flow rates into a particular area while maintaining lanes for emergency vehicle access and allowing users to leave an event before its conclusion.

Developed techniques will seek to provide instructions for adapting the physical and social infrastructure so as to facilitate the movement of the crowd to achieve both user and system goals. This approach recognizes that user and system goals may change in response to changes in the physical infrastructure, as well as other experiences. Individual and crowd behavior will be modeled through the use of a utility-based technique that captures heterogeneity in individual preferences and collective behavior in large public gatherings. This technique will be embedded within an optimization framework in which users selfishly seek to maximize their own utilities. No previous work has attempted to optimize the physical environment so as to support the changing desires of the system users and operators.

Evaluation of Dynamic Message Sign Operations and their Potential Impact on Traffic Pattern

Ali Haghani

The need to convey accurate travel information to motorists has become increasingly important in recent years as traffic volumes have increased and the ability to supply additional capacity no longer exists. Knowledge of rapidly changing traffic

conditions gives road users the option to modify their behavior in order to avoid delays and dangerous situations. Highway Dynamic Message Signs (DMS) are often referred to as the most visible form of ITS technology. Installed in conjunction with other technologies of an Advanced Traveler Information System (ATIS), they provide the ability to enhance knowledge of the highway network for all users viewing them. In doing so, they should be able to increase overall safety and reduce congestion and delays. In Maryland, there are over 80 such DMS installed on major interstates, highways, and arterials.

An important measure of the value of a DMS message is its credibility. It is vitally important that travelers believe that a message displayed on a DMS is based on fact and accurately describes present roadway conditions. Without consistently valid information, road users will begin to ignore DMS messages altogether. In the case of travel delays, terms such as "Major Delays," "Heavy Delays," and "Expect Congestion" are being used to describe the prevailing conditions, however more recently estimated travel times in terms of numbers are being posted on selected signs. In order to determine the meaning and accuracy of such messages, this study will examine the road conditions under which they are displayed. Specifically, Bluetooth travel time data will be collected and analyzed during the periods of time that certain DMS messages are displayed on sample freeway corridors in Maryland.

In some corridors dynamic message signs recommend drivers to take an alternative route toward their destination. The question is do drivers comply with the message, and if the answer is positive to what extend the traffic pattern changes? While tracking every individual vehicle before and after the message display may help answering this question, however is not practical.

To address the above issues and motivated by successful application of Bluetooth detectors in freeway travel time data collection in recent years, we propose an evaluation framework that incorporates the Bluetooth generated data into historical detector data to analyze the quality, effectiveness and timeliness of messages posted on DMS, as well as changes in traffic pattern triggered by message display. This proposal involves applied and advanced research in the area of traveler information.

Examination of the Pricing Structure of Toll Facilities to Maximize the Social Benefits

Hiroyuki Iseki

The proposed research seeks the pricing structure—toll schedules—to not only properly allocate responsible costs of using a facility to different classes of vehicles, but also send price signals to select type of vehicles as well as choose traveling time of day and route, so that it will maximize the efficiency and benefits in the use of toll facilities—by lowering road maintenance costs, congestion costs, and vehicle maintenance costs. The proposed research will incorporate into analysis: 1) costs of maintenance of toll facilities, particularly pavement, 2) administration and operating costs of tolling, 3) operating costs of driving vehicles of different classes, 4) costs in travel time due to congestion delay, 5) maintenance costs that are incurred to vehicles by driving on uneven surface of roads, 6) toll discounts associated with the use of EZ-pass, and 7) price elasticity of demand of different vehicle classes. It should be noted that effective tolls after discounts are the prices that affect the demand of different classes of vehicles, as well as toll revenues. While toll discounts are beneficial in terms of promoting the electric tolling system that enables vehicles to drive through toll facilities without stopping and therefore reduces travel time, disproportionate discounts

could induce sub-optimal demand levels of various vehicles classes.

The proposed research goes beyond the studies based on the highway cost allocation model (HCAM). While the results from such studies are quite useful to get a sense of the distribution of costs (capital costs and maintenance costs) of facilities among different vehicle classes by different number of axels, the static nature of the model does not adequately answer how revised toll schedules would affect the demand of each type of vehicle, and how the different mixture of vehicles would result in different level of road damage as well as traffic congestion on facilities. In addition, the studies based on the HCAM take into account the costs on the supply side, but not the costs on the demand side, and does not necessarily maximize the net benefits for the society.

While the initial research will address the pricing structure for the existing toll facilities in Maryland—6 bridges and 1 tunnel, the proposed research could be extended to take into account initial capital investment decision for the highway network in the state. Taking into account the State Highway Administration's consideration for express toll lanes (ETLs) on several corridors, such as I-95, I-270, I-495/I-95, and MD 5, in order to address traffic congestion and negative environmental impacts, provide alternative modes of travel, and develop an integrated highway system that optimizes efficiency and maximizes flexibility, the proposed research could be expanded also to include these corridors. Furthermore, the same approach could be applied to toll facilities and highway networks in other states. The analysis results are expected to show optimal toll schedules, cost savings in facility maintenance, travel time, vehicle maintenance, demand levels of different class vehicles, toll revenues, and an increase in social welfare (changes in costs).

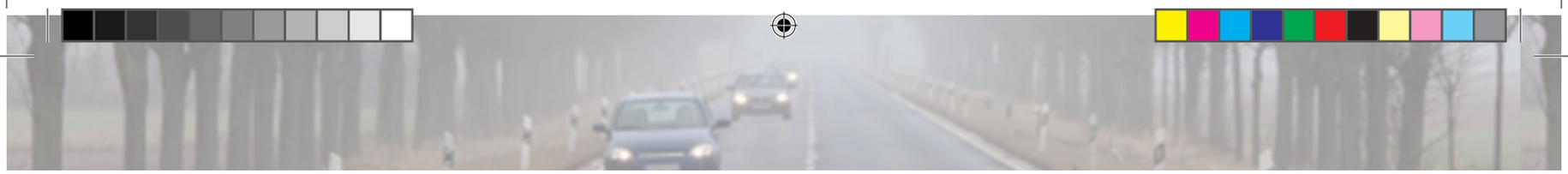
Intelligent, Multi-Camera Transportation Infrastructure Surveillance and Monitoring with High Data Rate Wireless Information Transfer and Networking

Christopher Davis and Stuart Milner

In this new project we will leverage our previous successes in CITSM and develop new capabilities for traffic surveillance and monitoring systems that use multiple cameras to simultaneously detect and track multi object motion as well as conduct anomaly detection and classification in real-time. The project will build on our already developed single camera-based object detection systems by developing and integrating a second, cooperating camera, which can autonomously zoom, pan and tilt in the process of tracking traffic incident. Having second camera "focus" on the persistent tracking of, and zooming in, on incidents allows the first camera to simultaneously detect and track the larger field of view or traffic scene.

In other words, it is like having two sets of "eyes" monitoring the traffic—one set of eyes monitoring the ongoing events (e.g., multiple lane highways, intersections, freeway ramps, parking lots, etc.) and the other set of eyes following the critical event such as an accident or sudden change in traffic patterns). The introduction of multiple coupled cameras and new algorithms for surveillance make this project very distinct from our other related work. Our research is unique in that we combine expertise in calibrated imaging hardware with advanced wireless networking and intelligent image analysis software that works with the hardware in real-time. Our technology can provide situation alerts to operations centers in real time. In contrast to all currently deployed conventional and analog-based video monitoring systems, we use uncompressed, high-definition (HD) camera images that allow real time analysis of multiple "events" (e.g., vehicle speed, type, number, pedestrians, etc.) and anomalies that would be missed by conventional compressed CCTV. In addition, following detected events that meet pre-defined criteria, we provide persistent follow-up and tracking using one camera and autonomous, calibrated zoom, pan and tilt using a second camera.

In summary, our research combines many engineering disciplines from infrastructure monitoring, optical design, control systems, servo stabilized platforms, opto-mechanics, computer vision, computer networking, data transfer protocols, and wireless network optimization for networks with fixed and mobile nodes. Our approach is to use low cost, deployable, non-proprietary, open systems and to integrate commercial off-the-shelf hardware and software that



is compliant with internet protocols. We believe that the advanced highway autonomous event detection and tracking capability that our network will provide will allow real-time traffic and transportation management information, an improved ability to respond to major events, and could also provide statistical information about traffic flows and patterns.

Flexibility and Responsiveness in Public Transportation Systems

Paul Schonfeld

The flexibility of a system may be defined in terms of its ability to adjust to different conditions. For a public passenger transportation system those conditions might include widely different demand patterns and densities at various locations and times, different user categories (e.g. elderly & handicapped, children, groups, unfamiliar users), traffic congestion and blockages, geometrically constricted roads and severe weather. Responsiveness connotes the speed and ease with which adjustments to circumstances can be made and user requests for service can be accommodated. Reliability indicates the extent to which expected service levels can be met despite disruptions (e.g. weather, traffic, sports events,) and possible failures in some system components. A system's reliability is also judged by the predictability and steadiness of its performance, which greatly concerns many passengers.

The willingness and ability of travelers to use public transportation services depends greatly on the accessibility, reliability, and convenience of those services. Conventional public transit services (which include most bus and rail transit services) can provide relatively high passenger-carrying capacities at relatively low average costs to system operators, but their service quality is limited since passengers must somehow reach some predetermined stations, wait for a vehicle, possibly transfer several times, and then move from their exit stations to their destinations. Thus, conventional transit services are most disadvantaged in areas and time periods with low demand densities, which cannot economically sustain high route densities and service frequencies.

Some paratransit services can provide more flexible routes and schedules, possibly with door-to-door service, and special assistance for handicapped passengers. Thus, taxis provide very high service flexibility, but at high unit costs (especially in labor cost per passenger-mile). Various forms of ridesharing and subscription services considered in this proposed study can provide intermediate combinations of unit cost and service quality.

To some extent, efficiency in public transportation services might be sought by identifying the most appropriate modes and service types for different areas, periods and user groups. However, the problem is considerably more complex since the areas, periods and user groups within a metropolitan region are usually quite interrelated. Excessive specialization usually also results in underutilization of resources (e.g. vehicles and drivers). To achieve desirable levels of flexibility and efficiency we must also seek to integrate systems so that resources can be switched among different routes and service types, as circumstances change.

In the applied research study proposed here we will develop performance measures that quantify the flexibility and responsiveness of public transportation systems and then develop mathematical models for optimizing flexible and responsive public transportation systems.

Bridge Health Monitoring System Based on Flexible, Wireless, and Batteryless Patch Sensors (Technical Assistance Funding)

Mehdi Kalantari

According to the National Bridge inventory Database of the Federal Highway Administration in year 2008, the U.S. transportation infrastructure has 601,027 bridges from which 71,429 are rated as structurally deficient. State of Maryland is not an exception of this issue. According to the above database, the State has a total of 5,168 bridges from which 396 are rated as structurally deficient. Structural health monitoring is required to anticipate the impending failure of bridges – as well as other critical infrastructure such as pipelines, railways, and drilling platforms. Yet, existing instrumentation techniques for structural health monitoring of bridges suffer from non-scalability due to high cost of instrumentation devices, large installation costs (e.g., due to wiring needs), or high maintenance costs.

Currently, the only practice for monitoring the health of bridges is a mandated bi-annual manual inspection; however, manual inspection has proved extremely insufficient to ensure safety of bridges, as such inspections do not provide enough information to prevent catastrophic failures. To protect the infrastructure systems against aging, structural malfunction, and collapse, this project will offer a cost effective and scalable solution for the real time monitoring of important structural state quantities such as stress, strain, fatigue cracks, vibration, etc. The solution is based on patent pending Active RF Test (ART) technology, which incorporates novel sensing, energy harvesting, and wireless communication technologies into a flexible, wireless, and batteryless sensor. The proposed approach is capable of accurately identifying structural distress such as overstrain, crack initiation and growth, and deformation. Key advantages of the proposed system include (1) flexibility and compact size of sensors, allowing them to be applied to curved surfaces and complex geometries; (2) wireless operation with a self-contained energy harvesting device as a power supply; and (3) very low cost, enabling a large scale distribution in which data fusion techniques can be utilized for enhanced damage severity evaluation and source location.

Sustainability Impact of Multimodal Corridor Improvements in Urbanized Area

Lei Zhang (MDSHA)

This research project will support the existing SHA Sustainability Initiative and CHC Program with the following objectives:

1. Develop methods to analyze the planning-level sustainability impact (i.e. mobility, safety, energy and environment, natural resources, socio-economic, and cost) of multimodal improvements on highway corridors, including:

- Road diet (i.e. lane removal)
- High occupancy vehicle (HOV) lane
- High occupancy toll (HOT) lane
- Bus rapid transit/bus-only lane
- Light rail transit
- Truck-only lane
- Express toll lane
- Park-and-ride facility

2. Refine and improve the existing MOSAIC modules by both developing improved impact evaluation methods (e.g. regarding pollution emissions, GHG emissions, and other environmental impacts) and replacing model parameters based on national-level analysis with Maryland-specific parameters (e.g. emission rates, vehicle fleet composition, construction and maintenance cost).

With these enhancements, MOSAIC will be capable of analyzing the long-term sustainability impact of both highway and multimodal corridor improvements in urban and rural areas in Maryland.

Developing a Data and Modeling Framework for Integrated Transportation Operations and Planning

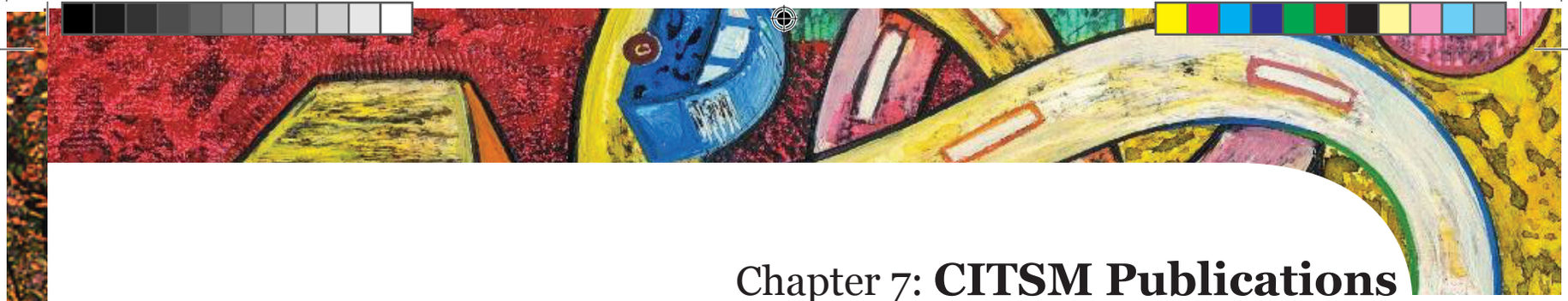
Lei Zhang (MDSHA)

This research project has three main objectives:

1. Develop a route choice/traffic diversion model based on existing travel behavior data for the ICC (Inter- County Connector) study area.

2. Develop a peak spreading model to capture departure time choice decisions based on existing travel behavior data for the ICC study area.

3. Integrate the traffic diversion and peak spreading models with a microscopic traffic simulation model for the ICC study area



Chapter 7: **CITSM Publications**

PUBLICATIONS

1. Cirillo, C. and R. Xu (2011, "Dynamic Discrete Choice Models for Transportation," Transport Reviews, 31(4), pp. 473-494.

2. Cirillo, C. and Y. Liu (2012), "A Vehicle Ownership Model for the State of Maryland: Analysis and Trends from 2001 and 2009 NHTS Data," Journal of Urban Planning and Development — ASCE Journal, "in press".

3. Maness, M. and C. Cirillo (2012), "Measuring and Modeling Future Vehicle Preferences: A Preliminary Stated Preference Survey in Maryland," Transportation Research Record, (in press).

4. Xu, R., Cirillo, C. and F. Bastin (2012), "A Dynamic Formulation for Car Ownership Modeling," Transportation Science, (submitted).

5. Liu, Y., and G.L. Chang (2011), "An Integrated Control Model for Freeway Corridor Under Non-recurrent Congestion," IEEE Transactions on Vehicular Technology, Vol. 60, No.4, 1404-1419.

6. Chang, G.L., S.-Y. Park, and J. Paracha (2011), "ITS Field Demonstration: Integration of Variable Speed Limit Control and Travel Time Estimation for A Recurrently Congested Highway," Transportation Research Record 2243, 55-66.

7. Kim, W. and G.L. Chang (2011), "Development of A Hybrid Model for Predicting Freeway Incident Duration," International Journal of Intelligent Transportation Systems Research, Vol. 10, No. 1.

8. Liu, Y., and G.L. Chang (2011), "An Arterial Signal Optimization Model for Intersections Experiencing Queue Spillback and Lane Blockage," Transportation Research Part C, Vol. 19C, No-1, 130-144.

9. Zhang, X. and G.L. Chang (2011), "A CA-based Model for Simulating Vehicle-pedestrian Mixed Flows in a Congested Network,' Transportation Research Record 2234, 116-124.

10. Lu, Y. and G.L. Chang (2011), "A Stochastic Model for the Estimating Time-dependent Arterial Travel Time and Its Variability with Only Link Detector Data," Transportation Research Record, (accepted).

11. Lu, Y. and G.L. Chang (2011), "Analysis of Queues and Delays for Continuous Flow Intersections: Model Calibration and Tool Development," Journal of Transportation Engineering, ASCE (accepted).

12. Kim W., Y. Liu and G.L. Chang (2011), "A Decision Model for Justifying the Benefits of Detour Operations Under Non-recurrent Congestion," Journal of Transportation Engineering, ASCE (accepted).

13. Lu, Y., X. Yang and G.L. Chang (2011), "Modeling Intersection Queue Dynamics in a Signalized Network: Formulations and Implementation," Transportation Research Part C, (under revision).

14. Cui, Q. and Zhu, X. "Green Contracting in Highway Construction: State of Practice," Transportation Research Records, 2228, 11-18.

15. Sadabadi*, K.F. and A. Haghani (2011), "Real-time Solution of Velocity-based First-order Continuum Traffic Model Using Finite Element Method," Transportation Research Record, Journal of Transportation Research Board 2260, pp 24-41.

16. Chou, C.-S. and E. Miller-Hooks (2011), "Exploiting Capacity of Managed Lanes in Diverting Traffic Around an Incident," Transportation Research Record 2229, 75-84.

17. Miller-Hooks, E., X. Zhang and R. Faturechi (2012). "Measuring and Maximizing Resilience of Freight Transportation Networks," Computers and Operations Research 39(7), 1633–1643.

18. Markovic, N. and Schonfeld, P. (Nov. 2011), "Scheduling under Uncertainty for a Single-hub Intermodal Freight System," Transp. Res. Record 2011, pp.24-31.

19. Chen, C.C. and Schonfeld, P. (Nov. 2011), "Alleviating Schedule Disruptions at Intermodal Freight Transfer Terminals: Real-time Dispatching Control," Transp. Res. Record 2238, pp. 32-41.

20. Markovic, N. and Schonfeld, P. (Sep. 2011), "Stochastic Scheduling for a Single-Terminal Transfer System with Poisson Arrivals," accepted for Strojniski Vestnik (Slovenian J. of Mechanical Eng.).

CONFERENCE PROCEEDINGS AND PRESENTATIONS

1. Cirillo C. and M. Maness (2011), "Estimating Demand for New Technology Vehicles," proceedings of the ETC European Transport Conference, Glasgow UK, October 2011.

2. Cirillo, C. and M. Maness (2012), "A Dynamic Approach for Future Vehicle Preference," IATBR International Association for Travel Behaviour Research, Toronto, July 2012.

3. Liu, Y., Tremblay, J.M. and C. Cirillo (2012), "A Model System for Household Vehicle Holding, Type and Usage based on 2009 NHTS," IATBR International Association for Travel Behaviour Research, Toronto, July 2012.

4. Kim, W. and G.L. Chang, "Benefit Estimation of Freeway Incident Traffic management Plan, A Case Study on I-95 Corridor," 1st T&DI Congress, ASCE, Chicago, March 2011.

5. Kim, W. and G.L. Chang, "Benefit Estimation Analysis for Traffic Incident Management Patrol Expansion," proceedings for 18th ITS World Congress, Orlando, Oct. 2011.

6. Zhu, W. and G.L. Chang, "Strategic Patrol Vehicle location-allocation Model for Freeway Incident Responses," proceedings for 18th ITS World Congress, Orlando, Oct. 2011.

7. G.L. Chang, "A Web-based Real-time Simulation System for Networkwide Traffic Controls," FHWA Fairbank workshop, December 2011.

8. Zhu, X.*, Whitten, L.* and Cui, Q. (2011), "Green Performance Contracting on Highway Construction Projects," Second Transportation Construction Management Conference in Orlando, FL, Feb 8-10, 2011.

9. Sadabadi, K.F. and A. Haghani (2011), "First Order Travel Time Model and Finite Difference Solution Schemes," 91st Transportation Research Board annual meeting Compendium of Papers, Washington, DC, January 2012.

10. Sharifi, E., M. Hamedi, A. Haghani and H. Sadrsadat (2011), "Analysis of Vehicle Detection Rate for Bluetooth Traffic Sensors: A Case Study in Maryland and Delaware," proceedings of the 18th World Congress on Intelligent Transportation Systems, Orlando, Florida, October 16-20.

11. W. Qiao, A. Haghani and M. Hamedi, (2011), "Real-time Short-term Travel Time Prediction: A Case Study Based on Bluetooth Data," proceedings of the 18th World Congress on Intelligent Transport Systems, Orlando, Florida.

12. Li, Juan and A. Haghani (2011), "Video-Based Pedestrian Traffic Data Collection," 91st Transportation Research Board annual meeting Compendium of Papers, Washington, DC, January 2012.

13. Robin L. Fish, M. Hamedi and A. Haghani (2011), "Analysis of Traffic Speed Response to Display of Dynamic Message Sign Messages," 91st Transportation Research Board annual meeting Compendium of Papers, Washington, DC, January 2012.

14. Qiao, W., A. Haghani and M. Hamedi, (2011), "Short Term Travel Time Prediction Considering Weather Impact," presented at the Annual Meeting of the Institute for Operations Research and the Management Science (INFORMS), Charlotte, North Carolina, November 13-16.

15. Miller-Hooks, E., "Resilience in Transportation Systems," invited speaker in the Department of Industrial and Systems Engineering Seminar Series at the State University of New York - Buffalo, October 2011.

16. Miller-Hooks, E., "Resilience in Transportation Systems," invited speaker in the Department of Civil and Environmental Engineering at the University of Texas - Austin, November 2011.

17. Lai, X. and Schonfeld, P. "Optimization of Rail Transit Alignments Considering Vehicle Dynamics," Annual TRB Meeting, Jan. 2012 (12-2553).

18. Markovic, N. and Schonfeld, P. "Simulation-based Optimization of Recovery for a Multi-terminal Freight Transportation System," annual TRB meeting, Jan. 2012 (12-2650).

19. Zhang, L. and Xiong, C. (2012), "A Positive Model of Departure Time Choice," paper presented at the 91st Transportation Research Board annual meeting, January 22-26, Washington, DC.

20. Zhang, L., Chang, G.L., Zhu, S., Xiong, C., Du, L., Mollanejad, M., Hopper, N. and Mahapatra, S. (2012), "Integrating an Agent Based Travel Behavior Model with Large-scale Microscopic Traffic Simulation for Corridor and Sub-area Transportation Planning Applications," paper presented at the 91st Transportation Research Board annual meeting, January 22-26, Washington, DC.

21. Zhang, L., Hong, J.H., Nasri, A. and Shen, Q. (2012), "How Built Environment Affects Travel Behavior: A Comparative Analysis of the Connections between Land Use and Vehicle Miles Traveled in U.S. Cities," paper presented at the 91st Transportation Research Board annual meeting, January 22-26, Washington, DC.

22. Nasri, A. and Zhang, L. (2012), "Impact of Metropolitan-level Built Environment on Travel Behavior," paper presented at the 91st Transportation Research Board annual meeting, January 22-26, Washington, DC.

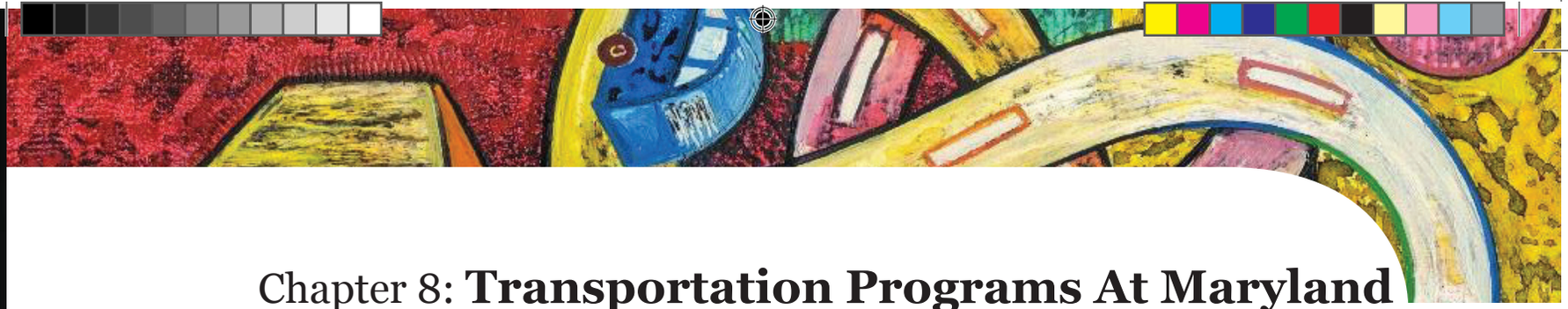
23. Zhang, L. and Lu, Y. (2012), Marginal Cost Vehicle Mileage Fee," paper presented at the 91st Transportation Research Board annual meeting, January 22-26, Washington, DC.

24. Zhu, S., Du, L. and Zhang, L.(2012), "An Economic Model for Vehicle Ownership Quota and Usage Restriction Policy Analysis," paper presented at the 91st Transportation Research Board annual meeting, January 22-26, Washington, DC.

25. Zhang, L., Nasri, A., Shen, Q. and Hong, J. (2011), "How the Built-environment Affects Travel Behavior: A Comparative Analysis of Travel Behavior and Land use in U.S. Cities," paper presented at the World Symposium on Transportation and Land Use Research, Whistler, BC, Canada, July 28~30.

26. Xiong, C. and Zhang, L. (2011), "National and Inter-regional Travel Demand Modeling: Data Sources, Methodological Options, and Applications," paper presented at the 11th ICCTP annual conference, Nanjing, China, August 14~17.

27. Zhang, L., Zhu, S., Xiong, C., Du, L. and Chang, G.L. (2011), "Integrating Dynamic Departure Time, Routing, and Traffic Simulation Models for Traffic Operations and Dynamic Pricing Analysis," presented at the 2011 INFORMS annual meeting, November 13-16, Charlotte, NC.



Chapter 8: **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 Software
- Incident Management Software
- Md 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
- Md Transportation Technology Transfer (MD T^2) Ctr
- 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 Information 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 T1 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)

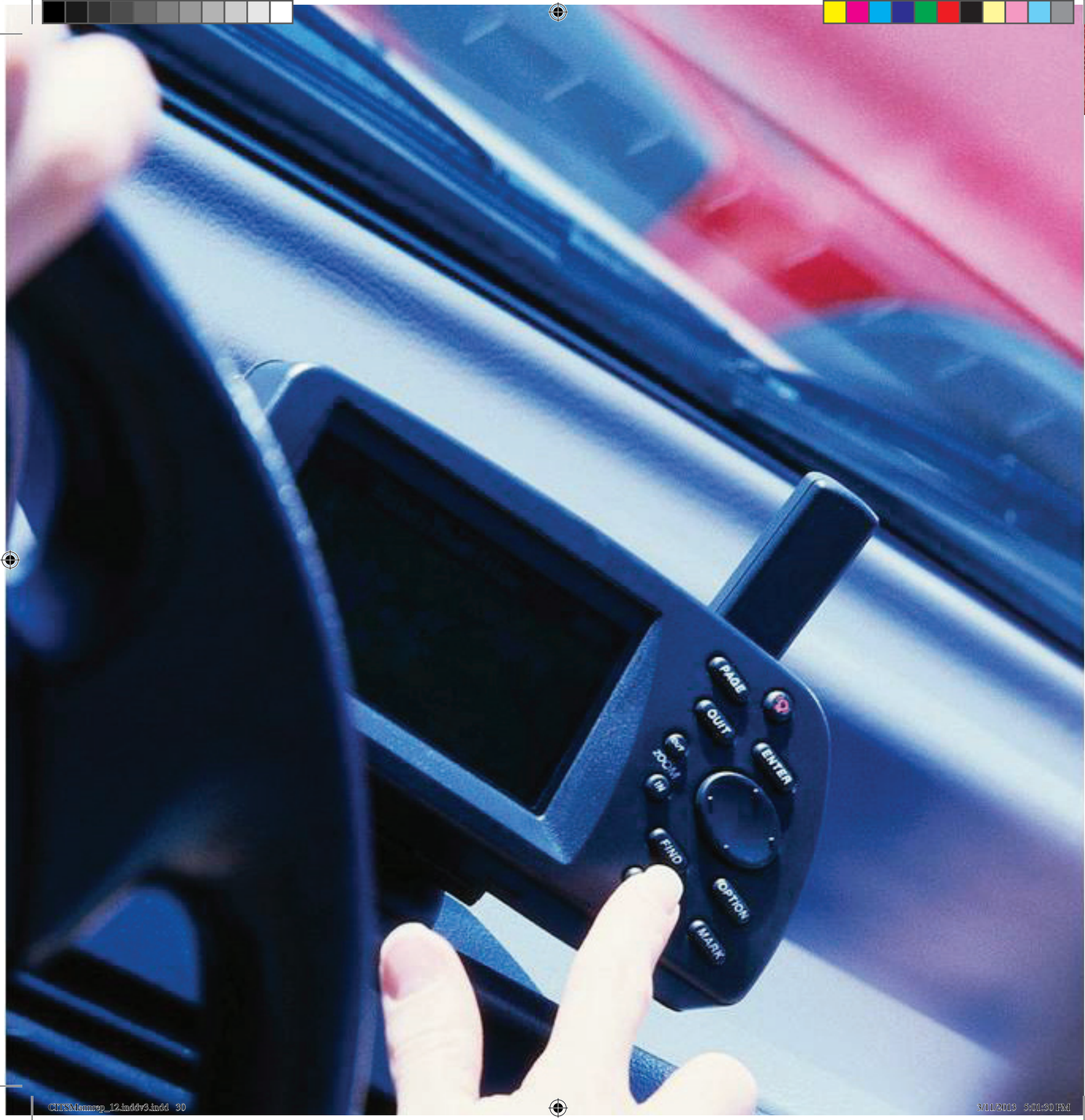
The CNIS is an interdisciplinary research center at the University of Maryland. CNIS is concerned with sensors, communication, and infrastructure security in the military and civilian domains. The University of Maryland, College Park, has developed a remote, real-time surveillance system to demonstrate 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/



Chapter 9: **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

MDT²

The Maryland Transportation Technology Transfer Center (MD T² Center) was established in 1984 at the University of Maryland, College Park. LTAP provides an excellent foundation for T² 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 T² 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 T² 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 T² 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 T² Center participates in transportation-related conferences and meetings throughout the state and region:

- County Engineers Association of Md
- 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/

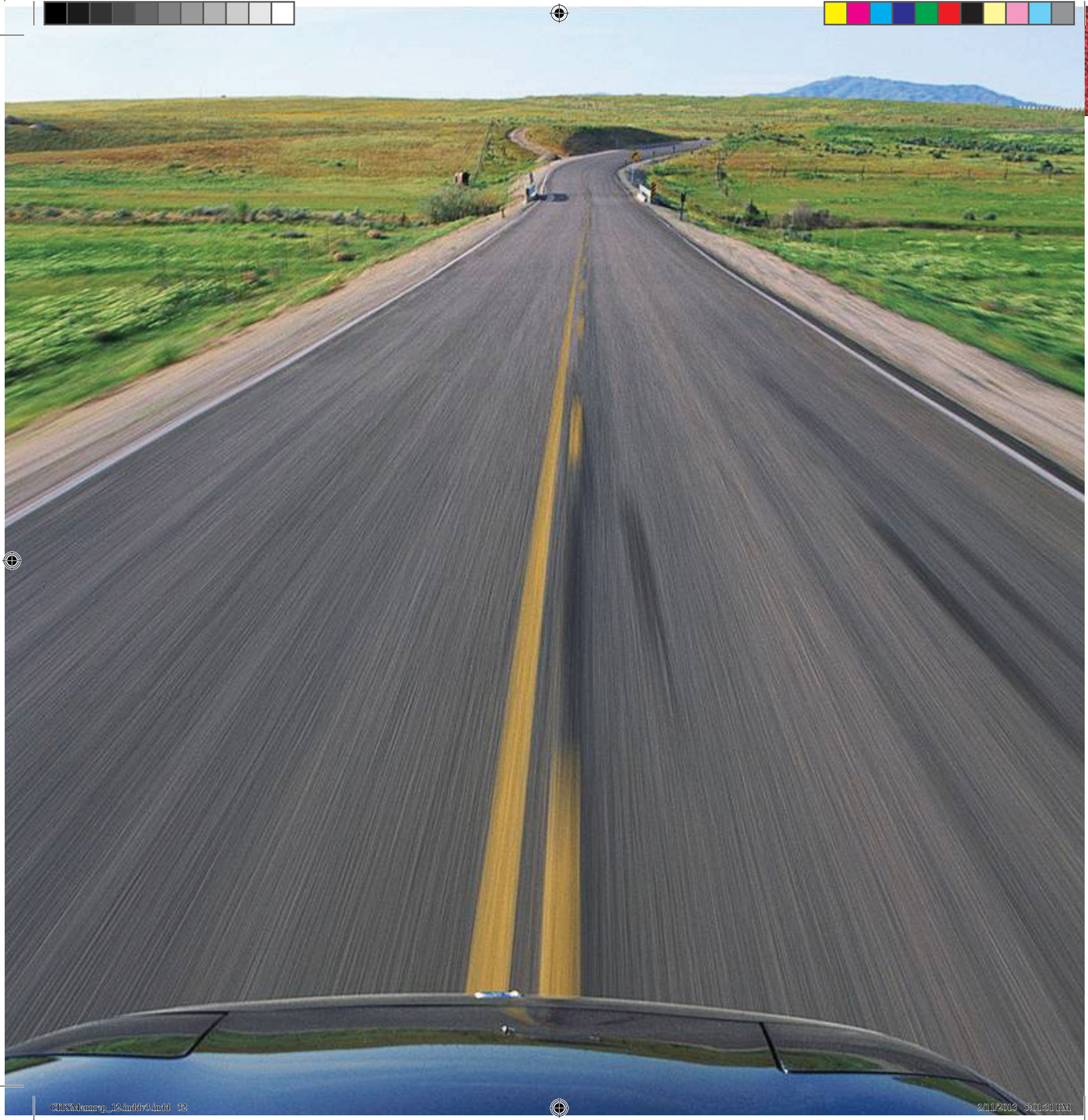
OPERATIONS ACADEMY

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



Chapter 10: **Seminar Series**

ITS STUDENT CHAPTER INVITED SPEAKER SERIES

(Sponsored by the Center for Integrated Transportation Systems Management)

The Aftermath of the Earthquake and Tsunami in Japan on March 11, 2011

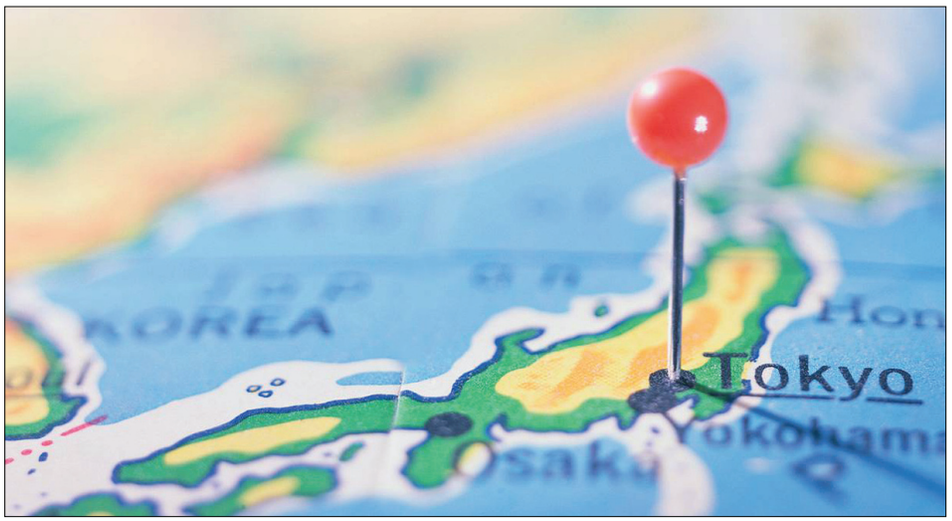
Dr. Tatsuo Oyama

Thursday, May 10th, 2012

Seminar: 2:00 pm-3:30 pm

Glenn L. Martin Hall Room 0312

Abstract: Japan experienced an extremely severe natural disaster, brought from earthquake of magnitude higher than 9.0, and tsunami caused by the East-Japan Great Earthquake on March 11, 2011. First, historical data on the natural disasters in Japan will be explained using graphs and mathematical models. Then the East-Japan Great Earthquake will be explained with their damages using regional data. We will compare the Japanese damage data with Indonesian Aceh earthquake case which occurred in December 2004. Survey data analysis on the stranded commuters behavior on the East-Japan Great Earthquake day will also be given. Recovering process especially in agricultural sectors will also be explained.



Short Biography: He obtained Bachelor of Science and Master of Science from College of Engineering of the University of Tokyo in Japan in 1969 and 1971, respectively. He was given degree of Ph.D from School of Operations Research and Industrial Engineering (ORIE) in the College of Engineering of Cornell University in 1977. After finishing Master's program at the Graduate School of the University of Tokyo he worked for the Economic Research Institute of the Central Research Institute of Electric Power Industry in Japan as a researcher from 1971 to 1980. Then he taught at the Department of Arts and Science, and Graduate School of Policy Science in Saitama University as Assistant Professor in 1980-81, Associate Professor in 1981-1988 and Professor in 1988-1997. He has been working as a Professor at the National Graduate Institute for Policy Studies (GRIPS) since 1997. He has been Dean since April, 2000 and Vice President since June, 2003 at GRIPS. He also has been very active working for the Operations Research Society of Japan. He has been Council Members since 1996 for Editing Committees, International Committee, Prize Committee, and so on. Currently he was a Vice President of the Society from April, 2003, to March, 2005.

His major research interests are in applying operations research theory to public sectors decision making, policy analysis and evaluation. He has published many papers in the areas such as mathematical programming model analyses for energy and environmental problems, spatial interaction model analyses for inter-regional commodity flow phenomena, optimal public facility location problems and mathematical modeling approaches, apportionment problem and political districting problem, city traffic

management policy analyses, mathematical modeling approaches for policy evaluation, and so on. His papers appeared in Journal of Combinatorial Theory (A), IEEE Transactions on Power Apparatus and Systems, Communications of Operations Research, Journal of Operations Research of Japan, Journal of Civil Engineering Society in Japan, OPSEARCH, *International Transactions in Operational Research*, Japan Journal of Industrial and Applied Mathematics, Journal of Higher Education, Journal of Asian Public Policy, and so on. He published 9 books in Japanese entitled such as "Graph, Network and Matroid", "Algorithm", "Optimization Model Analyses", "Discrete Mathematics", "Public Policy and OR", "Policy Evaluation: Theory and Practice", and so on.

Scheduling and Location Issues in Transforming Service Fleet Vehicles to Electric Vehicles

Dr. Pitu Mirchandani
Friday, May 4th, 2012
Seminar: 2:00 pm-3:00 pm,
Reception: 3:00 pm-3:30pm
Civil Engineering Conference Room
(Glenn L. Martin Hall Room 1179)

Abstract: There is much reason to believe that fleets of service vehicles of many organizations will transform their vehicles that utilize alternative fuels which are more sustainable. The electric vehicle (EV) is a good candidate for this transformation, especially which "refuels" by exchanging its spent batteries with charged ones. Unfortunately, although there is much research gone into technologies of EVs, little effort have gone into designing the battery charging-/ exchanging- infrastructure. This presentation discusses the issues that must be addressed if a transit service were to use electric vehicles, principally the issues related to the limited driving range of each electric vehicle's set of charged batteries and the possible detouring for battery exchanges. In particular, the paper addresses the optimization and analysis of infrastructure design alternatives dealing with (1) the number of battery-exchange stations, (2) their locations, (3) the recharging capacity and inventory management of batteries at each facility, and (4) routing and scheduling of the fleet. Some infrastructure design and optimization models, and some preliminary results, will be discussed in the presentation.

Short Biography: Dr. Pitu Mirchandani (BS, Engineering, UCLA; SM, Aeronautics and Astronautics, MIT; ScD, Operations Research, MIT} is a Professor of Computing, Informatics and Decision Systems Engineering at Arizona State University (ASU). He is also a Senior Sustainability Scientist within the Global Institute Of Sustainability. His areas of technical expertise include modeling, analysis, control theory and optimization, with special interest in applications to transportation, logistics, energy systems and sustainability. He has been a principal investigator on several large research programs, involving several faculty and student researchers; recent notables are Real-Time Traffic Adaptive Signal Control, Adaptive Ramp Metering, Evacuation Traffic Management, and Remote Sensing of Transportation Flows.

Dr. Mirchandani directs the ATLAS Laboratory which develops and tests systems and algorithms for traffic and logistics management. Notably, he has the led the development of a traffic adaptive signal control system referred to as RHODES. He has co-authored three books and over 150 articles in a variety of journals, magazines and books, those that focus on theory, to those on model and algorithm development and those that focus on applications.

City of Annapolis City Dock Transportation Concept Refinement & Traffic Analysis

Sabra, Wang & Associates, Inc.
Friday, April 20th, 2012
Seminar: 3:00 pm-4:00 pm,
Reception: 4:00 pm-4:30pm
Chance to speak with Sabra, Wang, and Associates, Inc. individually
Pepco Room (Room 1105)

The City Dock area, at the heart of the historic downtown Annapolis waterfront, centers around Memorial Circle at the intersection of Main St, Randall St, and Compromise St. Some stakeholders in the City of Annapolis have recently questioned whether those streets were well-designed with a balanced approach towards pedestrians, bicycles, and other modes of transportation since the wide lanes and ample shoulder space at Memorial Circle gives the impression of an auto-centric environment.

The presentation will focus on analysis of the primary roads and intersections of the City Dock Area in the context of the competing objectives of (1) Public Space & Ac-

residential and workplace location choice; "smart growth" and municipal fiscal decision making; and the connections between public transit, immigration and the economic growth of cities. His research relies heavily on original data collection including surveys, focus groups and interviews. Ongoing research projects include studies addressing which US transit systems succeed and why; the implications of immigration trends for sustainable development and economic growth; the effect of dynamic parking pricing on occupancy and use of on-street parking in San Francisco; and whether decisions about residential location and commuting patterns are economically rational.

A Macroscopic Tool for Estimating the Impact of Single Airport and Regional Airport System Delay on the National Airspace System

Dr. Yu Zhang
University of South Florida
Thursday, 3/29
Seminar: 2:00pm-3:00pm,
Reception: 3:00pm-3:30pm
Location: Pepco Room,
Kim Engineering Building
Cookies, coffee, and soft drinks will be provided.

Abstract: Airline delays lead to a tremendous loss of time and resources and cost billions of dollars every year in the United States (U.S.). At certain times, individual airports become bottlenecks within the National Airspace System (NAS). To explore solutions for reducing the delay, it is essential to understand factors causing flight delay and its impact on airports in the NAS. Major causal factors of flight delay at airports include over-scheduling, en-route convective weather, reduced ceiling and visibility around airports, and upstream delay propagation. Delay at one airport can be passed on to other airports in the NAS, in another word, operational improvement at one airport will have network effect and benefit other airports as well. Moreover delay at different airports in a region might agglomerate to cause delay at different regions in the NAS. Hence, to optimally allocate NAS resources, e.g. capital investment for airport capacity expansion, the impact of single airport delay to the NAS and vice versa need to be investigated and quantified.

For air transportation planning and policy purposes, this study concentrates on providing answers from a macroscopic point of view without being distracted by volatile operational details. In the first part, we estimate the interaction between flight delay at one single airport and delay at the rest of the NAS (RNAS) using case study for LaGuardia (LGA) and Chicago O'Hare (ORD) airports. Also, regional airport system development has been a hot topic of research in the air transportation community in recent years. Many metropolitan regions are served with more than one airport making their operations synchronized and interdependent and are known as regional airport system. In the second part of this study, key factors affecting the delay in nine different prospective regional airport systems in the U.S. are identified. Econometrics models and three stage least square (3SLS) estimation method are used to explore interdependency of delay at regional airport system and the RNAS. The outcomes from this research will help aviation planners understand the spillover effects of delays from regional airport systems and provide decision support for future NAS improvement.

Short Biography: Dr. Yu Zhang is an Assistant Professor in the Department of Civil and Environmental Engineering at University of South Florida in the US. Before she joined in the department in August 2008, she had obtained her M.S. and Ph.D. degrees in Civil and Environmental Engineering from the University of California at Berkeley with research concentration in Transportation Engineering and also had worked ten months for an airport management consulting company located in San Francisco Bay Area. Dr. Zhang's research interests include Transportation Flow Management both in Air and Ground Transportation, Multimodal Transportation Planning and Sustainable Transportation. She obtains research support from Federal Aviation Administration, Federal Highway Administration, Transportation Research Board Airport Cooperation Research Program, Florida Department of Transportation, Florida High Tech Corridor, and industry companies. Dr. Zhang has published numerous papers in prestigious transportation journals and high-influential international conferences. Dr. Zhang is the recipient of 2010 Fred Barggraf Award,

cess, (2) Safety, (3) Aesthetics, (4) Business Access, and (5) Traffic Operations. Discussion of the traffic operations elements of the project will include simulation of the study intersections and pedestrian/vehicular interactions in VISSIM, consideration given to upgrades to convert Memorial Circle from a circle to a true modern roundabout, and consideration given to removing the circle in favor of traditional signalized intersections with "Barnes' Dance" all-pedestrian signal phases.

Speaker: Josh Smith, P.E., PTOE
Josh is a Senior Project Manager at Sabra, Wang & Associates in Baltimore, Maryland, overseeing work on a variety of transportation planning, traffic simulation, maintenance of traffic, traffic control device design, traffic data collection, and signal operations projects. Originally from Clearwater, FL, he received B.S. (1999) and M.S. (2000) degrees in Civil and Environmental Engineering from Brigham Young University in Provo, Utah. Josh joined Sabra, Wang in January 2010.

Josh is a registered Professional Engineer in Maryland and has a Professional Traffic Operations Engineer (PTOE) certification. Some of his major projects have included downtown cycle track analysis for DDOT, VISSIM modeling for the Dulles Toll Road, maintenance of traffic and guide sign design for the I-95 Express Toll Lanes project north of Baltimore, BRAC-related transportation planning work for the Engineering Proving Grounds at Fort Belvoir, Virginia and Aberdeen Proving Ground in Maryland, and CORSIM modeling for project planning alternatives for I-81 through Hagerstown, Maryland.

Josh has been active in the Washington DC section of ITE for the past 11 years, including four years as chair of the Section's membership committee, two years as Baltimore Area Director, and one-year terms as Secretary-Treasurer, Vice-President, and President. He currently serves as the WDCSITE representative to the Mid-Colonial District of ITE.

Solving Capacitated Vehicle Routing Problem with Environmental Considerations

Javier Faulin,
Public University of Navarra (Spain)

Short Biography: Javier Faulin (javier.faulin@unavarra.es) is an associate professor of operations research and statistics at the Public University of Navarra (Spain). He is also a lecturer at the UNED (Pamplona, Spain). He holds a PhD in economics from the University of Navarre (Pamplona, Spain), a MS in operations management, logistics and transportation from UNED (Madrid, Spain) and an MS in mathematics from the University of Zaragoza (Zaragoza, Spain). He has extended experience in distance and Web-based teaching at several European universities. His research interests include logistics and simulation modeling and analysis. Dr. Faulin is the lead author of "Simulation Methods for Reliability and Availability of Complex Systems", a 2010 Springer book. He has also published numerous papers in international journals, books, and proceedings.

UMD TRANSPORTATION SEMINAR SERIES

Sponsored by the Center for Integrated Transportation Systems Management

A Household-level Activity Pattern Generation Model for the Simulator of Activities, Greenhouse Emissions, Networks, and Travel (SimAGENT) System in Southern California

Dr. Chandra R. Bhat,
University of Texas Austin
Thursday, 4/12
Seminar: 2:00pm-3:00pm,
Reception: 3:00pm-3:30pm
Location: Kay Board Rooms,
Kim Engineering Building

Abstract: This paper develops and estimates a Multiple Discrete Continuous Extreme Value (MDCEV) model of household activity generation that jointly predicts the activity participation decisions of all individuals in a household by activity purpose and the precise combination of individuals participating. The model is estimated on a sample obtained from the Post Census Regional Household Travel Survey conducted by the South California Association of Governments (SCAG) in the year 2000. A host of household, individual, and residential neighborhood accessibility measures are used as explanatory variables. The results reveal that, in addition to household and individual demographics, the built environment of the home zone also impacts the activity participation levels and durations of households. A validation exercise is undertaken to evaluate the ability of

the proposed model to predict participation levels and durations. The model has been embedded within the larger activity-based modeling structure for the Southern California region (labeled as Simulator of Activities, Greenhouse Emissions, Networks, and Travel or SimAGENT). In addition to providing richness in behavioral detail, the model contributes to the faster run speed of SimAGENT by obviating the need for several hierarchical sub-models typically used in extant activity-based systems to generate activity patterns. The presentation will discuss results from the implementation of the household-level activity generation model for policy sensitivity testing using a wide range of land-use and transportation policy scenarios.

Short Biography: Dr. Chandra R. Bhat is the Adnan Abou-Ayyash Centennial Professor in Transportation Engineering at The University of Texas at Austin, where he teaches courses in transportation systems analysis and transportation planning. Dr. Bhat is recognized nationally and internationally as a leading expert in the area of travel demand modeling and travel behavior analysis. His research interests include land-use and travel demand modeling, activity-based travel modeling, policy evaluation of the effect of transportation control and congestion pricing measures on traffic congestion and mobile-source emissions, marketing research of competitive positioning strategies for transportation services, use of non-motorized modes of travel, and physical health and transportation. His methodological research interests and expertise are in the areas of econometric and mathematical modeling of consumer behavior, including discrete choice analysis, discrete-continuous econometric systems, and hazard duration models.

Transit Investments and Agglomeration Economies: An Empirical Study of US Metropolitan Areas

Speaker: Dr. Dan Chatman
University of California at Berkeley
Wednesday, 3/28
Seminar: 2:00pm-3:00pm,
Reception: 3:00pm-3:30pm
Location: Kay Board Rooms,
Kim Engineering Building
Cookies, coffee, and soft drinks will be provided.

Abstract: It has long been argued in the academic literature that improvements to transportation could lead to easier interactions between firms, more centralized and higher-density employment clusters, and larger cities. These changes could increase the productivity of firms and workers by making labor markets more accessible, increasing information exchanges between firms, and enabling more specialization. Understanding under what circumstances transit investments have such benefits could inform planning and funding decisions. Some have estimated that agglomeration and associated benefits could add as much as a 25 percent increment to the benefits calculated in a conventional benefit-cost analysis. But despite the well-established theory, empirical research on the link between transportation investments, agglomeration, and productivity increases is limited. This is particularly true for transit projects, which are likely to have markedly different effects on agglomeration than roads or highways.

We compiled productivity, agglomeration, and transit capacity data for all of the metropolitan areas in the United States, and analyzed the data using a variety of methods, measures and model specifications, producing MSA-specific estimates of how wages and GDP are correlated with transit capacity due to agglomeration. We carried out our analysis in two stages. First, we estimated how transit capacity is associated with agglomeration; and second, how agglomeration is associated with wages and GDP. We applied both model stages in estimating the changes in productivity associated with adding additional transit capacity via the agglomeration link, controlling for other factors. Larger metropolitan areas with larger transit systems are associated with stronger relationships between additional transit investments and productivity. The estimates range between $1 and $50 per capita per year, depending on the metropolitan area. Among metropolitan areas with existing rail systems, the net agglomeration benefit of one additional track mile ranges from $10 million to $500 million per year in the US. We view these estimates with caution, as much more work remains to be done to refine the methods.

Short Biography: Dan Chatman is an assistant professor of city and regional planning whose research areas of interest include travel behavior and the built environment;

which is conferred by the National Academies of Science Transportation Research Board for recognizing the excellence of young researchers. Dr. Zhang is serving on two TRB committees and is the Board Director of Chinese Overseas Transportation Association (COTA). She has been invited to review manuscripts for Transportation Sciences, IEEE, Transportation Research Board, and other journals and conferences.

SEMINAR ANNOUNCEMENT

Automated Transit Networks Linking Airport Landside Facilities

March 22, 2012
Hosted by University of Maryland
Center for Advanced Transportation Technology (CATT) & Advanced Transit Association

David Holdcroft and David Little, originally scheduled to present at Maximizing Airport Landside Value on March 22 (which had to be cancelled), will present a seminar on March 22 at the University of Maryland.

David Holdcroft: Mr. Holdcroft was the terminal manager for British Airports Authority overseeing the installation and start up of the Ultra Personal Rapid Transit system that now serves Heathrow Airport Terminal 5, connecting the terminal with a parking facility. The Heathrow project has been under full operation for several months. Mr. Holdcroft will share the history of the project, experiences and lessons learned while the system has been under operation including user feedback and economic impact, as well as look forward to perspective future projects for this technology.

David D. Little, AICP: Mr. Little is a Principal at the transportation consulting firm of Lea+Elliott. He has worked on numerous airport landside mobility studies and implementations during his 20 years at Lea+Elliott. These studies and system implementations have included automated people movers and automated transit networks, as well as bus systems. David will present on airport landside development and how improved access to the landside facilities increases the facility's value. He will also discuss typical funding sources for landside transport systems. Mr. Little authored ACRP Report 37 on the planning and implementation of APMs at Airports, published in 2010.

ITS STUDENT CHAPTER INVITED SPEAKER SERIES

Sponsored by the Center for Integrated Transportation Systems Management

Heterogeneous Traffic Flow: Behavior, Simulation, and Signal Control

Dr. Tom V. Mathew,
Indian Institute of Technology Bombay
Wednesday, February 29th, 2012
Seminar: 1:00pm-2:00pm,
Lunch: 1:00pm-2:30pm
Kay Boardroom (Room 1107/1111)
Pizza and soft drinks will be provided

Abstract: Heterogeneous traffic flow conditions prevalent across much of the world is characterized by the presence of different types of vehicles and non-lane based movement. The presentation first portrays the characteristics and modeling challenges of such traffic. First, a new neural network framework for modeling such traffic is developed. Results from a car-following study where data from vehicles equipped with GPS from two arterial streets in India are presented. The challenges of traffic control in heterogeneous conditions are highlighted through the design of an real-time adaptive signal control where only departure data at stop line is available. An innovative strip-based model is proposed where a conventional lane is subdivided into strips to account for different vehicle classes and non-lane movement.

Biography: Dr. Tom V. Mathew is an Associate Professor of Transportation Systems Engineering at the Indian Institute of Technology Bombay, in Mumbai, India. He

holds a bachelors of technology in Civil Engineering from the College of Engineering, Trivandrum and has a masters and a Ph.D. from the Indian Institute of Technology Madras. His Ph.D. work was on bus transit route network design using genetic algorithms. His research interests include transportation network design, traffic flow modeling, evaluation of the impacts of transportation systems, and applications of metaheuristics in transportation.

Transit, Equity, and Regional Economic Development: Lessons from the Twin Cities

Yingling Fan
Tuesday, February 28, 2012 at 3:30pm
1112 Preinkert Fieldhouse
University of Maryland

In this seminar Yingling Fan will present the results of research she has conducted with colleagues at the University of Minnesota on the effects of investments in light rail on access to jobs, social equity and regional economic development.

Yingling Fan is an assistant professor in regional planning and policy. Her interdisciplinary work encompasses the fields of land use, transportation, social equity and public health. Her overarching research goal is to investigate the impacts of spatial planning (e.g., land use, growth management, and transit improvements) on human activities and movements as well as to understand the health and social aspects of such impacts. To this end, her research combines ecological and behavioral analyses, most quantitatively, as a means of addressing urban sustainability challenges.

A Career in Transportation Consulting

Kittelson & Associates, Inc.
Friday, February 17th, 2012
Seminar: 12:00pm-1:00pm,
Lunch: 12:00pm-2:00pm
Chance to speak with Kittelson & Associates, Inc. individually: 1:00-2:00 pm
Pepco Room (Room 1105)
Pizza and soft drinks will be provided by KAI

Our guests will discuss transportation's role in society, characteristics of the work environment, career paths, and tips for conducting a career search. KAI will provide highlights from three recent projects conducted in the Maryland-DC region. They will also provide a short summary of our internship program which is geared towards both undergraduate and graduate students. This is a good chance for students who are interested in hearing about the perspective of a transportation engineering and planning consulting firm. There will also be a Q&A session afterwards. KAI has expressed interest on students asking good questions. They will also be discussing their internship program, therefore this is also a great networking opportunity!

UMD TRANSPORTATION SEMINAR SERIES

Sponsored by the Center for Integrated Transportation Systems Management

Transportation Infrastructure: What Roles Should Electric Vehicles Play?

Dr. Z. Andrew Farkas
Director, National Transportation Center at Morgan State University Friday, 12/09
Seminar: 2:00pm-3:00pm,
Reception: 3:00pm-3:30pm
Location: 3164 Glenn Martin Hall
Cookies, coffee, and soft drinks will be provided.

Abstract: Transportation infrastructure supports economic growth, but infrastructure in the U.S. is under great stress. Trust funds are nearly empty, so funding is severely constrained. If user fees remain constant, funding will fall precipitously, as vehicles become even more fuel efficient. Maryland's public policy supporting deployment of electric vehicles should result in environmental benefits and exacerbate the funding shortfall, but could also provide an opportunity to transition to more effective user fees.

Short Biography: Dr. Andrew Farkas is Director of the National Transportation Center and Professor of Transportation at Morgan State University in Baltimore, Maryland. He has responsibilities for managing a federally funded university transportation center and all of its research, education and technology transfer programs. He was recently appointed to the Maryland Electric Vehicle Infrastructure Council by Governor Martin O'Malley to help the state plan and prepare for electric vehicles. He serves on the board of directors of the American Road and Transportation Builders Association and has served as president of the Council of University Transportation Centers, the organization for all university transportation centers in the nation.

Dr. Farkas has had responsibilities for teaching and research in transportation economics and policy, logistics, public transportation and land use. His most recent research focus has been on urban transportation policy, particularly transportation funding, congestion, safety, environmental impact and demand management. He has also developed grant proposals and conducted research on strategic transportation planning, energy consumption of transportation systems, employee commute options, and socioeconomic impacts of road pricing. He has published numerous articles on transportation research and presented research papers here and abroad.

Prior to joining Morgan State University in 1983, Dr. Farkas worked as transportation and engineering economist for the U.S. Department of Agriculture and as research associate in economics for the Georgia Department of Transportation. He received the Ph.D. in Geography and the M.A. in Economics from the University of Georgia and an A.B. in Economics from Georgia Southern College.

Highlights of the Applied Research Experience in the National Household Travel Survey Program

Speaker: Adella Santos
FHWA Program Manager for Nationa Household Travel Survey
Friday, 11/18
Seminar: 2:00pm-3:00pm,
Reception: 3:00pm-3:30pm
1107&1109 Kay Board Rooms in Kim Engineering Building
Cookies, coffee, and soft drinks will be provided.

Abstract: The National Household Travel Survey (NHTS) is a program under the umbrella of the FHWA, Office of Policy, Travel Monitoring and Surveys. Since 1969, the NHTS has served as the nation's principal source of the passenger side of travel. The survey data is collected from a sample of US households and expanded to provide national estimates of trips and miles of travel by travel mode, trip purpose, and other household attributes. This informal presentation will highlight, in general, the multi-disciplinary program management experience needed to conduct a national travel behavioral survey. The objective of this talk will cover practical experience in following the four major principles of a federal statistical program: (1) to provide objective information that is relevant to issues of public policy; (2) to provide credible data to users; (3) to develop trust from users; (4) to establish a strong independence of data production within the government.

Short Biography: Adella Santos joined the NHTS team in 2007 and became its Program Manager in 2010. She has expertise in survey management, operations, design and methodology, spanning a career of over 25 years managing national, state and local surveys. Her training began at some of the nation's leading social science research institutions, including the Survey Research Center at the University of Michigan, the Institute for Survey Research, Temple University, Institute for Community and Regional Development at Eastern Michigan University, and Westat. For the past ten years, she has incorporated her social science research experience into the transportation research arena while working for Nustats, Cambridge Systematics and now FHWA. Her specialty in surveying challenging populations, such as released prisoners, the homeless, language minority populations and the World Trade Center buildings survivors and family members who lost loved ones. She holds a BA from the University of Michigan and MPA from Eastern Michigan University.

Transfer Operation Strategy for Paratransit

Dr. Luca Quadrifoglio
Friday, 11/11
Seminar: 2:00pm-3:00pm,
Reception: 3:00pm-3:30pm
Kay Board Room (Rm 1107)

Jeong H. Kim Engineering Building
Cookies, coffee, and soft drinks will be provided.

Abstract: ADA paratransit systems are a demand responsive type of service offering disabled customers a more accessible service than fixed route transit systems because they provide door-to-door service and flexible schedules. For larger service areas (such as Los Angeles County), a zoning strategy is a more practical operating strategy, with each provider responsible for their service zone to which their vehicles have been assigned. This practice will, however, likely reduce the productivity of the whole system; in fact, additional geographical constraints (zone boundaries) are added and the scheduling solution intuitively cannot be improved. We therefore analyze a zoning with transfer strategy, an operating practice requiring customers to change vehicles at specific "transfer points" to complete their inter-zonal trips. This practice is attracting attention from transit providers because of its perceived potential to significantly reduce operating costs mainly by reducing empty backhaul miles and by increasing rideshare rates. Our results used the demand data of the paratransit system in Houston, Texas (a relatively low-density region), and concluded that the zoning with transfer method proved indeed to be a productive organizational structure. It was especially found that the transfer design in this study enabled the system to increase the passenger trips per revenue hour significantly without excessively increasing in-vehicle ride times for passengers.

Short Biography: Dr. Luca Quadrifoglio holds a Laurea in Chemical Engineering (1996) from the Politecnico of Milan (Italy), a M.S. in Engineering Management (2002) and Ph.D. (2005) degrees from the Daniel J. Epstein Department of Industrial and Systems Engineering at USC. After a year as a Postdoc at CREATE (USC), he joined the Faculty of the Zachry Department of Civil Engineering at Texas A&M University in 2006. He won the 2006 Pritsker Doctoral Dissertation Award (3rd place), the 2004 Council of University Transportation Center (CUTC) National Student Award for best publication in Science and Technology and published a number of papers in top rated Journals.

His research mostly focuses on modeling, design, optimization and scheduling of Transportation Systems, primarily DRT Services, such as Feeders and ADA Paratranist.

UMD TRANSPORTATION SEMINAR SERIES

Traffic Signal Performance Measurement Using High-Resolution Data: The SMART-SIGNAL System

Henry Liu
Thursday, April 7
Seminar: 10:30am-11:30am
Reception: 11:30am-12noon
Kim Engineering Building,
Pepco Room 1105

Abstract: Although measuring and archiving freeway traffic performance using commonly available loop detector data has become a norm for many transportation agencies, similar approaches for monitoring the performance of urban arterials do not exist. In practice, operational data from traffic signal systems are neither stored nor analyzed, which prevents proactive management of arterial streets. The development of the SMART-SIGNAL (Systematic Monitoring of Arterial Road Traffic Signals) system fills in this gap. The SMART-SIGNAL system simultaneously collects event-based high-resolution traffic data from multiple intersections and generates real-time arterial performance measures including intersection queue length and arterial travel time. Methodologically, this project provides innovative solutions to two long-standing traffic engineering problems: 1) how to measure intersection queue length when the vehicular queue spills over to the detector location, and 2) how to estimate arteria!

l travel time reliably. The development of the SMART-SIGNAL system has laid the groundwork for better traffic models and control strategies and opens up entirely new opportunities for managing traffic on congested roads. The SMART-SIGNAL system has been field-tested on three major arterial corridors in the Twin Cities area including Trunk Highway (TH) 55 in Golden Valley, France Avenue in Bloomington, and Prairie Center Drive. in Eden Prairie.

Short Biography: Dr. Henry Liu is currently an Assistant Professor of Civil Engineering at the University of Minnesota — Twin Cities. Before joining UMN, he was an assistant professor at Utah State University and a post-doctoral researcher at the University of California, Berkeley. He received

his Ph.D. in Civil and Environmental Engineering from the University of Wisconsin-Madison in 2000. His research interests are in the area of traffic network monitoring, modeling, and control, which includes traffic flow modeling and simulation, traffic signal operations, traffic management under network disruptions, and equilibrium traffic assignment. On these topics, he has published more than 45 articles in peer-reviewed journals. Dr. Liu a member of Transportation Network Modeling Committee of Transportation Research Board (TRB) and a member of Traffic Signal Operations Committee of Institute of Transportation Engineers (ITE). He is also on the editorial board for Journal of Intelligent Transport! ation Systems and IET Intelligent Transportation Systems Journal. Dr. Liu received the Research Partnership Award from the University of Minnesota in 2009 and the New Faculty Member Award from the Council of University of Transportation Centers in 2008.

Cumulative Impact of Developments on the Surrounding Roadways's Traffic

Mansoureh Jeihani
Tuesday, February 15
11am-12:00noon
Pepco Room (1105),
Kim Engineering Building

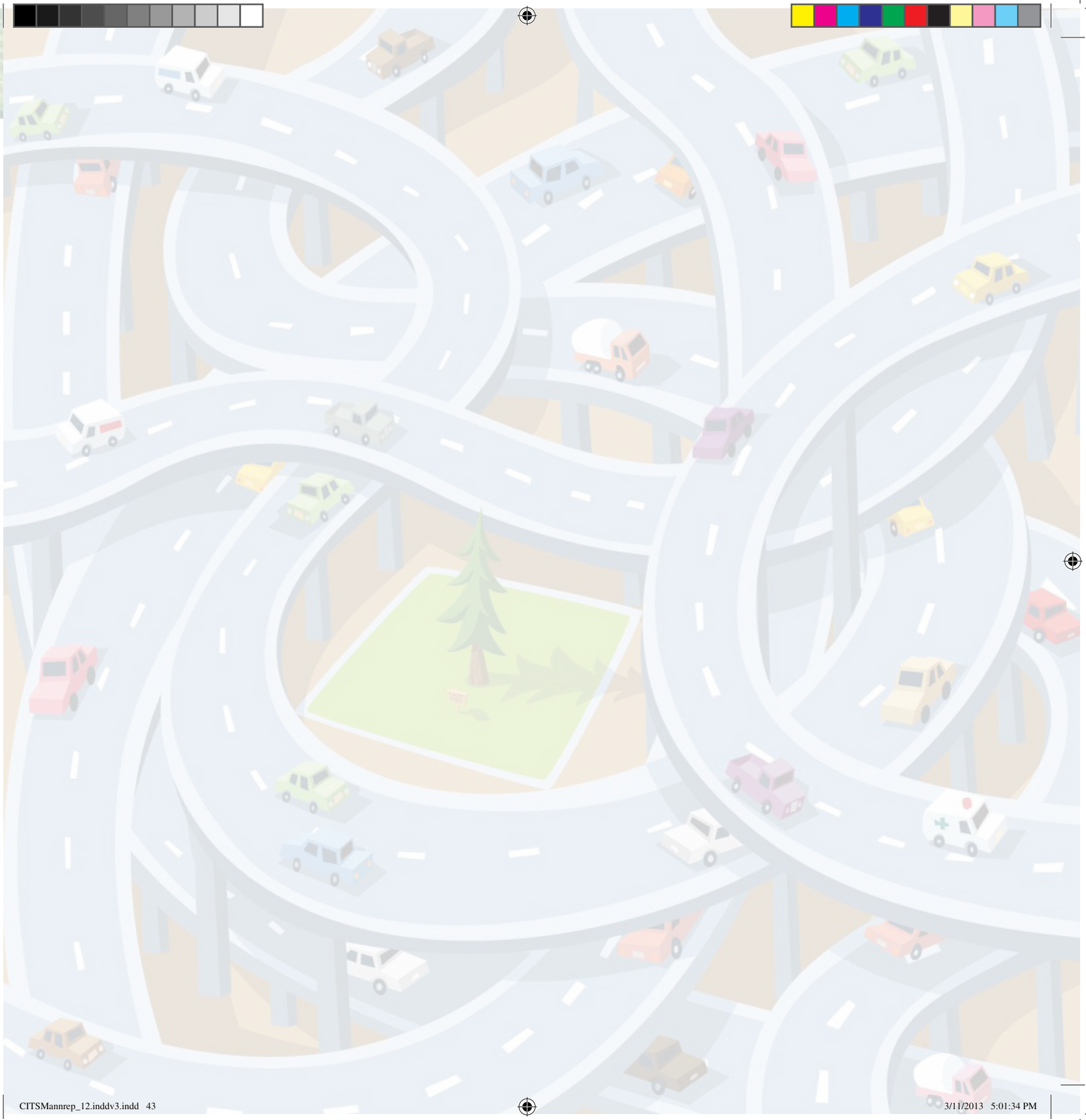
Abstract: An overview of different research activities at Morgan State University conducted by Dr. Jeihani and her team will be presented. She will then concentrate on her ongoing research with Maryland State Highway Administration, Cumulative Traffic Impact Study.

In order to get permission to obtain access to a state highway facility for their development, developers are required to conduct a traffic impact study (TIS) and submit it to the appropriate county in which the development would be located. A TIS reviews the impact of the proposed development (and the approved projects) on the surrounding roadway system with consideration given to traffic capacity, signalization, and safety issues. Since the traffic impact of many of the proposed developments is not considered, roads might become more congested than the individual TIS projected.

The cumulative traffic impact study (CTIS) includes all potential, proposed and approved projects within a specified area as it has an effect on transportation system. The CTIS can affectively produce results that can help overcome unforeseen congestion resulting from only a single TIS projection.

This research investigates the cumulative effect of developments and quantifies the problem by forming two case studies using a travel demand model (TDM) software package such as TransCAD. The gap between TDM and TIS is calculated. Furthermore, the effect of providing a more detailed network and utilizing activity based modeling on the TDM and TIS is investigated.

Short Biographies: Dr. Mansoureh Jeihani joined the department of Transportation and Urban Infrastructure Studies at Morgan State University as an assistant professor in January 2007. She has two years of work experience in both private and public transportation agencies before joining Morgan State. She has a multidisciplinary background, a PhD degree in Civil (Transportation Systems) Engineering and a Master's degree in Economics from Virginia Tech, a Master's in Socio-economics Systems Engineering from IRPD, and a Bachelor in Computer Engineering from Iran National University. Dr. Jeihani is interested in different research area such as transportation planning, traffic Safety, intelligent transportation systems, and traveler behavior. She has published several papers in top tire journals and conference proceedings. She is the faculty advisor of the ITE student chapter and a member of ASCE.



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MARYLAND

CENTER FOR INTEGRATED TRANSPORTATION SYSTEMS MANAGEMENT
University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD 20742
www.citsm.umd.edu Phone 301 405 1262 Fax 301 405 2585