This publication is a report of transportation research, education and technology transfer activities of the NEXTRANS Center from October 1, 2010 through September 30, 2011.

Written and Designed by Andrea McIntyre, NEXTRANS Center Communications Coordinator
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The efficiency of the global transportation network affects each of us. From economic impacts to environmental concerns, transportation is a key issue at all levels of government - local, state and federal. Investments in transportation promise economic revitalization and improvements to safety and congestion. Research is critical to equip policymakers with the knowledge needed to make sound investment decisions. Education and outreach are necessary to prepare students and current practitioners for the complex challenges associated with transportation in the 21st century. And finally, it’s essential that the full value of research be realized through technology transfer activities. It is with these goals in mind, that I am pleased to present the 2011 NEXTRANS Center Annual Report.

In research, twenty-four proposals are currently under external review (page 19). These projects are in line with the Center’s mission of developing holistic solutions that address multiple goals, exploit multiple modes, leverage technology and limited resources, and foster collaboration. Many projects are focused on sustainability, from exploration of internal curing as a new tool for infrastructure renewal, to improved design of railway crosstie rail seats. Others aim to incorporate emerging technologies to improve the overall efficiency of the system. Together, they will consider national priorities of safety, reduced congestion, global connectivity, environmental stewardship, and security preparedness and response.

This past January, I was honored to join three NEXTRANS researchers as they were recognized by the Council of University Transportation Centers (CUTC). Pengcheng Zhang, a May 2010 graduate of Purdue University, received the Pikarsky Award for Outstanding Ph.D. Dissertation in Science and Technology (page 16). Sofie Leon, a Ph.D. student at the University of Illinois at Urbana-Champaign, was recognized as the NEXTRANS Center’s 2010 Student of the Year for her achievements in the classroom, in research, and in the community (page 32). And, Satish Ukkusuri, associate professor...
of civil engineering at Purdue University, was awarded the CUTC-ARTBA 2010 New Faculty Award (page 16). Also over the past year, our Center funded a number of graduate students, participated in a regional science fair (page 33), and continued our successful Undergraduate Summer Internship in Transportation and Indiana High School Essay Competition programs (pages 34-36).

As part of our technology transfer activities, the NEXTRANS Center hosted transportation experts through our seminar series (pages 38-39) and presented at USDOT University Research Technology Transfer Day in Washington, D.C. (page 14). In addition to these highlighted events, students, faculty and staff participated in a wide range of conferences, meetings and workshops throughout the year.

I would like to thank NEXTRANS students, faculty, staff and our partners from government, academia and the private sector, for their dedication to the Center activities. The Center is always seeking new ideas and collaborative partners; we welcome your thoughts and participation.
The NEXTRANS Center is one of ten regional university transportation centers selected competitively by the U.S. Department of Transportation to serve as leaders in meeting the nation's need for safe, efficient and environmentally-responsible transportation systems. Headquartered at Purdue University in West Lafayette, Indiana, the Center represents Region V, which includes the states of Indiana, Illinois, Ohio, Michigan, Wisconsin, and Minnesota. NEXTRANS was established in 2007 based on an award from USDOT’s Research and Innovative Technology Administration (RITA), in order to implement a multidisciplinary program of transportation research, education and technology transfer.

The NEXTRANS Center is led by Purdue University, and administered by Purdue University’s Discovery Park. Its major university partners are University of Illinois at Urbana-Champaign (UIUC) and The Ohio State University (OSU). The Center’s strategic partners are Illinois Institute of Technology (IIT), Wayne State University (WSU), and the University of Wisconsin-Platteville (UWP). Indiana University-Purdue University at Indianapolis (IUPUI) is NEXTRANS’ institutional resource partner. Programmatic partners include the Mid-American Transportation Center (Region VII Regional University Transportation Center), National Cheng Kung University’s Department of Transportation and Communication Management Science (Taiwan), Koc-IBM Supply Chain Research Center at Koc University (Turkey), and National Dong Hwa University’s Graduate Institute of Global Operations Strategy and Logistics Management (Taiwan).

Non-university partners of the Center include the Indiana DOT (INDOT), Illinois DOT (IDOT), Illinois State Toll Highway Authority, Chicago DOT, Ports of Indiana, Consulate General of Canada-Detroit, and Indiana Local Technical Assistance Program. NAVTEQ, Ferrovial Group, Delphi, SemMaterials, Conexus Indiana, the Great Lakes Manufacturing Council, the Association of American Railroads, Transportation Technology Center Inc., Clever Devices, Inc., and Central Indiana Corporate Partnership (CICP) are among the NEXTRANS Center’s current private sector partners.
The theme of the NEXTRANS Center is to develop integrated and innovative solutions to transportation challenges, with some emphasis on intermodal freight transportation, to address regional needs and economic opportunities. In working towards these solutions, NEXTRANS recognizes that transportation goals such as mobility, safety and infrastructure renewal are not disconnected from one another; they are fundamental elements of a seamless, sustainable and efficient transportation system.

Because our nation’s transportation problems consist of interdependent components, NEXTRANS believes in integrated solutions. These solutions can be integrated across modes (auto, transit, freight, air, rail, and marine), sectors (public and private), or geography (within the Midwest and for the entire nation). They are innovative in that they seek to leverage technology, disparate data sources, limited resources, public-private partnerships, and novel financing strategies. Most importantly, NEXTRANS works towards these solutions by explicitly capturing the interactions between vehicle, traveler and infrastructure. By implementing this holistic approach, NEXTRANS aims not only to develop integrated solutions, but to foster a new generation of paradigms and a highly qualified transportation workforce.

**Figure 1: Center Theme**
MEETING NATIONAL & REGIONAL CHALLENGES

MOBILITY
Poor mobility has long-term environmental consequences, creates transportation choke points in the national economy, and reduces U.S. global competitiveness. Because congestion is fast outpacing the rate of infrastructure investment, the NEXTRANS Center strives to leverage technology and existing infrastructure to improve traffic management and provide congestion relief. NEXTRANS projects have aimed to improve traffic flow in congested intersections; utilize information technologies to improve traffic management; apply innovative technologies to measure travel-time reliability; study the feasibility of dynamic congestion pricing; expand the idea of a commercial on-demand air service; and quantify the value of real-time traffic information for travelers.

SAFETY
Despite an increase in vehicle miles traveled, highway deaths continue to fall in the United States. A record low number of fatalities set in 2009 was topped by an estimated 3 percent decline in fatalities in 2010 (National Highway Traffic Safety Administration). Since research can directly link safety to congestion and poor infrastructure, NEXTRANS seeks an integrated approach to safety concerns while keeping in mind the interaction between vehicle and driver. Recent projects have aimed to integrate safety with mobility and infrastructure goals; improve work zone safety; assess hazardous materials transportation safety risk management; and further the exploration of the relationship between safety and technology, which can cause driver distractions as well as prevent collisions through active safety paradigms.
INFRASTRUCTURE RENEWAL

The state of infrastructure in the United States has been graded a ‘D’ by the American Society of Civil Engineers (America’s Infrastructure Report Card 2009). By upgrading our highway, rail, air, and sea transportation systems, we can reduce congestion and improve safety, while at the same time lowering freight transportation and energy costs. NEXTRANS projects have aimed to promote sustainability by evaluating pavement properties, damage and failure mechanisms; utilize advanced visual sensing technology to improve railroad track inspection; help agencies make efficient investment decisions; study the impacts of bypasses on communities; develop new models for public-private partnerships; and improve infrastructure longevity.

REGION V

NEXTRANS has identified an efficient intermodal freight transportation system as a major regional need. Recent NEXTRANS projects with particular regional significance have aimed to efficiently monitor, assess and manage multimodal freight transportation systems; evaluate the potential of on-demand air service; estimate the economic impacts of disruptions to freight systems; and develop models for collaboration between small- to medium-sized trucking firms. Continuing our strong commitment to education and outreach, the NEXTRANS Center sponsored a prize, "Best Transportation-Related Project," at the Lafayette Regional Science and Engineering Fair and attended the Hoosier Association of Science Teachers, Inc. (HASTI) 40th Annual Conference to connect with science educators from across the state.
INNOVATIVE PARTNERSHIPS

The holistic solutions proposed by NEXTRANS require not only a new generation of paradigms and research, but a new generation of partnerships that leverage the resources of different transportation stakeholders through a more integrated approach. In the delivery of our research, education and outreach programs, NEXTRANS relies on innovative partnerships that optimize the utilization of available resources and maximize outcome value.

Rather than relying on one partnership model, NEXTRANS uses an open architecture that is based on commonality of goals, comparative advantages and emerging opportunities. These partnerships can be at the local, regional, national, and global level; with other universities, UTCs, or research centers; with the private sector, public sector or non-profit organizations; in the areas of research, education or outreach (see Figure 3 on page 9).

In research, NEXTRANS uses a variety of project types in forming partnerships with state departments of transportation. Depending upon the project components and fund distribution, these projects are categorized as joint, interlocking or supplemental. The resources being shared are also varied and can include items such as actual cash, in-kind, data, and equipment. Finally, these partnerships are not static or limited to some timeframe of a project's lifetime; they are ongoing, dynamic and interactive.

By fostering these innovative partnerships, NEXTRANS is able to collaborate on research that meets shared goals, maximize its resources, utilize innovative technologies and practices, and create a higher value for research results through efficient technology transfer.

Figure 2: Academic Partnerships
• **Research**  
  *(The Ohio State University)*

• **Education**  
  *(Illinois Institute of Technology)*

• **Technology Transfer**  
  *(Institute of Transportation Engineers)*

• **Outreach**  
  *(Lafayette Regional Science and Engineering Fair)*

• **Actual Cash**  
  *(Association of American Railroads)*

• **In-Kind**  
  *(University of Wisconsin-Platteville)*

• **Equipment**  
  *(Univ. of Illinois at Urbana-Champaign)*

• **Data & Information**  
  *(NAVTEQ)*

• **Local**  
  *(Ind. Local Technical Assistance Program)*

• **Regional**  
  *(Ports of Indiana)*

• **National**  
  *(National Science Council, Taiwan)*

• **Global**  
  *(National Dong Hwa University, Taiwan)*

• **Academia**  
  *(Wayne State University)*

• **Academia-Industry**  
  *(TransWorks, Inc.)*

• **Academia-Gov.**  
  *(Indiana Department of Transportation)*

• **Academia-Industry-Gov.**  
  *(Transport Canada)*

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*Figure 3: Innovative Partnerships*
The Center director is responsible for overall Center operation. He directs programs and activities, implements the Center’s strategic plan, manages funds, ensures compliance with UTC program requirements, and oversees center staff and research associates. The director reports to the executive director of Purdue’s Discovery Park, which provides administrative and fiduciary oversight on behalf of Purdue University. The director also chairs the Center’s Executive Committee, and administers the Center with the guidance of the NEXTRANS Advisory Council.

Figure 4: Management Structure
Expenditures by Partners 2010-2011

- Purdue University: 43%
- Ohio State University: 26%
- University of Illinois at Urbana-Champaign: 29%
- Wayne State University: 2%

Expenditures by Source 2010-2011

- Federal: 44%
- State: 29%
- Institutional: 27%

Expenditures by Activities 2010-2011

- Research & Education: 62%
- Center Administration: 15%
- Programs & Outreach: 23%
EXECUTIVE COMMITTEE

The seven-member Executive Committee sets strategy, approves budgets and makes final decisions on Center project funding. It is chaired by the NEXTRANS director and includes co-directors from OSU and UIUC.

Srinivas Peeta  
NEXTRANS Director  
Professor of Civil Engineering, Purdue University

Ray Benekohal  
NEXTRANS Co-Director  
Professor of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign

Rabi Mishalani  
NEXTRANS Co-Director  
Associate Professor of Civil and Environmental Engineering, The Ohio State University

Mark McCord  
Professor of Civil Engineering / City and Regional Planning, The Ohio State University

Erol Tutumluer  
Professor of Civil and Environmental Engineering (CEE) and the Paul F. Kent Endowed Faculty Scholar, University of Illinois at Urbana-Champaign

John Schneider  
Assistant Vice President for Industry Research, Purdue University

Darcy Bullock  
Professor of Civil Engineering, Purdue University  
Director, Joint Transportation Research Program
ADVISORY COUNCIL

The Advisory Council provides strategic and programmatic guidance for the NEXTRANS Center. It fosters vital links between the Center and the transportation community at large, and ensures that activities and goals are synergistic with regional and national needs and of value to the stakeholders.

James P. Stark, Deputy Commissioner, Indiana Department of Transportation - Chair
Ruben L. Anthony, Jr., Deputy Secretary, Wisconsin Department of Transportation
Randall S. Blankenhorn, Executive Director, Chicago Metropolitan Agency for Planning
Rich Cooper, Chief Executive Officer, Ports of Indiana
Bruce Cox, Vice President and Chief Technology Officer, TransWorks
Mike Finn, Vice President, North America Traffic, NAVTEQ
John C. Friend, Engineer, Bureau of Highway Delivery, Michigan Department of Transportation
Thea Graham, Ph.D., Manager, Strategy, Operations Planning Services, Federal Aviation Administration (FAA)
Richard Kowalewski, Senior Policy Advisor, Pipeline and Hazardous Materials Safety Administration (PHMSA)
Walter Kulyk, Director, Office of Mobility Innovation, Federal Transit Administration (FTA)
David L. Lippert, Engineer, Materials and Physical Research, Illinois Department of Transportation
Brian Majeska, Partner, Majeska and Associates
Fidel Saenz de Ormijana, Ph.D., Technical Director, Ferrovial Agroman US Corp
Robert F. Tally, Jr., Division Administrator, FHWA Indiana Division

CENTER STAFF

From left:
Sushant Sharma, Ph.D., Research Associate
Rick Evans, Managing Director
Nija Phelps, Secretary
Andrea McIntyre, Communications Coordinator
Lili Du, Ph.D., Research Associate
Srinivas Peeta, Ph.D., Director
NEXTRANS PRESENTS AT UNIVERSITY TECH TRANSFER DAY

Srinivas Peeta, NEXTRANS Center director, and Sushant Sharma, research associate, presented NEXTRANS project, “Field Deployment to Quantify the Value of Real-time Information by Integrating Driver Routing Decisions and Route Assignment Strategies,” on Wednesday, April 6, 2011 at United States Department of Transportation (USDOT) headquarters in Washington, D.C. during University Research Technology Transfer Day, hosted by the Research and Innovative Technology Administration (RITA).

The project analyzes how various stakeholders can participate beneficially and develop innovative partnerships in the evolving real-time travel information market. Real-time travel information enhances the quality and safety of the travel experience by providing travelers with information on congestion, accidents, alternate routes, weather conditions, work zones, and more. Innovative partnerships resulting from the evolution of the real-time travel information market will aid critical national goals: holistic innovation, advanced services, holistic policy-making, connected infrastructure, and auto sector rejuvenation.

Researchers of twenty-eight, competitively-selected projects from universities around the country were invited to attend. RITA Administrator Peter Appel, Transportation Deputy Secretary John Porcari, and other members of DOT leadership were in attendance. The event highlighted research products that have been, or are in the process of being deployed into the marketplace or impacting policy. The Center for Integrated Transportation Systems Management (CITSM) of the Department of Civil and Environmental Engineering at the University of Maryland, in partnership with RITA, organized the one-day exhibition.
NEXTRANS FACULTY MEMBER AWARDED ASCE PRIZE

Zongzhi Li, associate professor of civil, architectural and environmental engineering at the Illinois Institute of Technology (IIT) and NEXTRANS faculty affiliate, received the 2011 Arthur M. Wellington Prize from the American Society of Civil Engineers (ASCE). The Wellington Prize recognizes a paper on transportation on land, on the water, in the air or on foundations and closely related subjects.

Dr. Li’s paper, co-authored by Ph.D. student Sunil Madanu, “Highway Project Level Life-Cycle Benefit/Cost Analysis under Certainty, Risk and Uncertainty: Methodology with Case Study,” was published in the Journal of Transportation Engineering, August 2009.

Kumares Sinha, Edgar B. and Hedwig E. Olson Distinguished Professor of Civil Engineering at Purdue University, was awarded the 2011 James Laurie Prize from the American Society of Civil Engineers (ASCE) Transportation and Development Institute.

Professor Sinha was recognized for his contributions to the advancement of transportation infrastructure engineering and management and to the education of transportation professionals worldwide.

ZONGZHI LI RECEIVES 2011 ARTHUR WELLINGTON PRIZE
Satish Ukkusuri, associate professor of civil engineering at Purdue University, was awarded the Council of University Transportation Centers (CUTC)-American Road & Transportation Builders Association (ARTBA) New Faculty Award.

Dr. Ukkusuri’s research interests include freight transportation and logistics; engineering for extreme events; complex network science; climate change and transportation land use; modeling uncertainty in transportation networks; simulation of large scale robust transportation networks; online network equilibrium problems; information and sensor technologies for transportation applications; and infrastructure uncertainty.

Before joining Purdue, Dr. Ukkusuri was an assistant professor at Rensselaer Polytechnic Institute (RPI). He received a bachelor’s degree from the Indian Institute of Technology, Madras, a master’s degree from the University of Illinois, and a Ph.D. from the University of Texas.

Pengcheng Zhang, a former NEXTRANS researcher at Purdue University, was awarded the CUTC Pikarsky Award for Outstanding Ph.D. Dissertation in Science and Technology.

Dr. Zhang’s dissertation, “A Generalized Modeling Framework to Analyze Interdependencies Among Infrastructure Systems,” was advised by NEXTRANS Center Director Srinivas Peeta.

Dr. Zhang received his Ph.D. in Transportation and Infrastructure Systems from the School of Civil Engineering, Purdue University, in May 2010. He also holds master’s (1999) and bachelor’s (1994) degrees in Transportation Management Engineering from Northern (Beijing) Jiaotong University, Beijing, China. Since 2006, he has worked as a senior operations research analyst at American Airlines, Fort Worth, Texas.
2011 WORKFORCE DEVELOPMENT HIGHLIGHTS

As a regional university transportation center, NEXTRANS aims to be a leader in attracting and preparing students to be part of a highly-skilled 21st century transportation workforce. In addition to providing graduate students with experiential learning opportunities, the Center strives to attract new students to the field of transportation, as well as enhance the skills of current practitioners. In 2011, the Center’s existing educational and outreach programs continued with success. In the coming year, the Center plans to expand these programs as part of an ongoing effort to assist in the creation of a highly-skilled transportation workforce.

- Recognized Pengcheng Zhang, a 2010 graduate of Purdue University, as the recipient of the 2010 CUTC Milton Pikarsky Award.
- Honored Sofie Leon with the 2010 NEXTRANS Student of the Year Award. Sofie, a Ph.D. student at the University of Illinois at Urbana-Champaign, is the Center’s first female student of the year.
- Partnered with the University of Wisconsin-Platteville to support two programs that encourage underrepresented students to pursue education in science, technology, engineering, and math.
- Successfully completed the third Undergraduate Summer Internship in Transportation. This program allowed five competitively-selected students the opportunity to work with NEXTRANS-affiliated researchers at Purdue University, the University of Illinois at Urbana-Champaign and The Ohio State University.
- Graduate students Matthew Volovski and Yu-Ting Hsu presented their respective research projects at the 97th Annual Purdue Road School held March 2011.
- Presented sixth grade student Michael Plite with an award, "Best Transportation-Related Project," at the 2011 Lafayette Regional Science and Engineering Fair.
- Recognized Satish Ukkusuri, associate professor of civil engineering at Purdue University, as the recipient of the 2010 CUTC-ARTBA New Faculty Award.
- Attended the 2011 Hoosier Association of Science Teachers, Inc. (HASTI) 40th Annual Conference to connect with science educators from across the state.
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<td>Internal Curing as a New Tool for Infrastructural Renewal: Reducing Repair Congestion, Increasing Service Life, and Improving Sustainability (082PY04)</td>
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<td>Research, Education, and Outreach Derived from Campus Transit Laboratory (089OY04)</td>
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<td>Development of Improved Pavement Rehabilitation Procedures Based on FWD Backcalculation (094IY04)</td>
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<td>Integrated Hazardous Materials Transportation Safety Risk Management Framework (095IY04)</td>
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<td>Joint Parameter and State Estimation Algorithms for Real-time Traffic Monitoring (097IY04)</td>
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<td>Dynamic Multimodal Multi-objective Intersection Signal Priority Optimization (101IY04)</td>
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<td>Optimized Active Traffic Management and Speed Harmonization in Work Zones (103IY04)</td>
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<td>Agent-Based Real-Time Signal Coordination in Congested Networks (104IY04)</td>
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<td>Assessing the Prevalence of Cell Phone Use Under Various Driving Conditions (106OY04)</td>
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Dimensions Addressed by Proposed Year 4 Projects*

At the time of printing, project selection for Year 4 was ongoing.
Disruptions to the movement of goods can have significant short- and long-term consequences including fatalities, infrastructure destruction and economic loss. Immediate economic impacts result from the inability of travelers and businesses to adapt to changed circumstances after a disruption. In Figure 1, truck flows have to be re-routed to avoid disruptions on I-40 due to Mississippi River flooding. This re-routing implies an increase in trucking operational costs and truck-related externalities. Identifying and quantifying the economic impact of different facilities on the transportation network has the potential to strengthen transportation systems and develop sound policies for network recovery and mitigation.

Disruptions to freight movement lead to a variety of direct and indirect economic impacts including relocation of jobs, and changes to imports and exports, land use, production, sales, and prices. These issues have been highlighted by the acknowledgement of the interdependence of the national and global supply chains, where one transportation network is an integral part of a “flat” global transportation network. Depending on the duration of disruption, availability of alternatives, and resilience of the system, the extent of economic impacts can be measured. Various completed and ongoing studies have explored this topic from different perspectives. For example, the Washington State Department of Transportation (2008) estimated that the total economic loss due to the storm-related closures of I-5 and I-90 during the 2007-08 winter was $74.96 million. These studies, however, fail to arrive at comprehensive modeling approaches that quantify the complex relationship between goods movement and economic activity.

The goal of this project is to develop and apply methodologies to identify and estimate the economic impacts due to short- and long-term disruptions to freight movement. Figure 2 presents a quantitative framework summarizing freight disruption propagations through freight-related systems and the role of resilience in economic recovery. Models based on state-of-the-art economic concepts (input/output (I/O), computable general equilibrium (CGE) models) will be developed to allow
for the quantification of system-wide impacts at the regional and national levels. To quantify economic impacts, it is necessary to clearly capture the consequences of a disruption. In doing so, researchers will apply their methodologies and models to critically evaluate data from two case studies in the Midwest: one along the Borman Expressway and another at the Markland Locks and Dam.

The Borman Expressway, part of the Gary-Chicago-Milwaukee corridor, is a sixteen-mile segment of interstates 80 and 94 (I-80/94). The I-65 Borman Corridor has significant freight activity; average daily traffic (ADT) is approximately 140,000 vehicles, with trucks accounting for 30 percent of traffic on average, and peaking at 70 percent during the night. Currently, there is major, ongoing construction to complete rebuilding of the Borman Expressway between the Indiana/Illinois state line and I-65. Researchers will study the impacts of lane closures on truck movement on the corridor and neighboring areas to assess economic impacts due to operational disruptions in both the short- and long-term.

At the Markland Locks and Dam, a recent lock failure will be studied to assess the application of methodologies from a waterborne transportation network. A shutdown of barge shipments has significant impacts on local and regional economies. Typically, there is not enough truck or rail capacity to offset the barge shipments. Indiana ranks seventh in the nation for domestic waterborne shipping; the state’s three ports handle more than $1.5 billion in shipments each year, generating more than 10,500 jobs. Researchers will work in partnership with the Ports of Indiana, a statewide port authority operating a system of three ports on the Ohio River and Lake Michigan.

Further practitioner participation will be conducted to maximize the impact of results, both in developing the methodology and in implementing the case studies. Information about specific technical and operational issues that may be associated with each region along with data availability, institutional, political, legal, and security aspects will be sought. As such, the project has the potential to foster public-private partnerships in the region. Also, current practices to compute economic benefits will be considered and best practices from the study will be disseminated to be utilized by other transportation agencies.

Transportation disruptions affect local, regional and national economies; and while a critical need exists, there is very little understanding of the economic impacts of these disruptions. The ability to estimate the short- and long-term economic impacts using quantitative methodologies and simulation tools requires the integration of engineering, economic and policy frameworks. The results of this project will increase awareness of how to assess economic impacts, what data is available, and how it can be used by transportation agencies. Project results will be relevant to planners and decision-makers as they compute the short- and long-term economic impacts that affect the performance and policies of their transportation network.
Data from loop detectors are used throughout all levels of transportation planning and traffic operation. Single loop detectors have one detector per lane, allowing for direct measurement of flow, occupancy and average speed. Dual loop detector stations have two detectors per lane, allowing the detector to actually measure individual vehicle speeds from the known detector spacing and measured traversal time. Many emerging detector technologies employ similar measurements, but use different means of sensing to detect vehicles. It is almost always presumed that the data provided by detectors are accurate and reliable, but this presumption is not always true. Even after eliminating detector faults, the amount of time a given vehicle occupies the detection zone is a function of the vehicle’s lateral position when traversing the detection zone. Dual loop detectors have two additional complications that arise from the need to match a given vehicle’s actuation at each detector and can lead to problems. Some actuations at one detector simply do not have a match at the other, either arising from a vehicle that changes lanes or from unidentified detector faults. Secondly, it is implicitly assumed that vehicles pass over both detectors at a constant speed. While this is true for free speed, its validity degrades as speeds drop.

At the time of deployment virtually all vehicle detectors require calibration by a technician. It is generally labor intensive to calibrate...
the detectors and most detector systems do not provide direct user feedback. For these reasons, once calibrated, most operating agencies do not recalibrate detectors unless a significant anomaly is detected (i.e. chronically low speed measurements). The only available outputs are typically indicator lights on the sensor cards and the resulting aggregate measurements of flow, occupancy, and average speed. A technician might verify that a few actuations correspond to actual vehicle passages by looking at indicator lights, but the process is difficult to undertake and prone to error since it usually requires one person to watch the roadway and another to watch the sensor cards. The technician may also attempt to verify the aggregate vehicle count and speed match manual counts and measurements with a radar gun, but this method, also, is prone to large errors. There is a need for the controller to provide more feedback to users to ensure an optimal calibration. In this research, the investigators seek to address this deficiency. By developing algorithms to analyze the quality of the per-vehicle data, richer feedback will be provided to operating agencies.

This project aims to develop a suite of cost-effective tools to validate detector measurements by integrating technology with new methods of data collection. Researchers will develop a means for the controller to identify when vehicle acceleration impacts speed or on-time on a per-vehicle basis, model the impacts of acceleration, and devise a means to mitigate these impacts. While the focus of the research will be on loop detectors, since the fundamental analysis occurs at the level of the pulse train, the basic methodology should be transferable to side-fire microwave radar and other sensors that employ a similar pulse train from the detector. Improved loop detector measurements will enrich real-time traffic control, vehicle classification and aggregate performance measures.

Improved loop detector measurements will enrich real-time traffic control, vehicle classification and aggregate performance measures. The research results will be particularly beneficial in congestion, where inconsistent speeds can distort data collected by detector stations. More accurate detector data will assist operating agencies and policymakers to allocate resources more efficiently.

To collect needed data, researchers are utilizing existing raw data from previous research and employing three different approaches in order to generate ground truth data. The least labor-intensive approach is the use of a LIDAR equipped van. The vehicle has two vertical scanning LIDAR sensors configured in a speed trap, providing distance to the target, vehicle speed, vehicle length and height, and many other metrics. Secondly, the research team has developed Vehicle Video-Capture Data Collector (VEVID) to extract accurate vehicle trajectory data from video. In this research, onsite videotaping and VEVID are being used to collect vehicle trajectories over the loops. Lastly, the research team has also developed a second computer assisted video data reduction tool that allows a human to rapidly process large quantities of video data. Each of the three data reduction methods will yield a concurrent ground truth pulse train independent of the loop detectors, including individual vehicle speed, length and lateral position. The second and third methods will also provide acceleration.
Rail transportation is consistently viewed as one of the most viable solutions to the transportation system capacity overload that exists in North America due to its efficiencies in both fuel usage and overall land use. The North American railroad network is a complex system that is under growing capacity constraints due to increased traffic demands. As traffic increases, the effects of railway infrastructure being out-of-service for repair and renewal are becoming more pronounced, especially on high-density corridors, increasing the need for more reliable track components such as crossties.

Concrete railroad crossties are well-established within the North American railway industry as economical and effective means of restraining rails and transferring wheel loads to the track substructure. In addition to their use in freight, passenger and transit infrastructure, concrete crossties are used throughout the world to meet the stringent regulations required for high-speed passenger rail lines. There are, however, notable deficiencies in their service life and overall performance under the repeated heavy-axle load environment seen on high-density rail corridors in North America. Rail seat deterioration (RSD) and fastening system wear, often thought to be concurrent failure modes, have been identified as especially problematic by railway industry surveys. RSD is concrete degradation underneath the rail and pad that protects the bearing area of a concrete crosstie. Fastening systems are a set of components designed to hold the rail to the crosstie, providing vertical, lateral, longitudinal, and rotational restraint to the rail. Five mechanisms, or physical processes, have been identified that have the potential to cause RSD. The primary objective of this project is to iden-
tify methods of improving concrete cross-tie design and performance through experimental testing and modeling of RSD mechanisms.

Over the past two years, moisture-related mechanisms have been sufficiently addressed through modeling and experimental testing at the University of Illinois at Urbana-Champaign (UIUC) through matching funding from the Association of American Railroads (AAR); conclusions from this research have provided design recommendations to the railway industry. Based on expert opinion in the railway industry, abrasion has been selected as the next mechanism for detailed investigation in this study. Abrasion is widely considered to be a viable mechanism leading to RSD; however, a lack of understanding of the complex properties affecting abrasion has resulted in a highly iterative design process for concrete crossties and fastening systems. When combined with abrasive fines and water that penetrate into the rail seat and pad interface, the frictional forces and relative movement of the concrete crosstie and fastening system equate to a seemingly ideal situation for the occurrence of abrasive wear.

Isolating the abrasion mechanism of RSD will lead to a better understanding of how concrete mix designs, rail seat surface treatments, pad materials, and other cross-tie and pad design choices relate to one another. This will help to maximize the effectiveness of the overall design of the crosstie and fastening assembly. Currently, an original laboratory experiment is being performed at UIUC that has facilitated the collection of qualitative and quantitative data related to the abrasion resistance of concrete specimens. A large-scale abrasion resistance test that was designed to isolate the abrasion mechanism while representing the contact interface of the pad and rail seat in the field is shown on page 24.

The contact pressure, movement and material properties at the seat-pad interface are parameters that are suspected to be critical to the abrasion mechanism. These parameters will be investigated using the large-scale abrasion resistance test in the initial phase of experiments. In the second phase, various materials and surface treatments will be tested in order to determine the most economical methods of mitigating abrasion at the concrete rail seat. By identifying the factors that contribute to RSD, this research will seek to mitigate the effects of multiple RSD mechanisms, with an overall objective of improving the performance and service life of concrete crossties.

Rail infrastructure researchers investigate a rail seat exhibiting signs of rail seat deterioration (RSD) on a freight rail line in Missouri.
NEXTRANS has developed a holistic framework for project selection that is systematic, integrated, amenable to continuous improvement, and adaptable to changing priorities.
Integrated Hazardous Materials Transportation Safety Risk Management Framework

*Investigator: Christopher Barkan, University of Illinois at Urbana-Champaign*

Rail transport plays a key role in the multimodal supply chain needed to safely and economically move hazardous materials from production to consumption points. Using comparative analysis, this research aims to develop an integrated risk management framework model to assess safety and risk at the local, regional and national network levels. The results of this comprehensive project will be applicable to the continued study of risk management in rail and other modes, making it relevant to a wide variety of stakeholders.

Computing Moving and Intermittent Queue Propagation in Highway Work Zones

*Investigator: Rahim F. Benekohal, University of Illinois at Urbana-Champaign*

Long queues and heavy congestion are common in busy highway work zones. These congested areas can be dangerous for drivers entering stop-and-go traffic unexpectedly. Alerting drivers to queue presence in work zones could reduce the frequency and severity, increasing safety and efficiency. In this research project, user-friendly computer programs will be developed to accurately calculate queue propagation and shrinkage. Real-world applications would include the implementation of online systems placed in work zones to manage the growth of queues based on the data collected.

Agent-Based Traffic Management and Reinforcement Learning in Congested Intersections

*Investigators: Rahim F. Benekohal, University of Illinois at Urbana-Champaign; Satish Ukkusuri, Purdue University*

The loss of time and resources due to congestion, especially in urban areas, is significant. Appropriately operated traffic signals help to smooth the flow of traffic, leading to a reduction in commute time and fuel consumption. This study seeks to develop an agent-based traffic management technique with reinforcement learning principles. Agents, working independently within the same network, will learn from their environments to minimize travel time and reduce stoppage. The information produced by this innovative research will be applicable to improvements in mobility and reliability in the region.

Integration of Pavement Cracking Prediction Model with Asset Management and Vehicle-Infrastructure Interaction Models

*Investigators: William G. Buttlar, Glaucio H. Paulino, University of Illinois at Urbana-Champaign*

Sustainable pavement infrastructure will lead to decreased maintenance costs and safer, more reliable roadways for travelers. This project will build upon previous research to develop a user-friendly pavement cracking prediction tool to assist in infrastructure renewal planning across multiple modes. Researchers will integrate cracking prediction software with actual infrastructure conditions to generate more realistic and timely data.

Using Probe Vehicle Data to Understand Bottlenecks and Congestion

*Investigator: Benjamin Coifman, The Ohio State University*

Freeway congestion results in lost time and resources for goods and travelers. The congestion arises from bottlenecks and to date, these phenomena have predominantly been studied with point detectors, which are limited in their scope. This project proposes the use of an instrumented probe vehicle, equipped with both positioning sensors and ranging sensors, to collect data along I-71 in Columbus, Ohio. Research findings will lead to more accurate traffic flow models, impacting safety and fuel efficiency in heavily traveled areas.
Incorporating High Speed Passenger Rail into a Multimodal Network Model for Improved Regional Transportation Planning

Investigators: Dan DeLaurentis, Srinivas Peeta, Purdue University

This project will study the interplay of four modes of transportation: auto, commercial air, on-demand air service (ODAS), and rail, with the purpose of reducing travel times for regional intercity trips. Investigators will update their current multimodal transportation analysis model to include high speed passenger rail, while considering transportation policy and economic variables. Shorter doorstep-to-doorstep travel times could have significant effects on regional economies, demographics, land use, and quality of life, and lead to shifts in business activity.

The Regional Economic Impacts of Bypasses: A Longitudinal Study Incorporating Spatial Panel Econometrics and Multilevel Modeling

Investigator: Jon D. Fricker, Purdue University

This project seeks to understand the economic impacts of bypasses on communities at the ZIP code-level. The simultaneous analysis of 60 different bypasses across Illinois, Indiana, and Ohio, will allow researchers to make broader conclusions, while keeping in mind the individual characteristics of communities across the Midwest. Research findings are expected to have real-world applications in terms of enhancing mobility and safety by diverting trucks and other traffic; maintaining or restoring the economic vitality of affected communities' central business districts; and minimizing transportation costs.

Measuring and Documenting Truck Activity Times at International Border Crossings

Investigators: Mark McCord, Prem K. Goel, The Ohio State University; Colin Brooks, Michigan Tech Research Institute

Efficient international commerce is critical to the U.S. economy. In this project, NEXTRANS researchers will work with technical experts in Michigan and the freight industry to collect truck activity time data at major U.S.-Canada gateways using existing remote sensing and spatial information technologies in an innovative manner. In addition, integration of U.S. and Canadian R&D efforts on monitoring freight traffic at U.S.-Canada gateways will be pursued.

Smart Campus Transit Laboratory for Research and Education

Investigators: Rabi G. Mishalani, Mark R. McCord, Prem K. Goel, The Ohio State University

NEXTRANS investigators will work with OSU's transit service providers and Clever Devices, Inc., to take advantage of OSU's living Campus Transit Lab (CTL) in research, education, and outreach activities. CTL incorporates OSU's Campus Area Bus Service, which serves a diverse set of land-uses in and around campus and which has recently been equipped with a state-of-the-art "smart bus" system. Data from the system will support the continued advancement of transit planning, service design, and operation methods, as well as development of course modules. Results of this NEXTRANS showcase project will have meaningful implications for a variety of stakeholders.

Impact of Public Transit Market Share on Energy Consumption and GHG Emissions: Developing Statistical Models for Aggregate Predictions and Validation of Mechanistic Transportation Models

Investigators: Rabi G. Mishalani, Prem K. Goel, The Ohio State University

This continuing study aims to clarify and quantify the impacts of increased public transportation use on reducing energy consumption and greenhouse gas emissions (GHG) in urban areas. Researchers will develop
rich statistical relationships between GHG emissions and transit use under a variety of conditions using the comprehensive data set amassed during the first year of this project. The captured complexity will allow gross prediction of the impacts under various policy scenarios and validation of detailed travel demand models in terms of their ability to capture these impacts. Results will provide policymakers with the knowledge and means to develop more effective transportation and land-use policies that are sensitive to current environmental concerns.

Field Deployment to Quantify the Value of Real-time Information by Integrating Driver Routing Decisions and Route Assignment Strategies
Investigator: Srinivas Peeta, Purdue University

This showcase project aims to adequately understand the value of real-time information in real-world contexts for multiple stakeholders. An Indianapolis-based field experiment will allow researchers to study the actions of participants as they respond to real-time traffic information during their morning commute. A secure website will be developed for the initial survey of participants, as well as daily recording of trip diaries. Implications of real-time traffic information will be considered in terms of mobility, safety, and efficiency.

Investigators: Srinivas Peeta, Purdue University; Shou-Ren Hu, National Cheng Kung University, Taiwan

Origin-destination (O-D) patterns are crucial in traffic operations and transportation planning. This research will estimate a network O-D demand pattern using information from partial link counts, obtained by strategically installing detectors/sensors. The strategic placement of sensors allows researchers to make O-D demand estimates about the entire network under a limited budget. This research will help transportation/highway management agencies to develop transportation planning and infrastructure strategies by leveraging limited fiscal resources.

Highway Reservation System Design and its Application to Freight Transportation
Investigators: Srinivas Peeta, Purdue University; Chih-Peng Chu, National Dong Hwa University, Taiwan; Mei-Ting Tsai, National Dong Hwa University, Taiwan

Efficient and reliable freight transportation is a key contributor to economic development in both the United States and Taiwan. A lack of adequate government funding has motivated both nations to look to the private sector for innovative solutions to the various problems in the existing transportation systems. Researchers have proposed a highway reservation system for freight carriers using a truck-only lane that guarantees a threshold speed by charging a fee. The mutually beneficial system can potentially help to mitigate congestion; improve freight transportation efficiency and safety; and create a new financing source for highway infrastructure.

Investigation of Freeway Operations in Metro Detroit
Investigator: Peter T. Savolainen, Wayne State University

This study will continue to interpret data collected along four freeways in metro Detroit by the Michigan Intelligent Transportation Systems (MITS) Center. Researchers will further their examination of freeway operations to determine how site-specific variables impact accidents and response times. The results will also allow researchers to verify the reliability and accuracy of data collected by traffic detectors for use in future projects.
Pavement Damage Due to Different Tire and Loading Configuration on Secondary Roads
Imad Al-Qadi, University of Illinois at Urbana-Champaign

Traffic Flow Characteristics and Capacity in Intelligent Work Zones
Rahim Benekohal, University of Illinois at Urbana-Champaign

Development of a Finite Element Based Thermal Cracking Performance Prediction Model
William Buttlar, Glauco Paulino, University of Illinois at Urbana-Champaign

Length-Based Vehicle Classification on Freeways From Single Loop Detectors
Benjamin Coifman, The Ohio State University

Uncertainty-Based Tradeoff Analysis Methodology for Integrated Transportation Investment Decision-Making
Samuel Labi, Purdue University

Analysis of Travel-Time Reliability on Indiana Interstates
Fred Mannering, Purdue University

Estimating AADT From Combined Air Photos and Ground Based Data: System Design, Prototyping, and Testing
Mark McCord, Prem Goel, The Ohio State University

Optimal Conditioning Sampling of Infrastructure Networks
Rabi Mishalani, Prem Goel, The Ohio State University

Research and Education from a Smart Campus Transit Laboratory
Rabi Mishalani, Mark McCord, Prem Goel, The Ohio State University

Sensor Network Design for Multimodal Freight Transportation Systems
Yanfeng Ouyang, University of Illinois at Urbana-Champaign

A Decision Support Tool for Vehicle Infrastructure Integration: Advancing Data Fusion Algorithms for Traffic Management Applications
Srinivas Peeta, Purdue University

Integrating Supply and Demand Aspects of Transportation for Mass Evacuation
Srinivas Peeta, Purdue University

Srinivas Peeta, Purdue University; Shou-Ren Hu, National Cheng Kung University

Investigation of Emergency Vehicle Crashes in the State of Michigan
Peter T. Savolainen, Wayne State University

Nondestructive Pavement Evaluation Using Finite Element Analysis Based Soft Computing Models
Erol Tutumluer, University of Illinois at Urbana-Champaign

Transportation Infrastructure Implications of Development of a Cellulose Ethanol Industry for Indiana
Wallace Tyner, Frank Dooley, Purdue University
COMPLETED RESEARCH - YEAR 2

Effect of Friction on Rolling Tire-Surface Interaction
Imad Al-Qadi, Ilinca Stanciulescu, University of Illinois at Urbana-Champaign

Traffic Signal Coordination and Queue Management in Oversaturated Intersections
Rahim Benekohal, University of Illinois at Urbana-Champaign

Determining Queue and Congestion in Highway Work Zone Bottlenecks
Rahim Benekohal, University of Illinois at Urbana-Champaign

Thermal Cracking Performance Prediction and Asset Management Integration
William Buttlar, Glaucio Paulino, University of Illinois at Urbana-Champaign

Innovative Vehicle Classification Strategies: Doing More for Less
Benjamin Coifman, The Ohio State University

System Methods for Uncovering Economic, Technological, and Policy Enablers of an "On-Demand Air Service" Regional Passenger Transportation Solution
Daniel DeLaurentis, Srinivas Peeta, Purdue University

A Multi-scale Approach for Near Surface Pavement Cracking and Failure Mechanisms
C. Armando Duarte, Imad Al-Qadi, University of Illinois at Urbana-Champaign

Machine Vision Inspection of Railroad Track
J. Riley Edwards, Christopher Barkan, Narendra Ahuja, University of Illinois at Urbana-Champaign

Transportation and the Socio-economic Impacts of Bypasses on Communities: An Integrated Synthesis of Spatial Econometric Methods and Agent-Based Simulation
Jon Fricker, Purdue University

Impact of Public Transit Market Share on Energy Consumption and the Environment: Developing Statistical Models for Validation and Gross Predictions
Prem Goel, Rabi Mishalani, The Ohio State University

Public Private Partnerships (PPPs) in Highway Reconstruction, Rehabilitation, and Operations
Samuel Labi, Kumares Sinha, Purdue University

Financial and Technical Feasibility of Dynamic Congestion Pricing as a Revenue Generation Source in Indiana - Exploiting the Availability of Real-time Information and Dynamic Pricing Technologies
Samuel Labi, Kumares Sinha, Purdue University

Incorporating Image-Based Traffic Information for AADT Estimation: Operational Developments for Agency Implementation and Theoretical Extensions to Classified AADT Estimation
Mark McCord, Prem Goel, The Ohio State University

Smart Campus Transit Laboratory for Research and Education
Rabi Mishalani, Prem Goel, Mark McCord, The Ohio State University

Optimal Condition Sampling of Infrastructure Networks
Rabi Mishalani, Prem Goel, The Ohio State University

Development of Carrier-Carrier Collaboration and Transfer Location Models for Less-Than-Truckload Freight Logistics
Srinivas Peeta, Purdue University

Development of a Mobile Probe-Based Traffic Data Fusion and Flow Management Platform for Innovative Public-Private Information-Based Partnerships
Srinivas Peeta, Purdue University; Xuesong Zhou, University of Utah

Using Detector Data to Identify and Examine Crashes and Incidents on Freeways
Peter T. Savolainen, Wayne State University
2010 STUDENT OF THE YEAR: SOFIE LEON

NEXTRANS was pleased to announce the selection of Sofie Leon as 2010 Student of the Year. Sofie is pursuing her Ph.D. in Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign (UIUC).

At UIUC, Sofie has been working on a project to create new analysis and design tools to better predict thermal cracking in asphalt pavements. She created a general-purpose software being used to transfer technology from the university to industry and practitioners. In addition, she is involved in collaborative research with colleagues at the Pontifical Catholic University of Rio de Janeiro (PUC-Rio).

Now in her Ph.D. research, Sofie is investigating dynamic fracture including crack nucleation, initiation, propagation, branching and fragmentation in a multi-scale computational environment.

Sofie has also been involved in outreach and community service activities. As both an undergraduate and graduate student, she encouraged underrepresented students to pursue education in science, technology, engineering, and math through events such as, “Building an Engineer” and “High School Shadow.”

In recognition of her award, Sofie was honored at the Council of University Transportation Centers (CUTC) Annual Banquet and Awards Ceremony in Washington, D.C. on January 22, 2011.

Originally from Ventura, California, Sofie received her bachelor’s degree in civil engineering, with a minor in computer science, from California Polytechnic State University at San Luis Obispo in June 2008. She joined the University of Illinois at Urbana-Champaign in August 2008.
NEXTRANS SPONSORS PRIZE FOR "BEST TRANSPORTATION-RELATED PROJECT" AT SCIENCE AND ENGINEERING FAIR

The NEXTRANS Center sponsored a prize for, “Best Transportation-Related Project,” at the 2011 Lafayette Regional Science and Engineering Fair, held March 4-5 at Purdue University. The Science and Engineering Fair draws students in grades 5-12 from across a twelve-county region in Indiana. Judging was based on 14 categories including: engineering, environmental science, energy and transportation, and math and computer science.

Two NEXTRANS Center members attended the Science and Engineering Fair to judge entries based on creativity, accuracy and real-world application. Michael Plite, a sixth grade student from West Lafayette, Indiana, received the NEXTRANS prize for his project, “Plane Wing Angle Stability and Distance.” Using paper airplanes, Michael tested which airplane design would fly the farthest, while controlling for outside variables via a device intended to enforce consistency during “test flights.”

EXECUTIVE COMMITTEE MEMBER RECEIVES TEACHING AWARD

Mark McCord, professor of civil, environmental engineering, and geodetic sciences at The Ohio State University and NEXTRANS Executive Committee member, was awarded the Charles E. MacQuigg Outstanding Teaching Award in May 2010.

The Charles E. MacQuigg Award is named for the late Dean of the College of Engineering at The Ohio State University. The award is presented annually to faculty members who have demonstrated, in a superior manner, their interest in and willingness to help students, their interest in improvement of the high reputation of the College of Engineering, and their outstanding teaching ability. Students in the College of Engineering at OSU nominate and elect award recipients.
The third annual NEXTRANS Undergraduate Internship in Transportation concluded with final presentations on Wednesday, July 27, 2011 at Purdue University’s Discovery Park. This event was an opportunity for interns to showcase their research accomplishments to faculty, graduate mentors, staff, and other undergraduate students from the Center’s major partner universities.

This year’s internship provided five competitively-selected undergraduate students with the opportunity to complete a ten-week program of transportation research and activities at Purdue University, the University of Illinois at Urbana-Champaign or The Ohio State University. Interns participated in hands-on research involving a broad range of transportation modes and topics. They were challenged to learn basic modeling techniques, develop frameworks and experiments, participate in the collection of field data, and utilize a variety of innovative technologies.

Their broad research projects covered a variety of topics including:

- Freight transportation and the effect of disruptions to the system
- Sustainable pavements and thermal cracking
- Loop detectors compared to radar
- Transit in a large campus setting
- Concrete crosstie and fastening system design

### 2011 Interns

**Craig Collins** is currently pursuing a bachelor’s degree in civil engineering at Purdue University. This summer, Craig worked with Dr. Satish Ukkusuri at Purdue University to study the economic impacts of disruptions to freight systems. This project intends to identify and estimate the impact of disruptions through the integration of engineering, economics and policy frameworks. There is potential to strengthen transportation systems by analyzing the effects of disruptions to the movement of goods across multiple modes. Craig’s role was to develop a framework and familiarize himself with the broad research topic. Following his May 2012 graduation from Purdue, Craig is considering attending graduate school to study transportation.

**Steven Gresk** is currently pursuing a bachelor’s degree in civil engineering at the University of Illinois at Urbana-Champaign (UIUC). This summer, Steven worked with Dr. William Buttlar and graduate researcher Md Shahidul Islam at UIUC on a project aimed at integrating a pavement cracking prediction model with actual infrastructure conditions. This continuing project will build upon research to develop a user-friendly pavement cracking prediction tool to assist in the infrastructure renewal planning process across multiple modes. Steven’s role was to assist in software testing, including that related to climate data from different locations across the U.S. Steven plans to graduate in May 2012 and attend graduate school to study structural engineering.
Troy Karski is currently pursuing a bachelor’s degree in civil engineering at The Ohio State University (OSU). This summer, Troy assisted Dr. Benjamin Coifman at OSU on a project aimed at evaluating radar and loop detectors to detect vehicle speed. Data from loop detectors is used throughout all levels of transportation planning and traffic operation. Understanding the comparison between radar and loop detectors is especially important as the Ohio Department of Transportation (ODOT) is switching from loop detectors to low cost radar. Troy’s role was to evaluate speeds found by loop detectors and compare them to speeds collected by radar. Following his June 2012 graduation, Troy plans to look for a job in transportation, possibly at a state department of transportation.

Alyssa Moniaci is currently pursuing a bachelor’s degree in civil engineering at Texas Tech University. This summer, Alyssa worked in the Campus Transit Lab (CTL) at The Ohio State University with Dr. Mark McCord and Dr. Rabi Mishalani. Research done in the CTL is important in terms of providing useful information to other bus systems and as an educational tool for many graduate students from several disciplines. Alyssa worked to create stop groupings and origin-destination flows from zone-to-zone. The data is collected using technology including automatic passenger counting and automatic vehicle location. Following graduation in May 2012, Alyssa plans to attend graduate school to study business administration (MBA) and/or civil engineering.

"The internship opened my eyes to see what all is out there. I have come to realize that there is so much available within the field of transportation."

- Alyssa Moniaci

Emily Van Dam is currently pursuing a bachelor’s degree in civil engineering from the University of Illinois at Urbana-Champaign (UIUC). This summer, Emily worked with Riley Edwards and Dr. David Lange at UIUC on a project focused on identifying methods to improve concrete railroad crosstie and fastening system design and performance. Through this research, investigators will be able to provide design recommendations to the railway industry, increasing safety and reducing the lifecycle costs for certain railway infrastructure components. Emily’s role was to perform various abrasion tests. She also developed a test matrix with mix designs and curing environments. Emily plans to graduate in May 2012 and is considering graduate school.
WINNERS SELECTED IN HIGH SCHOOL ESSAY COMPETITION

More than 60 students from across the state participated in the 2010 NEXTRANS High School Writing Competition. Winning essays were chosen blindly by a panel of transportation scholars, Purdue University Discovery Park officials, and the NEXTRANS Center staff.

Matthew Prall, a senior at Columbus North High School in Columbus, Indiana, was awarded the $500 first place cash prize for his essay, "Creative Solutions to the Challenges Facing Indiana's Automotive Industry." Matthew is a participant in many extracurricular and community activities including: National Honor Society, Robotics Club, Science Olympiad, Columbus North High School tennis team, and Bartholomew County Youth Leadership. Following graduation, Matthew plans to attend college to study mechanical engineering.

Sarah Torline, a senior at Shawe Memorial High School in Madison, Indiana, received the second place prize of $250 for her essay about funding opportunities and sustainability of infrastructure in Indiana. Sarah is a member of National Honor Society and the varsity girls’ cross country and track teams. She is also student council president and an avid traveler. Following graduation, Sarah plans to attend college to study psychology and linguistics.

Jacob Rogers, a sophomore at North High School in Evansville, Indiana, was awarded $100 for his third place entry, "Dedicated Truck Lanes on Interstate 70 Corridor." In school, his favorite subjects are principles of engineering, geography, world history, chemistry, and Spanish.

Diamond Hubbard, a freshman at the Hammond Academy of Science and Technology in Hammond, Indiana, and Zack Vanness, a senior at Benton Central Junior-Senior High School in Oxford, Indiana, received honorable mentions for their essays.

Initiated in 2009, the NEXTRANS Indiana High School Essay Competition serves to encourage high school students to consider how integral transportation is to the future of Indiana and our nation, and interest them in pursuing careers and/or higher education in the field.
GRADUATE STUDENTS

Rodrigo Mesa Arango, Purdue University
Kivanc Avrenli, Univ. of Illinois at Urbana-Champaign
Abdul Aziz, Purdue University
Renardo Bezati, Wayne State University
Jonathan Bradley, Ohio State University
Cheng Chen, Ohio State University
Indrajit Ghosh, Wayne State University
Ali Hajbabaie, Univ. of Illinois at Urbana-Champaign
En-Pei Han, Purdue University
Samiul Hasan, Purdue University
Yu-Ting Hsu, Purdue University
Rex Hu, Ohio State University
Xudong Hu, Ohio State University
Shahidul Islam, Univ. of Illinois at Urbana-Champaign
Yuxiong Ji, Ohio State University
Prasanjit Kapat, Ohio State University
Ryan Kernes, Univ. of Illinois at Urbana-Champaign
Seoungbum Kim, Ohio State University
Yong Hoon Kim, Purdue University
Amit Kumar, Purdue University
Andrew Landgraf, Ohio State University
Choungryeol Lee, Purdue University
Ho Lee, Ohio State University
Sofie Leon, Univ. of Illinois at Urbana-Champaign
Xiang Lu, Univ. of Illinois at Urbana-Champaign
Honey Maria, Wayne State University
Juan Medina, Univ. of Illinois at Urbana-Champaign
Joshua Mills, Purdue University
Jeffrey Peters, Purdue University
Jason Pittenger, Wayne State University
Brooke Rabe, Ohio State University
Hani Ramezani, Univ. of Illinois at Urbana-Champaign
Herbert (Ted) Reinhold, Ohio State University
Brendan Russo, Wayne State University
Chenbo Shangguan, Ohio State University
Amogh Shurpali, Univ. of Illinois at Urbana-Champaign
Dong Yoon Song, Purdue University
Ryan Todd, Wayne State University
Ashley Westra, Ohio State University
Xiao Wei, Ohio State University
Xiaofei Xu, Ohio State University

UNDERGRADUATE STUDENTS

Craig Collins, Purdue University
Steven Gresk, Univ. of Illinois at Urbana-Champaign
Troy Karski, Ohio State University
Alyssa Moniaci, Ohio State University
Emily Van Dam, Univ. of Illinois at Urbana-Champaign
NEXTRANS SEMINAR SERIES PROMOTES TECH TRANSFER

Sankaran Mahadevan: Quantitative Methods for Risk Assessment and Management

The NEXTRANS Center and the Purdue University student chapter of the Institute of Transportation Engineers (ITE) hosted Sankaran Mahadevan on October 26, 2010. Dr. Mahadevan is a professor at Vanderbilt University with a joint appointment in civil and environmental engineering and mechanical engineering.

This seminar explored risk assessment and management from a researcher’s perspective. Using techniques from across engineering and management disciplines, Dr. Mahadevan discussed the value of a multidisciplinary approach to solving issues of risk and damage as they relate to transportation.

Gebisa Ejeta: Global Food Security and the Role of Transportation

The NEXTRANS Center and the Purdue student chapter of the Institute of Transportation Engineers (ITE) sponsored a seminar by 2009 World Food Prize Laureate, Gebisa Ejeta, Distinguished Professor of Plant Breeding & Genetics and International Agriculture at Purdue University, on March 1, 2011, at Purdue University.

The seminar presented various dimensions of global food security including the importance of storage, distribution and transportation, with a particular emphasis on developing countries.

Professor Ejeta’s research is focused on elucidating the genetic and physiological mechanisms of important traits in sorghum. Grain sorghum is the fifth most important cereal crop in the world; it is grown worldwide, serving as a staff of life for over 500 million people in developing countries, and as the second most important feed crop in the United States.
Yu (Marco) Nie: Modeling Heterogeneous Risk-Taking Behavior in Route Choice: A Stochastic Dominance Approach

The NEXTRANS Center hosted a seminar by Yu (Marco) Nie at Purdue University on April 1, 2011. Dr. Nie is an assistant professor of civil and environmental engineering at Northwestern University. Dr. Nie’s research covers a variety of topics in the areas of transportation systems analysis, traffic simulation and traffic flow theory.

This seminar explored reliability in transportation systems. A unified approach was proposed to model heterogeneous risk-taking behavior in route choice based on the theory of stochastic dominance (SD). Also, two applications of the SD approach were introduced.

Michael D. Meyer: Climate Change and Transportation: Challenges and Opportunities for the Transportation Sector

The NEXTRANS Center and Purdue student chapter of the Institute of Transportation Engineers (ITE) hosted a seminar by Michael D. Meyer, professor of civil and environmental engineering, and former Chair of the School of Civil and Environmental Engineering at the Georgia Institute of Technology, on Tuesday, September 27, 2011, at Purdue University.

Dr. Meyer discussed ongoing research looking at the potential threats of climate change on the transportation system in the U.S. and internationally. He presented examples of government agencies from around the world taking steps to protect transportation systems against climate-induced stresses. Dr. Meyer also discussed the FHWA Gulf Coast 2 project focused on developing a more detailed engineering approach to the strategies that might be needed in the Gulf Coast to protect vital transportation systems.
CENTER CO-HOSTS RECEPTION AT TRB ANNUAL MEETING

In partnership with the School of Civil Engineering at Purdue University and the Joint Transportation Research Program (JTRP), the NEXTRANS Center hosted a reception in Washington, D.C. on January 23, 2011 during the 90th Annual Meeting of the Transportation Research Board (TRB).

Faculty, students, staff, alumni, and friends of the three organizations attended the reception held at the Omni Shoreham Hotel.

RESEARCHERS PRESENT AT 2010 INDIANA LOGISTICS SUMMIT

Three researchers from Purdue University presented their work at the 2010 Indiana Logistics Summit in Indianapolis. "Economic Recovery: Fact or Fiction? What's Coming Down the Road, River, and Runway?" was the theme.

Wallace Tyner, James and Lois Ackerman Professor of Agricultural Economics, presented his NEXTRANS-funded research on cellulosic biofuels. Venkat Venkatasubramanian, Professor of Chemical Engineering, spoke about the steps necessary to transition from fuel-powered to electric cars in the U.S. And, Ananth Iyer, Susan Bulkeley Butler Chair in Operations Management and Director, DCMME and GSCMI, presented his project on opportunities for economic development in Indiana. NEXTRANS Managing Director Rick Evans closed the Purdue panel with a brief update of the Center's activities.
ENERGIZING THE FUTURE:
INFORMS 2010

NEXTRANS graduate students and faculty affiliates from NEXTRANS partner universities attended and presented at the 2010 INFORMS Annual Meeting held November 7-10 in Austin, Texas.

Each year, the INFORMS Annual Meeting hosts more than 1,000 sessions and just under 4,000 papers, covering a broad range of topics in operations research and management sciences. The theme of the 2010 meeting was, “Energizing the Future.”

Participants presented research on topics including (but not limited to) traffic surveillance, supply-chain management, enhancing energy consumption efficiency, Less-Than-Truckload (LTL) carrier-carrier collaboration, and quantifying the benefits of real-time traffic information.

RESEARCHERS PRESENT AT
97TH PURDUE ROAD SCHOOL

NEXTRANS researchers from Purdue University presented their research during the 97th Annual Purdue Road School, held March 8-10, 2011.

Associate Professor Dan DeLaurentis (Purdue) presented his research on on-demand air service; Professor Jon Fricker (Purdue) discussed the impacts of bypasses on communities; graduate student Matt Volovski presented research on public-private partnerships; and graduate student Yu-Ting Hsu addressed evacuation strategies in situations of man-made or natural disasters.

CONTINUING COMMITMENT TO COMMUNITY OF INTEREST

The Transportation Research Board’s (TRB) Transportation Network Modeling Committee (ADB30) promotes research and information exchange in transportation network modeling, an interdisciplinary field spanning computer science, logistics, mathematics, operations research, telecommunications, and transportation science.

As part of technology transfer activities, NEXTRANS staff members are continuing their support of this active committee by hosting a Community of Interest website. Research Associate Sushant Sharma acts as communications coordinator to maintain a new, more user-friendly design for the website.

The Center hopes this site will serve as a venue for the effective and rapid sharing of information and experiences among researchers, practitioners and decision-makers. This site can be viewed at www.nextrans.org/ ADB30.
PUBLICATIONS & PRESENTATIONS*


Coifman, B., McCord, M., Mishalani, R., "OSU Ongoing Technical Activities Related to Freight ATIS Effort," Presentation to FHWA in conjunction with Central Ohio Freight Technology Research Roundtable, Columbus, OH, March 31, 2011.


* This list is not comprehensive, but represents a sampling of presentations & publications related to NEXTRANS projects.


PUBLICATIONS & PRESENTATIONS*


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Peeta, S. “A Bi-Level Stochastic Program for Strategic Infrastructure Investment for Disasters,” INFORMS Annual Meeting, Austin, TX, November 2010.

Peeta, S. “A Centralized Time-Dependent Multiple Carrier Collaboration Problem for Less-than-Truckload Carriers,” INFORMS Annual Meeting, Austin, TX, November 2010.

Peeta, S. “A Dynamic Model for Analyzing Interdependent Infrastructure Systems,” INFORMS Annual Meeting, Austin, TX, November 2010.

Peeta, S. “A Sustainable Policy Decision Approach for Emissions and Travel Time Tradeoff for Large Urban Transportation Networks,” INFORMS Annual Meeting, Austin, TX, November 2010.

Peeta, S. “An Improved Traffic Assignment Algorithm that Inherits the Concept of Social Pressure and Slope,” INFORMS Annual Meeting, Austin, TX, November 2010.


Peeta, S. “Enhancing Energy Consumption Efficiency in Multimodal Transportation Networks,” INFORMS Annual Meeting, Austin, TX, November 2010.


Peeta, S. “Numerical Analysis of Infrastructure Interdependencies,” INFORMS Annual Meeting, Austin, TX, November 2010.

Peeta, S. “Optimal Advance Detector Location for Green Termination Systems on High Speed Isolated Intersections,” INFORMS Annual Meeting, Austin, TX, November 2010.

Peeta, S. “Quantifying the Qualitative Benefits of Real-time Travel Information,” INFORMS Annual Meeting, Austin, TX, November 2010.


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PUBLICATIONS & PRESENTATIONS*  (Continued from previous page)


Reinhold, H., "The Ohio State University Campus Transit Lab: Research, Education, and Outreach," Institute of Transportation Engineers Ohio Chapter Meeting, Columbus, OH, January 26, 2011.


Shurpali, A., Kernes, R., “Modeling the Abrasive Wear in Rail Seat Deterioration,” (RSD, Fall 2011 AREMA Committee 30 (Ties)) and UIUC FRA Tie and Fastener BAA Industry Partners Meetings, Lake Tahoe, NV, October 4-6, 2011.


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