McCormick

Northwestern Engineering

CCITT

Center for the Commercialization of Innovative Transportation Technology

2011 Annual Report

CCITT is operated within the Northwestern University Transportation Center

Welcome

Welcome to the 2011 CCITT Annual Report. Dr. Hani Mahmassani, CCITT principal investor, and I are pleased to share the work of our innovative faculty, dedicated students, and private and public sector research partners.

For the past two and half years, CCITT has operated within the organizational framework of the Northwestern University Transportation Center (NUTC). The benefits of this strategic realignment took firm root during 2011. The diverse research community of CCITT and NUTC includes more than 50 faculty across multiple departments in multiple schools across Northwestern. During the last year CCITT funded five new research projects, involving nine faculty investigators among five departments and eleven student research assistants. Of the nine faculty researchers, four were new to the CCITT research program and five were NUTC research affiliates. Furthermore, four of five projects are aligned with NUTC strategic areas of research: improving the user experience (2); energy and sustainability (1); and humanitarian logistics (1).

CCITT continues to foster a culture of innovation, entrepreneurship, and "commercialization" for transportation research on the Northwestern campus. As evidence, a spirit of collaborative research with potential implementers and users remained strong among newly funded projects. The new group of research partners involved four Fortune 500 companies, including Ford Motor Company and Google, Packet Video – a leading developer of mobile video software, the Chicago Transit Authority, and various disaster relief organizations. We are also thrilled that CCITT research continues to foster interest in follow-on investments and the adoption of research outcomes. Notable investors and users in 2011 include BNSF railroad, Norfolk Southern railroad, 350Green, and Google.

Last and perhaps most importantly, we are deeply committed to training the next generation of transportation researchers, teachers, innovators, decision makers, and leaders. During 2011, CCITT helped support two NUTC dissertation year research fellows, in addition to our large group of student research assistants. CCITT also continued to serve as a solid pipeline of projects for our engineering school's NUvention program, a multi-disciplinary, multi-school entrepreneurship and innovation curriculum for undergraduate and graduate students.

In sum, we are proud of our contributions to research, education and technology transfer. We invite you to look inside and learn more about our faculty, students, and their innovative research projects.

Sincerely,

Bret Johnson
Director, CCITT

Contents

Investigators

Jennifer Chan
Assistant Professor
Emergency Medicine
Northwestern Memorial Hospital

Yip-Wah Chung
Professor
Materials Science and Engineering

Ed Colgate
Professor
Mechanical Engineering

Irina Dolinskaya
Assistant Professor
Industrial Engineering and Management Sciences

Pablo Durango-Cohen
Associate Professor
Civil and Environmental Engineering

Morris Fine
Professor Emeritus in Service
Materials Science and Engineering

Aggelos Katsaggelos
Professor
Electrical and Computer Engineering

Diego Klabjan
Associate Professor
Industrial Engineering and Management Sciences

Yu Nie
Assistant Professor
Civil and Environmental Engineering

Michael Peshkin
Professor
Mechanical Engineering

Karen Smilowitz
Junior Patterson Professor of Transportation Associate Professor Industrial Engineering and Management Sciences

Sotirios Tsaftaris
Research Professor
Electrical and Computer Engineering

Semyon Vaynman
Research Professor
Materials Science and Engineering

CCITT Principal Investigator: Hani Mahmassani

Hani S. Mahmassani is CCITT's Principal Investigator. Dr. Mahmassani holds the William A. Patterson Distinguished Chair in Transportation and serves as Director of the Northwestern University Transportation Center. His research focuses on the role of information and communication in the operation of transportation systems, and the interaction between user decisions and system performance. He has developed simulation and optimization platforms for large-scale transportation networks that support operation and planning of these systems, including vehicular traffic, pedestrians and crowds, as well as intermodal freight and logistics systems.

CCITT Advisory Board

David Boyce
Professor
Civil Engineering
Northwestern University

Jeff Coney
Director
Economic Development
Northwestern University

Thomas Ewing
Senior Scientist
Associate Division Director
Nuclear Engineering
Argonne National Laboratory

Aaron Gellman
Professor
Transportation Center
Northwestern University

Michael A. Marasco
Director
Clinical Associate Professor
Center for Entrepreneurship and Innovation
Northwestern University

Michael J. Shiffer
Vice President for Planning
Translink - South Coast British Columbia Transportation Authority

Research

New Projects

Haptic Interface for Vehicular Touch Screens

Principal Investigators: James Edward Colgate, Professor, Mechanical Engineering
Michael Peshkin, Professor, Mechanical Engineering

Problem: Increased use of technology and access to information can lead to distracted driving in automobiles or operation of other modes of travel, such as locomotives. With the emergence of first generation touch screen displays, users lose the tactile feedback provided by analog controls (knobs, etc.)

Solution: Provide tactile feedback for switches, knobs or other controls on touch screen displays using haptic technology.

Impact: Improve the safety of drivers and operators when using these new and emerging control systems.

The principal investigators have developed a novel haptic technology – the Active TPaD – that lets a user feel and interact with controls on a touch screen, even in the absence of vision or audition. This technology innovation could lead to in-vehicle touch screens that are more natural to use and that require fewer glances away from the road (or rail) ahead. The investigators are working with Ford Motor Company to prototype two vehicular interaction scenarios, test usability, and assess the overall suitability of the Active TPaD for the vehicular environment.

The primary objectives of the research project are: 1) to develop algorithms for two common interactions scenarios: adjusting a slider, and locating a button by touch alone; 2) to design an experiment to measure a human subject's ability to complete tasks involving "touch screen" sliders and buttons while driving; and 3) to perform experiments on a virtual driving simulator to test the performance and robustness of the TPaD under realistic driving conditions.

The investigators will work closely with colleagues at Ford to design and test the TPad using Ford's VIRTTEX driving simulator.

iTRAC Wireless: Intelligent Compression of Transportation Video for Wireless Networks

Principal Investigator: Aggelos Katsaggelos, Professor, Electrical Engineering and Computer Science

Co-PI: Sotirios Tsaftaris, Research Professor, Electrical Engineering and Computer Science

Problem: Wider deployment of video traffic surveillance and analytics for highway operations is prohibited by the high cost of installation, operations and maintenance.

Solution: iTrac Wireless, a video processing technology that requires one-tenth the video bandwidth of existing video transmission systems and enables real-time video analytics, such as vehicle tracking.

Impact: High quality, lower-cost-of-deployment video information system enables wider spread adoption and deployment of camera networks for intelligent transportation systems.

An important source of information in the monitoring, development, and planning of transportation systems is video data. This type of data is acquired at the scene of interest and either processed on site or transmitted to a control center for observation, automated processing, and archiving. In almost all cases the digital video data is compressed to reduce the number of bits to be transmitted and/or stored. However, most video compression algorithms are not optimized for traffic video data and do not take into account the possible data loss that may occur when sending over "lossy" wireless channels. As a result, the quality of the video data may be too degraded for both view-

ing and downstream analysis (e.g. vehicle tracking) at the transportation control center.

The principal investigators previously developed a video processing technology, iTrac, suitable for centralized transportation surveillance applications, where low cost remote cameras with minimal onboard processing capability are connected to a powerful central data processing location. iTRAC incorporated video processing and compression algorithms that minimized the bandwidth (data throughput) required to transmit "usable" video information by an average of 90 percent in comparison with commercially-available state-of-the-art video compression systems. Such a dramatic drop in bandwidth requirements leads potentially to the substantial reduction of system wide deployment costs by allowing the use of low cost wireless links rather than dedicated hard wired links currently in use.

Leveraging the iTrac technology, the investigators are developing iTrac Wireless for lower-total-cost (than land-based fiber optic networks) cellular wireless camera networks that have been heretofore prone to data loss ("lossy" networks). The challenge in this project is to improve upon the video processing gains of iTrac through the development and application of new algorithms to deal specifically with the unique challenges of lossy cellular networks in the context of automated vehicle tracking. PacketVideo, a leading provider of software for mobile video applications, is providing engineering and testing support to this project.

Reliable Routing in Transit Networks

Principal Investigator: Marco Nie, Assistant Professor, Civil and Environmental Engineering

Problem: Riders can have a less than optimal "user experience" riding public transit in metropolitan and rural areas due to a wide variance in transit headways.

Solution: Develop routing algorithms to assess the reliability of transit routes for planning tools and for rider information and trip planning

Impact: Allow transit agencies to better evaluate the reliability of their bus systems and improve service to their ridership.

The researchers are developing routing algorithms that will help transit agencies

measure and analyze the reliability performance of transit services and help travelers hedge against uncertainties in transit networks. In partnership with the Chicago Transit Authority (CTA) and bus tracking applications available from Google Inc., the goal of the project is to implement a prototype reliability-based transit route planning tool, test it on a real-world transit network, and evaluate the proposed methods and tools.

Travel reliability is a critical dimension in the user experience of public transportation services. Prior to this project award, the investigator, his research assistants and a collaborator at CTA surveyed commuters from the Chicago metropolitan area and discovered that travel reliability is the second most important factor that affects commuters' route choices, next only to travel times. Transit systems are affected by uncertainties of various sorts, ranging from extreme weather conditions, serious traffic accidents to unforeseeable mechanical failures and human errors. While these uncertainties could adversely disrupt transit services, their overall impacts are rarely documented and understood in existing systems. As a result, neither transit operators nor transit users are able to make proactive decisions to ensure travel reliability. Ignoring the impacts of uncertainties often result in misallocation of limited resources in the transit system.

From the user point of view, the lack of reliability either encourages overly conservative risk-averse behavior or leads to uncomfortable, and sometimes disastrous, disruptions. Not surprisingly, almost half of the commuters who responded to the commuter survey described their transit service as "unreliable."

Research

Integration of Real-Time Mapping Technology in Disaster Relief Distribution

Principal Investigators: Irina Dolinskaya, Assistant Professor, Industrial Engineering and Management Sciences
Karen Smilowitz, Professor, Industrial Engineering and Management Sciences

Co-PI: Jennifer Chan, Assistant Professor, Emergency Medicine

Problem: Providing the timely delivery of relief aid in post-disaster situations

Solution: Develop and test routing models that incorporate emerging data sources to improve the delivery of aid in rapidly changing environments.

Impact: Saving lives by improving the effectiveness of disaster relief in complex, dynamic environments

Vehicle routing in humanitarian logistics, such as disaster relief distribution, involves many challenges that distinguish these problems from those in commercial settings, given the time sensitive and resource constrained nature of relief activities. There have been many promising advances in the literature on relief routing, and aid organizations have increasingly been collaborating with academic researchers to increase the practicality of such models. The proliferation in the availability and use of information technology in the wake of disasters can further the effectiveness of routing models for aid distribution. However, challenges still remain to make routing models more applicable to humanitarian aid delivery and more integrated with new streams of imagery, mapping, and crowd-sourced real-time data.

In this project, the investigators are focused on improving routing models for the distribution of relief supplies by incorporating new mapping technologies and real-time information to mitigate the effects of dynamic changes during humanitarian crises and disasters and the significant uncertainty that exists in these settings. The researchers are collaborating with relief organizations in the field to evaluate the expected improvements from these data sources. From the field investigations, a set of test cases will be developed that will provide the humanitarian logistics research community with a platform to design and test alternative routing models and relief solutions. To facilitate wide implementation of this research, the test cases will be made available online to practitioners and academicians, through a server dedicated to Humanitarian and Non-Profit Logistics at Northwestern University.

A Framework for Estimating Emissions of Freight Transport Operations

Principal Investigator: Pablo Durango-Cohen, Associate Professor, Civil and Environmental Engineering

Problem: The ability to measure and compare emissions of freight transport operations across an entire supply chain

Solution: An online software tool that estimates emissions based upon economic models of marginal emissions contributions from individual shipments across the supply chain

Impact: Quantitative support for strategic shipping and supply chain decisions, and consistent comparison of emissions among companies across years of operations

In recent years, corporations have shown increasing interest in measuring their environmental impacts, especially pollutant emissions. Business interests, e.g., preparing for imminent regulation, motivate this trend as much as ethics. Investors and customers factor environmental impact into their business decisions, and sustainable companies can have a competitive advantage.

For companies with large distribution systems, emissions from transport operations constitute a significant portion of their environmental impact. Many models have been developed to estimate vehicle emissions, though the focus in research and in practice has been on automobiles, as opposed to trucks and other heavy vehicles. In addition, there is a lack of standards governing emissions reporting. Wide variations and lack of documentation make comparisons between companies or years difficult.

The goal of this project is to develop a rigorous and practical framework for estimating the emissions of freight transport operations. It will be based on simple, defensible, and reliable economic models of marginal emissions contributions from individual shipments and will be implemented as an online tool. The initial focus will be on trucking, but extensions for other freight modes are possible.

The proposed framework and online implementation will be validated with commonly available data from the transportation operations of two Fortune 500 companies.

Ongoing Projects

Information System for Infrastructure Deployment in Support of Future Vehicles

Principal Investigator: Diego Klabjan, Industrial Engineering and Management Sciences

Problem: The public sector must optimize scarce dollars to purchase and deploy the initial phase of electric vehicle (EV) charging infrastructure. In time, the private sector will seek an efficient model to do the same.

Solution: A location-decision-making software tool that employs optimization and agent-based modeling techniques to pinpoint optimal locations of EV charging stations.

Impact: Enable the efficient deployment of a sustainable, alternative energy infrastructure for the mass roll-out of EVs.

Mass production electric vehicles (EVs) are available for sale, notably from Chevy, Nissan, and Tesla Motors, with more on the way from other manufacturers. Both passenger and fleet vehicles will be coming on the market en masse during the next few years. One critical barrier to EV adoption is the availability of charging infrastructure, notably charging stations not located in homes. A few cities have started deploying such stations and many are in the planning stage. The decision makers - city governments, utilities, or private partners such as retail outlets, seek to maximize the impact of their infrastructure investment decisions.

Through this research project, a web-based intelligent information system, EVIDENT, has been developed to assist in the deployment of EV infrastructure. The primary variables addressed by EVIDENT in the determination of optimal charging station location are: (1) EV demand consideration, (2) the actual location of stations, (3) the implied service time on car owners, and (4) power grid implications. These inputs are addressed using analytical methodologies, such as discrete choice modeling to capture demand, optimization for location recommendations, and comprehensive simulations to estimate the overall impact on the system.

The decision marking software tool has been made available as a web-based service to various potential users, including city governments and municipalities (installing charging stations in public parking spaces, curbside charging), utilities, and private entities (retailers, mall operators, fast-food and restaurant chains, garage owners, etc.). It is expected that future versions of EVIDENT will be applicable to other alternative fueling infrastructure, such as compressed natural gas, hydrogen, or biofuels.

Research

Evaluation and Application of Super-Tough Steel for Use in Tank Cars Transporting Cryogenic Liquids

Principal Investigator: Semyon Vayman, Materials Science and Engineering

Co-PIs: Morris Fine, Materials Science and Engineering
Yip-Wah Chung, Materials Science and Engineering

Problem: Railroad tank cars carrying hazardous materials, including cryogenic liquids, are at risk of fracture and puncture failures.

Solution: Design steels for tank cars that retain high-fracture toughness in cryogenic operating conditions, yet remain weldable and cost effective.

Impact: Next Generation Tank Cars will increase the safety of transporting high risk, volatile liquids

The goal of the proposed project was to further develop and market advanced 70-ksi yield strength super-tough cryogenic steel for use in tank cars transporting cryogenic liquids. The subsequently developed steel (designated as NUCu70ST) was included in the "Next-Generation Rail Tank Car Project," an innovative joint initiative of three companies – Dow, Union Pacific and Union Tank Car Company (UTLX), the Association of American Railroads, and US and Canada Departments of Transportation that is focused on the design and implementation of a future rail tank car with enhanced ability to safely transport hazardous chemicals.

The team has extensively collaborated and completed testing with UTLX on the project. The "super-tough" steel outperformed all other steels, including A709 HPS100, in fracture tests at low temperatures and in straight-punch tests, where no cracks of any kind were formed in steel. The ultimate tensile strength of NUCu70ST exceeded the 80 ksi requirement for tank car steels. The ductility of the steel was very high, with elongation to failure exceeding 30%. The absorbed fracture energy of the pre-heat-treated steel was excellent; specimens did not fracture during the Charpy absorbed fracture energy tests down to -30°F.

Although stress relief is not needed for low-carbon steels in general, such as NUCu70ST, the tank-car code requires the stress relief of welded steel. Therefore, exhaustive welding studies were completed on post stress-relief steel samples at the Edison Welding Institute and UTLX. The fracture toughness of the weld itself was low and did not meet specifications. Therefore, UTLX plans to conduct further welding tests on the steel and is also working with American Association of Railroads Standard Committee, in parallel, to gain acceptance for NUCu70ST for tank car applications without the stress relief requirement.

Completed Projects

Decision-Making Tools for Distribution Networks in Disaster Relief

Principal Investigator: Karen Smilowitz, Industrial Engineering and Management Sciences

Co-PI: Irina Dolinskaya, Industrial Engineering and Management Sciences

Problem: Lack of appropriate tools to manage supply chains and distribution in disaster relief settings.

Solution: Easy-to-use decision-making tools tailored for relief agencies operating with incomplete information.

Impact: More timely and efficient delivery of food, supplies and medical equipment to save lives in disaster scenarios.

The devastation caused by the 2010 earthquake in Haiti was compounded by the significant logistical challenges of distributing relief to those-in-need. Unfortunately this is the case with many disasters. Rapid and efficient distribution of water, food, medication and other essential supplies is crucial to saving lives and rebuilding the region. The investigators are leveraging their expertise in supply chain management and vehicle navigation under uncertainty to study design and operational improvements for humanitarian relief chains.

Distribution in commercial delivery services share some features with disaster relief; however, several critical attributes are not present. First, models and solution must be accessible and easy to implement by relief workers operating in extreme conditions.

These end users often lack the technical background and support during their operations, and cannot implement complex optimization software used in industry. Second, information about the environment can be very limited following a disaster, to a degree not often encountered in commercial settings. Third, the objectives in disaster relief have not been extensively studied in other sectors.

This research project had and achieved three key objectives: 1) learning from agencies about their current relief operations; 2) developing prototype logistics models to improve operations; and 3) transitioning this research knowledge to Northwestern engineers, trained through this project. The results of this project contributed to a successful application and subsequent grant from the Google Research Awards Program that will enable the team to evaluate and integrate advances in mapping technologies and real-time information to improve the distribution of humanitarian relief (see New Projects).

CCITT Faculty Awards

Irina Dolinskaya
2011 Dissertation Prize, INFORMS Transportation Science & Logistics Society

Aggelos Katsaggelos
2010 IEEE Signal Processing Society Technical Achievement Award

Hani Mahmassani
First Greenshields Prize for Best Paper in Traffic Flow Theory and Characteristics, Transportation Research Board of the National Academies (with Jiwon Kim)

Michael Peshkin
2011-2014 Charles Deering McCormick Professor of Teaching Excellence

Karen Smilowitz
McCormick Advisor of the Year

Education

2011 Student of the Year

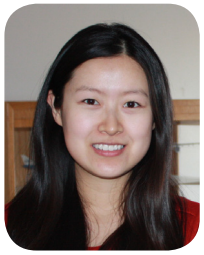
Luis de la Torre is currently a fourth-year PhD student in the department of Industrial Engineering and Management Sciences (IEMS). He received bachelor's degrees in economics and mathematics from the University of California at Davis, and a master's degree in IEMS from Northwestern University. His research focuses on developing stochastic and dynamic optimization models for transportation and distribution of critical supplies for disaster relief, as part of the humanitarian logistics team at Northwestern and as a graduate student intern in the CNLS Summer Student Program at Los Alamos National Lab. His co-advisors are Karen Smilowitz and Irina Dolinskaya. Luis is the principal instructor for IEMS 326, Economics and Finance for Engineers. He is also a member of the IEMS Graduate Liaison Committee, and is helping to prepare a new mini-course for incoming PhD students to teach and review fundamentals in mathematical analysis, statistics, and AMPL. In his spare time, he plays oboe in the Northwestern University Philharmonica.

Luis was selected as the CCITT Student of Year for his research and academic excellence as well as his self-motivation, contributions to the engineering educational community, mentorship of undergraduate students, and key role in the development of humanitarian logistics initiatives at Northwestern University.

Director Bret Johnson and CCITT Student of the Year Luis de la Torre at the CUTC Awards Banquet

Dissertation Year Fellows

Laurence Audenaerd earned his PhD in Civil and Environmental Engineering in December 2011, after completing his dissertation, "Bringing Short-Haul Air Down to Earth: Exploring the Trade-Space of Mode Substitution for Regional Air Passenger Transport Markets." Under supervision of Professor Joseph Schofer, he explored methodologies to understand the complex multi-dimensional tradeoffs (referred to as the trade-space) between scheduled air service and posited motor coach substitution for seventeen short-haul markets "hubbing" with Chicago O'Hare International Airport. Prior to his graduate studies at Northwestern, he had over 10 years industry experience performing aviation and intercity-related research for FAA, NASA, and DOD. He also holds an MS in Civil Engineering and Operations Research from Princeton University, an MS in Industrial and Systems Engineering from Rutgers University, and a BE in Mechanical Engineering and Applied Mathematics from Stony Brook University. Audenaerd recently returned full time to the MITRE Corporation.



Yang Liu is pursuing her PhD in the Transportation System Analysis and Planning Program in the Department of Civil and Environmental Engineering and is one of two new dissertation year fellows for the 2011-2012 academic year. Professor Yu "Marco" Nie is advising her dissertation research, "Welfare Effects of Congestion Pricing on Travelers with Different Value of Time: Strategies to Enable Transportation." Liu's dissertation is focused on congestion pricing and the obstacles preventing its widespread implementation. In particular, she seeks to address the regressive nature, or unequal welfare distribution, of congestion pricing. Her aim is to design Pareto-improving pricing schemes and implementation strategies that provide congestion alleviation without any net cost to the highway users. Lui's interest in congestion pricing originated during her pursuit of her MS in Transportation at Hong Kong University of Science and Technology. She also holds a BS in Civil Engineering from Tsinghua University, China.

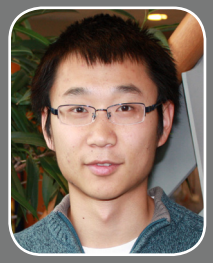
Student Researchers

Zhaofu Chen
PhD Candidate, Electrical Engineering and Computer Science

Mehrnaz Ghamami
PhD Candidate, Civil and Environmental Engineering

Edwin Shi
PhD Candidate, Industrial Engineering and Management Sciences

Teresa Chen
Undergraduate Student, Industrial Engineering and Management Sciences



Qianfei Li
PhD Candidate, Civil and Environmental Engineering

Tim Sweda
PhD Candidate, Industrial Engineering and Management Sciences

Luis de la Torre
PhD Candidate, Industrial Engineering and Management Sciences

David Meyer
PhD Candidate, Mechanical Engineering

Wilson Zhang
PhD Candidate, Civil and Environmental Engineering

Madison Fitzpatrick
PhD Candidate, Civil and Environmental Engineering

Joe Mullenbach
PhD Candidate, Mechanical Engineering

Tech Transfer

NUVention Energy Remains a Key Resource for Commercialization Strategy

NUVention Energy, an interdisciplinary entrepreneurship course created by the Farley Center for Entrepreneurship and Innovation in the McCormick School of Engineering and Applied Science, continues to provide commercialization assistance to CCITT sustainable-transportation-related research projects. Through a structured class setting led by Nicholas Switanek, Assistant Professor of management & organizations at the Kellogg Graduate School of Management, NUvention Energy connects students from engineering, business, arts and sciences, law and other graduate schools with Northwestern faculty who have developed innovations with commercial potential.

In winter 2011, the students worked with Professor Diego Klabjan to evaluate software in development via his research project, "Information System for Infrastructure Deployment in Support of Future Vehicles." Over the academic quarter, the student team outlined a business plan including cash-flow projections, market segments and size, risks, and growth strategies. The students also conducted meaningful primary research by obtaining feedback from subject matter experts. Their work contributed to baseline information that led to the creation of EcoGreen Analytics, a startup company formed by Professor Klabjan.

In fall 2011, NUvention Energy selected a project proposed by Pablo Durango-Cohen, Professor of civil and environmental engineering. This is his second project selected by NUvention Energy. The first project was pursued during the winter quarter of 2010. For this new project, a NUvention team will develop a commercialization strategy and business model for a proposed web-based software tool that will be used for estimating the emissions of freight transport operations. This analysis will be conducted in parallel with Professor Durango-Cohen's CCITT research project, "A Framework for Estimating Emissions of Freight Transport Operations" that was also awarded in fall 2011. A web-based software prototype of the emissions estimation tool is the planned outcome of the project. The NUvention team's recommendations should help to get the software in front of qualified users.

Investigators Tap External Awards to Further Commercialization Research

Three CCITT principal investigators secured additional awards to further advance previously-funded CCITT research toward implementation. Professor Marco Nie received an award from the Transportation Research Board's Innovations Deserving Exploratory Analysis (IDEA) program, and similarly, Professors Karen Smilowitz and Irina Dolinskaya received a joint award from Google's Faculty Research Awards program.

• Professor Nie will use funds from the SHRP 2 Reliability IDEA program to develop a proof of concept software tool to verify the utility of consumer GPS data for urban travel reliability analysis. The researchers will collaborate with PTV America Inc., the primary distributor of TomTom traffic data products in North America, to facilitate data acquisition and processing. The ultimate goal is to provide reliable route guidance for two primary applications: 1) for motorists through in-vehicle navigation systems, smart phone applications, or traditional web-based map services; and 2) for highway operators as a component of decision support tools.

• Professors Dolinskaya and Smilowitz will use their Google Research Award to apply advances in mapping technologies and real-time information to improve dynamic routing models for the distribution of relief supplies in humanitarian logistics. The researchers will collaborate in the field with relief organizations, evaluate the improvements provided from applying and using these technologies, and then develop a set of operational test cases for the research community to better design and test humanitarian logistics routing models.

Highlights

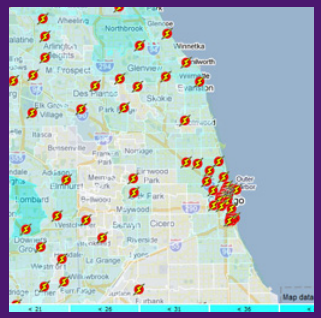
Project Title: Business Intelligence for Gang Scheduling

Principal Investigator: Diego Klabjan, Industrial Engineering and Management Sciences

Norfolk Southern and BNSF railroads are adopting customized applications of gang scheduling optimization software.

Project Title: Information System for Infrastructure Deployment in Support of Future Vehicles

Principal Investigator: Diego Klabjan, Industrial Engineering and Management Sciences



350Green, a developer of electric vehicle charging networks in major cities in the United States and around the world, and Carbon Day Automotive, a distributor of charging stations offered by Coulomb Technologies, have used EVIDENT, a web-based information system for site selection of electric vehicle charging stations, to facilitate site selections in selected areas.

Project Title: Evaluating and Application of Super-Tough Steel for Use in Tank Cars Transporting Cryogenic Liquids

Principal Investigator: Semyon Vaynman, Materials Science and Engineering

Co-Principal Investigators: Morris Fine, Materials Science and Engineering; Yip-Wah Chung, Materials Science and Engineering

A 70 ksi super-tough steel (designated NUcu70ST by Northwestern) was included in the “Next-Generation Rail Tank Car Project” by research collaborator, Union Tank Car Company (UTLX). UTLX is planning to conduct further welding tests on the steel and is working with American Association of Railroads Standard Committee to gain acceptance for tank car applications.

Events

User Experience Workshop

The user experience is at the core of transportation research at Northwestern University. To explore this concept further, CCITT co-chaired a workshop, "Improving the Customer Experience in Travel and Transportation Using Information Technology (IT)," with Teradata Corporation and the NUTC.

Perry Cantarutti, Delta Airlines

The workshop explored examples of good customer care and tools for improving the experience for both travelers and users of freight and logistics services in two panel discussions. The evidence suggested that current practices are only "fixing" disruptions in the current service delivery model. That is, when an experience fails to meet a predetermined expectation, agents intercede to alleviate the damage. In his opening remarks, event co-chair Peeter Kivestu of Teradata stated, "(although) meaningful progress in the customer experience increasingly depends on information technology, finding the sweet spot for leveraging information technology is not something that is easy to discover." Future research and applications should use tools and knowledge of customer behavior to anticipate disruptions and avoid them altogether.

While much potential exists for IT to improve the user experience, the traveler panel discussants (Dick Alexander, Veolia Transportation; Perry Cantarutti, Delta Airlines; and Kivestu) suggested customers still expect "warm, friendly service". Yet, they agreed technology will be a strong tool in aligning the customer and employee expectations so each can navigate smoothly through service disruptions. For example, Cantarruti noted that social media is particularly useful in this regard in allowing agents to serve multiple customers at a time. Customers tweeting their concerns and rebooking requests do not have to endure twenty minutes of elevator music interrupted by the periodic "all agents are busy, your call is important to us, please stay on the line" recordings. Two common questions surrounding enhanced customer traveler experience are: how much data is needed to make a difference, and how safe is that data? In order to answer these questions, researchers and providers need a clearer understanding of people's willingness to share private information and the level of customer participation required to minimize uncertainty.

In the freight panel, the presenters (David Adams, GTNexus; Dr. Mark Cooper, FedEx Services; and Gary Smith, Con-way Freight) shared insight regarding how businesses have been successfully benefiting from new information models, continually improving service quality indices, and using customer information for business decisions.

Freight companies, like their passenger carrier counterparts, are inspired by the latest developments in the internet environment. Examples provided by Adams included cloud storing of data, one-to-many and many-to-one ways of communicating as in social media platforms, and crowd sourcing in order to improve data quality by providing unmatched collaboration and correction opportunities.

Going from inter-enterprise to intra-enterprise, Cooper discussed the importance of measurable service quality indices in consummating the performance. These indices must reveal and address the true expectations of the customers, be continually reviewed to adapt to changes in technology and demand, partner with the operational team of the company to reach aggressive but attainable goals, and focus on the entire enterprise rather than a specific department.

Smith provided a solid example of the synergy between customer focus, innovative thinking and social media. Con-way leveraged customer feedback and IT to make a significant capital investment decision in a sour economy to address a critical user dissatisfaction - damaged freight.

In closing the workshop, NUTC Director Hani Mahmassani charged all participants to look beyond only meeting expectations to the delivery of new and pleasurable experiences for passengers and users of transportation services.

--Charlotte Frei and Ömer Verbas contributed to this article.

High-Speed Rail Symposium

In April the Northwestern University Transportation Center (NUTC) hosted a half-day symposium focused on overcoming the strategic, technical and operational challenges of implementing high-speed passenger rail service in the United States. At the symposium, Karen Hedlund, Chief Counsel of the Federal Railroad Administration, and Joseph Shacter, Director of Public & Intermodal Transportation at the Illinois Department of Transportation (IDOT), discussed their goals and shared vision for the United States and Illinois, provided updates on current infrastructure projects – notably CREATE, the Chicago Region Environment and Transportation Efficiency Program – and outlined future priorities for high-speed rail. According to Shacter, passenger rail ridership in between Chicago and St. Louis has increased 200 percent between 2006 and 2010, even without high-speed rail enhancements. IDOT expects ridership to further increase with high-speed rail investments that it projects to reduce the Chicago to St. Louis travel time by 40 minutes and improve travel time reliability by 80 percent or more.

Other speakers and topics included Jim Lindsay, Vice President & Customer Director US and Canadian Railroads at Alstom, on rolling stock technologies; Krishna Jha, Vice President of Research & Development at Innovative Scheduling, LLC, on scheduling challenges involving freight and passenger trains sharing the same tracks; Kimon Proussaloglou, a Principal at Cambridge Systematics, on the art and science of demand forecasting for proposed high-speed rail services; and Frank Koppelman, Emeritus Professor of Civil and Environmental Engineering at Northwestern University, on role of independent review processes in the conduct of HSR studies intended to inform policy and investment decisions.

First Congress of the Transportation Development Institute

CCITT principal investigator Hani Mahmassani and CCITT Director Bret Johnson served on the local organizing committee for the First Congress of the Transportation and Development Institute of the American Society of Civil Engineers, held in Chicago, Illinois in January 2011. The First Congress was co-chaired by University of Illinois professor Imad Al-Qadi, and Scott Murrell, Chief Civil Engineer of The Port Authority of New York and New Jersey. With a theme of "Integrated Transportation and Development for a Better Tomorrow," it brought together transportation and development researchers, engineers, planners, designers, project managers, construction managers, and contractors from around the world to discuss integrated strategies focusing on smart development and efficient multi-modal movement of people and goods. The Congress included an extensive technical program developed by five scientific committees with over 90 members. Mahmassani also served as the co-chair for the committee on "Transportation Operations and Safety." Northwestern also assisted with the development of two technical tours and recruited the awards banquet dinner keynote speaker, Bruce Mau, founder of Bruce Mau Design and the Massive Change Network and a thought leader on design and innovation implementation strategy.

NUTC/CCITT attracted more than 1,000 attendees at 34 educational and outreach events during 2011, including our academic seminar series, our "Sandhouse Gang" rail seminar series, industry workshops, the annual Patterson Transportation Lecture, and the inaugural Leon N. Moses Lecture in Transportation.

Organization

Staff

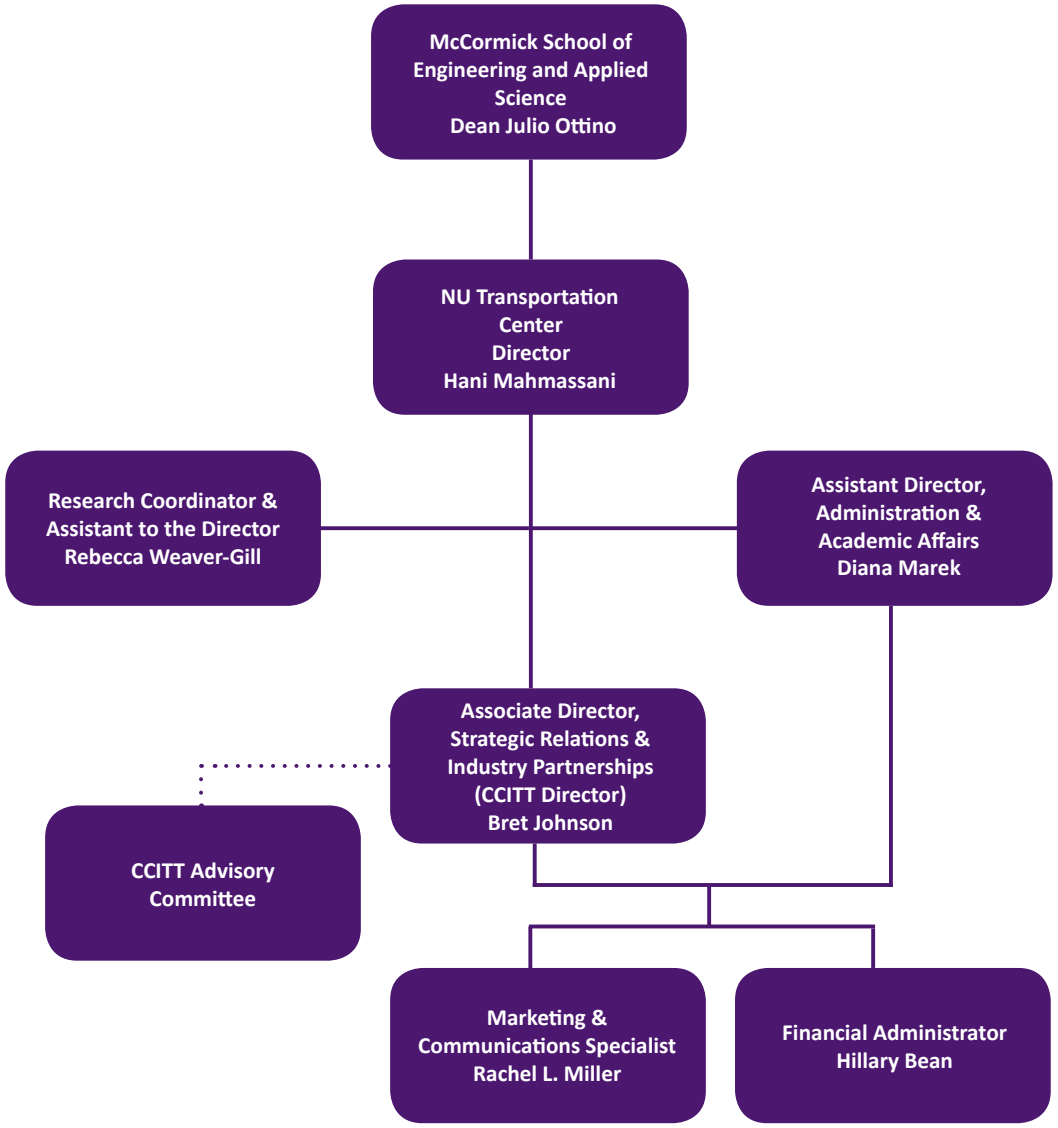
Bret Johnson
Director
bretj@northwestern.edu
TEL: 847-491-2194

Rachel L. Miller
Communications
Specialist
rachel-miller@northwestern.edu
TEL: 847-491-2787

Rebecca Weaver-Gill
Research Coordinator
r-weaver-gill@northwestern.edu
TEL: 847-491-2276

Hillary A. Bean
Financial Manager
h-bean@northwestern.edu
TEL: 847-491-2275

CCITT General Contact Information
ccitt@northwestern.edu
TEL: 847-491-7287
FAX: 847-491-3090



CCITT is operated within the Northwestern University Transportation Center in the Robert R. McCormick School of Engineering and Applied Science at Northwestern University. CCITT is a University Transportation Center Program of the Research and Innovative Technology Administration in the US Department of Transportation (http://utc.dot.gov/) and is funded through the Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).

Managing Editor
Bret Johnson

Editor
Rachel Miller

Designer
Rachel Miller

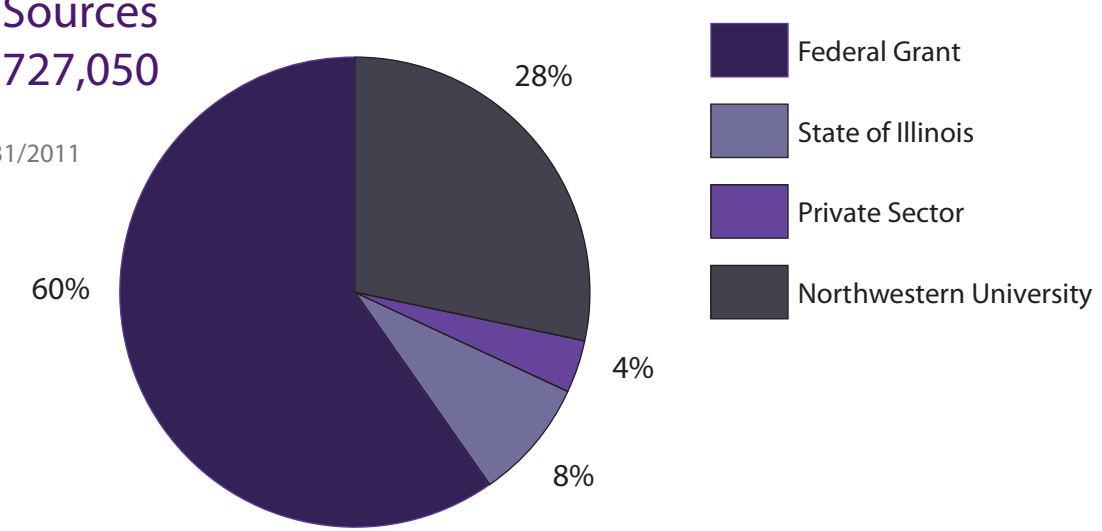
Writers
Yip-Wah Chung
James Edward Colgate
Irina Dolinskaya
Pablo Durango-Cohen
Morris Fine
Charlotte Frei
Bret Johnson
Aggelos Katsaggelos
Diego Klabjan
Marco Nie
Michael Peshkin
Karen Smilowitz
Sotirios Tsaftaris
Semyon Vaynman
Omer Verbas

Research images
Diego Klabjan

Funding

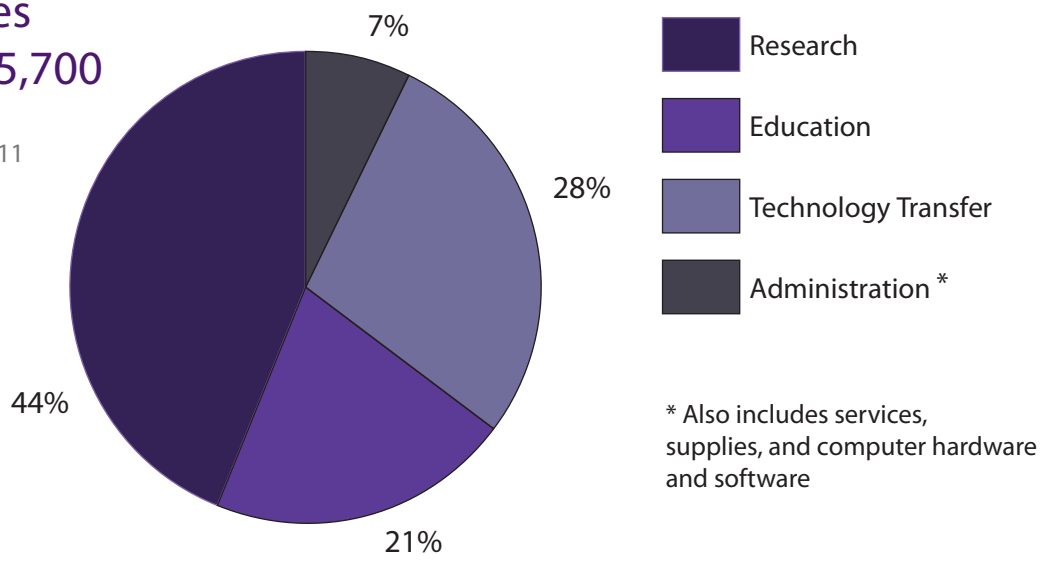
Funding Sources
Total: $3,727,050

Project Period:
8/10/2005-12/31/2011



Expenditures
Total: $2,695,700

Project Period:
8/10/2005-12/31/2011



* Also includes services, supplies, and computer hardware and software

www.ccitt.northwestern.edu

Center for the Commercialization of Innovative Transportation Technology
600 Foster Street Evanston, Illinois 60208

NORTHWESTERN
UNIVERSITY