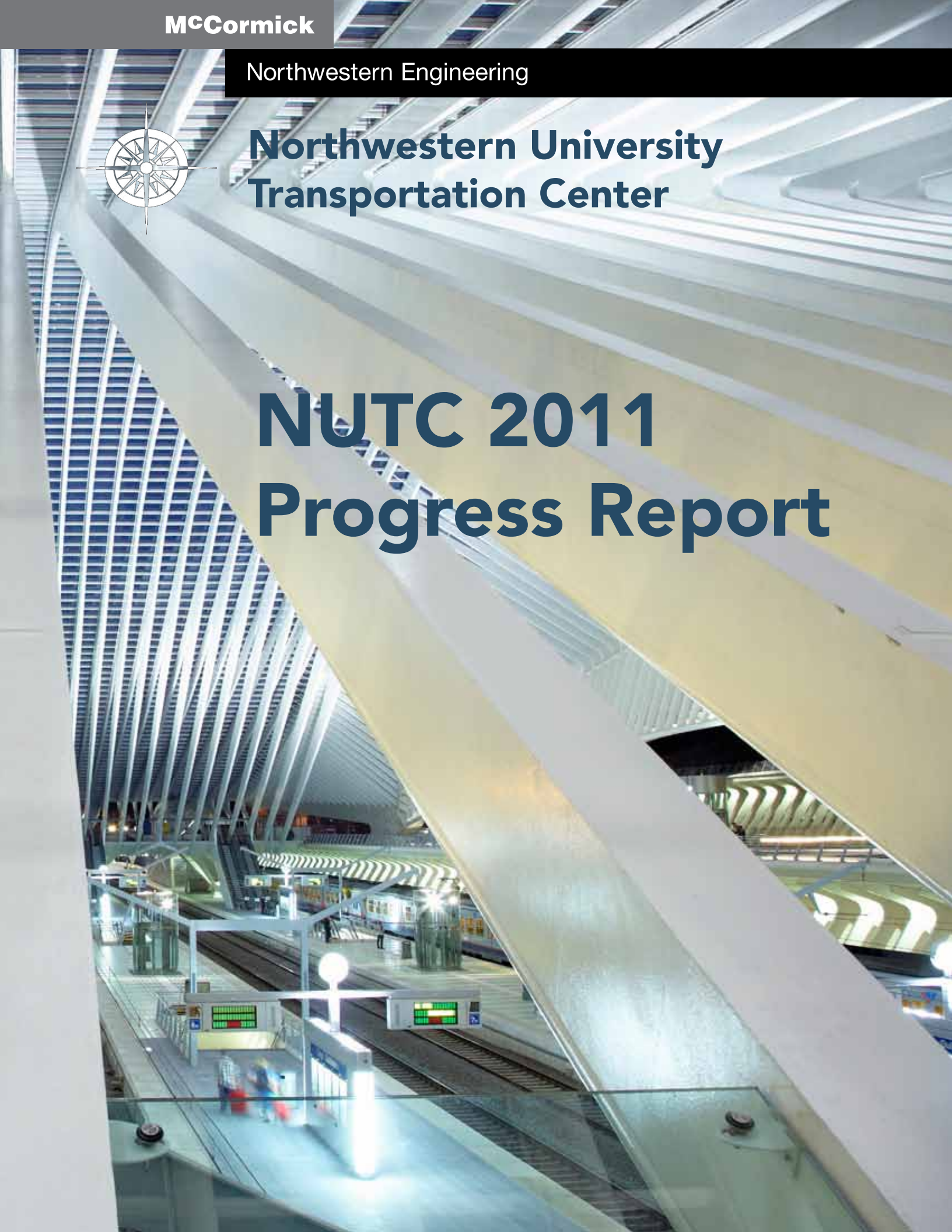




**Northwestern University  
Transportation Center**

**NUTC 2011  
Progress Report**





# Director's Message



We take a lot for granted—such as our mobility, both physical and virtual, the ability to have goods delivered to us when we expect them, and finding our preferred brand of cereal on the supermarket shelves. Only when disrupted do we take notice—road closure, major accident, snow storm, labor action, car breakdown. It is therefore a double-edge sword for transportation researchers and professionals when the general public increasingly becomes aware of mobility and of the transportation systems that provide it. On the one hand, it probably reflects experience with some disruption or noticeable degradation in service. On the other hand, it creates an opportunity to impress upon our society and elected representatives the need for solutions, and the significance of the work conducted at research centers such as ours.

Transportation remains at the core of several major concerns and challenges for our society. These problems have a global dimension, yet impact every locality. Concerns about energy and sustainability, economic growth and development, quality of life in congested cities, loss of life due to unsafe behaviors, infrastructure renewal, constrained financial resources, and inadequate institutional structures, are only a few of the strategic concerns that drive the transportation research and policy agendas.

Transportation research at Northwestern *matters*-- it may not lead to a cure for a rare disease, but it will help patients receive the treatment they need, and specimens reach laboratories with unique diagnostic equipment. It may also help characterize and prevent pandemics through advances in network science that allow accurate prediction of global migratory patterns. Especially in the wake of disasters, the logistics of aid delivery and health service provision critically determine how many lives can be saved and how quickly the impacted population can stand on its feet. Our faculty's research into humanitarian logistics and disaster planning and relief is leading the way for advancing operations research models and algorithms to address the unique challenges of these extreme environments.

NUTC research is expanding the sphere of transportation and mobility research to encompass the entire user experience—from origin to ultimate destination, and every step in between. Bringing together design of the physical environment, connectivity through information technologies, along with improvement in operational processes, a new initiative is targeting nothing less than reinventing the user experience in transportation. Opportunities derive from technological innovation, and call for new thinking in the realms of policy and service delivery models. Areas once at the periphery of the field have increasingly moved towards the core. By providing a synergistic environment for different disciplinary perspectives and specialties to come together, NUTC research enables novel problem definitions, perspectives, approaches and solutions to transportation, mobility and logistics problems.

For over a half century, the Transportation Center has played a key role in defining the field through fundamental as well as application-driven and industry-relevant research, along with excellent educational programs that continue to produce transportation leaders in academia, industry, and government. Successful research centers adapt, and set the pace for innovation in the field. With over 55 faculty affiliates from all parts of Northwestern's world-class programs, strong industry engagement, and a web of collaborative connections with local, national and international agencies and research entities, NUTC offers a unique think-tank and laboratory for cross-disciplinary research that matters.

This progress report is intended to highlight a year in the life of the Transportation Center community—an intellectually rich and diverse community of students and faculty, of researchers and dedicated staff members, loyal alums, our industry partners through the Business Advisory Committee (BAC), our special interest groups in aviation (Icarus Society) and rail (Sandhouse Gang), and a growing network of collaborators and friends in the region and around the world. We hope it will convey the breadth and richness of our activities in research, education, outreach and industry engagement, the distinction of our faculty and students, and the excitement and dynamism of our community.

Sincerely,

Hani Mahmassani  
 Director  
 Northwestern University Transportation Center  
 William A. Patterson Distinguished Chair of Transportation

# NUTC by the Numbers

1978

Year the Patterson Chair in Transportation was established

21

Number of new members to the Business Advisory Committee in 2010-11

2050

Number of people who attended NUTC sponsored seminars and events in 2010-11

18

Number of of research proposals submitted in 2010-11

5

Number of dissertation year fellows supported in 2010-11

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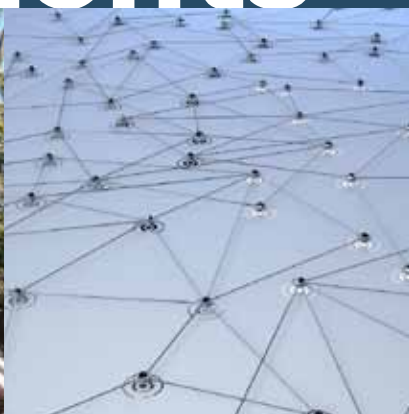
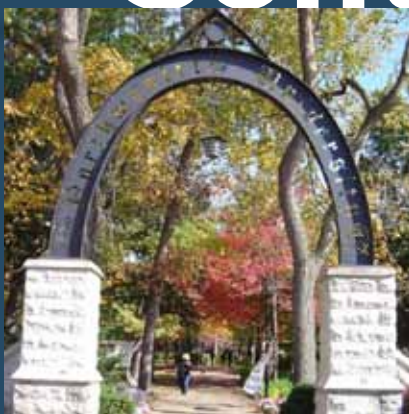
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# Center Overview

The Northwestern University Transportation Center (NUTC) is recognized as a leading interdisciplinary education and research institution serving industry, government and the public through a comprehensive research agenda, academic degree programs, executive education programs, and an array of outreach activities. NUTC is a collective asset of Northwestern University, the United States, and the worldwide transportation community.

Since its inception in 1954, the Center's mission has been to make substantive and enduring contributions to the movement of materials, people, energy, and information and in so doing influence national and international transportation policy, management, operations and technological developments. The pursuit of the Center's mission is rooted in its interdisciplinary approach to transportation and logistics education and research. The strength of the Center lies in the quality and productivity of its faculty, its focus on both scholarly and applied research, and an awareness of and responsiveness to the continual changes impacting the transportation and logistics industries.

NUTC exists to develop and share improved understanding of the economics and science of transportation and logistics systems. The Center brings together academic researchers, students, business affiliates, and others in open exploration of ways to make transportation and supply chain operations more productive, efficient, safe, secure, environmentally friendly, and socially beneficial.

# NUTC in the News

## **Zdenek Bazant**

"New Twin Tower Collapse Model Could Squash 9/11 Conspiracies" *LiveScience*

## **Sunil Chopra**

"Special Report – Disasters Show Flaws in Just-In-Time Production" *STV News*

"Aviation: At Full Throttle" *Financial Times*

## **Noshir Contractor**

"Yammer, Chatter, Hot Water" *BusinessWeek*

## **David Dana**

"A Simple Approach to Preventing the Next Housing Crisis: Why We Need One, What One Would Look Like, and Why Dodd-Frank Isn't It" *Huffington Post*

## **Aaron Gellman**

"United's Flight Mess Latest Caused By Computer Glitches" *USA Today*

"Is It Safe To Fly?" *National Public Radio*

"FAA to Order Closer Inspections Of Boeing 737s Worldwide" *Chicago Tribune*

"Travelers in Chicago React After Jets Land in DC with No Assistance" *ABC Local*

"Chicago Reaches Nearly \$1.2 Billion Agreement with United, American on O'Hare Expansion" *Washington Post*

"On time...most of the time" *Medill Reports*

## **William Kath**

"Findings Challenge Conventional Wisdom of How Neurons Operate" *McCormick News*

## **Diego Klabjan**

"Modeling Best Locations for Electric Vehicle Charging Stations" *UTC Spotlight Newsletter*

## **Hani Mahmassani**

"TSA to Fast-Track Frequent Fliers in "Trusted Traveler" Pilot Program" *ABC Local*

"OpEd: Express Rail to and from O'hare Benefits Region" *Crain's Chicago Business*

"Traffic Science Struggles to Keep Cars Flowing on Highways in D.C. and Elsewhere" *Washington Post*

"Carmageddon: Will Improvements to 405 Fix LA Traffic?" *LiveScience*

"Traffic in Chicago" *WGN Radio*

"New CTA Cars Prioritize Capacity, Not Service, Experts Say" *Medill Reports*

"Technology Keeps 'L' Riders Happy" *Chicago Tribune*

"Chicago Ranked the Most Road Congested City" *Medill Reports*

"Planes Will Fly, Even If Government Doesn't" *Medill Reports*

## **Kathryn Reid**

"Air Traffic Controllers Not the Only Sleepy Workers, Just the Scariest" *Chicago Tribune*

## **Ian Savage**

"Safer Crossings? New Signs as Freight Limits Lifted on Metra's UP West Line" *Chicago Tribune*

"Suburban Train Crossings Prove Most Deadly" *Chicago Tribune*

## **Joseph L. Schofer**

"Will Tollway Expansion Create 120,000 Jobs?" *Daily Herald*

"Speeding Rampant on Road to Navy Pier" *NBC Chicago*

"Grandparents Are Better Drivers - When Kids Are in the Car" *NBC Washington*

"More Than 2,000 Illinois Bridges Structurally Deficient: Report" *CBS Chicago*

"Chicago Traffic Gridlock" *ABC 7 Chicago*

"Are Fast Trains a Wise Investment?" *Northwestern News*

"Chicago's Transportation Infrastructure Weakening" *Chicago Tribune*

## **Karen Smilowitz**

"Karen Smilowitz Uses Logistics for the Greater Good" *McCormick News*

## **Fred Turek**

"Circadian Signs of Aging" *The Scientist*

"How Your Schedule Can Help (or Hurt) Your Health" *Wall Street Journal*

# Collaboration Highlights

Fred Turek addressed the National Transportation Safety Board on split sleep (anchor/nap sleep) strategy to reduce fatigue and risk on towing/barge vessels

Hani Mahmassani is organizing a workshop for the Federal Highway Administration, US DOT on travel behavior research to support operations and planning program activities.

NUTC hosted a High Speed Rail Symposium featuring Federal Railroad Chief Counsel Karen Hedlund

## Federal Government

Aaron Gellman serves on the Federal Aviation Administration's Air Traffic Services Committee, a subcommittee of the Research Development Advisory Committee

## Research Collaboration

Illinois Center for Transportation at UIUC  
-Partnering in projects with Illinois Department of Transportation (IDOT)  
-Closer strategic coordination

Joseph L. Schofer and Bret Johnson served on the Organizing Committee for the "Annual William O. Lipinski Symposium on Transportation Policy"

## Symposia, Conferences, & Committees

Argonne Transportation Analysis Group  
-Workshop under Initiative for Sustainability and Energy at Northwestern (ISEN)  
-Researcher seminars and visits

## Regional Activities

State Government  
-Illinois Department of Transportation (IDOT)  
-Illinois Tollway Authority

## State & Local Government

Local Government  
-Chicago Metropolitan Agency for Planning  
-Regional Transportation Authority  
-Chicago Transit Authority  
-Chicago Department of Transportation  
-Pace

Ian Savage and Ken Fuller analyzed pedestrian fatality in the Chicago area and presented their research to the City of Lake Forest, Ill.



## Northwestern University Transportation Center



NUTC was selected to organize the 22nd Symposium on Traffic and Transportation Theory, the oldest and most prestigious symposium series devoted to transportation theory, on the Northwestern campus in 2017 (H. Mahmassani, K. Smilowitz and Y. Nie will serve as co-chairs).

NUTC is organizing the second international conference on evacuation modeling (ICEM 2012).

Clarke L. Caywood presented a joint paper in June 2011 with Dean Kimi Kondo of Otaru University Theory to the AAA Brisbane conference.

#### Industry Research Partners

- Boeing
- CenterPoint Properties
- Echo Global Logistics
- Ford
- Ingram Barge
- Norfolk Southern
- Philips

#### Industry Research

#### Industry Knowledge Exchange Partners

- LAN Airlines
- Rand McNally
- Sensys
- Teradata
- TrafficCast

### Symposia, Conferences, & Committees

Aaron Gellman serves on the Panama Canal Advisory Board.

Hani Mahmassani gave the keynote lecture at the 2011 IEEE International Conference on Supernetworks and System Management in Shanghai, China

## International Activities

### International Governments

Hani Mahmassani led a team of NUTC and international experts in providing technical assistance to the Kingdom of Saudi Arabia's Ministry of Transportation, in the strategic planning and development of a national Roads & Transportation Research Center.

# CCITT

**Center for the Commercialization of  
Innovative Transportation Technology**

## **Moving Research to Realization for Surface Transportation**

The Center for the Commercialization of Innovative Transportation Technology (CCITT) completed its first full year under the leadership of NUTC. Launched at Northwestern in 2006, CCITT is part of a nationwide University Transportation Center program operated and funded by the Research and Innovative Technology Administration (RITA) of the US Department of Transportation.

During the 2010-2011 academic year, CCITT awarded four research projects to Northwestern faculty for translational research projects that reduce technical risk barriers and enhance opportunities for technology adoption (commercialization) by industry and transportation agencies. The diverse range of projects from four different engineering departments included: a decision support software tool for the selection and optimization of locations for alternative-fuel stations, including EV charging stations; a haptic technology that lets an automobile driver feel and interact with controls on a touch screen display, even in the absence of vision or audition; software to determine the reliability of bus routes for transit agencies; and software algorithms to maintain the integrity of compressed video data streams over wireless networks for transportation system monitoring, such as automated vehicle tracking. The new projects provided support for six graduate students. CCITT also provided partial financial support for four dissertation year graduate fellows.

Key numbers for program lifecycle (2006-11):

Projects funded – 12

Faculty member principal investigators – 12

Academic departments engaged – 5

Students supported – 19

CCITT funding committed – \$1,017,000

## **Transportation Library**

The Transportation Library was founded in 1958 to support NUTC's curricula and research programs. Containing close to 500,000 items, the Northwestern University Transportation Library is one of the largest transportation information centers in the world, encompassing information on all transportation modalities, including: air, rail, highway, pipeline, water, urban transport and logistics. It also includes a significant collection on law enforcement materials, 18th-21st century transportation companies' annual reports and its paper collection of environmental impact statements (EIS) is one of the most complete in the world.

The Transportation Library's staff produces TRANweb, a web-based periodical index of transportation and law enforcement articles and conference proceedings. Researchers from around the world, in the fields of transportation, law enforcement, and environmental impact assessment are encouraged to use the Transportation Library in accordance with its policies and procedures.

The Library's collections are available to the general public Monday through Friday 8:30pm - 5:00pm, and it provides reference assistance via email, telephone or in-person.





## Synergistic Centers

The Center's effective role in educating the university community and promoting awareness of transportation-related research needs and opportunities has led to a breadth and depth of activity in transportation-relevant subjects that is unmatched on any university campus. These programs and centers provide enhanced opportunities for students and faculty to learn about and engage in a wide range of subjects affecting the complex and diverse transportation industry. The activities they generate are open to the campus community, and generally to the transportation community beyond Northwestern. These activities contribute to a rich intellectual and professional experience in virtually all aspects of transportation systems research and education. Examples of NUTC's synergistic programs and centers are below.

### **Infrastructure Technology Institute (ITI)**

ITI is a University Research Center of Excellence supported by RITA of the US Department of Transportation. Its theme is to develop strategies and tools to protect and improve the condition, capacity, and performance of the nation's highway, railroad, and mass transit infrastructure systems. Researchers at ITI develop advanced methods for monitoring infrastructure condition and performance to assist owners and operators with critical decisions concerning structural integrity, renewal, and rehabilitation.

### **Initiative for Sustainability and Energy (ISEN)**

ISEN is an umbrella organization at Northwestern University designed to create, advance, and communicate new science, technology, and policy for sustainability and energy. Its particular focus is on sustainable energy supply, demand, and use. Its goal is to integrate the University's efforts in energy, sustainability, and outreach. Argonne National Laboratory is ISEN's primary research partner.

### **Northwestern Institute for Complex Systems (NICO)**

NICO is an institution that brings together scholars from across the university to study complex, emergent behavior of systems of interdependent actors.

### **Institute for Sustainable Practices**

This partnership between Argonne National Laboratory and Northwestern will facilitate joint research and educational initiatives to achieve sustainability in human and ecological systems. The institute's scope encompasses energy and other natural resources, and its work will include development of tools for assessing and monitoring sustainability.

### **Center for Energy Efficient Transportation**

The Center for Energy Efficient Transportation engages in fundamental research in the physical sciences aimed at enabling the development of energy-efficient vehicles.

### **Center for Operations & Supply Chain Management (COSCM)**

Based in the Kellogg School of Management, COSCM studies operational research questions in supply chains and other business contexts. It offers executive education and other programs that consistently rank among the nation's best.

# Faculty Affiliates and Researchers

## Jan D. Achenbach

Walter P. Murphy and Distinguished McCormick School Professor of Mechanical Engineering and Applied Mathematics; Former Director of the Center for Quality Engineering and Failure Prevention  
Airworthiness assurance of aircraft structures; ultrasonic methods in quantitative nondestructive evaluation; fracture mechanics

## Elodie Adida

Assistant Professor of Mechanical and Industrial Engineering, University of Illinois at Chicago  
Mathematical modeling, optimization, game theory, supply chain management, disaster preparedness and operations research in health care

## Hamed Alibabai

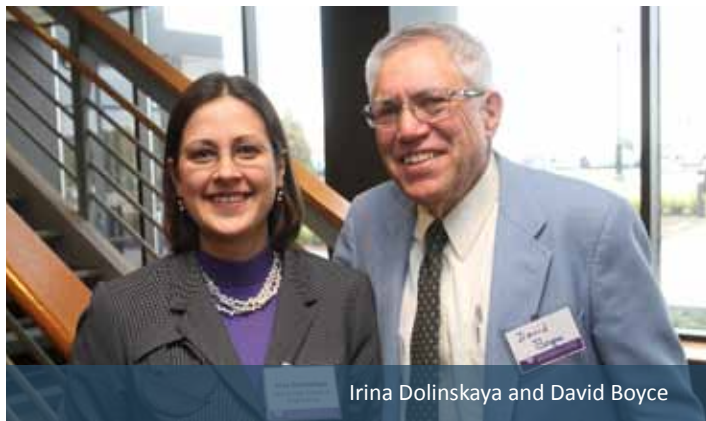
Post-Doctoral Research Fellow, Transportation Center  
Network flow modeling, simulation, system dynamics, theory, logistics, behavior modeling

## Zdenek Bazant

McCormick Institute Professor and Walter P. Murphy Professor of Civil and Environmental Engineering, McCormick School of Engineering and Applied Science  
Mechanics of materials and structures and structural safety, nanomechanics, and hygrothermal effects, and with applications to concrete, fiber composites, tough ceramics, rocks, soils, bone, snow and sea ice

## Henry Binford

Associate Professor of History and Urban Affairs, Weinberg College of Arts and Sciences  
Urban historian specializing in the evolution of subcommunities within cities; redevelopment of cities; history of transportation relating to growth of cities



Irina Dolinskaya and David Boyce

## David E. Boyce

Adjunct Professor of Civil and Environmental Engineering, McCormick School of Engineering and Applied Science; Professor Emeritus of Transportation and Regional Science, University of Illinois-Chicago  
Urban travel and location forecasting models; transportation network analysis and modeling; history of urban travel forecasting methods and practice

## Ronald R. Braeutigam

Associate Provost for Undergraduate Education; Harvey Kapnick Professor of Business Institutions; Professor of Economics, Weinberg College of Arts and Sciences  
Applied microeconomic theory and industrial organization; regulatory economics

## Dirk Brockmann

Associate Professor of Engineering Sciences and Applied Mathematics and Northwestern Institute on Complex Systems, McCormick School of Engineering and Applied Science  
Physics of complex systems; complex networks; human mobility networks; spatial disease dynamics; social networks; anomalous diffusion processes; stochastic processes; pervasive computing



Dirk Brockmann

## Fabián E. Bustamante

Associate Professor of Electrical Engineering and Computer Science, McCormick School of Engineering and Applied Science  
Design, deployment and evaluation of large-scale distributed systems in both wide-area and mobile networks; experimental systems, in particular operating systems and distributed computing

## Clarke L. Caywood

Professor of Integrated Marketing Communications, Director of Graduate Program in Corporate Public Relations, Medill School of Journalism  
Marketing and communications; crisis management and communications; stakeholder relationship management; political and deceptive messages and advertising

## Wei Chen

Professor of Mechanical Engineering, McCormick School of Engineering and Applied Science  
Engineering design; optimization under uncertainty; demand modeling; computational design methods; decision-making; automotive engineering

## Sunil Chopra

IBM Distinguished Professor of Operations Management & Information Systems, Kellogg School of Management  
Supply chain management and operations; design of communication and distribution networks; supply chain risk

## J. Edward Colgate

Allen and Johnnie Breed University Professor of Design, Mechanical Engineering; Co-Chair, Segal Design Institute, McCormick School of Engineering and Applied Science  
Human-machine interface, haptics, mechatronic systems

**James G. Conley**

Clinical Professor of Technology, Kellogg School of Management; Professor of Industrial Engineering and Management Sciences, McCormick School of Engineering and Applied Science  
Product design and development technologies; intellectual property strategies; intellectual capital; innovation management

**Noshir Contractor**

Jane S. & William J. White Professor of Behavioral Sciences; Professor of Industrial Engineering & Management Science, Communication Studies and Management & Organizations, Kellogg School of Management  
Social and knowledge networks; theories, statistical and computational methods; organizational theory

**Anne Coughlan**

Professor of Marketing, Kellogg School of Management  
Distribution channel management and design; pricing strategy; reverse channels for product returns; competitive strategy

**David A. Dana**

Dean for Faculty and Research, Northwestern University School of Law  
Environmental and land use law, regulation and policy (e.g. methods of allocating carbon credits; regulation and technological change in the automobile industry; eminent domain reform and urban sprawl)

**Irina S. Dolinskaya**

Assistant Professor of Industrial Engineering and Management Sciences, McCormick School of Engineering and Applied Science  
Optimal path finding; analysis of dynamic systems and networks; large scale and computationally demanding dynamic programming problems; applications include vessel, autonomous vehicles and robot routing

**David C. Dunand**

James N. and Margie M. Krebs Professor of Materials Science and Engineering, McCormick School of Engineering and Applied Science; Co-director of Initiative for Sustainability and Energy at Northwestern  
Light-weight metallic materials (alloys, composites, foams and sandwiches) for energy-efficient transportation; high-temperature alloys for energy-efficient internal-combustion and jet engines



Pablo Durango-Cohen

**Pablo Durango-Cohen**

Associate Professor of Civil and Environmental Engineering, McCormick School of Engineering and Applied Science  
Transportation infrastructure management; modeling and analysis of production control systems; capacity management; statistical performance modeling; contract analysis and design

**Steven Franconeri**

Assistant Professor of Psychology, Director of Undergraduate Studies, Cognitive Science, Weinberg College of Arts and Sciences  
Guidance and capture of visual attention and awareness; visual cognition; object tracking

**Andreas Frei**

Visiting Scholar, Transportation Center, McCormick School of Engineering and Applied Science  
Social networks and their implication on travel behavior; analysis of activities; modeling of transport behavior; changing behavior towards a more sustainable transport system

**Aaron J. Gellman**

Professor of Transportation, The Transportation Center, McCormick School of Engineering; Adjunct Professor of Management & Strategy, Kellogg School of Management  
Transportation management, economics and policy; aviation management; regulation; financial analysis; the management of technology and innovation; technology forecasting

**Robert J. Gordon**

Stanley G. Harris Professor in the Social Sciences, Weinberg College of Arts and Sciences  
Macroeconomic theory; monetary theory; airline economics; airline management; airline history; airline customer experience

**Kimberly A. Gray**

Professor of Civil and Environmental Engineering, McCormick School of Engineering and Applied Science  
Urban sustainability; brownfield and urban redevelopment; environmental impacts of transportation on ecological and human health; energy efficient technology

**Brian Hanson**

Associate Director of the Roberta Buffett Center of International and Comparative Studies; Lecturer in Political Science, Weinberg College of Arts and Sciences  
International political economy; globalization; international trade; the changing role of the state in world politics.

**Paul M. Hirsch**

James L. Allen Distinguished Professor of Strategy and Organizations; Kellogg School of Management  
Organizational change; mass communication; the sociology of culture

**Joel Horowitz**

Charles E. and Emma H. Morrison Professor of Market Economics, Weinberg College of Arts and Sciences  
Econometrics; travel demand modeling; urban transportation

**Thomas N. Hubbard**

John L. & Helen Kellogg Professor of Management and Strategy; Chair, Management and Strategy Department, Kellogg School of Management  
Industrial organization; trucking industry; economics of strategy; applied econometrics; economics of technology

**John C. Hudson**

Professor of Anthropology; Director of the Geography Program; Associate Director of Environmental Sciences Program, Weinberg College of Arts and Sciences  
Cultural and physical geography of North America; biogeography; economic geography; cartography; geographic information systems

# Faculty Affiliates and Researchers

## **Albert Hunter**

Professor of Sociology; Director of Urban Studies, Weinberg College of Arts and Sciences

Transportation in urban areas; public policy; urban sociology; community; ethnicity, culture and literature; methods

## **Arthur P. Hurter**

Professor Emeritus of Industrial Engineering and Management Sciences, McCormick School of Engineering and Applied Science

Logistics; applied microeconomic analysis; routing and risk analysis; facility locations; plant and equipment investment and replacement

## **Seyed Iravani**

Associate Professor of Industrial Engineering and Management Sciences, McCormick School of Engineering and Applied Science

Stochastic modeling and analysis; production and logistics; optimization

## **Bret Johnson**

Associate Director of the NU Transportation Center; Director of the Center for the Commercialization of Innovative Transportation Technology (CCITT); McCormick School of Engineering and Applied Science

Technology transfer and commercialization; technology based economic development; space and technology innovation policy

## **Richard Joseph**

John Evans Professor of International History and Politics; Roberta Buffett Center of International and Comparative Studies, Weinberg College of Arts and Sciences; Senior Fellow, The Brookings Institution Growth, governance, and sustainable development; comparative democratization; African politics; HIV prevention strategies; energy, environment and transportation

## **William L. Kath**

Professor of Engineering Sciences & Applied Mathematics, Neurobiology and Physiology Center for Photonic Computing and Communication; Co-Director of Northwestern Institute on Complex Systems Computational neuroscience; fiber optics; wave propagation; nonlinear dynamics; complex systems

## **Diego Klabjan**

Associate Professor of Industrial Engineering and Management Sciences, McCormick School of Engineering and Applied Science

Business intelligence and analytics in air transportation, logistics, railway industry, retail, and supply chain management

## **Frank S. Koppelman**

Professor Emeritus of Civil and Environmental Engineering, McCormick School of Engineering and Applied Science

Travel demand modeling and prediction; yield management; urban, regional and intercity transportation planning; development of advanced travel demand modeling concepts and methods

## **Raymond J. Krizek**

Stanley F. Pepper Professor of Civil & Environmental Engineering; Director of Master of Project Management Program, McCormick School of Engineering and Applied Science

Injectability & mechanical properties of grouted sands; disposal of waste slurries; problems involving soil-structure interaction; engineering behavior of dredged materials; dynamic response of soils

## **Hani S. Mahmassani**

Director, Northwestern University Transportation Center; William A. Patterson Distinguished Professor of Transportation, McCormick School of Engineering and Applied Science

Dynamic traffic system management; network modeling and optimization; dynamics of user behavior and telematics



## **Therese McGuire**

ConAgra Foods Research Professorship in Strategic Management; Professor of Management & Strategy; Director, Guthrie Center for Real Estate Research & Real Estate Management Program State and local public finance; fiscal decentralization; property tax limitations; education finance; regional economic development

## **Leon N. Moses**

Professor Emeritus of Economics, Weinberg College of Arts and Sciences Applied microeconomic analysis; logistics and transportation economics; economics of regulation safety and risk; urban and regional economics

## **Barry L. Nelson**

Charles Deering McCormick Professor of Teaching Excellence; Chair, Department of Industrial Engineering & Management Sciences, McCormick School of Engineering & Applied Science Computer simulation of dynamic; stochastic systems; design and analysis of simulation experiments

## **Yu (Marco) Nie**

Assistant Professor of Civil and Environmental Engineering, McCormick School of Engineering and Applied Science Network optimization; traffic flow theory; traffic simulation

## **Maciek Nowak**

Assistant Professor of Information Systems and Operations Management, Graduate School of Business, Loyola University Chicago Vehicle routing and tracking; supply-chain management; operations research and management; logistics and data analysis; quantitative methods; heuristic search

## **John C. Panzar**

Professor Emeritus of Economics, Weinberg College of Arts and Sciences

Theoretical and policy issues relating to network industries (telecommunication, electric transport, air transport and postal services); industrial organization; regulatory economics; applied microeconomic theory

**Kalyan Raman**

Professor of Integrated Marketing Communications, Medill School of Journalism; Professor of Marketing, Kellogg School of Management Integrated Marketing Communications, Marketing Mix Optimization Issues; sales force compensation; brand name recall and implications for advertising and market structure; pricing; diffusion models; supply chain management; reference prices; customer relationship management

**Mark A. Ratner**

Professor of Chemistry, Weinberg College of Arts and Sciences; Co-Director, Initiative for Sustainability and Energy at Northwestern Organic electronics and photovoltaics; energy storage materials, particularly electrochemical; energy concentration routes, including exciton fission; agent-based modeling of complex systems

**Kathryn Reid**

Research Assistant Professor of Neurology, Northwestern Feinberg School of Medicine  
Impact of sleep loss and circadian disruption on human performance; health and safety with emphasis on the impact of shiftwork

**Alberto Salvo**

Assistant Professor, Management and Strategy, Kellogg School of Management  
Industrial organization, international trade, environmental economics, applied microeconomics, strategy

**Roberto Sarmiento**

Library Department Head, Transportation Library, Northwestern University  
Management issues for the digitization of transportation collections; analysis of transportation library's collection at the national level; the role of journal article indexing in a full text world

**Ian Savage**

Associate Chair, Department of Economics; Distinguished Senior Lecturer, Weinberg College of Arts and Sciences  
Transportation safety; transportation economics; urban transit

**Joseph L. Schofer**

Associate Dean for Faculty Affairs; Professor of Civil and Environmental Engineering; Director of Infrastructure Institute of Technology, McCormick School of Engineering and Applied Science  
Urban transportation policy planning; data information and decision making in transportation; traveler behavior and market research; intelligent transportation systems; pedestrian and motor vehicle safety



Joseph Schofer

**Karen Smilowitz**

Junior William A. Patterson Professor of Transportation; Associate Professor of Industrial Engineering and Management Sciences, McCormick School of Engineering and Applied Science

Design and operations of logistics network; vehicle routing and scheduling; supply-chain management; applications in commercial and non-profit settings



Karen Smilowitz

**Richard Sobel**

Visiting Scholar, Buffett Center for International and Comparative Studies  
Political science, public opinion and policy; intersection of security and domestic politics, civil liberties, right to travel, and travel privacy, security and identification policies; housing and community development, and transportation articulation

**Joseph A. Swanson**

Visiting Scholar, Zell Center for Risk Research, Kellogg School of Management; President, Jos. Swanson & Co.  
Corporate bankruptcy; econometrics; investment banking; mechanism design; regulation; transportation

**Fred W. Turek**

Director of Center for Sleep and Circadian Biology; Charles E. and Emma H. Morrison Professor of Biology, Department of Neurobiology & Physiology, Weinberg College of Arts and Sciences  
Investigation of circadian rhythms and their importance to human health, safety, performance and productivity; relationship between abnormal sleep-wake cycles on fatigue and alertness in the workplace and transportation industry

**Jan A. Van Mieghem**

Harold L. Stuart Professor of Managerial Economics; Chair of Department of Managerial Economics & Decision Science; Professor of Operations Management, Kellogg School of Management  
Operations management and strategy; supply-chain management and analysis; management and investment under uncertainty (e.g. pricing and dynamic control of stochastic processing networks)

**Michael D. Whinston**

Robert E. and Emily H. King Professor of Business Institutions; Co-Director, Center for the Study of Industrial Organizations, Department of Economics, Weinberg College of Arts and Sciences  
Industrial organization; antitrust and regulation; incentives; microeconomic theory; and game theory

**Jun Xie**

Visiting Scholar of Civil and Environmental Engineering, McCormick School of Engineering and Applied Science, Transportation Engineering College, Tongji University  
Transportation network analysis

# Faculty Awards & Accomplishments

## INVESTITURE OF NEW CHAIRS

Barry L. Nelson  
Walter P. Murphy Professor  
McCormick School of Engineering and Applied Science

## AWARDS AND APPOINTMENTS

Jan Achenbach  
Honorary Doctorate Degree from Zhejiang University,  
China

Steven Franconeri  
2011 National Science Foundation CAREER Award

Zdenek Bazant  
2011 Biot Medal, American Society of Civil Engineers

Noshir Contractor  
2011 Top Paper Award, 3rd Annual International Web  
Science Conference

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

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

Alberto Salvo  
2011 Robert Mundell Prize for Best Article by a Young  
Economist, Canadian Journal Of Economics

Roberto Sarmiento  
2011 Transportation Division Innovation Award, Special  
Libraries Association

Joseph L. Schofer  
2011 Roy W. Crum Award, Transportation Research Board  
of the National Academies

Karen Smilowitz  
McCormick Advisor of the Year

Fred Turek  
Distinguished Scientist Award, Sleep Research Society  
Distinguished Service Award, Sleep Research Society  
Government Relations Committee

## FELLOWS OF SOCIETIES

Noshir Contractor  
Invited Fellow, Center for Advanced Study in the  
Behavioral Sciences, Stanford University, 2011-2012

William Kath  
Fellow, Society for Industrial and Applied Mathematics

Barry L. Nelson  
Fellow, Institute of Industrial Engineers

## ENDOWED AND KEYNOTE LECTURES

Hani Mahmassani  
Keynote Lecture, 2011 IEEE International Conference  
on Supernetworks and System Management, Shanghai,  
China

## NOTEWORTHY ACHIEVEMENTS

Clarke Caywood  
Edited and completed a 450,000 word textbook for  
McGraw-Hill as the second edition of The Handbook of  
Strategic Public Relations and Integrated Marketing Com-  
munications

Anne Coughlan  
Named Academic Member of the Incentive Compensa-  
tion Advisory Board, Sales Management Association

Fred Turek  
Addressed the National Transportation Safety Board  
(NTSB) on "Split Sleep (Anchor/Nap Sleep) Strategy to  
Reduce Fatigue on Towing/Barge Vessels." Recently, hu-  
man fatigue was added to its "Most Wanted List", a list  
representing NTSB advocacy priorities

Karen Smilowitz, Irina Dolinskaya  
Launched the Humanitarian and Non-Profit Logistics  
Initiative at Northwestern University

Karen Smilowitz  
Organized the symposium "Doing Good with OR: Ap-  
plying Operations Research for Societal Impact" at the  
American Association for the Advancement of Science's  
2011 Annual Meeting



# New Faculty Affiliates and Researchers



**Elodie Adida**  
Assistant Professor of  
Mechanical and Industrial  
Engineering, University of  
Illinois at Chicago



**Hamed Alibabai**  
Post-Doctoral Research  
Fellow, Transportation  
Center, McCormick School  
of Engineering and Applied  
Science



**Zdenek Bazant**  
McCormick Institute  
Professor and Walter P.  
Murphy Professor of Civil  
and Environmental Engi-  
neering, McCormick School  
of Engineering and Applied  
Science



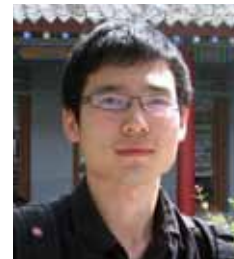
**J. Edward Colgate**  
Allen and Johnnie Breed  
University Professor of De-  
sign, Mechanical Engineer-  
ing; Co-Chair, Segal Design  
Institute, McCormick  
School of Engineering and  
Applied Science



**Andreas Frei**  
Visiting Scholar,  
Transportation Center,  
McCormick School of  
Engineering and Applied  
Science



**Alberto Salvo**  
Assistant Professor, Man-  
agement and Strategy,  
Kellogg School of Manage-  
ment



**Jun Xie**  
Visiting Scholar of Civil and  
Environmental Engineer-  
ing, McCormick School of  
Engineering and Applied  
Science



# Emerging Challenges

Research at the NU Transportation Center is driven by major challenges facing the transportation industry and modern society. Transportation is the lifeblood of the economy, and mobility is a critical determinant of quality of life in the world's cities and regions. Mobility, safety, environment, energy, security, infrastructure renewal, and financial sustainability continue to be at the forefront of the policy agenda for transportation agencies. Competitiveness, globalization, collaboration, uncertainty, volatility and technological change are major drivers of strategic and operational decision-making for the transportation enterprise.

The portfolio of research projects and activities at NUTC is continually evolving to anticipate, identify, and characterize significant challenges and problem areas faced by the transportation industry, in both private and public sectors, as well as at their interface. Faculty and student researchers work together with industry and agency partners at gathering information and devising methodologies to analyze these problems, formulate strategies, design solutions, and eventually work towards engaged implementation and evaluation.

Building on the core strengths of its faculty researchers, enhanced through collaborative arrangements with other research centers and entities, the NU Transportation Center has identified eight emerging challenge areas:

- Re-inventing the user experience in transportation
- Transportation energy and sustainability: Technology, economics, markets, and behavior
- Humanitarian logistics
- System Intelligence in transportation
- Designing interventions in transportation: Behavior change
- Coping with disruptions and extreme events
- Freight mobility and intermodalism for global competitiveness
- Telecommunications and mobility: the evolving connection

Diverse in scope, these areas share the following characteristics: (1) impact on society and/or industry; (2) fundamental and methodological challenges; (3) cross-disciplinary; and (4) strategic dimension. As such, they form the focus of targeted efforts both inside Northwestern as well as with our industry and agency partners. The top three in this list have gathered considerable momentum in the past year, and are featured in this report.

## Reinventing the User Experience in Transportation

In an age of *anytime anywhere* access to our virtual destinations, and ever greater expectations of near instantaneous communication for work and play, our everyday experience with physical mobility continues to deteriorate—from crumbling antiquated infrastructure to crippling congestion, long waiting lines to crowded planes and transit vehicles, the quality of the user experience is falling across the spectrum of transportation systems and services. By most measures, highway congestion in our cities continues to extract a huge cost in wasted time, burned fuel, strained physical and mental health, and missed opportunities (meetings, performances, flights). Travel by air, once considered an experiential luxury, has long ago become a prime opportunity for extended delays, cancellations, and cramped seats, before it got compounded by the baffling stages of progressive humiliation through security screening. Public transportation, essential to the mobility of most in large cities around the world, frequently subjects its users to long and unpredictable waits under inclement weather. Freight service is subject to disruption and delay due to a variety of factors, increasing logistics costs and



interfering with timely supply chain operations.

Yet in many other realms of personal consumption, new technologies and devices continue to please and delight consumers. Through clever design and a keen focus on the user experience, personal communication devices have become virtual hubs for social interaction, instant connectivity and context-specific information, and common products (e.g., coffee) have become the center of community oases, succeeding at providing, paradoxically, personalization to a mass audience. Might there not be something to be learned for transportation system providers from the approach followed by leading companies that have succeeded in these other realms of the everyday user experience?

Drawing upon the lessons of highly successful consumer products and service concepts, reinventing the user experience might call for rethinking the very definition of the output of a transportation system, or of the nature of the service provided by a transportation company. This means rethinking the total experience—from origin to final destination, recognizing that travel is part of a more elaborate activity pattern, and exploiting the contribution of personal communication and information devices and technologies in that process. This kind of thinking calls for a multi-disciplinary perspective that blends the creative contributions of product/service designers, the insight of behavior researchers, along with the skills of planners and transport system specialists.

The next wave of intelligent transportation system development holds the promise of customization and personalization—delivering information and services that better meet individual conditions and user preferences. NUTC researchers, for example, are devising novel operating concepts and advanced methodologies that provide the intelligence required for flexible real-time operation of transport systems, and can deliver personalized information to travelers. NUTC researchers have also teamed up with the designers at the internationally renowned Bruce Mau Design firm, based in Chicago and Toronto, and the Massive Change

Network (led by Bruce Mau and Bisi Williams) in addressing the challenge of reinventing the public transit user's experience. This effort has gathered momentum in the past year, eliciting media recognition and coverage, and has engaged several leading industry providers in productive discussions. It has also captured our students' imagination, resulting in smartphone apps and movie clips ([http://www.transportation.northwestern.edu/news\\_events/2011/Bustamante\\_TrailBlaze.html](http://www.transportation.northwestern.edu/news_events/2011/Bustamante_TrailBlaze.html), <http://www.youtube.com/watch?v=gN0wDDiaTiY>).



On the freight side, quality-of-service issues are paramount to system users and logistics managers. Tracking technologies have made considerable inroads in certain segments of the industry, enabling visibility through all stages of the transport process and beyond. Companies that take a complete logistics perspective are able to provide market responsiveness while controlling cost. Electronic platforms that dynamically match loads with carrier assets are transforming some sectors of the industry. NUTC researchers are partnering with selected BAC member companies in pushing the frontier in freight service design and reliability through advanced methodologies that exploit real-time tracking and transaction records to better design and control all aspects of the transportation and logistics process.

Leading this effort at NUTC is Dr. Hani Mahmassani, with involvement of researchers at the Segal Design Institute at Northwestern. Other researchers include Drs. Marco Nie, Joseph Schofer, Noshir Contractor, and Wei Chen. Key BAC industry partners include Teradata and Echo Global Logistics.



## Humanitarian Logistics

Advances in information technologies, optimization techniques, networking power, and the decision sciences have yet to be applied to the critical and most challenging problems that arise in disaster relief distribution operations. These problems further differ in substantial and substantive ways from those that are addressed under “normal” conditions—they are more chaotic, highly time-sensitive, fall under incomplete or non-existent information, occur in rapidly changing environments, require difficult and ethically challenging trade-offs, and must be deployed in an organizational void with uncoordinated, decentralized, and unsupervised agents.

To address these issues, the Humanitarian and Non-Profit Logistics initiative was recently launched at Northwestern University by NUTC faculty affiliates Karen Smilowitz and Irina Dolinskaya. Humanitarian logistics involves the coordination of people, organizations, and materials to deliver goods and services to people in need. Non-profit logistics focuses on the operations of non-profit organizations at local, regional and national levels. The researchers are bringing modern optimization techniques, information systems and the decision sciences to the challenging classes of problems that arise in the planning and deployment of relief operations under extreme conditions. The team of researchers are actively engaging in many areas of humanitarian and non-profit logistics, including disaster relief, emergency response, hunger relief, and mobile health clinics. Projects focus on approaches to develop and apply modeling and solution technology to promote welfare and equity through the efficient delivery of goods and services. This work involves close partnerships with organizations in the field to solve the complex problems that arise in humanitarian and non-profit logistics.

Faculty of the Humanitarian and Non-Profit Logistics initiative also include William Patterson Chair in Transportation and NUTC Director Hani Mahmassani (Civil and Environmental Engineering), Assistant Professor at the Indian School of Business Sarang Deo (Operations Management), Associate Professor Seyed Iravani (Industrial Engineering and Management Science), Assistant Professor at Northwestern Memorial Hospital and Associate Faculty at the Harvard Humanitarian Initiative Jennifer Chan (Emergency Medicine), Assistant Professor Marco Nie (Civil and Environmental Engineering), Assistant Professor Benjamin

Armbruster (Industrial Engineering and Management Science), and Associate Professor Pablo Durango-Cohen (Civil and Environmental Engineering).

## Transportation Energy and Sustainability

In the United States, transportation activities account for approximately thirty percent of overall carbon emissions. The desire to reduce this contribution and decrease reliance on uncertain fuel supplies drives the recent surge in transportation energy and sustainability related research. Engineering and science-oriented research on production processes of alternative fuels needs to be augmented with analysis of systemic impacts and consequences for transportation and the economic/societal systems it supports. New technologies benefit from appropriate government policies and bear many uncertainties spanning from financial and investment to governmental and infrastructure related.

Affiliated faculty members at Northwestern utilize a variety of analytical (data mining and forecasting), decision-making and route modeling, optimization and information technology skills to the topics of market adoption, infrastructure building, carbon footprint accounting, life-cycle analysis, and supply chain management. NUTC faculty affiliates are experienced in both developing and applying numerous operational, economic, and financial models to solve diverse energy, environmental systems, economics, and policy problems. They also have substantial expertise in the development of new materials benefiting transportation energy efficiency. NUTC also works closely with two programs on campus: the Initiative on Sustainability and Energy at Northwestern (ISEN) led by affiliated faculty members David Dunand and Mark Ratner; and the Center for Energy Efficient Transportation (CEET) led by affiliate faculty member Harold Kung. During the 2010-11 year, NUTC and ISEN co-hosted a workshop, The Greening of Transportation 2: Sustainability via Alternative Fuels, and featured speakers from influential US firms and government agencies sharing their practices in deploying alternative fuels and alternative-fuel vehicles.

The emerging research area of transportation sustainability and energy engages several faculty researchers including Diego Klabjan, Pablo Durango-Cohen, Joseph Schofer, Hani Mahmassani, and Frank S. Koppelman.



# CORE RESEARCH AREAS

Research at the Center is oriented toward analytic and empirical studies focusing on transportation and logistics systems and the development of advanced methods for systems and network planning, management, and operations. Through research, the Center's objective is to support the development of new insights, concepts, and tools that can be utilized by industry, business, and government

to support decision-making towards more efficient and responsive transportation services and systems.

The ongoing research work of the Center is centered around several broad areas of investigation including:

- Logistics and Supply Chain Management
- Network Modeling and Planning
- Transportation Demand, Economics and Forecasting
- Transportation Asset Management
- Transportation Policy
- Human Performance and Transportation Safety
- System Operations

The next few pages highlight selected ongoing or recently completed studies in each of these areas.

## Logistics and Supply Chain Management

*Decision-Making Tools for Distribution Networks in Disaster Relief*  
Karen Smilowitz, Irina Dolinskaya

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. Our research team at Northwestern University is leveraging our expertise in supply chain management and vehicle navigation under uncertainty to study design and operational improvements for humanitarian relief chains. Our proposed initiative will bring insights from this research to the relief community through the development of decision-making tools for supply distribution.

Distribution in commercial delivery services share some features with disaster relief; however, several critical attributes are not present. First, models and solutions 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. Our analysis will integrate this uncertainty in a dynamic approach that reflects the evolution of information. Third, the objectives in disaster relief have not been extensively studied in other sectors. We will analyze relief systems with multiple (often conflicting) objectives to ensure efficient and effective distribution of relief supplies.

The proposal has three key activities: learning from agencies about their current relief operations; developing prototype logistics models to improve operations; and transitioning this research to Northwestern engineers, trained through

this initiative. Upon completion of this one-year project, these engineers will adapt our prototype models to create and deploy decision-making tools for agencies to improve relief distribution, through an NU-incubated start-up company.

*In-House Globalization: The Role of Globally Distributed Design and Product Architecture on Product Development Performance*  
Bilal Gokpinar, Wallace J. Hopp, Seyed Iravani

Changes in the global economy and technological advances are stimulating an increasing geographic distribution of new product design and development efforts. For large organizations that design and develop complex products, this geographic distribution has added a new layer of complexity to product development operations. In this empirical study of a large auto manufacturer, the researchers examine the operational performance implications of splitting the design of vehicle subsystems across multiple geographic locations. The team's results indicate that global distribution diminishes the chance of completing tasks on time and degrades subsystem design quality. Finally, by examining the interplay between subsystem centrality and global distribution, the researchers found that higher centrality in the product architecture amplifies the impact of global distribution on subsystem error rates.





## Transportation Network Modeling and Planning

### *Complexity in Human Transportation Networks: A Comparative Analysis of Worldwide Air Transportation and Global Cargo Ship Movements*

Grastivia O'Danleyman, Jake Jungbin Lee, Hanno Seebens, Bernd Blasius, Dirk Brockmann

The study presents a comparative network theoretic analysis of the two largest global transportation networks: The worldwide air-transportation network (WAN) and the global cargo ship network (GCSN). The study shows that both networks exhibit striking statistical similarities despite significant differences in topology and connectivity. Both networks exhibit a discontinuity in node and link betweenness distributions which implies that these networks naturally segregate in two different classes of nodes and links. The study introduces a technique based on effective distances, shortest paths and shortest-path trees for strongly weighted symmetric networks and show that in a shortest path- tree representation the most significant features of both networks can be readily seen. The study shows that effective shortest-path distance, unlike conventional geographic distance measures, strongly correlates with node centrality measures. Using the new

technique the team shows that network resilience can be investigated more precisely than with contemporary techniques that are based on percolation theory. The study extracts a functional relationship between node characteristics and resilience to network disruption. The study concludes that dynamic processes that evolve on both networks are expected to share universal dynamic characteristics.

### *Providing Reliable Route Guidance Using the Gary-Chicago-Milwaukee Traveler Information System*

Yu (Marco) Nie, Peter C. Nelson

New techniques offer the potential to improve travel reliability for motorists, freight carriers and parcel delivery firms. This project confronts challenges to the implementation of these techniques, and demonstrates their feasibility and benefits using real data from the Chicago metropolitan area, one of largest transportation hubs in the US. Conceptually, the most reliable routes can be found by solving the Dynamic Shortest Path problem with On-Time arrival reliability (DSPOT). DSPOT has recently been formulated and solved using the dynamic programming technique.

The proposed research addresses two important issues that currently preclude its implementation: 1) development of solution algorithms fast enough for on-line application, and 2) validation using real data. In this project, historical traffic data from the Gary-Chicago-Milwaukee (GCM) traveler information system will

be used to prepare dynamic probability mass functions of travel times, which are the key inputs to DSPOT. Then a prototype path search tool will be developed, which implements DSPOT based on GCM data. This tool will be made available to the public through the Artificial Intelligence Laboratory at the University of Illinois at Chicago.

The ultimate goal of this project is to provide motorists and carriers with commercialized DSPOT products that will allow them to make tradeoffs between reliability and other costs and constraints. With the benefits and market value demonstrated through this project and further implementation stages, we believe that the related industries will be interested in adding DSPOT to their product offerings. These firms include but are not limited to the manufacturers of in-vehicle navigation systems, web companies that provide internet-based driving directions and software vendors that produce logistics tools for freight carriers.



# Transportation Demand, Economics, and Forecasting

## *The Effect of Residential Location on Vehicle Miles of Travel, Energy Consumption and Greenhouse Gas Emissions: Chicago Case Study*

Marshall Lindsey, Joseph L. Schofer, Pablo Durango-Cohen, Kimberly A. Gray

A Chicago-based case study explores the relationship between residential location on household patterns of vehicle miles of travel, and by extension, energy consumption and greenhouse gas emissions. Generally, vehicle miles, energy use and greenhouse gas emissions increase with residential distance from the city center, and thus, with decreasing residential density. Travel alone, however, does not account for the energy/greenhouse gas emissions profiles in the region's fringe where the use of low-efficiency vehicles dominates. Higher fringe energy values are a function of both increased vehicle miles of traveled and low-efficiency vehicle use. Various scenarios show that with increases in private vehicle fuel efficiency, the overall reduction in fuel use creates a more uniform spatial profile of energy/greenhouse gas emissions across the region. The most significant example is a scenario involving the shift of the survey fleet to 2012 European fuel economy standards resulting in an energy/greenhouse gas emissions reduction of 48%.

## *Analysis of Network and Non-Network Impacts upon Traveler Choice: Improve Modeling Accuracy for Better Transportation Decision Making*

Hani Mahmassani, Frank Koppelman

Flows observed in transportation networks and the associated performance of these systems are largely the result of choices made by travelers— choices of where to live, work, which activities to engage in and with whom, where,

when, by what mode to get there and along which path. These choices reflect travelers' activity patterns, situational and environmental variables (e.g. weather), as well as attributes of the transportation system which determine users' experienced service levels, particularly congestion and reliability. In addition, travelers are influenced by the information they receive about system conditions, as well as various controls such as prices, access limitations, dynamic control, and other measures.

Our understanding of traveler choice behavior in transportation systems, and the approaches used to capture its outcomes, have undergone several paradigm shifts over the past 50 years—often through the involvement of different disciplinary perspectives that have enriched the body of knowledge of this most elusive yet so critical aspect of transportation system performance. However, the ability to operationally represent traveler choices for the purpose of predicting responses to various interventions—from demand management to operational controls to pricing to real-time information provision—remains rather limited.

This project, funded by the US Department of Transportation, is intended to address this important gap in modeling capability to support a variety of initiatives that seek to improve traffic conditions and system safety and sustainability by targeting user choices before and during their travel. The main emphasis is on travelers' higher-level, predictive, strategic choices as these might be influenced by a range of variables that include experienced system



performance, environmental factors that affect both system performance as well as activity engagement opportunities, availability and accessibility to alternative modes, availability and cost of parking, bike lane treatments, quality of the walking environment reflected through sidewalk availability, as well as measures such as pricing, information supply, dynamic traffic management, and so on. The outcome of this project will provide a foundation for designing effective interventions to improve system performance, and for evaluating different policies and options by predicting how users will respond to these measures.



# Transportation Asset Management

## *A Data Processing and Control System to Support Remote Infrastructure Monitoring*

Yikai Chen, David Corr, Pablo Durango-Cohen

The Hurley Bridge (Wisconsin Structure B-26-7, pictured below) carries west-bound traffic on US Route 2 over the Montreal River from Ironwood, Michigan to Hurley, Wisconsin. The bridge is a three-span continuous five-girder steel structure with a composite deck. In cooperation with WisDOT, the Research Engineering Group (REG) of ITI has installed a continuous remote structure health monitoring system on the bridge consisting of strain gauges, thermocouples, accelerometers and displacement transducers at selected locations, in conjunction with a weigh-in-motion system installed by a third-party contractor.

The bridge is subject to heavy loads from daily truck traffic, many of which are believed to be overweight logging trucks travelling from Michigan into Wisconsin. WisDOT is concerned that the observed

traffic will cause premature degradation of the structure due to fatigue and over-stress conditions. Therefore, the main goals of the monitoring system are to:

- Process measurements related to structural health, traffic loads, and environmental conditions in an integrated fashion, thereby yielding comprehensive, facility-level condition assessment and forecasting capabilities;
- Provide real-time, reliable alerts when potential damage or risk of structural change in the facilities is detected; and
- Determine the nature of the detected changes, i.e., infer underlying structural properties, and identify possible assignable causes.

The research team is developing a statistical process control framework to achieve the aforementioned goals above. Distress measurements (strains on each girder & movements of the entire bridge) were collected for 13 months as real-time inputs of the framework. Weather conditions (temperature & humidity) were used to remove seasonal environmental effects through regressions. The process control system has been implemented as a set of individual control charts. The intuition is that monitoring (processed residuals/innovations) provides a basis to understand when a process drifts out-of-control. In particular, the residual series are laid out on a horizontal center line and two

limits were drawn equivalently to both sides of the center line. The idea is that observations falling outside the control limits provide reasonable evidence that a special-cause change has occurred in the structure.

## *A Polyhedral Study of Lot-sizing with Supplier Selection*

Yijia Zhao, Diego Klabjan

The traditional lot-sizing problem is to find the least cost production lot-sizes in several time periods. The study considers the lot-sizing model together with simultaneous selection of suppliers, which have variable and fixed cost. The researchers study the underlying polytope, provide valid inequalities for the uncapacitated case, and give sufficient and necessary conditions for facet-defining inequalities. The study also gives a full description of the underlying polyhedron. For the general capacitated case, the study shows how to derive several families of valid inequalities from standard lot-sizing valid inequalities.





# Transportation Policy

## *Is Arbitrage Tying the Price of Ethanol to that of Gasoline? Evidence from the Uptake of Flexible-Fuel Technology*

Alberto Salvo, Cristian Huse

Brazil is the only sizable economy to date to have developed a home-grown ubiquitously-retailed alternative to fossil fuels in light road transportation: ethanol from sugar cane. Perhaps unsurprisingly, the uptake of flexible-fuel vehicles (FFVs) has been tremendous. Five years after their introduction, FFVs accounted for 90% of new car sales and 30% of the circulating car stock. The researchers provide a stylized model of the sugar/ethanol industry which incorporates substitution by consumers, across ethanol and gasoline at the pump, and substitution by producers, across domestic regional, and export markets for ethanol and sugar. The researchers argue that the model stands up well to the empirical co-movement in prices at the pump in a panel of Brazilian states. The paper offers a case study of how agricultural and energy markets link up at the very micro level.

## *Making Data Matter for Transportation Decision Making*

Joseph L. Schofer

Joseph L. Schofer addressed the USDOT's Research and Innovative Technology Administration on making data matter for transportation decision-making. In his talk, Schofer explained that decision making for projects large and small may be becoming more complex and nuanced, and the role of data and information is more important than ever in an age of multiple challenges, diverse goals, and severe resource constraints. He also described decision processes, the factors affecting the role of objective

information, and the relative importance of values, ideology, data and expert advice. Additionally, Schofer identified challenges and opportunities in situations where decisions get ahead of the data, along with the merits of combining visionary decision-making and data analysis. The channels and barriers between data and decision makers were also outlined, and some strategies for success in the contemporary market for transportation information were presented.



# Human Performance in Transportation Safety

## *Spatiotemporal Cues for Tracking Multiple Objects Through Occlusion*

S. L. Franconeri, Z. W. Pylyshyn, B. J. Scholl

As we move about the world, and objects in the world move relative to us, objects constantly move in and out of view as they are occluded by other objects. Given such disruptions, how does the visual system maintain attention on objects of interest? The research team used a multiple object tracking task (Pylyshyn & Storm, 1988) to explore the

spatiotemporal cues used to track objects through occlusion. Observers tracked four target objects moving among four identical distractor objects, as all objects frequently passed behind static vertical occluders. Across three experiments, the team manipulated the way that objects behaved under occlusion, and observed the effect on tracking performance. When an object passes behind an occluder, the observer must link the preocclusion object to the postocclusion object across a brief disappearance. There are at least two major spatiotemporal features that could be important for making this link. First, the location where the object first disappears might be critical. When an item becomes occluded, a "marker" could be placed at the location where the object disappeared (the marker might also be placed on the expected location of the object's reappearance, based on an

extrapolation of the object's path). When an object disoccludes near this marker, it could signal the object's link to the original object. Additionally, the history of the object's motion could be an important feature that could be used to link the two views of the object across the disruption. A similar angle of disocclusion may be important for establishing this link.

Furthermore, it may be expected that that the object disocclude on the opposite side of where it occluded. Across three experiments, the researchers tested whether each of these cues was used to link two views of an object across an occlusion. In Experiment 1, objects exited the occluders at the "wrong" location along the occluder's edge (the object reappeared either 2 or 4 object diameters higher or lower than expected). If the linking of the preocclusion object

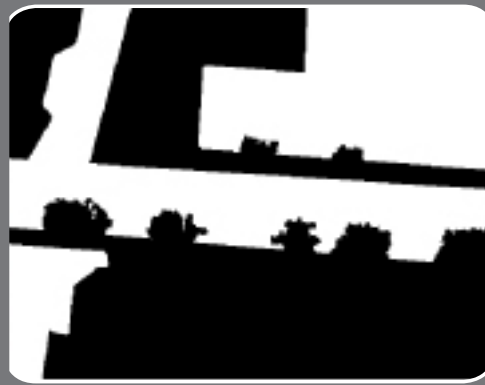
to the postocclusion object requires a marker of the location of the object's disappearance, then increasing this distance should impair performance. In Experiment 2, objects exited the occluders at the "wrong" angle (by turning either 30 or 60 degrees under the occluder). If the pre- and postocclusion objects are linked by matching the new trajectory to the old, then larger angle deviations should lead to a greater impairment in performance. In Experiment 3, objects exited the occluders at the "wrong" side (by either bouncing or reversing direction). If the process linking the pre- and postocclusion objects also relies on a representation of which side of the occluder an object should reappear, then these manipulations should also impair performance.

### ***A Structural Model Of Safety And Safety Regulation in the Truckload Trucking Industry***

Ian Savage

This paper models public policies to improve safety within a structural model of the truckload trucking industry. The policies are designed to ameliorate the market failures associated with the myopic ignoring of crash costs by some trucking firms, and institutional constraints that prevent full internalization of the costs of crashes. The paper compares two alternative public policies: (1) levying post-crash fines and making shippers bear secondary liability for damages incurred in crashes, and (2)

imposition of a minimum safety standard, in conjunction with a requirement to hold insurance, and assessing penalties for non-compliance with the standard.



## **Systems Operations**

### ***iTRAC Wireless: Intelligent Compression of Transportation Video for Wireless Networks***

Aggelos Katsaggelos, Sotirios Tsaftaris

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 or the analysis that will follow at the control center. As a result, the quality of the data may be low for viewing purposes, or as the principal investigators' past research in vehicle tracking has shown the tracking accuracy and efficiency using such video may be severely limited.

In 2009-2010, as part of the CCITT iTRAC project the principal investigators (PIs) developed a system 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 [1, 2, 3, 4]. iTRAC focused on developing

video processing and compression algorithms that minimized the bandwidth requirement of links between remote and central nodes, allowing on average the use of 90% less bandwidth than existing state-of-the-art video compression systems. Such a dramatic drop in bandwidth requirements leads to the dramatic reduction of ubiquitous system deployment costs by allowing the use of low cost wireless links rather than dedicated wired links currently in use.

The reduction in bitrate available through the use of iTRAC technology is particularly attractive for cellular infrastructure and can allow the adoption of automated transportation surveillance on a previously unfeasible scale. However, transmission of video over lossy channels,

such as cellular networks, presents its own a unique set of challenges to account for possible data loss, especially when the video in question is intended for tracking. The PIs propose to develop iTRAC Wireless, a system leveraging the gains from iTRAC while improving upon them by introducing algorithms to specifically deal with the unique challenges of lossy cellular networks in the context of automated tracking.

***Implementation and Evaluation of Weather Responsive Traffic Estimation and Prediction System***  
Hani Mahmassani

NUTC is conducting a study with the FHWA under a subcontract to SAIC, Inc. to show the value of incorporating weather effects in traffic modeling software, and how combining weather forecasts with traffic prediction can help operating agencies in weather-related traffic management.

The objective of the project is to develop a framework and procedure for implementing and evaluating weather-responsive traffic management (WRTM) strategies using Traffic Estimation and Prediction System (TrEPS). In a recently completed FHWA-funded project, the NUTC team developed and tested a methodology for incorporating weather impacts in off-line TrEPS. This capability is now included in on-line TrEPS (i.e., DYNASMART-X), which interacts with multiple sources of local real-time information, to provide operators with predicted traffic states under the current and future weather conditions. The main purpose is to support the decision making process for addressing the disruptive effect of inclement weather on the traffic system.

The project entails applying these tools in four different locations. The team is working in conjunction with operating agencies in these regions interested in improving traffic management in case of bad weather. After building the networks, the methodology is configured to run with real-time traffic data (e.g. from loop detectors or RTMS sensors). The methodology will then be used to evaluate the effectiveness of different weather-related traffic management strategies in that area. The networks selected include Salt Lake City, UT, New York’s Long Island Expressway Area, Chicago, IL and Irvine, CA. A successful implementation would ultimately lead to a TrEPS installation that is “always on”, up to date and adaptively calibrated to address a range of weather conditions and scenarios, retrievable on demand by local operating agencies through a scenario manager.



Salt Lake City Network - Speed



Salt Lake City Network - Queue Length

# Sponsored Research Highlights 2010-11

## Active Research Projects Through NUTC 2010-11

### **Ed Colgate**

-Haptic Interface for Vehicular Touch Screens (USDOT-CCITT)

### **Irina Dolinskaya**

-Integration of Real-Time Mapping Technology in Disaster Relief Distribution (USDOT-CCITT)

### **Pablo Durango-Cohen**

-Career: An Integrated Framework for Infrastructure Management (National Science Foundation)

### **Bret Johnson**

-Tier II University Transportation Center: Center for Commercialization of Innovative Transportation Technologies (with Hani Mahmassani) (USDOT)

### **Aggelos Katsaggelos**

-iTrac Wireless: Intelligent Compression of Transportation Video for Wireless Networks (USDOT-CCITT)

### **Diego Klabjan**

-Information System for Infrastructure Deployment in Support of Future Vehicles (USDOT-CCITT)  
-Truckload Sourcing and Pricing (with Hani Mahmassani) (Echo Global Logistics)

### **Hani Mahmassani**

-Incorporating Reliability Performance Measures in Operations and Planning Modeling Tools (Strategic Highway Research Program, with Delcan Corp.)  
-Effectiveness of Innovative Speed Enforcement Techniques in Illinois (Illinois Department of Transportation)  
-Clearview Font in Traffic Signs: Assessing IDOT Experiences & Needs (Illinois Department of Transportation)  
-Implementation and Evaluation of Weather Responsive Traffic Estimation and Prediction System (Science Applications International Corporation/FHWA)  
-Technical Support for Transportation Operations Research and Development (Science Applications International Corporation/FHWA)

-Uses of Mobile Data for Weather Responsive Traffic Management (Science Applications International Corporation/FHWA)

-Analysis of Network and Non-Network Impacts Upon Traveler Choice (Science Applications International Corporation/FHWA)

-Strategy for a Roads & Transport Research Center (RTRC) Workshop (Ministry of Transport, Kingdom of Saudi Arabia)

-Determinants of Industrial Space Demand (Center-Point Properties)

### **Yu (Marco) Nie**

-Toward More Reliable Mobility: Improved Decision Support Tools for Transportation Systems (National Science Foundation)

-Develop Travel Reliability Inventory for Highway Networks (Illinois Department of Transportation)

-Providing Reliable Route Guidance: Phase III (USDOT-CCITT)

### **Karen Smilowitz**

-Decision-Making Tools For Distribution Networks In Disaster Relief (USDOT-CCITT)

### **Fred Turek**

-Integrating the Crew Endurance Management System (CEMS) with Anchor Sleep/Nap Strategies to Reduce Fatigue and Risk on Towing/Barge Vessels (American Waterways Operators)

### **Semyon Vaynman**

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

# Special Research Events

## 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.



## 2010 William O. Lipinski Symposium

The 2010 William O. Lipinski Symposium, held in November at Northwestern University, focused on the challenges and opportunities facing public transit in Chicago, in the Midwest, and nationwide. Attendees participated in a full day of presentations, panel discussions and question and answer sessions with national and international transportation leaders and experts. Former US Representative William O. Lipinski's opening remarks strongly underscored the financial need facing public transit: "If we don't get an infusion of money on the state and federal level, mass transit is going to crumble. Not only in northeastern Illinois, but throughout this nation." His assertion was echoed by many presenters in the morning session.

At the Symposium NUTC Director Hani Mahmassani discussed new technologies and concepts available to enhance the travel experience of transit users, including sensor technologies that track vehicle location, systems to deliver real time information to users, and strategies to integrate highway and transit services to provide seamless travel. He urged participants that "the idea is to think mobility, not just transit."

Other speakers included ITI Director Joseph Schofer; US Representatives Peter DeFazio (D-OR) and Daniel Lipinski (D-IL); Richard Rodriguez, President of the Chicago Transit Authority; William Tupper, Acting Director of Metra; Thomas J. Ross, Executive Director of Pace; and Kristi LaFleur, Executive Director of the Illinois State Toll Highway Authority; Dr. Robert Peskin of AECOM; Glen Weisbrod, president of Economic Development Research Group, Inc.; Phillipe Payen, Chief Strategy Officer of Veolia Transport, Illinois Rep. Michael Madigan (D-22nd Dist.), House Deputy Republican Leader Timothy Schmitz (R-49th Dist.), Illinois Senate President John J. Cullerton (D-6th Dist.), and Illinois Senate Republican Leader Christine Radogno (R-41st Dist.)



Director Hani Mahmassani at 2010 Lipinski Symposium

# Special Research Events

## Aviation Symposium: The Future for Aviation

NUTC hosted a special Aviation Symposium on April 5, 2011, focusing on important aviation industry topics -- technical, operational, and managerial.

The symposium was organized in honor of Dr. Aaron Gellman, Professor of Transportation at Northwestern University and former Director of the Transportation Center, who celebrated his eightieth birthday in 2010. The symposium's purpose was to honor and recognize Dr. Gellman's significant contributions to the Transportation Center and the transportation industry during his long and distinguished career.

The symposium program featured highly distinguished speakers and covered a full range of aviation-related topics ranging from advances in airport infrastructure to meeting challenges in airline operations to innovative applications of technology for aircraft construction and maintenance. Topics and speakers are listed below.

"Air Traffic Management – the Path To Success" Neil Planzer, Vice President – Global ATM Solutions, The Boeing Company

"New Technologies in Airframe and Engine Development" Hans Weber, President, TECOP International, Inc.

"Use of Systems Data for Preventative Maintenance" John B. Maggiore, Program Manager, Airplane Health Management, The Boeing Company



**CDA Commissioner Rosemarie Andolino presents award to Professor Aaron Gellman**

"The Air Freight Market" Carl W. Asmus, Vice President, International Market Development, FedEx Services

"Airline Alliances and Joint Ventures: What's in it for Me" Perry A. Cantarutti, Senior Vice President Europe, Middle East and Africa, Delta Air Lines, Inc.; Robert Gordon, Professor of Economics, Northwestern University

"O'Hare and Midway: Preparing for the Future" Rosemarie S. Andolino, Commissioner, Chicago Department of Aviation

Christopher Seher, Director of Aviation Security & Safety for Applied Research Associates, served as symposium moderator.

The event was attended by over 150 transportation and aviation professionals, academics, students and government representatives. Professor Gellman was given a standing ovation at the conclusion of the program, following several testimonials referencing his contributions to the aviation industry.

## First Congress of the Transportation Development Institute

Director Hani Mahmassani and Associate 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 NUTC research collaborator, 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. Director Mahmassani also served as the co-chair for the committee on "Transportation Operations and Safety." NUTC 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 strategy.

# International Technical Assistance: Ministry of Transport, Kingdom of Saudi Arabia

The Northwestern University Transportation Center, in collaboration with SETS, an international architecture and engineering firm based in Beirut, Lebanon, is engaged with the Ministry of Transport (MoT) in the Kingdom of Saudi Arabia (KSA) in an effort to envision, design, and implement a national Roads and Transport Research Center (RTRC) for the KSA. The RTRC is intended as a world-class research entity that augments existing research capabilities in the Kingdom to address national issues such as congestion, safety, and unique environmental conditions, and achieve recognition as a regional and international center of transportation knowledge and expertise. As part of the project, NUTC and SETS jointly organized with the MoT a RTRC strategy workshop for transportation researchers and stakeholders. On December 7, 2010 in Riyadh, Saudi Arabia, approximately seventy participants from the MoT, government and military agencies, academic institutions, and transport research centers joined SETS, NUTC and NUTC's expert academic partners for the Roads & Transport Research Center Strategy Workshop.

At the strategy workshop, Engineer Mohammad Aazam from the MoT and Dr. Isam Kaysi from SETS and the American University of Beirut kicked off the workshop and outlined the mission

and vision and study approach and potential programming for the RTRC. NUTC Director Hani Mahmassani then provided an overview of international transport research practices and research center parameters, including ownership, stakeholders, funding and business models, and research portfolio composition. Dr. Imad Al-Qadi from the University of Illinois at Urbana Champaign, Dr. Fred Mannering from Purdue University, and Associate Director Bret Johnson on behalf of Dr. Joseph Schofer from Northwestern University provided international perspectives on transportation research activities in the areas of pavements and materials (Al-Qadi), safety (Mannering), and policy and planning (Johnson). Following a discussion of a proposed RTRC operating model by Dr. Mahmassani, Engineer Hathloul Al-Hathloul from MoT and Engineer Fadi Darwish from SETS led an open discussion with stakeholders. A Strategy Workshop summary report on these topics, including a proposed strategy for RTRC and next steps toward implementation, was subsequently presented to the MoT in March 2011.

NUTC remains engaged in this exciting project, focusing on matters of organizational structure, governance, research conduct, knowledge transfer, and definition of strategic research directions, as well as the conceptual design of the physical facilities and laboratories.



# NUTC Hosts 7th Annual Interuniversity Symposium on Infrastructure Management

In June, NUTC hosted the 7th Annual Interuniversity Symposium on Infrastructure Management (AISIM). The symposium's purpose was to advance infrastructure management technologies through information exchange and conversations. The informal forum allowed graduate students and their faculty to share their infrastructure management research findings with one another. Participating universities included Northwestern University, University of California at Berkeley, Georgia Institute of Technology, University of Arkansas, Iowa State University, University of Delaware, University of Waterloo, University of Texas at El Paso, and Air Force Institute of Technology.

The symposium was student-led, and participating students shared research on multiple aspects of asset and infrastructure management in the form of poster or oral presentations. Faculty members and industry colleagues attended and made contributions through questions, comments, and discussions. Two PhD candidates advised by NUTC faculty affiliate Pablo Durango-Cohen presented research at the conference. PhD candidate Weizeng Zhang shared research from work with his advisor Pablo Durango-Cohen on "The Application of Hidden Markov Models and Clusterwise Linear Regression in Pavement Performance Prediction," and fellow PhD candidate Yikai Chen presented on "Statistical Process Control in Structural Health Monitoring: A Case Study on the Hurley Bridge."



PhD Candidate Weizeng Zhang presents at AISIM

# Research Highlights

## Clearview Font in IL: Assessing IDOT Experiences and Needs

The Clearview font was developed in the 1990's as an alternative to the standard "Highway Gothic" font of the 1940s. Lab studies have shown Clearview is more legible than Highway Gothic at certain distances and speeds, meaning drivers experience less strain when reading signs and have more opportunity to react. NU's study seeks to understand whether these lab results hold true on actual freeways via online and intercept surveys of drivers in Illinois. In the process of producing deliverables for IDOT, NU researchers have developed a field and user survey technique to give IDOT and other state DOTs a framework for studying their highway signs and user response.



Using GPS trackers, researchers have geocoded about 50% of the highway signs in the state and used them to identify appropriate survey locations. The goal of the survey is to answer some questions about the nature of sign use in today's world: how do drivers perceive and interpret information while driving, and how much information do drivers extract from highway signs? Understanding how drivers use signs when they can rely on GPS navigation, personal experience, and maps printed from online will inform agencies about where they should direct their resources to move drivers more effectively across networks.

## Speed Enforcement Project

In addition to the mobility costs of highway traffic, motor vehicle crashes impose a significant societal cost on the public. Recent studies estimate that crash costs are even higher than congestion costs. Speeding and speeding related issues are known as one of the most important factors that increase the likelihood of vehicular crashes. To address this problem, different states implement different methods to keep the roadways safe. Among the several methods to influence driver behavior and enforce highway laws, police patrolling and enforcement is the most common strategy. Subsequently, the Illinois Department of Transportation (IDOT) selected NUTC to study and identify effective and efficient methods of police enforcement.

An analysis of ten years of highway crash data revealed several high-risk locations in the state of Illinois. As part of the study, NU researchers designed an enforcement survey to analyze implementation issues and results of common enforcement strategies. The goal of the survey is to recognize accurate (effective and efficient) enforcement strategies for different traffic conditions, and help IDOT and the Illinois State Police better prevent roadway traffic crashes. The final goal of the study is to evaluate the effectiveness of the best-practice police enforcement methods on reducing crash rates throughout the entire state highway system, in particular the high-risk locations identified at the outset of the study.





Courtesy George Hamlin

## NUTC Researchers Present Data on Chicagoland Pedestrian-Rail Fatalities to City of Lake Forest, Illinois

In June, findings on pedestrian-rail fatalities were presented by Northwestern University Transportation Center (NUTC) researchers to City of Lake Forest, Illinois, government officials. The findings came from a study analyzing six years worth of pedestrian-rail fatality data (2004-2010) covering all six counties of the Chicagoland area. The research was motivated by a discussion at NUTC's Pedestrian-Rail Safety Symposium conducted in June 2010 in partnership with the City of Lake Forest. The City of Lake Forest invited the research team to present the new data in response to the City's alarming number of pedestrian-rail fatalities in recent years.

NUTC faculty affiliate and economics professor Ian Savage and transportation and logistics minor undergraduate student Ken Fuller presented to Lake Forest Police Chief Joe Buerger, City Clerk Cathryn Buerger, and NUTC Sandhouse Gang Moderator Norman Carlson. The team's presentation included geographic data on recent local pedestrian-rail fatalities and how Lake Forest compares to other communities in the Chicagoland area. The researchers found that stations on certain Metra lines, including the Union Pacific North and Milwaukee District North lines that run through Lake Forest, have higher risks than other Chicagoland lines. The investigation considered three groups of pedestrian fatalities that occurred along commuter rail routes: 1) suicides, 2) non-suicidal deaths occurring at stations and crossings, and 3) non-suicidal deaths not occurring at stations and crossings (also referred to as trespassers).

The researchers' further examination of fatalities at or around certain stations confirmed the City of Lake Forest's suspicions that its stations have a high number of fatalities as compared to those of other local communities. Prior to this study, the city could only rely on anecdotal evidence. The presentation also gave insight into which nearby communities have succeeded in reducing their pedestrian-rail fatalities. With the information provided by the NUTC research team, the City of Lake Forest will be better equipped to make decisions on potential physical upgrades to stations and learn from local communities.

# Business Advisory Committee



## About the Business Advisory Committee

Since its inception in 1954, the Northwestern University Transportation Center has maintained strong ties with industry through its Business Advisory Committee (BAC). The BAC consists of industry executives from a wide variety of firms and organizations involved in providing, procuring and/or supporting transportation, logistics, and supply chain operations. Membership includes senior-level executives from shipper and carrier firms, freight-forwarders, equipment and technology

suppliers, trade associations, financial organizations, and management consulting firms. The Center’s industry connections link the Northwestern community to challenging problems as well as to opportunities to learn and test solutions in real world settings. Members serve as advisors to the Center, providing important insights into the transportation-related issues and problems they face in their businesses. Unequaled by any academic transportation advisory board in the country, the BAC has long been a major force behind the Center’s success.

Four distinct levels of membership are established – Leadership, Sustaining, Individual, and Associations. Each category carries with it a set of membership benefits, as well as a suggested



level of commitment and financial support for NUTC's research, education, and outreach activities.

Benefits to all members include access to Northwestern's world-class faculty, opportunities for networking with industry peers, invitations and involvement in special programs and events, insights into cutting-edge research and industry trends, discounted tuition fees for NUTC's executive programs, and access to Northwestern's renowned Transportation Library and its bright student population.

The BAC meets twice yearly on the Evanston campus to foster an exchange of ideas among its members and the Center faculty, staff, and students. The meetings are designed to explore areas of interest and relevance to the BAC member companies. Each meeting features working sessions, panel discussions, and speaker presentations, as well as opportunities for more informal networking and exchange. The spring meeting is scheduled to coincide with the Annual Patterson Transportation Lecture, named for William A. "Pat" Patterson, former president and CEO of United Airlines, lifetime trustee of Northwestern University, and co-founder of the Transportation Center.

## Fall 2010 Meeting

The Fall meeting of the Business Advisory Committee began with an evening presentation by Dr. Stephen Flynn, President of the Center for National Policy. Dr. Flynn, author, commentator, and national advisor on numerous policy matters outlined how to advance the case for designing, investing in, and constructing "The Next Generation Infrastructure." Dr. Flynn noted that renewing the nation's infrastructure is a pressing imperative that must be addressed if the US is to strengthen its economy and national security while protecting the environment and improving the quality of life for Americans. He stressed that ignoring this imperative puts the nation in jeopardy of decline, unforeseen threats and cascading consequences.

The BAC meeting Agenda the following day featured a welcome by McCormick School of Engineering and Applied Science Dean, Julio Ottino and the introduction of Northwestern University President, Morton O. Schapiro, to the BAC.

Center Director, Hani Mahmassani, followed with his report to the BAC members on the "State of the Center." Mahmassani highlighted a number of initiatives and programs sponsored by the Center over the 2009-2010 academic year including key international and national partnerships and strategic outreach events focused on public policy issues. He also reported on the Center's increased research activity, noting that there were twenty-two research projects underway at the Center during 2010 totally in excess of \$4 million dollars. Another high point of the year was the addition of a number of new companies and members to the BAC and several new affiliated faculty to the Center's research team.

The meeting featured a Panel on U.S. Freight Policy led by Associate Dean, Joseph Schofer, which examined the need for an official National Freight Policy; how such a national freight policy might impact the transportation system and enhance economic development; and the role of government and business in setting the policy. Panel Speakers included:

James C. LaBelle, Vice President, Chicago Metropolis 2020  
Paul Nowicki, Assistant Vice President, Government & Public Policy, BNSF  
Daniel Murray, Vice President, Research, American Transportation Research Institute (ATRI)

Noted Northwestern economics professor, Robert Gordon, provided an in depth analysis and update on the economic environment, focusing on the recession and resulting high unemployment. He compared the current recession to past recessions, offering reasons for its severity and outlined the many factors that contributed to it. He also provided a list of causes for the continuing weak recovery and examined the impact of the Obama Stimulus program and the federal debt on the recovery and what impact these factors may have on the transportation sector.

The day's program ended with reports by Transportation Center affiliated faculty offering insights into several of their transportation-related research projects including:

Dirk Brockmann, Associate Professor, Engineering Sciences and Applied Mathematics  
Novel Perspectives on Human Transportation and Mobility

Networks”

Wei Chen, Wilson-Cook Professor of Engineering Design,  
Mechanic Engineering

“Incorporating Consumer Heterogeneity in Choice Modeling of  
Advanced Vehicles”

Diego Klabjan, Associate Professor, Industrial Engineering and  
Management Science

“Carbon Footprint Accounting in Logistics”

# Spring 2011 Meeting

Justin Zubrod, BAC Chair, opened the April 6th meeting recounting the highlights of the first day of BAC-related activities including the very successful Aviation Symposium, “The Future for Aviation” and the Annual Patterson Transportation Lecture featuring President and CEO of United Airlines, Jeffery Smisek. The special Aviation Day events attracted a large contingency of aviation enthusiasts and practitioners from academia, business, and government, including many alumni of NU transportation-related programs. (Both events are covered in other sections in the progress report.)

McCormick School of Engineering Dean, Julio Ottino, was on hand to welcome the BAC members and thanked them for their interest, support and engagement with the MCC Transportation Center. The meeting was then turned over to the Vice President of Research, Jay Walsh, who provided the members with an overview of University research initiatives and priorities. He offered high praise for the growth and breadth of research activity under director Hani Mahmassani, noting the key role that industry partnerships play in the success of the Center’s research program.

Opening the next segment of the meeting focusing on Supply-Chain Trends, Innovations and Opportunities, Kellogg Associate Professor of Managerial Economics and Decision Science, Gad Allon, provided insights into what is being taught in the Kellogg classroom to MBA students to equip them with the tools needed to access the trade-offs between near-shore or offshore sourcing decisions. He introduced one such tool, the Global Dual Sourcing Game, which is used in the classroom to provide students with exposure to complex real-world scenarios faced by supply-chain managers making sourcing decisions.

Building on the topic of supply-chain management, the meeting next featured a Panel on “Enabling Market Growth: Reinventing Supply Chain Partnerships and Collaborations as a Key to Success.” The panel was moderated by Steven Rothberg, Managing Partner for Mercator International. Panelists included:

- Steve Holic, Supply Manager for Philips Electronics N.A. Forwarding & Distribution and Senior Director of Philips General Purchasing
- Marie Therese Houde, Director, Business Development, Canadian National Railway
- Douglas Gray, International Operations Manager, Caterpillar Logistics

The panel members each focused on the role that partnerships and collaborations played in their company’s global supply-chain strategy and market growth. Holic described Philips’ Vision 2015 plan, its goal being to move from cost driven to value driven physical distribution. In her presentation on “Partners in Innovation,” Ms. Houde outlined CN’s ground breaking supply chain agreements with port and terminal operators and showed how these partnerships served to improve transit times and customer satisfaction. Doug Gray described CAT Logistics’ international transportation process, noting the complexity of it compared to domestic shipments. He provided insights into how CAT merged order, shipment and transportation event data into a single platform – creating a powerful enabler for international supply chain operations.

Next the BAC membership were treated to a stimulating and highly technical presentation by Materials Science Professor Gregory Olson who explained the complex processes developed to test the design, structure, performance and properties of CyberSteels and bring these steels to the marketplace. His presentation showcased the innovation taking place in the university laboratory and highlighted the value of such work as it is utilized in the real world.

Professor Mahmassani delivered his “Director’s Report” recapping the Center’s many initiatives and accomplishments achieved since the fall 2010 meeting. He noted the success of the three Transportation Executive Education programs which were held in September and October of 2010. The successful delivery of these programs marked the Center’s return to providing executive management programs to the transportation industry. He was also pleased to report on the continuing growth of the Center’s research portfolio and the increased direct involvement of BAC companies in research projects, a continuing goal for improving value-added interactions to our BAC members and their firms.

The final meeting presentations focused on the “Reauthorization of the Transportation Bill and other Legislative Issues impacting the Transportation Industry.” Newly installed Eno Transportation Foundation President, Joshua Schank, presented an insightful and in-depth look at the inner workings of the Washington legislative process, outlining many of the key issues which were on the table and waiting for congressional action. He was joined by UPS Vice President, Tom Jensen who provided a sampling of the myriad surface transportation legislative and regulatory issues impacting UPS operations.

# Business Advisory Committee

## New Members

### New Leadership Members



Mr. Alberto Aleman Zubieta  
Administrator & CEO, Panama Canal Authority (ACP)



Mr. Keith Creel  
Chief Operation Officer  
Executive VP  
Canadian National Railway



Mr. Gene Seroka  
President, Americas  
APL Limited

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### New Sustaining and Association Members



Mr. Daniel W. Avramovich  
Chairman & CEO  
Pacer  
International, Inc.



Mr. Farrukh A. Bezar  
Partner  
Clarendon  
Consulting Group



Mr. Andrew Boyle  
Executive Vice  
President & CFO  
Boyle  
Transportation



Mr. Michael Broaders  
VP, Regional Field  
Operations  
Product Supply,  
Coca-Cola



Mr. Perry A. Cantarutti  
Senior VP  
Europe, Middle East  
and Africa  
Delta Air Lines, Inc



Mr. Bruce Carlton  
President & CEO  
National  
Industrial  
Transportation  
League (NITL)



Mr. Lee A. Clair  
Partner  
Norbridge, Inc.



Mr. Neil Collins  
Managing Partner,  
Transportation &  
Logistics  
Heidrick & Struggles  
International, Inc.



Mr. Edmund J. Feeley  
Managing Director  
Littlejohn & Co.



Mr. Andrew Fox  
President  
Chicago South  
Shore &  
South Bend  
Railroad



Mr. Eli Gross  
Managing Director  
Morgan Stanley



Mr. Howard Hayes  
Vice President  
Navteq Traffic



Mr. Christopher P. Jones  
Vice President Sales,  
North America  
Airbus America  
Sales, Inc.



Mr. Michael M. Mullen  
Chairman,  
Co-founder  
CenterPoint  
Properties



Mr. Steven Rothberg  
Founding Partner  
Mercator  
International, LLC



Mr. Joshua L. Schank  
President & CEO  
Eno Transportation  
Foundation, Inc.



Mr. John M. Smith  
Chairman of the  
Board  
CRST International



Mr. Jeff A. Starecheski  
VP Logistics Services  
Sears Holding  
Corporation

## Leadership Members



Mr. Alberto Aleman Zubieta  
Administrator & CEO, Panama Canal Authority (ACP)



Ms. Susan Bee  
Managing Partner  
Teradata



Mr. Doug Cook  
VP, International Planning & Engineering  
FedEx Express



Mr. Keith Creel  
Chief Operation Officer  
Executive VP  
Canadian National Railway



Mr. Charles R. Eisele  
Senior VP  
Strategic Planning & Administration  
Union Pacific



Mr. Edward Jenkins  
Assistant VP,  
E-Business & Marketing  
CSX Transportation



Dr. Robert E. Martinez  
VP, Business Development  
Norfolk Southern Corporation



Mr. Paul E. Nowicki  
Assistant VP,  
Government & Public Policy  
BNSF Railway Company

## Sustaining Members



Dr. Allen Adler  
VP, Enterprise Technology, Strategy  
Engineering Operations & Technology  
Boeing



Mr. Tom Anderson  
Senior Vice President,  
Services and Customer Support  
Airbus



Mr. Daniel W. Avramovich  
Chairman & CEO  
Pacer  
International, Inc.



Mr. Farrukh A. Bezar  
Partner  
Clarendon  
Consulting Group



Mr. Andrew Boyle  
Executive Vice President & CFO  
Boyle  
Transportation



Mr. Michael Broaders  
VP, Regional Field Operations  
Product Supply,  
Coca-Cola



Mr. Marc Bumgarner  
VP Planning & Acquisitions  
Matson Integrated Logistics



Mr. Edward A. Burkhardt  
Founder, President  
Rail World, Inc.



Mr. Reggie Dupré  
CEO  
Dupré Logistics, LLC



Mr. Edmund J. Feeley  
Managing Director  
Littlejohn & Co.



Mr. Andrew Fox  
President  
Chicago South Shore & South Bend Railroad



Mr. Eli Gross  
Managing Director  
Morgan Stanley



Mr. James L. Hamilton  
Managing Director  
Transportation  
Investment Banking  
J.P. Morgan & Co.



Mr. Robert W. Hart  
VP and Managing Director,  
Surface  
Transportation  
Fifth Third Bank



Mr. Howard Hayes  
Vice President  
Navteq Traffic



Mr. John Hellman  
President, CEO  
Genesee & Wyoming, Inc.



Mr. D. Stephen Menzies  
Group President  
Trinity Rail  
Trinity  
Industries, Inc.



Mr. Thomas Morrison  
Director  
Transportation Operations  
W. W. Grainger, Inc.



Mr. Michael M. Mullen  
Chairman,  
Co-founder  
CenterPoint Properties



Mr. Dennis Nash  
President, CEO,  
Director  
Kenan Advantage Group, Inc.



Mr. Aurelio Pérez Alonso  
Assoc. Director, CFO  
Grupo ADO  
S.A. De C. V.



Dr. Craig E. Philip  
CEO  
Ingram Barge Company



Mr. Clifford Porzenheim  
Senior VP  
Strategic Growth  
GATX Corporation



Mr. James P. Rankin  
President, CEO  
Air Wisconsin  
Airlines Corporation

## Association Members



Mr. Rick D. Blaugen  
President, CEO  
Council of Supply Chain Management Professionals (CSCMP)



Mr. Bruce Carlton  
President & CEO  
National Industrial Transportation League (NITL)



Gov. Bill Graves  
President, CEO  
American Trucking Associations (ATA)



Mr. Edward Hamberger  
President, CEO  
Association of American Railroads (AAR)



Mr. William Millar  
President  
American Public Transportation Association (APTA)



Mr. Joshua L. Schank  
President & CEO  
Eno Transportation Foundation, Inc.



Mr. Charles B. Lounsbury  
Former Senior Vice President  
Ryder System, Inc.



Mr. Eugene F. McCormick  
Partner  
McCormick Jahncke Group



Ms. Linda J. Morgan  
Partner  
Nossaman, LLP



Mr. Dennis P. Neumann  
Chairman  
BNY Capital Funding, LLC



Mr. David J. Rohal



Mr. James A. Ründe  
Special Advisor  
Investment Banking Division  
Morgan Stanley



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David Scott Consulting, LLC



Mr. Andy Sze  
Founder  
Fastraxx Group, LLC



Mr. Lester M. Passa  
VP, Strategic  
Planning  
CSX Corporation



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Senior VP  
Government Affairs  
American  
Airlines, Inc.



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Rose  
Chairman & CEO  
BNSF Railway Co.



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Corporate  
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and Africa  
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Transportation &  
Logistics  
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Supply Manager,  
Senior Director  
General Purchasing  
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Mr. Mike Malik  
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Transportation Man-  
agement Systems



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Transportation  
Practice  
Oliver Wyman



Mr. John M. Smith  
Chairman of the  
Board  
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Dev., Supply Chain  
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Mr. Jeff A.  
Starecheski  
VP Logistics Services  
Sears Holding  
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Accenture



Mr. Douglas R.  
Waggoner  
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Maritime Group, LLC



Ms. Vicki Bretthauer  
Independent  
Consultant



Mr. James H.  
Burnley IV, Esq.  
Partner  
Venable, LLP



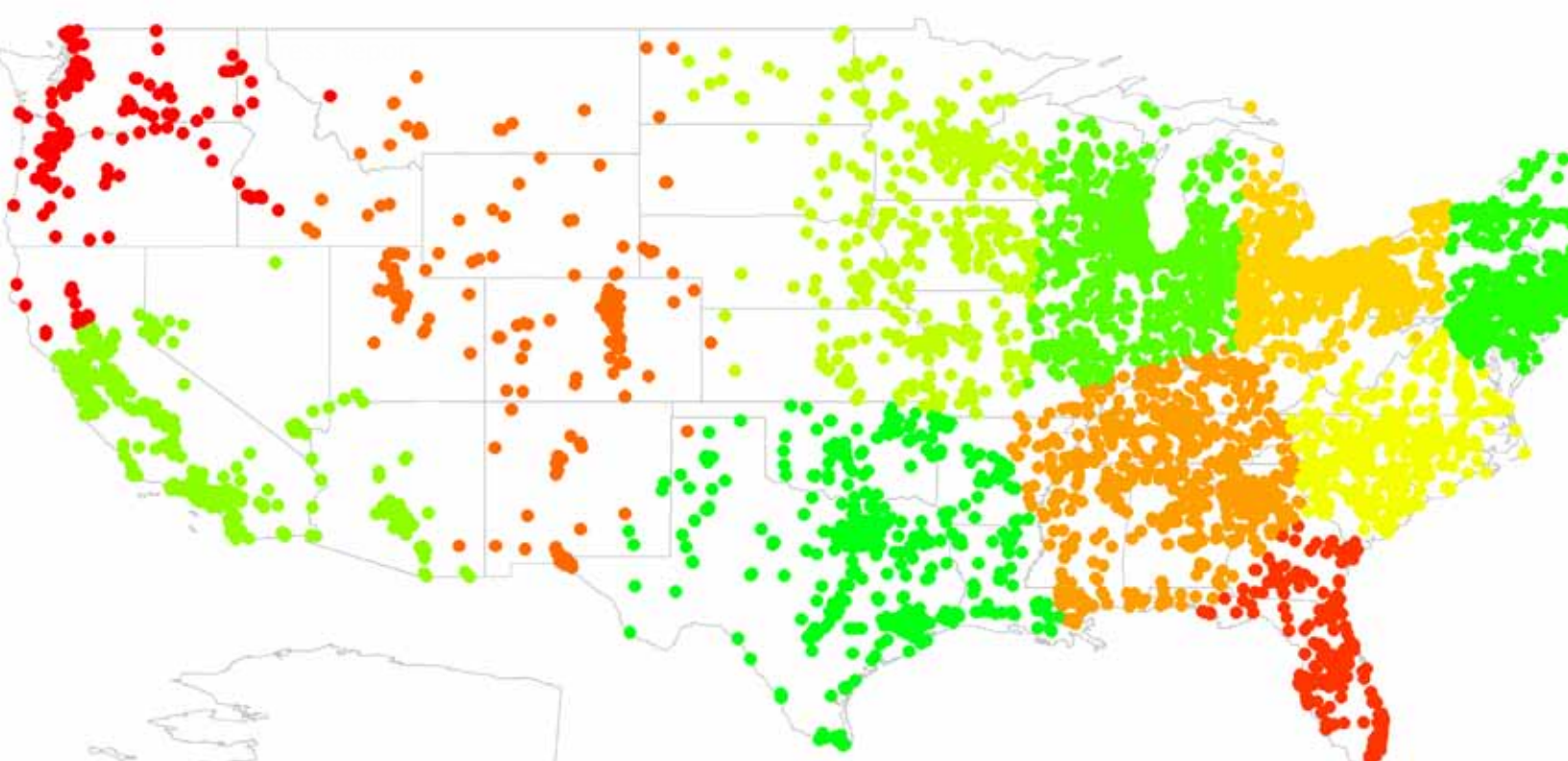
Mr. Norman Carlson  
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Hickman  
Managing Partner  
Transportation  
Management Group



Mr. Tim Krauskopf  
Founder  
Round Lake Freight



# Industry Focused Research

NUTC is committed to engaging industry, notably the companies represented on the Business Advisory Committee (BAC), in relevant, innovative research. The opportunity to conduct such research requires effective communication with industry partners through proactive outreach, critical listening, innovative thinking, patience, trust, and relationship building, among other factors. NUTC strives to embrace these characteristics as it engages its BAC partners and other valuable and important companies, agencies, and research institutions.

The Center has continued its practice of hosting technical “knowledge exchanges” with several companies, including BAC Member companies. We actively host these information and idea sharing forums and also travel to corporate locations to get a firsthand look at technical, operational, and management challenges. In some instances NUTC hosts multiple sessions, often at both the home of NUTC in Evanston, and our industry part-

ner’s site. Notable exchanges have occurred this past year with Centerpoint Properties, Echo Global Logistics, LAN Airlines, Rand McNally, Sensys, Teradata, and TrafficCast. The Center’s ultimate goal is to define a unique research project with each company or a broader based research initiative that may attract the support of multiple companies.

Over the last year, NUTC has initiated and completed research projects supported by our BAC companies, including Boeing, Centerpoint Properties, Echo Global Logistics, Ingram Barge, Philips, and Norfolk Southern. Other industrial partners who have recently provided support are Boeing, CH2M Hill, Coyote Logistics, FedEx Express, General Motors, Ryder System, Sabre Holdings, United Airlines, and UPS.

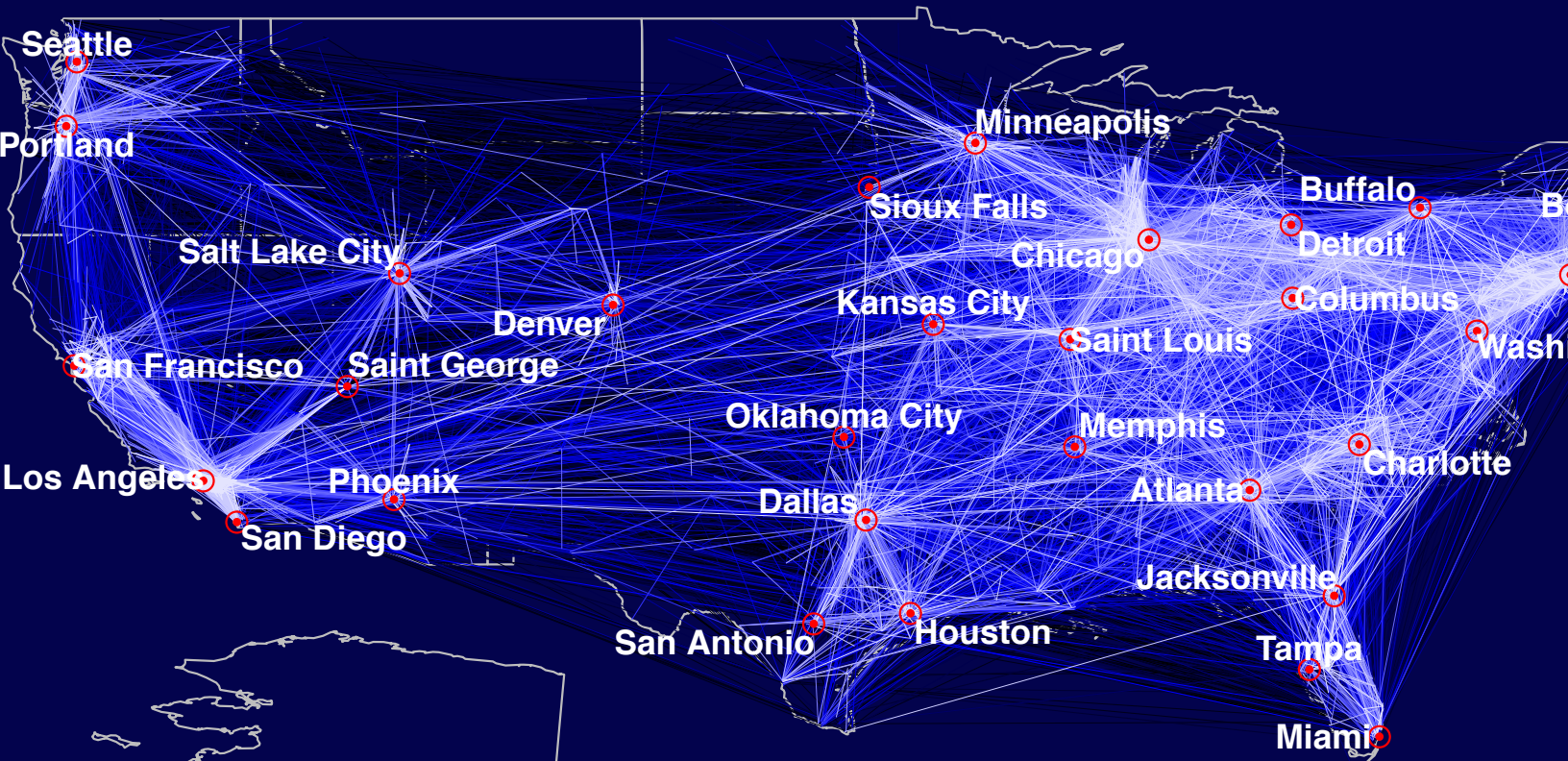


**Centerpoint Properties** – Emerging population centers and shifting patterns in the movement of goods have spurred a reassessment of logistics and supply chain strategies in academia and industry alike. Distribution channels are increasingly complex and time-sensitive as businesses increasingly operate within a global context. A particular topic that has gained much interest is the connection between land use and the flow of intermodal containers through metropolitan areas. Metropolitan areas are important because they contain potential consumer and labor markets, as well as the transportation facilities necessary to maintain global supply chains. An examination of the factors influencing metropolitan industrial real estate demand is important to developing real estate investment strategies and understanding their effect on supply chains. Therefore, an extensive econometric analysis of over 20 years of data on demand for industrial real estate in



NUTC-Teradata Knowledge Exchange





the largest markets in the US was conducted by Director Hani Mahmassani and civil engineering graduate student Christopher Lindsey. The study investigated and proved that demand for industrial real estate can be captured by econometric models using macroeconomic, demographic, and transportation-related explanatory variables.



**Echo Global Logistics** - Director Hani Mahmassani and Professor Diego Klabjan are leading a research study on the use of archived transactional data in conjunction with real time predictive analytics for truckload pricing and carrier load matching. The objective is to

examine the extent to which the vast amount of transaction data collected by third party shipping intermediaries can be used by sales agents in a real time environment to improve pricing, carrier selection, and decision making.



**Norfolk Southern** – With funding from CCITT, an information system for gang scheduling was developed in participation with Norfolk Southern, based upon

fundamental decision support techniques developed by Professor Diego Klabjan and his graduate students and post-doctoral researchers. Railways employ several “gangs” of track maintenance workers throughout the year to maintain a good state of repair of the system. The goal of this project was to develop a decision support system for budget allocation that will enable the efficient scheduling of gangs at the tactical and operational level. Through an intuitive and user-friendly interface, the maintenance schedulers have options in giving preferences to specific

items (tasks, travel budgets, safety priorities, etc.) prior to the output of an optimized maintenance schedule.



**Phillips** – Phillips funded a project to measure and report CO2 emissions associated with shipments throughout Philip’s North American supply chain. This effort is part of a new focus of companies and researchers to quantify emissions from all parts of a business, including manufacturing, transportation, and service operations. Primary challenges of the study involved collecting data from a large group of independent shippers and carriers, and applying appropriate methodologies to this data to calculate CO2 emissions. Northwestern also provided Phillips with recommendations for improvements and mitigation strategies for future emissions reporting, including standardization of data collection, incorporating the multi-modality of shipments, and promoting fuel-based emissions calculations. Madison Fitzpatrick, PhD candidate in Civil and Environmental Engineering, is leading the effort to develop best-practice standards throughout the supply chain for Phillips and others, under guidance of Professor Pablo Durango-Cohen.



## Industry Workshop

# Greening of Transportation 2: Sustainability via Alternative Fuels

The October 2010 industry workshop, presented by the NUTC, CCITT and the Initiative for Sustainability and Energy at Northwestern (ISEN), featured speakers from influential US firms and government agencies sharing their best practices in deploying alternative fuels. The event was an excellent opportunity to learn the status of and barriers to the adoption of several alternative fuels. Across several modes of transportation, the discussion considered the underlying economics, financial risks, and technical and infrastructure challenges standing in the way of wide scale implementation. After opening remarks from ISEN Director Bridget Calendo and NUTC Associate Director Johnson, speakers at the event included: Mike Ellis, President, EA Logistics – “Use of Biofuels and Hybrid Trucks in Logistics Operations;” Donald G. Hillebrand, Director, Center for Transportation Research, Argonne National Lab – “Research on Alternative Fuels at Argonne;” Joshua C. Milberg, First Deputy Commissioner, Chicago, Department of Environment – “Chicago Area Alternative Fuel Strategy: Moving In the Future;” Keshav Sondhi, Chief Engineer, FedEx – “Electrification of Transportation;” and Bob Sturtz, Managing Director Strategic Sourcing-Fuel, United Airlines – “Aviation’s Quest for Sustainable Biofuels.” NUTC affiliated faculty member Diego Klabjan moderated the closing discussion and question and answer session.

# Executive Education

The Northwestern University Transportation Center is well-known in the area of executive education, having offered a regular series of non-degree executive program courses for transportation and logistics professionals throughout most of its history. Developed for professionals engaged in and committed to the transportation and logistics fields, the courses provide exposure to a full range of management techniques and decision-making skills. The purpose of these programs is to provide industry participants with the necessary skills needed to function effectively and excel in the increasingly competitive global transportation and logistics business environment. All NUTC Executive Programs offer a rigorous and comprehensive educational experience and are taught by leading authorities in the field.

## Coping with Carbon: Sustainable Strategies for the Transportation and Logistics Enterprise

September 14-16, 2010

As the first executive program of 2010, "Coping with Carbon" was a great success. Participants learned from leading experts about carbon emissions and transportation. Topics included the importance of carbon emissions to transport and logistics, the rationale and means of carbon emissions regulation, cap-and-trade and carbon tax-based regulation, and alternative uses of carbon-derived public funds in a broad policy context.

Program faculty included Aaron Gellman, Professor of Transportation, Northwestern University; Thomas Cushing, former Senior Vice President, Chicago Climate Exchange (CSX); Clarke Caywood, Professor of Integrated Marketing Communications, Northwestern University; David Dana, Professor of Law, Northwestern University; Theodore Prince, Principal, T. Prince & Associates; and Ian Savage, Associate Chair of Economics and Distinguished Senior Lecturer, Northwestern University; Charlie Kuehmann, President and CEO, QuesTek Innovations, LLC; Gail Lobin, Vice President, APCO Worldwide; and James Rekoske, Vice President/General Manager, Renewable Energy and Chemicals UOP, LLC.



## Freight Transportation: Strategies for a Changing Landscape

October 12-14, 2010

NUTC's executive freight transportation course generated wide interest, and its popularity led to a second freight course planned for 2011. Attendees benefited from sessions on a variety of issues related to freight transportation. Topics included the current global freight and marketplace size, scope, and complexity; customers' perspective on emerging trends and needs in logistics; and how to apply analytics in freight transportation.

Faculty included Farukh Bezar, Partner, Clarendon Consulting Group; Lee Clair, Partner, Norbridge Consultants; Aaron Gellman, Professor of Transportation, Northwestern University; Diego Klabjan, Associate Professor of Industrial Engineering and Management Sciences, Northwestern University; Hani Mahmassani, William A. Patterson Distinguished Professor of Transportation, Professor of Civil Engineering, and Northwestern University Transportation Center Director; Maciek Nowak, Assistant Professor of Information Systems and Operations Management, Loyola University Chicago; Ian Savage, Associate Chair of Economics and Distinguished Senior Lecturer, Northwestern University; Karen Smilowitz Junior William A. Patterson Professor of Transportation and Associate Professor of Industrial Engineering and Management Sciences, Northwestern University; and Justin Zubrod, Managing Partner, Justin Zubrod & Co., LLC.



## Pricing Transportation Infrastructure

October 18-20, 2010

The highly regarded Pricing Transportation Infrastructure executive program was held again in 2010 after the large interest generated by the 2009 program. Those who attended gained insight on issues that included competitive price-setting, congestion pricing, demand responsive pricing, and differential prices across users.

Faculty included Ronald Braeutigam, Associate Provost, Harvey Kapnick Professor of Business Institutions, Professor of Economics, Northwestern University; Aaron Gellman, Professor of Transportation, Northwestern University; Hani Mahmassani, William A. Patterson Distinguished Professor of Transportation, Professor of Civil Engineering, and Northwestern University Transportation Center Director; Ian Savage, Associate Chair of Economics and Distinguished Senior Lecturer, Northwestern University; and Eric Schulz, Charles Deering McCormick University Distinguished Lecturer and Distinguished Senior Lecturer in Economics, Northwestern University.



## Icarus Society

The Icarus Society provides a public forum for the discussion and dissemination of a wide range of national and international issues impacting the aviation industry. The goal of the society is to share knowledge and ideas about all things relevant to aviation today with the widest possible audience. Formed in 2006, the Society promotes in-depth dialogue about airlines, aircraft manufacturing, aviation services, technology, government oversight, and significant elements of business aviation.



## Sandhouse Gang

The Hagestad Sandhouse Gang is a railroad-oriented discussion group hosted by NUTC. The group meets monthly to explore a wide range of current rail-related issues and to link active and semi-active rail practitioners with students and academics at Northwestern and other schools. Formed in 2005, the group has nearly 300 members.

# 2010-11 Sandhouse Meetings

September 13, 2011

Carl Van Dyke & Rodney Case  
Partners

Oliver Wyman's Global Surface Transportation Practice  
Economic Consequences of Positive Train Control



Carl Van Dyke

December 9, 2011

Robert J. Gordon

Distinguished Northwestern Economist  
Economic Update of Transportation/Rail Sector



David Burns

January 1, 2011

David Burns

Railroad Industrial Engineering Consultant  
Is there a Future for the Passenger Train? Yes, No, Maybe!

February 10, 2011

Joseph Lorenzini

Chief Engineering Officer

Metra

Bridging the Next Century: An Overview of Metra Rail  
Engineering and Update on Metra Bridge Projects



Steven R. Ditmeyer

March 15, 2011

Steven R. Ditmeyer

Adjunct Professor, Railway Management Program

Michigan State University

How to Maximize the Benefits from Your Railroad's Large  
Investment in Positive Train Control

April 19, 2011

Mark Hastings

Executive Vice President

Genesee & Wyoming

Buying Railroads



Joe Shacter

April 29

Joe Shacter

Director of Public & Intermodal Transportation

Illinois Department of Transportation

Karen Hedlund

Chief Counsel

Federal Railroad Administration

Special Half-Day Sandhouse Gang Event:

The Future State of High-Speed Rail in Illinois



William C. Thompson

June 30, 2011

William C. Thompson

CREATE Railroad Program Manager

Association of American Railroads

CREATE – an Update

# NUTC Seminar Series

September 23, 2010

Elise Miller-Hooks  
Associate Professor of Civil & Environmental Engineering  
University of Maryland  
Resilience in Freight Transportation Networks

September 30, 2010

Kenneth A. Small  
Research Professor, University of California at Irvine and  
Nonresident Fellow, Resources for the Future  
Energy Policies for Passenger Motor Vehicles

October 14, 2010

Bin Ran  
Professor of Civil & Environmental Engineering  
University of Wisconsin at Madison  
Application of Cellular Probe Data in Transportation Planning,  
Operations and Management

October 21, 2010

Marshall Lindsey  
Transportation Center Dissertation Year Fellow  
PhD Candidate, Chemical & Biological Engineering  
Northwestern University  
Location, Vehicle Miles of Travel, and the Environment: A Chi-  
cago Case Study

October 28, 2010

Ram M. Pendyala  
Professor of Transportation Systems  
School of Sustainable Engineering  
Arizona State University  
A Joint Tour-Based Discrete-Continuous Model of Vehicle Type  
Choice and Tour Length

November 11, 2010

Ivan Damnjanovic  
Assistant Professor, Construction Engineering & Management  
Group  
Department of Civil Engineering  
Texas A&M University  
Pricing Risks in Delivery and Management of Transportation  
Assets

November 30, 2010

Terry Friesz  
Harold and Inge Marcus Chaired Professor of Industrial  
Engineering  
Pennsylvania State University  
Differential Games on Networks: Dynamic Traffic Assignment and  
Other Applications

December 17, 2011

Sergio Jara-Díaz  
Professor, Civil Engineering  
Universidad de Chile  
Optimal Design and Pricing of Public Transport

January 6, 2011

Richard Sobel  
Visiting Scholar, Buffet Center for International and Comparative  
Studies  
Ramon L. Torres  
PhD Candidate, Transportation Engineering  
Northwestern University  
The Right to Travel: Intersection with the Right to Privacy and a  
Personal Liberty

January 20, 2011

Alberto Salvo  
Assistant Professor, Management and Strategy  
Kellogg School of Management  
Consumer Choice between Gasoline and Sugarcane Ethanol

February 3, 2011

Eric J. Miller  
Director, Cities Centre  
Professor, Civil Engineering, University of Toronto  
Agent-Based Modeling for Integrated Transportation – Land Use  
Policy Analysis

March 3, 2011

Hamed Alibabai  
PhD Candidate, Transportation Engineering  
Transportation Center Dissertation Year Fellow  
Northwestern University  
Sensitivity of Path Travel Time to Path Flow

March 10, 2011

Jeroen Struben  
Assistant Professor, Strategy & Organization  
Desautels Faculty of Management  
McGill University  
Transition Strategies for Alternative Transportation Fuels and  
Vehicles

April 7, 2011

Juan Carlos Muñoz Abogabir  
Visiting Professor at MIT  
Associate Professor, Transport Engineering and Logistics  
Pontificia Universidad Católica de Chile (PUC)  
What Services Should You Operate in a Bus Corridor? and What  
Can We Achieve in Time Savings, Reliability and Comfort if Prop-  
erly Controlled?

April 14, 2011  
Xing Wu  
PhD Candidate, Transportation Engineering  
Transportation Center Dissertation Year Fellow  
Northwestern University  
Modeling Heterogeneous – Taking Behavior in Route Choice: A Stochastic Dominance Approach



**Carolina Osorio**

April 21, 2011  
Carolina Osorio  
Assistant Professor, Civil & Environmental Engineering  
MIT  
A Simulation-Based Optimization Framework for Urban Traffic Control



**Alberto Salvo**

May 5, 2011  
Max Donath  
Director, Intelligent Transportation Systems Institute  
Professor, Mechanical Engineering  
University of Minnesota  
Driver Assist Technology: Deploying Bus Rapid Transit along a Narrow Lane or Road Shoulder

May 12, 2011  
Zitao (Arthur) Zhang  
PhD Candidate, Transportation System Analysis and Planning Program  
Transportation Center Dissertation Year Fellow  
Northwestern University  
Capacity Investment & Pricing Decisions in Highway Public-Private Partnerships



**Jereon Struben**

May 19, 2011  
Patrice Marcotte  
Professor and Acting Director  
Computer Science and Operations Research Department  
University of Montreal  
A Strategic Model of Assignment on a Transportation Network with Rigid Capacities

June 2, 2011  
Elaine Croft-McKenzie  
PhD Candidate  
Transportation Center Dissertation Year Fellow  
Northwestern University  
A Framework for Sustainable and Strategic Decision Making Using Economic Input-Output Life Cycle Assessment (EIO-LCA), Including Applications to the Transit Bus Fleeting Problem



**Sergio Jara Diaz**



**Elise Miller-Hooks**

# Transportation Research Board Conference

More than twenty-five Northwestern University Transportation Center (NUTC) faculty members and students shared research findings at the 2011 Transportation Research Board (TRB) Annual Meeting in Washington, D.C. The 2011 spotlight theme was “Transportation, Livability, and Economic Development in a Changing World” and the conference drew nearly 11,000 transportation professionals from around the globe.

NUTC had a strong presence at the 2011 TRB Meeting. NUTC faculty affiliates, researchers, and students organized and chaired sessions, led panel discussions, conducted workshops, presented papers, and gave poster presentations on a variety of transportation-related research. Presentation topics included network modeling, driver behavior, data and information innovations for researchers, and operations and traffic management. NUTC faculty and research affiliates presenting at TRB were David Boyce, Jing Dong, Kay Geary, Frank Koppelman, Hani Mahmassani, Marco Nie, Roberto Sarmiento, Joe Schofer, Surendra Shah, and Kuilin Zhang. NUTC students presenting at TRB were Hamed Babai, David Baumgartner, Charlotte Frei, Samer Hamdar, Michael Huang, Lan Jiang, Jiwon Kim, Emily Kushto, Omer Verbas, Alireza Talebpour, Xing Wu, and Zitao Zhang.

NUTC also hosted its annual TRB Reception and Alumni Reunion. The popular event attracted more than 400 guests and was one of the largest reception events at TRB. NUTC’s 400 guests were members of NUTC’s expansive network of transportation professionals representing industry, academia, and government.



NUTC Reception



David Baumgartner (right) presents at TRB



Tim Sweda (left) receives CCITT Student of the Year Award from Associate Director Bret Johnson



Emily Kushto, Meead Saberi, David Baumgartner, and Jiwon Kim



# William A. Patterson Lecture

On April 5, 2011, Jeffery A. Smisek, President and Chief Executive Officer of United Continental Holdings, Inc. delivered the 30th Annual Patterson Transportation Lecture to an audience of over 300 enthusiastic students, faculty, alumni, transportation professionals and members of the public.

In his talk, “The New United: Flying to Win in a Changed Industry,” Smisek outlined the changes which have taken place at United following the merger with Continental Airlines, making United the world’s largest airline. He addressed the many issues that the company has had to face, including rising oil prices, tough competition, changing customer preferences and ever-present government regulation. Though these issues proved challenging, Smisek confidently assured the audience that United was extremely well positioned for the future as it follows its “Go Forward Plan” to benefit employees, customers, shareholders and communities around the world.



**Jeffery A. Smisek, President and CEO of United Continental Holdings, delivers the 2011 Patterson Lecture**

## Patterson Transportation Endowment

The Annual Patterson Transportation Lecture Series is supported by the William A. Patterson Transportation Endowment which was established in 1978 as the intellectual focal point for transportation research and education at Northwestern. It is named in honor of the late William A. Patterson, former president and CEO of United Airlines, lifetime trustee of Northwestern University, and co-founder of the NU Transportation Center. Center Director, Hani Mahmassani, is the current William A. Patterson Distinguished Professor of Transportation and NUTC faculty member Karen Smilowitz is the Junior William A. Patterson Professor of Transportation.



# Education

## Transportation Academic Programs

Northwestern University is recognized throughout the world as one of the premier institutions for transportation and logistics education and for the quality of its graduates. Northwestern's varied menu of interdisciplinary transportation programs at both the graduate and undergraduate level prepare students for careers in diverse fields such as transportation operations, planning, engineering, and management in the private and public sectors, government service, consulting, and academia.

Transportation academic programs at Northwestern are specialized and thorough. Program structure balances highly technical and quantitative training in the engineering and mathematical fields with theories and applications drawn from the relevant disciplines of economics, management, finance, marketing, energy, and the social sciences. Each of these programs involves rigorous coursework, opportunities for involvement in research, and exposure to real-world learning experiences in the transportation industry.

### Undergraduate

- Interdisciplinary Minor in Transportation and Logistics

The minor is available to all Northwestern students, and its graduates benefit from an interdisciplinary approach to transportation and logistics education. Core courses come from the departments of Economics, Civil and Environmental Engineering, and Industrial Engineering and Management Sciences.

### MS/PhD

- MS and PhD in Transportation Systems Analysis and Planning
- MS and PhD in Industrial Engineering and Management Sciences
- MMM program — joint Master of Engineering Management and Masters of Business Administration



# Dissertation Year Fellowships

A primary goal of the Northwestern University Transportation Center is to promote academic excellence and quality research among its transportation students involved in graduate programs across campus. In support of this commitment, each year NUTC offers a number of Dissertation Year Fellowships to outstanding PhD candidates conducting thesis research on transportation, logistics, or supply-chain topics.

Dissertation Year Fellowships include full or partial funding to cover three quarters of tuition and a stipend for selected students during their final year of study.

## 2011-12 NUTC Dissertation Year Fellowship Recipients

### Laurence Audenaerd

Program: Transportation Systems Analysis, Civil and Environmental Engineering  
Faculty Advisor: Joseph L. Schofer

### Guy Arie

Program: Management and Strategy, Kellogg School of Management  
Faculty Advisor: Jeroen Swinkles

### Yang Liu

Program: Transportation Systems Analysis, Civil and Environmental Engineering  
Faculty Advisor: Yu "Marco" Nie

## 2010-11 NUTC Dissertation Year Fellowship Recipients

### Hamed Alibabai

Program: Civil and Environmental Engineering  
Dissertation Title: "Properties of Simulated Path Travel Times"  
Faculty Advisor: Hani Mahmassani

### Elaine Croft McKenzie

Program: Civil and Environmental Engineering  
Dissertation Title: "An EIO-LCA Framework for the Development of Sustainable Transportation Infrastructure"  
Faculty Advisor: Pablo Durango-Cohen

### Chan Seng Pun

Program: Industrial Engineering and Management Sciences  
Dissertation Title: "Analytics for Airline Revenue Management and Irregular Operations"  
Faculty Advisor: Diego Klabjan

### Xing Wu

Program: Civil and Environmental Engineering  
Dissertation Title: "Routing and Traffic Assignment in Stochastic Networks"  
Faculty Advisor: Yu (Marco) Nie

### Zitao Zhang

Program: Civil and Environmental Engineering  
Dissertation Title: "Analysis of Public-Private Partnerships in Transportation Infrastructure Investment and Management"  
Faculty Advisor: Pablo Durango-Cohen

# 2010-11 Student Awards Highlights

### Charlotte Frei

Greater Chicago Women's Transportation Seminar Leadership Legacy Scholarship

### Ken Fuller

Containerization & Intermodal Institute Scholarship, 2011

### Jiwon Kim

Greenshields Best Paper Award Prize (shared with Hani Mahmassani), Committee on Traffic Flow Theory and Characteristics

### Chris Lindsay

Eno Leadership Development Conference Attendee, Eno Transportation Foundation  
The Journal of Commerce Scholarship, Containerization & Intermodal Institute

### Yang Liu

The International Transport Forum Annual Summit Poster Scholarship  
Kuhmo Nectar Summer School in Transportation Economics Scholarship  
Terminal Year Fellowship, Northwestern University

### Bill Pun

History of Containerization/BYSA Scholarship, Containerization & Intermodal Institute

### Meead Saberi

Student Fellowship, 19th International Symposium on Transportation and Traffic Theory

### Luis de la Torre

Global Container Terminals Scholarship, Containerization & Intermodal Institute

### Arthur Zhang

International Road Federation (IRF) Fellowship, IRF Terry L. Priest Scholarship, Denver Foundation Fellowship in Leadership, Center for Leadership, Northwestern University  
TCI - Annual Valedictorian, Transportation Clubs International

# Community

## New Academic Year Boat Cruise

In September 2010 NUTC hosted a private boat cruise on the Chicago River to welcome new and continuing students to the academic year. New transportation students were introduced and networked with NUTC ongoing students and faculty.



## Holiday Party

In December, following the seminar given by Dr. Sergio Jara-Diaz, NUTC celebrated the holiday season with faculty, students, alumni, and staff.



## Annual End of the Year Picnic

In June NUTC celebrated the accomplishments of the 2010 academic year with its annual picnic. Guests included NUTC faculty, colleagues, students, friends, and family.



## NUTC Movie Night

2010-11 marked the beginning of NUTC's "Movie Nights." Students took a break from studying to enjoy Chicago-themed movies like "Chicago - The Musical" and "Blues Brothers."



## Social Media

### LinkedIn

With over 300 members, the NUTC LinkedIn group is a dynamic medium to engage the NUTC community. Along with showcasing upcoming NUTC events of interest, the NUTC LinkedIn Group allows its members to engage in transportation and logistics discussions with fellow members.

To join the NUTC LinkedIn Group, visit [transportation.northwestern.edu](http://transportation.northwestern.edu).



### Facebook

NUTC has two presences on Facebook, an NUTC Fan page and an NUTC Community Group page. Everyone has the option to "Like" the NUTC Fan page and receive important information on upcoming events and news of interest. The NUTC Community Group page is a special forum for close members of the NUTC community to keep in touch with one another. Unlike the NUTC Fan page, members of the Group page must be accepted.

To join NUTC on Facebook, visit [transportation.northwestern.edu](http://transportation.northwestern.edu).



## Kellogg Transportation Club

In 2010-11 the Kellogg Transportation Club continued its work of engaging students in the airline, aerospace, railroad, ocean shipping and logistics (supply chain) industries. The Kellogg Transportation club aims to raise student awareness and provide resources related to management opportunities with companies in these industries. Additionally, the club informs students about employment and recruiting opportunities and plans student events throughout the academic year.

# Organization



**Hani Mahmassani**  
Director

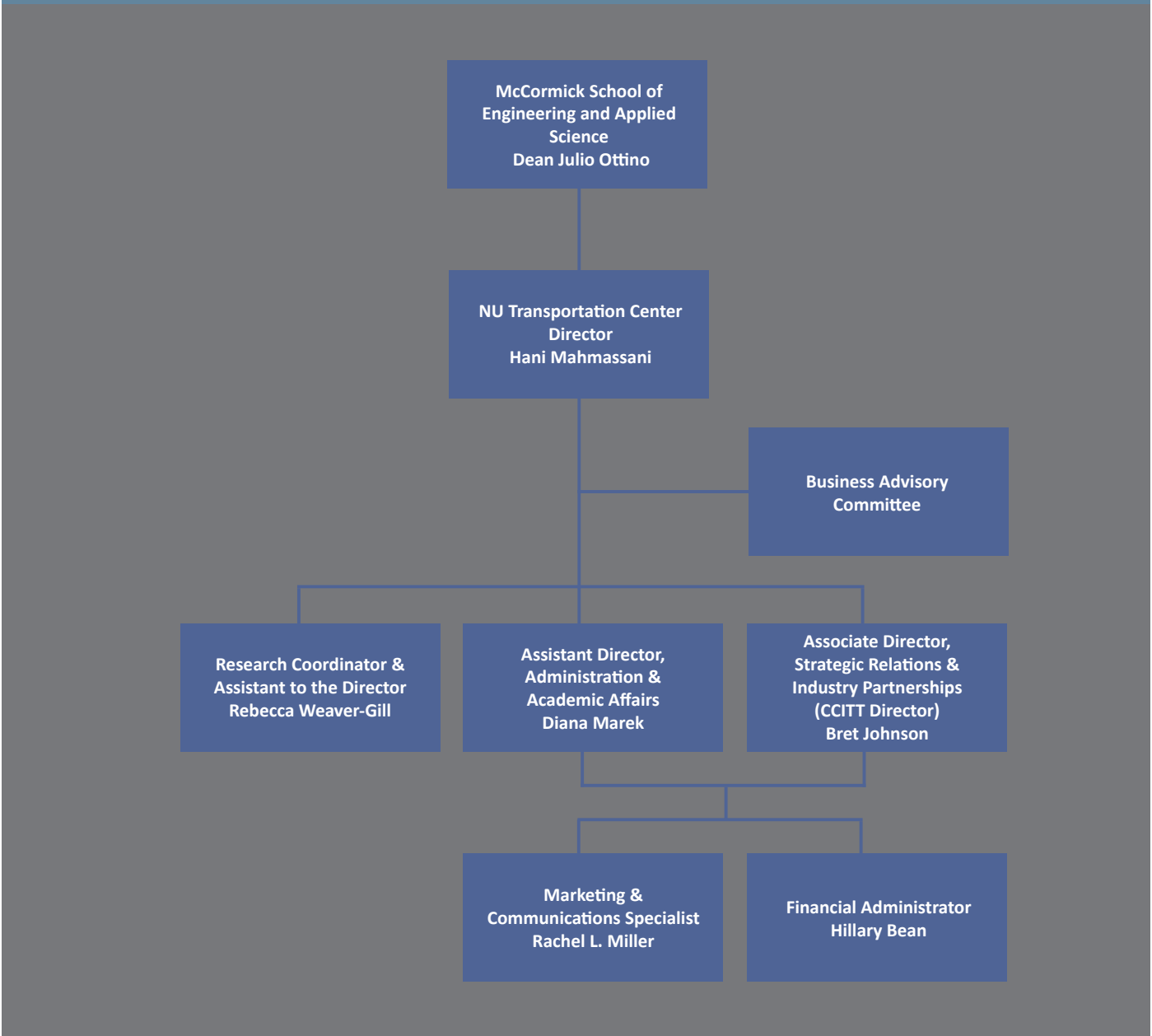
**Bret Johnson**  
Associate Director

**Diana Marek**  
Assistant Director

**Rebecca Weaver-Gill**  
Research  
Coordinator

**Rachel L. Miller**  
Communications  
Specialist

**Hillary Bean**  
Financial Manager



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President

Daniel I. Linzer  
Provost

Jay Walsh  
Vice President of Research

Julio Ottino  
Dean of McCormick School of  
Engineering and Applied Science

**NUTC 2010-11  
Progress Report**

**[transportation.northwestern.edu](http://transportation.northwestern.edu)**

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**NORTHWESTERN  
UNIVERSITY**