INTELLIGENT TRANSPORTATION SYSTEMS & TRANSPORTATION INFRASTRUCTURE

This report on MIT research prepared by MIT’s Industrial Liaison Program profiles selected faculty and research experts, research programs and centers, research projects and related papers and events in the areas of Intelligent Transportation Systems and Transportation Infrastructure. This survey captures information dated between 2008 and January 2010.

For more information, please contact MIT’s Industrial Liaison Program at +1-617-253-2691.

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INTELLIGENT TRANSPORTATION SYSTEMS & TRANSPORTATION INFRASTRUCTURE

MIT CENTER FOR TRANSPORTATION AND LOGISTICS (CTL)
Director: Yossi Sheffi, Professor of Engineering Systems and Civil and Environmental Engineering, http://cee.mit.edu/sheffi

Research: The MIT Center for Transportation & Logistics is the world’s leading center for research in supply chain management and logistics. The Center’s world-renowned research programs spans every aspect of supply chain management and directly involves over 75 faculty and research staff from a wide range of academic disciplines, as well as researchers in various affiliate organizations around the world.
More at... http://web.mit.edu/ctl/www/

CTL: Intelligent Transportation Systems Program (ITS)
Principal Investigator: Prof. Moshe Ben-Akiva, Edmund K Turner Professor of Civil and Environmental Engineering

Intelligent Transportation Systems (ITS) refers to transportation systems which apply emerging hard and soft information systems technologies to address and alleviate transportation congestion problems. For example, using advanced surveillance systems, the early stages of a traffic bottleneck situation can be detected, and traffic can then be directed to other routes to mitigate the congestion and to provide faster and more efficient routes for travelers. New technologies enable this type of surveillance and guidance response to occur in real time, and therefore, to allow potential congestion situations to be addressed before they develop into serious traffic jams. More at... http://mit.edu/its/index.html

CTL-ITS Research Project Descriptions: http://web.mit.edu/its/research.html

CityMotion: Data Fusion for Mobility Consumers, Providers, and Planners
Project Dates: December 2007 - December 2010

This project focuses on the development of a knowledge infrastructure, computational models, and user applications that allow access to real-time information about the state of transportation-related resources as well as predictions regarding their future state. A pilot service that exemplifies the usage potential of available data will be provided to citizens for making public transportation more efficient and pleasant to use and to policy-makers as a decision-support tool. The ITS lab is involved in developing a model-based data fusion engine (with simulation capabilities) that models a particular transportation network along with the behavior of travelers within it.
SCUSSE: Smart Combination of Passenger Transport Modes and Services in Urban Areas for Maximum System Sustainability and Efficiency

Project Dates: November 2007 - June 2010

The project aims to conceive, organize and simulate the implementation of new smart transport modes and services to optimize integration with lifestyles, and also with already existing individual and collective transport. For this, three levels of decision (strategic, tactic and operational) will be approached covering the institutional design required for the regulatory environment, network planning focusing on productive efficiency as well as efficiency in consumption, and enforcement and performance monitoring at the operational level. Performance assessment at the strategic level will also be developed. The ITS lab is involved in the modeling and simulation of these innovative modes and services. A stated preferences survey has been designed and will be used to collect data on users' preferences for these modes and services. DynaMIT and MITSIMLab are also being modified to add congestion pricing simulation capabilities.

SOTUR: Strategic Options for Integrating Transportation Innovations with Urban Revitalization

Project Dates: October 2007 - July 2010

The project aims to define innovative solutions with sufficient economic power of attraction for private investment that may simultaneously contribute to urban development patterns that leverage innovative transportation solutions and contribute, overall, to more sustainable urban development patterns. A particular focus of the work will be on the revitalization of urban districts in areas with low availability of street space.

Investigation of Traffic Congestion and Speed Reduction in London

Project Dates: June 1, 2008 - January 1, 2010

MIT will conduct a two-phase research plan to investigate the causes of traffic speed reductions and delays in London. The first phase will involve assembling data from multiple sources, processing the available data, performing initial econometric and traffic behavior analysis using the integrated data and identifying future data requirements and research directions. The second phase will include: extension of the econometric analysis, development of detailed driving behavior models and microscopic traffic simulation studies for selected sub-networks.

Collaborative development of dynamic traffic simulation models for Beijing

Project Dates: April 16, 2008 - January 15, 2010

Research: Beijing's rapidly increasing traffic congestion has led the BTRC to undertake a project to develop dynamic traffic simulation models to analyze and predict traffic congestion. MIT will assist BTRC by providing its DynaMIT and MITSIMLab software, and modify these traffic simulators to better represent the traffic behavior in Beijing. MIT will also work collaboratively with BTRC to design new data collection, develop new behavioral models, perform calibration, and apply the models to study traffic congestion in Beijing.
CTL-ITS MITSIMLab

http://mit.edu/its/mitsimlab.html
http://mit.edu/ITS/MITSIMLabOSnew.html -- Open Source MITSIMLab

MITSIMLab is a simulation-based laboratory that was developed for evaluating the impacts of alternative traffic management system designs at the operational level and assisting in subsequent design refinement. Examples of systems that can be evaluated with MITSIMLab include advanced traffic management systems (ATMS) and route guidance systems. MITSIMLab was developed at the MIT Intelligent Transportation Systems (ITS) Program. Professor Moshe Ben-Akiva, Director of the ITS Program at MIT, and Dr. Haris Koutsopoulos, from the Volpe Center, were co-principal investigators in MITSIMLab's development. Dr. Qi Yang, of MIT and Caliper Corporation, was the principal developer. More at... http://mit.edu/its/mitsimlab.html

CTL-ITS DynaMIT

DynaMIT is a state-of-the-art, real-time computer system designed to effectively support the operation of Advanced Traveler Information Systems (ATIS) and Advanced Traffic Management Systems (ATMS) at a Traffic Management Center (TMC). Sponsored by the Federal Highway Administration (FHWA), with Oak Ridge National Laboratories (ORNL) as the program manager, DynaMIT was the result of several years of intense research and development by the Massachusetts Institute of Technology Intelligent Transportation Systems Program... More at http://mit.edu/its/dynamit.html

CTL-ITS Master's Theses, Recent Examples

Development and Test of Dynamic Congestion Pricing Model
by Xu, Shunan; February, 2009

Measuring and Modeling Activity and Travel Well-Being
by Abou-Zeid, Maya; September, 2009
http://web.mit.edu/its/Papers/PhD%20Thesis_Maya%20Abou-Zeid.pdf

More at... http://web.mit.edu/its/publications.html

CTL: New England University Transportation Center (UTC)

Dr. Joseph F. Coughlin, Director, AgeLab and New England University Transportation Center,
http://esd.mit.edu/Faculty_Pages/coughlin/coughlin.htm

The nationwide University Transportation Centers program was created in 1987 by the US Department of Transportation to attract the nation’s best talent to the study of transportation. It established ten university transportation centers, one each in the ten standard Federal regions, to provide a national resource for research and education in both freight and passenger transportation. MIT is the lead university in Region One, where the UTC program is administered through the New England University Transportation Center. More at... http://utc.mit.edu/
Examples of Research Projects by MIT faculty:
http://utc.mit.edu/current-research-projects-year-22-31 [abstracts/descriptions at this link]

Project No. MITR22-1
Capturing Wellbeing in Activity Pattern Models Within Activity-Based Travel Demand Models
Prof. Moshe Ben-Akiva

Project No. MITR22-2
Caregiver Information Search Behavior for Alternative Transportation
Dr. Joseph Coughlin

Project No. MITR22-5
Linking Mileage to Auto Accident Risk and Urban Form
Prof. Joseph Ferreira Jr.

Project No. MITR22-6
Evaluation of a Natural Speech Based Informational Inquiry System as a Potential Means to Increase Transit Utilization
Dr. James Glass

Project No. MITR22-7
Individual Differences in Peripheral Physiology and Implications for the Real Time Assessment of Driver State
Dr. Bryan Reimer

Project No. MITR22-8
Transportation Strategy Development Under Economic Uncertainty
Prof. Joseph Sussman

INTELLIGENT TRANSPORTATION RESEARCH CENTER (ITRC)
Microsystems Technology Laboratories
Director: Dr. Ichiro Masaki, http://www-mtl.mit.edu/researchgroups/itrc/ITRC_people/masaki.html

The Intelligent Transportation Research Center (ITRC) focuses on the key Intelligent Transportation Systems (ITS) technologies, including an integrated network of transportation information, automatic crash & incident detection, notification and response, advanced crash avoidance technology, advanced transportation monitoring and management, etc., in order to improve the safety, security, efficiency, mobile access, and environment. There are two emphases for research conducted in the center: the integration of component technology research and system design research, and the integration of technical possibilities and social needs...
More at... http://mtlweb.mit.edu/researchgroups/itrc/itrc.html

MIT INTERNATIONAL CENTER FOR AIR TRANSPORTATION (ICAT)

Mission: To Improve the safety, efficiency and capacity of domestic and international air transportation and its infrastructure, utilizing information technology and human centered systems analysis. More at... http://web.mit.edu/aeroastro/labs/icat/
Paper: Assuring Safety through Operational Approval: Challenges in Assessing and Approving the Safety of Systems-Level Changes in Air Transportation

by Hansman, R. John; Weibel, Roland E.

Issue Date: 2009-10-01

Abstract: To improve capacity and efficiency of the air transportation system, a number of new systems-level changes have been proposed. Key aspects of the proposed changes are combined functionality across technology and procedures and large physical scale of deployment. The objective of this work is to examine the current safety assessment processes for systems-level changes and to develop an understanding of key challenges and implications for the assessment and approval of future systems-level changes. From an investigation of current U.S. and international safety regulatory policies and processes, a general model was created describing key processes supporting operational approval. Within this model, a framework defined as an influence matrix was developed to analyze key decisions regarding the required scope of analysis in safety assessment. The influence matrix represents the expected change in levels of risk due to changes in behavior of elements of a system. It is used to evaluate the appropriate scope of analysis in safety assessment. Three approaches to performing safety assessment of systems-level changes were analyzed using the framework: the risk matrix approach, target level of safety approach, and performance-based approach. Case studies were performed using eight implemented and pending systems-level changes. In this work, challenges expected in safety assessment of future systems-level changes were identified. Challenges include the large scope of proposed changes, which drives a need for a broad and deep scope of analysis, including the multiple hazards and conditions and complex interactions between components of a change and the external system. In addition, it can be expected that high safety expectations will increase the required accuracy of models and underlying data used in safety assessment. Fundamentally new operational concepts are also expected to expand the required scope of safety assessment, and a need to interface with legacy systems will limit achievable operations. The large scope of analysis expected for future changes will require new methods to manage scope of safety assessment, and insights into potential approaches are discussed.

More at... http://hdl.handle.net/1721.1/44957

DEPARTMENT OF URBAN STUDIES & PLANNING (DUSP)

Transportation in DUSP

Lead: Prof. Christopher Zegras, Ford Career Development Assistant Professor of Transportation and Urban Planning, http://web.mit.edu/dusp/idg/people/faculty/czegras.html

Within MIT's Department of Urban Studies and Planning (DUSP), transportation serves as one of the cross-cutting research/education areas, since transportation links to all elements of DUSP's Program Groups: housing and community economic development, environment, city design, and international development. Students pursue their transportation interests from a broad range of perspectives - focusing on policy, finance, modeling, design, etc. - drawing from DUSP and broader MIT expertise in urban planning and design, public transportation infrastructure and services, intelligent transportation systems, information and communication technologies, transportation economics, airports and air transportation systems, and more... More at... http://web.mit.edu/dusp/transportation/index.html
MIT-Porugal Program (MPP)
Principal: Prof. Daniel Roos, Japan Steel Industry Professor of Civil and Environmental Engineering and Engineering Systems, http://cee.mit.edu/node/2272

The MIT-Porugal Program is an international collaboration seeking to demonstrate that an investment in science, technology and higher education can have a positive, lasting impact on the economy by addressing key societal issues through quality education and research in the emerging field of engineering systems. The program has targeted bio-engineering systems, engineering design and advanced manufacturing, sustainable energy systems, and transportation systems and as key areas for economic development and societal impact... More at... http://www.mitportugal.org/

MPP Transportation Research
The overarching focus of the MIT Portugal Program (MPP) Transportation Systems focus area is the design of complex, large-scale systems that have major societal impact and provide opportunities for sustainable economic development. The mission of the educational program of the Transportation Systems focus area is the development of a cadre of transportation researchers and professionals in Portugal who are trained at the system level in the design and management of a technology-intensive, intermodal transportation system. More at... http://www.mitportugal.org/programs/transportation.html

Integrated Systems
Research in transportation systems integration aims to provide a research and analytical platform for integrating across the other three research areas. A specific research project, for example, will provide a better understanding of how urban development might be affected, on the local and regional scale, by the various transportation services and modes being examined by ITS and high-speed rail research... More at... http://www.mitportugal.org/trans/integrated-systems.html

The Strategic Options for Integrating Transportation Innovations and Urban Revitalization
The Strategic Options for Integrating Transportation Innovations and Urban Revitalization (SOTUR) project seeks to leverage transportation innovations (including those identified in the SCUSSE and CityMotion research projects) to promote desirable urban development patterns and travel outcomes. More at... http://www.mitportugal.org/trans/transportation-innovations-and-urban-revitalization-overview.html

Intelligent Transportation Systems (ITS)
ITS is an important new component in surface transportation as introduced over the last several decades. Under ITS, one of the research projects aims to conceive, organize and simulate the implementation of new smart transportation services and modes, such as congestion and parking pricing, incident detection and speed adaptation systems, car-sharing and one-way car rentals, etc... More at... http://www.mitportugal.org/trans/its.html
**MPP Transportation Master's Course: Complex Transport Infrastructure Systems (CTIS) Program**

The Complex Transport Infrastructure Systems (CTIS) program is unique, bringing together the tradition and rigor of a Master's in Engineering with the insights of an MBA. The CTIS course builds on three key domains: engineering and project management, financing and contracts, and policy and institutions. More at... [http://www.mitportugal.org/trans/transportation-systems-masters-course.html](http://www.mitportugal.org/trans/transportation-systems-masters-course.html)

**MPP News Story: MIT Portugal Collaboration Successfully Tests Software That Could Improve Traffic Management**

January 22, 2009

As part of the MIT Portugal Program, researchers from MIT and Portugal have made progress in developing traffic simulation software that could make it easier for traffic managers to analyze road conditions and ease congestion in real time. DynaMIT, a dynamic simulator based on model-based data fusion software, enables traffic engineers to integrate and analyze data from the dizzying array of information sources that have become available as a result of the proliferation of information and communications technologies—including road sensors, electronic toll collection devices, automatic video processing, global positioning systems, mobile sensor networks and smart phones. The software, developed by CEE Professor Moshe Ben-Akiva and the MIT Intelligent Transportation Systems Lab (ITS), recently underwent a successful demonstration at Brisa, Portugal’s largest toll road management company and an industry partner on the project... More at... [http://www.mitportugal.org/latest/mit-portugal-collaboration-successfully-tests-software-that-could-improve-traffic-management.html](http://www.mitportugal.org/latest/mit-portugal-collaboration-successfully-tests-software-that-could-improve-traffic-management.html)

**International Development Group (IDG)**

Principal: Prof. Diane E Davis, Professor of Political Sociology

Formerly known as the International Development and Regional Planning (IDRP) group, the International Development Group (IDG) in the Department of Urban Studies and Planning conducts research and assists in the planning practice in countries around the world striving for social, political, and economic development. IDG faculty examines the urban, regional, and national socioeconomic impacts of major public and/or private investments, and address problems of squatter housing, municipal finance, metropolitan sprawl, and social disparities at a variety of scales. IDG faculty and students believe that effective planners operating in today's world must acquire an integrated institutional and historical view of economic, physical, political, and social factors. More at... [http://web.mit.edu/dusp/idg/](http://web.mit.edu/dusp/idg/)

**Integrated Modeling for Sustainable Metropolitan Mobility**

Principal: Prof. Christopher Zegras, Ford Career Development Assistant Professor of Transportation and Urban Planning

This project aims to develop an integrated model of land use, transportation and energy use that will enable evaluation of a range of policies and projects for reducing energy consumption in
metropolitan areas. The model will include components based on micro-simulations of both individual/household behavior and organization/firm behavior, and outputs of the disaggregate models will be translated into aggregate measures of energy and resource consumption. The approach will allow the development of a new suite of performance metrics that will enable much more effective decision making in urban settings, and will also demonstrate the value of advanced information and communication technologies for data gathering and planning applications – a key contribution to planning, given the historical difficulties in gathering and updating reliable data for such purposes. More at... http://web.mit.edu/dusp/idg/research/details/zegras-integrated.html

Public-Private Partnerships for Urban Transportation Infrastructure
Principal: Prof. Christopher Zegras, Ford Career Development Assistant Professor of Transportation and Urban Planning

Carried out for the German overseas development agency (GTZ), this research examined the possibilities and challenges for utilizing private sector concessions to develop urban transportation infrastructure in developing countries, as part of the GTZ's Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities. More at: http://web.mit.edu/dusp/idg/research/details/zegras-publicprivate.html

Assessment and Development of CDM Methodologies for the Transport Sector
Principal: Prof. Christopher Zegras, Ford Career Development Assistant Professor of Transportation and Urban Planning

As part of a larger project by Grütter Consulting for the World Bank, this project developed a methodology for utilizing the Clean Development Mechanism (CDM) for developing transportation-efficient urban development projects. The methodology was developed utilizing the Chinese city Nanchang as the case study.


The Accessibility and Development Impacts of New Transit Infrastructure: The Circle Line in Chicago
Principal: Prof. Christopher Zegras, Ford Career Development Assistant Professor of Transportation and Urban Planning

Undertaken as part of the MIT/Transit Professional Development Program’s ongoing collaboration with the Chicago Transit Authority (CTA), this work developed and demonstrated a framework and methodology for quantifying the accessibility and development impacts of a transit infrastructure project, the proposed Circle Line, providing an example of how to improve the current Federal Transit Agency (FTA) evaluation methodology. More at: http://web.mit.edu/dusp/idg/research/details/zegras-access.html
TRANSPORTATION: DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING (CEE)

MIT’s transportation group has provided leadership in the field of transportation research for many years by emphasizing an interdisciplinary systems approach incorporating engineering, urban planning, transport system management and public policy. We are now applying this interdisciplinary approach to the concept of sustainable transportation to address the critical issues confronting the world today. More at: http://cee.mit.edu/research/transportation

Public Transportation Research Program for Planning and Operations in London
Principal: Prof. Nigel H M Wilson, Professor of Civil and Environmental Engineering,
http://cee.mit.edu/wilson

London’s century-old public transport system is undergoing more than $40 billion worth of renovation and expansion while facing major financial and capacity pressures. Our collaborative research program with Transport for London (TfL) focuses on the use of automatically collected data systems in strategic decision-making. Origin-destination matrices estimated based on data collected from the Oyster smart card ticketing system, as well as path choice models estimated from onboard surveys, will yield drastically improved, cheaper and more timely estimates of volumes and crowding on the London Underground and bus networks. Estimation of interchange behavior and multimodal journey patterns will aid in integrated network design. Methods are being developed to use end-to-end journey times, also measured by the Oyster system, to quantify the delays and unreliability experienced by passengers on London’s rail networks. Rail signaling information will be used to evaluate and improve day-to-day service control decisions. A parallel focus of our work with TfL is to examine the technology and policy requirements for using commercial contactless credit cards for ticketing, as well as the effects of such a system on fare policy. Finally, we are investigating the use of innovative strategies and structures for the finance and delivery of large rail infrastructure projects, including Crossrail. See more at http://cee.mit.edu/node/153#transportation

Transforming Transit in Chicago
Principal: Prof. Nigel H M Wilson, Professor of Civil and Environmental Engineering,
http://cee.mit.edu/wilson

Operating one of North America’s oldest and largest transit systems, the Chicago Transit Authority (CTA) faces the challenge of modernizing its transit system in a difficult and uncertain funding climate. The advent of automatically collected data systems provides opportunities for improved, data-driven decision-making. Three projects are underway. One will model the impact of schedules on the reliability experienced by passengers. Another addresses Chicago’s need for a modern approach to the problem of handling downtown congestion with CTA’s limited capital. This project will develop a service plan for a bus rapid transit solution, to provide rail-level service at bus-operational costs. A third project examines the case for adopting common fare payment media, which may better satisfy security concerns, operational efficiencies and contractual obligations than a custom system. Research will investigate the policy implications and implementation details of adopting credit cards as fare payment media in the CTA system. http://cee.mit.edu/node/153#transportation
CEE News story: MIT teams up with three universities in Singapore to develop smart, sustainable urban transportation solutions
November 2, 2009

The Massachusetts Institute of Technology and the National Research Foundation of Singapore announced a project to develop new models and tools for the planning, design and operation of sustainable future urban transportation. The five-year project will be led by Amedeo Odoni, Professor of Aeronautics and Astronautics and of Civil and Environmental Engineering. At the heart of the Singapore project is SimMobility, a simulation platform with an integrated model of human and commercial activities, land use, transportation, environmental impacts, and energy use. This simulation will be linked with a range of networked computing and control technology-enabled mobility innovations. More at... http://web.mit.edu/newsoffice/2009/transportation-collaboration.html

CEE News story: Sussman explains why high-speed rail and congestion pricing are needed in the U.S.
April 13, 2009

Joseph Sussman, the JR East Professor in the Department of Civil and Environmental Engineering and the Engineering Systems Division (ESD), appears in Good magazine’s transportation issue. In an interview with Siobhan O’Connor, he explains why the United States should spend more of its infrastructure dollars on high-speed rail and implement congestion pricing to help smooth traffic flow. More at... http://www.good.is/post/transportation-innovation

ENGINEERING SYSTEMS DIVISION (ESD): HUMAN-SYSTEMS ENGINEERING (HSE) TRACK

The Human-Systems Engineering track within ESD focuses on the characteristics of people—including organizational, social, and cognitive—throughout the system conception, development, validation, and operation processes. ... With the arrival of highly automated technologies in cars such as automated cruise control and telematics, human interaction with complex technology has become an almost everyday occurrence for a large section of the population. Recognizing that human interaction with complex technology has both individual and group elements, there is a need for a formal research program that forms key questions and develops principled methodologies, including system design and process interventions, to address these questions. More at... http://esd.mit.edu/hse/

SMART CITIES GROUP

The research of the Smart Cities group focuses on intelligent, sustainable buildings, mobility systems, and cities. It explores the application of new technologies to enabling urban energy efficiency and sustainability, enhanced opportunity and equity, and cultural creativity. The group is particularly concerned with the emerging roles of networked intelligence in fabrication and construction, urban mobility, building design and intelligently responsive operation, and public space... More at... http://cities.media.mit.edu/index.html
CityCar Chassis
Ryan C.C. Chin, William Lark, Jr., Michael Chia-Liang Lin, Raul-David Poblano and Wayne Higgins

The CityCar Chassis is a full-scale and modular testing platform consisting of four independently controlled Wheel Robots, an extruded aluminum frame, battery pack, driver's interface, and seating for two. Each Wheel Robot is capable of over 120 degrees of steering freedom, thus giving the CityCar chassis omnidirectional driving ability such as sideways parking, zero-radius turning, torque steering, and variable velocity (in each wheel) steering. The four-wheeler also allows the CityCar design team to add a highly personalized body/cabin and swap in an eventual folding frame. More at... http://cities.media.mit.edu/projects/citycar.html

GreenWheel Bicycle
Ryan C.C. Chin, Michael Chia-Liang Lin, Arthur Petron and the MIT Mobile Experience Lab

The GreenWheel is a modular, electric-assist wheel that can easily be fitted to any standard bicycle. It was first prototyped and demonstrated by Smart Cities in September/October 2008. The GreenWheel’s design packages the essential mechanical and electrical elements in a compact, modular hub unit that (1) complies with the demanding form constraints of a standard bicycle wheel and can be fitted to any standard bicycle, (2) requires no wires or other physical connections to other parts of the bicycle, and (3) provides an attractive combination of high performance, high reliability, and low manufacturing cost...
More at... http://cities.media.mit.edu/projects/greenwheel.html

Light Electric Vehicle (LEV) Project with ITRI
Ryan C.C. Chin, Chih-Chao Chuang, Michael Chia-Liang Lin and ITRI

Taipei City Government is going to hold the 2010 International Horticultural Expo in Taipei City and ITRI will debut and operate their 200 Light Electric Vehicles in the Expo site. Smart Cities will collaborate with ITRI to design an urban implementation plan for these vehicles in Taiwan after the Expo is over. The plan will be the pilot program for LEV in a real urban environment and base on the Mobility-On-Demand system.
More at... http://cities.media.mit.edu/projects/scooter.html

Mobility On Demand
Ryan C.C. Chin, Chih-Chao Chuang, William Lark, Jr., Michael Chia-Liang Lin, Arthur Petron, Raul-David Poblano and Dimitris Papanikolaou

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Mobility On Demand (MOD) systems consist of a fleet of lightweight electric vehicles placed at electrical charging stations that are strategically distributed throughout the city. MOD systems solve the “first and last mile” problem that public transit systems do not solve—providing mobility from the transit station to and from your home or workplace. In a MOD system, users simply walk up to the closest station, swipe a membership card, and are given access to vehicles. They are then allowed to drive to any other station (one-way rental) closest to their desired destination. The Vélib’ system in Paris, consisting of over 20,000 shared bicycles, is the largest and most popular MOD system in the world. The Smart Cities group has designed and developed three MOD vehicles: the CityCar, RoboScooter, and GreenWheel Bicycle...

More at... http://cities.media.mit.edu/projects/mobilityondemand.html

**Mobility On Demand: A Market Economy of Trips**
William J. Mitchell, Ryan C.C. Chin and Dimitris Papanikolaou

...Mobility-on-Demand (MoD) is a new self-organized one-way vehicle sharing system that uses dynamic pricing to incentivize users to redistribute the fleet and keep the system in balance. Similarly to a market, trip price adjusts to inventory needs in origin and destination stations. We develop a framework that uses System Dynamics and Network Analysis that explains MoD system behavior and can be used to determine optimum pricing policy, number of parking stations, and number of vehicles for having a stable yet profitable system.

http://www.media.mit.edu/research/groups/1459/mobility-demand

**BOOK: Reinventing the Automobile: Personal Urban Mobility for the 21st Century**
Authors: Prof. William J Mitchell, Alexander W Dreyfoos (1954) Professor in Media Arts and Sciences, http://www.media.mit.edu/people/wjm, Christopher E. Borroni-Bird, Lawrence D. Burns
MIT Press, March 2010

This book provides a long-overdue vision for a new automobile era. The cars we drive today follow the same underlying design principles as the Model Ts of a hundred years ago and the tail-finned sedans of fifty years ago. In the twenty-first century, cars are still made for twentieth-century purposes. They’re well suited for conveying multiple passengers over long distances at high speeds, but inefficient for providing personal mobility within cities—where most of the world's people now live. In this pathbreaking book, William Mitchell and two industry experts reimagine the automobile, describing vehicles of the near future that are green, smart, connected, and fun to drive. They roll out four big ideas that will make this both feasible and timely.

More at... http://mitpress.mit.edu/catalog/item/default.asp?type=2&tid=12044

**MIT MOBILE EXPERIENCE LABORATORY**
Director: Dr. Federico Casalegno, Associate Director, Design Laboratory
http://mobile.mit.edu/people/federico/

The MIT Mobile Experience Lab focuses on radically reinventing and creatively designing connections between people, information and physical places using cutting-edge information technology to improve people's lives through meaningful experiences. With a multidisciplinary
team, we research and design new technologies along with their impact in societies, spaces and communities. More at... http://mobile.mit.edu/about

**Smart Urban Mobility Systems**

Exploring how the notion of place and media transform urban mobility: RATP (Régie Autonome des Transports Parisiens, or Autonomous Transit Operator of Paris) has been in collaboration with the MIT Mobile Experience Lab since 2005, researching how information and communication technologies affect the public transportation system and understanding the ecosystemic relationship between the mobility system and the city. We are now interested in exploring new forms of urban mobility, both from a cognitive level, from the transportation and mobility perspective, and from a cognitive point of view, understanding information and communication technologies and new media.

More at... http://mobile.mit.edu/research/workshops/smart-urban-mobility-systems

**Sustainable Public Transportation**

Public transportation systems in the future can increase both their environmental and social sustainability by combining the latest technologies with the preferences and needs of their users. Each solution will necessarily depend on a number of factors specific to the city it serves. The MIT Mobile Experience Laboratory, in partnership with Cisco Systems, developed three scenarios for the future of public transportation, each based in an iconic world city. More at...

http://mobile.mit.edu/research/sustainable-mobility/sustainable-public-transportation

**NFC @ MIT**

Future near-field communication (NFC) usages in every-day life: Near-Field Communication is a short-range high-frequency wireless communication technology which enables the exchange of data between devices over approximately 10-cm distance. Current usages include mobile ticketing on public transportation systems, mobile payment, smart postering, and bluetooth pairing. More at... http://mobile.mit.edu/research/connective-tissue/nfc-applications-everyday-life

**SENSEABLE CITY LAB**

Director: Prof. Carlo Ratti, Associate Professor of the Practice, http://www.carloratti.com/

The real-time city is now real! The increasing deployment of sensors and hand-held electronics in recent years is allowing a new approach to the study of the built environment. The way we describe and understand cities is being radically transformed - alongside the tools we use to design them and impact on their physical structure. Studying these changes from a critical point of view and anticipating them is the goal of the SENSEable City Laboratory at MIT. More at...

http://senseable.mit.edu/

**The Copenhagen Wheel**

The Copenhagen Wheel aims to transform bicycle use in Denmark’s largest city through promoting urban sustainability and building new connections between the city’s cyclists. In this work, bicycles become smart mobile sensing devices that map the real-time flow of people and environmental conditions in Copenhagen. This is achieved through strategically placing small location and environmental sensors on bicycles to gather information as people ride through the city. This data then powers applications of benefit to citizens, city municipalities and researchers
interested in understanding more about city dynamics. The components of the project are an electric bicycle wheel that can be easily retrofitted into any regular bicycle and location and environmental sensors which are powered by the bike wheel and in turn provide data for a variety of applications. More at... http://senseable.mit.edu/copenhagenwheel/

EyeStop
The EyeStop is partially covered with touch-sensitive e-INK and screens, and features state-of-the art sensing technologies and a variety of interactive services. Riders can plan a bus trip on an interactive map, surf the Web, monitor their real-time exposure to pollutants and use their mobile devices as an interface with the bus shelter. They can also post ads and community announcements to an electronic bulletin board at the bus stop, enhancing the EyeStop's functionality as a community gathering space. More at... http://senseable.mit.edu/eyestop/

“THE FUTURE OF URBAN MOBILITY: A GLOBAL COLLABORATION TO MAKE URBAN TRANSPORT SUSTAINABLE”
Scott R Campbell, MIT News Office, January 5, 2010

The School of Architecture + Planning is one of three schools at MIT taking part in a global collaboration with the National Research Foundation of Singapore to develop new models and tools for the planning, design and operation of future urban transportation.

The central theme of the effort is to bring together recent advances in information technology and transportation science to increase the efficiency of urban transportation systems while at the same time ensuring a sustainable and livable environment — first in Singapore, and ultimately on a global scale.

At the heart of the project is SimMobility — a simulation platform with an integrated model of human and commercial activities, land use, energy use, transportation and environmental impacts — linked with a range of networked computing and mobility innovations.

The modeling initiative is akin to a new project recently funded by the MIT Energy Initiative on reducing urban energy consumption. Led urban planning professors Carlo Ratti and Christopher Zegras, working with Moshe Ben-Akiva of Civil and Environmental Engineering, that project aims to develop an integrated model of land use, transportation and energy use that will enable evaluation of a range of policies and projects for reducing energy consumption in metropolitan areas.

SELECTED FACULTY / RESEARCHERS

Professor Moshe E. Ben-Akiva
Edmund K. Turner Professor of Civil and Environmental Engineering

Research Interests: Transportation systems analysis; intelligent transportation systems; demand modeling; econometrics, infrastructure management.

Professor Amedeo R Odoni
Professor of Civil and Environmental Engineering, and Professor of Aeronautics and Astronautics

Professor Odoni’s research interests are in applied probability theory, stochastic processes and decision-making under uncertainty, principally in air transportation system infrastructure. He looks at models and tools for exploring demand/capacity and demand/delay relationships in airports and air traffic control (ATC) and effective uses of available airport and ATC resources on a daily basis. He and his research group develop optimization algorithms for application in real-time flow management of air traffic; dynamic statistical models for predicting the occurrence of various events in real-time, such as the time of take-off from congested airports; a model to compute delays on a network of airports; computer-aided design of passenger terminals; and dynamic queuing models.

He also pursues research in risk assessment for railroads involving the development of a comprehensive safety performance index for railroad operations, as well as the exploratory analysis of data on accidents at railroad grade crossings and development of statistical models for inter-arrival times of very rare accidents. He also works in probabilistic extensions and variations of classical combinatorial optimization models such as the traveling salesman problem.

Professor Cynthia Rudin
Assistant Professor of Statistics, Sloan School of Management, Operations Research Center
http://mitsloan.mit.edu/faculty/detail.php?in_spseqno=sp0026623&co_list=F

Professor Rudin's research interests are in statistical learning theory and applications of machine learning to industrial problems. She works on theoretical problems in the areas of algorithm convergence and algorithm development, with a focus on boosting-style classification and ranking algorithms. Her specific application areas include prioritization problems connected with the energy grid and recommendation systems for transactional data (for instance, from online retail vendors). Rudin is interested in prioritization problems, and underground distribution systems.

Professor Joseph M. Sussman
Professor Sussman specializes in the study of Complex, Large-Scale, Interconnected, Open, Sociotechnical (CLIOS) Systems and he has developed the CLIOS Process to study such systems. He has focused recently on developing a new methodology for regional strategic transportation planning, integrating ideas from strategic management, scenario-building, and technology architectures, and applying it to cases in the U.S. and abroad. Currently his work in the CLIOS area deals with transportation, technology and sustainability in Mexico City; Kuala Lumpur, Malaysia; and Portugal. Professor Sussman also has worked extensively on Intelligent Transportation Systems (ITS), helping to build the U.S. national program and develop an "intelligent corridor" in Bangkok. He has developed a comparison of ITS programs in Western Europe, Japan and the U.S. and helped develop regional ITS architectures in the U.S. His research in both freight and passenger railroads focuses on service reliability, rail operations, maintenance, high-speed rail, and risk assessment.

Professor Nigel H.M. Wilson
Professor of Civil and Environmental Engineering
http://cee.mit.edu/wilson

Research Interests: Public transportation, Transport system design, New transportation systems

Prof. Christopher Zegras
Ford Career Development Assistant Professor of Transportation and Urban Planning, International Development Group (IDG), Transportation Systems Focus Area Lead for the MIT Portugal Program

Research:
The relationship between transportation and the built environment
Transportation system finance
Transportation energy use and greenhouse gas mitigation

RELATED COURSES, CONFERENCES

MODELING & SIMULATION OF TRANSPORTATION NETWORKS, AUGUST 2-6, 2010, MIT PROFESSIONAL EDUCATION
Prof. M. Ben-Akiva
Tuition: $2,900 I Continuing Education Units (CEUs): 2.9

The course studies theories and applications of transportation network demand and supply models and simulation techniques. It provides an in-depth study of the world’s most sophisticated traffic simulation models, demand modeling methods, and related analytical techniques... More at... http://web.mit.edu/professional/short-programs/courses/simulation_transportation.html
2009 MIT GLOBAL OPERATIONS CONFERENCE—NEW VISIONS FOR GLOBAL OPERATIONS: FROM PRODUCT DEVELOPMENT THROUGH DELIVERY AND RECYCLING [VIDEO LINKS]
MIT Industrial Liaison Program, Leaders for Global Operations, MIT Forum for Supply Chain Innovation, System Design and Management
December 2-3, 2009

Agenda/Video links:
http://ilp-www.mit.edu/display_event_agenda.a4d?eventId=5105&key=P4f1

This conference gathers together thought leaders from MIT and industry to discuss the latest ideas to design, develop, manufacture and distribute. The sessions will cover topics from design through delivery and recycling, using a variety of examples from different industries. More at http://ilp-www.mit.edu/display_event.a4d?eventId=5105&key=P4f1