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Enhancing traffic signs to resist hurricane-force winds

The hurricane season in the Atlantic region extends from June 1 through November 30, during which nearly 97 percent of all hurricane activity occurs. The years 2004 and 2005 were very active for hurricane activity in the Atlantic basin—six intense hurricanes in 2004 and seven in 2005. During 2005, Miami-Dade County experienced extensive infrastructure damage from two of those hurricanes, Katrina and Wilma, within a time span of barely two months. Recovery costs were estimated at more than $5 million and included resetting or repairing traffic signals, traffic signs, streetlights, trees, guardrails, and sidewalks. Seven to ten hurricanes are predicted in the Atlantic region in 2007 and, of those, three to five may become major hurricanes (Category 3 or higher).

Continued on next page
One necessity in the hurricane recovery process is the reinstallation of roadside signs such as stop signs and speed limit signs. While the repair or reinstallation of roadside signs is sometimes delayed since the signs do not pose imminent danger to human life, as is the case when overhead signs fail, roadside signs greatly outnumber overhead signs, and their higher failure rate during a hurricane can significantly impact the recovery process and traffic safety after the hurricane.

Recently, in a study sponsored by Miami-Dade Metropolitan Planning Organization, CUTR analyzed the current design, installation and maintenance of traffic signs in Miami-Dade County to assist in formulating corrective actions for minimizing the number of damaged units during a hurricane. By improving the wind-force-withstanding capability of street signs, the costs associated with their repair and/or replacement are considerably reduced, and the County’s valuable resources can be concentrated on other aspects of the recovery process. Several alternatives that can strengthen roadside traffic signs and reduce the number of damaged signs during moderate hurricanes were reviewed.

In general, the most common and most critical single-pole roadside sign is the stop sign. After the 2005 hurricane season, about 56,000 street signs had to be replaced by the Miami-Dade County Public Works Department. (A sign is considered failed if it is leaning by more than 15 degrees from the vertical axis.) Over 90 percent of the signs failed at their foundations; no structural failures for traffic signs were reported by Miami-Dade County. The failure of signs at the foundation was primarily due to their embedded depth.

The recovery of roadside signs consists primarily of reinstalling the displaced sign; the installation process for a standard street sign can be performed by one crew member in approximately 25 minutes. The goal of the study was to identify and assess improvements to the wind-force-withstanding capabilities of street signs that also would not complicate the installation process.

**Improvement alternatives**

Four major alternatives were proposed to improve traffic sign hurricane-withstanding capabilities:

1. increase installation depth
2. use soil plates
3. use concrete foundations
4. use third-party hardware in the form of a drive anchor

Each of the alternatives was evaluated based on the maximum wind speed a sign can support before the soil fails. The alternatives were analyzed for different types of soils (sands, clays) and compared to the wind speeds observed during hurricanes Katrina and Wilma in Miami-Dade County, as well as hurricanes in the county during the past 100 years.

The wind loading criteria and methodology presented in the AASHTO Standard Specifications for Structural Supports for Luminaries and Traffic Signs were reviewed for this analysis.
Alternative evaluation

Evaluation of the alternatives indicated the following factors related to process and cost.

Increasing the installation depth of a sign consists of enlarging the buried section of the u-channel post (basepost); it requires horizontal clearance from the utility companies and involves pulling out the sign, disassembling the base post, assembling a new base post, and reinstalling the sign. This procedure has been estimated to be performed in 55 minutes. The material cost is estimated at $12. For sand, an installation depth of 4 ft will enable the signs to resist up to Category 2 hurricane winds. For clay, increasing the installation depth to 4 ft is not as effective. Only for stronger clays will this improvement work effectively.

Soil plates increase the soil reaction by adding more area to the buried section of the post. The addition of soil plates requires pulling out the sign, attaching a soil plate, and reinstalling the sign. If the installation depth is increased, the upgrading procedure includes disassembly of the base post and attachment of the new base post to the sign. The installation time for a soil plate is estimated to be 45 minutes. If the depth is also increased, this process will take 65 minutes. The cost of a trapezoidal soil plate is estimated to be $5.25. If the installation depth is increased, the cost of materials is estimated to be $17.25. For medium soil, the use of plates helps to get closer to the required standards. For weak soil, plates will restrain the sign from leaning only during a tropical storm and minor hurricane wind.

The width of the embedded section affects the performance of the sign when facing wind forces. This factor can be modified by using concrete in the installation procedure; however, the installation time will be significantly affected by this alternative. The installation time is estimated to be 60 minutes for the concrete base. Once the concrete base and the driving sleeve are installed, it is recommended that the concrete cure for one day. Post driving is then performed, which consists of removing the sign from its original location and driving it into the concrete foundation. This operation is estimated to take 25 minutes. The cost of the driving sleeve is estimated at $8. The cost of concrete is estimated...
to be $4.5 per cubic foot. A concrete foundation gives the best performance in ultimate wind load, but at the expense of installation time.

Authors of a previous study performed physical tests as well as finite element modeling of drive anchors and determined that concrete foundations and drive anchors can be used interchangeably for fence post foundations. For evaluation purposes, the performance of the drive anchor can be set equal to that of the concrete.

**Results**

The analysis showed that drive anchors or a concrete foundation, coupled with an installation depth of 4 ft, are the most effective alternatives for all soil types considered. Signs with drive anchors require less time to install than signs with concrete foundations, and both alternatives can be installed at relatively shallow depths with acceptable results. A foundation depth of 4 ft may offers promising results with the simplest installation procedure of all, but this is not always feasible due to the presence of buried utilities (phone, cable etc.) within the right-of-way.

Depending on the installation method chosen and the depth of insertion, signs installed in sand can be expected to meet and, in some cases, exceed, wind-load resistance during the most likely hurricane scenarios of any particular year. However, some difficulties may be faced when signs are set in clay, as only the concrete or drive anchor installations offer reliable wind load resistance when placed into medium or strong clay soils. The wind resistance of street signs fixed in very weak soil can be improved, but the likelihood of damage remains high, even in moderate hurricanes. Thus, the overall reliability of street signs depends greatly on which method is used, the depth of installation, and the soil type.

**Conclusions**

Of the four major alternatives proposed to improve traffic sign hurricane-withstanding capabilities, the use of concrete foundations and drive anchors tested consistently at the top of the ranks in terms of ultimate wind resistance for all soil types. Drive anchors can be used in all types of soils with similar results to those of concrete foundations, and the installation time for drive anchors (25 minutes) is significantly less than that required for a sign cast in a concrete foundation (60 minutes). If the foundation depth is increased, then the selected two alternatives can perform even better.

For loose sand, the three most cost-effective alternatives were drive anchor at 3 ft, increase installation depth to 4 ft, and use concrete at foundation at 3 ft. For medium and strong sand, the top three alternatives were drive anchor at 3 ft, increase the foundation depth to 4 ft, and use soil plates at 3 ft. For weak and medium clay, the top three alternatives were drive anchors, increase depth to 4 ft, and use concrete foundation at 3 ft. For strong clay, the top three alternatives were drive anchors at 3 ft, increase foundation depth to 4 ft, and use soil plates at 3 ft.

While this study covered the evaluation of proposed major actions that can be taken to improve the hurricane-withstanding capabilities of traffic signs for Miami-Dade County, its results may be applicable to other Florida counties.

For further information on this study, contact CUTR ITS, Traffic Operations & Safety Program Director Dr. Pei-Sung Lin at (813) 974-4910, lin@cutr.usf.edu, or Aldo Fabregas at (813) 974-9819, fabregas@cutr.usf.edu.
Kimberlee B. DeBosier, P.E., was elected to serve Chair of the CUTR Advisory Board at its April 2007 meeting, and Norman Mansour was elected to serve as Vice Chair.

A member of the Board since 2003, Ms. DeBosier is President of Bayside Engineering, Inc., a Tampa firm that conducts a wide variety of private and public works projects on the West Coast of Florida. She has been an engineer for 25 years and has held many leadership positions, including Chair of the Tampa-Hillsborough County Expressway Authority, Board Member of the Hillsborough County Metropolitan Planning Organization, Board Member and Past President of the MacDonald Training Center for disabled adults, and Board Member of the Greater Tampa Chamber of Commerce. She currently serves as President of the Florida Institute of Consulting Engineers (FICE). She was named 2005 Engineer of the Year by the Florida Engineering Society, the first woman to be honored in the statewide award’s 45-year history.

Mr. Mansour has been a member of the CUTR Advisory Board since 2004. A retired commercial real estate executive, Mr. Mansour is a former partner and founder of Florida Real Estate Advisors. He also served in various positions related to real estate and general administration and was Assistant County Administrator for Hillsborough County, Florida. He served as a Commissioner of the Florida Transportation Commission and was a Member and Secretary of the Florida High Speed Rail Authority.

Other members of the CUTR Advisory Board are:
- Hon. Stephanie Kopelousos, Secretary, Florida Department of Transportation
- Hon. Thomas Pelham, Secretary, Florida Department of Community Affairs
- Hon. Michael Sole, Secretary, Florida Department of Environmental Protection
- Michael Blaylock, CEO, Jacksonville Transportation Authority
- John Forney, Managing Director/Public Finance, Raymond James & Associates, Inc.
- James W. Holton, Commissioner, Florida Transportation Commission
- William V. Sheppard, Consultant
- Robert E. Skinner, Jr., Executive Director, Transportation Research Board

The CUTR Advisory Board was established in 1991 to periodically and objectively review and advise the center concerning its research program. Specific responsibilities of the Board include:  

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The level of violence and casualties related to terrorism is increasing. Larger explosives are being used, and the number of incidents committed against transit systems is significantly increasing worldwide. In 1991, 20 percent of violent attacks were against transit targets. That number rose to 40 percent in 1997, and today it is estimated to be more than 45 percent. In transit-related bombings in London in 2005, 53 were killed and more than 700 were injured. In Madrid in 2004, rail bombings killed 198 and injured 1,247. Trained response to such incidents has become imperative.

To provide the knowledge and skills needed to deal with the transit response to a bus hijacking, Florida’s Transit Training and Technical Assistance Program at CUTR hosted a bus hijacking exercise and seminar in March 2007. “Threat Management and Emergency Response to Bus Hijacking,” sponsored by the Florida Department of Transportation, is designed to aid individuals responsible for developing, administering, and implementing emergency response plans for transit bus hijackings, preparing for and initially responding to transit bus hijackings, and managing security threats to bus operations. Course participants were trained in how to respond to acts of terrorism, including workplace violence, and how to develop and implement plans and procedures for responding to bus hijackings.
The one-day course consisted of several modules that covered a variety of topics, including:

- threat types (kidnapping, terrorism, emotionally disturbed individuals)
- understanding terrorism (terrorist objectives, tactics, needs, characteristics, trends)
- weapons of mass destruction (bombs, biological/chemical agents, nuclear/radiological threats)
- responders to bus hijackings (operators, dispatchers, management, emergency personnel)
- media management (media relations, transit agency responsibilities)
- field exercise

Included in the response module were suggested responsibilities for operators, dispatchers, management, and emergency responders. For example, the response to a bus hijacking by the bus operator should include the following:

- Remain calm.
- Follow captor’s instructions.
- Communicate (silent alarm, radio or phone).
- Avoid physical resistance.
- Speak only when spoken to and instruct passengers to do the same.
- Accept the situation and wait for help.
- Observe and listen but don’t stare.

Terrorism Against Transit Worldwide 1997-2000

- Subways and trains 10%
- Subways and train stations 10%
- Bus terminals 8%
- Tracks 8%
- Tourist buses 5%
- Other 5%
- Bridges and train stations 1%
The response by a dispatcher should include the following:

- Remain calm.
- Follow notification procedures (system security program plan).
- Listen and document/record.

To enhance the effectiveness of the course, CUTR, the Hillsborough Area Regional Transit Authority (HART), and the Hillsborough County Sheriff’s Office S.W.A.T team joined forces to simulate a bus hijacking exercise. Course participants served as bus hostages, and a “perpetrator” from the S.W.A.T. team boarded the bus of innocent spectators to simulate a real-life hijacking scenario.

Aboard the HART bus, a “flash/bang” was tossed, giving the effect of an exploding grenade, including noise and smoke. In response, 16 members of the S.W.A.T. team, dressed in full combat uniform, surrounded the bus with firearms drawn, to rescue the “hostages.” In response to a signal, the team swarmed onto the bus, overtaking the perpetrator. The hostages, with their hands clasped behind their heads, were escorted one-by-one off the bus into a line-up and were checked out by the S.W.A.T. team to make sure they had not been an accomplice to the hijacking. The “hijacking” had been successfully diffused.

After the exercise, the S.W.A.T. team debriefed the group and provided an opportunity for course participants to ask questions. Participants also were provided with a guidebook.

Upcoming training by Florida’s Transit Training and Technical Assistance Program at CUTR includes:

- Transit Terrorist Tools and Tactics, August 14-16, 2007
- Effectively Managing Transit Emergencies, September 10-13

For more information on these courses or to register, contact Molly Buffington at (813) 974-3120, buffington@cutr.usf.edu. For further information on the Bus Hijackings course, contact CUTR Senior Research Associate Amber Reep, reep@cutr.usf.edu, (813) 974-9823.
CUTR has developed and hosts two websites on transit safety and transit security that serve as resources for state departments of transportation, transit systems, and transit professionals throughout the U.S.

The Transit Security Reference Resource website, www.cutr.usf.edu/security, provides available transit security information in areas including best practices, tools and resources, contact database, publications, and research. Links on the site include:

- “Reports”—provides reports on transit security published by a wide variety of government and private agencies.
- “Tools”—provides emergency preparedness plans and emergency response activities to help transit agencies develop or improve their security and emergency preparedness program plans.
- “Best Practices”—contains information from a 2006 transit-security-related report that illustrates solutions that transit agencies have implemented to improve security at maintenance facilities and passenger stations.
- “Organizations”—provides links to online resources, federal government agencies, public transportation organizations, and national organizations that deal with security, weapons of mass destruction, and chemical, biological, radiological, or nuclear attacks.

The Transit Bus Safety Resource Guide website, www.cutr.usf.edu/bussafety, aids those who are developing bus safety and security programs. Materials on the site are scalable for systems of any size and are intended to be used as outlines, models, and templates. The site provides resource materials on safety plans, driver/employee selection and training, vehicle maintenance, drug and alcohol abuse programs, safety data acquisition and analysis, security best practices, transit insurance pools, state legislation, and training.

Included on the site is the “Toolbox for Promotion the Bus Safety and Security Program in Your State: A Training Curriculum for Implementation,” which provides state departments of transportation and transit systems with resources and examples for developing and implementing a bus system safety program plan. The toolbox walks through the basic steps and core elements needed to develop the program and includes examples of how different agencies of various sizes incorporate the core elements into their system safety plans.

For more information on these sites, contact CUTR Research Associates Debbie Sapper, sapper@cutr.usf.edu, or Amber Reep, reep@cutr.usf.edu.
Public transit has an important role in maintaining the livability of Florida’s growing communities. Transit not only can help alleviate traffic congestion and improve air quality, but also provides mobility for many of Florida’s citizens, allowing better access to employment and school opportunities. Visitors and tourists to the state also benefit from public transit. The Florida Transit Handbook, prepared annually by CUTR for the Florida Department of Transportation (FDOT) Public Transit Office, provides a synopsis of FDOT’s transit resources, a profile of Florida’s transit systems, and a snapshot of their performance during the previous year.

While there are many urban and rural transit systems operating in Florida, the focus of the handbook is on the state’s urban fixed-route transit systems. (Information about Florida’s rural and demand-response transit systems can be obtained from the Annual Operations Report published by Florida’s Commission for the Transportation Disadvantaged.) In 2005 (the latest year for which complete data are available), Florida’s 27 fixed-route urban transit systems provided transportation for more than 243 million trips, which represents an increase of six percent from the previous year. During the same period, Florida’s transit ridership also grew at a rate two times faster than the rate of population growth.

The handbook also contains information about the FDOT Public Transit Office and its three sections (Transit Planning, Grants Administration, and Transit Operations), each of which has specific areas of responsibility. The mission of the Public Transit Office is to “identify, support, advance, and manage cost-effective, efficient, and safe transportation systems and alternatives to maximize the passenger-carrying capacity of surface transportation facilities.” The Transit Planning unit is responsible for statewide transit planning and policy analysis, including transit development plan rules and reviews, transit information systems, facilities planning, transit-oriented development, technical assistance, and training.

Financial and technical assistance to Florida’s transit agencies and commuter assistance services is the task of the Grants Administration and Commuter Assistance unit, which has responsibility in areas such as Federal Transit Administration coordination, grant and financial management, rural and urban transit technical assistance, innovative finance, and legislative analysis. The Transit Operations unit is responsible for developing and implementing transit programs that provide services and assistance to support transit operational and maintenance functions. Additional information about FDOT transit programs can be found at www.dot.state.fl.us/transit.

System statistics

In 2005, a total of 4 of Florida’s 27 fixed-route transit systems operated a form of a fixed-guideway mode. The South Florida Regional Transportation Authority provides regional rail service between Palm Beach, Broward, and Miami-Dade counties. Miami-Dade Transit Agency operates a heavy rail system (Metrorail), and an automated guideway system or peoplemover (Metromover). The Jacksonville Transportation Authority also operates an automated guideway system (Skyway Express), and Hillsborough Area Regional Transit Authority (HART) in Tampa operates a light rail system (TECO Line Streetcar).
To meet their service objectives, transit agencies in Florida (and across the United States) sometimes find it necessary to contract the operation of portions of their services to private operators. In 2005, 11 of Florida’s transit systems contracted for all or part of their regular fixed-route bus service (Broward County Transit, Collier Area Transit, Citrus Connection in Lakeland, LYNX in Orlando, Okaloosa County, Palm Tran in Palm Beach County, Pinellas Suncoast Transit Authority, South Florida Regional Transportation Authority, Ocala/Marion Metropolitan Planning Organization—Suntran, VOTRAN in Volusia County, and Winter Haven Area Transit).

During 2005, Florida’s transit agencies ranged in size from the 1-vehicle system in Martin County to the 873-vehicle system operating in Miami-Dade County. The year 2005 was the first year of fixed-route operations for the system in Martin County, as well as for two other systems in Collier County and Hernando County. Individually, 20 transit agencies experienced an increase in ridership between 2004 and 2005. Eight of these 20 systems had ridership increases of more than 10 percent. Some of the greatest growth in ridership occurred at Florida’s smaller transit agencies. Ridership on Pasco County Public Transportation’s small fixed-route bus service grew more than 34 percent during this period, while its number of revenue miles, an indicator of service supply, increased only 17 percent (the system also added two vehicles in peak service).

Similarly, Winter Haven Area Transit, another small system in the state, experienced a 20 percent increase in ridership between 2004 and 2005 while adding two vehicles in peak service. The other systems that had ridership increases of more than 10 percent during this time were the Bay Town Trolley (Panama City), St. Lucie County, VOTRAN in Volusia County, LeeTran in Lee County, HART in Tampa, and Palm Tran in Palm Beach County. Miami-Dade Transit, the largest system in Florida, experienced a five percent increase in ridership between 2004 and 2005.

NTD data and training

The handbook presents the most recent National Transit Database (NTD) information for the fixed-route services operated by each of Florida’s transit systems that receive State block grant funding. Statewide total data are also included. While NTD data are submitted to the Federal Transit Administration (FTA), many states and local agencies also use the data, including FDOT. To assist NTD reporters at Florida transit systems and to help ensure the accuracy of the data, FDOT sponsors an annual training course on NTD data collection and reporting.

CUTR prepares the Florida Transit Handbook on an annual basis to provide the most current data on the transit agencies that operate in the state. While several performance indicators and measures are included, it should be noted that there are numerous factors that affect the performance of individual transit systems, such as an agency’s management structure, governing body, and customer satisfaction. In addition, local policies that address land use, urban design, parking, and transit fares can affect system performance, along with the operating environment, which consists of densities, traffic congestion, geography, and levels of transit-dependency. Many of these factors can be difficult to quantify and are not typically obtainable from a source such as NTD; however, they must be considered when evaluating transit performance because they comprise the most unique features of each agency and the community it serves.

For more information, contact CUTR Senior Research Associate Victoria A. Perk, perk@cutr.usf.edu, (813) 974-7327.
FDOT produces Pocket Guide to Florida Transportation

One of the functions of Florida Department of Transportation’s Office of Policy Planning (OPP) is developing and monitoring the statewide and metropolitan planning processes. Successful implementation of the plans requires a full understanding of Florida’s entire transportation system. OPP tracks key “trends and conditions” that are widely used by Florida’s decisions makers, transportation professionals, and the general public to better understand transportation-related issues and make wise decisions. Trends and conditions information provides historical data and changes on key transportation issues. For several years, CUTR has provided ongoing support to the FDOT Office of Policy Planning in conducting research on policy issues relating to these transportation trends and conditions.

FDOT, with the support of CUTR, has been producing the Pocket Guide to Florida Transportation for the past several years. This handy pocket-sized publication contains facts and statistics pertaining to Florida’s transportation trends and conditions, with tabs providing quick and easy location of information. As data become available throughout the year, charts and corresponding text are updated.

The Pocket Guide is organized into three areas:

- the growing demand for transportation facilities and services
- the current system or supply of transportation
- the impacts of the transportation system on our society

The first section of the Pocket Guide, Travel Demand, includes information on increases in population, auto availability, VMT growth, and other measures.

The second section, Transportation System, provides insight on the current supply of transportation by different modes. This section covers the Strategic Intermodal System (SIS), roadway, transit, and rail systems as well as transportation disadvantaged services, pedestrian & bicycle services, airports, and seaports.
The last section deals with the impact of transportation on our society. This includes the travel behavior of Floridians, system performance, transportation safety, transportation and the environment, and transportation and the economy. Also presented is information on mode of travel for work commute, mean travel time to work, and household vehicle availability and how these compare with the national averages.

Some key safety trends are also provided, as the provision of a safe transportation system is one of the top priorities of the Florida Department of Transportation.

Selected highlights of the 2006 guide include:

- Florida had the largest total population increase among all states in 2005.
- Cruise travel showed the greatest percent change since 1995.
- All means of person travel have grown, with the exception of Amtrak.
- Passenger boardings in Florida approached 240 million in 2005, an increase of about 4.5% from 2004.
- Automobile travel provides 90% of all person trips made by Floridians, which is slightly higher than the national average.
- Commute time to work continues to increase, with Florida outpacing national trends.
- Florida’s highway fatality rate, as measured by the number of roadway fatalities per 100 million vehicle miles traveled, increased in 2005; however, it has been steadily declining in recent years.
Florida’s highway fatality rates have remained higher than the national average for more than 20 years.

The Pocket Guide to Florida Transportation is produced each year to provide an update on Florida’s Transportation system. The new guide containing data for 2006 will be released later this year. A PDF version of the most current pocket guide can be found at http://www.dot.state.fl.us/planning/policy/trends/default.htm.

For more information, contact CUTR Mobility Program Director Steve Polzin, (813) 974-9849, polzin@cutr.usf.edu.

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- maintaining a strong advocacy role on behalf of the center, including communicating specific CUTR assets and needs to appropriate administrative, legislative and customer bodies and seeking opportunities to contribute to the resolution of important societal issues
- assisting with the identification of future research directions for CUTR and maximizing its involvement in state and national problem solving
- assisting with activities related to advancement/development, specifically fundraising activities on behalf of CUTR
- providing advice on CUTR’s participation in education and training programs of the University of South Florida

For more information on the CUTR Advisory Board and its activities, contact Patricia Ball, (813) 974-3120, pball@cutr.usf.edu.
2007 NCTR GIS in Transit Conference

CUTR’s National Center for Transit Research is pleased to announce the 2007 GIS in Transit Conference at the Embassy Suites-USF in Tampa on **November 6-8, 2007**.

Papers and presentations are being solicited by the Steering Committee. Authors and presenters interested in preparing a paper or presentation should visit [www.nctr.usf.edu/gis](http://www.nctr.usf.edu/gis) to learn more about the topics and requirements for submission.

Themes being considered include:
- Managing Data
- Service Planning/Operations
- Stages for Developing Your GIS (case studies)
- Web-Based GIS
- Data Collection
- Transit Modeling Applications
- Mobile GIS and Transit Applications
- Census Data and Transit Planning
- Google Transit Examples
- Open Source Transit Applications
- Other GIS in transit topics

**Submission deadline has been extended to August 10, 2007.**

To attend the NCTR GIS in Transit Conference, register at [www.nctr.usf.edu/gis](http://www.nctr.usf.edu/gis). Credit cards accepted.

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Fall 2007 transportation classes

CUTR and the USF College of Engineering are offering the following transportation classes in the Fall 2007 semester:

- **Graduate Transportation Seminar**, Mondays, 11:00-11:50 am, Dr. Lu & guest speakers
- **Intelligent Transportation Systems**, Mondays and Wednesdays, 12:30-1:45 pm, Dr. Lu
- **Land Use and Transportation**, Tuesdays, 5:00-7:50 pm, Dr. Polzin
- **Transportation Planning & Economics**, Tuesdays and Thursdays, 11:00 am-12:15 pm, Dr. Liu
- **Traffic Systems Engineering**, Tuesdays and Thursdays, 8:00-9:15 am, Dr. Liu
- **Pavement Design**, Wednesdays, 6:00-8:50 pm, Dr. Gunaratne
- **Travel Demand Modeling**, Thursdays, 5:00-7:50 pm, Ms. Perk

For further information, contact the USF Department of Civil & Environmental Engineering at (813) 974-2275.
UTR is pleased to announce that Dr. Chan-young Lee has joined the CUTR ITS, Traffic Operations & Safety Team as a Senior Research Associate.

Dr. Lee holds a Ph.D. in Transportation Engineering from the University of Wisconsin-Madison and a certificate in Transportation Management and Policy from the Gaylord Nelson Institute for Environmental Studies at UWM. He earned an M.S. in Transportation Planning and a B.S. in Urban Planning from Hongik University in Korea.

Prior to joining CUTR, he was an Associate Researcher in the Traffic Operations and Safety Laboratory at UWM, where he conducted studies in traffic analysis support, winter weather mobility impacts, microsimulation calibration and validation, ramp metering retiming, and others. He is the author of numerous paper and reports.

At CUTR, Dr. Lee will focus on research in Advanced Traveler Information Systems (ATIS), ITS deployment evaluations, microscopic simulation models, and driver behaviors.