RESEARCH PROJECT HIGHLIGHTS

Mobility and Independence in Rural Communities: A Study On Teens and Transportation From the University of Vermont

Limited data are available on what youth can and cannot access in rural locations. Since development patterns in the U.S. are clearly planned, organized, and run by and for adults, and much of the current attention is on accessibility and independent mobility for an aging population, the transport needs of young people may be overshadowed. With challenging winters, limited or no public bus service, and often great distances between homes, schools, and other destinations, teens in many northern rural communities may be missing out on activities commonly experienced by peers in larger population centers. There remains much to learn about the (in)ability of rural youth to access education, recreation, entertainment, services, and employment; become self-sufficient; and nurture their own psychological and professional development.

Dr. Brian H. Y. Lee of the University of Vermont Transportation Research Center (UVM UTC) and his collaborator, Dr. Meghan Cope of the UVM Geography Department, are currently launching a new research study on youth accessibility and independent mobility by exploring different types of rural settlement patterns in Vermont. Lee and Cope’s research approach will include objective measures of youth accessibility and mobility as well as participatory research, for high school aged teens with and without driver’s licenses in grades 9 through 12. Surveys will be administered either in classes or advertised within the high school and will be available both online and in paper form. Survey questions will concern where the teens go and how they get there, what obstacles they face because of their environment, how they get together with their friends, and who, if anyone, they depend on for transportation. In-depth qualitative methods such as interview and participatory mapping will compliment these survey instruments.

This mixed method approach will help inform researchers where rural teens can go and what activities they would like to access but cannot. The findings will help build theories, provide conclusions about enabling factors, and eliminate barriers for youth accessibility and independent mobility in rural communities.
From the Director

We often forget that our student researchers have only been in the field of transportation for a few years. Their contributions to our projects reach a professional level and their refreshing insights and approaches remind us that they will someday lead the way in innovation.

The stories in this issue exemplify the New England Center’s achievements in education. Through our K-12 Outreach program, in which young students are given a hands-on introduction to our projects, as well as through the cutting edge research performed by our graduate students, we garner enthusiasm for the field of transportation that ensures a continuation of quality research and advocacy. In the following pages you will learn about an undergraduate student who challenges common assumptions about driver safety. We will introduce award-winning graduate students who already demonstrate leadership in the field. A look at current projects at University of Massachusetts Amherst, just one of the eight universities that make up this center, will reveal the depth and span of research this diverse team undertakes.

Beyond its students, the New England Center endeavors to educate government, industry and the public through its publications, websites, roundtable discussions, and the media. From our work with a local middle school to the nationally recognized research our students perform, we have built a tradition in educational excellence that will have lasting benefits for transportation research. I hope you will participate in this process by sharing any feedback. Through your input we can ensure the program continues to be an invaluable resource for the transportation community.

In addition to the fine work of our students, this issue includes highlights of our researchers, faculty and continuing outreach. On behalf of the New England University Transportation Center, we thank all of our sponsors, collaborators, and the transportation community.

Joseph F. Coughlin
Center Director & Policy Committee Chair, MIT

TECHNOLOGY TRANSFER

Inventioneers Bring the SMARTwheel 2.0 to the Volpe Center

The Inventioneers, a team of New Hampshire students ranging in ages from 10 to 17, travelled to the U.S. Department of Transportation’s Volpe National Transportation Systems Center to present their SMARTwheel device to senior officials. New England Center researchers who have partnered with the team in the past through the Center’s K-12 Outreach Program were also present to show support for the team and make plans for collaborations in the near future. The SMARTwheel is intended to give warnings if a driver does not have both hands on the wheel, thus discouraging driver distraction. The Inventioneers have presented their SMARTwheel to several policy makers, including Transportation Secretary Ray LaHood and President Obama. ■

Reimer discussed his findings relating to cognitive demand and visual distraction in a talk entitled, Myth: Technology Makes Things Easier. He demonstrated how innovations in in-vehicle technologies could hinder the safety of the driver by distracting them or disengaging them from the driving process. This is true even if the driver appears to be looking at the road. “Study after study has shown, as we’re looking forward, we don’t really see what’s in front of us,” said Reimer. “We’ve lost that situational awareness.” He mentioned that successful designs build on users’ existing experiences, or mental models.

“Designs that vary from previous experiences or provide little connection to experiences can be difficult to learn and may compromise safety,” said Reimer.

The ways we learn to use technology—through trial and error, sales staff or friends, and, rarely, the manual—require design to be intuitive and minimize workload to ensure the driver is alert and aware of his environment.

The Today Show video clip can be seen at today.msnbc.msn.com search: “Joe Coughlin”

The CBS Sunday Morning clip can be seen on cbsnews.com search: The new target demographic: Baby Boomers

The New England Center was featured on NBC’s Today Show. Correspondent Peter Alexander took a drive in Miss Daisy, the MIT AgeLab driving simulator, while wearing AGNES, the Age Gain Now Empathy System. AGNES is designed to give the user the physical limitations that may come with older age. “We developed this with the US Department of Transportation,” Coughlin said on the show, “I want you to imagine using public transit, walking across the street.” AGNES and Coughlin also made an appearance on CBS Sunday Morning.

Joe Coughlin participated in the New England Center-funded panel Driving Successfully: Giving Up the Keys?, part of the 24th Annual Catherine N. Stratton of the New England Center’s Katie Godfrey and Joe Coughlin with The Today Show’s Matt Lauer and Natalie Morales (in AGNES)
Systems providing real time information to motorists have increased considerably over recent years. 511, which gives to-the-minute traffic reports would ideally prevent traffic from continuing to pile on as motorists become aware of jams and seek an alternate route. Research jointly conducted at the University of Massachusetts and the University of Maine has lead to better understanding of the diversion patterns motorists tend to follow based on reported delay times, message content, use of 511 and drivers' familiarity with alternative route travel times. Through simulator study, the New England Center-funded project demonstrated that traffic engineers could make a reliable prediction of how often drivers will diverge from their typical commute when they are informed of different delays.

Researchers also factored in differences in behavior attributed to age. When older and younger adults did not know alternative route travel time, the two age groups behaved very differently. Interestingly, when the times were known, the groups behaved similarly. By presenting alternative route travel times as well as delays on the main route, the researchers suggest, behavior—despite age—would be more predictable.

The paper, entitled Predicting Drivers’ Route Choices When Given Information on Delays Ahead: The Effect of Age, Experience, and Prior Knowledge, was recently accepted for the Transportation Research Record. It was presented at TRB in January 2011 by Gautam Divekar, a doctoral student working in the Arbella Insurance Human Performance Laboratory in the College of Engineering at the University of Massachusetts Amherst.
Strategy Drives Us: Strategic Route Choice Modeling

Uncertainties in transportation, such as incidents, bad weather, vehicle breakdown, work zones, as well as constant fluctuation in demand lead motorists to make decisions to shorten driving time at the beginning of their journey and en route. New England Center researchers are drawing upon engineering, psychology, and even economic theory to build understanding of route choice. In a recent study on strategic route choice modeling, Xuan Lu and Song Gao of the University of Massachusetts teamed up with Michael Razo and Hengliang Tian from the Volpe National Transportation Systems Center to study how motorists strategize their route choice and react to information received en route.

When given the choice between the route with the shortest average duration and the route that allows for the flexibility to change course when the driver learns of traffic ahead, what proportion of motorists would make each choice?

In experiments involving 74 participants and 3473 observations, researchers made in-depth assessments of how subjects make this decision, to better predict driver behavior with or without incidents. They found a large proportion of subjects to be what they termed ‘strategic’ in their route choice. According to the team, a strategic traveler will minimize mean travel time by choosing a collection of paths so that, en route, one path can be chosen on a good day and another on a bad day.

The researchers determined fewer travelers to be non-strategic. Non-strategic travelers respond to information on the spot. If they want to minimize mean travel time they will choose the route that is shortest on average without considering future information they may receive.

The team found that network complexity had a negative effect on strategy—the more complex the journey, the less strategy used in planning the route. But the overall findings showed that a significant portion of the travelers were strategic in choosing a basic commute. And understanding how drivers strategize allows for better building of route choice models.

Leadership In Traffic Flow Theory, Modeling and Simulation

New England researchers at the University of Massachusetts are at the forefront in traffic flow modeling and simulation. Daiheng Ni, professor and researcher in the department of Civil and Environmental Engineering, is a member of the Transportation Research Board’s Committee on Traffic Flow Theory and Characteristics. He has already been involved in several 2011 publications that range in topic from stochastic modeling to intelligent transportation systems. In his paper, *Multiscale Modeling of Traffic Flow,* published in the first-ever edition of *Mathematica Aeterna,* he discusses seamlessly integrating traffic modeling and simulation at multiple scales within a single system. Courses he taught in the past year include Traffic Flow Theory and Simulation and Traffic Engineering.

To learn more about transportation research at the University of Massachusetts Amherst, visit http://cee.umass.edu/cee/research/transportation.
**NEWS AND EVENTS**

**Connectivity and the Car**

The New England Motor Press Association (NEMPA), with support from UnitedRoad, presented an industry roundtable on telematics that was moderated by New England Center Director Joe Coughlin and included New England Center Associate Director and Research Scientist Bryan Reimer. The event was hosted by MIT on May 20.

NEMPA described telematics as “the integrated use of telecommunications and informatics in vehicles in conjunction with controlling vehicles on the move.” Beginning with OnStar and leading towards the “smart cars” of the future, the young telematics industry used this roundtable to discuss legal, financial, safety and ethical concerns that arise as innovation continues.

The conversation on communications technology in the vehicle included senior industry representatives such as Tim Nixon, executive director of infotainment and OnStar engineering for General Motors, as well as telematics executives from Ford Motor Co., BMW, General Motors Corp., and Hyundai Motor America.

The panelists discussed their latest advancements in communications technologies, including Ford’s Sync and Hyundai’s Blue Link.

Reimer stated that his research “represents the consumer” and that his findings in driver distraction pointed to added technologies and autonomy as challenges in improving consumer safety.

---

**RESEARCH PROJECT HIGHLIGHTS**

**University of Maine Student Questions All-Wheel Drive’s Stopping Potential**

All-wheel and four-wheel drive vehicles are depended on heavily in northern New England because they are claimed to have superior traction over two-wheel drive vehicles. Limited literature exists to support these claims and, according to one undergraduate researcher at the University of Maine Department of Civil and Environmental Engineering, there are little or no studies attempting to correlate drivetrain to accident rates and injury severity.

Ian McKinnon, who is researching what safety advantages exist in driving four-wheel or all-wheel vehicles, has personal interest in the findings of his on-going study.

“Living in Maine for all my life, winter driving is a necessary part of life you become accustomed to,” says McKinnon. “Nearly all of my family and distant relatives rely on four-wheel drive, primarily pickups, to commute, work and remain productive in the Maine environment.”

According to McKinnon, four-wheel and all-wheel drive vehicles may have superior mobility and traction, but their stopping potential actually remains consistent with two-wheel drive vehicles.

“This false assumption may be leading to over-driving, or overconfidence on the road,” suggests McKinnon. “Drivers may experience a false sense of safety and the purpose of this research is to validate or deny that assumption.”

McKinnon’s research thus far has included observations of vehicle demographics and driver distributions on Stillwater Avenue in Old Town, Maine, which he compared with FARS Database. McKinnon notes that there are nearly 900 vehicle models produced in the USA in the past 30 years that can be seen on the road on any given day. He adds that most models now come with All Wheel Drive options, including cars and crossovers, and that the trend of preference towards AWD is independent of gas and oil prices and is steadily on the rise.

As McKinnon continues his research, he hopes his findings will be a wake-up call for drivers in winter conditions who may be overly confident about their vehicle’s performance.

“I would hope that the findings could be used to educate society of the misconceptions of four-wheel drive safety,” he says. “I hope the automotive industry considers the research as well, if not for policy of advertising change, but for consideration in future model designs.”
**Research Project Highlights**

**Students at the University of Connecticut Bring Passion to the Program**

The New England Center enables students to pursue passions in transportation research and extend boundaries in knowledge, innovations and policy planning. In this issue, we feature two outstanding New England Center-funded students from the University of Connecticut.

**Kelly Bertolaccini** is currently a MS student in the Transportation and Urban Engineering Program. She graduated from the University of Connecticut in 2010 with a BS in Civil Engineering and a BA in English. She was the 2010 recipient of the Eisenhower Grant and the 2011 recipient of the Helen Overly Memorial Scholarship, a Connecticut Valley Women’s Transportation Seminar graduate student award.

“My primary interest is socially equitable transportation networks. In particular, I am interested in how transportation networks can be designed to increase people’s economic and educational opportunities. Currently, I am investigating the relationship between arterial road networks and the distribution of wealth in metropolitan areas.”

**Alexander Bernier** is currently a MS student in Civil Engineering. He graduated from the University of Connecticut in 2010 with a BS in Civil Engineering focusing on geotechnical engineering with work experience in airport design. He received second place in a data analysis contest sponsored by the Federal Highway Administration in 2010. He has also worked with DHS in aviation security workshops and has an interest in airport infrastructure as a whole. Current projects include the Long-Term Pavement Performance SPS-9 closeout study, which involves testing and analysis for almost 200 samples taken from 6 test sections of pavement in Connecticut.

“My interest in pavement research stems from our nation’s critical dependence on roadways. Many people often overlook the use of petroleum in producing and placing our roadways, not to mention the traffic and safety concerns associated with frequent road repairs. I believe improvements to our roadways must go hand-in-hand with more fuel efficient cars and alternative fuels to truly improve the sustainability of our road infrastructure.”

---

**Technology Transfer**

**New England Center on BBC’s Surviving a Car Crash**

The New England Center was featured in the BBC’s Horizon series episode, “Surviving A Car Crash”. Findings in driver stress and cognitive distraction were discussed, including the relationship that exists between workload and performance and how this relationship connects to automotive safety and crash prevention. Test subjects drove the MIT AgeLab’s instrumented 2010 Lincoln MKS on the highway while performing moderately demanding cognitive tasks to increase the subject’s stress levels. The test demonstrated that as workload and stress increase, so do the driver’s heart rate and other measures of physiological arousal. In addition, changes in the subject’s gaze with increased cognitive demand suggest a restriction in how visual attention is allocated to the activities on the roadway.

Keyword search “Surviving a Car Crash” on utc.mit.edu to see the video clips.

**Associate Director Bryan Reimer Featured in Science Careers**

A profile on New England Center Associate Director Bryan Reimer was featured in the Careers page of Science.com. His research with the Aware Car, an instrumented vehicle built for evaluating new models and methods of monitoring driver state through physiology, visual attention, and driving performance in the field, was mentioned along with results from recent studies on driver workload and distraction. He also discussed working with industry and his preferences towards performing research in real environments rather than the laboratory.

The article, Focus on Aging: Engineering Safer Drivers is available on sciencecareers.sciencemag.org keyword search: Bryan Reimer
About the New England University Transportation Center

The New England University Transportation Center employs research and innovative technology to improve transportation system management. Its research and technology transfer serve as groundwork for progressive safety measures and for increasing the efficiency of the nation’s roads and mass transit systems.

The center’s research investigates how changes in the age distribution of the nation’s population and changes in technology, infrastructure, global climate, economics and politics affect transportation systems. The New England Center will use this research to educate future transportation professionals and leaders responsible for tackling transportation challenges of today and tomorrow.

In addition to these education goals, the New England Center has a mission to influence the transportation agenda and develop and disseminate new methodology and tactics for strategic change. The New England Center is part of the national UTC program. Massachusetts Institute of Technology is the lead university in the consortium, which also includes Harvard University, and the state universities of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

The New England Center will use this research to educate future transportation professionals and leaders responsible for tackling transportation challenges of today and tomorrow.

About MIT’s Center for Transportation and Logistics

MIT’s Center for Transportation and Logistics is part of the Engineering Systems Division in the School of Engineering. The center is widely recognized as an international leader in the field of transportation and logistics.

The CTL facilitates a basic understanding of transportation systems planning, operations and management, and the center makes significant contributions to logistics modeling and supply-chain management for shippers, to technology and policy analysis for government, and to management, planning and operations for trucking, railroad, air and ocean carriers.

In addition to administering the Master of Engineering in Logistics program, the center helps coordinate the extensive transportation and logistics research conducted throughout MIT. At any given time, research initiatives typically number more than 100 and range from modest projects involving a single faculty member and a few students to large-scale international programs involving scores of people and a full-time research staff.