University of Minnesota
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CTS Research E-News brings you the latest research project milestones, published reports, and seminar coverage.

In this issue:

Policy & Planning

Reconsidering spring load restrictions

Across the northern United States and Europe, spring thaws bring vehicle weight restrictions on many highways. But the efficacy of spring load restrictions continues to be debated by many transportation professionals and members of the freight and logistics community. A new report from a project led by by **David Levinson** and **Mihai Marasteanu** of the University of Minnesota's Department of Civil Engineering aims to assist policymakers by examining the benefits and costs of spring load restrictions.

Because ground saturated with water from melting snow and ice weakens the structure of roads and makes them more vulnerable to damage from heavy vehicles, transportation agencies restrict the amount of weight that can be carried by vehicles during the early weeks of warmer weather. These restrictions are imposed on county and municipal state-aid roads as well as some municipal roads, and primarily affect commercial trucks that carry the majority of freight in rural areas.

Behind the debate on spring load restrictions is the reality that road maintenance budgets are often stretched extremely thin. For state transportation agencies, limited budgets make accurate cost-benefit evaluation of maintenance policies critical. The challenge for Minnesota lawmakers is to debate the prospects of lifting these longstanding restrictions along with a practical mechanism to generate revenue.

The new report includes two parts: a technical research report on the costs and benefits of removing spring load restrictions, and a summary analysis that presents a background on the research issues and findings, along with concerns put forward by Minnesota Department of Transportation (Mn/DOT) experts.

The report and summary are available from the Mn/DOT Web site at www.lrrb.org/pdf/200515.pdf (report) and www.lrrb.org/pdf/springloadrestrictions.pdf (summary).

Intelligent Transportation Systems

Students build autonomous ground vehicle for international competition

Built any good robots lately? A team of students from the University of Minnesota's Department of Mechanical Engineering will meet rival teams from around the world June 11-13 in Traverse City, Michigan, to compete in the 13th annual Intelligent Ground Vehicle Competition (IGVC). With support from the ITS Institute, the Minnesota team is gaining invaluable experience in real-world vehicle engineering.

The ITS Institute supports student teams in competitions like the IGVC because it gives participants a chance to work with the kind of design and construction issues that they will face after they graduate—including visual and laser sensing, propulsion control, guidance algorithms, and mechanical design. The team has a work space in the Institute's Intelligent Vehicles Lab, and Institute director **Max Donath** is an advisor on the project.

To compete, each student team must design and build an autonomous vehicle capable of negotiating an obstacle course without human assistance. Obstacles include buckets, traffic cones, orange traffic barrels, sawhorses, and ramps. Vehicles compete in two challenges—a marked-course challenge in which the vehicle must negotiate an obstacle-ridden course without going outside marked lane lines using only onboard sensors, and a navigation challenge requiring the vehicle to reach a series of GPS coordinates while also avoiding obstacles.

The University of Minnesota has fielded several teams in the annual competition, which draws competitors from many of the nation's top engineering schools and as far away as Europe and Japan. This year's Minnesota vehicle is based on the one designed for the 2001 competition, the last year in which a Minnesota team successfully competed. However, the team has redesigned most of the vehicle's propulsion and guidance systems.

The Minnesota team's Web site, www.me.umn.edu/igvc/, offers more information on the history, goals, and technologies used in the Minnesota autonomous ground vehicle.

Safety

Technological assistance aims to reduce dangerous driving by teens

The tragedy of young, inexperienced drivers losing their lives behind the wheel resonates through families and communities every day. Despite making up less than five percent of licensed drivers, teens account for more than 13 percent of all passenger vehicle fatalities. But once kids leave the driveway, it seems there is little that can be done to regulate their behavior behind the wheel. Or is there?

Recently, new in-vehicle technologies have emerged, aimed at curbing dangerous behaviors such as speeding, driving while intoxicated, and failing to use seat belts. Some of these technologies are commercially available, while others are under development at the University of Minnesota.

With support from the ITS Institute, mechanical engineering graduate student **Shawn Brovold** is developing an in-vehicle "black box" called the Teen Driver Support System (TDSS) that could help curb unsafe teen driving behavior. Brovold is collaborating with Intelligent Vehicles (IV) Laboratory director **Craig Shankwitz**, as well as with human factors researchers in the University's HumanFIRST Program.

The project will integrate emerging technologies based on determination of vehicle location and road geometry via the integration of Global Positioning System data and geospatial databases with currently available technologies, including onboard data logging and, optionally, in-vehicle systems to detect alcohol use.

Teen drivers, according to U of M Law School professor **Stephen Simon**, are a good target for programs of this type because parents are able and willing to help ensure safe driving behaviors. Simon, founder and director of the Minnesota Criminal Justice System DWI Task Force, has contributed expertise in traffic safety and legal issues to the project.

Beyond the sphere of parental enforcement, such a monitoring system could potentially be integrated with graduated licensing procedures for beginning drivers. The system under development will take a three-tiered approach to reducing unsafe teen driving behavior:

- Seat-belt/ignition interlocks and alcohol breath-testing can prevent operation of the vehicle;
- Detection of excessive speed or other unsafe operation can provide feedback during vehicle operation;
- Incidents of speeding or unsafe operation can also be logged for later analysis by parents or licensing officials.

Proactive support for inexperienced drivers

Among the most powerful aspects of the system under development is the capability to correlate a vehicle's speed with its location. Similar devices have been tested extensively in Europe, but Brovald's group is the first to evaluate this technique in the United States, and the first to apply it specifically to teen drivers. Systems that simply monitor and log vehicle speed are of limited use in this context, because local speed limits and road geometries are not known. The combination of speed and location will enable the prototype system to respond to unsafe driving or violations of local speed limits.

The ITS Institute's Intelligent Vehicles Laboratory has previously developed onboard systems that use high-accuracy GPS and digital mapping to compute vehicle locations in real time—technology that is central to the SAFEPLOW technology-enhanced snowplow and the TechnoBus transit research vehicle.

Building on this experience, the system currently under development uses an onboard computer, based on the compact PC104 platform commonly used for embedded applications, to integrate speed and location data, determined by a GPS system. Speed and location can then be correlated with information about the road on which the vehicle is being operated, such as local speed limits and road geometry, contained in digital maps and databases. Future enhancements to the system may include the ability for the TDSS to interface directly with a vehicle's onboard diagnostic system to collect data such as vehicle speed.

This location awareness makes it possible for the system to not only look at current conditions, but to proactively look "down the road" and evaluate sudden curves or other changes in road geometry—a common cause of run-off-the-road crashes by inexperienced drivers, especially in rural areas. When the system determines that the vehicle speed is too great to safely negotiate an upcoming curve, intersection, or other road feature, it will be able to proactively warn the driver and/or log the incident.

Combining different technologies to create a single integrated system that supports driver capabilities is characteristic of many ITS Institute research projects, says Institute director **Max Donath**. A significant portion of the Institute's recent work has involved combining new and existing technologies to address specific safety and mobility issues.

Reprinted from the ITS Institute Sensor *newsletter, Spring 2005*

Transit & Alternative Modes

National Transit News

TCRP research publications available online

The federal Transit Cooperative Research Program (TCRP), administered by the Transportation Research Board, provides practical transit research to address technical and operational issues. TCRP emphasizes putting research results into the hands of organizations and individuals that can use them to solve problems. TRCP publications may be viewed at www4.trb.org/trb/onlinepubs.nsf/web/crp.

Recent TCRP publications include:

- e-Transit: Electronic Business Strategies for Public Transportation Volume 6, Strategies to Expand and Improve Deployment of ITS in Rural Transit Systems (TCRP Report 84, vol. 6)
- Strategic Planning and Management in Transit Agencies, (TCRP Synthesis 59)
- Evaluation of Recent Ridership Increases (TCRP Research Results Digest 69)

Transportation Infrastructure

Pavement conference presents road research insights

From pavement noise to seal coating, the Ninth Annual Minnesota Pavement Conference offered attendees a wide variety of new information on tools and techniques for better pavement maintenance. Coverage of the event is available in the Spring 2005 issue of the Local Technical Assistance Program's *Technology Exchange* newsletter.

Pavement preservation was the subject of a trio of presentations by researchers from Minnesota, Arizona, and Illinois. **Jerry Geib** of Mn/DOT gave an overview of his agency's experience with chip seal techniques, including rock size and emulsion properties. **Larry Scofield** of the Arizona Highway Department reported preliminary results of an FHWA study of fog seal performance. **Iman Al-Qadi** of the University of Illinois discussed an ongoing study of crack sealing being conducted by a consortium of U.S. and Canadian transportation agencies.

Other topics covered at the conference included the use of warranties in highway construction, findings from a scanning tour of European approaches to tire/road noise, tools and techniques for cone penetrometer testing, and an evaluation of a new compaction monitoring system produced by Caterpillar Corporation.

Extensive coverage of the Pavement Conference appears in the Spring 2005 issue of the *Technology Exchange* newsletter, distributed by the Local Technical Assistance Program and available on the Web at www.mnltap.umn.edu/publications/exchange/.

Upcoming Events

Mark your calendars for next year's slate of events. Visit the CTS Web site, www.cts.umn.edu/events, for more comprehensive event information. You may also subscribe to e-mail event announcements using our subscription form.

October 5-6, 2005
Minnesota Fall Maintenance Expo, St. Cloud. Call Kathy Warren, 651-351-7432.

October 11-12, 2005
AirTAP Fall Forum, Brainerd. Contact Mindy Carlson at 612-625-1813 or e-mail carlson@cts.umn.edu.

November 16-17, 2005
Toward Zero Deaths Conference, St. Cloud. Call Shirley Mueffelman, 612-624-4754.

May 24-25, 2006
17th Annual CTS Transportation Research Conference, RiverCentre, St. Paul.
