

# ODOT Research News

Winter Quarter 2003

ODOT Research News is a quarterly newsletter to bring you the latest research and resources from the Oregon Department of Transportation's Research Group. The Research Group manages over 40 active research projects, providing new information and methodologies to improve how ODOT works.

The [underlined links](#) throughout the newsletter will take you to different parts of the [Research Web Page](#). There you will find updates on current projects, links to reports and research notes, information on staff specialties, and links to send us questions or suggestions for research. You can also call us at 503-986-2700.



## Project Accomplishments:

**Cracked Bridges.** Under an ODOT Research project, Oregon State University is investigating the capacity and remaining life of shear-cracked, reinforced concrete bridges. The research developing a quantitative measure of Oregon's traffic loading, collecting data from cracked bridges under traffic and known loads, and breaking large-size beams in the laboratory. After analyzing this data, researchers will construct quantitative models of how shear-cracked bridges perform.



bridge have been tested. One more interstate bridge will be monitored. Several of the forty-four, large-size laboratory beams have been tested. These beams were built from concrete and steel characteristic of the materials used in the bridges that are exhibiting shear cracks, in order to replicate as closely as possible the condition of actual bridge components. The data are being incorporated into computer models to develop predictive engineering tools. Preliminary methods to calculate capacity and remaining life are expected within another four months.

Up to forty sensors monitor the steel reinforcement, cracks, and concrete during the bridge and laboratory tests in order to measure the behavior of the beams as load is applied. Two, 2-lane bridges and one interstate

For more information on this or other bridge research, contact [Steve Soltesz](#).

**Research Outreach.** He's back! Glenn Boyle is back on temporary assignment with Research to work with maintenance crews. Glenn is scheduling meetings with crews to share safety and cost-saving innovations and to learn about maintenance issues needing research.

Last year Glenn encouraged city and county maintenance shops, as well as ODOT crews, to submit entries for the Innovations Showcase of tools, equipment, and



processes. Glenn will be sharing these innovations, collecting more, and helping to answer questions as he meets with maintenance workers.

Some of the innovations shared last year were displayed in the Transportation Building's East showcase through March. They can be viewed on the [Research web page](#). New ideas and links to other states' innovations will be added as they are submitted.

To schedule a meeting, contact Glenn at (503) 986 6550 or <mailto:glenn.e.boyle@odot.state.or.us>

***LTTP Update: A Long Shot Pays Off!*** The U.S. and Canadian Long-Term Pavement Performance (LTTP) project is intended to give pavement design engineers the tools they need to design long lasting pavements. One product, the new AASHTO Pavement Design Guide, is scheduled for publication in 2003. Oregon Pavement Design Engineer Luci Moore said, "ODOT looks forward to the publication. We will evaluate the new guide when it comes out to determine how we will use it in the future. More data and research may be needed to make the new procedures meaningful and cost effective for Oregon."

Oregon has been part of the 20-year LTTP study since it began in 1989. ODOT monitors twelve sections of highway which met the requirements for the design cells of this international experiment. The research collected historical data from the sites and supplemented it each year. In 1992, eleven sites were automated for traffic data collection. Four sites have

been dropped from the study due to re-construction. Two other sites, located on I-84 in the La Grande section, are scheduled for an overlay of 8 inches of Stone Matrix pavement this summer. If this work is completed by December 31, these sites will not be dropped from LTTP, but will be placed in a different design cell for the last five years of the study.

This spring, the regional LTTP consultant will do falling weight deflectometer and dipstick evaluations of four sites. Later, all sites will be evaluated by the profiler. A piezo sensor at the Albany, North site, which has been out of action since last September, will be replaced.

A Western Regional Meeting for the LTTP study will be held in April. Some of the topics to be discussed include: LTTP products, benefits of LTTP data usage, a traffic pooled fund study and others. Contact Research Specialist [Mac Lynde](#) for more information on LTTP.

### ***Railroad Crossing Intrusion Detection -- Update.***

Last summer we reported on a project to evaluate automatic intrusion detection devices for railroad crossings. Such devices hold promise for alerting trains to hazards at rural, low-volume crossings. Under high speed operating conditions, trains need to be protected from derailment by vehicles or other objects on the track (such as fencing, irrigation pipe or building materials). Both microwave and video detection systems are currently used on streets and highways for vehicle and pedestrian detection. Their capability to reliably detect objects dropped on a rail line, however, is not known.



Laboratory testing of microwave and video detection technologies has been completed by an Oregon State University research team. The lab testing under controlled conditions showed that both a video detection unit and a microwave detection unit could consistently detect objects as small as 4 inches. Now a

system using both types of devices is being field tested.

Besides the detection devices, a logic system is needed to determine when an intrusion should be reported. For example, if an object is dropped in the rail crossing and then later retrieved, the system should log the initial detection of an object but must also signal a change back to the normal state with the removal of the object. The system also needs to minimize false alarms from wildlife, windblown debris and objects too small to pose a hazard.

Field testing of the detection devices is underway on the OSU campus at the intersection of the Willamette & Pacific Railroad and 26<sup>th</sup> Street. A set of standardized shapes are being used to determine their detectability under a number of adverse lighting and weather conditions. In addition, the field test is collecting data on the detection of objects of varying shapes and sizes.

The field testing will be finished by May, and a final report is expected by the end of June. The findings of this research may be useful at railroad crossings in urban as well as rural settings. For more information, contact [Alan Kirk](#).



***Guiding Drivers through Work Zones*** safely and efficiently is a key concern on every construction project, particularly when space limitations require detours. At night or in poor weather, drivers have more difficulty anticipating and responding to the changes indicated by the signs and barriers. Specially-designed concrete barrier marking products may improve the delineation of sharp turns and detour curves in work zones, increasing safety and reducing crashes.

ODOT is evaluating the installation, maintenance and effectiveness of the 3M Scotchlite™ Linear Delineation System (LDS). The LDS is intended to reduce crashes on highway curves or through a construction work zone by providing motorists with continuous, positive guidance along the roadway. This system has been mounted on concrete barriers to enhance the alignment of entrance and exit curves at the West Coast Fork Willamette River bridge project and throughout the length of the Medford Viaduct

project. ODOT Research will evaluate the effectiveness of the 3M Scotchlite™ LDS in reducing the potential for work zone crashes.

Identification of a better solution for concrete barrier delineation would help ODOT achieve its goal of providing improved guidance for motorists negotiating Oregon's work zones. The 3M Scotchlite™ LDS has the potential to enhance visibility for drivers allowing them to better assess and adjust to changes in roadway alignment. Contact [Kevin Haas](#) or [Norris Shippen](#) for

more information on this project.



***New Projects to start in July.*** In February, the ODOT Research Advisory Committee prioritized a slate of projects to begin in fiscal year 2004. These projects were selected from more than 90 problem statements submitted by ODOT staff, local governments, universities and others interested in transportation research.

“The number of problem statements is comparable to numbers received in previous years, but the quality and the diversity of research ideas continues to improve,” said Barnie Jones, Research Manager.

Problem statements were sorted and assigned to one or more of six general subject matter areas, including:

1. Structures
2. Construction and Maintenance
3. Pavements and Materials
4. Roadway design, Hydraulics, Geotechnical and Environmental
5. Traffic, Safety, Human factors and ITS
6. Public Transit, Socio-economic, Planning and Multi-modal.

For each area, Expert Task Groups (ETG) reviewed problem statements, selecting up to 3 for development. Detailed problem statements were reviewed and prioritized by the Research Advisory Committee. The following projects were selected:

- Asphalt Mix Characterization Using Dynamic Modulus and APA Testing
- Crack Injection Under Live Load
- Update and Enhancement of ODOT's Crash Reduction Factors for Engineering Safety
- Culvert Database and Facility Condition Assessment Program
- Transportation Impact Analyses and Methods to Improve Them
- Assessing Effects of using Natural Flocculants to Manage Turbidity
- Reduced Skid Resistance of First-of-the-Year Anti-Icer Applications
- Flagger Nighttime Visibility
- Effectiveness of Teen Licensing Requirements and Restrictions Program
- Capabilities of Shear-Cracked Beams Repaired with FRP Composites

Projects not selected were also considered for other possible research funding, such as the Experimental Features Program, the ODOT State Research Program or the National Comprehensive Highway Research Program. For more information on the project selection process and other research underway, see the [Research web page](#).



## **New Research Notes: (click on underlined items to go to the notes)**

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[\*The pH of Water in Contact with Fresh Concrete\*](#) describes the monitoring of standing and flowing water near concrete shaft pours near Zigzag. Changing pH levels from the fresh concrete can threaten fish survival, but the measures used on this project reduced the high pH levels before the water reached the stream.

The [\*Humectants to Augment Zinc CPS\*](#) research note describes how the cathodic protection systems, which help to extend the life of reinforced concrete bridges, can be enhanced by the use of moisture-attracting chemicals called humectants.



## **Recently Published Reports: (click on underlined items to go to electronic reports)**

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[\*Aggregate Resource Inventory and Needs Forecast Study\*](#): An inventory of 750 ODOT owned or leased aggregate sites to determine the availability and quality of aggregates to build and maintain the state's transportation infrastructure. The aggregate which will be required to meet ODOT maintenance and construction needs for the next 15 years was estimated.

[\*Assessment & Mitigation of Liquefaction Hazards to Bridge Approach Embankments\*](#): This study provides recommendations for evaluation and improvement of soils at bridge sites, and modeling the performance of sloping abutments and soil improvements. Soil densification limitations are discussed.

[\*Institutional Options for VMT Data and Fee Collection Centers\*](#): An analysis of public vs. private data and fee collection centers for vehicle miles traveled (VMT) fees. Includes discussion of cost, enforcement debt collection, flexibility and public perception issues.

[\*Data Transmission Options for VMT Data and Fee Collection Centers\*](#): This report considers data transmission options and provides cost estimates for mileage-based data and fee collection centers. This includes issues related to data transmission, data collection, fee collection, data processing, billing and payment.

[\*Technology Evaluation for Implementation of VMT Based Revenue Collection Systems\*](#): Information on available technologies that could potentially be used in an electronic revenue collection system based on vehicle miles. Included were GPS-based devices, Radio-Frequency Automatic Vehicle Identification devices and different means of electronic data transfer.

[\*Improving the Effectiveness of Partnering\*](#): A summary of partnering practices from across the country. Surveys and case studies of successful and unsuccessful ODOT partnering experiences are included in this report, along with recommendations for improving partnering for both ODOT and contractors.

[\*Humectants to Augment Current for Metallized Zinc Cathodic Protection Systems on Concrete\*](#): Cathodic protection systems are used to mitigate corrosion in reinforced concrete structures. This report investigates the effectiveness of two water-soluble chemical additives that attract water and prolong the useful life of the cathodic protective system.

[\*Effectiveness of Double Fines as a Speed Control Measure in Safety Corridors\*](#): Double fines have been applied in safety corridors in Oregon as a speed control measure since 1999. Double fine signing has been used on

a trial basis in two locations. This research examined a survey of drivers to determine whether their judgments differed based on double fine signing.

**[Field Trial of Solvent-Free Emulsion in Oregon:](#)** In June 2001, ODOT tested a solvent-free emulsion mix near Tygh Valley. This report documents the construction, laboratory data and performance of the mix.



## Other Good Resources:

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The ***Transportation Research Board*** (TRB) sends an electronic **[TRANSPORTATION RESEARCH E-NEWSLETTER](#)**, a brief e-mail message full of web links to events, resources, publications and news items. Check out past editions by clicking the link above – the information on how to subscribe is available at the site.

And remember, the Research Group can provide many ***reports from other states***. Here's a **[link to the latest list of reports from other states](#)**. Or if you'd like to find an ODOT report, check this **[link to the latest ODOT Research reports](#)**. Or send us the topic and we'll do the search for you!



## T2 – Technology Transfer

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The Research Group also manages the Technology Transfer Program which provides resources for local governments on transportation, particularly roads, streets and bridges. T2 offers training through its Roads Scholar and Circuit Rider programs and provides a lending service for publications and videos on safety, maintenance and other transportation topics. Additional information can be obtained by calling Bob Rath at 503-986-2854, Andrea Asher at 503-986-2855 or by visiting the T2 program website at: **[www.odot.state.or.us/tddt2/](http://www.odot.state.or.us/tddt2/)**



## Questions? Problems?

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Got a transportation-related work problem that you think should be researched? Need a resource to answer a question? Call or e-mail the Research Group and we may be able to help.

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*For more information on ODOT's Research Program and Projects,  
check the website at **<http://www.odot.state.or.us/tddresearch/>***