ODOT Research News

Fall 2006

ODOT Research News

Research Unit Seeks Your Ideas

Each year the ODOT Research Unit solicits ideas for transportation research that would benefit ODOT and transportation needs in Oregon.

Funds and other resources are available for RESEARCH (study of a transportation problem), DEVELOPMENT (design and/or testing of a new transportation tool or procedure), and TECHNOLOGY TRANSFER (demonstration of, or education about, new transportation technology) activities.

We are now beginning to prepare our FY 2007-08 Research program, and there will be funds available for new research projects. The deadline for submission of research problem statements is December 15, 2006.

Anyone may submit a research problem statement for consideration. Research projects for the coming fiscal year are selected from among these problem statements. The research project selection process involves two steps.

1. In December and January 2007 one or more of the following Expert Task Groups (ETGs), each consisting of 6 to 9 subject area experts, will review the problem statements received by the Research Unit.

   Screening and selection will focus on problems related to priority research needs. If your problem statement is identified as a top candidate by one of these groups, a member of the Research Unit staff will work with you in developing a more detailed "second stage" problem statement.

   Expert Task Groups
   - Construction and Maintenance
   - Hydraulics, Geotechnical, Environmental
   - Integrated Multimodal
   - Pavements and Materials
   - Planning and Economic Analysis
   - Roadway Design and Human Factors
   - Structures
   - Traffic, Safety, and ITS

2. Near the end of February 2007, the ODOT Research Advisory Committee (RAC) will review the second stage problem statements and decide which of them will be developed as research projects in FY'08.

All of the information and materials you need to submit a problem statement is available from the ODOT Research Unit web page: http://egov.oregon.gov/ODOT/TD/TP_RES/ResearchProgram.shtml

A problem statement form is included there. After you complete it, e-mail it to:Barnie.P.JONES@odot.state.or.us. Please rename the completed form with a short name relating to the research topic. If you prefer, a web-based form is also available, which you may submit online.

The Research Program web page also includes the following information:

- Summary of current Research Priorities
- Information about the Expert Task Groups and the selection process
- Information for consultants and other non-ODOT individuals and organizations
- Names and e-mail addresses of staff for advice and assistance
- Regularly updated postings of new problem statements received
- An example of a completed problem statement

The deadline for submission of a problem statement is December 15, 2006.

If you are unable to get what you need from our web page, please request assistance by contacting Barnie Jones by e-mail: Barnie.P.JONES@odot.state.or.us or by phone: 503-986-2845.

Improved Bridge Load Rating

A research project sponsored by ODOT and conducted by OSU is collecting data on how Oregon bridges are loaded due to truck traffic. The goal of the study is to reduce the number of bridges identified as having deficient load capacity while maintaining the same high level of safety.

The equations used in load rating bridges incorporate live-load factors to account for uncertainties in actual truck weight and the presence of more than one truck on a bridge at the same time. The national code includes default factors based on data from other states. However, the code allows a state to develop customized factors based on statistical analysis of state-specific data. That is precisely what Oregon has done, and the result is live-load factors that are less than the default factors.

Development of these customized factors was possible because Oregon collects a large amount of high quality weigh-in-motion (WIM) data from sites around the State. The WIM data accurately reflects truck loads because there are few convenient alternative routes around WIM sites. The data were used to account for traffic direction, freight route type (interstate or state), truck volume, seasons, location, and sampling effects.

The lower live-load factors are due to the low level of overloads found in Oregon's truck traffic. Essentially, there is less uncertainty in Oregon's truck traffic that needs to be accounted for in the live-load factors compared to national statistics. Several factors account for Oregon's lower degree of overloads: the low cost of overweight permits; the large number of such permits authorized; easy access to the overweight permits; the weight mile tax that results in lower tax for loads placed on more axles; the "Trusted Carrier" program that promotes load compliance; and the significant penalties imposed on non-compliant vehicles.

After Federal Highway Administration approval, the customized live-load factors have been incorporated into ODOT's load rating policy. As long as the statistical basis for the factors does not change, ODOT will be able to use the less stringent factors and still maintain the same level of safety as the rest of the nation. Higher load rating values for bridges will mean fewer load restrictions for repairs or replacement.

For more information on this study, call Steve Soltesz at 503-986-2851, or by e-mail: Steven.M.SOLTESZ@odot.state.or.us.

Rust Never Sleeps in Western Oregon

In Western Oregon, anyone who has ever left an iron object out-of-doors knows that corrosion (rust) doesn't take long. In the 1970's a new type of retaining wall came into use in the construction of highways. The Mechanically Stabilized Earth (MSE) wall consists of loose earth materials built up with man-made reinforcing elements embedded in them.

MSE wall at the Oregon Route 217-Interstate 5 interchange. The faux rock, concrete panels in the left of the photo are the facing panels of an MSE wall supporting the end of the ramp from northbound I-5 to northbound OR 217.

This vertical edifice is then protected from erosion by being faced with a solid material such as reinforced concrete panels. These panels protect, but do not support, the wall. A number of these MSE walls have been built as part of the Oregon highway system. ODOT has commonly used metallic reinforcing elements to assemble these walls.

The Research Unit is currently working with OSU to investigate whether or not the metallic reinforcements of these MSE walls are performing as designed in the corrosive environment of Western Oregon. Some corrosion is expected and incorporated into the design parameters, but the question is: did the design parameters accurately predict the corrosion that is actually taking place?

This research project will review the design processes used, determine the effectiveness of non-destructive testing approaches, and likely exhume reinforcing elements at one or more sites in Oregon. Based on what is found, recommendations will be made for monitoring and maintaining existing walls and designing new walls.

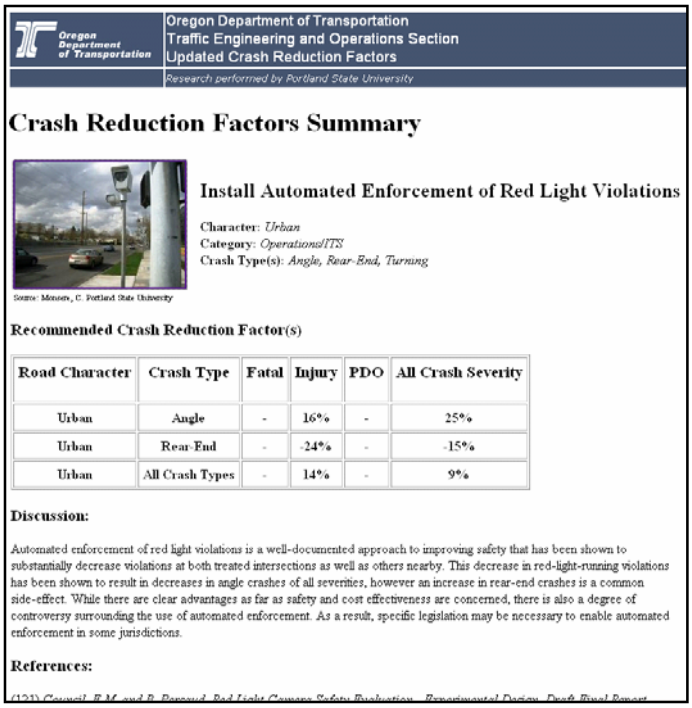
One fact has already emerged from this research. Many DOT's routinely include sacrificial reinforcing elements that can easily be retrieved for monitoring corrosion. This has apparently not been ODOT's practice in the past. For more information, contact Matthew Mabey at 503-986-2847, or by e-mail: Matthew.MABEY@odot.state.or.us.

New Resource for Addressing Crash Reduction Factors

Some sections of roadway have a higher than average number of crashes. The factors that create these high crash rate sites are as varied as the different settings of the roads themselves. There may be weather related factors, vision limitations, structures near the road, intersection issues, congestion, driver inattention, pedestrian interaction, or other causes. Identification and implementation of appropriate safety countermeasures are key to highway safety improvement planning. A well-organized and comprehensive list of accurate, up-to-date, and well documented crash reduction factors is critical to this effort.

Selecting methods by which the specific problems in a roadway section may be addressed requires professional judgment and a good knowledge of the research on the efficiency and applicability of specific roadway treatments. As an aid in this process, ODOT sponsored a project by Portland State University to create an interactive web-based tool to provide suitable treatment options for specific roadway situations.

The interactive Updated Crash Reduction Factors internet site is currently being hosted at the Portland State University website: http://its.pdx.edu/CRF/CRFweb/. This resource is expected to be moved to the ODOT website when program support issues are resolved. For more information on the Crash Reduction Factors project, call Mark Joerger at 503-986-3464 or by e-mail: Mark.D.JOERGER@odot.state.or.us.



Oregon Department of Transportation
Traffic Engineering and Operations Section
Updated Crash Reduction Factors

Research performed by Portland State University

Crash Reduction Factors Summary

Install Automated Enforcement of Red Light Violations

Character: *Urban*
Category: *Operations/ITS*
Crash Type(s): *Angle, Rear-End, Turning*

Source: Monsere, C. Portland State University

Recommended Crash Reduction Factor(s)

Road Character	Crash Type	Fatal	Injury	PDO	All Crash Severity
Urban	Angle	-	16%	-	25%
Urban	Rear-End	-	-24%	-	-15%
Urban	All Crash Types	-	14%	-	9%

Discussion:

Automated enforcement of red light violations is a well-documented approach to improving safety that has been shown to substantially decrease violations at both treated intersections as well as others nearby. This decrease in red-light-running violations has been shown to result in decreases in angle crashes of all severities, however an increase in rear-end crashes is a common side-effect. While there are clear advantages as far as safety and cost effectiveness are concerned, there is also a degree of controversy surrounding the use of automated enforcement. As a result, specific legislation may be necessary to enable automated enforcement in some jurisdictions.

References:

Sample Crash Reduction Factors website display showing recommended crash reduction factors

Evaluation of the Driver Improvement Program

The purpose of the ODOT DMV Driver Improvement Program is to improve traffic safety by temporarily restricting unsafe drivers or removing them from Oregon's highways through the license suspension process. The two current programs, which began in January 2002, have different thresholds for restriction and suspension of driving privileges – one for adults and one for drivers under 18. Prior to 2002 the Driver Improvement Program included warning letters, driver improvement interviews, and driver improvement classes. The changes were required due to a decision by the Oregon Attorney General that prohibits the use of highway funds for warning letters and interviews. ODOT Research has now contracted with researchers at Portland State University to undertake an evaluation of the new program for adults.

The researchers have completed a demographic comparison of persons who are in the Driver Improvement Program (DIP) and the state's driving population. The DIP population is primarily young males. Persons 18-24 account for about 38% of the DIP sample but only 11% of the general driving population. Males account for 78% of the DIP population. Initial analysis indicates that crash rates and convictions decline significantly after license suspension but still pose a heightened risk relative to the general driving population. The researchers are also reviewing programs in other states.

The study is scheduled to be completed in spring 2007 and will include recommendations for program enhancements. For more information, contact June Ross at 503-986-2846 or by e-mail: June.H.ROSS@odot.state.or.us.

They Say It Always Rains in Western Oregon

The proliferation of electronic and computer equipment that has so changed society in the last four decades has also had a profound impact on the collection of weather related data. ODOT is now tapping into that treasure trove of data to help improve the design of stormwater treatment and handling facilities across the state.

The currently available precipitation intensity maps for Oregon were published in 1973. At that time most historic weather station data only gave 24-hour precipitation amounts, and stations collecting data more frequently than hourly were rare. Now hourly data is common, and 5-minute data is available for some stations. There are also many more stations with 10 or more years of data. These data allow a much better understanding of shorter duration and higher intensity precipitation events as well as longer duration and less intense storms.

ODOT's Rainfall Analysis research project is being conducted by the Oregon Climate Service at OSU. This newer precipitation data will be combined with the older data to construct maps and equations that will allow anyone to compute the probability of various rainfall intensities and durations anywhere in the state. The Oregon Climate service will also be using their PRISM model to include the effects of topography on weather and climate.

This research project is a cooperative effort of ODOT, the Oregon Department of Water Resources, and the Central Oregon Intergovernmental Council. ODOT will be able to eliminate a great deal of over-design that is required because of the inadequacy of the currently available maps. All organizations and consultants designing for stormwater in Oregon will similarly be able to reap the benefits of this research. In fact, even though the project only started this summer, the Research Unit has already received calls from outside ODOT, wanting to know when the results will be available. For more information, contact Matthew Mabey at 503-986-2847, or by e-mail: Matthew.MABEY@odot.state.or.us.

ODOT Studies Ramp Metering

A System-wide Adaptive Ramp Metering (SWARM) system is being implemented in the Portland metropolitan area, replacing the previous pre-timed ramp-metering system. SWARM has been deployed on six freeway corridors and operates during the morning and afternoon peak hours.

ODOT Research has undertaken a project with Portland State University to compare the new SWARM system to the pre-timed system, using archived data supplemented with data from closed circuit television (CCTV) cameras. The objective is to quantify the system-wide benefits of the new system in terms of savings in delay, emissions, fuel consumption, and safety. The findings will aid in the optimal deployment of the current SWARM system and will be transferable to other areas.

To develop a strategic design for the study, a pilot study was conducted for two weeks in June 2006 on southbound OR 217, a seven-mile freeway corridor. SWARM was shut-off for one week and turned back on the following week. During the shut-off period, ramp meters operated at the pre-timed rates that were deployed prior to the SWARM implementation.

Data collection and analysis were focused on the morning peak period. Changes in freeway conditions were measured in terms of flow, speed, travel time, delay, vehicle-miles-traveled (VMT), and vehicle-hours-traveled (VHT). The data showed that the VMT increased marginally under the SWARM operation, indicating that the morning demand for this freeway corridor remained nearly independent of the ramp metering control method. However, the VHT and the average travel time increased under SWARM, corresponding to a significant increase of 34.7% in total freeway delay.

The lessons from the pilot study will assist ODOT in fine-tuning the deployment of the SWARM system and will be incorporated in the future regional-level study. The research project is scheduled to be completed in mid-2007. For more information, contact June Ross at 503-986-2846 or by e-mail: June.H.ROSS@odot.state.or.us.

Research Looks at New Springfield Roundabout

The city of Springfield Oregon has just completed the first urban multi-lane roundabout in the state. The two-lane roundabout replaces the signaled 'T' intersection at Hayden Bridge Way and Pioneer Parkway. It incorporates a continuation of Pioneer Parkway to the north (Martin Luther King Jr. Parkway) and a minor fifth leg into a residential area.

ODOT Research is collecting traffic data before and after the construction of the roundabout to test and quantify some assumptions about traffic flow through such intersections. Vehicle approach speeds were recorded prior to construction and will be compared to speeds in the new intersection to look for a possible 'calming' effect of the roundabout. A video camera recorded driver reactions to the new intersection during the first day of operation, for comparison to videos to be taken at intervals to see how quickly drivers adapt to the experience of driving the roundabout.

For additional information on the Springfield Roundabout go to the following web site:

http://www.ci.springfield.or.us/Pubworks/Martin_Luther_King_Webpage_files/mlk_project.html

For more information about the ODOT Research study, contact Mark Joerger at 503-986-3464 or by email: Mark.D.JOERGER@odot.state.or.us.

Diagram of the Springfield multi-lane roundabout

Survey Reveals Oregonians' Views on Transportation

The Traveler Opinion and Perception (TOP) Survey was conducted in 2004 under the sponsorship of the Federal Highway Administration (FHWA). The objective of the survey was to assess the needs and expectations of users of the nation's transportation system and obtain their opinions on how well those expectations are being met. The study consisted of a national sample of approximately 2,600 travelers. ODOT funded an additional 1,250 interviews in Oregon.

The TOP Survey probed several areas and issues: Traffic flow and congestion, operations and infrastructure, safety, transportation funding, support for future transportation projects, environmental issues, perceptions of value per tax dollar, quality of the transportation system, and some general travel characteristics.

Since national data were available, the analysis compared Oregon to the nation, the Pacific Coast states, Western states, and to selected peer states. The Oregon data also allowed comparisons of ODOT Regions. Among the highlights of the findings were the following:

- In both Oregon and the nation, the most important factors in contributing to an effective and high quality transportation system were safety, the ability to get around easily, and bridge and pavement conditions.
- Two-thirds of Oregonians believed that work zone management on their highways was well done. Corresponding percentages in the nation and the Pacific Coast state were notably lower.
- Overall, Oregonians were more satisfied with their state's transportation system than were either the Pacific Coast states or the nation as a whole.
- Oregonians expressed higher levels of support for the expansion of pedestrian walkways, bikeways, and public transportation services than for building more roadways.

For more information on the TOP Survey, contact Vince VanDerHyde at 503-986-3419, or via e-mail: Vincent.A.VANDERHYDE@odot.state.or.us

RECENTLY PUBLISHED REPORTS (click on underlined items for electronic reports)

Evaluation of Deicer Applications on Open Graded Pavements (FHWA-OR-DF-06-12)

The scope of this research was to study the effects of liquid magnesium chloride on open-graded pavements. Four sections on two different highways in Oregon were selected to be skid tested. It was found that the application of deicer on either type of pavement at either application rate appeared to have little if any effect on the Friction Number (FN). The Friction Numbers obtained in the skid tests were also compared with those recommended in an FHWA study, and they turned out to be well above the FHWA recommended FN values.

Field Evaluation of the Myrtle Creek Advanced Curve Warning System (FHWA-OR-RD-06-13)

As part of a larger study focusing on determining optimum countermeasures for speed related crashes, this research covered an evaluation of a dynamic curve warning system deployed at one site on northbound and southbound Interstate 5 in Myrtle Creek, Oregon. The quantitative evaluation indicated that the advanced curve warning system was effective in reducing the mean speeds of passenger cars and trucks by approximately 3 mph for the southbound direction and 2 mph for the northbound direction. Intercept surveys of motorists at nearby rest areas revealed a positive perception of the system. Overall, the results of the evaluation indicate that the advanced curve warning system is effective.

Comparison of Identification and Ranking Methodologies for Speed-Related Crash Locations (FHWA-OR-RD-06-14)

The objective of this study was to improve the procedures used to select locations for speed-related safety countermeasures. The report includes a literature review focused on the relationship between speed and crashes, as well as past research on speed reduction techniques. An analysis of speed-related crash data indicated that a number of variables such as ice, curves, and others are overrepresented in speed crashes. Based on these findings, the study then developed and compared alternate ranking methods for speed/ice crash locations, including a unique refinement of the rate quality control (RQC) method, using climate data that helps identify road segments that exhibit statistically significant high speed/ice crash patterns.

Best Practices for Traffic Impact Studies (FHWA-OR-RD-06-15)

This research project examined decisions being made from traffic impact studies to develop a set of best practices to supplement existing guidelines for developing and reviewing traffic impact studies. The research project selected and analyzed 12 case studies to compare post development traffic conditions to the traffic impact study forecasts of post implementation traffic conditions. Results of these comparisons were mixed. Best practices were identified for the following areas: land use code selection and application; pass-by trip reduction assumptions; seasonal variations; evaluation of other modes; analysis software; regional demand model verse growth rates; future year analysis; and safety.

Electric Heating of I-84 in Ladd Canyon, Oregon (FHWA-OR-RD-06-16)

When highway grades in mountainous areas are combined with adverse winter weather conditions, these sections of highway can become particularly hazardous for large truck traffic. This report covers the design and installation of a system of electric heating cables on a bridge deck that transitions to a steep uphill grade while making a superelevated turn and continues for 7,700 ft up the incline. A section of the report discusses problems with the system and planned upgrades and changes.

Capabilities of Diagonally-Cracked Girders Repaired with CFRP (FHWA-OR-RD-06-17)

Oregon has many reinforced concrete bridges built from the late 40s to the early 60s that now exhibit diagonal cracks in the concrete girders. ODOT has established a strategy to strengthen or replace cracked bridges that require action. Fiber reinforced polymer composites (FRP) attached to the concrete surface with adhesive is one option that can be employed for strengthening. ODOT sponsored research at Oregon State University to investigate the strength improvement that can be expected if FRP are used to repair cracked girders.

Animal Vehicle Crash Mitigation Using Advanced Technology, Phase I: Review, Design and Implementation (FHWA-OR-TPF-07-01)

This report documents Phase I of a multi-state pooled fund project. The report identifies existing animal detection system technologies and their vendors; describes the selection of two experimental detection systems and their installation at two field sites; documents the experiences with planning and design, installation, operation and maintenance; documents test results on the reliability of the two systems; documents system acceptance; and provides advice for the future development and application of animal detection systems.

Investigation Of The Bailey Method For The Design And Analysis Of Dense-Graded HMAC Using Oregon Aggregates (FHWA-OR-DF-07-02)

This report details the research effort to evaluate a method of aggregate gradation design and analysis called the Bailey Method. The recent adoption of SuperPave and Stone Matrix Asphalt (SMA) technology has created new criteria for selecting gradations. This research involved using the Bailey Method to design and evaluate Oregon specific aggregate blends. Specimens were compacted and tested using the gradations developed under the Bailey Method. Finally, rut testing was performed on those mixture specimens.

NEW RESEARCH NOTES (click on underlined items for electronic reports)

Nighttime Illumination of Work Zone Flaggers
Oregon State University developed guidelines for the optimal illumination of flaggers during nighttime maintenance and construction operations on highway projects.

Transportation Planning Performance Measures
This note summarizes a study that examined transportation planning policies and recommended multi-modal transportation performance measures.

Repairing Cracked Bridges with Plastic
Oregon State University investigated the improvement that can be expected if fiber reinforced polymer composites are used to strengthen reinforced concrete beams with diagonal cracks.

Linking Land Use to Traffic Impacts at Interchanges
Portland State University examined the effects of comprehensive plan amendments on interchange performance on the Oregon highway system.

T2 CENTER

The Research Unit also manages the Technology Transfer (T2) Center, which provides transportation resources to local governments. Funding for the T2 Center is provided by ODOT, the cities and counties of Oregon, and the Federal Highway Administration under the Local Technical Assistance Program (LTAP). The Center publishes a quarterly newsletter, distributes or loans publications and videos, and provides technical assistance to customers. The Center also offers training through its *Roads Scholar* and Circuit Rider programs as well as by partnering with other agencies and organizations.

Since its inception in 1984, the T2 Center has partnered with many organizations, including the Oregon Chapter of the American Public Works Association (APWA) in sponsoring training for local governments. This year alone, the T2 Center and the Oregon APWA have co-sponsored the *Spring Street Maintenance and Collection Systems School* in April, the *Preventive Maintenance for Roadway Surfaces* course in May and the *Fall Street Maintenance and Collection Systems School* in October. In addition, *Public Works Essentials*, the first training course of the newly created Northwest Public Works Institute (NWPWI), will be offered in December. The NWPWI is a joint undertaking by the T2 Center and the Oregon and Washington Chapters of the APWA. In addition to the APWA, the T2 Center continues to work with other agencies, organizations and individuals to develop timely training courses and technical material for sharing with its customers.

Additional information regarding the T2 Center is available at www.oregon.gov/ODOT/TD/TP_T2/. The current issue of the *Oregon Roads* newsletter providing the latest in T2 news, as well as past issues, is also available on the web site. For more information, contact T2 Center Director Bob Raths at 503-986-2854 or by e-mail at Bob.Raths@odot.state.or.us, or T2 Assistant Beth Hunter at 503-986-2855 or by e-mail at Beth.Hunter@odot.state.or.us

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What can we do for you?

Let us help you! Do you have a transportation-related problem that you think could be addressed through research? Need help in locating current research on an issue? The Research Unit may be able to help. We are available year-round to help answer transportation-related questions.

We often answer information requests from ODOT staff by locating technical references, conducting literature searches, or conducting a research project.

Check Us Out!
www.oregon.gov/ODOT/TD/TP_RES/