



NEW PROJECTS SELECTED

Each year, the ODOT Research Advisory Committee prioritizes a slate of projects to begin during the following fiscal year. Based on preliminary budget estimates for fiscal year 2006, seven new projects were selected from more than 100 problem statements submitted by ODOT staff, local governments, universities and others interested in transportation research.

As problem statements were received, they were sorted and assigned to one or more of eight general subject matter areas, including:

- Structures
- Construction and Maintenance
- Pavements and Materials
- Multi-modal
- Hydraulics, Geotechnical and Environmental
- Traffic Safety and ITS
- Planning and Economic Analysis
- Roadway Design and Human Factors

For each of the eight areas, Expert Task Groups (ETG) reviewed the problem statements, selecting two for further

development. Detailed problem statements were further reviewed and prioritized by the Research Advisory Committee. Based on the estimated funding levels, the following seven projects were selected for fiscal year 2006:

- Field Verification of Load Capacity Model
- Establishing Advisory Exit, Ramp, and Curve Speeds on Oregon Highways
- Mechanistic Pavement Design Input Parameters
- Evaluation of Metallic Reinforcement and Connections in MSE Retaining Walls
- Economic Assessment of Upgrading Oregon's Short-Line Rail Network
- Operational Benefits of a System wide Adaptive Ramp Metering System
- Alternatives to Liquidated Damages for Ensuring Project Performance

Projects will start at the beginning of fiscal year 2006 on July 1st, 2005.

For more information on the project selection process and other research currently in progress, visit the [Research Unit Web site](#).

COMMERCIAL PRODUCTS R&D PROGRAM

Legislation enacted in 2003 called for ODOT to establish a public-private partnership research and development program. This legislation which became part of the Oregon Revised Statutes specified that the department may enter into joint research and development agreements for the purpose of developing products for market, which may reduce the cost of maintenance and preservation or extend the useful life of the state's highways, or which may improve highway safety.

In the summer of 2004, an advisory committee was formed to develop the Oregon Administrative Rules (OAR). Based on the advisory committees recommendations, an Advisory Board was established and met for their initial meeting in January, 2005. The board is comprised of three representatives from the Oregon University System, three representatives from the private sector, and one representative from the Oregon Economic and Community Development Department.

It was decided that a Request for Information (RFI) would be the best way to determine the level of interest in the program and also get a perspective outlook of potential products.

The RFI was announced and released to the public in late February. The closing date for submitting a product idea to the RFI is April 15, 2005. There have been several interested organizations and companies that have contacted ODOT about the RFI and the program.

The products and ideas identified through the RFI process will be reviewed by ODOT and the Advisory Board. Those ideas identified for further development will then be subject to a formal Request for Proposal (RFP) process.

The public-private partnership will be a contractual agreement and may be with individuals, businesses, nonprofit organizations, or universities. These agreements will provide funding for research and development, and will also allow ODOT to receive royalties or other financial benefits from the sale or use of successful products.

You can learn more about this program on the Commercial Products Research and Development web site at:
<http://egov.oregon.gov/ODOT/TD/COMPRODUCTS>

MANAGING A MULTITUDE OF DRAINAGE FACILITIES

How many spoons do you own? When you are washing dishes the answer is probably too many. When you go to get a spoon for your bowl of ice cream and there are not any in the drawer, the answer is not enough. The truth is you may not know. ODOT is in much the same situation when it comes to many of its assets like guardrails and culverts. As Oregon's highway system was built during the 20th century, technology and resources limited how many details could be recorded, maintained, and accessed. To efficiently manage Oregon's transportation system in the 21st century we need easy access to details of the highway system.

One piece of this asset management puzzle is the Drainage Facility Management System Research Project. This research project has two basic objectives. The first is to assist in the development and implementation of an Oregon-specific system for inventorying, evaluating, and managing the condition of pipes, culverts, and storm water facilities. The project is gathering information about ODOT's data needs and functional requirements, as well as what other state DOTs have done. As part of this research, it was learned that Connecticut DOT had used their video road log to inventory guardrails. This was shared with the Geo-Environmental Section's GIS committee and now ODOT is also using the Digital Video Log to inventory guardrails.



The second objective of this project is to determine the methods, time, and effort required for collecting and inputting data on all culverts, pipes, and storm water facilities within the entire ODOT transportation system. This is being done by analyzing existing databases, as well as collecting data along short segments of highway throughout the state. The research will be focusing on culverts, but work is also being done to address other drainage facilities that ODOT must manage.

Early results seem to indicate that the number of culverts to be inventoried is not as great as was once thought. However, identifying how to determine where *all* the culverts are is still being researched. The Geo-Environmental Section is experimenting with using the latest GPS/Mobile GIS technology for field data collection on this research project, and with their landslide and rockfall inventory project.

With the help of this research, ODOT will eventually be able to more efficiently manage all of their drainage facilities. This will help to protect the environment and keep the highway system running smoothly. In other words, we will have a better idea of how many spoons we have ready for that next bowl of Rocky Road.

For more information about this project, contact Matthew Mabey at 503-986-2847.

ODOT HELPS WITH SEISMOGRAPH NETWORK

The southeastern corner of Oregon is one of those out-of-the-way places - but things do happen there. In the Spring of 2004, a swarm of earthquakes occurred there. When the earthquakes started to occur near the town of Jordan Valley, people knew about them because seismographs in southwestern Idaho and in Oregon's Alvord desert recorded some of the larger events. However, it takes at least three, and preferably more, stations to locate an earthquake. The existing stations were also too far away to be used to locate the smaller earthquakes in the swarm.

For many parts of the US, earthquakes, as small as magnitude 1 or 2, can be located with regional networks of seismometers. Oregon benefits from one of these regional networks, Pacific Northwest Seismograph Network (PNSN), that is operated out of the University of Washington. The University of Oregon and the US Geological Survey's Earthquake Program and Cascade Volcano Observatory also cooperate in the operation of this regional network. For over a decade ODOT has also helped with this network by carrying some seismograph data over its microwave network. You can see some of the data being gathered with the help of ODOT's microwave network from the Pine Mountain Station at: <http://www.pnsn.org/WEBICORDER/BB/welcome.html>.

Unfortunately, the earthquakes near Jordan Valley were outside the coverage of the PNSN. An expansion of the regional PNSN into southeastern Oregon was needed. Enter the ODOT Research Unit. The Oregon Department of Geology and Mineral Industries

and PNSN contacted Matthew Mabey of ODOT's Research Unit to see if there was anyway ODOT could help out. They needed to know what data communication resources ODOT had in the area and if they could be used. A Research Discretionary Fund project was quickly created and the Research Unit worked with ODOT's Wireless Communications Group to determine what capabilities were available. It was determined that the closest facility was in Burns, Oregon.

With the Research Unit acting as a liaison, PNSN was able to quickly establish a seismograph installation at the Burns microwave tower site and begin sending the data over the ODOT microwave network using excess capacity. Working with ODOT's Office of Information Technology they were also able to establish an internet connection in Salem to carry the data the rest of the way to Seattle. PNSN also worked with Jordan Valley High School to install a seismograph there using the school's internet access.

Similar to the weather, geologic events can also affect the highway system. Although these geologic events are admittedly rarer than weather events, by working cooperatively with organizations like PNSN and USGS it is possible for ODOT to have access to this data at very little cost. It is hoped that the kind of cooperation exhibited in this project can be carried forward for mutual benefit in the future. For more information about this project, contact Matthew Mabey at 503-986-2847.

METHODS FOR INSPECTING COMPOSITE-STRENGTHENED BRIDGES

Since the late 1990s, Oregon has used fiber reinforced polymer (FRP) composites to increase the load capacity of reinforced concrete bridges. As more bridges in the state require strengthening, composites will be applied to even more structures. However, the effect of specific defects on performance has not been well documented, and viable methods for detecting defects have not been investigated. Consequently, ODOT funded a research project with the University of California at San Diego to evaluate non-destructive detection methods for composites and to develop guidelines on the criticality of various defects.

The research classified potential defects based on location in the concrete-composite system and when defects can occur. Defect types were illustrated with schematics and photographs, and the potential effects of these defects on structural integrity, durability, and aesthetics were described. Possible non-destructive evaluation (NDE) techniques for detecting the defects were reviewed and incorporated into a ranking matrix

that summarizes the applicability of the methods for inspecting FRP-rehabilitated concrete components.

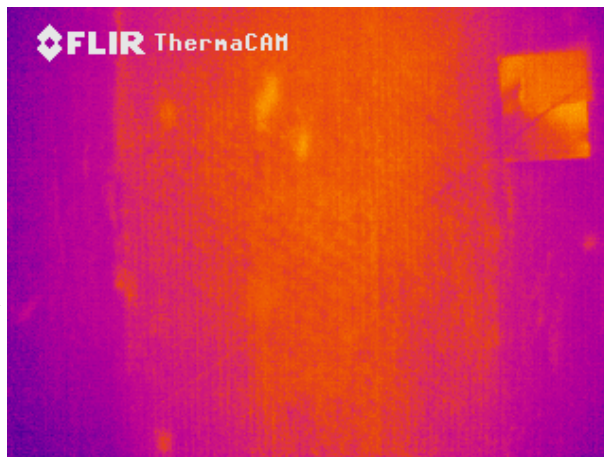
The review of NDE methods showed that in addition to the mainstream methods of FRP inspection, visual and tap test,

infrared thermography can be an effective inspection tool.

Thermography detects differences in heat dissipation from the surface of the composite to locate defects. It is relatively easy to conduct and does not require extensive training or certification.

The information provides bridge personnel with a valuable reference for inspection, maintenance, and quality assurance. As more bridges are strengthened using FRP composites, bridge personnel will need to determine the condition of the composite system on each bridge over time. This research

will help set allowable defect levels and provide guidance in selecting appropriate inspection techniques. For more information about this project, contact Steve Soltesz at 503-986-2851.



Thermographic image using ODOT's infrared camera shows FRP strip (orange) with two small areas that are not bonded to the concrete (yellow spots).

ODOT RESEARCH PARTNERING WITH PSU ON NATIONAL SPEAKERS FOR SEMINARS

For several years the Center for Transportation Studies at Portland State University has been hosting weekly Friday transportation seminars, open to students, faculty, transportation professionals, and the public. The topics are wide-ranging, including safety, congestion, traffic management, transit, modeling, ITS, parking, freight movement, land use, finance, planning, pedestrian and bicycle issues.

This year ODOT Research is partnering with PSU to bring prominent national figures to speak at the seminars and also meet with interested PSU and ODOT personnel. Under the Visiting Scholar Program, the funds provided by ODOT help pay for the speakers' travel costs. In turn, interested ODOT staff are invited to attend a reception to meet with the speaker after the seminar.

The seminars are held from 12:00 noon to 1:00 p.m. in Room 204 of the Urban Center at PSU. The Urban Center is in the block between 5th and 6th Avenue and Hill and Montgomery Streets. The seminars are open to any ODOT staff wishing to attend.

The reception with the speakers takes place after the seminars from 1:30 to 3:00 p.m. Those wishing to attend the reception should send an RSVP to:

Jennifer Dill, phone: 503-725-5173, e-mail: jdill@pdx.edu; or Robert Bertini, phone: 503-725-4249, e-mail: bertini@pdx.edu.

For the full weekly seminar schedule, see the PSU Center for Transportation Studies web site:

<http://www.cts.pdx.edu/seminars.htm>

For more information about this program, contact Alan Kirk at 503-986-2843.

Date	Seminar Topic	Speaker
1-Apr	Extending the Value of Automatic Data Collection Systems in Transit	Nigel Wilson, Professor, Civil & Environmental Engineering, Massachusetts Institute of Technology
15-Apr	A Quiet Revolution in Transportation Finance	Martin Wachs, Director, Institute of Transportation Studies, University of California at Berkeley
3-Jun	If You're Not Part of the Solution, You're Part of the Problem: The Planner's Role in Meeting the Transportation Needs of An Aging Society	Sandra Rosenbloom, School of Planning, University of Arizona

Upcoming and Past Speakers funded by the Visiting Scholars Program

SKOOKUMCHUCK CULVERT TEST BED YIELDS RESULTS

The name Skookumchuck may bring a smile to your face but the Skookumchuck Culvert Test Bed is intended to learn how to keep fish happy. For the last four years ODOT has contributed to a pooled fund project, led by the Washington Department of Transportation, to build and operate a facility to study fish passage through culverts in a controlled setting. Washington DOT is managing the pooled fund project while Alaska, California and the Federal Highway Administration have also contributed.

Most of the first two years were spent designing, fabricating and installing the test bed, but these past two years have brought the first results from the research testing. The reports are currently out for review and comment.

Culverts are an inexpensive and commonly used method for passing a river or stream under a roadway. The problem is that many culverts create flow conditions that block the movement of juvenile, or sometimes even adult, fish. The test bed was built at the Washington Department of Fish and Wildlife's Skookumchuck Fish Hatchery. This allows for a large supply of clean, cold water as well as easy access to several species of fish. Recent research has shown that upstream movement of juvenile salmon is much more substantial than previously thought.

The test bed allows for careful observation and control of hydraulic flow conditions. The slope, size and shape of the culvert are changeable as is the volume of water. A micro-acoustic Doppler velocimeter can be precisely positioned throughout the culvert to measure the direction, velocity, and turbulence of the water

flowing in the culvert. This instrument applies the same concepts that Doppler weather radar uses to track thunder storms and predict microbursts at airports, but it uses sound waves instead of radio waves.

If and how fish can move through a culvert are very important questions for the test bed to answer. Infrared cameras and lights in the test bed allow for the behavior of fish to be

recorded and analyzed under day or night lighting conditions. During tests designed to measure juvenile Coho salmon leaping ability, fish were observed leaping up to 5 times their body length into the culvert. While this may not be considered typical of Coho salmon, it illustrates the complexities of trying to measure and understand the behavior and capabilities of living creatures. The controlled conditions of the culvert test bed are intended to help with these problems.



This photograph shows the Skookumchuck Culvert Test Bed. The silver culvert in the middle is a movable and removable section to allow different shapes and sizes of culverts to be tested. The green "A-frame" just to the right of center is used to change the slope of the culvert.

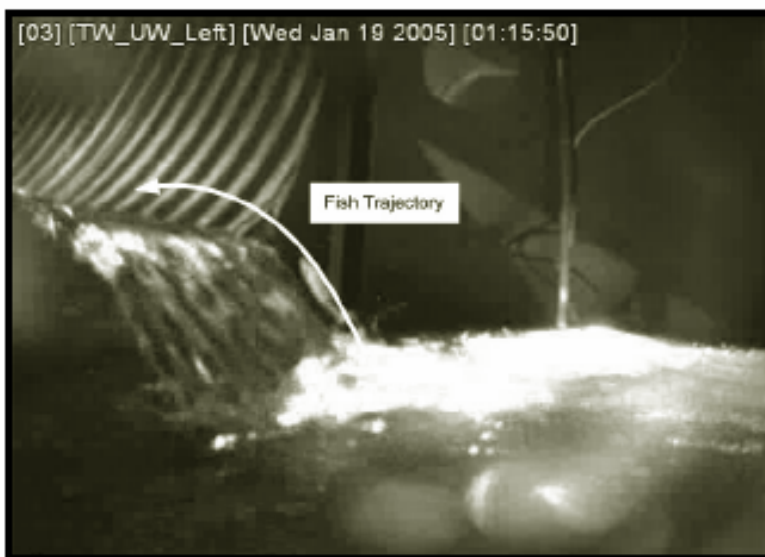


Image from an infrared video camera showing a juvenile Coho salmon in the test bed jumping a 20 cm high waterfall at the end of the culvert. The fish can be seen between the white line and the waterfall.

So far the tests have been intended to establish a baseline for juvenile salmon passage under various flow conditions and fish behavior in a bare culvert. Later this year, a commonly used type of fish-passage-enhancing baffle will be added so that the changes in flow conditions and fish behavior can be carefully observed. It is hoped that this research will validate the efficacy of current techniques and that improved techniques for enhancing fish passage can be developed based on testing.

For more information about this project, contact Matthew Mabey at 503-986-2847.

RECENTLY PUBLISHED REPORTS [\(click on underlined items for electronic reports\)](#)

[Fish Passage Through Retrofitted Culverts](#)

FHWA-OR-RD-05-05

Long term and short term studies of fish movement were conducted at several retrofitted culverts within Oregon. This was done to assess the effectiveness of retrofitting culverts with baffles to improve fish passage. The observations from the study indicate that fish can and do move through culverts retrofitted with baffles and that the addition of baffles can improve the ability of juvenile fish (especially steelhead trout) to move upstream through a culvert.

[Durability of Truncated Dome Warnings on Existing Curb Ramps](#)

FHWA-OR-DF-05-06

In 2002, FHWA notified ODOT that the state was required to use truncated dome detectable warnings on curb ramps. A research project was undertaken to monitor four products that appeared to be best suited for retrofitting existing curb ramps. Over a two-year monitoring period adhesion to the concrete was good, and physical damage was not a problem. Changing color and contrast over the two-year period was an issue, however.

[Evaluation of Latex Polymers to Resist Stripping in Asphalt Pavements in Oregon](#)

FHWA-OR-RD-05-07

This study assessed the effectiveness of latex polymer anti-stripping treatment by inspecting and evaluating the condition of pavements constructed in Oregon from 1997-2001. Ten

hot mix asphalt concrete paving projects were identified throughout the state. Five of the projects used hydrated lime as an anti-stripping additive, and five used latex polymer (UP-5000) as an anti-stripping additive. Cores were taken and then tested to determine their Tensile Strength Ratio (TSR). The TSR and condition ratings were used to compare the effectiveness of the UP-5000 to hydrated lime.

[Methods for Detecting Defects in Composite Rehabilitated Concrete Structures](#)

FHWA-OR-RD-05-09

Fiber reinforced polymer (FRP) composites are increasingly being used to rehabilitate understrength or deteriorating concrete structural elements and to prolong useful service-life of bridge structures. The report address four specific aspects related to the identification of defects during the inspection of FRP repairs. Potential defects are identified, classified by type and stage at which they could occur and their effects are listed within the report.

This report is available on CD only. Please request a copy by contacting the ODOT Research Unit.

NEW RESEARCH NOTES [\(click on underlined items for electronic reports\)](#)

[Inlaid Durable Pavement Markings: Year One](#)

RSN 05-04 (December 2004)

In the summer of 2003, a test deck was installed to evaluate the performance of inlaid durable pavement markings within a snow zone. Three different durable pavement markings are being evaluated - Dura-Stripe (methyl methacrylate), Permaline (hot-poured thermoplastic), and 3M Stamark 380 tape. The depth of the groove was varied, as was the thickness of the material. In the Spring of 2005 another evaluation will be held.

[Retroreflectivity: How Oregon Signs Measure Up](#)

RSN 05-05 (January 2005)

In July 2004, FHWA published notice of a proposed rulemaking on maintaining the retroreflectivity of traffic signs. The proposed rule speaks to minimum retroreflectivity levels, sign assessment methods, and sign management methods. In 1999, ODOT Research conducted a study to examine how the

age of signs and other factors affected sign retroreflectivity. This research note summarizes how the 1999 study compares to the proposed minimum standards from FHWA.

[Retrofitting Culverts for Fish](#)

RSN 05-06 (January 2005)

Culverts are a well established method to pass a roadway over a waterway. This project explored the effectiveness of placing baffles in an existing culvert. The project used a long term mark and recapture experiment, as well as a controlled release experiment - all using juvenile fish.

[GIS Mapping of Environmental Justice Populations](#)

RSN 05-07 (March 2005)

As part of the requirements for receiving federal funds, ODOT is responsible for successfully integrating environmental justice into its program and planning activities. This study assembled a GIS database which identifies census tracts and block groups statewide where low-income and minority populations reside.

T2 CENTER REACHES 20 YEAR MARK



The Oregon Technology Transfer (T2) Center recently celebrated its 20th year anniversary. The T2 Center was established in September 1984 with little fanfare. The purpose was to help local agencies obtain the latest and best available information and training on transportation technology. The center has survived many changes

in location and personnel in the last 20 years, but the mission remains the same

In 1984, the T2 Center was one of 20 Technology Transfer Centers established nationwide by the Federal Highway Administration (FHWA) with the express purpose to furnish transportation information and training to local jurisdictions. Twenty years later the center continues to operate with a small staff on a limited budget - but with significant results. The program continues to be funded by FHWA with matching funds from the Association of Oregon Counties (AOC), League of Oregon Cities, and ODOT.

The Center's tasks remain virtually the same as they were 20 years ago, but the level of emphasis has changed. Due in-large part to the development of the internet, less emphasis is given

to the distribution of technical assistance and publications. At the same time, their video lending library keeps growing and continues to be a very popular service.

The largest change occurred in 2001 with the development of the Oregon *Roads Scholar* training program. The Oregon *Roads Scholar* program provides local government personnel the opportunity to enhance their maintenance skills with training on current procedures and technologies. Recently, the T2 Center awarded certificates to 17 program participants for completing the requirements for *Roads Scholar* Level 1. Their achievement represents a high level of professionalism and demonstrates their commitment to self-improvement and personal development. Those recognized were from Josephine and Clackamas counties, and from the cities of Redmond and Salem.

For more information about the Oregon *Roads Scholar* program, or the Oregon T2 Center visit their web site at: http://egov.oregon.gov/ODOT/TD/TP_T2/

FUN FACT!

In 1987, after a 39 year career with ODOT, Richard Young was one of three new Circuit Riders (trainers) for the T2 Center - and he's still doing it today!



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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/](http://www.oregon.gov/ODOT/TD/TP_RES/)**