



Research Notes

Oregon Department of Transportation

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Monitoring the Health of Bridges

Oregon has hundreds of decade old reinforced concrete bridges with large cracks in the concrete. Many of these bridges are slated for replacement as part of the highway improvement initiative passed by the state legislature.

However, not all of the bridges can be replaced, nor do they need to be replaced any time soon. Research at Oregon State University has provided ODOT with better analytical tools for determining the safe load capacity of the cracked bridges. ODOT personnel now know that cracks alone do not necessarily mean that a bridge must be replaced. Methods are in place to decide which bridges are replaced, repaired, or left alone based on rational safety, engineering, and economic criteria.

But what about the cracked bridges that are not replaced or repaired? Calculations show that they are able to safely accommodate the loads - but watching cracks open and close with each truck passing overhead can be very unnerving. As an additional measure of assurance, the ODOT Bridge Engineering Section is pursuing structural health monitoring systems that continuously check the vital signs of a bridge. Gauges are permanently connected to the steel reinforcement at critical locations to measure the amount of stress the steel feels with

each passing vehicle. Other sensors detect the amount a crack opens and closes. Temperature and humidity sensors provide environmental information so that engineers can determine whether changes in the vital signs are just a

normal function of the bridge adjusting to the weather. Instruments on site collect the data and send it to computers at ODOT headquarters, where engineers check on the past and current condition of the bridge. If any sensor surpasses a threshold, a message is immediately sent to engineers for action. Currently, ODOT has two structural health monitoring systems in operation, with four more being installed. If the

systems work well, additional systems are likely to be installed on critical bridges.

ODOT also is conducting research into a technology, called acoustic emission, that listens to the internal sounds that a bridge makes. An array of sensitive sensors is attached to the bridge, near cracks, to hear the sound patterns that result when the bridge flexes due to traffic. The sound patterns may reveal the degree of damage and even the precise location of new damage. If the technique can be perfected, it will become another test for checking the health of Oregon's bridges.



Crack opening and temperature sensors installed on bridges



Acoustic Emission Test

For further information on ODOT's structural health monitoring, contact Steven Lovejoy via e-mail at: steven.c.lovejoy@odot.state.or.us.

For more information on ODOT bridge-related research, contact Steven Soltesz via e-mail at: steven.m.soltesz@odot.state.or.us



Research Unit
200 Hawthorne Ave. SE, Suite B-240
Salem, OR 97301-5192

Telephone: 503-986-2700
FAX: 503-986-2844

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visit the web site at***
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