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Background Brief on...

# Bridges

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## Background

Approximately 6,590 bridges connect Oregon's 44,400 mile road and highway system. The road system is vital to the movement of citizens, visitors, freight, and other commerce. Bridges are points where the road system is especially susceptible to interruption. When officials must limit the weight of loads allowed on bridges that are not built to handle today's heavy loads or are beginning to show signs of deterioration, commerce can be seriously disrupted by requiring long detours for heavy trucks on alternate routes.

The Oregon Department of Transportation (**ODOT**) owns and maintains over 2,600 bridges. Most of the rest are under the control of local governments throughout the state. Of the state bridges, 70 are currently under load restriction until they can be repaired or replaced, including 27 bridges on major state routes.

## The Bridge Program

ODOT inspects most bridges every two years; those that are beginning to show signs of significant wear are inspected annually or every few months. Funding for bridge inspection, maintenance, repair and replacement is part of existing highway funding mechanisms. Bridge maintenance and minor repairs fall to ODOT maintenance crews and are covered in the maintenance portion of ODOT's budget. Bridge structural repair or replacement is part of the bridge program's biennial budget.

## Bridge Cracks

Over 350 of Oregon's bridges are nearing the end of their 50-year "design life." The passage of time, traffic, effects of the elements, and the structural weight of the bridges themselves have begun to take their toll on these older bridges, which were designed for lower vehicle weights, slower traffic speeds, and less traffic volume than are typical on Oregon's roads today.

The average age of state-owned bridges is 41 years, and 20 percent are over 50 years old. A significant number of reinforced concrete deck girder bridges built between 1947 and 1961 are now beginning to show significant cracking problems. ODOT has documented the cracks in the past, but they are growing in number and in size. Of the 555 bridges of this type, 487 now show some degree of cracking: 178 have low-density cracks that could

become problematic in the future; 180 have medium-density cracks, mostly around supports, and are likely candidates for replacement or repair; and 129 bridges show dispersed high-density cracks and are also candidates for repair or replacement. Until repairs can be effected on these bridges, weight limits must be enforced to prevent further degradation or failure.

Today's trucks are heavier than those in use when many of the state's bridges were designed and built. The number of miles traveled annually by trucks exceeding 70,000 pounds has increased from roughly 100,000 in 1965 to over 1.5 million today. In some cases the trucks exceed what older bridges were designed to carry. Enforcement of an 80,000 lb. weight limit on a significant portion of Oregon's bridges would impose a number of costs on motor carriers, including the need to purchase additional trucks, hiring additional drivers and higher weight-mile taxes. Those costs, when passed on to producers, would also have a negative effect on many business sectors, particularly manufacturing.

The ODOT Bridge Strategy Task Force was formed to analyze the cracking problems and released its final report on June 20, 2002. In that report, the task force recommended moving away from ODOT's traditional bridge repair strategy, in which bridges in the worst condition are the first to be repaired. Instead, the report recommends repair efforts focus on returning the state's two main corridors, Interstate 5 and Interstate 84, to full freight service by repairing all load limited bridges. The estimated cost of replacing the 22 cracked and 12 load limited bridges on Interstate 84 is \$108 million; repairing and replacing 124 cracked and 33 load limited bridges on Interstate 5 will cost an estimated \$673 million. Subsequent repairs would also be undertaken following this "corridor-based" strategy. Also, the task force recommends appropriate weight enforcement and further study on the relationship between bridges and load size.

### Seismic Risk

Oregon lies in a region of particularly high seismic activity, due primarily to its proximity to the "Cascadia Subduction Zone," where the Juan de Fuca (tectonic) Plate pushes under the North American Plate. The seismic activity below Western Oregon is capable of generating earthquakes of magnitudes as high as 8 or 9 on the Richter scale, sufficient to cause

catastrophic damage to structures, including bridges. ODOT estimates that as many as 70 percent of the state's 6,500 bridges could be susceptible to a subduction seismic event.

Prior to 1958, bridge designs did not account for "seismic loading," due to the lack of understanding at that time of the earthquake potential in the Northwest. More sophisticated analysis in the past several years has alerted ODOT engineers to the potential for bridge failures during an earthquake, as well as methods for retrofitting most of those bridges to enhance their ability to survive such an event.

ODOT has identified retrofit methods that can help protect bridges from earthquake damage, but engineers note that it is impossible to absolutely assure no damage from a high magnitude earthquake. Routes have been prioritized according to their importance during an emergency situation. Refits scheduled for Phase 1 (tying the deck onto the bridge) would include 375 bridges at a total cost of \$198 million, while Phase 2 refits (strengthening of piers and footings) would address 668 bridges at a cost of \$796 million. The total cost, \$994 million, would require \$50 million annually for 20 years.

In regard to seismic retrofits, ODOT spends only about \$4 million annually. The agency has retrofitted 160 bridges and replaced 296 others with new seismic designs.

### Historic and Coastal Bridges

Forty-four of Oregon's bridges are especially valuable because of their historical significance. Because these bridges are older they require additional maintenance. Because of their locations, many of these bridges also experience greater wear from environmental conditions. In order to fully restore and preserve the state's historic bridges, 10 require major painting (at a cost of \$139 million), four require corrosion protection (\$59 million), and four are moveable bridges requiring restoration (\$32 million), for a total cost of \$230 million.

### Local Bridges

ODOT is responsible for all bridges on state roads. However, state highways make up only 7,500 miles of Oregon's road system, compared to 27,000 miles of county roads and 9,300 miles of city streets. There are 3,910 bridges on county and city roads, and

those bridges must also be inspected, maintained, and periodically replaced. Responsibility for inspections falls to local government engineers. The Association of Oregon Counties (AOC) reports that approximately 10 percent of county bridges are either structurally deficient or functionally obsolete. A complete survey of local bridges with reinforced concrete girders is underway to determine the extent of cracking.

### **Recent Legislative Action**

The 2001 Legislative Assembly passed the Oregon Transportation Investment Act (OTIA) with the passage of House Bill 2142 (and House Bill 4010 during Special Session). The acts authorized \$500 million in bonding for modernization, pavement preservation, and bridge projects throughout the state. Most of the additional revenue to repay the bonds is from an increase in title transaction fees. Projects were selected by the Oregon Transportation Commission and many have been completed or are underway. Of the \$500 million, \$174 million has been applied to 19 state bridges and 46 county and city bridges.

In 2003 the Legislature passed HB 2041, referred to as OTIA III, authorizing ODOT to issue additional Highway User Tax revenue bonds for highway improvement projects, including bridge repair and modernization. The measure increased vehicle registration and title transaction fees to help repay bonds providing an additional \$2.5 billion for improvements over the next ten years. The amount dedicated to bridge projects is divided between state bridges (\$1.3 billion) and city and county bridges (\$300 million). Projects were selected by the Oregon Transportation Commission with input from technical rating committees, the Oregon Freight Advisory Committee, Area Commissions on Transportation and stakeholders.

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