Background Brief on …

Bridges

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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 may not have been built to handle today's heavy traffic and 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. 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

A 2002 ODOT report revealed that over 350 of Oregon's bridges were 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 taken their toll on older bridges that 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 at the time of the report was 39 years, and 20 percent were over 50 years old. A significant number of reinforced concrete deck girder bridges built between 1947 and 1961 had begun to show significant cracking problems. ODOT had documented the cracks in the past, but they were growing in number and in size. Of the 555 bridges of this type, 487 had begun to show some degree of cracking. Until repairs were affected on these bridges, weight limits had to be enforced to prevent further degradation or failure; 70 were placed under load restriction until they could be repaired or replaced, including 27 bridges on major state routes.

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 pound weight limit on a significant number 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 Oregon Transportation Investment Act

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 were the first to be repaired. Instead, the report recommended 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 was $108 million; repairing and replacing 124 cracked and 33 load-limited bridges on Interstate 5 was expected to cost $673 million. Subsequent repairs were also to be undertaken following this "corridor-based" strategy.

The 2001 Legislative Assembly enacted the Oregon Transportation Investment Act **(OTIA)** with the passage of House Bill 2142, followed by OTIA II with the passage of House Bill 4010 during the 2002 Special Legislative 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 was to come from an increase in title transaction fees. Projects were selected by the Oregon Transportation Commission. Of the $500 million, $174 million was applied to 19 state bridges and 46 county and city bridges.

In 2003, the Legislative Assembly passed House Bill 2041, referred to as OTIA III, authorizing ODOT to issue additional 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 10 years. The amount dedicated to bridge projects was 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.

A 2004 study by Oregon State University **(OSU)**, commissioned by ODOT, led to a revision in the size and scope of the bridge replacement and repair program. The study changed the nationally accepted thinking about the way bridges support weight and allowed bridges to remain in operation while awaiting repairs or replacement. It also allowed ODOT to re-evaluate the cracked bridges and modify the planned action in many cases. As a result, some bridges identified in the OTIA III program will not require any work, while others will require repair rather than replacement.

As of August 2006, every project funded through OTIA I and II is in design (13 state and 8 local), under construction (24 state and 12 local), or open to traffic (60 state and 57 local). Of OTIA III projects, 108 state bridge projects are awaiting design; 84 state and 7 local bridge projects are in the design process; 45 state and 13 local bridges are under construction; and 36 state and 4 local bridge projects have been completed. As a result of the OSU study, 71 state bridge projects originally slated for OTIA III have been determined to need no work.

Design-Build vs. Design-Bid-Build

Design-bid-build contracting has historically been used for most public works projects,

separating the delivery process into three distinct phases. During the design phase, ODOT or a private sector contractor produces the engineering design; in the bid phase, ODOT assembles the documentation, advertises the bid, and awards a construction contract; in the build phase, a private contractor builds the project with ODOT oversight.

With the passage of OTIA III, ODOT sought to transition to the *design-build* method of contracting. In this process, a bid is put out for both design and delivery of a project. Bids can be submitted by a single entity, a consortium, a joint venture, or other organization assembled for a particular project. Design-build contracting has become widely used throughout the United States during the past 15 years and can reduce delivery time and related delays, simplify relationships, more quickly develop solutions and establish project costs, and decrease the number of construction contract changes.

Customary practice with design-build contracting is to rely on best value, which takes into account both the technical capabilities and qualifications of the design-build team and the cost of the bid. There is no universally accepted approach for determining best value and the request for proposals usually specifies the relationship between cost and technical factors.

Context Sensitive and Sustainable Solutions

As part of ODOT's bridge delivery program under OTIA III, the agency has adopted a framework known as Context Sensitive and Sustainable Solutions, or CS^3. The framework is organized around five core principles for bridge program projects:

- Stimulate Oregon's economy
- Employ efficient and cost-effective delivery practices
- Maintain freight mobility and keep it moving
- Build projects sensitive to their communities and landscapes
- Capitalize on funding opportunities

CS^3 is designed to preserve Oregon's scenic, aesthetic, historical, cultural and economic and environmental values while building safe and enduring projects.

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 eight or nine 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. Based on data from 2004, retrofits scheduled for Phase 1 (tying the deck onto the bridge) would include 375 bridges at a total cost of $198 million, while Phase 2 retrofits (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 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; hence, 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), 4 require corrosion protection ($59 million), and 4 are moveable bridges that require 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 ten percent of county bridges are either structurally deficient or functionally obsolete. A complete survey of local bridges with reinforced concrete girders was to be performed to determine the extent of cracking. The OTIA III program also provided $300 million for local bridge repair and replacement.

Columbia River Crossing

The Columbia River Crossing is a bridge, highway, and transit project that is meant to address transportation challenges on the Interstate 5 Bridge between Oregon and Washington and its approaches in Portland and Vancouver. With only 3 lanes in each direction, the existing bridge is strained to capacity to carry the current 135,000 vehicles each weekday. With the population of the region expected to increase by over 1 million people during the next 25 years and freight truck traffic expected to more than double during that same period, transportation planners are seeking solutions for congestion, safety, bicycle and pedestrian access, public transportation needs, seismic vulnerability, and marine navigation and mobility constraints.

Oregon and Washington created a 39-member Columbia River Crossing Task Force to represent a broad range of perspectives to advise the project team. The project is currently considering alternatives, including: whether to replace the existing Interstate Bridge or to add a supplemental span; whether the project should include a light rail connection or bus rapid transit; funding alternatives such as tolling (including possibly tolling the Interstate 205 bridge across the Columbia River as well); and related projects.

The current estimated cost of the Columbia River Crossing project ranges from $3.1 billion to $4.2 billion.

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