



New Life in Old Material

by Geoff Crook, Oregon Department of Transportation

Concrete Reuse and Recycling on Oregon's Bridge Program

With a 10-year duration, involving 365 bridges, and costing \$1.3 billion, the Oregon Transportation Investment Act (OTIA) III State Bridge Delivery Program is Oregon's largest infrastructure project in five decades.

The massive scope of the bridge program has given the Oregon Department of Transportation (ODOT) an opportunity to make the three "Rs" of reduce, reuse, and recycle standard practices in bridge and highway construction. In 2005, the agency and the Oregon Department of Environmental Quality worked to develop a set of materials performance standards for use on the bridge program. These standards direct contractors to handle construction waste, including concrete debris, to achieve the "highest and best end use," preventing waste generation and minimizing disposal in landfills.

According to the Construction Materials Recycling Association, more than 140 million tons of concrete are recycled every year in the United States. ODOT is eager to contribute to this process. Halfway through the bridge program, we already have many successes to report.

Recycling: Making the Old New Again

For contractors working on the bridge program, the benefits of recycling are many, such as the avoidance of hauling costs and landfill fees. For local communities, recycling on site or nearby means less noise and truck traffic and better air quality. In addition, recycled or reused concrete conserves land and aggregate resources.

Contractor Staton Cos. helped ODOT set the standard for success in reuse and recycling early in the program when it demolished the Burlington Northern Santa Fe railroad bridge in Madras and the California Avenue and Green Springs Drive Bridges in Klamath Falls, both on U.S. 97. On these projects, Staton salvaged 100% of the concrete from the demolitions.

In Madras, almost 580 tons of concrete were delivered to Cinder Butte Rock in Redmond for crushing and reuse. In Klamath Falls, the company was able to set the bar even higher by recycling the material on site. It removed 7227 tons of concrete from two bridges and crushed it into 1-in. rubble. Five hundred tons of

On the OTIA III State Bridge Delivery Program, ODOT took an opportunity to capitalize on the program's scope and emphasized environmental consciousness. Because many of Oregon's bridges are built using precast concrete, the potential for recycling and reuse is tremendous. All Photos: ODOT.

this gravel were then reused as fill and to pave an approach road.

On a separate project near Cottage Grove, Capital Concrete Construction matched Staton's achievement by recycling all the concrete from a demolished bridge into new embankments.

To give an idea of the savings involved in avoiding disposal costs, Hamilton Construction, which rebuilt two bridges south of Portland, estimates 3000 tons of bridge demolition materials, including 1000 yd³ of concrete, were either reused (15%) or recycled (85%), resulting in an estimated savings of \$120,000 in landfill fees.

When they can't use the rubble they generate themselves, contractors recycle by collaborating. Holm II Inc. and its subcontractor, Goodfellow Bros. Inc., were demolishing and rebuilding an overpass above I-5 south of Eugene that would leave them with roughly 30,000 yd³ of rubble. A short distance away, Ross Bros. & Co. needed nearly 40,000 yd³ of embankment materials to use beneath four bridges and to widen an I-5 interchange. Working together, the



ODOT's 1.3 billion OTIA III State Bridge Delivery Program is replacing or repairing hundreds of bridges like this one to ensure that motorists and freight reach their destinations quickly and safely.

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three independent contractors agreed to exchange the aggregate free of charge. Goodfellow Bros. avoided disposal costs, and Ross Bros. avoided purchasing fill.

The collaboration was made possible by ODOT's commitment to the design-build method of construction, which gives contractors the flexibility to propose creative solutions that address current needs, future needs, or both. On a tightly packed construction schedule, this sort of collaboration keeps everyone on time and within budget. In addition to keeping the rubble out of a landfill, Goodfellow Bros. and Ross Bros. saved money on transportation costs. Because the work sites were less than two miles apart, fuel costs and pollution were decreased significantly.



ODOT saved money through this initiative as well. Every construction contract has a clause that allows for rising fuel prices. Reusing the waste material and transporting it over a shorter distance reduced the amount of money spent on diesel fuel, making the contract price more stable and helping to stay under budget.

Upping the Ante: Reuse of Bridge Beams

While we strive to keep concrete out of landfills whenever possible, the reuse of intact bridge beams saves even more time and money than recycling by avoiding the need to crush the aggregate, as well as cast new beams. Reuse requires creativity and

ODOT has been proactively addressing Oregon's aging bridges for more than six years. Oregonians have not seen an investment of this magnitude in highway and bridge construction in 50 years, since the state's interstate freeway system was built in the 1950s and 1960s.



Of the 365 bridges in the program, 119 are currently under construction, and another 76 have been completed and opened to traffic.

Hundreds of tons of epoxy-coated reinforcement were used for the Green Springs Drive Overpass on U.S. 97 in Klamath Falls, Ore. When the original structures were demolished, the contractor recycled 100% of the concrete.



forethought that demonstrate ODOT's and contractors' joint commitment to sustainability as more than just an economic decision.

Near Creswell, a manager from Goshen Forest Products noticed construction taking place near his lumber mill, so he approached the superintendent for the contractor, Holm II, about needing some bridge beams for his lumberyard. After construction was complete, rather than demolishing the beams and grinding the concrete to rubble, Holm II decided to take the beams out in pieces and deliver them to the mill.

The six 105-ft-long beams and bridge deck equate to approximately 214 yd³ of concrete that will be diverted from local disposal or recycling facilities. The mill will reuse the beams in their entirety as foundations for supporting harvested logs.

In other cases, strategic planning leads to thoughtful reuse of bridge beams. A standard plan for keeping traffic moving when replacing an interstate highway bridge is to install a temporary detour structure. Because CH2M Hill was both the designer and the builder of 10 replacement bridges on I-5 between Eugene and Roseburg, it was able to design an early detour structure so that most of its 88 prestressed concrete box beams could be reused on three subsequent detour bridges. Because each beam is worth approximately \$6300, reusing 80 of them reduced the cost of the contractor's bid by about \$500,000.

As the cost of quarrying and casting concrete beams continues to rise, it makes increasing sense to preserve

On the I-5, Clarks Branch to Tunnel Mill Race project, contractors demolished the River Drive overpass and salvaged 30,000 yd³ of rubble, which was reused as aggregate on another OTIA III State Bridge Delivery Program project.



Good planning on the bridge program has allowed contractors to reuse precast concrete beams from detour structures. On a project near Eugene, 56 precast, prestressed box beams were salvaged from a detour structure and will be used on later projects.

them for future use even when no immediate need exists. Recently, ODOT and Hamilton Construction collaborated to salvage 56 precast, prestressed box beams, each 115 ft long, from a detour bridge near Eugene and deliver them to a storage lot on the other side of the city. With five years of bridge program construction ahead, we are confident there will be a future need for these salvaged beams. And when we supply them to contractors, the state will save an estimated \$1 million off the contracts in which they're reused.

Next Steps

In 2008, ODOT will include special provisions in construction contracts to guide and better track waste management activities. Construction companies will be asked to forecast the percentage of materials they anticipate reusing or recycling on their bridge projects and submit quarterly reports about their actual progress.

Targets have been established for various material types, upward of 80% for concrete, depending on the area of the state. To assist contractors, ODOT has developed template reuse and recycling plans, reporting forms, and a statewide recycling directory and guidebook.

With these new tools, ODOT will be able to collect complete and accurate information about what is feasible. These data will provide information about our business practices and help us set realistic goals for the future. We also want to highlight the good work that contractors are doing on behalf of the environment in the course of bridge repairs and replacements.

The economics of recycling concrete are more than convincing. Crushed recycled aggregate saves money and landfill space. Reused beams recover the value of the raw materials, as well as the labor that goes into their long-lasting construction. And perhaps most compelling of all are the benefits for ourselves and future generations as we lessen our demand for non-renewable natural resources.

Geoff Crook is the environmental program manager for the Oregon Department of Transportation's OTIA III State Bridge Delivery Program.

For more information on this or other projects, visit www.aspirebridge.org.

On the California Avenue overcrossing project, Staton Companies, an ODOT contractor, recycled 100% of the concrete from the demolitions.

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For more information, please contact Jim Toscas, PCI President (jtoscas@pci.org). Your communications will remain confidential.



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