

Small Highway Project Yields Big Results – For Fish and Drivers

Crews Replace Culvert and Improve Road on State Route 548 Near Birch Bay

By Katie J. Skipper, WSDOT Communications

At first glance, work this summer on State Route 548 appears to be just a little culvert replacement project. But what started as a concern from a local environmental nonprofit group has yielded benefits beyond the work zone. It resulted in improved habitat, structure and safety, and served as a classroom and field training opportunity for a young engineer.

SR 548, or Blaine Road, is a rural highway tucked up in the northwest corner of Washington near Birch Bay in Whatcom County. On average, about 2,000 vehicles a day travel the highway over Terrell Creek.

About 45 feet below the asphalt, a rusted steel pipe was intended to convey Terrell Creek from one side of the highway to the other, providing a passageway for fish moving upstream. Puget Sound steelhead, recently listed as threatened under the federal Endangered Species Act, are among the fish that depend on the stream for habitat.



WSDOT took the opportunity to flatten a dip in State Route 548 in Whatcom County while they were replacing a culvert.



The broken ends of an old steel culvert flipped up when water was running high, blocking passage for fish trying to swim upstream. The broken culvert also was an indication that water could be seeping in around the pipe, jeopardizing the road above.



The old culvert sat high above the stream bed.

Problems Emerge

Nooksack Salmon Enhancement Association, a Whatcom County-based environmental nonprofit group, alerted WSDOT that the culvert was failing and creating a barrier to fish. Part of the group's focus is lowland streams such as Terrell Creek, where habitat is degraded by past land uses such as farming.

Salmon Association members noticed the Terrell Creek culvert, a corrugated pipe about 110 feet long and 12 feet in diameter, was hanging about a foot above the surface of the creek, creating a difficult jump for fish. During high water, sections of the decaying pipe would flip up at the upstream end and close off the pipe completely.

Kristin Fredericks, a WSDOT wetland and fisheries biologist, said the constricted space was shooting water through with too much force, leaving no place for fish to rest.

"It's like a fire hose," Fredericks said before the improvement project began. "It's too small, and the water flows too fast."

Engineers knew that if the culvert was falling apart, damage could extend beyond fish passage. A crack in the metal beneath the road could allow water to pool and wash out pockets of soil around the pipe, potentially creating a dangerous sinkhole.

"The culvert was going to have to be replaced eventually because of rust, but it wasn't a high priority," said Marco Foster, a WSDOT engineering manager. "Coupled with the fact that it is a high priority for fish – that's what got the project funded."

Since the work was going to involve tearing out a section of road to replace the culvert, WSDOT took the opportunity to improve driver safety, too. Cars were obscured from other drivers' view when they traveled through a significant dip in the road. From crest to crest, the hills were 600 feet apart, with a dip that dropped 9 feet in the middle.

WSDOT secured \$2.2 million in federal funding for the highway preservation project. Ferndale-based Callen Construction Co. was awarded the \$1.3 million construction contract.

Learning Experience

About two years ago, 28-year-old transportation engineer Brian Charleston was assigned the lead design role for the project. Charleston was still cutting his teeth with WSDOT. He had been with the department for a year, straight out of the University of Illinois.

After designs were complete, project engineer Chris Damitio put Charleston on the project as lead inspector so he could see the process from beginning to end.



The culvert was 25 to 30 feet below the road, making it difficult to get to.



WSDOT project engineer Chris Damitio, left, and lead inspector Brian Charleston, discuss details of the culvert replacement project at Terrell Creek.



King sized bucket brigade: Crews worked in tight spaces and on steep slopes to conserve space and limit adverse effects to the surrounding area.

"It's not uncommon, and it is instructive," Damitio said. "When we get the opportunity, we try to match the designer with the construction project, especially a beginning engineer."

The culvert replacement was perfect for Charleston because it was a smaller, shorter-term project.

"To be able to do that, you learn a lot," Charleston said. "I know how stuff is built now and what the material looks like."

And he knows where he can improve his designs for next time. For example, he underestimated how much material it would take to fill the road in over the culvert, and he didn't intervene when he noted the contractor was overbuilding side slopes.

As a result, the project required 11,000 tons more fill material and nearly \$100,000 more than Charleston had estimated in his design. But overall, the project finished on time and on budget.

Damitio pointed out that errors are made on every project, and contingencies are built into all plans.

"He did a wonderful job," Damitio said. "As long as he learned from his mistakes, those challenges become successes."

Moving Dirt

Starting June 11, Callen crews spent three weeks clearing trees so the phone company could move overhead lines.

Water from the stream had to be pumped out and diverted through the work zone to an area downstream.

Fredericks, the WSDOT biologist, removed all the fish from a large scour hole downstream of the culvert so they wouldn't be harmed during construction.

Once the fish were removed, crews were ready to start digging. Crews would need to close the highway for 43 days because they were cutting out a section of roadway and rebuilding it. But traffic control was a breeze because of the relatively small amount of regular traffic, and because alternate routes were available on county roads, adding about a mile to a drive through the area.

It took about a week for crews to dig down 45 feet to the culvert in a section about 100 feet long, and chip out the old culvert. About 4,000 cubic yards of material – filling more than 250 dump trucks – were hauled off and stockpiled nearby to be used later for fill. All but the clay layer was saved to be put back. Charleston estimated that about 75 percent of the excavated material was used as fill.

In the interest of disrupting as little soil as possible, they built a steep service road down to the culvert base. With a 30 percent grade, the trucks could make it down the hill, but a bulldozer had to pull them back out.

"The crane driver was worried the brakes weren't going to work," Charleston said.



A crane lowers one of the first sections of the culvert into place.



The new culvert measures 145 feet long, 18 feet wide, and 10 feet tall.



Replacing the culvert required cutting out a section of the highway.

New Culvert, New Design

The rusty old steel culvert was replaced with a concrete box culvert. The advantage of the box culvert design was that the flat bottom could create a seamless transition to the adjacent streambed, both in terms of the level and the gravel material.

An 80-ton crane lifted 30 base slab pieces and 30 top pieces of the culvert into place. Each 40,000 pound concrete section took about a half hour to put in place. Crews lined the edges of each piece with a fine cement grout to seal the joints. Assembling the culvert took about a week. The new culvert is 145 feet long, 18 feet wide and 10 feet tall.

Once the pieces were in, it was time to start refilling the hole and lining the culvert with streambed gravel. Backfilling took about two weeks, and putting in stream gravel took about two days.

With the new culvert in place and the road base built over it, all that was left to do was wait for the pore pressure in the clay layer to dissipate before crews put down the final layer of embankment and pavement.

Charleston expected to open the road temporarily and let cars drive over it for a week or two. But the soils quickly settled into place and the pressure remained stable, indicating that the embankment was stable enough to place the last layers of material.

"We just went ahead and finished building the last layers," Charleston said. "Then we just paved, striped, placed guardrail and planted."

Nearly 300 trees and shrubs of 12 different types were planted, including cedar, Indian plum, elderberry, salmonberry, Douglas fir and broadleaf maple.

Through an agreement with WSDOT, the Nooksack Salmon Enhancement Association planted and is maintaining a stream buffer downstream as mitigation for the environmental effect of construction.

"That saves us time and money," Charleston said. "We didn't have to purchase any property because they're planting on a conservation easement owned by BP (the nearby refinery)."

The road opened Sept. 14 and planting at the project site was finished in early October.

The final product was a dramatically improved section of highway that provides a smooth path for both fish, and the drivers above.



Crews laid streambed gravel across the base of the new culvert creating a seamless transition with the natural streambed.

"This was a great first project because I got exposure to several different aspects of design and construction on a small scale," Charleston said. "It was challenging, but I learned a lot."

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Water starts flowing through the new culvert.