DAILY JOURNAL OF COMMERCE
WWW.DJC.COM

January 23, 2017

Best in state: Gold award
Unique or innovative applications
Otak

Photo courtesy of Otak
Otak managed the installation of this Willapa Hills Trail bridge, replacing a trestle that was destroyed during the 2007 Chehalis River flood

Project: Willapa Hills Trail bridge replacements
Client: Washington State Parks and Recreation Commission

In the late 1800s, the Northern Pacific Railway's South Bend Branch line was built to connect Chehalis and South Bend. The line allowed the delivery of lumber and farm products to the rest of the country.

In 1993 as railroad commerce died out in the area, the Washington State Parks and Recreation Commission bought the railroad and converted the route into Willapa Hills State Park.

The park includes numerous stream and river crossings, including the two largest over the Chehalis River — at Spooner and at Dryad — about nine miles apart. In 2007, a devastating flood completely destroyed the two trestles, sending the center steel truss spans downriver. Ultimately, the Federal Emergency Management Agency (FEMA) approved funding to replace both bridges.

Otak was hired as prime consultant for the Willapa Hills Trail bridge replacements. The firm was responsible for project management, bridge engineering, trail design, landscape architecture and construction support.

Challenges facing the design team included performing a detailed hydraulic analysis on the river to determine the maximum probable flood elevations, since the Chehalis River was well known for its flash floods and large wood debris pileups from the surrounding forests.

After completing extensive geotechnical and environmental reconnaissance, 10 bridge options were studied for each site. Ultimately, the team decided that a 300-foot clear-span bridge with a steel-truss superstructure design would work best for both bridges. But the design team realized that the typical 20-foot-high truss sections (to accommodate a 300-foot clear span) would be extremely difficult to get to the remote sites, and it would be too expensive to assemble the trusses piece by piece.

The solution involved the use of post-tensioning tendons inside a grouted duct installed inside a bottom chord, a technique rarely done with steel trusses. But the truss height needed to be limited for shipping while still maintaining deflection control.

The contractor, Quigg Bros., was able to adjust the final level or camber of the bridge by varying the amount of post-tensioning. Quigg Bros. also devised and constructed unique long-span erection platforms that allowed the bridge erection to occur without any supports in the river, allowing the team to work outside of the normal fish window.

One of the project's unique problems was the ultimate thinness of the overall structures and whether they would be stable enough for trail users. A thorough analysis of bridge movement revealed that the final stiffness and mass of the structures yielded dynamic characteristics that were in the nearly imperceptible range.

The new crossing structures are well above the new predicted flood elevations, with ample clearance for large debris flows. Also, the foundations for the structures are set far back on the bank and protected with riprap, reducing the potential for scour or lateral river movement.

The reopening of the trail section over the two new pedestrian bridges represents part of the long-term goal of the State Parks Commission to have a trail system that connects the Idaho border to the Pacific Ocean. At a total cost of $3.4 million, or about $400 per square foot, the design and construction costs for the two bridges were about 50 percent less than the typical long-span pedestrian bridge.

“Constructing two 300-foot span bridges at remote locations was a challenging endeavor,” wrote Brian Yearout, project manager with State Parks. “Otak produced a design that satisfied permit requirements, design requirements, FEMA, and was aesthetically pleasing.”