Interstate 90 Sunset Interchange: Like Threading a Needle

The new I-90 Sunset Interchange project is a testament to innovative engineering, resiliency to challenges, and commitment to teamwork.

By Karl Winterstein

With as little as 100 ft in which to work, building the $116.6-million Interstate 90 Sunset Interchange project in Issaquah, WA, was like trying to thread a needle. The site for this X-shaped, 1.6-mile project was flanked by mountainous terrain, complex underground soils, glacial remains, underground water, and aquifers and boulders, some as big as small automobiles. In addition, Issaquah Creek, home to an endangered species of Chinook salmon, ran through the site.

To thread this needle required a design that called for an elongated interchange with three levels to help it climb up the Sammamish Plateau, which is 250 ft higher than the interchange. Threading this needle also required the use of tight roadway alignments for interchange operations.

Included in the project, which took six years to complete, are four new bridges equipped with an innovative seismic isolation system, aesthetic enhancements, and habitat improvements. The four bridges span 3,200 ft. One in particular, the Crossing Bridge, is a 374-ft, three-span bridge that crosses I-90 and the Issaquah Creek. Construction also added one lane to I-90 along with a new undercrossing bridge with adjoining ramps, spanning the six lanes of I-90.

An aerial view of the $116.6-million Interstate 90 Sunset Interchange project.

Using Post-Tensioning

To expedite construction while keeping I-90 traffic flowing in both directions, the bridge was designed and constructed using 45 precast concrete U-shaped girder segments that were dropped into place and post-tensioned together. Building the bridge in this manner eliminated the use of temporary supports in the lanes of I-90 and in the environmentally-sensitive Issaquah Creek.

The second bridge, the Braid Bridge, is a 1,444-ft, eight-span, cast-in-place, post-tensioned concrete box girder bridge that carries the eastbound off-ramp over the eastbound on-ramp with a skew of nearly 70 degrees. Because of this skew, the columns at the fourth and fifth piers could not be located directly under the box girder. In lieu of outrigger bents to support the bridge's 197-ft spans, eccentric bents were used. This eliminated the need to acquire additional rights-of-way while allowing for a greater contextual appearance.

The remaining bridges are the Flyover Bridge and the Issaquah Creek Crossing, both of which were built using twin steel box girders. The Flyover Bridge is a four-span, 925-ft long, horizontally-curved bridge and the Issaquah Creek Crossing is a two-span, 492-ft long bridge. These bridges were designed and built using pipe and structural tubing with concentric connections to provide more efficient structural strength. This design and construction also enabled these bridges to have longer span lengths, tighter horizontal curves, and lower overall weights.

Seismic Isolation

All four of the project's bridges use an innovative seismic isolation system on

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the curved structures. This system incorporates the use of a large isolation bearing between the bridge deck and the columns upon which they rest. The top of the bearing is connected to the underside of the bridge deck and the bottom is connected to the column. In the middle is a friction-reduced, bowl-shaped plate to provide a flexible, movable surface. A special breakaway joint is used, which in the event of a major earthquake, allows the front position of the approach slab to break away, permitting the girders to move while providing additional seismic dampening.

To meet the challenge of locating an interchange within the urban growth boundary, the design was made context sensitive to the physical surroundings. To achieve this, long sweeping bridge spans were used. This design also minimized the number of foundations adjacent to the creek. Habitat restoration, wetlands, and stream buffers, some of which were replaced and others restored, were constructed to maintain and preserve the wildlife and aquatic environment.

Before the bridges could be built and the seismic isolation systems installed, the massive girders for these bridges had to be transported 180 miles to the project site. To accomplish this task, specially-designed tractor-trailer rigs had to be built for the transport, each over 200 ft long and with 86 wheels.

Another construction challenge was underground boulders, identified during preliminary studies. During drilling operations for the concrete foundations for the bridges, the contractor encountered boulders the size of small cars that were left behind from centuries-old glacial activity. Cutting through these boulders required drilling rigs equipped with oscillating drill heads capable of drilling down 80 to 100 ft.

Team Approach

A team approach was used for both the monthly and weekly meetings to resolve issues. The monthly meetings addressed issues at the highest levels while weekly, and if required, impromptu project team meetings, were held to resolve site, design, and access issues as construction progressed. This proved of great benefit when it came to permitting. Due to multiple jurisdictional permit requirements, overlaps and conflicts had to be resolved. The solution was simple: each municipality or public agency facilitated resolutions for permits and timed them with the construction schedule.

For a project of this size, coordination was critical between the various elements such as the complex structural designs, trail development, wetland mitigation, traffic engineering, and hydraulic engineering for stormwater ponds, stream restoration, endangered species, public involvement, and traffic maintenance.

An outreach program was developed to keep neighborhoods and the local municipality informed of the issues and progress of the construction activity. This included night work and sudden changes in plans as a result of ongoing construction. To keep people informed, the outreach program used a monthly bulletin, a Web site, and a telephone hotline. It also included briefings by the Washington State Department of Transportation to city council members, the public, and media.

The I-90 Sunset Interchange project team also coordinated work efforts with a number of other related and impacted projects in the area, including the North Sammamish Plateau Access Road and the South Sammamish Plateau Access Road through the Issaquah Highlands, which form an approximately four-mile long new arterial network at the edge of the urban growth area.

Fraught with complexities and unanticipated construction challenges, the project and area improvements were delivered on time and within budget constraints. The new interchange has alleviated traffic congestion locally and on I-90 adjacent interchanges, has stimulated the local economy, and improved the overall quality of life in the region. And all of this was done by not so simply "threading a needle." GE

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