Emergency steel spans reopen an Interstate river crossing shortly after a bridge collapse.

QUICK Thinking

BY WILLIAM KILLEEN, P.E.

WSDOT

▲ The north span of the Skagit River Bridge, following the collision.

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IT WAS THE THURSDAY EVENING before Memorial Day weekend of 2013 when the unthinkable happened.

As western Washington commuters headed home and vacationers got underway via Interstate 5 about 60 miles north of Seattle, a southbound truck hauling an oversized load shifted to the right as it crossed the Skagit River Bridge, causing the load to strike the overhead parts of the bridge. Within moments, the damaged north span of the bridge collapsed, carrying with it numerous vehicles and their drivers and passengers into the river below. Fortunately, the accident did not result in any loss of life, but Washington State Department of Transportation (WSDOT) now had to find a quick and safe solution for resolving a connectivity disaster with significant negative financial implications in the making.

I-5 is the main interstate highway on the West Coast of the U.S., stretching from Canada to Mexico and connecting several major cities, including Vancouver, Seattle, Portland, Sacramento, Los Angeles and San Diego. The commercial and passenger traffic that this critical transportation artery carries on a daily basis is enormous. The I-5 Skagit River Bridge has four main spans of 160 ft each and is part of the primary route connecting Vancouver and Seattle, with an estimated 71,000 vehicles crossing the steel through-truss bridge every day. Its collapse created a transportation nightmare with immediate financial impact; a nearby Costco alone reported a loss of $1 million in one day as a result of the collapse.

Temporary spans were erected, and the bridge reopened only 23 days after the collapse.

Erection of the temporary spans.

Crisis Averted

Clearly, a solution needed to be developed and commissioned as quickly as possible to stem the losses in business and tax revenues as well as the disruption to daily life and its widespread consequences. Different options were considered for the reopening of the river crossing, and in the end, WSDOT selected a bridging solution of prefabricated modular steel, which could be mobilized and assembled with great speed while providing the strength and durability demanded.

WSDOT awarded Atkinson Construction the emergency construction contract two days after the incident, and Acrow Bridge, a fabricator of modular bridges, became part of the team charged with engineering a rapid solution for bridge replacement. Acrow supplied two modular, prefabricated steel panel bridges. Each bridge weighed 180 tons, with clear spans of 160 ft and road widths of 24 ft, to replace the damaged section of the bridge. Modular steel orthotropic deck sections, which were overlaid with asphalt, were used for the roadway, and heavy-duty crash barriers were installed on each side for driver safety.

Acrow bridges are all-steel bridges composed of smaller components that pin and bolt together. All of the bridge components are available on a COTS (components off the shelf) basis and can be rapidly mobilized. With all components prefabricated and requiring no field welding, the bridges can be rolled into position with or without the use of sophisticated equipment, including a crane. This became an important factor in the Skagit River Bridge installation, as no suitable crane was available at the time for a lift-in of the spans. A crane-assisted launch was also not possible, as the existing multi-span through truss was an obstruction. The only workable approach for putting the emergency bridges into place was by rolling each bridge across the gap in full cantilever, balancing each span like a large playground seesaw, without the use of a crane.

To facilitate the installation, the bridge pedestals were designed to allow for the sliding of the bridges sideways on Hilman rollers, which was necessary because the existing through truss was 8 ft narrower than our structures. Once the pedestals were in place, the first bridge (northbound lanes) was rolled into place, jacked down onto the rollers, moved eastward, cantilevered over the bridge pedestals and positioned out of the way to make room for the second bridge (southbound lanes). The second bridge was jacked down and positioned on permanent bridge bearings, 6 in. from the first bridge, and the deck was then situated and asphalted.

Speed and Service

We coordinated our response to the emergency through our local office and depot in Camas, Wash. When we first learned of the collapse, we made the decision to send eight truckloads of Acrow prefabricated bridge steel to the project site that would be used to construct the bridge spans—even though a contract to supply the bridges had not yet been awarded—as we thought it would be best to have everything in place for quick assembly.

We also deployed field technicians to work side by side with the WSDOT and Atkinson Construction team. The technicians were a critical element in our ability to deliver a bridging solution within a very tight time frame, working closely


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◀ Two 160-ft spans, weighting 180 tons each, were installed via Hilman rollers.

with our engineers at our corporate headquarters in New Jersey and the engineers at Atkinson. Everyone worked around the clock to assemble the emergency bridges and roll them out across the Skagit River. The highway bridge was formally reopened in June, only 23 days after the collapse of the damaged span. The Acrow spans were in place until mid-September when the permanent spans were installed via a roll-out/roll-in method. The Acrow bridge was then disassembled and shipped to the company's storage yard in Washington. Later in the year, almost all of these components were shipped to California as part of a planned detour bridge. ■

Owner and Structural Engineer
Washington State Department of Transportation

General Contractor
Atkinson Construction of Renton, Wash.

Steel Fabricator and Detailer
Acrow Corporation of America, Parsippany, N.J. (AISC Member)