Skagit River Bridge facts

- 71,000 vehicles were detoured through the city streets of Burlington and Mount Vernon.
- The lightweight girder concrete compressive strength was 9,500 pounds per square inch.
- A 500 ton and a 200 ton crane were used in unison to move girders.
- Concrete girders had 48 high strength steel pretension strands.
- A row of pilings and bents were built to support the rails for superstructure sliding.

Bridge collapse incident

On May 23, 2013 the evening commute was just ending along a four-lane stretch of the Interstate 5 corridor, which lies between the Canadian Border and Seattle. At roughly 7 p.m., a semitruck heading southbound and carrying a permitted oversized-load struck the first portal and several subsequent sway members along the steel truss section of the bridge. The northern truss span of the bridge collapsed into the Skagit River.

While the semi-truck made it across hitting several more sway frames along the way, several vehicles didn't and the occupants had to be rescued. No one was killed in the collapse.

The Washington State Patrol (WSP), the Washington State Department of Transportation (WSDOT) and local agencies responded immediately, setting up and manning detour routes both east and west around the bridge.

WSDOT bridge engineers assessed the damage and began plans for both emergency and permanent repairs, while communication staff responded to the media, sent out updates and Freight Alerts region-wide. Traffic engineers worked through the night to refine the detour routes for the roughly 71,000 vehicles that were detoured through the city streets of Burlington and Mount Vernon.

Within 24 hours a contractor was hired under an emergency contract to remove the collapsed span, and began working with WSDOT engineers to install a temporary span to get the Interstate back open. As the work was being done to temporarily restore I-5 traffic, WSDOT engineers began assembling contract documents for a permanent span repair.

View construction photos at: www.flickr.com/photos/wsdot/sets/7157634573080718/
Immediate response project delivery

Hours after the collapse, discussions were underway at WSDOT about how best to replace the collapsed span, and how to restore traffic as quickly as possible. Time requirements, vertical clearance requirements, and superstructure dead load limitations quickly became the primary guiding factors in designing the span replacement.

Minimizing traffic disruptions dictated the installation of temporary side-by-side dual lane modular truss bridge spans supplied by ACROW, and subsequently replaced with the permanent span. Demolition of the collapsed span and installation of the two temporary spans was completed by Guy F. Atkinson Construction of Renton, Washington. For navigational purposes, Washington State Department of Transportation’s Bridge and Structures Office provided over-the-shoulder reviews of Parsons Brinckerhoff’s design, shop drawings, and construction submittals.

MAY 23rd
Emergency installation of temporary side-by-side dual lane modular truss bridge spans.

24th
Contraction to remove collapsed span.

JUNE 14th
Contract awarded for permanent span.

19th
Temporary replacement bridge open.

JULY 9th
Fabrication of prestressed girders.

12th
Temporary construction begins.

SEPTEMBER 14th
Permanent superstructure rolled into place.

15th
Permanent span open to traffic.

NOVEMBER 19th
Finish fill, guard rails and swan bridge repair.

I-5 closure:
Traffic closed for 27 days.

I-5 open with temporary replacement bridge:
Traffic had been diverted 208 days.

Temporary closure:
Temporary closure for one day.

I-5 permanently open:
Traffic was restored 86 days.

Timeline

Bridge builders innovate

The WSDOT plan to reconstruct the bridge consisted of constructing the permanent replacement span using accelerated construction techniques. The permanent replacement span, composed of deck bulb-tee girders made of lightweight aggregate with concrete overlay, was built adjacent to the bridge and its temporary spans.

The WSDOT Bridge and Structures Office provided the best-value proposal, submitted by Max J. Kuney Company (MJK) of Spokane Washington, which utilized a prestressed concrete girder deck bulb-tee replacement span.

Lightweight concrete was specified for the girders, diaphragms and barriers, to stay within the stipulated span dead load limitations. The concrete girder proposal chosen offered competitive initial costs, low overall life-cycle costs, the shortest construction time required to replace the temporary span with the permanent span.

Four design-build teams submitted proposals for the permanent span replacement. Two of the proposals included steel girder replacement spans, and the remaining two proposals included prestressed concrete girder span options. WSDOT selected the best-value proposal, submitted by MJK.

MJK received notice to proceed on June 19 and fabrication of the eight bulb-tee girders began July 9.

In order to limit the weight of superstructure, the 7’-6” girder spacing was considered to keep the replacement structure as light as possible. The total weight of new superstructure including the lightweight concrete traffic barriers and concrete overlay was 815 tons.

The permanent superstructure was constructed on a steel piling and bents, just downstream of the temporary spans. The crane work required 19 specific moves, including passing the end of the girder from the derrick to the barge crane, gripping the girder under the boom of the barge crane - while re-ballasting the barge system - and finally re-ballasting the barge as the girder was placed on the temporary bent.

A vertical and horizontal jacking system was concurrently installed using rafts supported by temporary piling and bents. To complete the installation of the new span, first the temporary spans were lifted off the existing substructure and slid off onto the temporary bents upstream of the bridge.

A time lapse series of the entire girder setting operation can be found at: www.youtube.com/watch?v=IdUap4IvY

Fouroptions were investigated; a steel through-truss (a near duplicate of the original span), a steel plate girder span with concrete deck, and a prestressed concrete girder span with concrete deck. The steel through-truss, though light in weight and aesthetically consistent with the original bridge, was thought to be too time-consuming to fabricate and erect. The project was advertised for Proposal with the assumption that the most-likely structure types were going to be the steel or concrete girder options.

Lightweight concrete was specified for the girders, diaphragms and barriers, to stay within the stipulated span dead load limitations. The concrete girder proposal chosen offered competitive initial costs, low overall life-cycle costs, the shortest girder procurement time, and the minimum closure time required to replace the temporary span with the permanent span.

Goal: rapid construction. The best option was a three-option steel girder replacement span, and the remaining two proposals included prestressed concrete girder span options. WSDOT selected the best-value proposal, submitted by MJK. The projects were awarded to Parsons Brinckerhoff for their design engineering services, and Parsons construction services.

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