

# Worth Their Salt



# Contractor Cuts on World's Longest Floating Saltwater Bridge

In a project that lasted from 2003 to 2009, both approach spans, eastern pontoons and east and west transition spans had to be replaced on the Hood Canal Bridge in Washington State. Multiple closures were required prior to a May 1, 2009 shutdown, after which only 45 days were allotted to replace the major eastern pontoon and approach sections. The required cutting and separation of the existing floating concrete pontoons had to be done quickly, so that other phases of the works could be completed on time. A CSDA member contractor worth its salt was found to take on this challenging job.

The Hood Canal Bridge connects the Olympic Peninsula with the Kitsap Peninsula over a finger of the Puget Sound waterways called the Hood Canal. At 7,269 feet long, it is the world's third-longest floating bridge and the longest situated in a saltwater tidal basin. First opened in 1961, the Hood Canal Bridge has become a vital commerce and recreational link, with its center opening span controlling the access of the West Coast United States Navy Trident submarine fleet that enters the port of Bangor, Washington. In 1979, 18 years after opening, the bridge suffered catastrophic failure during a severe windstorm, sinking the western draw span and pontoons after sustaining several hours of



A Trident nuclear submarine passes through the Hood Canal Bridge as Tim Beckman of Cutting Edge Services looks on.

120+ mph winds. Efforts to repair the bridge began immediately. Works were completed in three years and the bridge reopened in 1982.

Since this time, further wear and tear from the elements had taken its toll on 11 of the original east-half bridge pontoons, including the draw span, so plans were put in place to remove these sections and replace them with 17 new structures designed to last 75 years. The installation of the new pontoons required high levels of precision, as the roadways on each of the pontoon sections had to achieve tolerances of 0.125-inch for every 10 feet of surface. Kiewit of Washington and General Construction Company of Poulsbo formed a Joint Venture to act as the general contractor for the project.

Kiewit-General, A Joint Venture, under contract with the Washington State Department of Transportation, sought innovative and time-saving ideas to cut piers, separate pontoons and sever high-tensioned tendons. Besides addressing the technical issues of making the cuts, the cutting specialist would have to control all slurry and debris that might enter





The bridge pontoons were joined by 3.5-inch tendons and 1.5-inch bolts.

the pristine Puget Sound. In 2003, Kiewit-General selected Cutting Edge Services Corporation to perform its cutting operations. “We were happy to have been chosen to be part of such a major project, and that the general contractor had as much confidence in our abilities to get the job done as we did ourselves,” said Tim Beckman, president and CEO of Cutting Edge Services.

The general contractor required a method that would maintain the structural integrity of the floating pontoons, reduce bridge shutdown time and produce less dust and debris than other applications. The dependability provided by wire sawing was ideal and met all of these requirements, giving the ability to make the different types of cuts in pontoon joints. Test cuts on the tendons were made with shears. However, these test cuts failed and cutting with shears was ruled out. The use of jackhammers and cutting torches was also ruled out due to increased noise and vibration. Therefore, the use of specialized remote-clamping wall saws with diamond blades was deemed to be the most suitable application for cutting the tendons.

Two phases involving the cutting of the east approach piers were completed prior to the major shutdown. Typical pier cross-sections were five feet in width and 40 feet in length. Working from an adjacent temporary pier, Cutting Edge set up diamond wires 190 feet in length, which were transitioned to various cutting heights at 5-foot intervals during the course of the cutting work. The cutting contractor completed these two phases on time so that cutting of the pontoons and tendons could begin on the day of the shutdown. The majority of the cut pier sections were lifted out prior to the shutdown, however some remained



Diamond blades cut through the 1,000-foot, high-tensioned tendons with speed.

in place until larger cranes could perform the lifts during the outage.

The 14-foot-high by 50-foot-wide floating pontoons were joined together by 80 1.5-inch bolts and 24 3.5-inch tendons. The high-tensioned pipe tendons had 12 0.5-inch steel cables grouted inside. The pontoon joints were also pressure grouted within a perimeter of heavy rubber molding. Cutting Edge engineered and fabricated clamps that were remotely operated and bolted onto CC1600 hydraulic wall saws made by Diamond Products. These clamps were the key to the success of the May 2009 shutdown, as all primary tendon cutting had

to be done or made remotely, with no personnel allowed below deck. Following the completion of the tendon cuts with the wall saws, four wire saws were used to separate the pontoons.

Several months of design and trial cutting were done on sections of tendons, including test cuts on location prior to the outage. Angular core holes were then drilled into the upper corners of each planned separation, to allow for initial wire cuts and re-tensioning prior to commencing the primary wire cuts on May 1. Once the clamped wall saws were in place, actual cutting time was less than three minutes per tendon. Due to the pre-stressing of the tendons, the initial cut on the 1,000-foot tendons caused a separation of more than 15 feet.

After the tendons in the upper corners were removed, these sections were then wire cut. Temporary tendons were installed to carry the load during primary wire sawing, and shims were put in place to fill any spaces or gaps that remained. Primary wire sawing began and continued until the lower corners were severed. Following a precise sequence of water plugs and inspections of the cut paths, wire sawing was halted for installation of shims and temporary tendons on these underwater corner sections. With all four corners shimmed and re-tensioned, three wire saws worked in parallel to cut the remaining sections of the pontoon joint while the specialized wall saws severed the remaining 20 tendons, taking approximately 32 hours to perform. These steps were then repeated for the other pontoon until the work was completed seven days later on May 8.

One problem encountered by the cutting team was the process of raising the saw and clamp assembly by 12 feet to the upper tendons while working inside dozens of concrete cells. To avoid man-handling and excess scaffold installations, Cutting Edge installed 120-volt cable winches onto each clamp, which allowed the team to raise the saw assembly onto the tendons. The natural environment on the job site also provided Cutting Edge with some challenges. Strong winds and water currents produced heavy stresses on the severing operation, and at one stage of the outage these high winds forced a complete evacuation of all personnel and equipment from the job site.

In addition to the weather conditions above water level, working inside concrete cells below sea level involved extra risk for the cutting

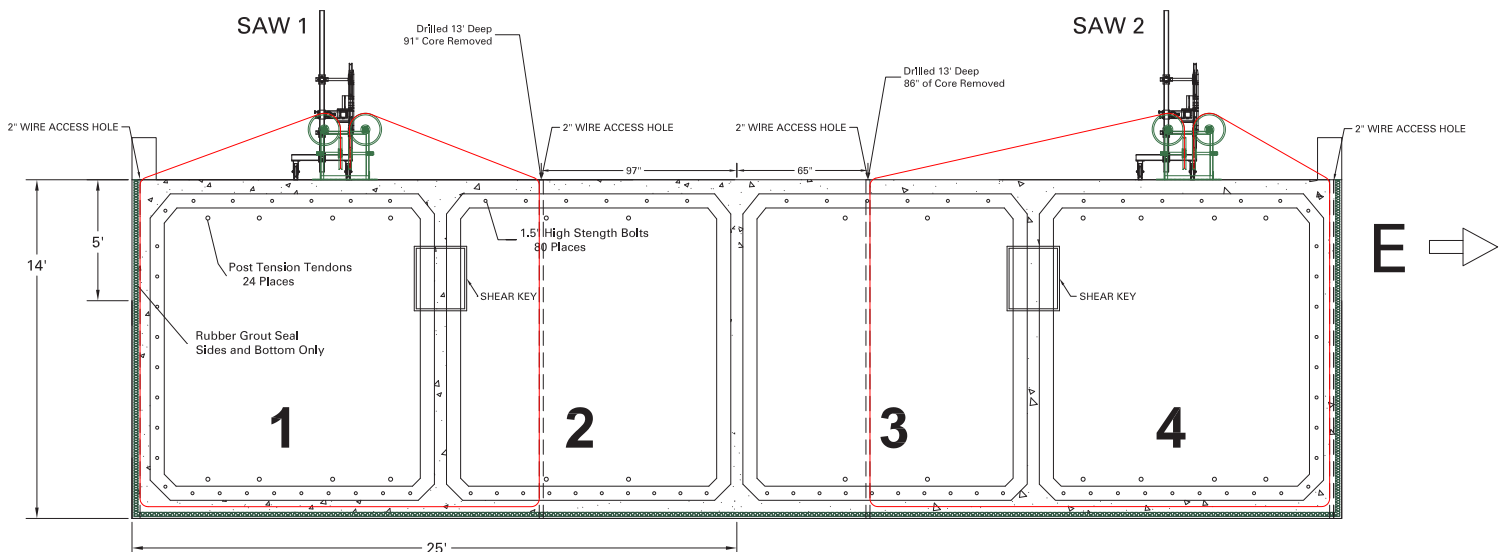


Some of the pontoon sections were as long as three football fields.



The cut pontoons were towed north to be reemployed as floating piers.

team and created a need for confined space monitoring and strict safety procedures. Potential dangers included the significant failure of the pontoon separation, which could have sunk several pontoons during the works.







Aerial view of the Hood Canal Bridge during the course of the work.

Cutting Edge worked very closely with the general contractor to identify significant design considerations and special precautions required for the pontoon separations, including the sequence of cutting, a plan for the stabilization of the bridge and the close monitoring of below-sea-level confined space work. In addition to standard items of personal protective equipment, all workers had to wear flotation vests.

Wire sawing on the east approach piers and on the floating pontoons was performed with 50-horsepower hydraulic power units and Diamond Products WS 25 wire saws using Tyrolit plated diamond wires.

The cutting contractor did not want to waste any time in getting to work, so cutting commenced at 12:01 AM on May 1. By working in such a fast, yet safe and efficient manner, Cutting Edge completed the pontoon work on May 8. Despite a couple of days of bad weather delaying the job, cutting finished approximately four days ahead of schedule and within budget. This in turn helped the general contractor to earn the highest early-finish bonus awarded by the Washington State Department of Transportation for its commendable work.

"We had an extremely nice thank you from a lead engineer, stating how Cutting Edge went "the extra mile" to help ensure that a very unique set of tasks were done with a high level of success," explains Joe Shebesta, Project Engineer for Cutting Edge. These words came from Kent Werle, Senior Engineer for Kiewit-General, "We appreciated not only their significant procedural and engineering help on the front end, but also during the long nights of execution where their highly skilled people worked to be sure that we got through the difficult spots. This should be marked down as a success story," Werle concluded.

As for the disposition of the existing pontoons—they were taken to Vancouver, British Columbia, where they were sold to a company that will convert them into floating piers.

The precision and decreased vibration from cutting with diamond wire and blades was a profitable choice for the general contractor, as the structural integrity of the pontoons was maintained so that they could be reemployed elsewhere. Cutting Edge proved that the Hood Canal Bridge wasn't a bridge too far, and that this cutting contractor was worth its salt.

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#### COMPANY PROFILE

Cutting Edge Services Corporation has been in business for over 12 years and is based in Batavia, Ohio. Support operations are located in Houston and Seattle. The company offers primary services of engineered solutions, diamond wire sawing, underwater cutting and core drilling. Cutting Edge has been a member of CSDA since 1997.

#### RESOURCES

##### General Contractor:

Kiewit-General, A Joint Venture

##### Sawing and Drilling Contractor:

Cutting Edge Services Corporation  
Batavia, Ohio

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Email: [beckman@cuttingedgeservices.com](mailto:beckman@cuttingedgeservices.com)

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Methods Used: Wire Sawing, Core Drilling, Wall Sawing