BALANCING NEEDS IN

BASCULE BRIDGE PROJECT

BY JASPER CALCARA, PE

If you can imagine the risks of two sumo wrestlers jumping on a child's seesaw, you can start to visualize the challenges facing engineers on the Ballard Drive Bridge painting project.

The Ballard Drive Bridge in Seattle is just one of many historic bridges scattered throughout the Pacific Northwest that has maintained regular service for nearly 100 years. Due to their age, continuous use and exposure to the elements, these bridges require regular inspection, maintenance and repainting. Performance of this work can often result in difficult challenges for specialty bridge and painting contractors to provide efficient, safe and contained access.

The 218-foot span double-leaf bascule bridge was one of four bascule bridges built in Seattle between 1917 and 1925. It acts as a critical artery for local roadway and boat traffic.

It was added to the National Register of Historic Places in 1982 and uses a system of finely tuned counterweights and machinery to raise the bridge to near vertical.

Purcell Painting & Coatings was contracted to blast and paint the entire structure and contain all the lead paint debris without restricting operations of the bridge. Raising the bridge anywhere from 250 to 500 times a month prohibited dismantling and reinstalling the access system each time, and therefore the platform would have to rise with the bridge.

Raising the platform presented extreme challenges to the design team, as the suspended deck and bridge structure would be exposed to complex loading conditions not normally experienced by a traditional horizontal platform. Intense wind loading on the underside of the platform, stabilization during raising, analysis of all bridge framing and very sensitive counterweight restrictions were only a few of the issues to be resolved.

After working with multiple engineering groups who were unable to devise a suitable solution, Purcell decided to proceed with the system proposed by D.H. Charles Engineering. President Jasper Calcara, PE and suspended platform design engineer Josh Rubero, PE outlined a Safespan suspended platform and staged containment program, which would allow for full erection, stabilization and containment within all bridge limitations. The key to the design was the use of extremely light decking, as every pound of platform added to the bridge had to be carefully counterbalanced within strict limitations.

The platform loading and added counterbalance proved to be the sumo wrestlers on the seesaw, wanting to overload the bridge if too much weight was added to each side of the pivot point. It was such a critical issue that a city engineer was on site throughout the duration of the project, carefully monitoring the addition and removal of over 900 pieces of 50-pound

counterweights strategically placed in accordance with the design plans. With the loading limits satisfied, the stability of the platform and strength analysis of the bridge framing had to be resolved.

The Safespan platform consists of corrugated steel decking, longitudinal support cables and vertical suspension devices, which result in a very flexible overall system. Although the deck is very light, it lacks the critical rigidity that a typical scaffold or suspended platform system provides. Unfortunately, it was the weight of more rigid systems that made them impossible to utilize, and engineers were faced with the task of stabilizing a system that would turn into a nearly 4,500 square foot flexible wind sail.

When the platform rotated to near vertical, engineers were concerned that high winds would hit the exposed face of the decking and slam it into the underside of the bridge, while gravity attempted to shift the deck out of position. Therefore, a series of rigid anti-uplift and horizontal bracing members were installed to hold the deck firmly in place, while intentionally passing the load to the stronger framing points of the bridge substructure. Lastly, an array of vertical to horizontal suspension cables were devised to allow the platform to shift orientation and eliminate any sag or sway of the deck toward the water.

Although the structural evaluation of the bridge and platform design were extremely extensive, the final product functioned perfectly throughout the duration of the project. The entire system proved safe and stable, requiring very little modification or maintenance as the job proceeded. Even with rain on 70 percent of the workdays, there were no breaches of the containment system, and the job finished on schedule and within budget.

The careful consideration and evaluation of all the potential risks, as well as close collaboration between the contractor, engineers and city representatives, were critical to the completion of this project. With another innovative solution executed with precision, the industry is that much more prepared for the next challenge to be presented.

ABOUT THE AUTHOR

Jasper Calcara, PE, is the President of D.H. Charles Engineering, Inc., headquartered in northern California, and has experience in scaffold, suspended platform and containment designs on some of the highest profile bridges in the country.

DHC has specialized in the design of temporary structures for customers throughout the United States and Canada for over 15 years, and with a staff of 11 engineers it has ensured they are able to provide experienced and emergency response on even the most complicated of projects.•

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