

## Historic Warren Bridge Reopens with Link to the Past

By

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The reconstructed Warren Bridge, an historic span on Rhode Island's busy Route 114, opened the week of July 27<sup>th</sup> after a multi-year effort in which Resource Controls' engineering division, Siegmund & Associates, played an instrumental role. Originally constructed in 1914, the two-lane bridge over the Palmer River in Warren, RI serves picturesque towns along Narragansett Bay and is an important link between Providence and Newport. The multi-year project had its share of challenges, but the end result shows that a modern bridge can rival the aesthetic quality of early 20<sup>th</sup> Century stone and concrete structures.

The original bridge, a stately three-arch concrete span, was one of the first bridges constructed by Rhode Island's public works entity. The Rhode Island Historical and Preservation Commission took interest in the project and wanted the new bridge to acknowledge the original. Thus, the reconstruction incorporated elements that emulate the original span's aesthetics. For example, the railing system includes a pedestrian rail with intermittent decorative concrete pylons between rail sections supporting ornamental period lighting.

*Before*



*After*



### Inspection Shows Serious Decay

Siegmund's participation began in 1987 with an inspection of the bridge and its companion span one-quarter mile to the west in Barrington. The resulting report to the Rhode Island Department of Transportation (RIDOT) outlined significant deterioration in both structures. The extent of damage was so severe that rehabilitation was deemed too risky, so RIDOT elected to perform a full replacement.

Due to the high volume of traffic on the bridges (22,000 vehicles per day), taking them out of service was questionable at best, and RIDOT hired Siegmund for a traffic study to determine the impact of closing one lane on both bridges while the other side was reconstructed. This alternative would have required traffic to halt in one direction while vehicles heading the opposite way crossed, and vice versa. The study predicted severe traffic snarls in Warren and Barrington resulting from that strategy, so RIDOT opted to build temporary bridges to maintain normal traffic during demolition and reconstruction.

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Siegmund was retained to design the two temporary bridges, which were constructed in 1997; and in 1998, the firm took on the design of the reconstructed bridges. The original Warren Bridge was a three-span, reinforced concrete structure with filled spandrel walls. Three elliptical arches allowed the Palmer River to flow underneath. The 30-foot-wide roadway was bounded by concrete sidewalks and parapet walls on both the north and south sides of the span; these added another 13 feet of width for an overall width of 43 feet.

### **New Design Improves Boater Safety**

The new bridge is a four-span design that provides for lower water velocity of the tidal river around the structure. This will reduce the impact of erosion on bridge abutments and make for easier navigation around the bridge. A pre-stressed concrete structure composed of pre-cast concrete panels, the new Warren Bridge resembles an arch bridge from most perspectives. However, box girders that are visible only from beneath the bridge support the roadway. Fascias that look like the original concrete arch design hide the girders. This design, by using pre-cast construction techniques, is considerably less costly to construct than the classic arch bridge.

A major challenge on this project was anchoring abutments to a rocky layer of river bottom buried under sediment. “Our borings had indicated that the soil under the riverbed should have allowed the cofferdam and piles to be installed to the elevations shown in our design,” says Mary Vittoria Bertrand, RIDOT project manager. “However, during construction, we found that they could not be installed to those depths because rock was a lot shallower or too dense to penetrate. We ended up having to redesign our cofferdams and pier foundations for the three river piers.” Siegmund and the contractor worked together to devise a suitable anchoring alternative—spread footings anchored to bedrock. This redesign had to be completed quickly in order to minimize construction schedule delays.

## Details add to Challenges

Other challenges, Bertrand says, were the numerous decorative elements. “A pre-stressed butted box beam bridge isn’t difficult in general to construct,” she says. “But due to the complex architectural features, significant attention to detail was required.”

The project will be fully complete when the temporary bridge is removed, along with the fill for the temporary roadway approach. After that fill is removed, the river will flow freely under the fourth arch. This project ensures that the scenic coastal vista, observed by thousands of carloads of tourists—and some on foot—each summer day, will be enhanced by an aesthetically pleasing structure. It is proof that a bridge design can take the qualities of durability and cost efficiency from modern materials and construction techniques while emulating the beauty of classic structures.



## About the Author:

**Robert C. Atwood, PE, LSP** - *President* of Resource Controls, founded Resource Controls in 1986. His primary area of focus is in the area of business development and engineering design services. Mr. Atwood’s 34 year background as a Registered Professional Engineer and Licensed Site Professional offers broad-based experience and knowledge of civil engineering design and construction management, as well as environmental assessment and remediation.

**Laszlo Siegmund, PE** – *Chief Engineer* of Siegmund & Associates, now a division of Resource Controls. He has over forty years of engineering experience in the areas of transportation, structural design, wastewater collection and treatment, waters supply and facilities planning and other branches of civil engineering. For a ten-year period (1972-1982) he was the managing partner of a medium-sized firm with offices in Rhode Island and Connecticut. He was the founder (1983) and principal engineer of Siegmund & Associates, Inc., and in 2008, he merged Siegmund & Associates into Resource Control Associates, Inc. to form Resource Controls’ expanded engineering division. He has supervised engineering activities of the firm from its foundation in early 1983 to the present time.