Sarah Mildred Long Bridge

Between Kittery, Maine and Portsmouth, New Hampshire

By Christopher Burgess, P.E., S.E., P.Eng., Peter Roody, P.E., and Jeffrey Folsom, P.E.

FIGG and Hardesty & Hanover were Award Winners for the Sarah Mildred Long Bridge project in the 2019 Annual Excellence in Structural Engineering Awards Program in the Category – New Bridge and Transportation Structures. Photos courtesy of FIGG.

The new Sarah Mildred Long Bridge carries the US Route 1 Bypass and a heavy rail line that serves the Portsmouth Naval Shipyard over the Piscataqua River. Coined "three bridges in one," the crossing consists of vehicular approach bridges stacked over railroad approach bridges leading to a vertical lift span over the navigation channel. The moveable span lifts from the normal roadway position to allow passage of tall vessels underneath and lowers to railroad track level, allowing trains to pass on the rail in the roadway median of the lift span. With a 56-foot vertical clearance in the "resting" position at the vehicular level, there are 68% fewer bridge openings compared to the previous bridge.

The 2,434-foot-long segmental vehicular bridge provides two 12-foot lanes with 5-foot shoulders and tall bridge railings for cyclists. The new bridge has long open spans of up to 320 feet and 11 fewer piers than the previous bridge, providing enhanced vistas for residents and motorists while minimizing impacts to the river and the surrounding environment.

The 1,437-foot-long segmental railroad bridge is 19 feet wide with spans up to 160 feet long. The heavy rail live loads were quite different than the live loads used to design the vehicular bridge due to the Cooper E80 and Alternate Navy Load requirements. For efficiency, the single shaft reinforced concrete railroad piers were spaced approximately one-half that of the vehicular bridge piers to keep the railroad and vehicular bridge superstructure elements nearly the same depth. There are three shared piers where the railroad bridge is supported at the footing between two vertical columns that are integrated into the vehicular bridge superstructure above.

The lift span is a multi-box steel girder system with a composite steel plate and concrete deck. The 300-foot-long span is supported at each end by steel lifting girders that transfer loads to the substructure through wire rope attachments on each end and multiple sets of bearings mounted to the underside of the girder. The total load to lift, including all permanent loads from the girder span and lifting girders, is four million pounds. The 200-foot-tall precast concrete lift towers fully encase the counterweights and related lift mechanisms.

The precast concrete superstructure segments were erected using the balanced cantilever construction method. The precast segmental design allowed for segments to be erected at multiple locations simultaneously with both land-based cranes and a barge-mounted ringer crane. Erecting the railroad bridge first provided access and support for the construction of the vehicular bridge directly above.

The project team provided an enhanced alignment for the new bridge, which improved navigation by reducing the bridge skew from 25 to 15 degrees and allowed larger ships to access the Port and Portsmouth Naval Shipyard. The span layout enabled the new bridge to cross Market Street without a pier in the median and serve as a gateway entrance into historic downtown Portsmouth.

The new Sarah Mildred Long Bridge opened to traffic on March 30, 2018, and has a design life of over 100 years.▪

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Project Team

Owners: Maine Department of Transportation and New Hampshire Department of Transportation
Designer: FIGG/Hardesty & Hanover Joint Venture