



Photo Courtesy of RS&H

Construction on the \$115 million (\$78.7 million construction contract) Lesner Bridge project began in 2014 and reached substantial completion in December 2018. The primary component of the project involved the replacement of the structurally deficient existing bridges with twin pre-cast segmental box girder bridges. The bridges are on the Shore Drive corridor in Virginia Beach, Virginia, lying adjacent to the mouth of the Chesapeake Bay. Each new bridge is 1,575 ft long and provides a 45 ft navigational clearance over the Lynnhaven Inlet. The precast, segmental structures were built using the span-by-span and balanced cantilever erection methods. Each structure consists of 10 spans; nine at 150 ft with a channel span of 225 ft and include nine piers and two abutments. The new bridges greatly improve the corridor by providing wider lane widths, wider shoulders, new 10 ft multi-use paths in each direction, landscaping improvements, improved signalization, and decorative lighting for the new bridges.

Lesner Bridge

Category: Urban Bridges (within city limits)

Innovation of Design and/or Construction

Given the specified 100-year design life, the project incorporated innovative materials to achieve this standard. All reinforcing steel was either stainless steel or low-chromium/low carbon alloy to achieve the corrosion-resistant requirement. All concrete was designed to be low permeability concrete and superstructure concrete was designed to be 8,000 PSI.

Before erection began, a full-size grouting mock-up of a 150 ft tendon with vertical deviations matching the profile of some of the tendons in the bridge was constructed on site. The mock-up procedure required the use of the same equipment, personnel, same mixing procedure, and same grout that would be used during the actual bridge grouting. After the mock-up was complete and the grout had set the mock-up tendon was cut into sections and analyzed to ensure there were no voids, no segregation, and no bleed water from the grout was observed.

The superstructure utilized both span-by-span and balanced cantilever erection methods for superstructure construction, which is very unique. The project was designed this way to accommodate the 250 ft main span length that was drastically longer than the standard 150 ft long typical spans. The design still allowed the use of the overhead gantry to erect all spans without any additional crane support.

Rapid Construction

With a vehicle count of 20,000 ADT, the Lesner Bridge was required to be constructed without reducing capacity during temporary operations. This requirement inhibited construction duration. To help offset longer construction, three of the four abutment foundations were changed from the designed 4 ft diameter, 100+ ft depth drilled shafts to driven piles, a change that resulted in fewer days to construct the foundations and footings and no additional cost. Additionally, footings in the water were constructed using pre-cast seal slab bottom forms. The pre-cast nature

of the footing falsework expedited formwork and helped reduce the eight footing installation durations.

Aesthetics and/or Harmony with Environment

Given the prominent location and role as signature structures, aesthetics served an important factor in the design and construction. Residents and visitors to Virginia Beach will immediately notice the inherent aesthetic value of the trapezoidal box girders and additional aesthetic features including:

- Individually programmable, multi-color LED lights located in the piers, superstructure, and walkways. These lights allow the City to regularly change the appearance of the bridges to fit the seasons all year long.
- A signature piece of artwork commissioned by the City based on public input and installed on the new eastbound bridge.
- A custom, decorative wave pattern for the bridge handrails.
- Over \$1 million worth of landscape improvements.
- A painted finish coating for the superstructure and substructure whose color was chosen to match the beach sand that surrounds it.

Cost Competitiveness

The new bridges, completed at a cost of approximately \$350/sf, provide a signature structure for the City of Virginia Beach and the surrounding community. Cost control was balanced with the aesthetic desires of the Owner and the community as a whole. Prior to bidding, a Value Engineering Workshop was held to discuss cost savings options for the project. One initiative included performing a load test of the proposed foundations to improve the design to allow for fewer drilled shafts. This initiative resulted in fewer shafts, and shorter shafts which translated to a construction cost saving of greater than \$100,000.

Jury Comments

The Lesner Bridge is visible throughout the Virginia Beach community, as well as Southbound on the Chesapeake Bay Bridge and tunnel, making this a prime location for a segmental bridge. The simple, but eloquent lines of this structure flow naturally with the town's skyline and the natural beauty of the Lynnhaven inlet. A well-executed bridge at a modest scale that compliments the site. The aesthetic choices are sound and clear priority was given to the functional needs during construction. Precast segmental construction utilized both span-by-span and balanced cantilever erection methods to minimize impacts, reduce on-site construction, preserve the environment and maintain access for waterway users.



Photo Courtesy of FIGG

By using the highest quality materials, the latest technology, and the latest most comprehensive specifications, the quality and minimal maintenance for these bridges was valued highly by the Owner. By achieving such high-quality and low maintenance, the true cost of the project (short-term and long-term) is significantly more competitive than other options.

Minimization of Construction Impact on the Traveling Public

The Virginia Beach economy depends heavily on tourism, with additional concerns related to the freedom of movement for military personnel present in the project area as well.

This crossing of the Lynnhaven Inlet serves as the gateway to the ocean front tourism center and is also an important route for the United States Military. Route 60, which is part of the US Strategic Highway Network (STRAHNET), connects two important military installations that routinely use this corridor. Additionally, the only alternative to this corridor would require a more than 20-mile detour. For these reasons, the contract requirements dictated by the City of Virginia Beach required the

Photo Courtesy of RS&H



existing four lanes of traffic throughout the corridor to be maintained for the duration of the project.

The design of the twin bridges, and the project phasing, dictated that the first structure be designed and built to accommodate all four lanes of traffic, while the existing bridges were demolished, and the second new bridge was constructed. A unique barrier wall concept was needed as the wall had to be placed in a temporary location during construction from where it would be permanently. It had to meet safety standards, without the ability to install full-depth anchor bolts into the deck because of the presence of transverse post-tensioning. A special temporary wall detail was found from the Maryland DOT and was successfully utilized on the project.

Significant coordination throughout the project was needed for marine traffic as well. Located within the project limits and continually accessing the waterways under the bridges are the Virginia and Maryland Pilots Associations. These organizations, whose history dates to the mid 1700's, are tasked with navigating all cargo ships that enter the Chesapeake Bay en route to the Port of Virginia and the Port of Baltimore. Each ship engaged in foreign trade coming to port is required to take on a local ship handling specialist, known as the Pilot, to navigate the vessel safely into port. Pilot boats had to cross under the Lesner Bridge continually, day and night, every single day for the entirety of the project. Access to the channel could not be interrupted, at any time, because of the Pilots.

CREDITS

- Owner:
City of Virginia Beach
- Owner's Engineers:
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- Construction Engineering Inspection:
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- Precast Producer:
Atlantic Metrocast
- Formwork for Precast Segments:
EFCO
- Erection Equipment:
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- Post-Tensioning Materials:
Freyssinet, Inc.
- Bearings:
R.J. Watson, Inc.
Scougal Rubber
- Expansion Joints:
D.S. Brown Company
- Epoxy Supplier:
Pilgrim Permocoat, Inc.
- Prepackaged Grout:
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