

# Bridge Fills Dual Roles

Project first divides, then unites, town.

By Fred Parkinson



*The Eltham Bridge over the Pamunkey River connects West Point to Route 33 in coastal Virginia. (Aerial Photography by Crow's Nest Photography)*

**H**ow long does it take to replace a bridge? In the case of the new Eltham Bridge that connects the Town of West Point to Route 33 in coastal Virginia the answer is: ten years. And there's good reason why.

Residents of the small town of West Point (population about 4,000) demanded a bridge that would serve the interests of their community as well as traffic moving past the town to other parts of Virginia. After a campaign of ten years, the town gained a bridge that improved a direct connection to the national highway system and also resulted in an enhanced business district, redesigned streetscapes, and a safe way to cross the bridge on bicycle.

West Point is located in a narrow peninsula between two big bridges: the Eltham Bridge, which crosses the Pamunkey River and the Lord Delaware Bridge, which crosses the Mattaponi River. In its heyday, the town served as a deep water port for the City of Richmond as well as a tourist destina-

tion. A shipyard and pulp paper mill, built in 1917 and 1918, respectively, provided an industrial base; manufacturing is still the mainstay of the local economy. Today, West Point retains the setting of a "turn-of-the-century industrial town," with historic Victorian and Green Revival houses and a Main Street downtown district with numerous buildings of Richardson Romanesque architecture.

No one in the town questioned the need for a new bridge. The old two-lane swing bridge, built in the 1940s, was in poor structural condition. It lacked shoulders and did not provide safe access for bicyclists, maintenance workers, or operators. The main roadway through town was only two lanes wide and featured a center turning lane that many considered a "suicide" lane.

Many factors had to be considered in selecting the route for the new bridge, and all of them would have a major impact on the town. Bypasses would have cut off the town from significant traffic flow past its businesses, but a

route through town would require substantial relocations and disruptions. Studies were done to quantify the costs and impacts so that the town could properly gauge the effects. The extensive marsh system around town would also be effected, and played into route selection. In the end, the people of West Point did not want to be cut off from the national highway system by a bypass. They fought hard to make sure the new bridge alignment, amenities, and construction would continue to serve their community and even enhance it.

The Virginia Department of Transportation (VDOT) and Commonwealth Transportation Board (CTB) worked closely with the town to ensure that the needs of the town and the traveling public were properly accounted for in this process. An extensive public involvement program, including a website and regular meetings during construction, were used to gather input and modify the project where possible to better meet the needs of the community.

## Creative Connectivity

The main requirement expressed by the community was that the new structure connect at existing grade with the town's main intersection to improve traffic flow, yet avoid the sensitive historic district. The new bridge is four lanes wide with shoulders, allowing for bicycles. Separate pull-offs were included at the bascule pier to allow for a safe refuge for bridge operators and maintenance personnel. In addition, the vertical alignment of the new structure has practically eliminated bridge openings, which translates directly into smoother traffic flow. Ship collision resistance has also been upgraded through the use of four 40-ft dolphins designed to prevent barges from contacting the pier.



**The Eltham Bridge project used innovative designs such as the bulb tee, a pre-stressed concrete girder that allows for longer bridge span lengths and reduces the number of piers needed in deep water.**

Furthermore, the vertical alignment of the roadway has eliminated stoppages at the active railroad crossing that provides access to the paper mill in town.

The new wider roadway did require additional right-of-way that threatened to drive away several local businesses. To retain as many businesses in town as possible, West Point purchased an abandoned supermarket that was situated on the alignment and subdivided it to accommodate the displaced businesses. The new shopping center has become a centerpiece of the revitalized community.

To further address the town's concerns, wide brick sidewalks were added to the downtown and historic-themed street lighting put into place. Landscaped parkways and special aesthetic treatments of the bridge piers and operating house further contribute to the new look and feel of West Point.

### **New Bridge—New Materials**

To accommodate the requirements of the community while keeping costs in check, some creative engineering was necessary, especially in the design of bridge's structural elements. Given the wide span the Eltham Bridge needs to cover, a lightweight steel structure would have been the most obvious solution for replacing the old bridge. Instead, lightweight concrete spliced-bulb tees were used, a first in the Commonwealth of Virginia. Extensive

research before the design phase, which was corroborated by the Virginia Transportation Research Council, showed that this material would best serve the need for light weight, long life, and minimal maintenance expenses.

Special post-tensioned precast lightweight concrete spliced bulb tees were developed to allow spans up to 240 ft while maintaining economical founda-

tions similar to those of lighter steel girders. Previously, prestressed bulb tees would be expected to span up to 150 ft or 160 ft, but by the addition of a field splice and post tensioning ducts, the beams can achieve economical span lengths while minimizing the number and size of the foundation elements. At the railroad spans, the desired vertical clearances and bridge profile were achieved through the use of low-profile 9,000-psi precast concrete bulb tees, which minimize structure depth.

The project is also one of the first in the Commonwealth to utilize an "end result specification" for concrete production. Rather than specify the exact components to be used by the manufacturer, performance targets were specified and the manufacturer was allowed to determine what would be the best mix to reach that goal. This approach allows suppliers to provide the most cost-effective solutions. For example: A permeability target of 1,500 coulombs was determined for the cast-in-place concrete. The producer was able to beat that benchmark by producing concrete with an aver-

age permeability of 369 coulombs and a maximum over 199 samples of 928 coulombs. This is significant since lower permeability will make concrete more resistant to chloride penetration, which will in turn lower the risk of rebar corrosion and deck deterioration.

To support the approaches on the Eltham side of the river, Parsons Brinckerhoff ([www.pbworld.com](http://www.pbworld.com)) developed an innovative embankment design geared towards preventing future settlement at the transitions between the roadway and the bridge structure. To reinforce the weak marshy soils, concrete piles and caps with geotextile-reinforced soil layers were installed.

### **Conclusion**

From both a technical perspective and in terms of its positive impact on the community, the Eltham Bridge project has proven be a great success. Traffic flow through West Point has improved, bridge opening delays have essentially been eliminated, and there are no more delays at the railroad crossing. The town's main employer, a paper mill, has easy access to both sides of its facility and the community has been enhanced by architectural features like brick sidewalks, improved lighting, and street-scaping. Businesses were retained by innovative partnering between the town and the business community. Last but not least, the project was completed on time, just under budget, and without any outstanding claims or litigation.

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**Traffic flow at the town's main intersection was improved while avoiding the sensitive historic district.**