



FAST FACTS:

Carbon Fiber Reinforced Polymer Strands

PROJECT LOCATION:	Virginia Beach, Virginia
AGENCY	Virginia Department of Transportation Hampton Roads Transportation Accountability Commission
URL:	hrbtexpansion.org/default.asp aii.transportation.org (select <i>Carbon Fiber Reinforced Polymer Strands</i>)
PROJECT NAME:	Hampton Roads Bridge-Tunnel (HRBT) Expansion
PROJECT DESCRIPTION:	<p>The I-64 Hampton Roads Bridge-Tunnel in southeastern Virginia has long been one of the region's most congested corridors. The existing 3.5-mile facility consists of two 2-lane immersed-tube tunnels on artificial islands, with trestle bridges to shore. These tunnels opened in 1957 (current westbound lanes) and 1976 (eastbound lanes) and are approximately 7,500 feet long. Traffic on these four lanes exceeds 100,000 vehicles per day during peak summer traffic.</p> <p>The Hampton Roads Bridge-Tunnel Expansion Project will ease this congestion with the addition of twin 2-lane bored tunnels just west of the existing eastbound tunnel. Also, the 4-lane segments of the I-64 corridor in the cities of Hampton and Norfolk will be widened.</p>
STATUS: IN PROGRESS:	The construction contract was awarded in April 2019, with an estimated completion in November 2025. It is at the early stages of design and construction.

PROJECT PURPOSE AND NEED:

The project purpose is to relieve congestion at the I-64 HRBT in a manner that improves accessibility, transit, emergency evacuation, and military and goods movement along the primary transportation corridors in the Hampton Roads region, including the I-64, I-664, I-564, and VA 164 corridors.

OVERALL BUDGET / COST ESTIMATE:

\$3.8 billion

WHAT WAS UNIQUE ABOUT THIS PROJECT?

Currently, this is the largest highway construction project in Virginia, with this region having significant highway and maritime traffic, including the US Navy.

DESCRIBE TRADITIONAL APPROACH:

Concrete with traditional steel materials, which mainly follow the ASTM A 416, grade 270 low relaxation strand designation, are uncoated, and subject to corrosion, section loss, and eventually loss of prestressing force especially due to leaking of chloride solutions at deck joints and exposure to marine environment. This becomes even more of an issue with beams in certain geographic locations since a beam with little vertical clearance could in effect be in a splash zone of a saltwater environment resulting in the beam being exposed to salt with daily wetting and drying cycles. This aggressive environment can reduce the service life of these elements, leading to costly repairs.

DESCRIBE NEW APPROACH:

If the Carbon Fiber Reinforced Polymer (CFRP) design is selected, during casting, CFRP strands are handled with care and ends prepared with protective material to prevent damage since they are brittle especially in the direction perpendicular to the fibers. During beam placement and while in service, CFRP strands behave similarly to steel strands at service loads. Concrete handles compression and CFRP strands handle tension in beams. The main difference between the two options is at ultimate load. The CFRP used in the project has higher ultimate strength compared to the steel strands. However, the more brittle nature of CFRP strands when compared to conventional steel strands and the limited experience of fabricators with this material has capped the prestressing stress to 65% of the ultimate strength at this time.

TOP INNOVATIONS EMPLOYED:

If the CFRP design is selected, the CFRP reinforced beams or piles will be corrosion free.

PRIMARY BENEFITS REALIZED TO DATE:

Project is currently in the early stages of design and construction.

OTHER BENEFITS REALIZED / EXPECTED:

This location has significant highway traffic on these bridges, so corrosion free prestress beams or piles will minimize maintenance and traffic disruptions.

PROJECT START DATE / SUBSTANTIAL COMPLETION DATE:

The construction contract was awarded in April 2019, with an estimated completion in November 2025.

AFFILIATIONS:

Hampton Roads Connector Partners: Flatiron, Dragados USA, HDR/Mott McDonald Design Joint Venture, Dodin Campenon Bernard, Vinci Construction.

PROJECT CONTACT:

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REFERENCES:

Project Website: hrbtexpansion.org/default.asp



Visit aii.transportation.org and click on **Carbon Fiber Reinforced Polymer Strands**





▶ This photograph shows the structures leading to the tunnels and open shipping channel.



▶ If the CFRP design is selected, the CFRP reinforced beams or piles will be corrosion free. This photograph shows a close-up images of the CFRP strand that was taken at a fabricator's facility in the morning after a rain storm as they made beams as part of an earlier VDOT project.