460 Connector Bridge – General Information

The 460 Connector is a post-tensioned bridge. Post-tensioned bridges employ high-strength steel strands, similar to wire ropes, to hold segments of the bridge together. Multiple steel strands are placed inside a hollow duct, and together a duct and the strands inside are collectively referred to as a tendon. The strands are pulled with extremely large forces after being placed in ducts. Those large forces are referred to as “post-tensioning” forces, and they serve to connect separate segments and serve a crucial function in the load-carrying capacity of the bridge. After post-tensioning forces are applied, grout is pumped into the ducts in order to protect the tendons from corrosion. At the ends of the segments, tendons are anchored using an anchorage system as shown in the following photograph.

Tendons are grouted along their entire length to protect the strands from corrosion. A cross section of a grouted tendon is shown below.

Collectively, the strands, duct and grout form a tendon

Grout, pumped into tendon to protect the strands from corrosion

Individual 7-wire Strands

Anchorage of a Post-Tensioning Tendon (located at ends). The strands are pulled with extremely large tension force to create internal forces within the precast concrete segments

Cross Section of a Grouted Tendon
### Large Complex Structures - Major Projects in 30-Year Plan

<table>
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<tr>
<th>Project Number</th>
<th>Project Description</th>
<th>Start Year in 30-Year Plan</th>
<th>Cost (2018 Dollars)</th>
<th>Reason for Importance/Potential Consequences of Inaction</th>
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<td>1</td>
<td>Health Monitoring</td>
<td>2</td>
<td>$1M</td>
<td>• A monitoring system will allow VDOT to remotely monitor the system for any premature wire breaks</td>
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<tr>
<td>2</td>
<td>Concrete Overlay</td>
<td>18</td>
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<td>• Protect Deck</td>
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<td>3</td>
<td>Deck Rehabilitation</td>
<td>28</td>
<td>$3M</td>
<td>• Full deck rehabilitation. Concrete overlay over hydrodemolition</td>
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**Route 460 30-Year Plan Total in 2018 Dollars** $5M

### Project #1 – Health Monitoring - Start Year 2 in 30-Year Plan

Acoustic monitoring systems are the most economical technology for identifying corrosion in tendons. The system identifies the time and locations of any wire breaks on a structure. This close monitoring allows for plans to be made for replacement. The monitoring system uses sensors, placed at strategic locations throughout the bridge. The sensors detect sound signatures of the structure and use triangulation to locate any localized wire failures. A photo of a typical sensor is provided at left.

### Project #2 – Deck Rehabilitation - Start Year 18 in 30-Year Plan

This project envisions a conventional concrete overlay over a milled surface. This will extend the life of the structure until a deck rehabilitation is required in Year 28 of 30-Year Plan.

### Project #3 – Deck Rehabilitation - Start Year 28 in 30-Year Plan

As the bridge reaches age 30, the deck will require significant rehabilitation. Deck rehabilitation is required on a periodic basis. This project will require a concrete overlay, which consists of a thin layer of concrete placed over the existing riding surface. This concrete will have very low permeability, which means that it will resist the infiltration of chlorides. The concrete will be placed over a deck that has been prepared with a process known as “hydrodemolition”. The hydrodemolition process used very high pressure water nozzles to remove contaminated portions of the concrete surface. It also provides a very rough surface for the concrete overlay to be placed on, which improves the durability of the overlay.

The photos below show a deck prepared with hydrodemolition, along with photos of an overlay during and after installation.