Monitor Merrimac Memorial Bridge Tunnel – Supplemental Information

The Monitor Merrimac Memorial Bridge Tunnel (MMMBT) is a 4.6-mile-long combination bridge-tunnel crossing the James River carrying Interstate 664 in the southeastern portion of Virginia. The MMMBT connects the independent cities of Newport News on the Virginia Peninsula and Suffolk in South Hampton Roads. It is a four-lane bridge-tunnel composed of trestles, two (2) man-made portal islands, one (1) tunnel under a portion of the Hampton Roads Harbor, and 3.2 miles (5.1km) of twin trestle. The northbound and southbound roadways each consist of two lanes of traffic.

Tunnel construction started in 1988 and was completed in 1992. The twin bore tunnel is 4,800 feet long from portal to portal, and it is constructed of reinforced concrete inside a large, fabricated steel plate form. It was built by the immersed tube method, comprised of 15 prefabricated segments. Each segment is 300 feet long, 80 feet wide, 40 feet high, and weighs 28,000 tons. The segments were placed by lay-barges and joined together in a trench dredged in the bottom of the harbor, and backfilled over with earth. The tunnel has two bores, with each bore carrying a two-lane highway consisting of the northbound and southbound roadways. The traffic lanes in the tunnel are 13 feet wide, with an approximate 2.5-foot-wide sidewalk along the left travel lane and an approximate 1.4-footwide ledge along the right travel lane, and with 16.5 feet of vertical clearance from the roadway to the ceiling.

The two tunnel bores are linked by 15 cross passageways which connect the sidewalks that run the full length of the tunnel. The side walls of each tube are finished with ceramic tile. The ceiling serves as the floor of the exhaust air duct and the roadway serves as the ceiling of the fresh air duct.
<table>
<thead>
<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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</table>
| 1              | Communications                                           | 1                          | $2M                 | • Ability to communicate during emergency situations suffers.  
|                |                                                          |                            |                     | • Legacy Analog UHF/VHF inadequate (dead zones)           |
| 2              | Facilities, Structure and Security                       | 5                          | $36M                | • Loss of Building and Back-up Control Room  
|                |                                                          |                            |                     | • Degraded fire detection capability  
|                |                                                          |                            |                     | • Critical Roadway repairs needed  
|                |                                                          |                            |                     | • Inadequate drainage            |
| 3              | Traffic Control System                                   | 7                          | $25M                | • Degraded ability to identify and respond incidents  
|                |                                                          |                            |                     | • Impending system failure due to lack of parts  
|                |                                                          |                            |                     | • Loss of signals due to age of system             |
| 4              | Waterway and Navigation                                 | 9                          | $2M                 | • Potential erosion issues  
|                |                                                          |                            |                     | • Drainage concerns                             |
| 5              | Electrical, Mechanical, Fire Detection, Plumbing         | 11                         | $118M               | • Loss of Building and Back-up Control Room  
|                |                                                          |                            |                     | • Degraded detection capability  
|                |                                                          |                            |                     | • Critical Roadway Pin Pocket repairs needed  
|                |                                                          |                            |                     | • Inadequate drainage            |
| 6              | Communications                                           | 14                         | $1M                 | • Ability to communicate during emergency situations |
| 7              | Facilities and Traffic Control, Electrical, Mechanical, Fire Detection, Plumbing, Security | 21                         | $50M                | • Loss of Building and Back-up Control Room  
|                |                                                          |                            |                     | • Degraded fire detection capability  
|                |                                                          |                            |                     | • Critical Roadway repairs needed  
|                |                                                          |                            |                     | • Inadequate drainage            |
| 8              | Communications                                           | 25                         | $3M                 | • Ability to communicate during emergency situations |
| 9              | Electrical, Mechanical, Fire Detection, Plumbing, Security and Facilities | 26                         | $59M                | • Loss of Building and Back-up Control Room  
|                |                                                          |                            |                     | • Degraded fire detection capability  
|                |                                                          |                            |                     | • Critical Roadway repairs needed  
|                |                                                          |                            |                     | • Inadequate drainage            |
| 10             | Traffic Control System                                   | 30                         | $19M                | • Degraded ability to identify and respond incidents |

**Monitor Merrimac Memorial Bridge Tunnel 30-Year Plan Total in 2018 Dollars**  
$315M
Project #1 - Communications - Start Year 1 in 30-Year Plan

The existing communication system includes high-frequency (HF), ultra-high-frequency (UHF) and very-high-frequency (VHF) base and portable systems, antennas and amplifiers to provide communications throughout the topside island facilities as well as inside the tunnel and engineering spaces. There is also an AM/FM radio repeater system and an emergency broadcast communications network that overrides normal AM/FM radio transmissions inside the tunnel to allow the Control Room to direct motorists via in-car radio in case of emergency.

The communication systems provide voice, video and data from field equipment and devices located throughout the tunnel and ventilation building spaces, to the Control Room.

The communications systems include the following:

- VDOT Facility Telephone System
- Motorist Emergency Telephone System (telephones located along tunnel walkway)
- Closed Circuit Television System (CCTV)
- VDOT Two-Way FM Radio Communications
- AM/FM Commercial Radio Rebroadcast with Operator Override
- Personal Commercial Cellular Telephone Communications
- Supervisory Control and Data Acquisition System (SCADA) - Control and monitoring system that provides operator interface from the Control Room for the tunnel ventilation system, CO monitoring system and power distribution system.

Additionally, outside service provider voice grade telephone line services are provided by the local telecom company for outside facility telephone service access.

Proposed actions:

- Replace 2-way Radio Rebroadcast System
- Emergency/Evacuation Communication to replace legacy analog UHF/VHF Communication system which is inadequate.

Project #2 - Facilities, Structure and Security - Start Year 5 in 30-Year Plan

The project includes rehabilitation of the 1.1 mile tunnel structure, upper and lower air ducts, engineering support spaces and all topside facility buildings on each island, including the control room, maintenance buildings, inspection booths and emergency response buildings. A robust security system is also in place that meets the Homeland Defense Departments requirements for critical infrastructure to include fencing, drive through and walk through gates, badge readers, alarms, security cameras inside and outside and infrared and motion sensors.

The purpose of a facility security system is threefold:

- Detect unauthorized personnel or vehicles in sensitive, strategic or restricted areas
- Control access to these areas
- Provide video surveillance and monitoring of the perimeter and premises

Proposed actions:

- Refurbish/Maintain Surveillance and Detection System Structure
- Structural Repairs - Concrete and Steel Components
- Replace Building Roofs
- Rehabilitate Overhead Doors
- Tunnel Ceiling Projects
**Monitor Merrimac Memorial Bridge Tunnel: I-664 under James River (#11)**

**Project #3 - Traffic Control System - Start Year 7 in 30-Year Plan**

This project will provide control of numerous traffic signal lights, variable message signs, over height detectors and alarms and the encoders, cabling and fiber optics to integrate those systems with the control room. These systems are located on the islands, inside the tunnel, and throughout the trestle bridges.

Traffic surveillance and control systems are provided to monitor traffic and other conditions within the tunnel. These systems are used to detect incidents and control traffic flow, including stopping traffic outside the tunnel when required.

**Traffic incident detection and control systems:**

- Closed Circuit Television (CCTV) System
- Variable Fixed Message Signs (VMS)
- Variable Speed Limit Signs (VSLS)
- Lane Use Signals (LUS)
- Loop Vehicle Detection System
- Drop Arm Gate
- Vehicle Over Height Detection

**Proposed actions:**

- Replace Roadway Cameras
- Upgrade Variable Message Signs
- Lane Use Signals
- Renovations to Control Room
- Traffic Control Systems
- Replace PLC/RTU
- Booth Replacement

**Project #4 - Waterway and Navigation - Year 9 in 30-Year Plan**

The islands and bridges span 4.6 miles of waterway across the Hampton Roads Bay and Intercostal Waterway. There are numerous navigation lights, navaids and the associated cabling and control devices present throughout the perimeter of each island and the trestle bridges required by US Coast Guard to ensure safety of navigation by all marine traffic.

**Proposed actions:**

- Riprap
- Open Cut Seepage
- Slurry Seal Island, signs, markings & helicopter pad

**Project #5 - Electrical, Mechanical, Fire Detection, Plumbing - Start Year 11 in 30-Year Plan**

The project will provide rehabilitation of major components, including the Emergency SCADA system, 24 ventilation fans, multiple 13.8kV switchgear suites, complete facility wide electrical system cabling, generator backup systems, numerous drain pumps, fire pumps, fire plug niches, drain tanks and lines and miles of associated plumbing lines.

**Proposed actions:**

| Electrical and Mechanical Systems | Drainage and Plumbing | Fire Detection |
|----------------------------------|-----------------------|----------------|----------------|
| Overhaul Tunnel Ventilation System | Replace Submersible Pumps & Controls | Overhaul/Replace Fire Detection/Alarms |
| Ventilation Control System       | Replace Hydrocarbon Detection Systems | Cross Passage Egress and Signage |
| Replace Roadway Lighting         | Overhaul Floodgates | Inspect/test/Maintain Water-Based Fire Protection System |
| Repair Automatic Lighting System |                       |                 |
| Replace Emergency Generators     |                       |                 |
| Protect Utility Conduit Suspended on Bridges |               |                 |
| Maintain Power Distribution System|                       |                 |
| Switchgear Replacement           |                       |                 |
| Second Source of Utility Power   |                       |                 |
| Replace Emergency Batteries      |                       |                 |

**Pipes and Values in Drainage Pump Room - Severe Corrosion**
Tunnels

Monitor Merrimac Memorial Bridge Tunnel: I-664 under James River (#11)

**Project #6 - Communications - Start Year 14 in 30-Year Plan**

These projects are cyclical in nature, as the upgrades have a limited life span. Project #6 entails upgrades of elements installed or improved as part of Projects #1.

**Project #7 - Facilities and Traffic Control, Electrical, Mechanical, Fire Detection, Plumbing, Security - Start Year 21 in 30-Year Plan**

These projects are cyclical in nature, as the upgrades have a limited life span. Project #7 entails upgrades of elements installed or improved as part of Projects #2 through 4.

**Project #8 - Communications - Start Year 25 in 30-Year Plan**

These projects are cyclical in nature, as the upgrades have a limited life span. Project #8 entails upgrades of elements installed or improved as part of Projects #1.

**Project #9 - Electrical, Mechanical, Fire Detection, Plumbing, Security and Facilities - Start Year 26 in 30-Year Plan**

These projects are cyclical in nature, as the upgrades have a limited life span. Project #9 entails upgrades of elements installed or improved as part of Projects #2 through 4.

**Project #10 - Traffic System - Start Year 30 in 30-Year Plan**

These projects are cyclical in nature, as the upgrades have a limited life span. Project #10 entails upgrades of elements installed or improved as part of Projects #3.