Hampton Roads Bridge Tunnel – General Information

The Hampton Roads Bridge Tunnel (HRBT) facility is a 3.5-mile-long combination bridge-tunnel crossing Hampton Roads carrying Interstate 64 in the southeastern portion of Virginia. The HRBT connects the independent cities of Hampton on the Virginia Peninsula and Norfolk in South Hampton Roads. It is a four-lane bridge-tunnel composed of 1.8 miles of trestles, two manmade portal islands, and two tunnels under the Hampton Roads Harbor. The westbound and eastbound roadways each consist of two lanes of traffic.

The original HRBT (WB) was opened to bi-directional traffic in 1957 and connected Route 60 (now I-64) in Hampton with Route 60 in Norfolk as a toll facility. In 1976, the second HRBT (EB) was opened to eastbound traffic. With construction of the second tunnel, tolls were removed and the original 1957 tunnel now carries Westbound I-64 traffic from Norfolk to Hampton.

Built by the immersed tube method, the tunnel was constructed of 300+/-foot long prefabricated tubes that were placed by lay-barges and joined together in a trench dredged in the bottom of the harbor, and backfilled with earth. The Eastbound Tunnel consists of 21 prefabricated tubes.

The Eastbound and Westbound Tunnels are separate structures, each of carries a two-lane highway. The traffic lanes in the tunnel are 12 feet wide, with 3-foot-wide barrier (including a sidewalk and curb) on one side of the roadway and a 1.5-foot wide barrier (including a ledge and curb) on the other side of the roadway. The Eastbound Tunnel has a posted vertical clearance of 14’-6” and the Westbound Tunnel has a posted vertical clearance of 13’-6”.

Each tunnel has a sidewalk that runs the full length of the tunnel. The side walls of the tunnels are finished with ceramic tile. The ceilings serve as the floor of the exhaust air ducts and the roadways serve as the ceiling of the fresh air ducts.
<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>
</tr>
</thead>
</table>
| 1              | Communications                                           | 1                          | $2M                 | • Ability to communicate during emergency situations suffers  
• Legacy Analog UHF/VHF inadequate (dead zones)                                                                       |
| 2              | Electrical, Mechanical, Fire Detection, Plumbing          | 2                          | $75M                | • Loss of Building and Back-up Control Room  
• Degraded fire detection capability  
• Critical Roadway repairs needed  
• Inadequate drainage                                                                                                    |
| 3              | Facilities, Structure and Security                       | 5                          | $16M                | • Degraded security  
• Structural deterioration of tunnels continues to spread                                                                                 |
| 4              | Traffic Control System                                    | 7                          | $19M                | • Degraded ability to identify and respond to incidents  
• Impending system failure due to lack of parts  
• Loss of signals due to age of system                                                                                       |
| 5              | Waterway and Navigation                                  | 9                          | $4M                 | • Potential erosion issues  
• Drainage concerns                                                                                                           |
| 6              | Communications                                           | 14                         | $1M                 | • Ability to communicate during emergency situations suffers.  
• Legacy Analog UHF/VHF inadequate (dead zones)                                                                             |
| 7              | Electrical, Mechanical, Fire Detection, Plumbing          | 15                         | $19M                | • Loss of Building and Back-up Control Room  
• Degraded fire detection capability  
• Critical Roadway repairs needed  
• Inadequate drainage                                                                                                         |
| 8              | Security                                                 | 18                         | $3M                 | • Degraded security                                                                                                          |
| 9              | Facilities and Traffic Control                           | 21                         | $31M                | • Degraded security  
• Structural deterioration of tunnels continues to spread  
• Degraded ability to identify and respond to incidents  
• Impending system failure due to lack of parts  
• Loss of signals due to age of system                                                                                       |
| 10             | Communications                                           | 25                         | $2M                 | • Ability to communicate during emergency situations suffers  
• Legacy Analog UHF/VHF inadequate (dead zones)                                                                             |
| 11             | Electrical, Mechanical, Fire Detection, Plumbing, Security and Facilities | 26 | $119M            | • Loss of Building and Back-up Control Room  
• Degraded fire detection capability  
• Critical Roadway repairs needed  
• Inadequate drainage                                                                                                         |
| 12             | Traffic System                                           | 30                         | $18M                | • Degraded ability to identify and respond to incidents  
• Impending system failure due to lack of parts  
• Loss of signals due to age of system  
• Degraded security                                                                                                           |

Hampton Roads Bridge Tunnel 30-Year Plan Total in 2018 Dollars: $309M
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 - Electrical, Mechanical, Fire Detection, Plumbing - Start Year 2 in 30-Year Plan

The Life Cycle Maintenance Plan of this large industrial complex includes the Emergency SCADA system, 32 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:

- Overhaul/Replace Tunnel Ventilation System
- Ventilation Control System
- Replace Roadway Lighting
- Replace Emergency Generators
- Protect Utility Conduit Suspended on Bridges
- Maintain Power Distribution System
- Switchgear Replacement
- HRBT Admin Building Upgrade
- Replace Submersible Pumps & Controls
- Replace Hydrocarbon Detection Systems
- Overhaul Floodgates
- Drainage Piping
- Heat Trace Waterlines
- Overhaul/Replace Fire Detection/Alarms
- Inspect/test/Maintain Water-Based Fire Protection System
- Install/Maintain Roadway Suppression System
Project #3 - Facilities, Structure and Security - Start Year 9 in 30-Year Plan

The maintenance and upkeep for each of the 1.2 mile tunnel structures, upper and lower air ducts, engineering support spaces and all topside facility buildings on each island to include the Control Room, maintenance buildings, inspection booths and emergency response buildings. A robust security system is also in place that meets the Homeland Defense Department’s requirements that 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:
- Security
  - Refurbish/Maintain Surveillance and Detection Systems
  - Structural Repairs - Concrete and Steel Components
  - Replace Building Roofs
  - Rehabilitate Overhead Doors
  - Tunnel Ceiling Projects
  - Address HRBT South Island Leakage

Project #4 - Traffic Control System - Start Year 7 in 30-Year Plan

Includes control from the islands, inside the tunnel, and throughout the trestle bridges 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.

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 (VSL)
- 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
**Hampton Roads Bridge Tunnel: I-64 under James River (#10)**

**Project #5 - Waterway and Navigation - Start Year 9 in 30-Year Plan**

The islands and bridges span 3.5 miles of waterway across the Hampton Roads Bay. 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
- South Island Paving

**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 - Electrical, Mechanical, Fire Detection, Plumbing - Start Year 15 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.

**Project #8 - Security - Start Year 18 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 #3.

**Project #9 - Facilities and Traffic Control - Start Year 21 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 #3 and 4.

**Project #10 - Communications - Start Year 25 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 #1.

**Project #11 - 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 #11 entails upgrades of elements installed or improved as part of Projects #2 and 3.

**Project #12 - Traffic System - Start Year 30 in 30-Year Plan**

These projects are cyclical in nature, as the upgrades have a limited life span. Project #12 entails upgrades of elements installed or improved as part of Projects #4.