



## **Hampton Roads Bridge Tunnel Final Report and Conclusions**

**Presented to the Joint Commission  
on Transportation Accountability**

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## Background

- **Water main break on July 2<sup>nd</sup> caused flooding at Hampton Roads Bridge-Tunnel and closed facility for eight hours**
- **VDOT Commissioner convened panel of industry experts to review existing tunnel operations, technology and management in response to flooding**
  - **Panel of industry experts provided list of recommendations for needed improvements to ensure use of best practices**
  - **Six recommendations were offered to enhance operations and maintenance at all VDOT tunnels for all types of potential incident conditions**
  - **Panel recommended a phased implementation plan be developed**

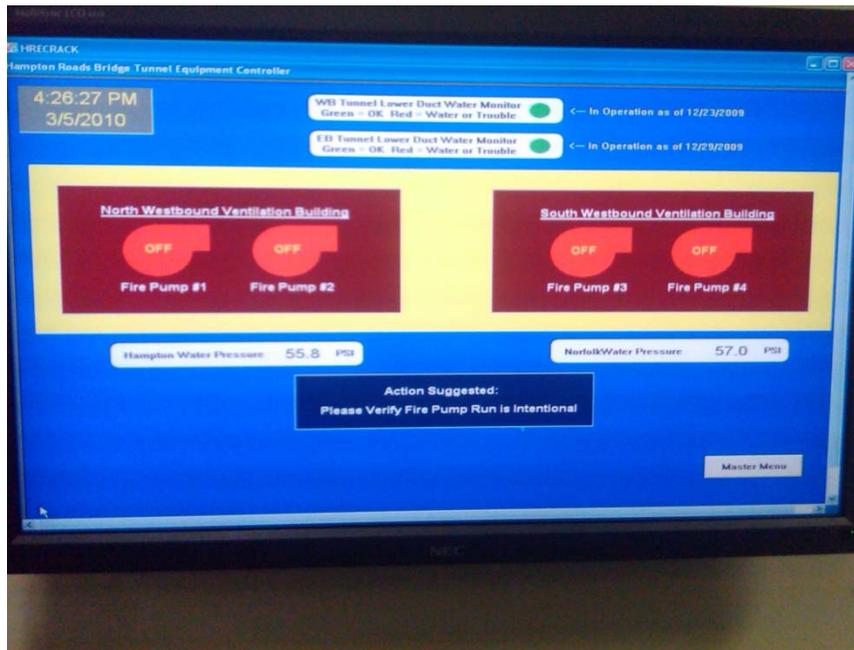
## VDOT Response To July 2<sup>nd</sup> Events

- VDOT responded to July 2<sup>nd</sup> fire main break with numerous immediate, on-going, and long-term actions
- These actions are risk mitigation measures reducing the likelihood of future catastrophic failures
- Initiatives cover a range of activities including:
  - Technology Upgrades
  - Staffing Modifications
  - Increased Employee Training & Recurring Skills Assessment
  - Changes to Policies and Procedures
  - Further Research and Analysis of Key Tunnel Functions
  - Increased Organizational Coordination & Collaboration

## **Immediate Operational VDOT Actions in Response to July 2<sup>nd</sup> Events**

- 1. Installed Water Detection System in Lower Duct at HRBT**
- 2. Implemented computerized logging system to track operations and maintenance activities at all tunnels**
- 3. Conducted preliminary risk analysis of critical tunnel systems**
- 4. Identified and recommended fire main replacement strategy for HRBT**
- 5. Reviewed staffing resources and developed training plans at all tunnels**

# Immediate Operational VDOT Actions in Response to July 2<sup>nd</sup> Events



HRBT Lower Duct Water Detection and Pressure Alarms on EC System

**Tunnel Facilities Critical Systems Risk Analysis**

**Recommendation #1**  
 Conduct a risk assessment to identify the critical systems for which failure would result in closure of the facility or risk to safety of the facility.

The critical tunnel systems are defined as follows: that system or individual components that work together to supply life support, safety, and protection to the facility. These critical systems are vital in keeping the facility functional and provide a safe passage for traveling public. The below table indicates the critical systems in which system failure would adversely impact tunnel operations and the Department's ability to deliver expected services. Through this systems risk assessment, the critical systems are identified as follows:

1. Power Distribution System
2. Fire Suppression System
3. Drainage System
4. Ventilation System

The following table illustrates the risk analysis to identify the critical tunnel systems and the consequences of systems failure.

	Threat to Life and Safety	Threat to Tunnel Operation	Threat to tunnel infrastructure	Out of compliance to fire code (IFC)	Inability to perform a safety function	Impact ability to implement lane reversal	Creates traffic delay at facility	Critical System
Power Distribution System	✓	✓	✓	✓	✓	✓	✓	✓
Fire Protection System	✓	✓	✓	✓	✓			✓
Drainage System	✓	✓	✓				✓	✓
Ventilation System	✓	✓	✓	✓	✓			✓
Communications System	✓	✓	✓			✓	✓	
Traffic Control System*	✓	✓	✓		✓			
Equipment Controls &	✓	✓	✓		✓		✓	

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Tunnel Systems Risk Analysis Study

## Immediate Operational Actions

- Undertaken to ensure other similar tunnels events did not occur
- Based on risk analysis of priority systems
- Focused on both maintenance and operations

## HRBT Independent Review Panel Recommendations

1. **Conduct a risk assessment to identify the critical events that would result in closure of the facility or risk to the safety of the facility users.**
2. **Evaluate the staffing patterns and expertise required for each functional unit.**
3. **Enhance facility management plans and procedures for tunnel facilities.**
4. **Enhance traveler information dissemination during incidents and other major events as a means of reducing overall traveler delay.**
5. **Enhance the emergency plan coordination with local and first responders.**
6. **Implement periodic reviews of security-related plans and policies.**

# On-going VDOT Actions in Response to IRP Recommendations

## 1. Conducted Further Analysis on Key IRP Recommendations

- Independent tunnel systems risk analysis on all tunnels
- Consolidate tunnels traffic management functions at the TOC
- Tunnel inspection process review

## 2. Implementation of Key Projects

- Installing flow sensors in potable water and fire protection systems at HRBT and ERT
- Implementing Automated Maintenance Management System (AMMS) on top four critical systems at all tunnels
- Installing Electronic Controls System at MMMBT consolidating industrial systems monitoring into a single interface

## 3. Development of Plans and Procedures

- Incident diversion plans
- Emergency response / security plans
- Public education and outreach

## On-going VDOT Actions in Response to IRP Recommendations

### 4. Coordination and Formation of Key Work Groups

- Implemented Asset Management working group to guide overall tunnel asset maintenance management program
- I-95 Corridor Coalition and other states (NC, MD)
- Local emergency responders

### 5. Formation of Tunnels Statewide Oversight Committee

- Formation and commencement of Statewide Tunnels Committee to provide organizational guidance and support
- Address unique needs and challenges of the six tunnel facilities that VDOT owns and operates
- Includes Executive Steering Committee and Technical Committee

## Long-Term Initiatives to Reduce Risk at Tunnels

- 1. Continue to identify best practices and necessary changes to business practices for operations and maintenance for potential implementation at all statewide tunnel facilities as feasible**
- 2. Utilize Statewide Tunnels Oversight Committee as a venue for bringing forward issues of significance for tunnels and as mechanism for identifying dedicated resources for tunnels**
- 3. Expand coordination and collaboration among VDOT tunnels stakeholders**
- 4. Additional internal and external tunnels scan tours**

## Long-Term Initiatives to Reduce Risk at Tunnels



Hampton Roads Bridge Tunnel



Big Walker Mountain Tunnel

### Long-Term Initiatives

- Address statewide tunnel issues at a programmatic level
- Improves agency visibility of needed tunnel resources
- Provide sustainable program for investment in tunnels

## Next Steps for VDOT

- **Continue to implement IRP Action Plan to include on-going and long-term initiatives**
- **Evaluate independent reports developed as required by IRP**
- **Develop and implement tunnels investment plan strategy**
- **Utilize Statewide Tunnels Oversight Committee to provide structured and sustainable approach to overseeing tunnels program**

# Questions?