OVERVIEW AND IMPLEMENTATION of the TUNNEL MANAGEMENT SYSTEM

TRB Tunnel Workshop
January 11, 2009
Washington, DC
PRESENTATION TEAM

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- Rick Patrick, P.E.
DISCUSSION TOPICS

- Development of TMS for FHWA/FTA
- Reflections on Implementation
- Overview of Current Research for NCHRP
- TMS Demonstration
DEVELOPMENT OF TMS FOR FHWA/FTA

Objectives:

- Conduct synthesis of tunnel inspection and maintenance/rehabilitation practices
- Develop preliminary inventory of highway and rail transit tunnels
- Develop manuals for inspection and rehabilitation
- Develop prototype database
- Ensure compatibility with future management systems for assets
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DEVELOPMENT OF TMS FOR FHWA/FTA

- Surveyed Highway and Rail Transit Tunnel Owners via Questionnaire for:
  - Maintenance and Inspection Practices
  - Documentation Methods
  - Inventory of Tunnels
RESULTS OF SURVEY

- 40 out of 45 Highway Tunnel Owners Responded
- 21 out of 26 Rail Transit Tunnel Owners Responded
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### Preliminary Inventory of Highway Tunnels

<table>
<thead>
<tr>
<th>Tunnel Ages (Years)</th>
<th>No. of Tunnels</th>
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<tbody>
<tr>
<td>&lt; 10</td>
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<tr>
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<td>TOTALS</td>
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**PRELIMINARY INVENTORY OF RAIL TRANSIT TUNNELS**

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<tr>
<th>Tunnel Ages (Years)</th>
<th>Tunnel Length (Miles)</th>
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PRELIMINARY TUNNEL INVENTORY

- State, Tunnel Name, ID #, County, Segment or Line, Route No., Year Built, Height, Width, Length, Vertical and Horizontal Roadway Clearances
- Tunnel Construction Method – Cut and Cover, Shield Driven, Bored, Drill and Blast, Immersed Tube, NATM
- Tunnel Shape - Circular, Rectangular, Horseshoe, Oval/Egg
- Ground Conditions- Soft, Subaqueous, Mixed Face, Rock
PRELIMINARY TUNNEL INVENTORY

- Lining and Support System – Unlined Rock, CIP Concrete, Shotcrete/Gunite, Precast Liners, Steel/Iron Plates, Masonry, Slurry Wall/CIP Concrete
- Type of Ventilation System – Longitudinal, Semi-Transverse, Full Transverse, Single Point Extraction, Natural
- Location of Ventilation Fans
- Lighting – Fluorescent, HPS, LPS, Metal Halide, Pipe Lighting
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NATIONAL TUNNEL MANAGEMENT SYSTEM

Developed Tunnel Inspection Manual

- For Highway and Transit Tunnels
INSPECTION MANUAL

INSPECTION MANUAL

- Inspection Procedures for Structural Elements and M/E Systems
- Definition of Condition Codes (0 to 9 similar to Bridge Inspection Codes)
- Inspection Documentation
- Repair Priority Definitions
- Report Format
MAINTENANCE AND REHABILITATION MANUAL

- Preventive Maintenance Recommendations for various Tunnel Elements and Systems
- Rehabilitation Guidelines for Structural Elements for Water Infiltration, Concrete Repairs and Liner Repairs
- Appendix A: Life Cycle Cost Methodology
Objectives:

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Developed Computerized Tunnel Management System
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TMS IMPLEMENTATION LOCATIONS

- d., Washington, DC
- PennDOT
- North Texas Tollway Authority
- Pennsylvania Turnpike Commission
- Others?
TMS IMPLEMENTATION FOR d.

- Verified that the procedures for inspection/documentation were appropriate
- Ensured element condition evaluation criteria in Inspection Manual were sufficiently described
- Adapted the prototype database to fit client specific requirements
TMS IMPLEMENTATION FOR d.

TMS Customization for d.

- Configured to Meet Specific IT requirements
- Converted database from Access to SQL Server
- Added the Hot Sync Feature
- Added Mechanical and Electrical Equipment Condition Data into TMS
- Added Maintenance Tracking
Problem = Maintenance Concerns
- Aging equipment
- No maintenance records
- No test records

Solution = Computerized Maintenance Management System
Saber: Computerized Maintenance Management System (CMMS)

- Plan and track maintenance and repair costs (labor, materials)
- Clearinghouse for maintenance data
- Decision-making tool
REFLECTIONS ON TMS IMPLEMENTATION

- Database is easy to use and provides useful record of asset conditions over time.
- Inspection manual and condition definitions provide standardization and consistency in results.
However, greater ability to track preventive maintenance and repair of mechanical and electrical systems may be desirable.
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OVERVIEW OF CURRENT RESEARCH FOR NCHRP

Tasks:

- Literature search and review of current national and international practices
  - QA/QC methods for ensuring accuracy in tunnel inspection results
  - Established operational /emergency procedures
  - Regular testing of emergency systems and procedures
Survey of highway and transit tunnel owners for current practices:

- Emergency systems in place (communications, fire/incident detection, fire suppression, lighting, tunnel ventilation, traffic control, pedestrian egress, etc.)
- Established emergency response procedures
- Frequency for testing of emergency response procedures
- Established inspection procedures
- Methods to ensure quality and consistency of inspection results
OVERVIEW OF CURRENT RESEARCH FOR NCHRP

Literature search of current domestic and international practices
OVERVIEW OF CURRENT RESEARCH FOR NCHRP

Tasks:
- Develop best practices for tunnel inspection, and operational safety and emergency response systems testing.
OVERVIEW OF CURRENT RESEARCH FOR NCHRP

Tasks:

- Develop draft guidelines (data format and data field definitions) for recording and tracking tunnel inventory and performance of tunnel elements.
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