



# RESEARCH REPORT AND FINDINGS: SPECIFICATIONS AND GUIDELINES FOR RAIL TUNNEL INSPECTION AND MAINTENANCE

## Background

After a Washington Metropolitan Area Transit Authority (WMATA) L'Enfant Station accident in 2015, in which electric arcing of a circuit, due to prolonged moisture from tunnel leakage, caused a passenger train to stop in the smoke-filled tunnel resulting in a passenger fatality, the National Transportation Surface Board (NTSB) issued two recommendations directed at the Federal Transit Administration (FTA). As a result of delays in evacuations from the passenger train in the tunnel caused by the presence of smoke, failed ventilation fan components, and delayed emergency egress under less-than-desirable conditions (lighting and walkways), researchers assisted FTA and the transit industry in developing standards and/or recommended practices for tunnel inspection and maintenance, repair/rehabilitation, and emergency egress.

## Objectives

Project objectives included three focus areas:

- Improved tunnel inspections and maintenance by exploring new and existing technologies for inspection elements.
- Tunnel repairs and rehabilitation, including a condition-based rating system for tunnels as a tool for evaluation for rehabilitation and guidelines for a tunnel inventory database.
- Standards or guidelines for planning emergency egress from tunnels.

## Findings and Conclusions

*Transit agencies with tunnels have a wide range of practices regarding tunnel design, inspection, and maintenance; adjustments to agency inspection procedures and FTA's rating system and investments in new technologies could benefit rail tunnel safety.*

In general, it was observed that transit agencies with tunnels have a wide range of practices regarding tunnel design, inspection, and maintenance. About half of the tunnels were built over 50 years ago and about 15% over 100 years ago. As of 2017, only about 20% of U.S. rail transit tunnels had been fully or partially rehabilitated since their original construction. A literature review reveals inspection requirements, frequency, techniques, documentation, and tunnel condition rating criteria. Sources include the *Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual* and the *Specifications for National Tunnel Inventory (SNTI)*. Other tunnel and maintenance references include APTA RT-FS-S-001-02, SRT TSI 4.5, NCHRP Project 20-07 (Tasks 261 and 276), the *AREMA Manual*, and the *AREMA Bridge Inspection Handbook*.

Findings based on standard comparisons, guideline assessments, and working group discussions include the following:

- The SNTI and the *TOMIE Manual* were the most comprehensive documents for tunnel maintenance and inspection. Transit agency inspection procedures could be aligned with the criteria and techniques described in these manuals.
- FTA's tunnel structural component rating system could be refined to use elements of the SNTI rating system; FTA uses a five-point scale, and the SNTI uses a four-point scale and defines conditions for each tunnel element/component.
- FTA may consider developing a standard or recommendation through the rulemaking process that would become a part of the Transit Asset Management (TAM) requirement for rail tunnel inventory, similar to FHWA's National Tunnel Inventory (NTI) database of highway tunnels.
- Investments in new technologies and comparisons of existing technologies for waterproofing, groundwater intrusion mitigation, and tunnel inspection tools are beneficial to agencies. Future research on application, demonstration, and testing under certain conditions is necessary to evaluate the full benefits of these technologies for transit tunnels.

## Benefits

Study findings can support future FTA efforts in providing guidance to the industry on minimum Guidelines for Rail Tunnel Inspection and Maintenance.

## FTA Report No. 0236 Project Information

This project was performed by the Transportation Technology Center, Inc., (TTCI) in support of FTA's Standards Development Program. For more information, contact FTA Project Manager Raj Wagley at (202) 366-5386 or [Raj.Wagley@dot.gov](mailto:Raj.Wagley@dot.gov).

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