

EPG 753.20: Tunnel Inspection Requirements in Missouri

When compared to bridges and culverts, the number of tunnels around the country that serve highway traffic is very small. Many of the tunnels that are in existence are complex structures that require a variety of systems to function properly in order to allow for safe passage of vehicles thru the tunnel. In recent decades, there have been some incidents in tunnels that have resulted in injuries and fatalities. These incidents have resulted in calls for some type of national program for inspection of tunnels.

In 2012, congress passed a federal transportation bill that was called MAP21. This bill established in federal law a requirement for a national tunnel inspection program to be developed by FHWA and implemented nationwide. The program was required to be developed in a similar manner as the national bridge inspection program.

After the passage of MAP21, FHWA began working on developing a national program for the inspection of tunnels. The first part of this process involved creating federal regulations to define the scope and requirements for a national tunnel inspection program. The finalized regulations were published in August of 2015 and were designated as the *National Tunnel Inspection Standards (NTIS)*. These standards can be found in federal regulations as *23 CFR 650 Subpart E*.

Between 2015 and 2017, FHWA developed a compliance review process for tunnels that was like what is used for reviewing the bridge inspection program. The purpose of this process is to review how states are complying with the requirements in the NTIS and provide recommendations on improvements that can be made to the inspection programs in states that have tunnels. This new compliance review process was piloted in several states in 2017. Based on feedback from the pilot process, additional updates were made to the review process and the final review process document was published in early 2019. The first official yearly review of the tunnel inspection program in each state was started on April 1, 2019.

At the present time, Missouri only has one tunnel within the state, which is the Lindbergh Tunnel in St. Louis. The purpose of this section of the BIRM is to define the requirements for tunnel inspection in Missouri, to ensure that inspections are completed in compliance with the NTIS. Because Missouri only has one tunnel, this section of the BIRM will be focused on dealing with the requirements for this tunnel. If additional tunnels are built within Missouri, then this section will be updated to be more generalized.

EPG 753.20.1: Definitions and References

The following definitions and references are provided for use with this section.

FHWA—Federal Highway Administration.

MoDOT—Missouri Department of Transportation.

MAP21—Moving Ahead for Progress in the 21st Century Act, passed in July of 2012.

NBIS—National Bridge Inspection Standards, 23 *CFR* 650 Subpart C.

NTIS—National Tunnel Inspection Standards, 23 *CFR* 650 Subpart E.

NTI—National Tunnel Inventory, which is an inventory of the nation’s tunnels.

SNTI—*Specifications for the National Tunnel Inventory*, provides requirements for the data tracked on tunnels and the format for submittal of the data to FHWA.

TOMIE—*Tunnel Operations, Maintenance, Inspection, and Evaluation Manual*, provides nationwide guidance on all aspects of managing tunnels.

TUNNEL—The following definition for a tunnel comes directly from the NTIS. *A tunnel is an enclosed roadway for motor vehicle traffic with vehicle access limited to portals, regardless of type of structure or method of construction, that requires, based on the owner’s determination, special design considerations to include lighting, ventilation, fire protection systems, and emergency egress capacity.* Tunnels do not include structures currently inspected under NBIS requirements.

COMPLEX TUNNEL—For the purposes of fulfilling requirements in the NTIS, a complex tunnel will be considered any tunnel that requires advanced systems to ensure the safe passage of motorists thru the tunnel. A tunnel would be considered to have advanced systems when the NTI file for the tunnel includes elements from the SNTI groupings of: Mechanical Systems, Electrical Systems, and Fire/Life Safety/Security Systems.

CRITICAL FINDING—A structural or safety related deficiency that requires immediate action to ensure the safety of the public or to protect the integrity of the tunnel.

FUNCTIONAL SYSTEMS—Per NTIS definition, the following items may be present within a tunnel and considered a functional system: electrical, mechanical, fire suppression, ventilation, lighting, communications, monitoring, drainage, traffic signals, emergency response, and traffic safety components.

EPG 753.20.2: Tunnel Inspection Organization

For the purpose of compliance with the broader requirements of the NTIS, the responsibilities of MoDOT and St. Louis City are defined below.

MoDOT

- Serves as the Program Manager for tunnel inspection in Missouri.
- Maintains the NTI data file for the Lindbergh Tunnel in St. Louis and submits this data file to FHWA each year by the deadline set by FHWA.
- Serves as the point of contact for the yearly review by FHWA of the tunnel inspection program in Missouri.
- Responsible for ensuring general compliance with the requirements of the NTIS for tunnels in Missouri.
- Provides quality control and quality assurance for the Lindbergh Tunnel, or provides direction to St. Louis City on tasks needed to fulfil QA/QC requirements.
- Works with St. Louis City to develop timelines and the actions needed to address tunnel inspection program compliance issues and concerns that FHWA identifies

- as part of the national tunnel inspection program compliance reviews that FHWA completes each year.
- Provides any comments or concerns on a draft tunnel inspection report within 30 days of receiving the draft from the city.
 - Reviews and approves team leader and other inspector credentials within two weeks of the date they are provided by the city.
 - Provides contact information for the Program Manager, Supervising Bridge Inspection Engineer, and District Bridge Engineer to the city for providing to the Team Leader overseeing the tunnel inspection.

St. Louis City

- Provides a Project Manager that oversees the inspection program for the Lindbergh Tunnel and serves as the single point of contact for questions or concerns from FHWA or MoDOT.
- Completes inspections for the Lindbergh Tunnel that comply with the requirements in the NTIS.
- Provides the Program Manager at MoDOT with the plan for completing inspections that are due for the Lindbergh Tunnel.
- Provides to MoDOT for approval by the Program Manager, information on the Team Leader and other inspectors that are going to be utilized for any inspection that is being completed. This information should be provided at least 30 days prior to the inspection, so that the Program Manager has time to review the information and address any concerns that may exist.
- Provides MoDOT with information on the inspection dates and inspectors participating in the inspection within 60 days of the completion of the inspection.
- Provides MoDOT with updated condition state and quantity information for all existing elements in the NTI data file for the Lindbergh Tunnel within 60 days of the completion of the inspection. This would include any additions or deletions that are needed for elements.
- Provides MoDOT with a draft copy of the final report for the tunnel inspection within 120 days of the completion of the inspection and allows for a 30 day period to provide any comments or concerns back to the city.
- Once the review period for the draft report has ended, the city shall provide MoDOT with a final version of the report within 60 days. The final version of the report shall be signed and sealed by a professional engineer registered in the State of Missouri.
- Provides the Team Leader with the contact information for the MoDOT personnel listed above and for the person at the city in charge of the inspection contract.
- Informs the consultant performing the inspection that personnel from MoDOT and FHWA will likely be on site for multiple days during the inspection as part of the inspection oversight role.

EPG 753.20.3: Program Manager Qualifications and Responsibilities

The Program Manager will be responsible for setting statewide policies and procedures for the inventory, inspection, and load rating of tunnels in Missouri that are part of the NTI. The Program Manager shall be a registered professional engineer in the State of Missouri and shall meet the requirements to be a Nationally Certified Tunnel inspector.

The Bridge Management Engineer in Bridge Division will serve as the Program Manager over all tunnel inspections in Missouri. In the absence of the Bridge Management Engineer, the Supervising Bridge Inspection Engineer in Bridge Division or the District Bridge Engineer for the St. Louis District may be designated to serve in the role of Program Manager on a temporary or long-term basis, as needed. Anyone designated to serve as the Program Manager shall meet the requirements specified in the first paragraph of this section.

The Program Manager shall be responsible for maintaining a registry of nationally certified tunnel inspectors that are actively involved in tunnel inspections within the state. This registry shall include information for positive identification, professional engineer registration information, engineer in training information, educational information, tunnel inspection training completed, tunnel/bridge inspection experience, and whether the person meets Team Leader requirements for complex tunnels.

EPG 753.20.4: Team Leader Qualifications and Responsibilities

All current tunnels in Missouri are considered complex tunnels, which limits the avenues for someone to qualify as a Team Leader for tunnel inspections. Team Leaders lead the inspection teams completing a tunnel inspection and are required to be on site for the duration of all initial, routine, and in-depth tunnel inspections. Team Leaders for tunnel inspections in Missouri shall meet all the requirements shown below.

- Be currently registered as a Professional Engineer in the State of Missouri.
- Be a nationally certified tunnel inspector.
- Have six months of bridge or tunnel inspection experience.

Team Leaders that are actively inspecting tunnels in the State of Missouri shall be responsible for ensuring that the Program Manager has the information needed to demonstrate that they meet the NTIS and MoDOT requirements to be designated as a Team Leader. This would include inspection experience, professional registrations, and tunnel inspection training. In situations where trainings or registrations periodically lapse and require refresher training, updated information shall be provided to the Program Manager for maintaining an active approved status of Team Leader for tunnel inspections in Missouri.

EPG 753.20.5: Nationally Certified Tunnel Inspector Requirements

Tunnel inspectors in Missouri shall be nationally certified in accordance with the NTIS. To comply with the NTIS, inspectors shall meet the following requirements.

- Successfully complete the training course: *NHI-130110 Tunnel Safety Inspection*.
- Successfully complete the refresher training course: *NHI-130125 Tunnel Safety Inspection Refresher* every five years as designated in the NTIS.
- Maintain supporting documentation for the training required in the above bullets and provide this information to the Program Manager in Missouri so that a registry of nationally certified tunnel inspectors performing inspections in accordance with the NTIS can be maintained.

Tunnel inspections may include multiple teams of inspectors focused on different parts of the tunnel, working under the guidance of the Team Leader. This is more likely to happen on larger tunnels or on tunnels where there are time constraints limiting the duration of lane closures for inspection purposes. It is acceptable to have non-trained people working within these teams for the purposes of documentation or other assistance that an inspector may need. However, each inspection team for initial, routine, and in-depth inspections should include at least one Nationally Certified Tunnel Inspector that is working under the direction of the Team Leader for the inspection.

EPG 753.20.6: Load Rating Engineer Qualifications

The Load Rating Engineer will be responsible for the general oversight of load rating issues on tunnels. The Bridge Rating and Inventory Engineer in Bridge Division will serve as the Load Rating Engineer for the State of Missouri. In the absence of the Bridge Rating and Inventory Engineer, the Bridge Management Engineer in Bridge Division will serve in the capacity of the Load Rating Engineer. The Load Rating Engineer shall be a registered professional engineer in the State of Missouri.

EPG 753.20.7: Inspection Types and Interval Requirements

The following types of inspections may be required on tunnels in Missouri as part of the NTIS. A general description of each type of inspection is provided and the required intervals for these inspections are identified as required by the NTIS.

EPG 753.20.7.1: Initial Inspection

The first inspection that is completed on a new tunnel is called the initial inspection. This inspection is used as a means for collection of inventory data, appraisal information, and other items necessary to establish the baseline condition of the structural components and functional systems of a tunnel at the time it opens to traffic. This inspection should be completed prior to the tunnel being open to traffic.

EPG 753.20.7.2: Routine Inspection

The NTIS provides the following definition for a routine tunnel inspection: *a regularly scheduled comprehensive inspection encompassing all tunnel structural elements and functional systems and consisting of observations and measurements needed to determine the physical and functional condition of the tunnel, to identify any changes from initial or previously recorded conditions, and to ensure that tunnel components continue to satisfy present service requirements.*

Each tunnel in Missouri shall have a target routine inspection date designated so that it can be included on the NTI. Routine inspections shall be completed on 24 month intervals correlating with the established inspection date in the NTI. To comply with the NTIS, the actual routine inspection shall be completed within the two months prior to the target inspection date or the two months after the target inspection date.

EPG 753.20.7.3: Special Inspection

Special inspections are inspections that are used to monitor a known or suspected deficiency on a structural element or functional system of a tunnel. These inspections are typically done at more frequent intervals than the routine inspection. These inspections usually result from specific conditions found during routine inspections. However, they may also be warranted for older components in a tunnel that are at higher risks for developing problems resulting in the need for closer monitoring. An example might be the need to monitor bearing conditions on an older ventilation fan where the likelihood of a bearing failure is high before the next scheduled routine inspection. The goal is to catch an issue while it is still minor in nature and get the component repaired or replaced before it develops into a bigger issue.

The Team Leader should be considering the need for special inspections as part of the assessment of the results of a routine inspection. When the Team Leader identifies the need for a special inspection, they should discuss this with the Project Manager and the Program Manager and collectively decide on the need for that inspection, the interval for completion of that inspection, and the qualifications needed for a person that would complete that inspection. Special inspections that are completed shall be documented with a short write up of any findings, the date of the inspection, and the personnel completing the inspection. This information shall be provided to the Program Manager so that the NTI file for the structure can be updated.

EPG 753.20.7.4: Damage Inspection

Damage inspections are unscheduled inspections that are required to assess damage resulting from environmental factors or human actions. The damage may include the structural elements of the tunnel as well as function systems within the tunnel. Incidents that may trigger the need for a damage inspection include impact events from motor vehicles, fire events, flooding events either in or near the tunnel, seismic events near the tunnel, and blast events.

When triggering events happen, the District Bridge Engineer, Supervising Bridge Inspection Engineer, or the Program Manager should be contacted for a determination on the need for a damage inspection and a determination on who will complete that inspection. Any damage inspection that is completed shall be documented with a short write up of any findings and include information about the incident, the personnel doing the inspection, and the date of the inspection. This information shall be provided to the Program Manager so that the NTI file for the structure can be updated.

EPG 753.20.7.5: In-Depth Inspection

In-Depth inspections are close up (i.e. hands on) inspections of one or more components of a tunnel. The components may include structural elements or functional systems. They are typically done as a follow up to a routine, special, or damage inspection to better define deficiencies that were observed. However, they may be needed as a regular part of monitoring a specific component or functional system within a tunnel and may need to be completed outside of the normal routine inspection interval.

When the Team Leader identifies the need for an in-depth inspection, the concern shall be provided to the Project Manager and the Program Manager for further discussion and a final decision on the need for that inspection, the interval for completion of that inspection, and the qualifications needed for the personnel completing that inspection. If specific functional systems within a tunnel need an in-depth inspection on regular intervals that are outside of the normal routine inspection, then information on that should be included in the tunnel specific inspection procedures, including a frequency for this inspection. This information shall be provided to the Program Manager so that the NTI file for the structure can be updated.

EPG 753.20.7.6: Extended Interval Inspections

The NTIS allows for routine tunnel inspections to be completed on extended inspection intervals up to 48 months. Because of the complexities of the current tunnels in operation within Missouri, extended interval inspections will not be allowed.

EPG 753.20.7.7: Reduced Interval Inspections

As tunnels age and deteriorate, more frequent routine inspections may be warranted to maintain the safety of the traveling public. As part of each routine inspection, the Team Leader for the inspection shall review the overall conditions of the tunnel to determine if the standard 24 month inspection interval is still appropriate. If the Team Leader has concerns that more frequent inspection may be needed, those concerns should be presented to the Project Manager as well as the Program Manager. After this information is provided, further discussions and a final decision on whether a reduced interval inspection is required or whether some other type of inspection focused on a specific area of concern could be completed as an alternative solution.

EPG 753.20.8: Load Posting and Other Restrictions

The NTI requires that tunnels be evaluated for the safe vehicular load capacity whenever they have elements that are not on grade, requiring that the element be capable of fully supporting vehicular and other loads. When a posting analysis is completed and the results indicate that a load restriction is needed, then the load posting signs shall be installed as soon as possible but no later than 30 days after the posting need has been identified. Problems found with existing posting signs during inspection are required to be resolved within 30 days of the inspection finding.

The Lindbergh Tunnel has an at grade slab, so no load rating for vehicular loadings is required. Because no load ratings are required for the tunnel, no load posting restrictions will be in place.

The Lindbergh Tunnel does have other restrictions in place that have to be maintained over the life of the tunnel. These restrictions are shown below.

- No oversize or overweight permit traffic will be allowed to travel through the tunnel. These permitting restrictions are maintained in the computer system that MoDOT uses for issuing permits.
- No vehicles hauling hazardous materials may travel through the tunnel. The hazardous material restriction is maintained by traffic signs on each approach to the tunnel.

EPG 753.20.9: Critical Inspection Findings for Tunnels

The Team Leader in charge of a tunnel inspection is responsible for determining if an inspection finding in a tunnel raises to the level that requires issuance of a critical inspection finding (CIF). When it is not clear if a finding rises to the level of a CIF, the Team Leader shall contact the Project Manager for the airport and the Program Manager at MoDOT to discuss the appropriate course of action for the finding. If the Program Manager at MoDOT is not available, then the District Bridge Engineer for the St. Louis District or the Supervising Bridge Inspection Engineer from Central Office Bridge Division shall be contacted to discuss the finding.

When a critical finding is determined during a tunnel inspection, the Team Leader is responsible for completing the items listed below.

- If the finding requires immediate tunnel closure or lane restrictions within a tunnel to protect the safety of the traveling public, the Project Manager at the city and the District Bridge Engineer for the St. Louis District shall be immediately contacted and provided with the immediate actions needed. This would include a discussion on who was responsible for moving forward with implementing any actions that were needed because of the finding.
- The Team Leader shall be responsible for filling out a CIF form and sending an email to document the CIF. This email shall be sent on the same day as the finding

is observed and include the CIF form as an attachment. This email or the attached CIF form shall meet the requirements listed below.

- Provide a verbal description of the finding, including the location of the finding within the tunnel.
- Provide photographs of the finding that sufficiently represent the observed condition.
- Define the potential risk that resulted in the decision to elevate the finding to the level of a CIF.
- Provide a recommended course of action necessary to fully address the finding and return the tunnel to the previous level of service.
- Provide the names of the inspectors on site for the day and the person that was acting as the Team Leader.
- The date of the inspection finding.
- Copy at least the following people on the email: Project Manager for the city, Program Manager, Supervising Bridge Inspection Engineer, and the District Bridge Engineer.

After receipt of the email documenting the CIF, the Program Manager will notify the local office of FHWA about the CIF within 24 hours of receiving the email.

EPG 753.20.10: National Tunnel Inventory Responsibilities

The NTIS requires that states maintain an inventory of the tunnels on public highways within each state. The minimum requirements for storage of tunnel information are defined in SNTI. Submittal to FHWA of a data file for the tunnels within a state is required by March 15th each year.

MoDOT will be responsible for maintaining NTI data for the tunnels in Missouri. This will include creation of the NTI record for new tunnels and maintenance of the record for existing tunnels. MoDOT will submit this data file to FHWA by the deadline each year.

The NTIS requires that tunnel record information for the NTI be updated within 90 days of the completion of a tunnel inspection. For the purposes of compliance with this requirement, MoDOT requires the submittal of inspection dates and inspector information within 60 days of the completion of the inspection. Additionally, updates to element quantities and condition states shall be provided to MoDOT within 60 days of the inspection completion date.

A draft of the tunnel inspection report prepared by the consultant shall be submitted to MoDOT for review within 120 days of the inspection completion date. Once received, MoDOT will review the draft report and provide comments back to the city and consultant within 30 days. After submittal of the draft comments back to the city, a final copy of the report shall be provided to MoDOT within 60 days. The final copy of the report shall be signed and sealed by a professional engineer registered in the State of Missouri.

The NTIS requires that a tunnel file be maintained for each tunnel that is on the inventory. Compliance with this requirement will be a shared responsibility between MoDOT and St. Louis City. Each entity will be required to maintain information on the Lindbergh Tunnel in relation to their general responsibilities, as shown below.

Information Maintained by MoDOT

- NTI data file used for tracking of the tunnel condition and characteristics, including inspection dates and frequencies.
- Original plans for the construction of the tunnel.
- Copies of agreements between MoDOT and St. Louis City.
- Copies of pertinent information related to critical inspection findings on the tunnel.
- Copy of the final inspection report from each inspection cycle.
- Other information collected as part of our oversight role for the tunnel inspections that are completed.

Information Maintained by St. Louis City

- Maintain tunnel specific inspection procedures that define the general requirements needed to complete an inspection on the tunnel and include these procedures in some format within the tunnel inspection report.
- Develop procedures for testing of the different functional systems within the tunnel. Specific procedures shall identify the applicable system for the testing procedure, the qualifications needed for personnel completing the tests, the required frequency of the tests, the actions needed to complete a test, and the documentation requirements once each test is completed.
- Maintain documentation on all the different testing procedures that are completed on the tunnel. The information in this file shall be provided to the Team Leader each inspection cycle for review and inclusion (as needed) in the inspection report that is generated each inspection cycle.
- Maintain a file of all the maintenance and construction activities completed on the tunnel. This would include normal regular maintenance activities as well as more involved activities (maintenance or construction) that are completed by contracts.
- Maintain a general file of information on the tunnel. This file would include things such as general correspondence, copies of inspection contracts, inspection reports and other pertinent information on the tunnel.
- Work with MoDOT and FHWA to address issues and concerns that are found during yearly compliance reviews in relation to the NTIS.

EPG 753.20.11: Quality Control and Quality Assurance

MoDOT will assume the role of providing quality control and quality assurance for tunnel inspections in Missouri. Since there is only a single tunnel in Missouri, the normal practices of random sampling and review of tunnel inspections will not be used.

QC/QA will be done by having MoDOT personnel on site during each tunnel inspection for portions of the inspection. This may include general observation of inspection activities or it may include participation in actual portions of the inspection to get a better understanding of how the inspectors are completing and documenting the inspection process.

For functional system testing that is done on a more frequent basis than the routine inspection, MoDOT may request copies of the inspection procedures for general review and may ask to be present as part of one of these tests to observe the test being completed and the documentation that is completed as part of that testing.

The Supervising Bridge Inspection Engineer will primarily be responsible for completion of the field activities for the QC/QA process. After completion of any field activities, a summary of the observations and findings, including dates and inspection personnel, shall be provided to the Program Manager in an email that can be included in the file that MoDOT maintains for the tunnel. This information and findings should be provided to the Project Manager at the airport and the Team Leader for the tunnel inspection, as needed.

As part of the QC/QA process, MoDOT will review draft copies of the routine inspection reports for compliance with tunnel inspection requirements. Any issues or concerns with the draft copies of the reports will be provided to the Project Manager so that they can be addressed in the final copy of the inspection report.