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Title 23 –Highways

Chapter I –Federal Highway Administration, Department of Transportation

Subchapter G –Engineering and Traffic Operations

Part 650 –Bridges, Structures, and Hydraulics

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Subpart E National Tunnel Inspection Standards

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Subpart E–National Tunnel Inspection Standards

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§ 650.501 Purpose.

This subpart sets the national minimum standards for the proper safety inspection and evaluation of all highway tunnels in accordance with 23 U.S.C. 144(h) and the requirements for preparing and maintaining an inventory in accordance with 23 U.S.C. 144(b).

§ 650.503 Applicability.

The National Tunnel Inspection Standards (NTIS) in this subpart apply to all structures defined as highway tunnels on all public roads, on and off Federal-aid highways, including tribally and federally owned tunnels.

§ 650.505 Definitions.

The following terms used in this subpart are defined as follows:

American Association of State Highway and Transportation Officials (AASHTO) Manual for Bridge Evaluation.

The term “AASHTO Manual for Bridge Evaluation” means the “Manual for Bridge Evaluation”, incorporated by reference in § 650.517.

At-grade roadway. The term “at-grade roadway” means paved or unpaved travel ways within the tunnel that carry vehicular traffic and are not suspended or supported by a structural system.

Bridge inspection experience. The term “bridge inspection experience” has the same meaning as in § 650.305.

Complex tunnel. The term “complex tunnel” means a tunnel characterized by advanced or unique structural elements or functional systems.

Comprehensive tunnel inspection training. The term “comprehensive tunnel inspection training” means the FHWA-approved training that covers all aspects of tunnel inspection and enables inspectors to relate conditions observed in a tunnel to established criteria.

Critical finding. The term “critical finding” has the same meaning as in § 650.305.

Damage inspection. The term “damage inspection” has the same meaning as in § 650.305.

End-of-course assessment. The term “end-of-course assessment” means a comprehensive examination given to students after the completion of a training course.

Federal-aid highway. The term “Federal-aid highway” has the same meaning as in 23 U.S.C. 101(a)(5).

Functional systems. The term “functional systems” means non-structural systems, such as electrical, mechanical, fire suppression, ventilation, lighting, communications, monitoring, drainage, traffic signals, emergency response (including egress, refuge room spacing, or carbon monoxide detection), or traffic safety components.

Hands-on inspection. The term “hands-on inspection” has the same meaning as in § 650.305.

Highway. The term “highway” has the same meaning as in 23 U.S.C. 101(a)(11).

In-depth inspection. The term “in-depth inspection” means a close-up inspection of one, several, or all tunnel structural elements or functional systems to identify any deficiencies not readily detectable using routine inspection procedures. In-depth inspections may occur more or less frequently than routine inspections, as outlined in the tunnel-specific inspection procedures.

Initial inspection. The term “initial inspection” means the first inspection of a tunnel to provide all inventory, appraisal, and other data necessary to determine the baseline condition of the structural elements and functional systems.

Inspection Date. The term “Inspection Date” means the date established by the Program Manager on which a regularly scheduled routine inspection begins for a tunnel.

Legal load. The terms “legal load” means the maximum legal load for each vehicle configuration permitted by law for the State in which the tunnel is located.

Load rating. The term “load rating” means the determination of the safe vehicular live load carrying capacity within or above the tunnel using structural plans, and information gathered from an inspection. The results of the load rating may include the need for load posting.

Operating rating. The term “operating rating” has the same meaning as in § 650.305.

Portal. The term “portal” means the entrance and exit of the tunnel exposed to the environment; portals may include bare rock, constructed tunnel entrance structures, or buildings.

Procedures. The term "procedures" means the written documentation of policies, methods, considerations, criteria, and other conditions that direct the actions of personnel so that a desired end result is achieved consistently.

Professional Engineer (P.E.). The term "Professional Engineer (P.E.);" means an individual who has fulfilled education and experience requirements and passed examinations that, under State licensure laws, permits the individual to offer engineering services within areas of expertise directly to the public.

Program Manager. The term "Program Manager" means the individual in charge of the inspection program who has been assigned or delegated the duties and responsibilities for tunnel inspection, reporting, and inventory. The Program Manager provides overall leadership and guidance to inspection Team Leaders and load raters.

Public road. The term "public road" has the same meaning as in 23 U.S.C. 101(a)(21).

Quality assurance (QA). The term "quality assurance (QA)" means the use of sampling and other measures to ensure the adequacy of quality control procedures in order to verify or measure the quality of the entire tunnel inspection and load rating program.

Quality control (QC). The term "quality control (QC)" means the procedures that are intended to maintain the quality of a tunnel inspection and load rating at or above a specified level.

Routine inspection. The term "routine inspection" means 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.

Routine permit load. The term "routine permit load" means a vehicular load that has a gross weight, axle weight, or distance between axles not conforming with State laws for legally configured vehicles, and is authorized for unlimited trips over an extended period of time to move alongside other heavy vehicles on a regular basis.

Special inspection. The term "special inspection" means an inspection, scheduled at the discretion of the tunnel owner, used to monitor a particular known or suspected deficiency.

State transportation department (State DOT). The term "State transportation department (State DOT)" has the same meaning as in 23 U.S.C. 101(a)(28).

Team Leader. The term "Team Leader" means the on-site individual in charge of an inspection team responsible for planning, preparing, performing, and reporting on tunnel inspections.

Tunnel. The term "tunnel" means 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 that may include lighting, ventilation, fire protection systems, and emergency egress capacity. The terms "tunnel" does not include bridges or culverts inspected under the National Bridge Inspection Standards (subpart C of this part).

Tunnel inspection experience. The term "tunnel inspection experience" means active participation in the performance of tunnel inspections in accordance with the National Tunnel Inspection Standards, in either a field inspection, supervisory, or management role.

Tunnel inspection refresher training. The term "tunnel inspection refresher training" means an FHWA-approved training course that aims to improve the quality of tunnel inspections, introduce new techniques, and maintain the consistency of the tunnel inspection program.

Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual. The term "Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual" means the "Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual" (incorporated by reference, see § 650.517).

Tunnel-specific inspection procedures. The term "tunnel-specific inspection procedures" means the written documentation of the directions necessary to plan for, and conduct an inspection. Directions include coverage of inspection methods, frequency of each method, inspection equipment, access equipment, identification of tunnel elements, components and functional systems, traffic coordination, and specialized qualifications for inspecting personnel.

§ 650.507 Tunnel inspection organization responsibilities.

- (a) Each State DOT shall inspect, or cause to be inspected, all highway tunnels located on public roads, on and off Federal-aid highways, that are fully or partially located within the State's boundaries, except for tunnels that are owned by Federal agencies or tribal governments.
- (b) Each Federal agency shall inspect, or cause to be inspected, all highway tunnels located on public roads, on and off Federal-aid highways, that are fully or partially located within the respective agency's responsibility or jurisdiction.
- (c) Each tribal government shall inspect, or cause to be inspected, all highway tunnels located on public roads, on and off Federal-aid highways, that are fully or partially located within the respective tribal government's responsibility or jurisdiction.
- (d) Where a tunnel is jointly owned, all bordering States, Federal agencies, and tribal governments with ownership interests should determine through a joint formal written agreement the inspection responsibilities of each State, Federal agency, and tribal government.
- (e) Each State that contains one or more tunnels subject to these regulations, or Federal agency or tribal government with a tunnel under its jurisdiction, shall include a tunnel inspection organization that is responsible for all of the following:
 - (1) Statewide, Federal agency-wide, or tribal government-wide tunnel inspection policies and procedures (both general and tunnel-specific), quality control and quality assurance procedures, and preparation and maintenance of a tunnel inventory.
 - (2) Tunnel inspections, written reports, load ratings, management of critical findings, and other requirements of these standards.
 - (3) Maintaining a registry of nationally certified tunnel inspectors that work in their State or for their Federal agency or tribal government that includes, at a minimum, a method to positively identify each inspector, documentation that the inspector's training requirements are up-to-date, the inspector's current contact information, and detailed information about any adverse action that may affect the good standing of the inspector.

- (4) A process, developed under the direction of a Professional Engineer and approved by FHWA, to determine when an inspection Team Leader's qualifications must meet § 650.509(b)(4) in order to adequately and appropriately lead an inspection of a complex tunnel or a tunnel with distinctive features or functions. At a minimum, the process shall consider a tunnel's type of construction, functional systems, history of performance, and physical and operational conditions.
- (f) A State DOT, Federal agency, or tribal government may delegate functions identified in paragraphs (e)(1), (2), and (3) of this section through a formal written agreement, but such delegation does not relieve the State DOT, Federal agency, or tribal government of any of its responsibilities under this subpart.
- (g) The State DOT, Federal agency, or tribal government tunnel inspection organization shall have a Program Manager with the qualifications listed in § 650.509(a), who has been delegated responsibility for paragraphs (e)(1), (2), and (3) of this section.

§ 650.509 Qualifications of personnel.

- (a) A Program Manager shall, at a minimum:
 - (1) Be a registered Professional Engineer, or have 10 years of tunnel or bridge inspection experience;
 - (2) Be a nationally certified tunnel inspector;
 - (3) Satisfy the requirements of paragraphs (a)(1) and (2) of this section by August 13, 2017; and
 - (4) Be able to determine when a Team Leader's qualifications must meet the requirements of paragraph (b)(1)(i) of this section in accordance with the FHWA approved process developed in accordance with § 650.507(e)(4).
- (b) A Team Leader shall, at a minimum:
 - (1) Meet at least one of the four qualifications listed in paragraphs (b)(1)(i) through (iv) of this section:
 - (i) Be a registered professional engineer and have six months of tunnel or bridge inspection experience.
 - (ii) Have 5 years of tunnel or bridge inspection experience.
 - (iii) Have all of the following:
 - (A) A bachelor's degree in engineering or engineering technology from a college or university accredited or determined as substantially equivalent by the Accreditation Board for Engineering and Technology.
 - (B) Successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination.
 - (C) Two (2) years of tunnel or bridge inspection experience.
 - (iv) Have all of the following:
 - (A) An associate's degree in engineering or engineering technology from a college or university accredited or determined as substantially equivalent by the Accreditation Board for Engineering and Technology.
 - (B) Four years of tunnel or bridge inspection experience.
 - (2) Be a nationally certified tunnel inspector.

- (3) Provide documentation supporting the satisfaction of paragraphs (b)(1) and (2) of this section to the Program Manager of each State DOT, Federal agency, or tribal government for which they are performing tunnel inspections.
- (4) Be a registered Professional Engineer and have six months of tunnel or bridge inspection experience if the Program Manager determines through the approved process developed under § 650.507(e)(4) that the tunnel being inspected is complex or has distinctive features or functions that warrant this level of qualifications.
- (c) Load ratings shall be performed by, or under the direct supervision of, a registered Professional Engineer.
- (d) Each State DOT, Federal agency, and tribal government shall determine inspection personnel qualifications for damage, cursory, and special inspections.
- (e) A nationally certified tunnel inspector shall:
 - (1) Complete an FHWA-approved comprehensive tunnel inspection training course and score 70 percent or greater on an end-of-course assessment;
 - (2) Complete a cumulative total of 18 hours of FHWA-approved tunnel inspection refresher training over each 60 month period; and
 - (3) Maintain documentation supporting the satisfaction of paragraphs (e)(1) and (2) of this section, and, upon request, provide documentation of their training status and current contact information to the Tunnel Inspection Organization of each State DOT, Federal agency, or tribal government for which they will be performing tunnel inspections.
- (f) Acceptable tunnel inspection training includes the following:
 - (1) **National Highway Institute training.** NHI courses on comprehensive tunnel inspection training.
 - (2) **FHWA approval of alternate training.** A State DOT, Federal agency, or tribal government may submit to FHWA a training course as an alternative to the NHI course. The FHWA shall approve alternative course materials and end-of-course assessments for national consistency and certification purposes. The Program Manager shall review the approved alternative training course every 5 years to ensure the material is current. Updates to approved course materials and end-of-course assessments shall be resubmitted to FHWA for approval.
- (g) In evaluating the tunnel inspection experience requirements under paragraphs (a) and (b) of this section, a combination of tunnel design, tunnel maintenance, tunnel construction, and tunnel inspection experience, with the predominant amount in tunnel inspection, is acceptable. Also, the following criteria should be considered:
 - (1) The relevance of the individual's actual experience, including the extent to which the experience has enabled the individual to develop the skills needed to properly lead a tunnel safety inspection.
 - (2) The individual's exposure to the problems or deficiencies common in the types of tunnels being inspected by the individual.
 - (3) The individual's understanding of the specific data collection needs and requirements.

§ 650.511 Inspection interval.

- (a) **Initial inspection.** A State DOT, Federal agency, or tribal government tunnel inspection organization shall conduct, or cause to be conducted, an initial inspection for each tunnel described in § 650.503 as follows:

- (1) For existing tunnels, conduct a routine inspection of each tunnel according to the inspection guidance provided in the Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual (incorporated by reference, see § 650.517) by August 13, 2017.
 - (2) For tunnels completed after these regulations take effect, the initial routine inspection shall be conducted after all construction is completed and prior to opening to traffic, according to the inspection guidance provided in the Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual (incorporated by reference, see § 650.517).
- (b) **Routine inspections.** A State DOT, Federal agency, or tribal government tunnel inspection organization shall conduct, or cause to be conducted, routine inspections for each tunnel described in § 650.503 as follows:
- (1) Establish for each tunnel the NTIS routine Inspection Date in a month and year (MM/DD/YYYY) format. This date should only be modified by the Program Manager in rare circumstances.
 - (2) Inspect each tunnel at regular 24-month intervals.
 - (3) For tunnels needing inspection more frequently than 24-month intervals, establish criteria to determine the level and frequency to which these tunnels are inspected, based on a risk analysis approach that considers such factors as tunnel age, traffic characteristics, geotechnical conditions, and known deficiencies.
 - (4) Certain tunnels may be inspected at regular intervals up to 48 months. Inspecting a tunnel at an increased interval may be appropriate when past inspection findings and analysis justifies the increased inspection interval. At a minimum, the following criteria shall be used to determine the level and frequency of inspection based on an assessed lower risk: Tunnel age, time from last major rehabilitation, tunnel complexity, traffic characteristics, geotechnical conditions, functional systems, and known deficiencies. A written request that justifies a regular routine inspection interval between 24 and 48 months shall be submitted to FHWA for review and comment prior to the extended interval being implemented.
 - (5) Inspect each tunnel in accordance with the established interval. The acceptable tolerance for inspection interval is within 2 months before or after the Inspection Date established in paragraph (b)(1) of this section in order to maintain that date. The actual month, day, and year of the inspection are to be reported in the National Tunnel Inventory.
- (c) **Damage, in-depth, and special inspections.** The Program Manager shall establish criteria to determine the level and frequency of damage, in-depth, and special inspections. Damage, in-depth, and special inspections may use non-destructive testing or other methods not used during routine inspections at an interval established by the Program Manager. In-depth inspections should be scheduled for complex tunnels and for certain structural elements and functional systems when necessary to fully ascertain the condition of the element or system; hands-on inspection may be necessary at some locations.

§ 650.513 Inspection procedures.

Each State DOT, Federal agency, or tribal government tunnel inspection organization, to carry out its inspection responsibilities, shall perform or cause to be performed all of the following:

- (a) Inspect tunnel structural elements and functional systems in accordance with the inspection guidance provided in the Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual (incorporated by reference, see § 650.517).

- (b) Provide at least one Team Leader, who meets the minimum qualifications stated in § 650.509, at the tunnel at all times during each initial, routine, and in-depth inspection. The State DOT, Federal agency, or tribal government shall report the nationally certified tunnel inspector identification for each Team Leader that is wholly or partly responsible for a tunnel inspection must be reported to the National Tunnel Inventory.
- (c) Prepare and document tunnel-specific inspection procedures for each tunnel inspected and inventoried that shall:
 - (1) Take into account the design assumptions and the tunnel complexity; and
 - (2) Identify the—
 - (i) Tunnel structural elements and functional systems to be inspected;
 - (ii) Methods of inspection to be used;
 - (iii) Frequency of inspection for each method; and
 - (iv) Inspection equipment, access equipment, and traffic coordination needed.
- (d) Establish requirements for functional system testing, direct observation of critical system checks, and testing documentation.
- (e) For complex tunnels, identify specialized inspection procedures and additional inspector training and experience required to inspect complex tunnels. Inspect complex tunnels according to the specialized inspection procedures.
- (f) Conduct tunnel inspections with qualified staff not associated with the operation or maintenance of the tunnel structure or functional systems.
- (g) Rate each tunnel's safe vehicular load-carrying capacity in accordance with the Sections 6 or 8, AASHTO Manual for Bridge Evaluation (incorporated by reference, see § 650.517). A State DOT, Federal agency, or tribal government shall conduct a load rating evaluation as soon as practical, but not later than three months after the completion of the inspection, if a change in condition is identified. Post or restrict the highways in or over the tunnel in accordance with Section 6, AASHTO Manual for Bridge Evaluation (incorporated by reference, see § 650.517), or in accordance with State law, when the maximum unrestricted legal loads or State routine permit loads exceed those allowed under the operating rating or equivalent rating factor. Postings shall be made as soon as possible but not later than 30 days after a valid load rating determines a need for such posting. At-grade roadways in tunnels are exempt from load rating. A State DOT, Federal agency, or tribal government, shall maintain load rating calculations or input files with a summary of results as a part of the tunnel record.
- (h) Prepare tunnel inspection documentation as described in the Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual (incorporated by reference, see § 650.517), and maintain written reports or electronic files on the results of tunnel inspections, together with notations of any action taken to address the findings of such inspections. Maintain relevant maintenance and inspection data to allow assessment of current tunnel condition. At a minimum, information collected will include data regarding basic tunnel information (e.g., tunnel location, posted speed, inspection reports, repair recommendations, and repair and rehabilitation work completed), tunnel and roadway geometrics, interior tunnel structural features, portal structure features, and tunnel systems information. When available, tunnel data collected

shall include diagrams, photos, condition of each structural and functional system component, notations of any action taken to address the findings of such inspections, and the national tunnel inspector certification registry identification for each Team Leader responsible in whole or in part for the inspection.

- (i) Use systematic quality control and quality assurance procedures to maintain a high degree of accuracy and consistency in the inspection program. Include periodic field review of inspection teams, data quality checks, and independent review of inspection reports and computations.
- (j) Establish a Statewide, Federal agency-wide, or tribal government-wide procedure to ensure that critical findings are addressed in a timely manner. Notify FHWA within 24 hours of any critical finding and the activities taken, underway, or planned to resolve or monitor the critical finding. Update FHWA regularly or as requested on the status of each critical finding until it is resolved. Annually provide a written report to FHWA with a summary of the current status of the resolutions for each critical finding identified within that year or unresolved from a previous year.
- (k) Provide information at least annually, or more frequently upon request, in cooperation with any FHWA review of State DOT, Federal agency, or tribal government compliance with the NTIS. The FHWA will assess annually State DOT compliance using statistical assessments and well-defined measures based on the requirements of this subpart.

§ 650.515 Inventory.

- (a) **Preliminary inventory.** Each State, Federal agency, or tribal government shall collect and submit the inventory data items described in the Specifications for the National Tunnel Inventory (incorporated by reference, see § 650.517) for all tunnels subject to the NTIS by December 11, 2015.
- (b) **National Tunnel Inventory.** Each State, Federal agency, or tribal government shall prepare, maintain, and make available to FHWA upon request, an inventory of all highway tunnels subject to the NTIS that includes the preliminary inventory information submitted in paragraph (a) of this section, reflects the findings of the most recent tunnel inspection conducted, and is consistent and coordinated with the Specifications for the National Tunnel Inventory.
- (c) **Data entry for inspections.** For all inspections, each State DOT, Federal agency, or tribal government shall enter the appropriate tunnel inspection data into its inventory within 3 months after the completion of the inspection.
- (d) **Data entry for tunnel modifications and new tunnels.** For modifications to existing tunnels that alter previously recorded data and new tunnels, each State DOT, Federal agency, or tribal government shall enter the appropriate data into its inventory within 3 months after the completion of the work.
- (e) **Data entry for tunnel load restriction and closure changes.** For changes in traffic load restriction or closure status, each State DOT, Federal agency, or tribal government shall enter the data into its inventory within 3 months after the change in status of the tunnel.

§ 650.517 Incorporation by reference.

- (a) Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the FHWA must publish notice of change in the FEDERAL REGISTER and the material must be available to the public. All approved material is available for inspection at 1200 New Jersey Avenue SE., Washington, DC 20590. For questions regarding the availability of this material at FHWA, call the FHWA Regulations Officer, Office of the Chief Counsel, HCC-10, 202-366-0761. This material is also available

for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030 or go to http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.

- (b) American Association of State Highway and Transportation Officials (AASHTO), Suite 249, 444 N. Capitol Street NW., Washington, DC 20001, 800-231-3475, <https://bookstore.transportation.org>.
 - (1) “The Manual of Bridge Evaluation,” Section 6 “Load Rating” and Section 8 “Nondestructive Load Testing,” Second Edition, 2011, copyright 2011, incorporation by reference approved for §§ 650.505 and 650.513(a).
 - (2) 2011 Interim Revisions to “The Manual of Bridge Evaluation,” Section 6 “Load Rating,” Second Edition, 2010, copyright 2011, incorporation by reference approved for §§ 650.505 and 650.513(a).
 - (3) 2013 Interim Revisions to “The Manual of Bridge Evaluation,” Section 6 “Load Rating,” Second Edition, 2010, copyright 2013, incorporation by reference approved for §§ 650.505 and 650.513(a).
 - (4) 2014 Interim Revisions to “The Manual of Bridge Evaluation,” Section 6 “Load Rating,” Second Edition, 2010, copyright 2013, incorporation by reference approved for §§ 650.505 and 650.513(a).
 - (5) 2015 Interim Revisions to “The Manual of Bridge Evaluation,” Section 6 “Load Rating,” Second Edition, 2010, copyright 2014, incorporation by reference approved for §§ 650.505 and 650.513(a).
- (c) Office of Bridges and Structures, Federal Highway Administration, U.S. Department of Transportation, 1200 New Jersey Avenue SE., Washington, DC 20590.
 - (1) FHWA-HIF-15-005, “Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual,” 2015 edition, available in electronic format at <http://www.fhwa.dot.gov/bridge/inspection/tunnel/>. Incorporation by reference approved for §§ 650.505, 650.511(a), and 650.513(a) and (h).
 - (2) FHWA-HIF-15-006, “Specifications for National Tunnel Inventory,” 2015 edition, available in electronic format at <http://www.fhwa.dot.gov/bridge/inspection/tunnel/>. Incorporation by reference approved for § 650.515(a) and (b).