



# Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

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## **NBI Subscription Service Announcement 20201221**

### **Illinois Department of Transportation (IDOT) *Structural Services Manual* Section 5 – Tunnel Inspection**

The purpose of this NBI Subscription Service Announcement is to provide information to Illinois Certified National Tunnel Inspection Standards (NTIS) Program Managers, Team Leaders and others involved in the tunnel inspection program of an effort to improve the State of Illinois compliance with the National Tunnel Inspection Program (NTIP).

#### **Issue: Inadequate Documentation of IDOT Tunnel Inspection Policy**

#### **History/Purpose**

In 2019, the Federal Highway Administration (FHWA) implemented a data-driven, risk-based approach to oversight of the National Tunnel Inspection Program (NTIP) and monitoring State compliance with the National Tunnel Inspection Standards (NTIS).

Under this approach, the FHWA assesses 15 compliance metrics, each having direct reference to the NTIS. Metric 1 assesses the Tunnel Inspection Organization and includes IDOT's overall tunnel inspection organization; IDOT's documented roles, policies, and procedures for tunnel inspection; and Illinois certification of tunnel inspectors. The FHWA measures a State's compliance for each metric and assigns it to one of three performance categories: Compliant, Substantially Compliant, and Non-Compliant.

The FHWA determined IDOT to be Substantially Compliant for the NTIP Metric 1 in 2019. The FHWA-approved Improvement Plan, developed by the IDOT District 1 Bureau of Operations and the Central Bureau of Bridges & Structures (BB&S), included an Action Item to properly document IDOT's Tunnel Inspection Policy and to incorporate into the IDOT *Structural Services Manual*.

Due to a complete overhaul of Section 3 and revisions to the National Bridge Inspection Standards (NBIS) expected to be released in 2021, an updated IDOT *Structural Services Manual* is not being published at this time. This release of Section 5 – Tunnel Inspection, supersedes the 2017 IDOT *Structural Services Manual* Section 5 and serves as IDOT's Official Tunnel Inspection Policy.

Questions regarding this NBI Subscription Service Announcement are to be directed to the Bridge Management and Inspection Unit by telephone at 217/785-4537 or by email at [DOT.BBS.BridgeMgmt@illinois.gov](mailto:DOT.BBS.BridgeMgmt@illinois.gov).

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# Section 5 Tunnel Inspection

## 5.1 General

The highway bill Moving Ahead for Progress in the 21st Century Act (MAP-21) required the Federal Highway Administration (FHWA) to establish national standards for tunnel inspections. The National Tunnel Inspection Standards (NTIS) (23 CFR 650 Subpart E – National Tunnel Inspection Standards) contains the regulatory requirements for the tunnel inventory and inspection program. The NTIS can be obtained from the Federal Registrar using the link below:

<https://www.govinfo.gov/content/pkg/CFR-2019-title23-vol1/xml/CFR-2019-title23-vol1-part650.xml>

### 5.1.1 Purpose and Scope

A tunnel is defined as: “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, ventilations, fire protection systems, and emergency egress capacity. The term “tunnel” does not include bridges or culverts inspected under the National Bridge Inspection Standards (23 CFR 650 Subpart C – National Bridge Inspection Standards).”

### 5.1.2 National Tunnel Inspection Standards

The FHWA administers the NTIS under the guidelines outlined in the FHWA *Specifications for the National Tunnel Inventory* (SNTI) and the FHWA *Tunnel Operations, Maintenance, Inspection and Evaluation Manual* (TOMIE). The inventory and inspection information collected, as required by the NTIS, is reported to the FHWA and recorded in the National Tunnel Inventory (NTI).

The SNTI contains information on conducting inspections and for submitting the inventory and inspection data to the FHWA. The TOMIE provides uniform and consistent guidance on the operation, maintenance, inspection and evaluation of tunnels.

The NTIS, SNTI, TOMIE, and NTI were developed to ensure that tunnels continue to provide safe, reliable, and efficient levels of service for the traveling public.

To maintain full compliance with the NTIS, the Illinois Department of Transportation (IDOT) must adhere to all policies, procedures, and regulations established by the FHWA. The District One Bridge Maintenance Engineer will act as the State Program Manager overseeing the NTIS Program for all tunnels in the state regardless of the jurisdiction the tunnel is located in.

This section of the IDOT *Structural Services Manual* provides documentation of the official tunnel inspection policies for the State of Illinois.

The primary purpose of this section is to provide information pertaining to tunnel inventory and inspection activities. The information provided in this section summarizes IDOT inspection policies and guidelines for the effective and efficient management of the tunnel inspection program. The information provided regarding inspection types and frequencies is also applicable to structures under the jurisdiction of agencies other than IDOT, where the oversight for inspections is the responsibility of the agency having jurisdiction.

The primary function of the tunnel inspections performed in accordance with the NTIS is to ensure that tunnels serving roadways in Illinois remain safe for all users of the highway system. The results of the inspections are also used as a tool to assist in determining maintenance and improvement needs.

### **5.1.3 Illinois Tunnel Inspection Organization**

Illinois complies with the NTIS program requirements for inspection and inventory data through the following responsible positions.

State Program Manager: The IDOT District One Bridge Maintenance Engineer shall provide statewide oversight for all NTIS related activities. The State Program Manager is responsible for inspection policy and to ensure the quality of the NTIS program.

Agency Program Manager: All local public agencies with jurisdiction of a tunnel in the National Tunnel Inventory (NTI) must designate a Program Manager to ensure compliance with the NTIS and provide guidance and management of their tunnel inventory. Local

public agencies may designate in-house staff or a consultant who is an approved Program Manager. The consultant and agency should discuss and clarify the program manager duties such as submitting inspection reports to IDOT, maintaining official tunnel files, responding to IDOT requests for additional NTIS information, and other NTIS related activities.

The local public agency should complete IDOT Form BBS LAPMD, “Local Agency Program Manager Designation” to designate their Program Manager.

#### ***5.1.4 Illinois Structure Information System***

The Illinois Structure Information System (ISIS) is the official database containing all Illinois bridge and tunnel inventory and inspection information. The data stored in ISIS for each tunnel includes an inventory record, current and previous inspection records, and information related to construction, reconstruction, highway routes, microfilm, and design.

#### ***5.1.5 Structure Information Management System***

The Structure Information Management System (SIMS) provides IDOT personnel with access to information contained in ISIS. SIMS provides those involved in managing tunnel inspection programs with a means to easily and quickly access NTIS information and run data queries for individual structures.

For tunnels under the maintenance jurisdiction of local public agencies, the SIMS-County database file of local structures for each county may be obtained from IDOT’s website.

#### ***5.1.6 Bridge Inspection System***

The Bridge Inspection System (BIS) is utilized by tunnel inspectors to record the results of the tunnel inspections into the following databases:

- Illinois Structure Information System, which contains data from the following NTIS related inspections:
  - Routine Tunnel Inspections
  - Special Inspections

Using BIS, inspection personnel can download the most recent inspection information onto a laptop computer prior to an upcoming field inspection. The inspector can then utilize the laptop computer during the next field inspection and can input new inspection data during the inspection or at any time prior to returning to the office, subsequent to the field inspection. After returning to the office, the inspector can utilize BIS to directly upload the recently obtained inspection information for eventual inclusion into ISIS, after approval by supervisory personnel.

## **5.2 Tunnel Inventory**

### **5.2.1 Reporting Inventory Information**

Each tunnel involved with a public road, must be included in the tunnel inventory. In accordance with NTIS, tunnels carrying a public roadway must be inspected and reported to FHWA. Directions for recording tunnel inventory information is provided in the FHWA *Specifications for the National Tunnel Inventory* (SNTI).

<https://www.fhwa.dot.gov/bridge/inspection/tunnel/snti/hif15006.pdf>

Tunnel inventory information, or changes to the tunnel that affect the inventory, must be recorded in ISIS, within 90 days of opening to traffic or within 90 days of completion of inspection, completion of rehabilitation/repair work, or a change in status of the tunnel. In general, the inventory data is entered by Region/District personnel.

Data entry for some items, such as load rating, is the responsibility of the Bureau of Bridges & Structures.

For tunnels not directly under IDOT jurisdiction, IDOT policy requires that the Illinois Structure Information System must also be updated within 90 days of the inventory change taking effect.

The agency with jurisdiction of the public roadway which is enclosed by the tunnel is responsible for submitting the revised inventory information to IDOT.

### ***5.2.2 Updating Inventory Information***

A general review of inventory items should be a part of each Routine Inspection, with any needed corrections promptly reported to appropriate personnel, so that the tunnel data in ISIS can be kept as accurate as possible. This general review of inventory information during the Routine Inspection does not necessarily require the inspector to take physical measurements but should include an effort to identify obvious errors in existing inventory information. The Statewide Program Manager will review the Federal Submittal for all tunnels in advance of the submittal.

### ***5.2.3 The National Tunnel Inventory***

ISIS data is submitted to FHWA annually. The data becomes part of the National Tunnel Inventory (NTI) which is defined by FHWA as:

National Tunnel Inventory: The NTI is a collection of information (database) covering over 500 of the Nation's tunnels located along public roads, including Interstate Highways, U.S. highways, State, County or Local roads. It presents a State by State summary analysis of the number, location, and general condition of highway tunnels within each State.

## **5.3 Tunnel Inspections**

### ***5.3.1 General***

There are various types of tunnel inspections derived directly from the NTIS and other FHWA referenced publications and technical documents as follows:

Initial Inspection: The first inspection of a new tunnel or a tunnel that has undergone rehabilitation to provide all Structure Inventory and Appraisal (SI&A) data and other relevant data and to determine baseline tunnel conditions.

Routine Inspection: A regularly scheduled inspection consisting of observations and/or 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 the structure continues to satisfy present service requirements.



Special Inspection: An inspection scheduled at the discretion of the Program Manager or Bureau of Bridges & Structures, used to monitor a particular known or suspected deficiency, typically at a more frequent interval than the routine inspection allows.

Damage Inspection: An unscheduled inspection performed to assess structural damage resulting from environmental factors or human actions.

Complex Inspection: When a tunnel is complex, the Statewide Tunnel Program Manager shall determine whether special procedures, increased training, or additional qualifications and experience are necessary to lead the inspection. In accordance with the NTIS, the type of construction, functional systems, history of performance, and the physical and operating condition of the tunnel should be considered when determining the inspection requirements for complex tunnels.

In-depth Inspection: 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; hand-on inspection may be necessary at some locations. In-depth inspections may occur more or less frequently than routine inspections, as outlined in the tunnel-specific inspection procedures.

Load Rating Inspection: A scheduled inspection performed to investigate damage or deterioration in order to evaluate potential reductions in the live load carrying capacity. The load rating analysis must be performed by a qualified professional engineer. Tunnels must also be posted or restricted, as appropriate, after conducting the load rating in accordance with the NTIS.

These various inspections are performed at intervals controlled by such things as structural condition, structure type and details, site conditions, and load capacity evaluation. IDOT policy requires that SI&A data must be entered into ISIS within 90 days of inspection for all tunnels regardless of jurisdiction.

NTIS related inspections must be coordinated and performed by qualified personnel as stated in the NTIS requirements. The individuals with overall responsibility for controlling the quality of the NTIS inspection program in a specific area, designated as Program Managers, and the individuals leading field inspection teams, designated as Team Leaders, must meet the qualifications

specified in Section 5.6.2. An approved Team Leader must be present during Initial, Routine, In-Depth, Damage, Load Rating, and Complex Tunnel Inspections.

NTIS requires that all Routine Inspections, Special Inspections, In-Depth Inspections, and Complex Tunnel Inspections be performed within the inspection interval specified in Section 5.4. Program Managers must ensure that their NTIS inspections do not become delinquent.

Inspection procedures vary greatly depending on the characteristics of the tunnel, the inspection type, and the extent of deterioration. Detailed inspection procedures including guidance for taking and recording field measurements are provided in FHWA *Tunnel Operations, Maintenance, Inspection and Evaluation Manual* (TOMIE), AASHTO *The Manual for Bridge Evaluation*, and in this manual inspection procedures are provided for commonly encountered tunnel types and elements.

When taken as a whole, the element level data collected during the tunnel inspection will provide information on the overall safety and reliability of the structural, civil, and functional systems. The structural elements contained in the NTI database include tunnel liners, roof girders, columns and piles, cross passageways, interior walls, portals, ceiling slabs, ceiling girders, hangers and anchorages, ceiling panels, invert slabs, slabs on grade, invert girders, joints, and gaskets. The civil elements included in the NTI database are roadway wearing surfaces, traffic barriers, and pedestrian railings. The functional systems contained in the NTI database include the mechanical, electrical and lighting, fire and life safety, security, systems, sign, and protective systems.

If possible, tunnels should be observed during the passage of heavy vehicular loads to assess the presence of excessive vibration, deflection, or noise. If detected, further investigations should be made to determine their cause. Complex tunnels require specific inspection procedures that are documented in an inspection plan for each Complex Tunnel as specified in Section 5.3.7.

#### 5.3.1.1 Inspection Forms

The applicable IDOT forms must be used to document each inspection. The latest IDOT inspection forms, available on the date of the inspection, shall be used. If the inspections are entered into BIS by the Team Leader and approved by the Program Manager no hard copy signature will be required. If not entered into BIS by the Team Leaders, the form must be signed.

For situations where the Program Manager and the Team Leader are employed by separate entities, the Program Manager still has ultimate responsibility for the quality of the inspections. The Program Manager may delegate quality control of the Team Leader's work to others but should require documentation of this for quality assurance purposes. This policy is in no way intended to discourage additional QC/QA measures within an inspection program but to clarify ultimate responsibility for that program.

### **5.3.2 Initial Inspection**

An initial inspection should be performed on rehabilitated highway tunnels within 90 days of the completion of all significant repair activities. If the tunnel was closed to complete the rehabilitation, the inspection should be completed prior to reopening the tunnel to traffic. On new tunnels, the initial inspection should be conducted after the completion of construction activities and the testing of functional systems but prior to opening the tunnel to traffic.

At a minimum, the initial inspection should consist of a sufficient number of observations and measurements to determine the physical and functional condition of the tunnel. These inspections are intended to be comprehensive covering the structural, civil, mechanical, electrical and lighting, fire and life safety, security, signs, and protective systems. The results are to be recorded in accordance with the instructions contained in the SNTI.

The initial tunnel inspection establishes the baseline conditions of the tunnel; and it is used to field verify the initial tunnel inventory data. The baseline results can be used to evaluate changes over time to the tunnel systems and to help identify trends. The tunnel owner is responsible for performing the inspection in accordance with NTIS requirements and reporting the information to IDOT, allowing sufficient time for data entry by IDOT. Agencies should coordinate the timing of submittal of inspection data with IDOT.

Documents, including photographs, drawings (design, as-built, and shop), foundation information, pile driving records, and field changes shall be included in the Tunnel File as applicable. See Section 5.6.3.4 for Structure File content requirements.

### 5.3.3 Routine Inspection

Although commonly used to also determine tunnel maintenance and repair needs, the primary focus of the Routine Inspection is public safety.

Following the initial inspection, routine inspections are conducted within the intervals specified in the NTIS. (See Section 5.4) Routine inspections are regularly scheduled inspections that help to ensure continued safe, reliable, and efficient service. These inspections are similar in scope to the initial inspection. Routine tunnel inspections record the changes to the tunnel over time and can be used to help identify trends and predict future life expectancy of components.

Inspectors should understand how defects impact the function and capacity of tunnel systems. Tunnel inspectors should be able to recognize the common deficiencies that impact the structural, civil, and functional systems. The observations and measurements used to carry out the inspection should be comprehensive. For each NTI tunnel element, the SNTI defines the general extent of deficiencies for each of the four condition states: good, fair, poor, and severe.

Inspection procedures are the written documentation of policies, methods, considerations, criteria, directions, and other conditions for planning and conducting tunnel inspections. Written procedures are used to enhance the overall effectiveness of the tunnel inspection program and to formalize the inspection process. Procedures should be developed to ensure that adequate planning and scheduling takes place prior to conducting the inspection. The written inspection procedures should also capture inspections for functional systems as appropriate for the tunnel. Written procedures should describe the requirements for:

- Inspection documentation, forms, and reports
- Record keeping and documentation requirements.
- Planning and scheduling to include unique structural or functional system characteristics.
- Inspection “best practices” and inspection techniques.
- Requirements for functional system testing, direct observation of critical system checks, and testing documentation.
- General, tunnel-specific, and specialized instructions.
- Specialized procedures, training, and experience for complex tunnels.
- Components to disassemble or clean.
- Measurements and survey control.

- Use of current technology and practices.
- Addressing critical findings and reporting to FHWA within 24 hours.
- Maintenance and protection of traffic during the inspection.
- Parking and staging areas during the inspection.
- Contact information for delegated maintenance / inspection responsibility
- Quality assurance and quality control implementation plans

Examples of tunnel specific procedures include identification of:

- Interval of Non-destructive Testing (NDT) or In-Depth inspections
- Tunnel elements, especially for Agency Defined Elements

Examples of specialized inspection procedures:

- Level of effort required to inspect certain unique tunnel components
- Certain details about accessing portions of the tunnel and/or tunnel equipment

At a minimum, routine inspections consist of a sufficient number of observations and measurements that can be used to determine the physical and functional condition of the tunnel. These inspections are intended to be comprehensive covering the structural, civil, mechanical, electrical and lighting, fire and life safety, security, signs, and protective systems. The results are to be recorded in accordance with the instructions contained in the SNTI. The inspection shall accomplish the following functions:

- Verification and updating element ratings assigned to various items pertaining to the physical condition and the functionality of the tunnel.
- Identification and documentation of potential problems that may affect tunnel safety.
- Correction of inaccuracies in the tunnel inventory data. During Routine Inspections, inspectors are encouraged to verify inventory data items.
- Determination of need for the Bureau of Bridges & Structures, or an Illinois Licensed Structural Engineer retained by an agency, to evaluate load carrying capacity or repair needs.
- Documentation of maintenance work that may be required.

IDOT Form BBS-ELI, "Element Level Inspection Report" contains "Comments" fields for all elements inspected during the Tunnel Inspection. A concise description of deficiencies are required to be included in the comment fields for elements with a Condition State of 3 or 4, and encouraged for Condition States 1 or 2. The BBS-ELI for each Routine Inspection is kept in the official Tunnel File at the headquarters of the District or the Agency responsible for inspection. If entered directly into BIS, no hard copy of the inspection is required.

If a tunnel includes any members which meet the definition of "Fracture Critical Member" as stated in Section 3.3.5, that member shall receive a hands-on inspection during each routine inspection. Routine Inspection interval shall not exceed 24 months for any tunnel with Fracture Critical Members. The inspection of those members shall be documented in the inspection plan for the tunnel, similar to the Fracture Critical Member Inspection plan for bridges as shown in Appendix A-5.

Tunnels with any significant quantity of structural elements (i.e. tunnel liners, roof girders, columns and piles, cross passageways, interior walls, portals, ceiling slabs, ceiling girders, hangers and anchorages, ceiling panels, invert slabs, slabs on grade, invert girders, joints, or gaskets) deemed to be in severe condition, a subsequent Load Rating Inspection as specified in Section 5.3.6 may be required to evaluate load carrying capacity. Such a condition rating is an indication that a main structural member may have deteriorated to a point where its load carrying capacity has been reduced.

After approving any tunnel inspection with any significant quantity of structural elements deemed to be in severe condition, the Program Manager shall advise the Bureau of Bridges & Structures that a Load Rating Inspection will be required. The Bureau of Bridges & Structures will schedule an inspection and perform analysis as needed to determine the revised load carrying capacity of the deteriorated structure.

If an inspection reveals that an imminent danger to the travelling public is likely, the inspector should immediately take necessary action to protect the travelling public prior to notifying the Program Manager responsible for the structure and the Bureau of Bridges & Structures.

When the Bureau of Bridges & Structures cannot provide a Load Rating Inspection for an Agency within 180 days, the responsible Agency will be notified to retain the services of an Illinois Licensed Structural Engineer to evaluate the load carrying capacity of the affected tunnel. If the

inspection findings are deemed urgent and require an immediate load rating, the Bureau of Bridges & Structures will require that the evaluation of the load carrying capacity be expedited. The Structural Engineer's recommendation must be submitted to the Bureau of Bridges & Structures for concurrence and approval.

### **5.3.4 Special Inspections**

A special inspection is typically performed after an initial, routine, damage or in-depth inspection when significant deficiencies have been discovered and need to be monitored. Special inspections are scheduled based on the needs of the tunnel facility, inspection findings, and established written procedures. These types of inspections continue, but perhaps at adjusted intervals or durations, until the deficiency is repaired, the component is removed from service, or further study determines that the conditions are no longer deteriorating at accelerated levels. For example, a light fixture built of dissimilar metals and installed over traffic might have problems with excessive corrosion. As such, this light fixture may be monitored on a regular basis to ensure that it remains securely anchored and safe until repairs can be made.

Special Inspections are performed to monitor a specific structural feature, deficiency or condition that must be monitored more frequently than the Routine Inspection Interval. Special Inspections may be initiated by structural damage or deterioration, conditions affecting the stability of the structure, or for other reasons at the discretion of the responsible District or Agency Program Manager or the Bureau of Bridges & Structures. Some examples of concerns that may be cause for a Special Inspection are damage/deterioration to main load carrying members, existing or structural details with histories of poor performance. Procedures used during these inspections should be adopted in accordance with the specific deficiency or condition to be monitored.

Special Inspections for local public agency or other non-IDOT State Agency tunnels are typically initiated by or after consultation with the Statewide Tunnel Program Manager. Failure to comply with the inspection frequency and/or the established procedure for the required Special Inspection may result in posting, reduced posting, or closure of the tunnel.

#### **5.3.4.1 Recording and Performing Special Inspections**

The frequency of the Special Inspection shall be recorded in ISIS as the "Special Inspection Interval" (ISIS Item 92C). See IDOT *Structure Information and Procedure Manual* (SIP Manual)

“Special Inspection Type” (ISIS Item 92C1) for a list of feature types that can be specified. Note, Special Inspection Type ‘Z’ can be used for any inspection which doesn’t fit into one of the previously establish codes.

The dates when the Special Inspection was initiated and rescinded are recorded in ISIS as the “Special Inspection Determination Date” (ISIS Item 92C6) and the “Special Inspection Close Date” (ISIS Item 92C3) respectively. The Agency that initiated the Special Inspection should be recorded in ISIS as “Special Inspection Initiated By” (ISIS Item 92C4). The Agency responsible for initiating the Special Inspection must determine a time frame for conducting the first Special Inspection by entering the “Special Inspection Inspect By Date” (ISIS Item 92C7). The actual date of the First Special Inspection is recorded as the “Special Inspection Date” (ISIS Item 93C).

In order to record information specific to the “Special Inspection Type” (ISIS Item 92C1) and to provide information relative to the conditions that initiated the need for a Special Inspection, comments should be entered for “Special Inspection Remarks” (ISIS Item 92C5).

The performance of each inspection is recorded by entering the date of the inspection in ISIS for “Special Inspection Date” (ISIS Item 93C) and the results of each inspection are recorded by entering a Condition Type Code in ISIS for “Special Inspection Condition Status” (ISIS Item 93C1). See IDOT *Structure Information and Procedure Manual* (SIP Manual) Item 93C1.

Except when the Special Inspection Condition Status is coded as 2 or 4, the inspector must document the change in condition in ISIS by providing information for “Special Inspection Remarks” (ISIS Item 92C5).

It is imperative that personnel performing Special Inspections compare the conditions noted in the field. The comparison of current conditions to initial conditions determines the proper coding of “Special Inspection Condition Status” (ISIS Item 93C1). When a Special Inspection Condition Status code of 1 or 0 is applicable, the Bureau of Bridges & Structures should be contacted immediately to determine if additional information is required and to discuss measures that must be taken to ensure safety.

The inspection team for the Special Inspection should be established by the Program Manager based on the specific requirements of the Special Inspection. The responsible Program Manager must emphasize to personnel performing the inspections that they are to compare observed



conditions to the conditions that initiated the need for the Special Inspection. In some cases, a qualified Team Leader may not be required, provided the inspection team is fully instructed on what specific observations are needed. Personnel performing Special Inspections must be knowledgeable of the conditions that initiated the need for the inspections. The inspectors must understand, based on their observations, decisions will be made relative to the need for follow-up inspections or the need for traffic restrictions. Whenever possible, consecutive Special Inspections should be performed by the same inspection personnel to ensure sufficient site specific knowledge.

Observations made during Special Inspections are recorded as “Special Inspection Remarks” (ISIS Item 93C4). IDOT Form BBS SI-1, “Special Inspection Report” should be utilized by personnel performing Special Inspections. The form must be accepted by means of the signature of an IDOT approved Program Manager, if approved by the Program Manager in BIS no signature is required. Photographs or other evidence are suggested to validate Special Inspection findings.

### **5.3.5 Damage Inspections**

Damage inspections are performed in response to natural disasters or human activities that damage the tunnel. Damage may occur by motor vehicle impact, fire, flood, earthquake, vandalism or explosions. When severe damage occurs, the tunnel should remain closed until a damage inspection has been completed. Structural analysis and follow-up emergency repairs may be needed. Structural materials may need further evaluation as identified in the Tunnel Operations, Maintenance, Inspection, and Evaluation Manual for (TOMIE).

Safety is of paramount importance after an incident. Devices such as breathing apparatus, protective clothing, and specialized equipment may be necessary. Inspection work should be coordinated with emergency responders. It is important that the tunnel inspection organization develop detailed plans and conduct training exercises with tunnel facility personnel in advance of these events.

Damage Inspections are performed on an emergency basis. The inspection shall be performed by District staff, Agency staff, Bureau of Bridges & Structures staff, or an Illinois Licensed Structural Engineer who is an Illinois certified Team Leader or Program Manager, for tunnels or bridges.

The scope of a Damage Inspection should be enough to determine the need for emergency load restrictions or closure of the tunnel to traffic, and to assess the level of effort necessary to repair the damage. The level of effort required for a Damage Inspection may vary significantly, depending upon the extent of the damage. If major damage has occurred, the inspection team must evaluate the damaged members, determine the extent of section loss, take measurements for misalignment of members, and check for any loss of foundation support. It may be desirable to make on-site calculations to establish emergency load restrictions.

Photos, sketches, and detailed description documenting defects that potentially impact the load carrying capacity of the tunnel should be transmitted from the field immediately to the Bureau of Bridges & Structures.

Any calculations or analysis performed as a result of a Damage Inspection must be sealed by an Illinois Licensed Structural Engineer and submitted to the Bureau of Bridges & Structures for review and concurrence. A Damage Inspection may be supplemented by a timely Load Rating Inspection to document verification of field measurements and calculations. In addition, a more refined analysis may be warranted to establish or adjust interim load restrictions or required follow-up procedures.

#### 5.3.5.1 Damage Inspections for State Maintained Tunnels

Damage Inspections are typically conducted by the Bureau of Bridges & Structures for state owned structures. However, the inspection may be performed by District personnel, at the direction of the Statewide Tunnel Program Manager with guidance from the Bureau of Bridges & Structures, for the measurement and recording of existing conditions. These inspections include measurement of main structural members to obtain detailed documentation of member size, section loss, structural defects, and member deflections/distortions that may be present.

Traffic control and special equipment are often necessary to accomplish these inspections.

The results of these inspections, for state owned structures, are reviewed by the Structural Ratings and Permits Unit in the Bureau of Bridges & Structures, which performs an analysis to determine the load carrying capacity of each inspected structure. After completing the analysis, the Bureau of Bridges & Structures will provide the Region/District with documentation of the inspection and the results of the structural rating. The documentation provided to the Region/District will include field data and photographs, recommended revisions to condition

ratings, updated Inventory and Operating Ratings, and recommendations for load restrictions and/or Special Inspections.

#### 5.3.5.2 Damage Inspections for Local Public Agency Tunnels

For local public agency tunnels, Damage Inspections should be performed by properly trained agency staff, or consultants.

Local public agencies also have the option of employing the services of a qualified Illinois Licensed Structural Engineer to perform Damage Inspections, calculate the load ratings and provide posting recommendations. The Structure Load Rating Summary sheet (Form BBS 2795) shall be included with the Load Rating and submitted to the Bureau of Bridges & Structures for review and approval.

### **5.3.6 Load Rating Inspections**

Load Rating Inspections are performed to confirm and document the variables that affect the safe live load carrying capacity of the tunnel. Load Rating Inspection personnel are not required to have any particular qualifications but must be trained to collect and document the information necessary to conduct a quality load rating analysis.

#### 5.3.6.1 Load Rating Inspections for State Maintained Structures

Load Rating Inspections are typically conducted by the Bureau of Bridges & Structures, Structural Ratings and Permits Unit for state owned structures. The inspections may be performed by District Personnel, at the direction of the Statewide Tunnel Program Manager with guidance from the Bureau of Bridges & Structures, for the measurement and recording of existing conditions. These inspections include measurement of main structural members to obtain detailed documentation of member size, section loss, structural defects, and member deflections/distortions that may be present. Traffic control and special equipment are often necessary to accomplish these inspections.

The results of these inspections are reviewed by the Structural Ratings and Permits Unit in the Bureau of Bridges & Structures, which performs an analysis to determine the load carrying capacity of each inspected structure. After completing the analysis, the Bureau of Bridges & Structures will provide the Region/District with documentation of the inspection and the results of

the structural rating. The documentation provided to the Region/District will include field data and photographs, recommended revisions to element level condition ratings, updated Inventory and Operating Ratings, and recommendations for load restrictions and/or Special Inspections.

### ***5.3.7 Complex Tunnel Inspections***

When a tunnel is complex, the Statewide Tunnel Program Manager shall determine what special procedures, increased training, or additional qualifications and experience are necessary to lead the inspection. In accordance with the NTIS, the type of construction, functional systems, history of performance, and the physical and operating condition of the tunnel should be considered when determining the inspection requirements for complex tunnels.

A Complex tunnel is defined as a tunnel characterized by advanced or unique structural elements, or advanced functional systems.

#### **5.3.7.1 General Complex Tunnel Inspection Procedures**

A comprehensive Complex Tunnel Inspection Plan should provide a detailed outline for conducting all aspects of the inspection process. The following is a brief outline for a detailed plan.

Team Members: The Program Manager should select an experienced inspection team, trained for the specific tasks required for the unique structure. The Team Leader should provide experience and guidance to the remainder of the inspection team. It is preferable that members of the team have previous experience inspecting the subject tunnel type and are familiar with any past issues and concerns. The Team Leader should assign specific tasks for each member in order to conduct an efficient and thorough inspection.

Discipline Specific Specialists – When complex civil/structural, mechanical, or electrical systems need to be inspected, the team leader should assign discipline specific specialists with suitable training and experience to help conduct these inspections. Ideally, these specialist individuals should be registered professional engineers or at least engineers-in-training.

Traffic Control: The inspection of a Complex Tunnel may require an extensive Traffic Control Plan. The Program Manager / Team Leader should coordinate the Complex Tunnel Inspection Plan with IDOT or Agency Traffic Operations, Maintenance, and Construction personnel in order to assure that the inspection operation, lane closures, or lane width restrictions do not interfere with other activities in the area. The plan should detail timing and sequence of operations, including lane closure sequences, signage, flagman responsibilities, and coordination with movement of inspection access equipment.

Access Equipment: A Complex Tunnel Inspection will typically require use of a wide variety of access equipment, including bucket trucks, manlifts, and ladders. The Complex Tunnel Inspection Plan should coordinate availability of equipment and operators for the entire inspection. Access to enclosed areas should be documented, including box girder access doors, tower entrance doors, etc.

Documentation: A Complex Tunnel Inspection will typically require a greater extent of documentation and should therefore be compiled into an Inspection Report. The report should contain all inspection notes, photos, and findings in an organized narrative. It should contain an overall description of the structure, a table or listing of significant findings, and recommendations for both general maintenance and any needed repairs. The findings should be prioritized by importance and severity. Any defect of a structural member that could potentially affect the load carrying capacity of the structure must be reported immediately to the Statewide Tunnel Program Manager. See Section 5.3.8 for details and requirements for a Critical Finding.

### **5.3.8 Critical Findings**

A Critical Finding is defined as a structural or safety related deficiency that may pose an imminent threat to the safety of the traveling public.

#### **5.3.8.1 Identifying a Potential Critical Finding**

Any of the following will be considered a Potential Critical Finding:

- Tunnels that sustain damage from vehicle impacts, fire, severe flooding or other natural disaster

- Tunnels with any significant quantity of structural elements (i.e. tunnel liners, roof girders, columns and piles, cross passageways, interior walls, portals, ceiling slabs, ceiling girders, hangers and anchorages, ceiling panels, invert slabs, slabs on grade, invert girders, joints, or gaskets) deemed to be in severe condition
- Any unforeseen event that the inspector considers to be a threat to the safety of the traveling public

When a Potential Critical Finding is identified, the safety of the traveling public must be the initial focus. The Team Leader must take all necessary steps to ensure the tunnel is secured. If the Team Leader determines that the identified defect may seriously reduce a tunnel's load carrying capacity, the Team Leader should isolate the defect from traffic by closing lanes. If the defect is extensive enough that lane closures may be inadequate, the tunnel should immediately be closed to traffic. Based on the conditions present, a conservative decision to limit traffic or close the tunnel must be made until further analysis can be performed.

#### 5.3.8.2 Critical Finding Determination

On each occasion that a Potential Critical Finding is identified, information regarding the conditions that contributed to a Potential Critical Finding must be immediately provided by the Team Leader to the Statewide Tunnel Program Manager. The Statewide Tunnel Program Manager shall then immediately contact the Bureau of Bridges & Structures.

The Statewide Tunnel Program Manager shall provide sufficient, detailed information to allow the Bureau of Bridges & Structures to make an initial determination of the severity of the finding. The Bureau of Bridges & Structures will then work with the Statewide Tunnel Program Manager to determine if there is a need for a Damage Inspection, Load Rating Inspection, follow-up structural analysis, Special Inspection, submission of IDOT Form BBS CF 1, "Critical Finding Report" and to develop a plan of action to mitigate the deficiency.

If the Bureau of Bridges & Structures determines that submission of a "Critical Finding Report" is not required, the responsible Program Manager shall follow the initial plan of action, unless conditions change or additional deficiencies are subsequently found.

**5.3.8.3 Submitting a Critical Finding Report**

If the Bureau of Bridges & Structures determines that the deficiency will require FHWA notification, the Statewide Tunnel Program Manager will be required to submit IDOT Form BBS CF 1, "Critical Finding Report" within 24 hours. The Statewide Tunnel Program Manager shall provide in sufficient detail all required information on the form and submit it to the Bureau of Bridges & Structures, retaining a copy for the Tunnel File. This shall include basic structure inventory and location information, a description of the deficiency, the immediate steps that were taken to ensure public safety, and a summary of the initial plan of action to mitigate the finding.

**5.3.8.4 Reporting Critical Findings to FHWA**

The Bureau of Bridges & Structures will report each Critical Finding to the Illinois Division Office of the FHWA within 24 hours of receiving the "Critical Findings Report". A complete file, containing all pertinent data, will be retained by the Bureau of Bridges & Structures for each Critical Finding.

***5.3.9 Inspection of Structures under Construction***

When a highway tunnel is open to public travel, it is to be inspected per the NTIS.

**5.3.9.1 Existing Structure Rehabilitation**

For an existing tunnel that is closed to public traffic during rehabilitation work, an NTIS inspection is to be completed prior to reopening the tunnel and the tunnel inventory data is to be updated within 90 days of completion of the work (all lanes open to public travel).

For an existing tunnel that is open to public traffic during rehabilitation work, regularly scheduled NTIS inspections are to be performed. If an NTIS inspection cannot be conducted due to reasonable circumstances such as a hazardous project site or conditions unfavorable to complete an inspection, then those circumstances should be documented, in a written notice to the Statewide Tunnel Program Manager for concurrence by the FHWA. The inspection is to be rescheduled at the earliest date possible. Once all risks have been mitigated, an NTIS inspection is to be completed and updated SI&A data is to be input within 90 days.

**5.3.10 Inspection of Closed Structures**

NTIS requirements do not extend to tunnels closed to traffic. Please note that to be considered closed, it must be closed to traffic travelling through the tunnel, as well as traffic of any variety traveling over the tunnel. Be aware, though that IDOT policy is to continue to inspect all closed tunnels, unless the closure is permanent.

The following “Tunnel Status” (SNITI Item L4) codes represent closed tunnels in the inventory:

Tunnel Status	Description
K	Tunnel Closed to all traffic

**5.3.11 In-depth Inspections**

In-depth inspections are close-up, hand-on inspections conducted on one, several, or all of the elements or functional systems. These inspections are used to identify deficiencies that are not readily detectable during initial, routine, or damage inspections. In-depth inspections may involve testing of tunnel system, components, and materials. More extensive disassembly and cleaning of equipment parts may occur. This type of inspection may be used to support a structural analysis or a functional system evaluation where more information is needed. In-depth inspections are scheduled based on the needs of the tunnel facility, inspection findings, and established written procedures.

**5.4 Tunnel Inspection Intervals**

**5.4.1 General**

The following sections document IDOT policy for the required frequency of different tunnel inspection types.

Every Tunnel shall receive periodic Routine Inspections. Those inspections must be completed within 2 months (before or after) of the Tunnel’s assigned Routine Inspection Date (RID).



In the case of a Special Inspection with an interval of twelve months or less, the inspection must be completed by the due date.

#### ***5.4.2 Routine Tunnel Inspection Interval***

The Routine Tunnel Inspection Interval may vary over the life of the structure. After the first Routine Inspection, a RID will be assigned by the Statewide Program Manager and the inspection interval will remain at 24 months until the tunnel requires a 12-month inspection interval as described in Section 5.4.2.1.

Each tunnel has an established NTIS Routine Inspection Date (RID) for determining timing of future inspections. Subsequent routine inspections are conducted within 2 months before or after the established RID, typically on 24-month intervals. RIDs cannot be changed. However, under extremely rare circumstances, the statewide tunnel program manager can approve a modification to the RID with adequate justification.

The NTIS recognizes that certain tunnels in poor condition should be inspected at lesser intervals

##### **5.4.2.1 Routine Inspection 12-Month Interval Criteria**

Tunnels with the following characteristic shall receive a Routine Inspection at 12-month maximum intervals.

Tunnels with a significant quantity (i.e. greater than 50%) of structural elements (i.e. tunnel liners, roof girders, columns and piles, cross passageways, interior walls, portals, ceiling slabs, ceiling girders, hangers and anchorages, ceiling panels, invert slabs, slabs on grade, invert girders, joints, or gaskets) or essential functional systems deemed to be in Condition State 3 or 4. The statewide tunnel program manager shall made the final determination of when the inspection interval shall be reduced to 12-months, based on a review of the routine inspection reports.

#### **5.4.3 In-depth Inspection Interval**

In-depth inspections are scheduled based on the needs of the tunnel facility, inspection findings, and established written procedures. Intervals are determined by the Statewide Tunnel Program Manager.

## **5.5 Tunnel Inspection Safety**

Safety of the inspection team and traveling public is of paramount importance during tunnel inspections. Please refer to section 3.8 Bridge Inspection Safety for relevant information.

## **5.6 Quality Control and Quality Assurance**

### **5.6.1 General**

#### QC/QA of Tunnel Inspections

Quality in the inspection and the resulting documentation is an important aspect that must be considered to ensure the safety of the traveling public in tunnels. The definitions for QC and QA are as follows:

QC refers to quality related activities associated with the creation of project deliverables, i.e. the inspection results. QC is used to verify that deliverables are of acceptable quality and that they are complete and correct. Examples of QC activities include peer reviews of deliverable products from the inspection documentation and verifying the findings in the field are as recorded by the inspector.

QA refers to the process used to create a quality product or deliverable, (or in this case inspection) and can be performed by a manager, client, or even a third-party reviewer. Examples of QA for tunnel inspections include the establishment of guidelines or checklists that would lead to quality inspections, creating minimum inspector qualifications, establishing condition state requirements that yield consistency between inspection periods, requiring that equipment be calibrated, having testing personnel submit certifications on the equipment being used, developing standard inspection forms with data fields included, and following standard processes/procedures for performing inspections.

Both QC and QA must be performed to ensure that the inspections conducted and deliverables produced meet the tunnel owner's quality requirements, while ultimately ensuring the public's safety.

IDOT recognizes that established and documented Quality Control and Quality Assurance (QC/QA) procedures are essential for ensuring that tunnel inspections are performed in an appropriate, consistent, and uniform manner by all inspection Program Managers and Team Leaders employed by various agencies having tunnel inspection responsibilities throughout the state. Through the application of QC/QA procedures, agencies enhance their ability to obtain accurate inspection information required for determining load capacity and tunnel maintenance, repair, rehabilitation and replacement needs. Of utmost importance is the role QC/QA plays for ensuring tunnel inspection staff are adequately trained and experienced to readily identify conditions that adversely affect public safety.

The National Tunnel Inspection Standards (NTIS) states that agencies must “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.” The NTIS provides the following definitions:

### **5.6.2 Personnel Qualifications**

The quality of an agency’s bridge inspection program is very much dependent on the performance of the Program Manager in charge of the agency’s inspection program, and on the Team Leaders leading the inspection teams that perform the field inspections. These individuals must be qualified to perform their duties. IDOT has established procedures for reviewing, verifying and approving the acceptability of the education, training and experience of an individual to function as a Program Manager or Team Leader. IDOT Form BBS 2610, “Program Manager Qualifications” and IDOT Form BBS 2620, “Team Leader Qualifications” shall be used for documenting the qualifications of Program Managers and Team Leaders.

#### **Statewide Program Manager / Program Manager (Tunnel)**

The statewide program manager is the individual in charge of the tunnel inspection program for a State, Federal Land, or Tribal government that has one or more tunnels within their jurisdiction. This person must be capable of leading the tunnel inspection organization and ensuring that the requirements of the NTIS are fulfilled. The statewide program manager may delegate duties and responsibilities to qualified delegates, i.e. program managers, who take charge of a particular subset of tunnels; however, the statewide program manager for the jurisdiction remains responsible for ensuring compliance. The delegated program managers must remain in close

communication with the statewide program manager on all issues concerning compliance with the NTIS.

On behalf of the tunnel inspection organization, the program manager develops written procedures, schedules inspections, procures inspection and safety equipment, coordinates with tunnel facility staff, and advises the team leader as necessary. Ideally, the program manager should have a general understanding of all aspects of tunnel engineering including design, construction, operation, maintenance, inspection, evaluation, load rating, and rehabilitation. Good judgment is essential for this position in order to respond appropriately to safety and structural concerns within the tunnel.

Refer to the NTIS for the complete requirements of this position. The program manager must be a registered professional engineer or have at least 10 years of tunnel or bridge inspection experience. This individual must also be a nationally certified tunnel inspector, which requires comprehensive training, end-of-course assessment, and periodic refresher training.

### **Team Leader (Tunnel)**

The team leader is the person on-site who is in charge of the inspection team. This person is responsible for inspection planning, preparing, performing and reporting to include coordinating the field work. The team leader is responsible for evaluating the deficiencies, quality checking of the inspection data, and making sure that the inspection reports are complete, accurate, and legible. The team leader should also conduct safety briefings as needed. The team leader should be able to provide recommendations for the repair of defective items and must initiate appropriate actions when critical findings are discovered.

Refer to the NTIS for the complete requirements. A team leader must be a nationally certified tunnel inspector which requires comprehensive training, end-of-course assessment, and periodic refresher training. Additionally, the team leader is expected to meet at least one of the following:

- Registered professional engineer and at least 6 months of tunnel or bridge inspection experience.
- 5 years of tunnel or bridge inspection experience.
- Appropriate combination of education and experience as described in the NTIS.

**5.6.2.1 Tunnel Inspection Training**

Federal regulations require all personnel, including registered (note the term is “licensed” in Illinois) professional or structural engineers, managing tunnel inspection programs or directing inspections in the field, to have successfully completed the Federal Highway Administration (FHWA) Tunnel Safety Inspection (FHWA-NHI-130110). The course is primarily directed at members of Federal, State, local (Authority or Commission) and Tribal highway agency employees, who are involved with tunnel design, inspection and maintenance, as well as consultants involved in inspecting tunnels or in tunnel inspection management and leadership positions.

Prior to taking this course, individuals shall be a Certified Illinois NBIS Team Leader or Program Manager.

Subsequent to being approved as an Illinois Tunnel Inspection Team Leader, each Team Leader will be required to obtain 18 hours of refresher training every 5 years. Training such as NHI 130125 Tunnel Safety Inspection Refresher will meet that requirement.

**5.6.3 Quality Control**

Quality control and quality assurance programs are used to promote accuracy, ensure consistency, facilitate improvement, and help maintain a high level of reliability. Periodic field reviews of inspection team and their work, quality checks on data, and independent reviews of the inspection results should also be part of the program. The use of checklists is recommended practice. Quality control refers to observations, monitoring, and performance testing to maintain the quality of the tunnel inspections and load ratings; these practices are usually performed continuously by the teams performing the work. Quality assurance is associated with a systematic approach to improve the overall program effectiveness, verify the accuracy of the quality control procedures, and ensure that established standards are met; these procedures are performed independent of the inspection and load rating teams performing the work.

The quality control (QC) procedures established by IDOT are intended to define, monitor, and document the qualifications and performance of personnel engaged in the management of inspection programs, the performance of field inspections, and the load rating of tunnels.

Factors related to the maintenance of effective QC procedures are:

- Review of tunnel inspection reports
- Inspector's performance
- Personnel qualifications
- NTIS data verification
- Tunnel inspection refresher training
- Identifying special skills, training or equipment

#### 5.6.3.1 Review of Tunnel Inspection Reports

To ensure the quality of a Team Leader's inspection reports, all reports must be reviewed by the Program Manager prior to the data being entered into ISIS. The depth of review shall be determined by the Program Manager based on the experience level of the Team Leader as well as the type, age and typical exposure of the tunnel. At a minimum, the review should verify that the element condition states are appropriate and that the documentation meets the requirements of Section 5.3.3.

#### 5.6.3.2 Inspector's Performance

The Statewide Tunnel Program Manager must conduct in-depth reviews of the field procedures of all Team Leaders functioning under their supervision to ensure that inspections are being performed in an appropriate, consistent, and uniform manner.

At least once every 48 months, Program Managers should accompany each Team Leader to observe the performance of NTIS bridge inspections on at least one (1) tunnel inspection. Program Managers shall document the results of their observations for each Team Leader.

#### 5.6.3.3 Personnel Documentation

The Bridge Management and Inspection Unit maintains documentation of the qualification approvals issued for all Program Managers and Team Leaders employed by IDOT and by other agencies. The Bridge Management and Inspection Unit also maintains documentation of performance deficiencies reported by the Statewide Tunnel Program Manager for resolution.

Approved Tunnel Program Managers and Approved Tunnel Team Leaders shall be documented in the BIS Program.

The Statewide Tunnel Program Manager must maintain a file containing documentation of education, professional registrations, training, and certifications received from each Program Manager and Team Leader functioning under their direction.

In addition, the file must contain documentation of Tunnel Inspection Performance Reviews performed to monitor the tunnel inspection procedures used by the Team Leader. The documentation for all inspection personnel functioning in a District or Agency should be located in a central location and readily accessible by the Statewide Program Manager.

#### 5.6.3.4 NTIS Tunnel Inspection Reports in the Tunnel File

The available records for each tunnel facility shall be kept in the official Tunnel File. Important records that are normally part of the Tunnel File include the construction plans, shop drawings, working drawings, as-built drawings, specifications, cost-estimates, correspondence, photographs, material certifications, material test data, and load test data. The history of the operating, inventory, maintenance, inspection, and repair records should also be maintained. Also included are accident records, posting, and permit loads

Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual provides the following guidance for the contents of a Tunnel File:

- Construction Plans
- Correspondence
- Photographs
- Maintenance, Inspection, and Repair records
- Accident Reports
- etc

A separate file must be maintained for each tunnel. The documentation for all tunnels in a District or Agency should be located in a central location that is maintained and readily accessible by the Team Leader.

A Tunnel File Checklist must be completed and updated, as required, for each tunnel and stored with the Tunnel File.

It is recognized that it is not practical or necessary to physically store all required items in the file. However, the actual location of each item should be referenced on the File Checklist. This can include separate file locations, plan stacks, electronic files, databases, and data in document storage systems, where applicable.

#### 5.6.3.5 NTIS Data Verification

##### 5.6.3.5.1 Recognizing Errors, Omissions, or Changes in the Field

The Tunnel Inventory shall be reviewed in the field and any errors brought to the attention of the Tunnel Statewide Program Manager.

##### 5.6.3.5.2 Resolution of Inspection Errors or Omissions

During the review of inspection reports or the monitoring of field tunnel inspection procedures, the Statewide Program Manager must note data errors or omissions and provide personnel responsible for their occurrence with directions that will eliminate similar incidents in the future. For minor reporting deficiencies, the initial resolution of the findings may be in the form of verbal instructions by the Program Manager to the Team Leader with a note to the Team Leader's file, if considered necessary by the Program Manager. For major deficiencies, such as those that result in the assignment of inappropriately high element condition state ratings to deteriorated tunnel elements or the omission of data concerning critical structural or functional deficiencies from an inspection report, the Program Manager must provide documentation to the Team Leader's file describing the inspection report deficiency and the measures taken to both correct the inspection deficiency and to prevent the reoccurrence of the inspection deficiency.

If the Team Leader continues to provide inspection reports or to perform field inspections in a manner that does not address a previously noted major deficiency, the Program Manager should no longer utilize the Team Leader for NTIS tunnel inspection purposes, and the situation must be reported to the State Program Manager for final resolution.



#### 5.6.3.6 Tunnel Inspection Refresher Training

All Program Managers and Team Leaders must receive periodic NTIS tunnel inspection refresher training at intervals not to exceed 60 months. However, each Program Manager must evaluate the performance and experience level of each Team Leader performing field inspections within their designated area of responsibility and, if necessary, establish an interval for tunnel inspection refresher training that is less than the maximum allowed to maintain inspection quality.

The “Tunnel Safety Inspection Refresher Training” (FHWA-NHI-130125) class is available through the NHI and is utilized to satisfy NTIS tunnel inspection refresher training needs.

#### 5.6.3.7 Identifying Special Skills, Training, and Equipment

Inspection teams performing Complex Tunnel or Functional System Inspections must have skills, training, and equipment suitable for the inspection being performed. NHI offers various courses that address the above-mentioned inspections. District or Agency Program Managers should utilize these courses for training purposes, as needed, to ensure that personnel are knowledgeable of required inspection methods and procedures for the structures assigned to them for inspection.

Equipment such as man-lifts, safety harnesses, and probing poles must be available, as needed to address the type of inspection being performed.

### **5.6.4 Quality Assurance**

Quality Assurance (QA) measures are required to ensure that established Quality Control (QC) procedures are being followed and are effective for ensuring tunnel safety on all public roadways. Quality Assurance reviews of all agencies with highway tunnels are performed to assure the quality of tunnel inspections and tunnel load ratings. The Statewide Tunnel Program Manager will oversee the Quality Assurance review

#### 5.6.4.1 Quality Assurance Reviews

Due to the limited number of tunnels in the state of Illinois, IDOT will conduct Quality Assurance reviews on a four year basis to determine the adequacy and effectiveness of the Quality Control

procedures utilized for tunnel inspections and load ratings. Reviews shall be performed on both the State Tunnels and Local Agency Tunnels in subsequent reviews. The intervals between these reviews may be reduced in response to agency personnel changes or to address findings from previous Quality Assurance reviews.

#### 5.6.4.1.1 Office Reviews

Quality Assurance reviews include a review of the office files and procedures used to document inspections, to track personnel performance and qualifications, and to schedule follow-up inspections or repairs to address NTIS tunnel inspection findings. The procedures used to establish inspection schedules and to select Team Leaders and inspection personnel will be included in the Quality Assurance review. During the office review, the Statewide Tunnel Program Manager and member of their staff included in the review process, will be requested to provide information describing the procedures employed within their designated area of responsibility to ensure tunnel safety and compliance with NTIS.

#### 5.6.4.1.2 Field Reviews

Quality Assurance reviews include field observations of at least one tunnel within the Agency's jurisdiction.

The Statewide Tunnel Program Manager or a suitable substitute must be present during the Quality Assurance field review. Personnel conducting the Quality Assurance field review will refer to the Tunnel Files maintained by the Program Manager to compare the inspection information contained in the files to the conditions observed during the Quality Assurance field review. The most recent Federal Structure Inventory and Appraisal (SI&A) should be obtained and reviewed for accuracy. The Quality Assurance staff should note inventory data errors or omissions as well as observed element level condition state-related discrepancies. Conditions that could affect load ratings will be noted during the Quality Assurance field review. Follow-up must occur to ensure the noted conditions have been considered in the current load rating.

#### 5.6.4.2 Final Quality Assurance Review Report

A "Final Quality Assurance Review Report - Tunnel" noting commendable practices, review findings, and the measures to be taken to address Quality Control deficiencies will be provided to

the Program Manager. When requested and noted in the “Final Quality Assurance Review Report”, the reviewed Program Manager must provide the State Program Manager with documentation verifying that corrective measures described in the report have been implemented.

IDOT will provide FHWA with a copy of every “Final Quality Assurance Review Report - Tunnel”.