26. Bridge and Tunnel Inspection Programs

26.1. Federal Bridge Inspection Program

Alaska has approximately 1,000 bridges on public roads and streets excluding federally-owned bridges.

In general, bridges are designed and constructed with the intent of providing a safe structure and a long service life (50 to 75 years). DOT&PF uses stringent design criteria and construction specifications to accomplish this objective. Nevertheless, all structural elements deteriorate over time, sometimes prematurely and if left unchecked, will become deficient.

In addition, increasing traffic volumes and truck weights subject bridges to stresses for which they were not designed. Therefore, a systematic program of periodic bridge inspections is necessary to evaluate condition and functionality, to detect structural problems, and to extend the useful life of bridges.

26.1.1. National Bridge Inspection Standards

The collapse of the Silver Bridge over the Ohio River in 1967 prompted the United States Congress to enact legislation in Title 23 United States Code 151 "National Bridge Inspection Program."

This legislation established the National Bridge Inspection Standards (NBIS) (23 CFR Part 650, Subpart C), creating a nationwide bridge inspection, load rating, and inventory program. The Federal Highway Administration has promulgated regulations to establish the specific criteria that each state transportation department must meet; i.e., state DOTs are responsible for proper NBIS safety inspection and evaluation for all public bridges located within the geographic b oundaries of the state but not within federal lands.

Primary Elements

The following summarizes the primary elements of the National Bridge Inspection Standards:

- NBIS requires the periodic inspection of all highway "bridges" located on public roads and open to public travel. The NBIS (§650.305) and FHWA *Specifications for the National Bridge Inventory (SNBI)* defines a bridge as:

  "A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it includes multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening."

  Figure 26-1 provides examples illustrating this definition.

- Title 23 United States Code 101 defines "public road" as "…any road or street under the jurisdiction of and maintained by a public authority and open to public travel."

- The state DOTs must load rate all bridges to determine their structural capacity. This includes the calculation of both the operating and inventory ratings. The ratings provide an indication of the bridge's safe load-carrying capacity. This information also assists in the determination of necessary load restriction posting, the issuance of special overload permits, and the scheduling for rehabilitation or replacement. See Chapter 27 for DOT&PF policies, procedures, and practices related to load rating.

- NBIS establishes the basic requirements for each component of a state DOT bridge inspection program.

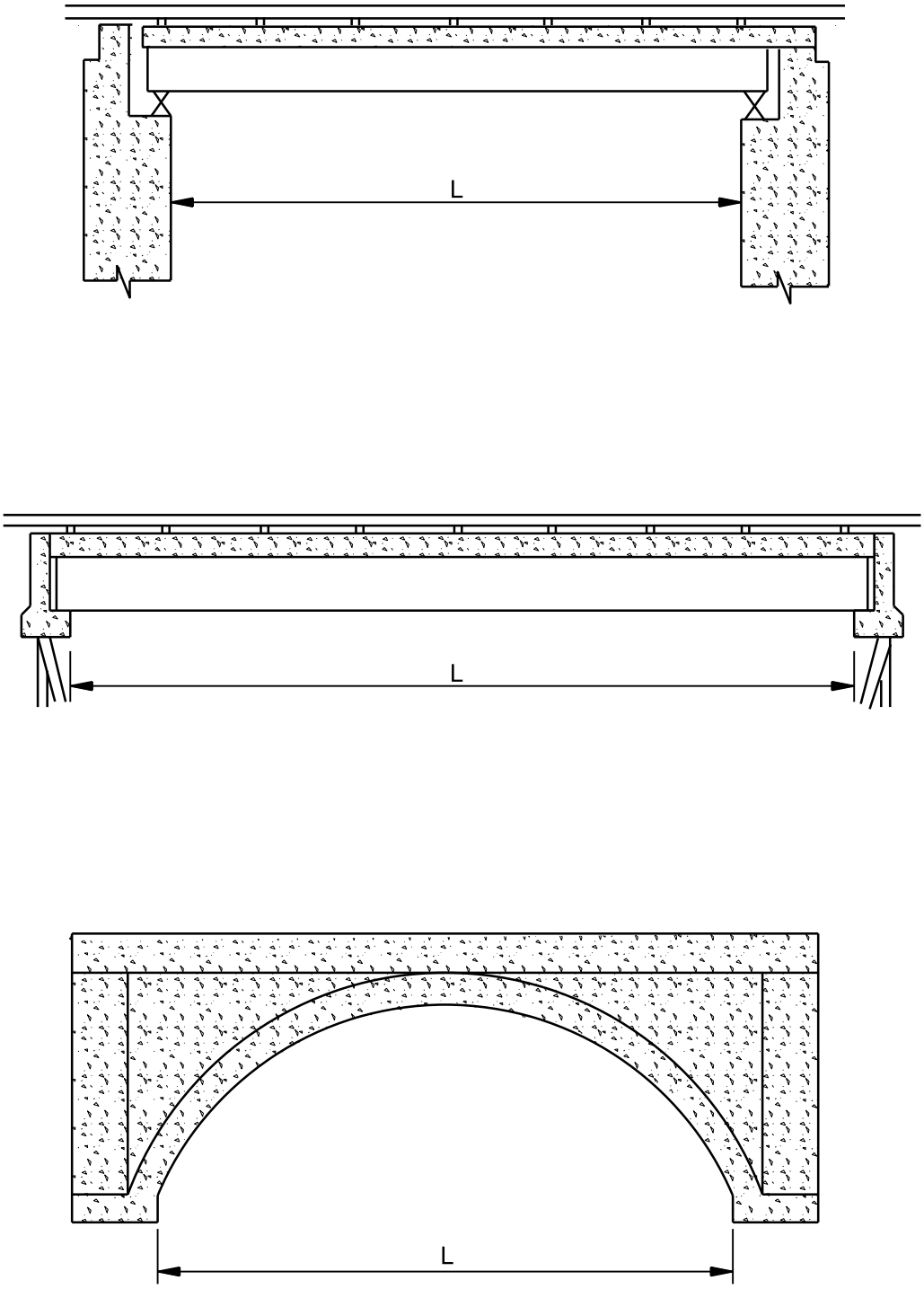


Figure 26-1
NBIS Bridge Length
(Page 1 of 2)

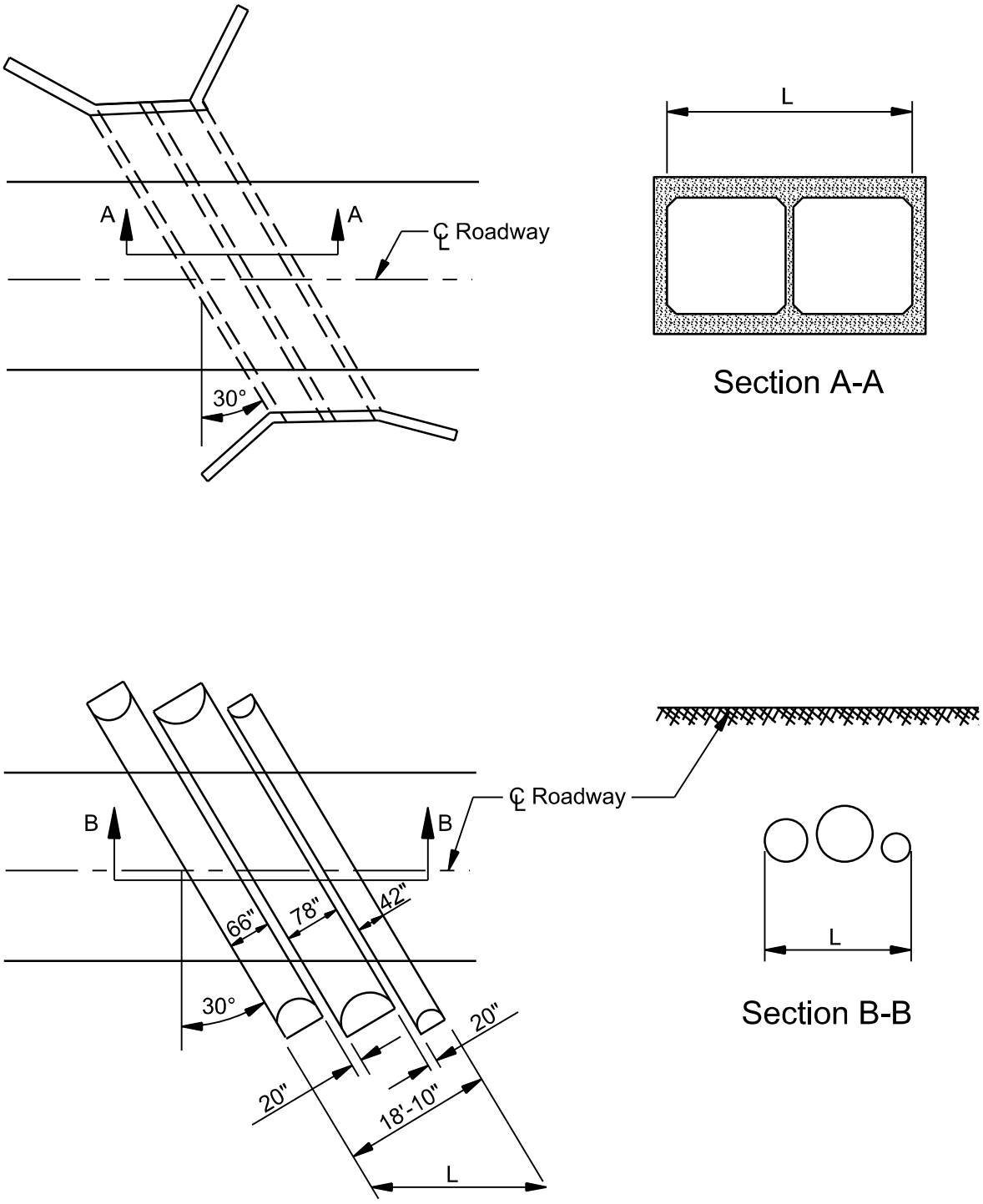


Figure 26-1
NBIS Bridge Length
(Page 2 of 2)

26.1.2. National References

AASHTO and FHWA have developed several references at the national level for the implementation of the NBIS.

FHWA *Specifications for the National Bridge Inventory*

The FHWA *Specifications for the National Bridge Inventory* (SNBI) were adopted in May 2022. State DOTs use the SNBI when entering specific data items in the National Bridge Inventory (NBI) database. The NBI data is used to prepare legislatively required reports to Congress and comply with federal requirements for performance management of bridges.

FHWA mandates the submission of bridge inventory data to FHWA in a standardized format as required by NBIS. Therefore, DOT&PF has adopted the conventions, terminology, etc., within the SNBI for the collection, recording, and reporting of bridge inspection data. AASHTOWare Bridge Management software (BrM) is used by DOT&PF for NBI data.

FHWA *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*

The FHWA *Recording and Coding Guide* was first published in 1971 and is sunset as of December 31, 2025. The FHWA *Recording and Coding Guide* has several items that were discontinued in the SNBI, e.g., approach guardrails, project costs, and future average daily traffic. Additionally, the following calculated items from the FWHA *Recording and Coding Guide* are no longer included in the NBI: sufficiency rating, structurally deficient status, functionally obsolete status.

AASHTO *Manual for Bridge Element Inspection*

The AASHTO *Manual for Bridge Element Inspection* (MBEI) supersedes the AASHTO *Guide for Commonly Recognized Structural Elements*, and the "Commonly Recognized" (CoRe) elements were replaced with National Bridge Elements (NBE), Bridge Management Elements (BME), and Agency Developed Elements (ADE).

AASHTO *Manual for Bridge Evaluation*

The AASHTO *Manual for Bridge Evaluation* (MBE) serves as a standard and provides uniformity in the procedures and policies for determining the physical condition, maintenance needs, and load capacity of highway bridges in the United States. This publication establishes inspection procedures and load rating practices that meet the NBIS.

The MBE superseded the AASHTO *Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges*.

The MBE incorporates the load and resistance factor rating (LRFR) methodology plus the traditional allowable stress rating (ASR) and load factor rating (LFR) methodologies.

FHWA *Bridge Inspector's Reference Manual*

The FHWA *Bridge Inspector's Reference Manual* (BIRM) provides guidelines for training bridge inspectors. The BIRM presents a fundamental discussion on the inspection and evaluation of specific bridge components, and it discusses field inspection procedures and reporting requirements. In addition, the BIRM discusses the basic qualifications of bridge inspectors and field safety procedures.

The BIRM is used as a primary reference in the comprehensive training program on bridge inspection presented by the National Highway Institute (NHI).

AASHTO Culvert and Storm Drain System Inspection Guide

AASHTO has accepted but not yet published this *Guide*. The *Guide* provides inspection and asset management information for culverts that updates the 1986 FHWA *Culvert Inspection Manual*. The *Guide* is not intended to be used as a standard or policy statement, but is a resource that provides supplemental information for culvert assessment.

26.1.3. Federal-Aid Program

See Section 28.3.2.

26.2. Alaska Bridge Inspection Program

The Alaska Bridge Inspection Program represents DOT&PF's implementation of the National Bridge Inspection Standards for all public bridges in the state of Alaska not owned by federal agencies and incorporates data collection to support the state's bridge management system.

Sections 26.3 through 26.7 discuss specific procedures and criteria adopted by DOT&PF for its implementation of the Alaska Bridge Inspection Program. It is the policy of DOT&PF that the provisions for bridge safety inspection and evaluation in this *Manual* meet or exceed the minimum NBIS standards and related FHWA policy.

26.2.1. Coding Bridge Inspection Data

FHWA and AASHTO have developed rating systems to aid bridge inspections. The two primary rating systems currently in use are the National Bridge Inventory rating system and the element level rating system. Both rating systems promote uniformity for rating the structural condition of a bridge. The bridge inspector must complete both an NBI and an element level inspection of each bridge inspected.

National Bridge Inventory Inspection

The bridge inspector collects NBI data in accordance with the SNBI. The FHWA Supplemental Rating Guidelines for rating decks, superstructures, and substructures may be used. See Appendix 26.A.

An NBI inspection is organized into two sections: a component-level evaluation and an element-level evaluation. The component inspection evaluates the deck, superstructure, substructure, channel protection, and culvert, etc. adequacy for each bridge, and assigns a single "Condition Rating" representing the condition of the component type as a whole, regardless of quantity. Condition rating codes range from 9 to 0, where 9 is the best rating possible ("excellent condition") and 0 is the worst rating possible ("failed condition").

The Bridge Management Unit incorporates these specific condition ratings into the Structure Inventory and Appraisal (SI&A) sheet, which is a comprehensive listing of all NBI data for any given bridge.

An element-level inspection identifies each bridge component as a separate element, based not only upon function but also material type, and it evaluates each element by sub-dividing its total quantity into different "condition states," or states of physical deterioration or damage. The AASHTO *Manual for Bridge Element Inspection* describes the bridge element-based rating system.

In an element-level inspection, each bridge element has an element number and a standard description. The total quantity for each element is then sub-divided among the available condition states, where condition state 1 indicates the best possible condition. Bridge owners use defect elements to track event-driven damage, such as traffic impacts or fatigue cracks that are unique to a specific bridge. The bridge inspector supplements the quantitative condition states with narrative descriptions of their observations. Repair recommendations are presented as "work candidates."

The element level rating system incorporates data that, over time, can be used to estimate deterioration rates based on the structural material and the bridge environment. This allows bridge owners to schedule preventive and corrective actions more uniformly, predict future bridge conditions, and estimate necessary funding to maintain a desired bridge condition. In this way, DOT&PF can make informed decisions to optimize the expenditure of funds and to determine when to take action and what type of action to take. See Chapter 28 for DOT&PF policies, procedures, and practices related to bridge management.

26.3. Responsibilities/Qualifications for Bridge Inspection

26.3.1. DOT&PF Bridge Management Unit (§650.307)

The Bridge Management Unit is responsible for:

- ensuring that all bridges subject to the NBIS (excluding federally owned bridges) are inspected and load rated
- developing statewide inspection and load rating policies
- maintaining a registry of nationally certified bridge inspectors who perform the duties of a team leader (TL) in Alaska
- supporting bridge asset management.

26.3.2. Qualifications of Personnel (§650.309)

Bridge Management Engineer

The Bridge Management Engineer serves as the Program Manager (PM) for implementing National Bridge Inspection Standards. The PM meets NBIS qualification requirements. The PM is defined under §650.305 as:

"The individual in charge of the program, that has been assigned the duties and responsibilities for bridge inspection, reporting, and inventory, and has the overall responsibility to ensure the program conforms with the retuirements of this subpart. The program manager provides overall leadership and is available to inspection team leaders to provide guidance."

The PM ensures that DOT&PF complies with federal regulations and directives for structure inspection, load rating, and inventory maintenance.

The responsibilities of the PM include:

- Oversee Alaska Bridge Inspection Program including quality assurance and quality control reviews.
- Monitor the inspection program for structures with nonredundant steel tension members, underwater members, or unique or complex features requiring additional attention during inspection to assure the safety of such structures; confirm that load-posted structures receive interim inspections as required.
- Review proposals from consultants or contractors to supplement DOT&PF staff, as needed, to perform specialized inspection, testing, or repair. Recommend selected firm and monitors contract performance.
- Recommend coordination actions with federal, state, and local governmental agencies.
- Recommend load posting and bridge closures.
- Develop, monitor, and update training for state and consultant inspectors.
- Analyze federal and state legislation, administrative rules, and national and industry standards, and recommends implementation into DOT&PF programs and policies.
- Assist in emergency response (e.g., earthquakes, major bridge damage, bridge failures).
- Assist applicable DOT&PF staff in determining appropriate maintenance or repair actions.

Bridge Inspection Manager

The Bridge Inspection Manager assists the Bridge Management Engineer in fulfilling the responsibilities of the Program Manager including the day-to-day management for the Alaska Bridge Inspection Program.

Load Rating Manager

The PM serves as the Load Rating Manager through direct supervision of the individuals who are responsible for calculating bridge inventory and operating ratings, recommending the load posting for existing bridges, and analyzing overweight vehicles for operating permit purposes. §650.309(d) of the NBIS states that:

"Load ratings must be performed by, or under the direct supervision of, a registered professional engineer."

See Chapter 27 for DOT&PF policies, procedures, and practices related to the responsibilities of the Load Rating Manager.

Team Leader

All inspection team leaders meet the NBIS qualification requirements and are on-site during field inspections. Team leaders are responsible for reports completed under their direction. §650.305 of the NBIS defines the TL as the:

"on-site, nationally certified bridge inspector in charge of an inspection team and responsible for

planning, preparing, performing, and reporting on bridge field inspections."

§650.309(b) of the NBIS identifies the qualifications of the TL.

Refresher Training

The PM and all TLs must attend a total of 18 hours of bridge inspection refresher training every 60 months.

26.3.3. Region Offices

Each regional office has a Maintenance and Operational Director who oversees the maintenance operations in that region. This Director is the primary contact for coordination between the regional office and the Bridge Management Unit for the Alaska Bridge Inspection Program. Regional office involvement in the Program includes the following:

- The region may provide assistance during the bridge inspection as requested by the Bridge Inspection Manager.
- Copies of all bridge inspection reports for state-owned bridges are sent to the appropriate Regional Director.
- The region performs bridge maintenance activities identified in the bridge inspection reports.
- When necessary, the region provides an equipment operator (e.g., boom truck) and traffic control personnel.
- The region reviews and approves the Traffic Control Plan prepared by the Bridge Management Unit.
- Regional personnel may perform initial damage inspections following vehicle impacts, earthquakes, and floods.

26.3.4. Consultant Program

When the state chooses to retain consultants, they are an extension of DOT&PF staff for the implementation of the Alaska Bridge Inspection Program.

During a field inspection, consultant employees must represent DOT&PF professionally in their interface with the public. Typical examples where consultants are retained are:

- nonredundant steel tension member (NSTM) inspections,
- underwater (UW) inspections,
- NDE inspections, and
- specialized load ratings.

For consultant NSTM and UW inspections, the DOT&PF assembles a term agreement or RFP, which presents the specifics of the consultant scope of work.

Operational Issues

In general, consultants must comply with all DOT&PF requirements in implementing the Alaska Bridge Inspection Program. The following discusses a few specific issues:

1. **Engineer in Charge (EIC)**. The EIC is a professional civil engineer registered in the state of Alaska and meets the NBIS team leader requirements and additional time requirements in overall management of the consultant's project. This includes UW and NSTM inspections.
2. **Underwater Divers**. Consultants perform all dive inspections. Dive inspectors must meet NBIS qualification requirements for a bridge inspection diver and have additional work experience. The consultant must provide only certified commercial divers.
3. **Non-Destructive Evaluation.** NDE tasks are conducted by specialized technicians whose primary expertise is specific to the evaluation method but may not be specific to bridges in general. Some forms of NDE, such as aerial deck scanning or multi-beam sonar arrays, require extensive post-processing in the office in order to make informed judgements of bridge conditions. In such situations, it is not necessary for a qualified team leader to be on-site during data collection activities.
4. **Submission of Reports**. A professional engineer registered in the state of Alaska must sign and seal final consultant bridge inspection reports prior to submittal to DOT&PF.
5. **DOT&PF QA Review**. The PM or his designated representative will review all bridge inspection reports submitted by consultants for quality, spelling, photograph labeling, completeness, and accuracy. The nature of the DOT&PF review is a quality assurance review, not an "approval."
6. **Load Ratings**. A professional engineer registered in the state of Alaska must sign and seal final consultant prepared load ratings.

26.4. Types of Bridge Inspections and Frequencies

26.4.1. General

The following identifies three general parameters for bridge inspections:

1. **Inspection References.** §650.313(a) of the NBIS requires that each state DOT:

   > *Inspect each bridge to determine condition, identify deficiencies, and document results in an inspection report in accordance with the inspection procedures in… [the] AASHTO Manual (incorporated by reference, see §650.317).*

2. **Inspection Team Composition.** Initial (inventory), routine, in-depth, nonredundant steel tension member, damage, special, and underwater inspections must have a qualified inspection team leader onsite and actively participating in the inspection at all times. The minimum crew size is typically two, including the TL.

3. **Inspection Intervals.** §650.311 of the NBIS provides two risk-based methods for determining inspection intervals, Method 1 and Method 2:

   *"**Method 1.** Inspection intervals are determined by a simplified assessment of risk to classify each bridge into one of three risk categories…"*

   *"**Method 2.** Inspection intervals are determined by a more rigorous assessment of risk…"*

   DOT&PF uses Method 1 to determine inspection intervals. Policies for reduced and extended intervals under Method 1 are presented in the sections for the relevant inspection type.

26.4.2. Safety

During inspections, evaluate traffic and pedestrian safety features in addition to structural items. Provide special attention to the condition of railings, pedestrian fencing, guardrail, sidewalks, etc. The following are some examples of conditions that may warrant documentation in the bridge inspection report:

- tripping hazards, severe approach roadway settlements, or large spalls on sidewalks
- rebar protruding from decks, walks, or parapets
- loose, missing or damaged railings, or parapets
- missing or damaged guardrail
- loose concrete that could fall onto the traveled way, sidewalk, waterway, or railroad
- any other condition that the inspector perceives as a threat to public safety.

If these conditions are observed during any bridge inspection, they should be documented. See DOT&PF Policy and Procedure 07.05.060 for further information.

26.4.3. Inventory Inspections

§650.305 of the NBIS defines the inventory (or initial) inspection as:

"The first inspection of a new, replaced, or a rehabilitated bridge. This inspection serves to record required bridge inventory data, establish baseline conditions, and establish the intervals for other inspection types."

An inventory inspection is the baseline inspection that must be completed for every new structure before it can be entered into the Alaska Bridge Inventory. An inventory inspection is a fully documented inspection, using the bridge plans, to determine basic data for a specific structure for entry into the file.

The team leader conducting the inspection must verify quantities and dimensions and must collect the data for the SI&A as required by FHWA regulations.

Inventory inspections are also used when a structure is discovered that has never been inventoried. These inspections are also performed when the configuration or geometry of a structure changes (e.g., widening) or when structural improvements are made that alter previously recorded data (e.g., rehabilitation).

In addition to verifying dimensions and quantities, collect all data required for a routine inspection. Complete inventory inspections within 3 months of the bridge opening to traffic.

26.4.4. Routine Inspections

§650.305 defines a routine inspection as a:

Regularly scheduled comprehensive inspection consisting of observations and measurements needed to determine the physical and functional condition of the bridge and identify changes from previously recorded conditions.

Routine inspections are generally conducted from the deck, ground, or water level or from permanent work platforms and walkways, if present. Inspect the

critical load-carrying members (e.g., steel and concrete girders, decks, slabs, piers, bearings, abutments) and closely examine any element that appears distressed. DOT&PF performs routine inspections on a 24-month interval during the assigned month, except as detailed below. Typical data collected during this inspection includes:

- NBI and element data
- vertical clearance or under clearance
- stream cross-section at upstream bridge edge (soundings); and
- information for the Hydraulic Sheet, including an attempt to wade-inspect all substructure members in the water.

The inspection team should take the necessary photographs to visually document the critical aspects of the inspection. Typical photographs, as applicable, are:

1. Ahead at Bridge
2. Back at Bridge
3. Looking Upstream
4. Looking Downstream
5. Banks
6. Near End Load Posting Signs
7. Far End Load Posting Signs
8. Bridge Mounted Signs
9. Typical Deck Condition
10. Elevation
11. Superstructure Underside
12. Abutments
13. Piers
14. Bridge Rail
15. Approach Rail
16. Pin & Hangers
17. In-Span Hinges
18. Seismic Retrofits
19. Stream Bank Condition
20. Stream Bank Protection
21. Typical Streambed Material
22. Utilities

Reduced Routine Inspection Interval

Additional inspections may be required to monitor bridges with excessive deterioration, extreme scour vulnerability, or other potentially serious conditions. Alaska's policy is to complete reduced interval routine inspections according to 650.311(a)(1)(ii)(B) and (C). Other criteria for a reduced interval may be recommended by TLs in consultation with the Bridge Management Engineer. Such frequencies are determined on a case-by-case basis by the Bridge Management Engineer.

Extended Inspection Interval for Culverts and Buried Structures

A culvert or buried structure may be inspected on a 48-month interval during the assigned month if it meets the following criteria:

- Culvert components, channel, and channel protection are rated in satisfactory (6) or better condition.
- The inventory rating factors are greater than 1.0.
- The minimum vertical clearance for vehicular traffic traveling through the culvert is greater than 17 feet.

Extended Inspection Interval for Concrete Bridges

A concrete bridge may be inspected on a 48-month interval during the assigned month if it meets the following criteria:

- Deck, superstructure, substructure, channel, and channel protection components are in satisfactory (6) or better condition.
- The bridge is not scour critical and has only minor or isolated moderate scour conditions.
- The inventory rating factors are greater than 1.0.
- The minimum vertical clearance is greater than or equal to 17 feet and the bridge has not experienced bridge strikes in the past five years.

Extended Inspection Interval for Steel Bridges

A steel bridge may be inspected on a 48-month interval during the assigned month if it meets the following criteria:

- Deck, superstructure, substructure, channel, and channel protection components are in satisfactory (6) or better condition.
- The bridge is not scour critical and has only minor or isolated moderate scour conditions.
- The inventory rating factors are greater 1.0.
- The minimum vertical clearance is greater than or equal to 17 feet and the bridge has not experienced bridge strikes in the past five years.
- No members are classified as Nonredundant Steel Tension Members
- No members have fatigue category E or E' details.

26.4.5. In-Depth Inspections

§650.305 defines an in-depth inspection as:

"A close-up inspection of one or more members above or below the water level to identify any deficiencies not readily detectible using routine inspection procedures; hands-on inspection may be necessary at some locations."

The Bridge Management Engineer determines the need and interval for in-depth inspections. If follow-up inspections are needed with a interval of 24 months or less, then the in-depth inspection becomes a special inspection. A routine inspection often identifies conditions that prompt an in-depth inspection. These include:

- need for specialized access,
- need for special inspection/testing techniques and equipment, and
- need for increased inspection of an element.

NBI and element condition data are collected for the members inspected during in-depth inspections.

Thoroughly document the activities, procedures, and findings of in-depth inspections with the appropriate photographs, a location plan of deficiencies, test results, measurements, and a written report. Enter any changes in the condition of the structure into the bridge inspection report, and document any maintenance recommendations.

If a bridge element condition is sufficiently severe, collect sufficient information to load rate the bridge. This inspection data can also be used to develop repair/rehabilitation plans for the bridge.

Description

An in-depth inspection is a close-up visual inspection that often requires special access equipment. Each element under investigation should be within arm's reach of the inspector. The Bridge Management Engineer determines if non-destructive evaluation (NDE) tests and/or other material tests are required. Non-destructive load tests may be conducted to assist in determining a safe load-carrying capacity.

In-depth inspections may also consist of:

- sounding of concrete elements to determine the limits of delamination/deterioration;
- sounding and probing/drilling of timber elements to determine the limits of internal deterioration, rot, and decay;
- connection inspections (bolts, rivets, welds) to identify failing welds/rivets and loose/failing bolts;
- remaining section measurements (as practical) for steel elements; and
- inspection of bearings, paints, or finishes and other miscellaneous structural elements.

26.4.6. Special Inspections

§650.305 defines a special inspection as:

An inspection scheduled at the discretion of the bridge owner, used to monitor a particular known or suspected deficiency.

The Bridge Management Engineer determines the need and frequency for special inspections. A special inspection may be scheduled when a bridge requires more frequent inspections than is provided by the routine or nonredundant steel tension member inspection cycle. A special inspection is typically used to monitor issues that are sufficiently severe to warrant heightened scrutiny, such as foundation settlement, scour, member conditions, and the public's use of a load-posted bridge.

NBI and element condition data are collected for the members inspected during special inspections.

26.4.7. Underwater Inspections

§650.305 defines an underwater inspection as:

"Inspection of the underwater portion of a bridge substructure and the surrounding channel, which cannot be inspected visually at low water by wading or probing, generally requiring diving or other appropriate techniques."

The Bridge Management Engineer determines the need and interval for underwater and low water inspections. An underwater inspection is scheduled when a bridge inspector cannot easily observe significant underwater structural conditions from above water or at low water until the defect has progressed to where distress is evident. In general, an underwater inspection is required if, during a routine inspection, water conditions exist at the structure that prohibit access to all portions of an element by visual or tactile means that would ensure a level of certainty.

The Bridge Management Unit maintains an underwater master list identifying structures for low-water inspection during low flows and underwater dive inspections. Underwater inspections are performed on a 60-month interval.

Structural conditions that cannot easily be observed during a routine inspection, but can be seen at low water will receive a low water inspection. Low water inspections are performed on a 60-month interval from the last time the substructure was inspected.

Structural conditions that cannot be inspected due to unsafe diving conditions may have other means such as acoustic imaging or similar methods used to assess the underwater condition of substructure units.

NBI and element condition data are collected for the members inspected during low water and underwater inspections.

Reduced UW Inspection Intervals

Alaska's policy is to complete reduced interval routine inspections according to 650.311(b)(1)(ii)(B) and (C). Other criteria for a reduced interval may be recommended by TLs in consultation with the Bridge Management Engineer. Such frequencies are determined on a case-by-case basis by the Bridge Management Engineer.

Extended UW Inspection Intervals

Bridges that meet the criteria of §650.305(b)(1)(iii)(A) and the following criteria may be inspected on a 72-month interval with the Bridge Management Engineer's approval:

- The substructure is comprised of concrete-filled steel pipe pile bent system with the concrete fill extending below the scour depth.
- The inventory rating factors are greater than 1.0.
- There is no history of vessel collision and a low probability of vessel collision.

26.4.8. Nonredundant Steel Tension Member Inspections

Section 650.305 defines a NSTM as a *"primary steel member fully or partially in tension, and without load path redundancy, system redundancy or internal redundancy, whose failure may cause a portion of or the entire bridge to collapse."*

A NSTM inspection is a "hands-on" inspection; i.e., made at a distance no greater than arm's length from the entire member/member component surface. NDE may be used to examine potential deficiencies on nonredundant steel tension members.

NSTM inspections typically require special access to perform a hands-on inspection, and they are completed separate from routine inspections. The Bridge Management Engineer is responsible for determining if a structure member meets the definition of NSTM and requires a NSTM inspection. The Bridge Management Unit maintains a NSTM master list identifying NSTM structures and members. NSTM inspections are performed on a 24-month interval, unless a more frequent inspection is necessary to monitor known issues.

NBI and element condition data are collected for the members inspected during NSTM inspections.

Reduced NSTM Inspection Intervals

Additional inspections may be required to monitor bridges with excessive deterioration and/or cracking in tension members subject to cyclic fatigue loading. However, due to the low inventory of NSTM bridges in Alaska, their low average daily traffic and truck traffic, and lack of widespread known deficiencies, the only criteria of DOT&PF policy for a reduced interval is an NSTM condition rating of 4-Poor or less. Other criteria for a reduced interval may be recommended by TLs in consultation with the Bridge Management Engineer. Such intervals are determined on a case-by-case basis by the Bridge Management Engineer.

Extended NSTM Inspection Intervals

DOT&PF policy does not currently allow for extended NSTM inspection intervals.

26.4.9. Complex Bridge Inspections

§650.305 of the NBIS defines a complex bridge as a *"movable, suspension, cable stayed, and other bridges with unusual characteristics."*

§650.313(f) discusses the NBIS requirements for their inspection. Alaska has a few "complex" bridges, including those that are cable-stayed.

The Bridge Management Engineer determines the need and interval for complex bridge inspections. Complex bridge members will be assessed visually during routine and fracture critical member inspections; otherwise, a special inspection is scheduled.

NBI and element condition data are collected for the members inspected during complex bridge inspections.

26.4.10. Damage Inspection

§650.305 defines a damage inspection as an *"unscheduled inspection to assess structural damage resulting from environmental factors or human actions."*

Common examples of events that may require a damage inspection include earthquakes, floods, vehicular impacts, fire damage, and marine vessel impacts. The Bridge Management Engineer determines the need and interval for damage inspections. See Section 26.5.1 for the Bridge Section's emergency response procedure.

The scope of the inspection must be sufficient to determine the need for emergency load restrictions or closure of the bridge to traffic and to assess the level of effort necessary to implement a repair. The level of effort for a damage inspection can vary significantly and depends on the severity of the damage.

The damage inspection is often followed by an in-depth inspection to better document the extent of damage and the urgency and scope of repairs. Follow-up activities include proper documentation, verification of field measurements and calculations and, perhaps, a more refined analysis to establish or adjust interim load restrictions.

NBI and element condition data are collected for the members inspected during damage inspections. For damage inspections of precast prestressed girders, complete the "Prestressed Girder Damage and Repair Summary" form located in Appendix 26.B. This form should be used to document sufficient information so that the repair procedure in Appendix 23.A can be designed and implemented.

26.4.11. Inspections of Miscellaneous Structures

Although NBIS does not require the inspection of the following structures, DOT&PF practices for inspecting these miscellaneous structures is:

High-Mast Lighting

DOT&PF performs periodic inspections on these structures on a four- to five-year cycle.

The Bridge Management Unit maintains a master list identifying high-mast lighting requiring inspection. The Bridge Management Unit has developed a special form for inspecting high-mast lighting and a computer program to record the inspection data.

Pedestrian Structures

DOT&PF performs inspections of pedestrian structures over highways that are owned and maintained by public agencies.

Vertical clearance measurements are verified for privately owned pedestrian structures located over public roadways.

Inspections and vertical clearance measurements are performed as part of routine inspection trips on a 24-month interval.

Marine Structures

Marine facilities serving the Alaska Marine Highways ferries are routinely inspected. Those structures and structural elements that qualify as bridges are inspected according to NBIS requirements. Other structures, such as shoreside facilities, and elements, such as dolphins, fenders and bollards, are routinely inspected to ensure vessel and passenger safety. These shoreside condition assessments are completed by Marine Highway staff, Southcoast Region staff or consultants, generally on the same frequency as bridges.

Other Structures

DOT&PF-owned structures meeting the following criteria are inspected on a four- to five-year interval:

- Bridge lengths between 10 feet to 20 feet
- culverts with a diameter between 10 feet and 20 feet
- separated pedestrian structures within the highway right-of-way

26.5. Special Bridge Inspection Activities

26.5.1. Emergency Response

For an emergency such as a flood or earthquake, the Bridge Section will assemble an appropriate response team. The typical disaster response procedure is:

1. A regional office or upper management contacts the Chief Bridge Engineer or, in his/her absence, contacts the Bridge Management Engineer or a Design Squad Leader.
2. If the emergency is after hours, the Chief Bridge Engineer will contact the appropriate staff in the Bridge Section to assemble and prepare a response plan. This will most likely result in the formation of a response team for bridge inspection and possibly repair.
3. The response team leader will contact the Bridge Section staff as necessary to form the team and implement the response plan.

Additional emergency response information may be found in the DOT&PF "Incident Field Operations Guide," 2018. This guide includes information on bridge assessments and Department-wide phone numbers. It is available on the DOT&PF employee intranet site at http://web.dot.state.ak.us/stwdmno/safety/.

Contingency plans for select essential bridges and other available emergency resources are contained in the "Final Highway Bridge Incident Management Plan Report," 2003.

26.5.2. Bridges with Critical Deficiencies, Policy and Procedure

DOT&PF policy is to provide immediate corrective or protective action to safeguard the traveling public when a bridge is determined to be critically deficient.

This section provides procedures and guidance for bridge inspectors and maintenance personnel for addressing bridges with critical deficiencies. The Chief Bridge Engineer and regional Maintenance and Operations Directors share the responsibility to implement this policy.

A critical deficiency is defined as the existence of a bridge or bridge-related condition that is hazardous and requires *immediate* corrective or protective action to safeguard the traveling public. This is comparable to the definition of "critical finding" in §650.305 of the NBIS.

A structural or safety related deficiency that requires immediate action to ensure public safety.

Bridge inspectors and the authority responsible for maintaining the bridge (responsible authority) must follow this procedure for bridges with critical deficiencies.

See DOT&PF Policy and Procedure 07.05.060.

26.5.3. Scour

Scour is the movement of channel bed material by the action of the moving water, and it has been the leading cause of bridge failures. This movement may result in degradation, or erosion of material or aggradation, or accumulation of material. Degradation of the channel bed may lead to structure instability, posing an often unseen threat to safety. Scour is generally most severe during periods of high flow. When flows recede to normal levels, the presence of scour is often hidden by silt or debris, making detection difficult.

All routine and underwater inspections include an evaluation of substructure/foundation exposure including the assessment of any foundation undermining found during the inspection. Often foundation undermining can only be found or assessed using divers. Record this evaluation under Item 60 of the NBI.

All routine and underwater inspections also include an evaluation of the waterway beneath and adjacent to the bridge. This evaluation includes an assessment of channel scour in the vertical orientation and channel embankment erosion/lateral channel migration in the horizontal orientation. The evaluation also assesses vegetation intrusion and channel bottom material aggradation adjacent to the bridge, and the effectiveness of channel embankment protective measures (e.g., riprap, slope pavement).

Non-State-Owned Bridges

The Bridge Section sends correspondence to local agencies and other state agencies identifying scour-critical bridges that they own and for which they have maintenance responsibility. The correspondence includes a brief explanation of scour critical, why the bridge is considered scour critical, and possible consequences of being scour critical. DOT&PF notifies the owners of their responsibility to take appropriate actions to address their scour-critical bridge(s). An offer is made to provide information on bridge scour and a summary of possible scour countermeasure options.

The Bridge Section maintains a suspense file mechanism to track and periodically send follow-up correspondence to non-DOT&PF bridge owners notifying them of their bridge scour vulnerabilities and requesting their scour plans of action. The Regional Director is copied on all correspondence.

26.5.4. Bridge Instrumentation Program

The purpose of the bridge instrumentation program is to better understand the shear and moments in existing bridges through a more accurate characterization of transverse live-load distribution than that reflected in the tabulated distribution factors. Revised load ratings are calculated using these observed distributions.

26.5.5. Special Bridge Inspection Practices

See Appendix 26.A for chloride deck testing procedure, deck delamination mapping procedure, rocker bearing special inspection procedure, and supplemental rating guidelines.

26.6. Bridge Inspection and Inventory Procedures

26.6.1. Bridge Inspection Document Filing

File original bridge inspection reports in the files located in the "Vault" at the front of the office with the following exceptions.

Bridge Inspection Reports

When hard copy reports are large, place a copy of the cover sheet in the bridge file in the vault with instructions indicating where the complete report is stored. Place electronic copies of all bridge inspection reports in the appropriate bridge file in the Bridge Section "e-vault."

Hydraulic Information

File flood inspection reports in the bridge file(s) in the vault. Flood data may be included in flood inspection reports by state or USGS personnel and are stored in the hard copy bridge folder, e-vault, hard copy hydraulic files, or the "hydro" folder within the Statewide Division's server network.

Waterway adequacy is noted in the SI&A sheets, which are included as part of routine bridge inspection reports.

Channel cross sections are included in routine and scour inspection reports.

File underwater inspection reports in the bridge file in the vault, and file an electronic copy in the e-vault.

File scour data, scour assessments, and USGS hydraulic related reports in the hydraulic files.

The DOT&PF scour Plan of Action (POA) is located in the "hydro" folder within the Statewide Division's server network and maintained by the Bridge Section hydraulic staff.

26.6.2. Scheduling

Section 26.4 presents the frequencies for bridge inspections as required by NBIS. Table 26-1 presents the specific months that DOT&PF schedules routine bridge inspections for locations and even and odd years. Inspection year and month for fracture critical member and underwater inspections are in contained master lists maintained by the Bridge Management Unit.

26.6.3. Office Pre-Inspection Procedures

The team leader should perform the following office procedures to prepare for the bridge inspection:

Preparation

Review previous bridge inspection reports to identify items requiring special equipment or emphasis.

Equipment

Coordinate all equipment checkouts with the Bridge Inspection Manager.

Determine the inspection equipment that will be needed for the group of bridges that will be inspected and where this equipment is located. Refer to the standard equipment checkout list.

Make the necessary arrangements to relocate the equipment to where it is needed.

Make arrangements for NDE examination and traffic control if applicable.

Where needed, secure the hydraulic equipment (e.g., boogie board, truck-mounted sounding equipment).

Verify that the laptop has the appropriate inspection programs and data.

Coordination

Where possible, notify local agency owners of scheduled inspection dates.

Coordinate inspections on the Yukon River with the Bridge Inspection Manager and Alyeska. Contact Alyeska Security (907-451-5827) and Pump Station 6 (907-787-4606) a minimum of six weeks in advance of the inspection.

Visit local M&O facilities to get local observations and insights regarding local bridges.

Table 26-1
Schedule for Routine Inspections

	Even Year Inspection Trips	Month
1	Alaska Highway	July
2	Aleutians, Kodiak	September
3	Cordova	September
4	Dalton Highway	July
5	Elliott/Steese Highway	August
6	Fairbanks	August
7	Haines,Skagway, Yakutat, Hoonah	May
8	Matsu	June
9	Nome	August
10	North Parks Highway	July
11	South Parks Highway	June
12	Western Outlying	July

	Odd Year Inspection Trips	Month
1	Anchorage	August
2	Denali, North Richardson	July
3	Glenn Highway	July
4	Juneau	June
5	Ketchikan, Hyder	June
6	North Seward, Whittier	June
7	Prince of Wales	July
8	Sitka, Gustavus, Petersburg, Wrangell, Kake	May
9	South Richardson	August
10	South Seward, Chenega	August
11	Sterling Highway	August
12	Tok Cutoff, Taylor Highway	July

Railroad. DOT&PF must coordinate with the Alaska Railroad Corporation (ARRC) when its inspection team will be working within 20 feet of the centerline of tracks or when an under bridge inspection vehicle is working over tracks. If necessary, contact AARC Chief Dispatcher (907-265-2421) a minimum of two weeks in advance of the inspection.

Railroad Bridges over Public Roads. Take vertical clearance measurements. If damage is observed, contact the AKRR Chief Dispatcher (907-265-2421) or General Supervisor for Bridges and Buildings (907-265-2541).

Access Keys. The bridge inspector will need to acquire the keys to access fenced areas of bridges or inside of box girders. For DOT&PF-owned bridges, this will be the local maintenance station; for locally owned bridges, this will be the local agency.

Where necessary, coordinate with local maintenance stations for transportation.

26.6.4. Field Inspection Procedures

The following are recommended field procedures for inspections with specialized access equipment or traffic control:

1. **Safety Briefing.** When non-DOT&PF personnel are present, brief them on DOT&PF safety requirements before starting the inspection. Do not proceed with any inspection without the proper personnel being present and having received a safety briefing.

2. **Inspection Plan Review.** Examine the detailed inspection plan to determine where to position equipment. Modify the inspection plan by noting the location of piers, abutment slopes, and any other obstructions under the bridge.
3. **Equipment Check.** Verify that the necessary equipment has been assembled and is on site.
4. **Traffic Control.** The team leader is responsible for obtaining an approved Traffic Control Plan.

Bridge-specific inspection procedures, if applicable, are located in the inspection report, bridge file, or both for the subject bridge and inspection type.

Complex bridge inspection procedures for inspection types occurring on a frequency greater than 5 years should be reviewed prior to the inspection to ensure that the most current procedures are used.

Bridge Inspection Safety Task Analysis

See Appendix 26.C.

26.6.5. Office Post-Inspection Procedures

Return all inspection equipment to the Bridge Inspection Manager immediately upon returning to the office. Return the laptop to the database manager. Notify the inspection and/or database manager of any equipment or computer problems. Notify the Bridge Management Engineer or Chief Bridge Engineer of any significant findings or issues encountered during the inspection trip.

26.6.6. Inspection Reporting Procedures

§650.313 presents the NBIS bridge inspection reporting procedures. The following sections present specific DOT&PF reporting procedures for the Alaska Bridge Inspection Program.

Report Preparation

The bridge inspection report incorporates the results of the NBI inspection and element inspection comments and serves as the permanent inspection record. This report portrays the condition of the bridge as it relates to public safety and is used for future rehabilitation and replacement decisions. Therefore, it is imperative that the report presents accurate and thorough information. Reports should include photographs, sketches, addenda, etc., as necessary to adequately and thoroughly document the condition of the structure but also be as concise as possible. Include only information that is necessary to communicate the nature of the structure's condition.

Review and Processing

Use the following for processing bridge inspection reports developed by state personnel:

1. **Field Notes.** Field notes should be reviewed at the inspection site for completeness and accuracy.
2. **Data Entry.** With few exceptions, the TL or Inspection Assistant will enter the bridge inspection data into the appropriate computer program while at the bridge site.
3. **Draft.** The Bridge Management Unit prints draft reports, which are reviewed both by the TL and Inspection Assistant for completeness and accuracy. Rectify all errors and omissions.
4. **QC Review.** The Program Manager or a designee will review all reports generated.
5. **Corrections.** The draft reports are returned to the TL for corrections, which will be revised as necessary.
6. **Final Report.** The Bridge Management Unit prints final corrected reports. The TL and Inspection Assistant initial corrected final reports.
7. **Distribution and Filing.** The Bridge Management Unit copies and distributes final reports. One copy will be filed in the DOT&PF bridge inventory files and e-vault with two copies distributed to the Regional Director or the owner.

Submittal Time Requirements

§650.315(b) of the NBIS stipulates that states have 90 days following the date of inspection for state-owned bridges (180 days for non-state-owned bridges) to update the state bridge inventory. This is required following a field inspection, or at any other time that there is a bridge modification that alters previously recorded data. §650.315(c) of the NBIS stipulates that states have 90 days following the completion of work for new state-owned bridges (180 days for non-state-owned bridges) to update the state bridge inventory. NBIS inventory dates are completed when the TL enters inspection report corrections into BrM.

26.6.7. Bridge Inventory

Definitions

§650.315 (a) of the NBIS requires states to prepare and maintain an inventory of all bridges subject to the NBIS. The following definitions apply:

National Bridge Inventory (NBI): The aggregation of structure inventory and appraisal data collected to fulfill the requirements of the National Bridge Inspection Standards.

National Bridge Inventory Record: Data that has been coded according to the FHWA *Recording and Coding Guide* for each structure carrying a highway.

Structure Inventory and Appraisal Sheet: The report of data recorded and stored for each NBI record in accordance with the FHWA *Recording and Coding Guide*.

NBI Data Reporting

The state annually submits the NBI data to FHWA. The submission to FHWA is typically due by March 31 of each year.

Bridge Inventory Report

The Bridge Management Unit periodically prepares a bridge inventory report for all publicly owned bridges in the state of Alaska that are not owned by the federal government. The report summarizes the structural, dimensional, and location data for bridges and culverts that are biennially inspected by the Bridge Section. See the DOT&PF Bridge Section website.

26.7. Bridge Quality Control/Quality Assurance

§650.305 of the NBIS defines quality assurance (QA) as:

"The use of sampling and other measures to assure the adequacy of quality control procedures in order to verify or measure the quality level of the entire bridge inspection and load rating program."

and quality control (QC) as:

"Procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level."

§650.307(e)(6) requires that a state DOT perform QC and QA procedures.

See Appendix 26.D for DOT&PF QC/QA procedures.

26.8. Federal Tunnel Inspection Program

Alaska has four tunnels on public roads and streets excluding federally owned tunnels.

Tunnels are designed and constructed with the intent of providing a safe structure and, in general, a long service life. DOT&PF uses stringent design criteria and construction specifications to accomplish this objective. Nevertheless, all structural elements deteriorate over time, sometimes prematurely and if left unchecked, will become deficient.

26.8.1. National Tunnel Inspection Standards

In 2015, the FAST Act established the National Tunnel Inspection Standards (NTIS) (23 CFR Part 650 Subpart E), creating a nationwide tunnel inspection and inventory program. The Federal Highway Administration has promulgated regulations to establish the specific criteria that each state transportation department must meet, i.e. state DOTs are responsible for proper NTIS safety inspection and evaluation for all public tunnels located within geographic boundaries of the state but not within federal lands.

Primary Elements

The following summarizes the primary elements of the National Tunnel Inspection Standards:

- NTIS requires the periodic inspection of all highway tunnels located on public roads and open to public travel. The NTIS (§650.505) defines a tunnel as:

  "[A]n 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."

- NTIS establishes the basic requirements for each component of a state DOT tunnel inspection program.

26.8.2. National References

AASHTO and FHWA have developed several references at the national level for the implementation of the NBIS.

FHWA *Tunnel Operations, Maintenance, Inspection, and Evaluation Manual*

The FHWA *Tunnel Operations, Maintenance, Inspection, and Evaluation Manual* (TOMIE) serves as a standard and provides uniformity in the procedures and policies for determining the physical condition, typical operations and personnel, maintenance needs, and load capacity of highway tunnels in the United States. This publication establishes inspection procedures and load rating practices that meet the NTIS.

FHWA *Specifications for the National Tunnel Inventory*

The FHWA *Specifications for the National Tunnel Inventory (SNTI)* is used with the TOMIE to inspect and collect data on highway tunnels. State DOTs use the SNTI when entering specific data items in the National Tunnel Inventory database. The NTI data is used to prepare legislatively required reports to Congress.

FHWA mandates the submission of tunnel inventory data to FHWA in a standardized format as required by NTIS. Therefore, DOT&PF has adopted the conventions, terminology, etc., within the SNTI for the collection, recording, and reporting of tunnel inspection data.

26.9. Alaska Tunnel Inspection Program

The Alaska Tunnel Inspection Program represents DOT&PF's implementation of the National Tunnel Inspection Standards for all public tunnels in the state of Alaska not owned by federal agencies and incorporates data collection to support the state's bridge management system.

Sections 26.9 through 26.12 discuss specific procedures and criteria adopted by DOT&PF for its implementation of the Alaska Tunnel Inspection Program. It is the policy of DOT&PF that the provisions for tunnel safety inspection and evaluation in this *Manual* meet or exceed the minimum NTIS standards and related FHWA policy.

26.9.1. Coding Tunnel Inspection Data

FHWA has developed rating systems to aid tunnel inspections. The primary rating system currently in use is the National Tunnel Inventory rating system, which promotes uniformity for rating the structural condition of a tunnel.

National Tunnel Inventory Inspection

The tunnel inspector collects NTI data in accordance with the FHWA *Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual*. An element level inspection identifies each tunnel component as a separate element, based not only upon function but also material type, and it evaluates each element by sub-dividing its total quantity into different "condition states," or states of physical deterioration or damage. The *SNTI* describes the tunnel element-based rating system.

In an element level inspection, each tunnel element has an element number and a standard description. The total quantity for each element is then sub-divided among the available condition states, where condition state 1 indicates the best possible condition. The tunnel inspector supplements the quantitative condition states with narrative descriptions of their observations. Repair recommendations are presented as "work candidates."

The element level rating system incorporates data that, over time, can be used to estimate deterioration rates based on the structural material and the tunnel environment. This allows the Department to schedule preventive and corrective actions more uniformly, predict future tunnel conditions, and estimate necessary funding to maintain a desired tunnel condition. In this way, DOT&PF can make informed decisions to optimize the expenditure of funds and to determine when to take action and what type of action to take.

26.10. Responsibilities/Qualifications for Tunnel Inspection

26.10.1. DOT&PF Bridge Management Unit (§650.507)

The Bridge Management Unit is responsible for:

- ensuring that all tunnels subject to the NTIS (excluding federally owned tunnels) are inspected and load rated
- developing statewide inspection and load rating policies
- maintaining a registry of nationally certified tunnel inspectors who perform the duties of a tunnel team leader in the state
- supporting tunnel asset management.

26.10.2. Qualifications of Personnel (§650.509)

Bridge Management Engineer

The Bridge Management Engineer serves as the Program Manager (PM) for implementing National Tunnel Inspection Standards. The PM meets NTIS qualification requirements. The PM is defined under §650.505 as:

"[T]he 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."

The PM ensures that DOT&PF complies with federal regulations and directives for structure inspection, load rating, and inventory maintenance.

The responsibilities of the PM include:

- Oversee Alaska Tunnel Inspection Program including quality assurance and quality control reviews.
- Review proposals from consultants or contractors to supplement DOT&PF staff, as needed, to perform specialized inspection, testing, or repair. Recommend selected firm and monitors contract performance.
- Recommend coordination actions with federal, state, and local governmental agencies.
- Recommend load posting and tunnel closures.
- Develop, monitor, and update training for state and consultant inspectors.
- Analyze federal and state legislation, administrative rules, and national and industry standards, and recommends implementation into DOT&PF programs and policies.
- Assist in emergency response (e.g., earthquakes, major tunnel damage, tunnel failures).
- Assist applicable DOT&PF staff in determining appropriate maintenance or repair actions.

Bridge Inspection Manager

The Bridge Inspection Manager assists the Bridge Management Engineer in fulfilling the responsibilities of the Program Manager including the day-to-day management for the Alaska Tunnel Inspection Program.

Load Rating Manager

The PM serves as the Load Rating Manager through direct supervision of the individuals who are responsible for calculating tunnel inventory and operating ratings, recommending the load posting for existing tunnels, and analyzing overweight vehicles for operating permit purposes. §650.509(c) of the NTIS states that:

"Load ratings shall be performed by, or under the direct supervision of, a registered Professional Engineer."

See Chapter 27 for DOT&PF policies, procedures, and practices related to the responsibilities of the Load Rating Manager.

Team Leader

All inspection team leaders meet the NTIS qualification requirements and are on-site during field inspections. Team leaders are responsible for reports completed under their direction. §650.505 of the NTIS defines the TL as the:

"[T]he on-site individual in charge of an inspection team responsible for planning, preparing, performing, and reporting on tunnel inspections."

§650.509(b) of the NTIS identifies the qualifications of the TL.

Refresher Training

The PM and all TLs must attend 18 hours of FHWA-approved tunnel inspection refresher training over each 60-month period.

26.10.3. Region Offices

Each regional office has a Maintenance and Operational Director who oversees the maintenance operations in that region. This Director is the primary contact for coordination between the regional office and the Bridge Management Unit for the Alaska Tunnel Inspection Program. Regional office involvement in the Program includes the following:

- The region may provide assistance during the tunnel inspection as requested by the Bridge Inspection Manager.
- Copies of all tunnel inspection reports for state-owned tunnels are sent to the appropriate Regional Director.
- The region performs tunnel maintenance activities identified in the tunnel inspection reports.
- When necessary, the region provides an equipment operator and traffic control personnel.
- The region reviews and approves the Traffic Control Plan prepared by the Bridge Management Unit.
- Regional personnel may perform initial damage inspections following vehicle impacts, earthquakes, etc.

Tunnel Operations

The Anton Anderson Memorial Tunnel (AAMT) and Portage Lake Tunnel (PLT) are operated by a contractor under the supervision of Central Region staff. The AAMT is also a dual use highway and railroad tunnel, with jurisdiction shared between the DOT&PF and the Alaska Railroad Corporation. Operations staff frequently inspect tunnel systems and structural elements and develop their own work items separately from NTIS requirements.

26.10.4. Consultant Program

When the state chooses to retain consultants, they are an extension of DOT&PF staff for the implementation of the Alaska Tunnel Inspection Program.

During a field inspection, consultant employees must represent DOT&PF professionally in their interface with the public. Typical examples where consultants are retained are:

- routine inspections,
- in-depth inspections
- special inspections, and
- specialized load ratings.

For consultant inspections, the DOT&PF assembles a term agreement or RFP, which presents the specifics of the consultant scope of work.

Operational Issues

In general, consultants must comply with all DOT&PF requirements in implementing the Alaska Tunnel Inspection Program. The following discusses a few specific issues:

4. **Engineer in Charge (EIC)**. The EIC is a professional civil engineer registered in the state of Alaska and meets the NTIS team leader requirements and additional time requirements in overall management of the consultant's project.

5. **AAMT and PLT**. All inspection activities at the AAMT and PLT must be conducted with strict communication between tunnel operations staff and inspection personnel. Prior to inspecting these facilities, consultants should discuss inspection scheduling, any potential safety concerns, ongoing construction work in the tunnels, and maintenance items identified in the time since the previous NTI inspection.

   The AAMT is a complex tunnel and the EIC for this inspection must meet the requirements for complex tunnel team leaders outlined in §650.509(b)(4).

6. **Submission of Reports**. A professional engineer registered in the state of Alaska must sign and seal final consultant tunnel inspection reports prior to submittal to DOT&PF.

7. **DOT&PF QA Review**. The PM or his designated representative will review all tunnel inspection reports submitted by consultants for quality, spelling, photograph labeling, completeness, and accuracy. The nature of the DOT&PF review is a quality assurance review, not an "approval."

8. **Load Ratings**. A professional engineer registered in the state of Alaska must sign and seal final consultant prepared load ratings.

26.11. Types of Tunnel Inspections and Frequencies

26.11.1. General

The following identifies two general parameters for tunnel inspections:

1. **Inspection References.** §650.513(a) of the NTIS requires that each state DOT:

   "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)."

2. **Inspection Team Composition.** Initial, routine, in-depth, damage, and special inspections must have at least one qualified inspection team leader. The minimum crew size is typically two, including the TL.

26.11.2. Safety

During inspections, evaluate traffic and pedestrian safety features in addition to structural, geotechnical, mechanical, electrical, and/or fire safety items. Provide special attention to the condition of railings, pedestrian fencing, guardrail, sidewalks, etc. The following are some examples of conditions that may warrant documentation in the tunnel inspection report:

- tripping hazards, severe approach roadway settlements, or large spalls on sidewalks
- rebar protruding from walks, or parapets
- loose, missing or damaged railings, or parapets
- missing or damaged guardrail
- any other condition that the inspector perceives as a threat to public safety.

If these conditions are observed during any tunnel inspection, they should be documented. See DOT&PF Policy and Procedure 07.05.060 for further information.

26.11.3. Initial Inspections

§650.505 of the NTIS defines the initial inspection as:

"[T]he 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."

An initial inspection is the baseline inspection that must be completed for every new structure before it can be entered into the Alaska Tunnel Inventory. An initial inspection is a fully documented inspection, using the tunnel plans, to determine basic data for a specific structure for entry into the file.

The team leader conducting the inspection must verify quantities and dimensions and must collect the data for the Structure Inventory and Appraisal (SI&A) as required by FHWA regulations.

Initial inspections are also used when a structure, such as a large diameter corrugated metal pipe, is moved from the bridge inventory into the tunnel inventory. These inspections are also performed when the configuration or geometry of a structure changes, when structural improvements are made that alter previously recorded data (e.g., rehabilitation), or functional systems are altered.

In addition to verifying dimensions and quantities, collect all data required for a routine inspection.

26.11.4. Routine Inspections

§650.505 defines a routine inspection as:

"[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 inspections are generally conducted from the ground or manlifts. Inspect the critical load-carrying elements and function systems and closely examine any element that appears distressed. DOT&PF performs routine inspections on a 24-month interval during the assigned month, except as defined below.

The inspection team should take the necessary photographs to visually document the critical aspects of the inspection.

Reduced Inspection Interval

Additional inspections may be required to monitor excessive deterioration or other potentially serious conditions. In such circumstances, the Bridge Management Engineer will determine if a special inspection will be conducted at an appropriately determined interval, as outlined in Subsection 26.11.6, or if a reduced inspection interval is more appropriate. Such routine inspection intervals are determined on a

case-by-case basis by the Bridge Management Engineer.

Extended Routine Inspection Interval

Tunnels in Alaska in satisfactory or better condition commonly exhibit only minimal deterioration and infrequently require only minor maintenance. Therefore, these structures are deemed to have a minimal risk of failure.

A tunnel may be inspected on a 48-month interval during the assigned month if it meets the following criteria:

- The tunnel is not complex.
- The does not have any rockfall hazards either within the tunnel or in the vicinity of its portals.
- The inventory rating factors are greater than 1.0.
- The minimum vertical clearance for vehicular traffic traveling through the tunnel is greater than 17 feet.

Other items that will be considered are tunnel age, time from the last major rehabilitation, and known deficiencies that may impact tunnel operations.

26.11.5. In-Depth Inspections

§650.505 defines an in-depth inspection as:

"[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 bridge specific inspection procedures."

The Bridge Management Engineer determines the need and interval for in-depth inspections. If follow-up inspections are needed with a interval of 24 months or less, then the in-depth inspection becomes a special inspection. A routine inspection often identifies conditions that prompt an in-depth inspection. These include:

- need for specialized access,
- need for special inspection/testing techniques and equipment, and
- need for increased inspection of an element.

NTI and element condition data are collected for the members or functional systems inspected during in-depth inspections. Each element or functional system under investigation should be within arm's reach of the inspector. The Bridge Management Engineer determines if non-destructive evaluation (NDE) tests and/or other material tests are required.

In-depth inspections may also consist of:

- sounding of concrete elements to determine the limits of delamination/deterioration;
- connection inspections (bolts, rivets, welds) to identify failing welds/rivets and loose/failing bolts;
- remaining section measurements (as practical) for steel elements; and
- inspection of paints or finishes and other miscellaneous structural elements.

Thoroughly document the activities, procedures, and findings of in-depth inspections with the appropriate photographs, a location plan of deficiencies, test results, measurements, and a written report. Enter any changes in the condition of the structure into the tunnel inspection report, and document any maintenance recommendations.

If a tunnel element condition is sufficiently severe, collect sufficient information to load rate the tunnel. This inspection data can also be used to develop repair/rehabilitation plans for the tunnel.

26.11.6. Special Inspections

§650.505 defines a special inspection as:

An inspection scheduled at the discretion of the tunnel owner, used to monitor a particular known or suspected deficiency.

The Bridge Management Engineer determines the need and interval for special inspections. A special inspection may be scheduled when a tunnel requires more frequent inspections than is provided by the routine inspection cycle. A special inspection is typically used to monitor issues that are sufficiently severe to warrant heightened scrutiny, such as foundation settlement, rockfall, member conditions, and functional system conditions.

NTI and element condition data are collected for the members inspected during special inspections.

26.11.7. Damage Inspection

§650.505 references §650.305, which defines a damage inspection as an *"unscheduled inspection to*

assess structural damage resulting from environmental factors or human actions."

Common examples of events that may require a damage inspection include earthquakes, vehicular impacts, fire damage, and large rockfall events. The Bridge Management Engineer determines the need for damage inspections.

The scope of the inspection must be sufficient to determine the need for emergency restrictions or closure of the tunnel to traffic and to assess the level of effort necessary to implement a repair. The level of effort for a damage inspection can vary significantly and depends on the severity of the damage.

The damage inspection is often followed by an in-depth inspection to better document the extent of damage and the urgency and scope of repairs. Follow-up activities include proper documentation, verification of field measurements and calculations and, perhaps, a more refined analysis to establish or adjust interim load restrictions.

26.12. Tunnel Inspection Procedures

See Appendix 26.D for tunnel QC/QA Procedures.

Tunnel inspections are completed in April.

Complete the inspection of the Anton Anderson Memorial Tunnel at times when it is controlled by the DOT&PF. No ARRC permits should be required while working during this time.

26.12.1. Tunnel Inventory

Definitions

§650.515(b) of the NTIS requires states to prepare and maintain an inventory of all tunnels subject to the NTIS. The following definitions apply:

National Tunnel Inventory: The aggregation of structure inventory and appraisal data collected to fulfill the requirements of the National Tunnel Inspection Standards.

National Tunnel Inventory Record: Data that has been coded according to the SNTI for each structure carrying a highway.

Structure Inventory and Appraisal (SI&A): The report of data recorded and stored for each NTI record in accordance with the SNTI.

NTI Data Reporting

The state annually submits the NTI data to FHWA. The submission to FHWA is typically due by March 31 of each year.

26.12.2. Tunnel Quality Control/Quality Assurance

§650.505 of the NTIS define quality assurance (QA) as:

"the use of sampling and other measures to assure the adequacy of quality control procedures in order to verify or measure the quality level of the entire tunnel inspection and load rating program."

Quality control (QC) is defined as:

"the procedures that are intended to maintain the quality of a tunnel inspection and load rating at or above a specified level."

§650.513(i) requires that a state DOT, *"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."*

Appendix 26.A
Special Bridge Inspection Practices

26.A.1 Chloride Deck Testing Procedure

1. Setup traffic control.
2. Chain drag deck, sketch delaminations and spalls, and select test hole locations with pachometer.
3. Follow procedures per *Federal-Aid Highway Program Manual* and "SHRP."
   - Collect 1 sample every 500 sq ft (min.) but not less than 10 per structure.
4. Remove surface contaminants: Drill a ¼-inch deep hole with a 1¼-inch diameter drill bit.
5. Clean concrete dust from drill site with compressed air.
6. Place wind shield (cardboard box) around drill site.
7. Drill a 1-inch deep hole with a 1¼-inch diameter drill bit.
8. Collect sample with plastic sundae spoon into a vial and label (5 grams min.).
9. Clean concrete dust from drill site and bit with compressed air and clean spoon.
10. Measure depth of sample hole and record.
11. Drill another ½-inch to 1-inch more with a 1-inch diameter drill bit in the same hole.
12. Collect sample (5 grams min.) with plastic sundae spoon into a vial and label.
13. Clean concrete dust from drill site with compressed air.
14. Measure depth of sample hole and record.
15. Mix cementitious material and fill test holes.
16. Change traffic control in opposite lane.
17. Send sample vials to a testing laboratory, such as:

    CTL Group
    5400 Old Orchard Road, Dock B
    Skokie, IL 60077-1030

Equipment List (alphabetically):

- Chain drag
- Compressed air
- Ear plugs & eye protection
- Drill bits
- Data collection sheet
- Generator
- Measuring tapes
- Mixing bucket
- Paint sticks & cans
- Pencils & felt-tip markers
- Rebar locator (Pachometer)
- Rite-in-the Rain book
- Rotary hammer
- Set 45
- Spoon(s) (less than 1-inch diameter)
- Traffic control
- Vials, 40 dram size or larger, locking caps
- Wind shield (bottomless packing box)
- Water

26.A.2 Deck Delamination Mapping Procedure

1. Setup traffic control.
2. Chain drag dry deck.
3. Identify delaminated concrete, patch repairs, exposed reinforcing steel, and spalls by using colored spray paint for each area.
4. Measure the length and width of each area.
5. Map out and establish an identification key by lane and span.

Record the following to the nearest 5 feet:

- Total deck surface area to the nearest square foot.
- Total exposed reinforcing steel length.
- Estimated deck surface area of spalls.
- Estimated deck surface are of sound patches.
- Estimated deck surface area of unsound patches.
- Estimated deck surface area of delaminated concrete.
- Estimated defective areas per span using a span-by-span, lane-by-lane table such as below:

Sample Table of a Lane

SPAN	1	2	3	4	5	6	7	Total
Spalls (SF)	150	100	100	150	150	30	20	400
Sound Patch (SF)	50	40	30	60	50	10	5	250
Unsound Patch (SF)	5	0	5	5	5	—	—	20
Delaminations (SF)	100	40	50	100	50	10	20	400
Exposed Rebar (FT)	40	20	60	60	100	—	—	300
Remainder (SF)	2100	2250	2250	2120	2130	2380	2370	15,950

Additional notes (example):

- ***Note:*** *Over one-half of the deck damage is located in the wheel tracks.*

Equipment List (alphabetically):

- Chain drag
- Measuring tape
- Measuring wheel
- Paint roller sticks and spray cans
- Pencils and felt-tip markers
- Rite-in-the-Rain book
- Traffic control devices

26.A.3 Rocker Bearing Special Inspection Procedure

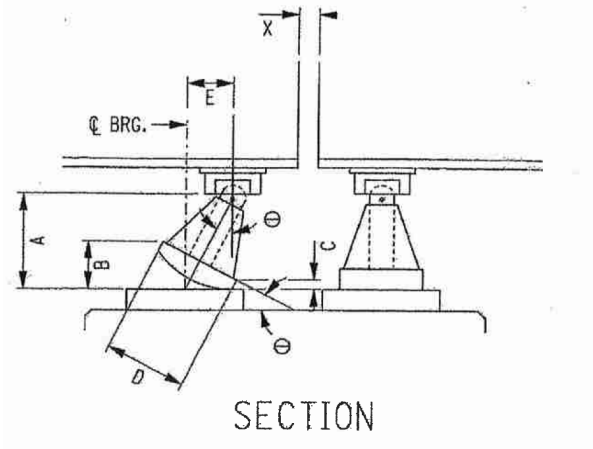
The inspection of rocker bearings is intended to ensure their stability. Compromised (i.e., tipping) bearings could become unstable with relatively small additional deformation or tipping. Use the following procedure to inspect rocker bearings:

1. **Inspection.**

   - Clean dirt and debris off the bearings.
   - Measure tilt of rocker bearings:
     - Hang a plumb bob for reference.
     - Place folding ruler for scale.
     - Mark superstructure for location.
     - Position camera a fixed distance from bearing. Use a 2-foot distance.
     - Take picture with camera the same height as the center of the pin.

2. **Evaluation.** Measure the angle of rotation graphically on the photographs and evaluate. Determine if the vertical line of force is in the middle half of "D" (rocker bearing width). Determine the following:

   - If the vertical line of force is within the middle half of "D," then the bearing is acceptable.
   - If the vertical line of force is outside the middle half of "D," then additional evaluation is necessary.



26.A.4 FHWA Supplemental Rating Guidelines

The following guidelines have been developed as a training guide for the condition rating of a variety of structural elements. They are suggested as a supplement to the FHWA *Recording and Coding Guide* to make it easier to assign the most appropriate condition rating.

26.A.4.1 Timber Deck Condition Rating

Code	Description
9	EXCELLENT CONDITION. No noticeable or noteworthy deficiencies that affect the condition of the deck.
8	VERY GOOD CONDITION. No crushing, rotting, or splitting. Tightly secured to floor system.
7	GOOD CONDITION. Minor checking or splitting with a few loose planks.
6	SATISFACTORY CONDITION. Some of planks checked or split but sound. Some loose planks. Fire damage limited to surface scorching with no measureable section loss. Some wet areas noted.
5	FAIR CONDITION. Numerous (30%-40%) planks checked, split, rotted, or crushed. Many planks are loose. Fire damage limited to surface charring with minor, measurable section loss. Some planks (<10%) are in need of replacement.
4	POOR CONDITION. Majority (over 40%) of the planks are rotted, crushed, or split. Fire damage with significant section loss that may reduce the load carrying capacity of the member. Over 10% of the planks are in need of replacement.
3	SERIOUS CONDITION. Severe signs of structural distress are visible. Extensive plank damage evident with reduced deck load carrying capacity.
2	CRITICAL CONDITION. Advanced deterioration with partial deck failure. May be necessary to close bridge until corrective action is taken.
1	"IMMINENT" FAILURE CONDITION. Bridge is closed. Corrective action may put back in light service.
0	FAILED CONDITION. Bridge closed. Deck replacement necessary.

26.A.4.2 Concrete Deck Condition Rating

	Condition Indicators (% deck area)			
Rating	**Spalls**	**Delaminations**	**Electrical Potential**	**Chloride Content (lbs/cy)**
9	None	None	0	0
8	None	None	None > 0.35	None > 1.0
7	None	< 2%	0-5% > 0.35	None > 2.0
6	< 2% spalls or sum of all deteriorated and/or contaminated deck concrete < 20%			
5	< 5% spalls or sum of all deteriorated and/or contaminated deck concrete 20% to 40%			
4	> 5% spalls or sum of all deteriorated and/or contaminated deck concrete 40% to 60%			
3	> 5% spalls or sum of all deteriorated and/or contaminated deck concrete > 60%			
2	Deck structural capacity grossly inadequate			
1	Deck has failed completely; repairable by replacement only.			
0	Holes in deck; danger of other sections of deck failing.			

26.A.4.3 Steel Grid Deck Condition Rating

Code	Description
9	EXCELLENT CONDITION. No noticeable or noteworthy deficiencies that affect the condition of the deck.
8	VERY GOOD CONDITION. Tightly secured to floor system with no rust.
7	GOOD CONDITION. Loose at some locations with minor rusting. A few cracked welds and/or broken grids.
6	SATISFACTORY CONDITION. Moderate rusting evident with indications of initial section loss. Loose at many locations. Some cracked welds and/or broken grids.
5	FAIR CONDITION. Considerable rusting with some areas of minor section loss. Loose at numerous locations. Numerous cracked welds and/or broken grids.
4	POOR CONDITION. Heavy rusting, resulting in considerable section loss and some holes through deck. Many welds cracked and/or girds broken.
3	SERIOUS CONDITION. Severe signs of structural distress are visible. Repair plates missing with some panel replacement necessary.
2	CRITICAL CONDITION. Many holes through deck.
1	“IMMINENT” FAILURE CONDITION. Bridge is closed. Corrective action may put back in light service.
0	FAILED CONDITION. Bridge closed. Deck replacement necessary.

26.A.4.4 Timber Superstructure Condition Rating

Code	Description
9	EXCELLENT CONDITION. New condition.
8	VERY GOOD CONDITION. No noteworthy deficiencies that affect the condition of the superstructure.
7	GOOD CONDITION. Minor decay, cracking, or splitting of beams or stringers at non-critical locations.
6	SATISFACTORY CONDITION. Some decay, cracking, or splitting of beams or stringers. Fire damage limited to surface charring with minor, measureable section loss.
5	FAIR CONDITION. Moderate decay, cracking, splitting, or minor crushing of beams or stringers. Fire damage limited to surface charring with minor, measurable section loss.
4	POOR CONDITION. Extensive decay, cracking, splitting, or crushing of beams or stringers, or significant fire damage. Diminished load carrying capacity of members is evident.
3	SERIOUS CONDITION. Severe decay, cracking, splitting, or crushing of beams or stringers, or major fire damage. Load carrying capacity is substantially reduced. Local failure may be evident.
2	CRITICAL CONDITION. Beam defects noted in Code 3 have resulted in significant local failures. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
1	"IMMINENT" FAILURE CONDITION. Bridge is closed. Corrective action may put back in light service.
0	FAILED CONDITION. Bridge closed. Replacement necessary.

26.A.4.5 Reinforced Concrete Superstructure Condition Rating

Code	Description
9	EXCELLENT CONDITION. New condition.
8	VERY GOOD CONDITION. No noteworthy deficiencies that affect the structural capacity of members.
7	GOOD CONDITION. Some minor problems. Non-structural hairline cracks without disintegration may be evident. Load carrying capacity of structural members unaffected.
6	SATISFACTORY CONDITION. Structural members show some minor deterioration or collision damage. Hairline structural cracks or spalls may be present with evidence of efflorescence. Minor water saturation marks. Generally, reinforcing steel unaffected.
5	FAIR CONDITION. Structural members are generally sound (structural capacity unaffected) but may have evidence of deterioration or disintegration. Numerous hairline structural cracks or spalls may be present with minor section loss of reinforcing steel possible.
4	POOR CONDITION. Extensive disintegration. Measurable structural cracks or large spall areas. Corroded reinforcing steel evident with measurable section loss. Structural capacity of some structural members may be diminished.
3	SERIOUS CONDITION. Serious deterioration and/or disintegration of primary concrete members. Large structural cracks may be evident. Reinforcing steel exposed with advanced stages of corrosion. Local failures or loss of bond possible.
2	CRITICAL CONDITION. Advanced deterioration of primary structural elements. Concrete disintegration around reinforcing steel with loss of bond. Some reinforcing steel may be ineffective due to corrosion or loss of bond. Numerous large structural cracks may be present. Localized failures of bearing areas may exist. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
1	“IMMINENT” FAILURE CONDITION. Bridge is closed to traffic. Major deterioration or section loss present on primary structural elements, obvious vertical or horizontal movement is affecting the structure’s stability. Corrective action may put back in light service.
0	FAILED CONDITION. Bridge is closed: out of service. Beyond corrective action: replacement necessary.

26.A.4.6 Prestressed Concrete Superstructure Condition Rating

Code	Description
9	EXCELLENT CONDITION. New condition.
8	VERY GOOD CONDITION. No problems noted.
7	GOOD CONDITION. Non-structural cracks less than 0.015 inch in width may be evident. No rust stains apparent.
6	SATISFACTORY CONDITION. Minor concrete damage or deterioration. Non-structural cracks over 0.015 inch. Isolated and minor exposure of mild steel reinforcement may be present.
5	FAIR CONDITION. Isolated and minor exposure of prestressing stands may be present. Structural cracks with little or no rust staining. Primary members sound, but may be cracked or spalled.
4	POOR CONDITION. Moderate damage or deterioration to concrete portions of the member exposing reinforcing bars or prestressing strands. Possible bond loss. Structural cracks with medium to heavy rust staining may be present. May be loss of camber.
3	SERIOUS CONDITION. Severe damage to concrete and reinforcing elements of the member. Severed prestressing strand(s) or strand(s) are visibly deformed. Major or total loss of concrete section in bottom flange. Major loss of concrete section in the web, but not occurring at the same location as concrete section loss in the bottom flange. Horizontal misalignment to member or negative camber. Unless closely monitored, it may be necessary to restrict or close the bridge until corrective action is taken.
2	CRITICAL CONDITION. Critical damage to concrete and reinforcing elements of member. This damage may consist of one or more of the following: • Cracks extend across the bottom flange or in the web directly above the bottom flange damage that are not closed below the surface damage. (This indicates that the prestressing strands have exceeded yield strength.) • An abrupt lateral offset as measured along the bottom flange or lateral distortion of exposed prestressing strands. (This also indicates that the prestressing strands have exceeded yield strength.) • Loss of prestress force to the extent that calculations show that repair cannot be made. • Excessive vertical misalignment. • Longitudinal cracks at the interface of the web and the top flange that are not substantially closed below the surface damage. (This indicates permanent deformation of stirrups.)
1	"IMMINENT" FAILURE CONDITION. Critical damage requiring the replacement of a member. Bridge is closed to traffic and installation of temporary falsework to safeguard the public and the bridge should be taken at the time of the inspection.
0	FAILED CONDITION. Bridge closed and out of service.

26.A.4.7 Steel Superstructure Condition Rating

Code	Description
9	EXCELLENT CONDITION. New condition.
8	VERY GOOD CONDITION. No noticeable or noteworthy deficiencies that affect the condition of the superstructure.
7	GOOD CONDITION. Some rust may be evident without any section loss.
6	SATISFACTORY CONDITION. Rusting evident, but with minor section loss (minor pitting, scaling, or flaking) in critical areas.
5	FAIR CONDITION. Moderate section loss in critical areas. Fatigue or out-of-plane distortion cracks may be present in non-critical areas. Hinges may be showing minor corrosion problems.
4	POOR CONDITION. Significant (measurable) section loss in critical areas. Fatigue or out-of-plane distortion cracks may be present in critical areas. Hinges may be frozen from corrosion. Load carrying capacity of structural members affected.
3	SERIOUS CONDITION. Severe section loss or cracking in a critical area. Minor failures may have occurred. Significant weakening of primary members evident.
2	CRITICAL CONDITION. Severe section loss in many areas with holes rusted through at numerous locations in critical areas.
1	"IMMINENT" FAILURE CONDITION. Bridge closed. Corrective action may put back in light service.
0	FAILED CONDITION. Bridge closed. Replacement necessary.

26.A.4.8 Substructure Condition Rating

Code	Description
9	EXCELLENT CONDITION. No noticeable or noteworthy deficiencies that affect the condition of the superstructure. Insignificant scrape marks caused by drift or collision.
8	VERY GOOD CONDITION. Shrinkage cracks, light scaling, or insignificant spalling that does not expose reinforcing steel. Insignificant damage caused by drift or collision with no misalignment and not requiring corrective action.
7	GOOD CONDITION. Minor cracking with possible leaching or spalls on concrete or masonry unit with no detrimental effect on bearing area. Leakage of expansion devices have initiated minor cracking. Some rusting of steel without measurable section loss. Insignificant decay, cracking, or splitting of timber. Minor scouring may have occurred.
6	SATISFACTORY CONDITION. Minor deterioration or disintegration, spalls, cracking, and leaching on concrete or masonry units with little or no loss of bearing area. Corrosion of steel section, but no measurable section loss. Some initial decay, cracking, or splitting of timber. Fire damage limited to surface scorching of timber with no measurable section loss. Shallow, local scouring may have occurred near foundation.
5	FAIR CONDITION. Concrete or masonry units may exhibit some section loss with exposed reinforcing steel possible. Measurable, but minor section loss in steel members. Moderate decay, cracking, or splitting of timber; a few secondary members may need replacement. Fire damage limited to surface charring of timber with minor, measurable section loss. Some exposure of timber piles as a result of erosion, reducing the penetration. Scour may be progressive and/or is becoming more prominent with a possibility of exposing top of footing, but no misalignment or settlement noted.
4	POOR CONDITION. Structural cracks and advanced deterioration in concrete and masonry units. Extensive section loss in steel members. Substantial decay, cracking, splitting, or crushing of primary timber members, requiring some replacement. Fire damage with significant section loss of timber that may reduce the load carrying capacity of the member. Extensive exposure of timber piles as a result of erosion, reducing the penetration and affecting the stability of the unit. Additional cross bracing or backfilling is required. Extensive scouring or undermining of footing affecting the stability of the unit and requiring corrective action.
3	SERIOUS CONDITION. Severe disintegration of concrete. Generally, reinforcing steel exposed with advanced stages of corrosion. Severe section loss in critical stress areas. Major fire damage to timber that will substantially reduce the load carrying capacity of the member. Bearing areas seriously deteriorated with considerable loss of bearing. Severe scouring or undermining of footings affecting the stability of the unit. Settlement of the substructure may have occurred. Shoring considered necessary (not just precautionary) to maintain the safety and alignment of the structure.
2	CRITICAL CONDITION. Concrete cap is soft and spalling with reinforcing steel exposed with no bond to the concrete. Top of concrete cap is split or concrete column has undergone shear failure. Structural steel members have critical section loss with holes in the web and/or knife-edge flanges typical. Primary timber members crushed or split and ineffective. Scour is sufficient that substructure is near state of collapse. Pier has settled.
1	"IMMINENT" FAILURE CONDITION. Bridge closed. Corrective action may put back in light service.
0	FAILED CONDITION. Bridge closed. Replacement necessary.

Appendix 26.B
Prestressed Girder Damage and Repair Summary

Bulb Tee Girder Damage and Repair Summary

Bridge Name: Span: *of*

Bridge Number: Girder: **of** **(from LT)**

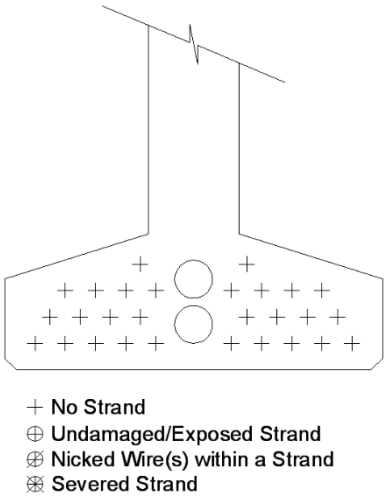
Inspector(s): NE toward:

Damage Summary:

Damage Date:

Damage Location (Start/Stop):

Yes	No	
☐	☐	Straight Strands Damaged (Severed, Wire(s) Broken, Nicked, Pitting)
☐	☐	Harped Strands Damaged (Severed, Wire(s) Broken, Nicked, Pitting)
☐	☐	Stirrups Damaged (Plastically Deformed, Severed)



Notes:

Repair Summary:

Date:

Yes	No	N/A	
☐	☐	☐	Damaged Straight Strands Spliced (show on drawing)
☐	☐	☐	Severed Straight Strands Spliced (show on drawing)
☐	☐	☐	Stirrups repaired

Notes:

NE = Near End; FE = Far End; LT = Left; RT = Right, P = Pier, FB = Floorbeam, G = Girder, S = Span

Appendix 26.C
Bridge Inspection Safety Task Analysis

1. **Preparation.** Review related tasks and safety programs in the *DOT&PF Safety Manual*:

Tasks	Programs (*Manual* Chapter)
Ladders	3.1
Personal Protective Equipment	8.1
Fall Protection	8.3
Confined Space Entry	9.3
Hand Tools (Power and Manual)	14.1

2. **General.**

   - Each inspection team will consist of at least two individuals.
   - Each inspection team will have a first-aid kit readily available.
   - Each inspection team will have capability to notify emergency services by radio, cell phone, or satellite phone.

3. **Traffic Control.** Determine the appropriate traffic control requirements:

   - Where possible, schedule bridge inspections at low traffic periods.
   - On heavily traveled routes and where blind corners lead into a bridge, consider using advance warning signs to alert the traveling public of bridge inspection activities. Place signs as shown in the approved traffic control plans.
   - When approaching a bridge or when parked on the roadside, consider using emergency flashers and strobe light or flashing bars on signal boards.
   - Where possible, to alert drivers of inspection activities, park inspection vehicles behind the traffic rail or off the shoulder as far as possible, yet in a location that maximizes visibility of emergency flashers and strobe light or flashing bars on signal boards.
   - As needed, use traffic cones to alert drivers while inspecting in the shoulder area. Do not place traffic cones inside the fog line.
   - When a lane closure is required, provide traffic control in accordance with an approved traffic control plan.

4. **Potential Hazards.** While inspecting the bridge, be aware of the following potential hazards:

   - Moving traffic.
   - Loose riprap and embankment materials, steep embankments and embankment drop-off, tripping hazards.
   - Overhead hazards including bridge rail posts, girder flanges, drains, and protruding nails.
   - Potential cutting hazards including trash, debris, and exposed metal edges.
   - Locate all utilities on the bridge prior to inspecting. Use caution if there is an observed break in the conduit or protective sheathing.

- Potential insect and animal hazards. Minimize disturbance of bird droppings to avoid exposure to histoplasmosis.

5. **Protective Equipment.** Wear appropriate personal protective equipment consistent with the hazard:

   - Fluorescent vests are required equipment at all times.
   - Fluorescent pants are required equipment during nighttime hours (sunset to sunrise).
   - Use proper fall protection equipment when inspecting from under the bridge unit or aerial platform, and when performing similar activities at heights greater than 6 feet above the ground.
   - Wear hard hats when inspecting from under the bridge unit or aerial platform and around potential head injury hazards.

6. **Confined Spaces.** Adhere to the following procedures when entering confined spaces:

   - An attendant must be present outside the confined space and must be able to communicate with the inspectors using a two-way radio.
   - Follow established lock-out/tag-out procedures.
   - Prior to entering a confined space, test the inside air using a calibrated 4 gas air monitor.
   - If the air is acceptable, then enter keeping the monitor with you. Note air monitor readings and times in report.
   - If the air monitor readings are not acceptable, then do not enter the confined space.
   - Bridges with box-type superstructures are considered a confined space.
   - Deep abutments with limited access are considered a confined space.
   - A culvert is a confined space if one or more of the following are present:
     - Contains or has the potential to contain a hazardous atmosphere.
     - Material blocking safe access through the structure.
     - An internal configuration such that the inspector cannot see from one end to the other.
     - Water depth and/or water current pose a potential hazard.

7. **Culvert Hazards.** Assess culverts for hazards prior to entering. Proceed only if safe. Check based on the confined space criteria.

8. **Stream Cross Sections.** Adhere to the following while taking stream cross sections from the bridge deck:

   - When deemed necessary, while one inspector is taking soundings, the other inspector will be on the bridge deck assisting and acting as a traffic spotter.
   - Do not expose the upper torso out beyond the vertical plane of the railing.
   - Lower the body's center of gravity by kneeling or crouching

9. **Wading and Probing Inspection.** Adhere to the following while performing wading and probing inspections:

   - Prior to entering the water, determine the water depth visually or by measuring from the bridge deck.

- Prior to entering the water, notify another inspection team member. When deemed necessary, wear a life jacket and have the other inspection team member remain in close proximity and continuous visual contact with the person wading.
- Be sure that there is firm footing and a sound bottom. Probe areas as necessary.
- Consider water depth, velocity, and debris present while assessing conditions.
- To avoid becoming stuck, use extreme caution while walking and wading on silty stream banks and tidal mud flats.

10. **Ladder Use.** Review the manufacturer's recommended guidelines for the proper use of ladders.
11. **Traffic Spotter.** When deemed necessary, while one inspector is chain dragging the concrete bridge deck, the other inspector will be on the bridge deck assisting and acting as a traffic spotter.
12. **Hot and Cold Conditions.** Take extra precautions to prevent heat and cold stress when working in hot or cold temperatures.
13. **Removing Paint.** Wear approved respirator and eye protection when removing paint from steel members by chipping, scraping, and wire wheel:
    - Avoid inhaling or ingesting paint debris.
    - Brush paint debris off clothes and wash hands prior to eating.
14. **Vagrants.** Notify local authorities of vagrants under bridges. Inspect the bridge after the individual has been removed or has left the area.
15. **Accident Reports.** Report accidents as directed in Chapter 2.9 of the *DOT&PF Safety Manual*:
    - Immediately contact law enforcement of a vehicle accident with injury or damage exceeding $2,000. Notify the supervisor and regional Safety Officer as soon as possible.
    - Contact OSHA within eight hours of an occupational fatality or hospitalization.
    - Immediately notify the supervisor of employee accidents.
    - Notify Risk Management of property damage accidents.

Appendix 26.D
Inspection Quality Control/Quality Assurance

26.D.1 Inspection Quality Control (QC) Procedures

The following applies:

1. **General Inspection Requirements**

   - All inspection team leaders must meet 23 CFR 650.309 or 23 CFR 650.509 team leader requirements, as applicable. The Program Manager maintains a list of qualified team leaders performing bridge inspections for the state of Alaska.

2. **Inspection Interval**

   Routine, NSTM, special and underwater inspections

   - Complete routine, NSTM, special, and underwater inspections within the identified calendar month. Within 30 days of the inspection team's return to the office, notify the FHWA Alaska Division, Structural Engineer of all occurrences where inspections are not completed within the identified calendar month. Include the following information:
     - structure number and name,
     - reason the bridge could not be inspected, and
     - proposed actions to complete the inspection.

3. **Inspection Findings Which May Affect Load Capacity**

   For all structures with an increase in dead load (typically a change in asphalt wearing surface thickness greater than 1 inch) or a decrease in the deck, superstructure, or substructure NBI or NTIS condition rating to 4 (poor) or lower, the inspector shall:

   - In consultation with the Bridge Inspection Manager, determine if the structure's load rating requires updating and then send an email to the Program Manager and Bridge Inspection Manager discussing the situation.
   - As necessary, load rate the structure to reflect current conditions and provide the load rating to the Bridge Inspection Manager within 60 days of the consultation.

4. **In-House Inspections and Reports**

   - Perform independent review of all inspection reports for quality, spelling, completeness, photograph labeling, and consistency.
   - Inspectors must provide the Program Manager written justification when:
     - changing an NBI or NTI condition rating by two or more,
     - lowering an NBI or NTI condition rating to 4 (poor) or less
     - raising an NBI or NTI condition rating from a 4 (poor) or less

5. **Consultant Inspections and Reports**

   - Perform detailed review of all draft consultant reports for quality, spelling, completeness, photograph labeling, and consistency and provide written comments to consultant. Ensure comments are addressed prior to final report printing.

26.D.2 Inspection Quality Assurance (QA) Procedures

The following applies:

1. **In-House Inspections and Reports**

   - Program Manager shall annually generate a list of structures on which NBI or NTIS condition ratings have changed by two or more or where an NBI or NTI condition rating is lowered to 4 (poor) or less and verify that inspectors have provided written justification for these actions.

   - Program Manager shall annually generate a list of structures on which the component condition ratings have decreased to 4 (poor) or less and verify that the need to update load ratings has been considered.

   - Program Manager shall perform independent review of at least three inspection reports from each routine inspection team and one inspection report from each special inspection team.

   - Program Manager or a designated representative shall periodically as needed perform independent field reviews of routine bridge inspections completed by two inspection teams. The recommended interval for field review of TLs is every 10 years. The field reviews will independently assess the following items on 5% to 10% of the bridges inspected by those inspection teams:

     - component condition ratings,
     - element condition ratings,
     - inspection observations,
     - work candidates, and
     - overall report completeness including signing, hydraulic sheet, and photographs.

2. **Consultant Inspections and Reports**

   - Program Manager evaluates significant findings and recommendations and ensures that information is entered into BrM. This information shall clearly identify from which inspection the findings and recommendations are made and who entered the information into BrM using the format in the following example:

     The following comments are from previous NSTM inspections:

     1) *The upper lateral bracing rods between U2 and U2' are loose.*
     2) *US L1-U1 has significant impact damage.*
     3) *Other verticals and diagonals have minor damage.*
     4) *Tack welds typical on truss members.*

     For additional information, refer to MM/DD/YYYY consultant inspection report. Entered by ABC.

   - Program Manager or a designated representative shall make periodic field site visits to observe consultant bridge inspections. The Program Manager will observe at least one inspection performed by each consultant under contract with a maximum interval of four years, with two years being the recommended interval. The field site visits will focus on verifying that contract requirements are met including:

     - traffic control is implemented in accordance with the approved TCP,
     - approved Engineer-in-Charge and inspectors are on-site completing the inspection,
     - required bridge or tunnel members are inspected, and
     - significant findings including those not accessible by the Program Manager are discussed.