

26. Bridge Inspection Program

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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 boundaries 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 *Recording and Coding Guide* 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 may also include 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.

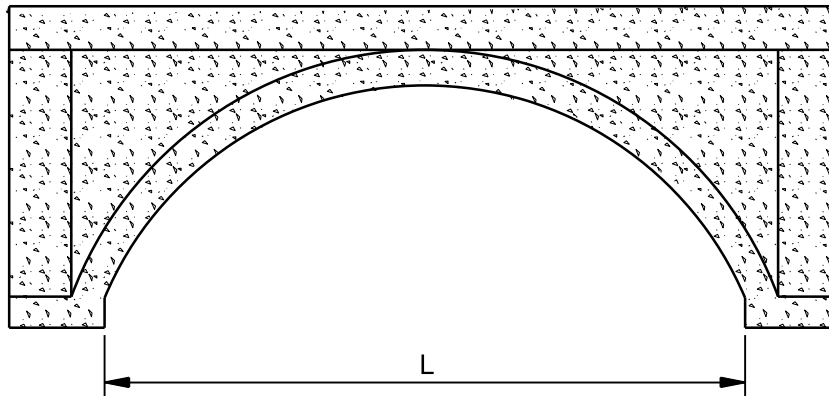
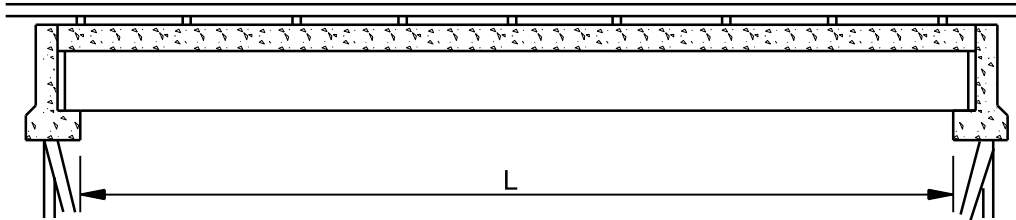
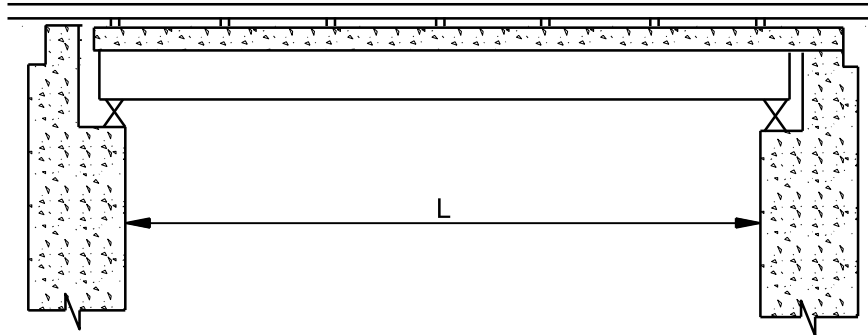
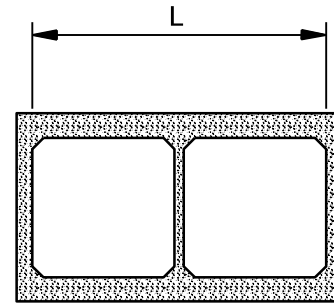
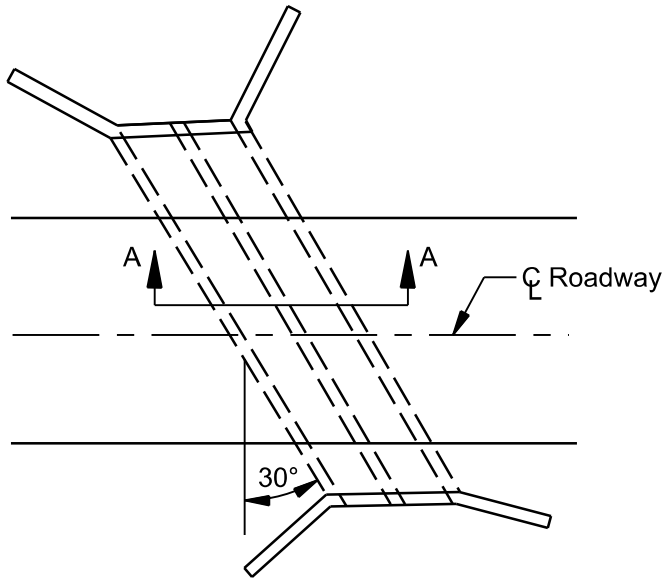
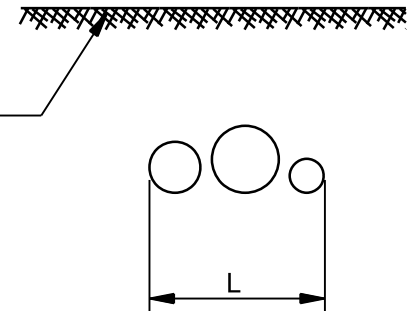
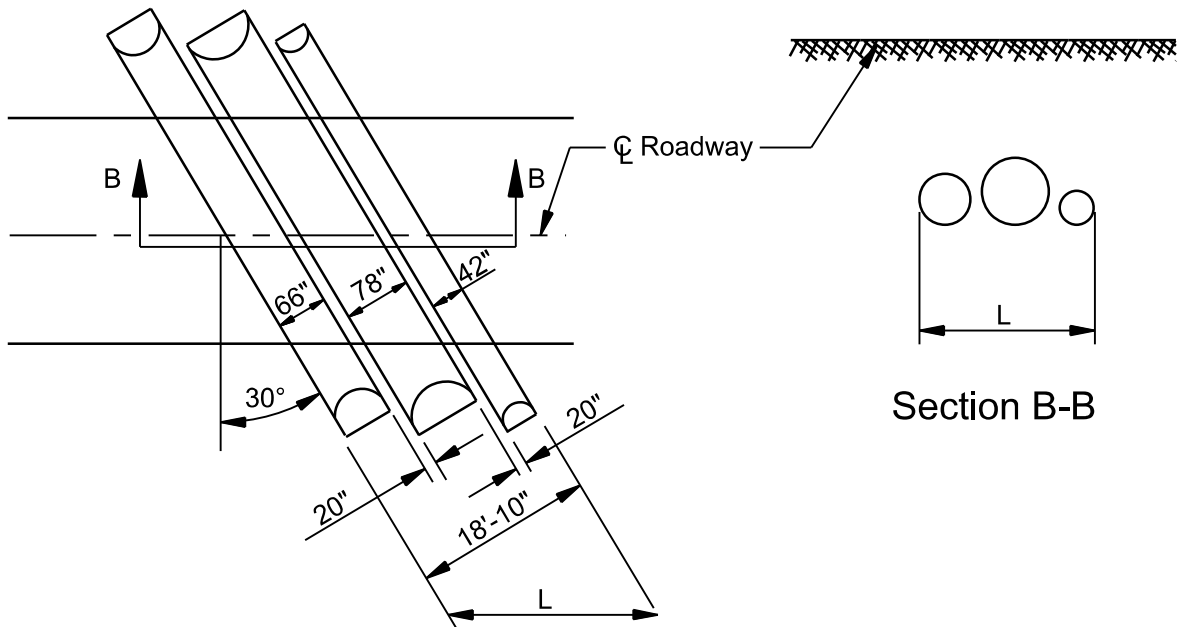


Figure 26-1
NBIS Bridge Length
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Section A-A



Section B-B

Figure 26-1
NBIS Bridge Length
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26.1.2. National References

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

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

State DOTs use the *FHWA Recording and Coding Guide* when entering specific data items in the National Bridge Inventory (NBI) database. The NBI data is used to prepare legislatively required reports to Congress. The *Recording and Coding Guide* also describes the data necessary for FHWA and the Military Traffic Management Command to identify and classify the Strategic Highway Corridor Network and its connectors for national defense.

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 *FHWA Recording and Coding Guide* for the collection, recording, and reporting of bridge inspection data.

AASHTO Guide for Commonly Recognized Structural Elements

The *AASHTO Guide* provides descriptions of structural elements that are commonly used in highway bridge construction and evaluated during bridge inspections. These elements are termed “Commonly Recognized” (CoRe) structural elements because of their nationwide recognition and use.

Although the element descriptions were originally developed for Pontis (AASHTOWare Bridge Management software), these descriptions were not unique to Pontis; rather, they provided a uniform basis for data collection for any bridge management system and enabled the sharing of data among states.

DOT&PF used the CoRe element descriptions to set up data collection procedures for the DOT&PF bridge management system until October 2014 when the newly adopted AASHTO National Bridge Elements were implemented.

AASHTO Manual for Bridge Element Inspection

The *AASHTO Manual for Bridge Element Inspection* supersedes the *AASHTO Guide*, and the CoRe elements were replaced with National Bridge Elements (NBE), Bridge Management Elements

(BME), and Agency Developed Elements (ADE). AASHTOWare Bridge Management software (BrM) continues to be used by DOT&PF.

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 (NBI) 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 (NBI) Inspection

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

An NBI inspection evaluates the deck, superstructure, substructure, channel protection, and culvert 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. FHWA uses the condition ratings, in part, to determine the Sufficiency Rating (SR) for the bridge, to determine eligibility for Federal Highway Bridge Funds, and to allocate these funds to the states.

Element Level Inspection

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 additional agency-developed elements called "smart flags" 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 DOT&PF policies, procedures, and practices related to bridge management.

26.3. Responsibilities/Qualifications

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
- 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 or delegated the duties and responsibilities for bridge inspection, reporting and inventory. 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 fracture critical 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 private 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(c) of the NBIS states that:

“The individual charged with the overall responsibility for load rating bridges must be 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 (TL) 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:

“Individual in charge of an inspection team responsible for planning, preparing, and performing field inspection of the bridge.”

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

Refresher Training

The PM and all TLs must attend bridge inspection refresher training on a ten-year maximum frequency, with six years being the recommended frequency.

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:

- fracture critical member (FCM) inspections,
- underwater (UW) inspections,
- NDE inspections, and
- specialized load ratings.

For consultant FCM 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 FCM 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. **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.
4. **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."
5. **Load Ratings.** A professional engineer registered in the state of Alaska must sign and seal final consultant prepared load ratings.

26.4. Types of Inspections and Frequencies

26.4.1. General

The following identifies two general parameters for bridge inspections:

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

Inspect each bridge 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, fracture critical, damage, special, and underwater inspections must have a qualified inspection team leader (TL). The minimum crew size is typically two, including the TL.

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 bridge as it becomes a part of the bridge file to provide all Structure Inventory and Appraisal (SI&A) data and other relevant data and to determine baseline structural conditions.”

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 Structure Inventory and Appraisal (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.

26.4.4. Routine Inspections

§650.305 defines a routine inspection as:

Regularly scheduled inspection consisting of observations and/or measurements needed to determine the physical and functional condition of the bridge to identify any changes from initial or previously recorded conditions, and to ensure that the structure continues to satisfy present service requirements.

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 frequency during the assigned month. 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. Near End Load Posting Signs
6. Far End Load Posting Signs
7. Bridge Mounted Signs
8. Typical Deck Condition
9. Elevation
10. Superstructure Underside
11. Abutments
12. Piers
13. Bridge Rail
14. Approach Rail
15. Pin & Hangers
16. In-Span Hinges
17. Seismic Retrofits
18. Stream Bank Condition
19. Stream Bank Protection
20. Typical Streambed Material
21. Utilities

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 frequency for in-depth inspections. If follow-up inspections are needed with a frequency 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 fracture critical 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 frequency 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 frequency.

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 frequency 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.

26.4.8. Fracture Critical Member Inspections

§650.305 defines a fracture critical member (FCM) inspection as:

“A hands-on inspection of a fracture critical member or member components that may include visual and other nondestructive evaluation.”

Section 650.305 defines a FCM as a *“steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.”*

A FCM 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 fracture critical members.

FCM 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 FCM and requires a FCM inspection. The Bridge Management Unit maintains a FCM master list identifying FCM structures and members. FCM inspections are performed on a 24-month frequency, unless a more frequent inspection is necessary to monitor known issues.

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

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 frequency 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 frequency 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.

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:

Tunnels

Tunnels carrying unrestricted highway traffic receive routine inspections every 24 months. The inspection report includes condition ratings, written documentation of findings, and maintenance and rehabilitation recommendations.

MAP 21 requires states to develop a tunnel inspection program.

Mandatory inspection frequency will be determined by future federal regulations.

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 frequency.

Other Structures

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

- 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 online 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 follow-up inspection or action.

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 (TL) 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	August
4	Dalton Highway	July
5	Elliott/Steese Highway	August
6	Fairbanks	August
7	Haines/Skagway/Yakutat	June
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	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.B.

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 (SI&A) 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 publically 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. 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.”

§650.313(g) requires that a state DOT have QA procedures that:

“Include periodic field review of inspection teams, periodic bridge inspection refresher training for program managers and team leaders, and independent review of inspection reports and computations.”

See Appendix 26.C.

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, Attn: Cyler Hayes
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 area 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

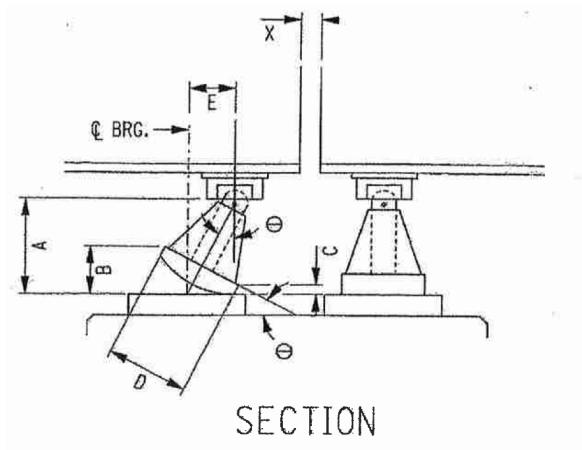
The inspection of rocker bearings is intended to ensure their stability. Compromised (i.e., tipping) bearings could become unstable with relatively small additional deformation or tipping. Use the following procedure to inspect rocker bearings:

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

<u>Code</u>	<u>Description</u>
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

Rating	Condition Indicators (% deck area)			
	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 <u>or</u> sum of all deteriorated and/or contaminated deck concrete < 20%			
5	< 5% spalls <u>or</u> sum of all deteriorated and/or contaminated deck concrete 20% to 40%			
4	> 5% spalls <u>or</u> sum of all deteriorated and/or contaminated deck concrete 40% to 60%			
3	> 5% spalls <u>or</u> 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

<u>Code</u>	<u>Description</u>
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

<u>Code</u>	<u>Description</u>
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

<u>Code</u>	<u>Description</u>
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

<u>Code</u>	<u>Description</u>
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 strands 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: <ul style="list-style-type: none">• 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

<u>Code</u>	<u>Description</u>
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. Minor 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

<u>Code</u>	<u>Description</u>
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.

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Appendix 26.B Bridge Inspection Safety Task Analysis

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

<u>Tasks</u>	<u>Programs (Manual Chapter)</u>
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.

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Appendix 26.C

Quality Control/Quality Assurance

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

The following applies:

1. General Inspection Requirements

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

2. Inspection Frequency

Routine, fracture critical member, special and underwater bridge inspections

- Complete routine, fracture critical member, special, and underwater bridge 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:
 - bridge 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 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 condition rating by two or more,
 - lowering an NBI condition rating to 4 (poor) or less
 - raising an NBI 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.C.2 Inspection Quality Assurance (QA) Procedures

The following applies:

1. In-House Inspections and Reports

- Program Manager shall annually generate a list of bridges on which NBI condition ratings have changed by two or more or where an NBI 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 bridges on which deck, superstructure, or substructure NBI 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 annually perform independent field reviews of routine bridge inspections completed by two inspection teams. The field reviews will independently assess the following items on 5% to 10% of the bridges inspected by those inspection teams:
 - NBI 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 fracture critical member 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 bridge inspection performed by each consultant under contract with a maximum frequency of four years, with two years being the recommended frequency. 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 members are inspected, and
 - significant findings including those not accessible by the Program Manager are discussed.