Bridge Inspection Program Manual

NEBRASKA
Good Life. Great Journey.
DEPARTMENT OF TRANSPORTATION

Nebraska Department of Transportation
Bridge Division
1500 Hwy 2
Lincoln NE 68509-4759
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Bridge Inspection Program Manual Table of Contents

INTRO.1 PURPOSE

This Program Manual will be used by NDOT, FHWA, local Bridge Owners and engineering Consultants to reference and clarify the requirements set forth by the National Bridge Inspection Standards (NBIS) and NDOT.

The NBIS and NDOT program objectives include:

- Assuring the information submitted to the Nebraska Bridge Inventory, and subsequently to the Nation Bridge Inventory, maintains a high degree of accuracy and consistency;
- Safeguarding the public's safety; and
- Protection of the capital assets of NDOT and Nebraska Public Agencies.

The objective and intent of the Manual is to assure consistent application of the NBIS and NDOT requirements for the maintenance of the Bridge Inventory in the state of Nebraska. This Manual is to be used in conjunction with the NBIS, FHWA and AASHTO publications on bridge inspection and inventory maintenance. Although this Manual's purpose is to support the bridge inspection program, **it does not preclude justifiable exceptions or actions based on sound engineering principles**

INTRO.2 BIP MANUAL CONTENTS

The **Manual** includes **policies and procedures** for participants to follow in their work on the Nebraska Bridge Inspection Program.

The **Appendix** includes several types of documents:

- **Forms** supporting the program and form instructions. These will be on the website as individual documents. Program participants are urged to always check the website to ensure they are using the most current form.
- **Reference Documents** that are used by participants in the Program activities but that typically do not change. The NBIS is an example of this type of document.
- **Supplemental Guidance** that revises Manual contents or that may provide new guidance during the period between Manual revisions.
- **Bridge Inspection Program Memos** from NDOT will also be placed on the website as individual documents.

INTRO.3 MANUAL ISSUE AND MAINTENANCE

The Manual and Appendix documents are posted on the NDOT Bridge Inspection Program website. Program participants are urged to always check the website to ensure they are using the most current information. The website link is:

http://dot.nebraska.gov/business-center/bridge/inspection/

The Manual and Appendix parts are issued as PDF files. NDOT will not issue hard-copy Manuals.

The Manual was updated in its entirety through Revision 2, March 2013. NDOT anticipates that in the future only sections of the Manual will be revised as needed prior to a given inspection cycle. This allows Manual users who prefer hard-copy Manuals to only update pages with revisions. It is the responsibility of each user to keep their hard-copy Manuals up to date. NDOT will send notification of revisions.

The Forms and their instruction will be updated as needed and may be updated between Manual revisions. The Appendix will be updated as needed.

INTRO.4 PROGRAM PARTICIPANT COMMENTS AND SUGGESTIONS

Program participants are encouraged to provide feedback on the Manual, Forms or other aspects of the BIP.

Submit your comments and suggestions to the Nebraska Bridge Inspection Program, Program Manager. The Program Manager's name and contact information can be found on the Bridge Division's website.

You may mail or email your suggestions and comments.

Please include the following:

- Your name
- Date
- Comment or Suggested Revision/Addition
- Reason for Suggested Revision/Addition
- Benefit of Suggested Revision/Addition
- Note any deviation from current NBIS, FHWA or AASHTO policy

The mailing address:

State Bridge Inspection Program Manager

Bridge Division

Nebraska Department of Transportation

1500 Hwy 2

Lincoln NE 68509-4759

INTRO.5 REVISION HISTORY

NDOT has completed several iterations of the Bridge Inspection Program Manual.

- 2008 March, Bridge Manual and Coding Guide: This Manual included policies and coding procedures written by several different Bridge Division Departments.
- 2008 November 10, Draft Manual: The QA Consultant assisted NDOT with consolidation and reorganization of the Manual, and in some cases, de facto current procedures that had not yet been documented were reduced to writing for the initial draft. The initial draft was dated November 10, 2008. This draft was reviewed by FHWA. The draft was posted to NDOT Bridge Division website in March 2009.
- 2009 July 1, Interim Manual: The Interim Manual was posted on the NDOT BIP website July 1, 2009 for the use of program participants, as well as their review and comments. This Interim Manual incorporated the following: FHWA's comments on the November 2008 Draft Manual; Comments received on load rating from some of NDOT's NBI Inspection/Load Rating consultants; Additional refinements of procedures as a result of QA in the inaugural cycle of the QA program to address some clarifications needed on coding; and General comments from NDOT staff, the QA Consultant's team and senior Technical Advisor.
- 2010 January, Initial Issue: The BIP Manual Initial Issue was to be used for the 2010 bridge inspection cycle effective January 25, 2010. This is the FHWA effective date that the most recent version of the AASHTO Manual – *AASHTO Manual for Bridge Evaluation, First Edition, 2008* (MBE) – is incorporated by reference into the National Bridge Inspection Standards at 23 CFR § 650.317. The BIP Manual incorporates the following: Changes references to the AASHTO Manual to the MBE; FHWA's comments on the July 2009 Interim Manual, Other miscellaneous comments; Best practices and process improvements from the Inaugural QA cycle on all operations have been incorporated; Stream Behavior information for Routine Inspectors; Coding clarifications for 18 items; Underwater inspection expected documentation; Updates to Chapter 6, Scour to delete hydraulic assessment procedures and incorporation by reference the Hydraulic Assessment Guidelines, 2009 now issued and posted on the NDOT website; Other revisions from NDOT staff and the QA Consultant's team.

- 2011 November, Revision 1: This manual incorporates information on the FHWA NBIS Metrics; a history of the NBIS; a description of the general life of a Nebraska Bridge; instructions to Bridge Owners on the use of QA findings in improving their programs, expansion on Chapter 2 on Owner records, revision and expansion of NDOT policy for routine (NBI) and special inspections, requirement for Team Leaders to check signs against the Load Rating Summary Sheet, expansion of instructions for load posting and bridge closures, use of maintenance forms revised by NDOT.
- 2013 March, Revision 2: This revision included a reformatting of all parts of the Manual for appearance and also to allow NDOT to revise and issue individual subsections. Therefore, in the future, each subsection will have its own revision number and date. Abbreviations for the Bridge Inspection Program that were in the Introduction were moved to the Appendix. References that were in each Chapter were moved to the Appendix. Chapter 1 revisions include more detailed BIP definitions of maintenance, repair and reconstruction and which of these requires the involvement of a NE Professional Engineer, addition of list of FHWA's NBIS Metrics, the reorganization of the details for the QA Program. Chapter 3 was separated into two parts, one for the NBI Items and one for the NE Items. The NBI Items are coded for all bridges and nearly all will not change with the implementation of Element Level Inspection in Nebraska, which will be detailed in a third part of Chapter 3. Only bridges on the NHS are required by Map-21 to use Element Level Inspection; it is optional to Local Bridge Owners at this time. Chapter 3-NE Bridge Inventory Coding includes additional pictorial guidance for culvert NE Items, additional pictorial guidance for bearings. Chapter 4 Bridge Inspection was reorganized to emphasize the four inspection types to be recorded in Pontis, and provide additional guidance for Special Inspections. The section on routine inspections for bridges over waterways was moved from Chapter 6 Scour to Chapter 4. Chapter 5 now explicitly states that a Load Rating Report with all the supporting components must be prepared and an electronic copy sent to NDOT, and other verbiage revisions. Chapter 6 included minor verbiage revisions. The Appendix now includes BIP Reference, BIP Manual Abbreviations and the section on repair/maintenance/reconstruction was deleted.
- 2015 March, Revision 3: This revision included numerous minor edits and formatting corrections. Several Nebraska Level 300 Items were removed and others received additional guidance. Guidance on Assistant Team Leaders was added to Chapter 1. The correct table for Item 43B was added to Chapter 3. Direction on coding of concrete tapers in urban sections was added to NBI Item 36 in Chapter 3. New policy on how to code Item 58 after new asphalt overlay has been added in Chapter 3. Additional clarification on when to code NE Item 342 was added in Chapter 3. Several NE Items are no longer used.

- 2016 March, Revision 4: This revision included removal of Pontis references where necessary as well as other minor edits. Item 58 was updated to give additional guidance on rating structures with new overlays. A new table in Section 4.8 was added to give guidance on fracture critical superstructure types. Clarification was added to require a note in BrM for any NBI Condition item rated 5 or lower.
- 2017 March, Revision 5: This revision included a rework of Chapter 5 – Bridge Load Rating. Significant updates include the addition of Special Hauling Vehicles to the load rating vehicles, guidance on how to post for these additional vehicles, details about the new Load Rating Summary Sheet, and computational means using AASHTOWare.
- 2018 March, Revision 6: This included revising the Department from NDOR to NDOT throughout the manual, revising the NBIS descriptions for Items 58, 59, and 60. Chapter 4 Section 9 Underwater Inspection was thoroughly revised. Item 354A was added for flow against abutments in the NE items section. Various other minor edits completed.
- 2020 March, Revision 7: This revision included minor edits throughout the manual.

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1.1 GENERAL

The National Bridge Inspection Standards (NBIS) is a Federal Regulation (23 CFR § 650C) that sets the national standard for the proper safety inspection and evaluation of highway bridges located on all public roads. The current NBIS is in the Appendix of this Manual. All participants in the Nebraska Bridge Inspection Program should visit the FHWA Bridge Technology webpage on the NBIS, http://www.fhwa.dot.gov/Bridge/nbis.cfm.

The Nebraska Bridge Inspection Program has been established to meet the NBIS requirements. The data and information collected from meeting the NBIS requirements also aids Bridge Owners to protect public safety, manage their bridges and preserve these assets.

The primary responsibilities delegated to state transportation agencies in the National Bridge Inspection Standards are for the following:

- Bridge Inspection Organization (23 CFR § 650.307)
- Qualifications of Personnel (23 CFR § 650.309)
- Inspection Frequency (23 CFR § 650.311)
- Inspection Procedures (23 CFR § 650.313) (including inspection, load rating, owner's records, scour and follow-up)
- Inventory (23 CFR § 650.315)

Each requirement of the NBIS is summarized in the NDOT Bridge Inspection Program Operation Matrix in this Chapter.

The Nebraska Department of Transportation (NDOT) is responsible for implementation or causing implementation of the NBIS and all requirements of a Bridge Inspection Program (BIP). This Manual provides the procedures adopted by NDOT for meeting requirements.

1.2 NBIS HISTORY AND FHWA OVERSIGHT

1.2.1 History

On December 15, 1967, the Silver Bridge over the Ohio River in Point Pleasant, VA collapsed during holiday and rush hour traffic resulting in the deaths of 46 people. This tragic loss of lives focused national attention on the condition of the nation's bridges.

The Silver Bridge was built in 1928 and was a suspension bridge with non-redundant eyebar chains from which the deck was hung. Forensic engineering pointed to failure of a single eye-bar due to a small manufacturing flaw, which over time had grown larger. On the cold December day, with the bridge under heavy live load from the rush hour traffic, the eyebar fractured.

As a result, the U.S. Congress passed legislation establishing the National Bridge Inspection Standards (NBIS), which is today overseen by the US Department of Transportation Federal Highway Administration.

The following chronology summarizes events establishing and refining the NBIS. See the FHWA website https://www.fhwa.dot.gov/bridge/nbi/library.cfm for all policies and related information on the NBIS.

1967 The Silver Bridge over Ohio River

1968 FHWA Memo initiating review and inventory of all existing structures

1971 NBIS published – regular, comprehensive inspection for Federal highways

1978 NBIS extended to all public bridges

1987 Office of Inspector General reviewed the Program

1988 FHWA issued revisions to the NBIS

2001 FHWA issued revision of Coding Guide, Item 113 - Scour Critical Bridges

2005 FHWA issued revisions to the NBIS

2006 Office of Inspector General Audit of Oversight of Load Rating/Posting

2007 FHWA Memo on Oversight of Load Rating/Posting

1.2.2 FHWA Oversight

FHWA has the responsibility for overseeing the implementation of the NBIS for all states in the US. In recent years, the oversight has become more rigorous because the US Department of Transportation (US DOT) has continually identified the National Bridge Inspection Program as a high-risk area. The US DOT Office of Inspector General conducted audits of state bridge inspection programs nationally following the I-35W bridge collapse in Minneapolis, MN. The US Congress Conference Report to FY 2010 Appropriations Act issued strong direction stating it "expects the Federal Highway Administration to make more significant progress in improving its oversight of bridge conditions and safety over the course of fiscal year 2010."

FHWA developed a risk-based, data-driven process to establish uniform oversight. This process is detailed in the NBIS Metrics which were released and first used in 2011. An updated description of the Metrics can be found at https://www.fhwa.dot.gov/bridge/nbip/metrics.pdf.

FHWA completes their review for each Performance Year that begins after all state transportation agencies submit their inventory data in April of a given calendar year. FHWA completes each states' metric assessment by the end of December, and then a final summary of each state's metric performance and possible plan of corrective action are completed by end of March. A national summary report is completed by the following May. These metrics have also been identified in the NDOT Bridge Inspection Program Operation Matrix in this Chapter for Nebraska program participants' information.

1.3 THE LIFE OF A NEBRASKA BRIDGE

This section briefly describes the overall life of a bridge on the Nebraska road system. It is provided here for the benefit of all program participants. If there is any conflict between information shown in this Manual and current source document for the information, the source document always governs.

1.3.1 NDOT Policy for Design, Load-Rating and Inspection of Public Road Bridges, May 24, 2010

This policy summarizes Bridge Owner responsibilities regarding their bridges. This policy does not apply to bridges located on private property or private roads.

1.3.1.1 Definitions

1.3.1.1.1 Bridge

Bridge shall have the definition set out in 23 CFR § 650.305.

1.3.1.1.2 Maintenance

Maintenance means the act, operation, continuous process of repair, reconstruction or preservation of the whole or any part of any highway, including surface, shoulders, roadsides, traffic control devices, structures, waterways, and drainage facilities, for the purpose of keeping it at or near or improving upon its original standard of usefulness and safety (Neb. Rev. Stat. § 39-101(6)).

1.3.1.1.3 Public Road

Public road means any road or street under the jurisdiction of and maintained by a public authority and open to public travel (23 USC § 101(a(22))).

1.3.1.2 General

Any Bridge on a Public Road under the jurisdiction of the state, a municipality, a county, or a village shall be designed, constructed, inspected and maintained in accordance with state and federal law. The public entity with jurisdiction for any Bridge located on a Public Road in Nebraska shall provide to NDOT copies of all bridge plans, hydraulic design reports, load-rating reports and inspection reports applicable to each Public Road Bridge.

1.3.1.3 Hydraulic Design

The hydraulic design will satisfy the requirements of Federal-Aid Policy Guide, 23 CFR § 650A (Location and Hydraulic Design of Encroachments on Floodplains) and FHWA-IP-90-017 (HEC-18 Scour), which is covered in the NDOT Hydraulic Analysis Guidelines. The Nebraska Natural Resources Commission provides minimum standards governing the hydraulic design of improvements in floodplains (See 455 NAC Section 004 and 005, and Chapter 31 of the Nebraska statutes).

A Nebraska licensed professional engineer with training and experience in the hydraulic design of Public Road Bridges shall complete, seal and sign the hydraulic design report. The hydraulic design reports for bridge projects on Federal-aid projects shall be submitted to the NDOT Local Projects Division in accordance with the LPA Manual. For all other bridge projects submit to the NDOT Bridge Division prior to construction a Bridge Data Sheet or a Culvert Data Sheet for bridge-sized culverts.

1.3.1.4 Geometric and Structural Design

All Public Road Bridges shall be designed and constructed to meet the minimum standards of the Nebraska Board of Public Roads Classifications and Standards for the geometric and structural design of bridges (See Minimum Standards created pursuant to Neb. Rev. Stat. § 39-2113). These standards apply to the original construction and any reconstruction, rehabilitation or retrofit of the bridge.

A Nebraska licensed professional engineer with training and experience in geometric and structural design of Public Road Bridges shall complete, seal and sign the bridge design plans. The plans for bridge projects on Federal-aid projects shall be submitted to the NDOT Local Projects Division in accordance with the LPA Manual. The plans for all other bridge projects shall be submitted to the NDOT Bridge Division prior to construction.

1.3.1.5 Load-Rating and Inspection

All Public Road Bridges are subject to the National Bridge Inspection Standards (NBIS). The NBIS requires that all Public Road Bridges be load-rated and inspected. The NDOT Bridge Inspection Program (BIP) Manual sets out the policy covering load-rating and inspection of Public Road Bridges.

All bridges shall be load-rated in accordance with the BIP Manual and the load-rating documents shall be sealed and signed by a Nebraska licensed professional engineer with training and experience in bridge load-rating. The load-rating documents of any bridge constructed as a part of a Federal-aid project shall be submitted to the NDOT Local Projects Division in accordance with the LPA Manual. The load-rating documents for all other bridges shall be submitted to the NDOT Bridge Division in accordance with the BIP Manual. Bridges must be inspected regularly as designated in the BIP Manual, or funding sanctions may be imposed.

1.3.2 Bridge Information Required by the NDOT Policy on Design, Load-Rating and Inspection

This table summarizes required information and their submittal deadlines.

Bridge Records Required for New or Reconstruction/Rehabilitation/Retrofit of Bridges			
Item	**Prepared / done by**	**Submit to NDOT, Federal-aid project**	**Submit to NDOT, for ALL other public road bridges**
Bridge Plans (Geometric and Structural design)	PE	LPA Manual (a deadline prior to construction)	Prior to construction
Hydraulic Design and Analysis Report (for LPA) or Data Sheet (all others)	PE	LPA Manual (a deadline prior to construction)	Prior to construction
Load Rating Report	PE	LPA Manual (a deadline prior to construction)	Prior to construction
Initial Inspection	As designated in the BIP Manual*	As designated in the BIP Manual*	As designated in the BIP Manual*
Inventory updated	As designated in the BIP Manual*	As designated in the BIP Manual*	As designated in the BIP Manual*

* See Chapter 4, Bridge Inspection

1.3.3 Maintenance, Repair or Reconstruction of Bridges

This section provides guidance on these activities and compares the differences and similarities between the state statute and BIP definitions.

1.3.3.1 Nebraska State Statute Definition of Maintenance, Required Records for Bridges

"Maintenance means the act, operation, continuous process of repair, reconstruction or preservation of the whole or any part of any highway, including surface, shoulders, roadsides, traffic control devices, structures, waterways, and drainage facilities, for the purpose of keeping it at near or improving upon its original standard of usefulness and safety" (Neb. Rev. Stat. § 39-101(6)).

"The county highway superintendent or some other qualified person designated by the county board shall keep in his office a road record which shall include a record of the proceedings in regard to the laying out, establishing, changing, or discontinuing of all roads in the county hereafter established, changed or discontinued, and a record of the cost and maintenance of all such roads. Such person shall record in the bridge record, a record of all county bridges and culverts showing number, location and description of each, and a record of the cost of construction and maintenance of all such bridges and culverts….." (Neb. Rev. Stat. § 39-1411).

1.3.3.2 Bridge Inspection Program Definition of Maintenance, Repair and Reconstruction

The BIP uses these definitions when addressing issues on bridges. The state statue definition of "maintenance" includes all of these types of activities.

Bridge Owners often consult NDOT on whether work on structures constitutes repair, maintenance or reconstruction, and which situations require the involvement of a Professional Engineer. Owners should continue to contact NDOT BIPPM with any questions.

1.3.3.2.1 Maintenance

Maintenance is work that preserves the good condition of the bridge by general upkeep or removal of hazards. Examples include:

- Cleaning roadway expansion devices
- Sweeping decks
- Clearing plugged floor drains
- Removing debris from superstructure and bearings

- Removing debris rafts from bents/piers/abutments
- Clearing trees from a channel
- Filling in erosion (on side slopes or banks, under approach slabs, at culvert ends)
- Removing silt from culvert waterway openings
- Sealing cracks

1.3.3.2.2 Repair

Repair, in general, is work to bring the bridge back to its prior condition. There usually is no need for a Professional Engineer (PE) to develop plans for this work, or to complete a hydraulic analysis. Local Owners should contact their consulting engineer or NDOT if they have any questions or need clarification. Examples include:

- Driving a new pile next to an existing that has deteriorated
- Replacing wingwall or backwall within its prior dimensions
- Replacing cracked timber stringers
- Patching a bridge deck

1.3.3.2.3 Reconstruction/Rehabilitation

Reconstruction/Rehabilitation is any work that changes the bridge roadway width, the load carrying capacity (increase or decrease), the hydraulic capacity or the scour resistance. Structural and geometric changes all require a PE to complete design, then seal and sign the plans and specifications. Structural and geometric changes can alter the hydraulic capacity or scour resistance if they change the low superstructure elevation or the bottom elevation of abutments or wingwalls. In this case, a hydraulic analysis report by a PE will be necessary.

Examples of reconstruction/rehabilitation include:

- Two or more substructure pile replaced
- Replacing the substructure
- Replacing the existing stringers with different size or type
- Replacing the superstructure
- Replacing the deck
- Adding new spans
- Bridge widening
- Culvert extension

1.4 RESPONSIBILITIES

1.4.1 Nebraska Department of Transportation

Under the NBIS, state transportation agencies are responsible for the inspection of all highway bridges located on public roadways except for bridges that are federally owned or tribally owned. The state transportation agencies, i.e. NDOT, may, in accordance with the regulation, delegate responsibilities. The responsibilities include:

- Provide a bridge inspection organization
- Provide a Program Manager who will be responsible for the following:
  - Setting statewide bridge inspection policies and procedures
  - Setting statewide quality assurance and quality control
  - Preparing and maintaining a bridge inventory
  - Bridge inspection
  - Bridge reporting
  - Bridge load rating
  - Scour monitoring
  - Maintaining a master list of critical findings
  - Providing FHWA an updated critical findings master list periodically or as requested by FHWA
- Other requirements.

1.4.2 Bridge Owners

NDOT has delegated these specific tasks as the responsibility of Bridge Owners for bridges under their authority, and this is supported by agreements between NDOT and local Bridge Owners.

- Bridge inspection (Routine, Special, and Fracture Critical). (Note that as of the date of this revision, NDOT completes Underwater Inspections only.)
- Bridge Load Ratings
- Bridge Hydraulic Assessment: through the continual assessment of the hydraulic 300 series items during routine NBI inspections
- Monitoring bridges according to their Scour Plans of Action
- Addressing critical and non-critical findings
- Maintaining bridge files and records at their headquarters
- Cooperating with the NDOT in its implementation of the NBIS.

Bridge Owners may delegate these responsibilities to other parties, including engineering consultants, but Owners are ultimately responsible for ensuring that all NBIS and NE BIP requirements are met.

1.4.3 Engineering Consultants

NDOT or other Nebraska Bridge Owners often use engineering consultants. Consultants assisting Bridge Owners with their NBIS responsibilities are responsible for:

- Educating the members of the firm in NBIS regulations and requirement;
- Providing inspection Team Leaders with the training and experience required by NBIS and NDOT
- Completing bridge load ratings under the direct supervision of and the signing of the Load Rating Report by a Nebraska professional engineer in accordance with the Nebraska Engineers and Architects Regulation Act
- Completing bridge scour assessment under the direct supervision of and the signing of the Hydraulic Analysis Report by a Nebraska professional engineer in accordance with the Nebraska Engineers and Architects Regulation Act.

1.5 NBIS TERMS AND THEIR USE IN THE NE BIP

Terms used in the NBIS and in this Bridge Inspection Program Manual are defined in the NBIS. Some terms are included in this Chapter and in other Chapters of this Manual to provide clarification or further instruction to those who will execute the Bridge Inspection Program.

1.6 ABBREVIATIONS AND ACRONYMS

The abbreviations and acronyms for the Bridge Inspection Program Manual are located in the BIP Manual Introduction, Section Intro-6.

1.7 BRIDGE INSPECTION PROGRAM (BIP) ORGANIZATION

1.7.1 General

The Nebraska Bridge Inspection Program Organization includes NDOT staff that performs management and oversight functions for the execution of the NBIS requirements. These key functions include:

- BIP Manager
- BIP Inventory Data Manager
- BIP Load Rating Manager
- BIP Hydraulic Analysis Manager

Each Bridge Owner is responsible for following the policies and procedures of the BIP for bridges under their jurisdictions, which are summarized earlier in this Chapter. The four primary categories of Bridge Owners include:

- Nebraska Department of Transportation
- Nebraska Counties
- Nebraska Municipalities and Cities
- Private Owners operating public bridges

1.7.2 Qualifications

1.7.2.1 Bridge Inspection Program Manager

The NBIS requires that the Program Manager must:

- Be a registered professional engineer; or have a minimum of ten years of bridge inspection experience, **and**
- Have successfully completed an FHWA approved comprehensive bridge inspection training course.

1.7.2.2 Bridge Inspection Team Leader Qualifications and Certification

The NBIS allows five ways to qualify as a Team Leader. NBIS requires that the Team Leader must:

- Have the qualifications of the Program Manager (be a registered professional engineer or have a minimum of ten years of bridge inspection experience, **and** have successfully completed an FHWA approved comprehensive bridge inspection training course); **or**
- Have five years bridge inspection experience and have successfully completed an FHWA approved comprehensive bridge inspection training course, **or**
- Be certified as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Certification in Engineer Technologies (NICET) **and** have successfully completed an FHWA approved comprehensive bridge inspection training course; **or**
- Have a bachelor's degree in engineering from a college or university accredited by or determined as substantially equivalent by the Accreditation Broad for Engineer Technology, and have successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination, and two years of bridge inspection experience, **and** successfully completed an FHWA approved comprehensive bridge inspection training course; **or**
- Have an associate's degree in engineering or engineering technology from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology, and four years of bridge inspection experience, **and** successfully completed an FHWA approved comprehensive bridge inspection training course.

NDOT issues each Team Leader status to inspectors who meet the NBIS qualifications and NDOT requirements for a Bridge Inspection Team Leader Certification. Certification may be obtained as any of the following:

- NBIS Routine Inspection Team Leader **or**
- NBIS Routine Inspection and Fracture Critical Inspection Team Leader **or**
- NBIS Routine Inspection and Underwater Inspection Team Leader **or**
- NBIS Routine Inspection, Fracture Critical Inspection and Underwater Inspection Team Leader

The term of certification is a period of five years, and Team Leaders must be recertified every five years, prior to expiration of certification.

The ten-day FHWA NHI Course No. 130055, *Safety Inspection of In-service Bridges,* is an NDOT-approved comprehensive bridge inspection training course. The 3½-day FHWA NHI Course No. 130078, *Fracture Critical Inspection Techniques for Steel Bridges,* must be successfully completed to be certified by NDOT as a Fracture Critical Inspection Team Leader. The 4-day FHWA NHI Course No. 130091, *Underwater Bridge Inspection,* must be successfully completed to be certified by NDOT as an Underwater Inspection Team Leader. NDOT defines successful completion of all training as achieving a minimum score of 70% on the final exam of the training course.

1.7.2.2.1 Initial Application and Issuance of Inspector ID

An applicant for certification must submit to the NDOT Program Manager the following:

- Completed application, Nebraska Bridge Inspector Information Form DR Form 97, the form can be found at http://dot.nebraska.gov/business-center/bridge/forms/ **and**
- Documents that serve as proof of the achievement of the registration, certification, education and training for the single way that the applicant is pursuing certification (of the five listed by the NBIS and shown in the table below).

After acceptance of qualifications by the NDOT Program Manager, an Inspector ID will be issued. The Inspector ID will be the applicants first and last initials followed by the last four digits of the applicant's social security number.

Certification Application – Accepted Proof of Achievement	
Accomplishment	Document
PE registration	Photocopy of the registration certificate with the PE license number
NICET certificate	Photocopy of certificate
Education	Photocopy of diploma from the institution showing degree attained
FHWA-approved training	Photocopy of the certification of completion from the organization conducting the training
Field experience	Photocopy of inspections, one for each of five separate years for which the applicant served as assistant bridge inspection team leader and verification of experience by current supervisor.

1.7.2.2.2 Certification Revocation

A Team Leader may have their certification revoked if:

- Quality Assurance review for a given yearly inspection cycle finds that the team leader condition evaluations and other coding are not consistent with established national and state inspection procedures **or**
- Inspection data and reports are not submitted to the Program Manager as prescribed by NDOT **or**
- The Team Leader is not performing inspection and reporting duties in substantial compliance with the NBIS, as determined by the Program Manager.

1.7.2.2.3 Recertification

A Team Leader who has lost certification either by certification lapse or certification revocation may be recertified. Recertification requires that the Team Leader achieves:

- Successful completion of the three-day FHWA National Highway Institute (NHI) Course No. 130053 *Bridge Inspection Refresher Training* **or**
- Successful completion of a minimum of twenty-four (24) hours of other bridge inspection refresher training approved by the NDOT Program Manager.

A Team Leader who fails to successfully complete the refresher training may make a second attempt to pass a refresher training course. Any Team Leader who fails to pass on the second attempt will be required to successfully complete the ten-day FHWA NHI Course No. 130055 *Safety Inspection of In-service Bridges* before being recertified.

1.7.2.3 Assistant to the Inspection Team Leader

Currently, the NBIS does not give minimum requirements for individuals who assist during bridge inspections. NDOT may develop these in the future. NDOT recommends, but does not require Assistants obtain an ID from the NDOT Program Manager to be used in the NE BIP. If an Assistant has an ID, the Team Leader should record in the inspection data the Inspector ID of each Assistant participating in the inspection (See Chapter 3.) In this way, Assistants who have an ID will have their experience record documented by NDOT for future certification as a Team Leader.

1.7.2.4 Load Rating Engineer

The NBIS and NDOT require that individuals charged with the overall responsibility for load rating bridges, the Load Rating Engineer (LRE), be registered professional engineers in Nebraska.

1.7.2.5 Underwater Bridge Inspector

The NBIS requires that an underwater bridge inspection diver must:

- Complete an FHWA-approved comprehensive bridge inspection training course **or**
- Complete other FHWA-approved underwater diver bridge inspection training course.

FHWA approved courses include the following; either will be accepted by NDOT.

- FHWA NHI Course No. 130055, Safety Inspection of In-service Bridges
- FHWA NHI Course No. 130091, *Underwater Bridge Inspection*.

NDOT further requires that Underwater Bridge Inspectors be NDOT certified Team Leaders and also be a licensed commercial diver certified by OSHA 29 CFR Part 1910, Subpart T, *Commercial Diving Operations*.

1.7.2.6 Hydraulic Engineer

NDOT requires that Hydraulic Engineers (HE) performing hydraulic assessments, scour evaluations and related site visits be registered professional engineers in Nebraska. Hydraulic Engineers need not be certified inspection team leaders, but it is preferred. The HE is assisted by the Interdisciplinary Scour Assessment Team, which includes geotechnical and structural engineers; however, the HE is responsible for the assessments.

1.7.2.7 Quality Control and Quality Assurance Personnel

NDOT requires that an individual completing Quality Control (QC) must have experience that is equal to or better than the individual that originates the program product (inspection report, load rating, etc.) Typically, this is the supervisor of the individual.

Individuals completing Quality Assurance (QA) for the program operations shall meet the qualifications for the particular operation. A party that is independent from the creation of the original program product should complete Quality Assurance.

1.8 NDOT BRIDGE INSPECTION PROGRAM OPERATION MATRIX, PROGRAM REPORTS AND DATA GENERATED MATRIX

The NDOT Bridge Inspection Program Operation Matrix begins on the following page. This Matrix tabulates the NBIS requirements and the parties (program participants) that complete those NBIS requirements for the NDOT Bridge Inspection Program. The participants are the variables in each of the program operations required by the NBIS. The Matrix also shows the FHWA Metric Number related to each of the NBIS requirements.

The Program Reports and Data Generated Matrix is also included in this section after the Operation Matrix. This Matrix tabulates which program participants generate reports, National Bridge Inventory data, and NE Inventory data. The Matrix includes Manual Chapter number that specifies the processes to be followed in generating the reports and/or data and for maintaining the records for these.

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NDOT Bridge Inspection Program Operation Matrix

BIP	= Bridge Inspection Program	CP	= Complex	LPA	= Local Public Agency	QA	= Quality Assurance
BIPDM	= BIP Data Manager	DR	= Department Transportation (DR form prefix)	NDOT	= Nebraska Department of Transportation	QC	= Quality Control
BIPPM	= BIP Program Manager	FC	= Fracture Critical	PE	= Professional Engineer	R	= Routine
BO	= Bridge Owner	HE	= Hydraulic Engineer	POA	= Plan of Action	SC	= Scour Critical
CF	= Critical Finding	LRE	= Load Rating Engineer				

NBIS References (see end of matrix)	FHWA Metric (see end of matrix)	Operation	Operation completed by	Operation product / result	QC of product § 650.307 (c1) § 650.313 (g) (FHWA Metric 20)	QA of product § 650.307 (c1) § 650.313 (g) (FHWA Metric 20)	Objective – Program data accuracy; Operation verification; Follow-up
§ 650.307 (a), (c), (e) § 650.313 (g)	1, 20	Establish bridge inspection program, Policies & procedures, QC/QA Prepare & maintain bridge inventory	State, BO	Policies & procedures in a Manual Bridge Inventory data	See below.	See below.	See below.
§ 650.309 (a)	2	Maintain minimum BIPPM qualifications	State Bridge Engineer	Certifications & registrations	Set minimum requirements	Process: Review appointed BIPPM qualifications against NBIS	Program participant qualifications
§ 650.309 (b), (d)	3, 5	Maintain minimum inspector qualifications	Inspectors	Inspector certification	Set minimum requirements	Process: Independent verification of Team Leader qualifications Random sample of active inspectors in the NBIS data submittal	Program participant qualifications
§ 650.309 (c)	4	Maintain minimum engineer qualifications	Engineers	Registration	NE registration process	Process: Verify engineer registrations. Random sample of LREs and HEs drawn from active engineers for a given NBIS data submittal	Program participant qualifications
§ 650.311	6 – 11	Maintain specified inspection frequencies (R, UW, FC, Damage/In-depth/Special)	BO, BIPPM	Bridge Inventory data	Set requirements if different than NBIS	Process: Review database records for inspections & check Random sample of R, FC and UW inspections	Operation verification
§ 650.313 (a), (b), (d), (e1), (e2), (e3), (f) § 650.315 (a)	12, 16 – 19, 22	Inspection – R Inspection – FC Inspection – UW Inspection – SC Inspection – CP	TL and Inspectors	BrM record Inspection reports Findings Identification NBIS Condition Ratings	Inspector's organization supervisor review of products	Process: independent inspection. Random sample drawn from population of a given submittal to FHWA; with 2% from each active inspector, minimum of two structures, whichever is greater.	NBIS Condition Rating Items NBIS Inspection dates Accurate and complete reporting
§ 650.313 (f)	19	Identify inspection procedures, TL qualifications for complex bridges	BO, BIPPM	Complex bridge inspection procedures and TL qualifications to complete	BIPPM review of inspection reports	Process: Review of Complex Bridges list, inspection procedures,	Complex bridges addressed in detail
§ 650.313 (c) § 650.315 (a)	13, 22	Load Rating	LRE	NBIS Load ratings from - LARS ratings - Non-LARS rating - NDOT policy	LRE's internal organization supervisor review of products	Process: independent load ratings, review of load ratings Random sample drawn from population with revised ratings of a given submittal to FHWA; with 2% from each active LRE, minimum of two structures, whichever is greater.	NBIS Load Rating Items Accurate load rating and posting
§ 650.313 (c) § 650.315 (a)	14, 22	Load Posting	BO	Load posting signs installed and maintained	Define posting deadline and require notification to BIPPM	Process: independent verification in the field by QA team on sample drawn from population of all BOs.	Operation verification
§ 650.313 (e3)	18	Scour Assessments	HE	Scour Assessment Report and/or BR385, BR385A, BR385B forms	HE's organization supervisor review of report	Process: independent review of scour assessment reports Random sample of reports completed in the NBIS data submittal	Operation verification

NDOT Bridge Inspection Program Operation Matrix

BIP = Bridge Inspection Program	CP = Complex	LPA = Local Public Agency	QA = Quality Assurance
BIPDM = BIP Data Manager	DR = Department Transportation (DR form prefix)	NDOT = Nebraska Department of Transportation	QC = Quality Control
BIPPM = BIP Program Manager	FC = Fracture Critical	PE = Professional Engineer	R = Routine
BO = Bridge Owner	HE = Hydraulic Engineer	POA = Plan of Action	SC = Scour Critical
CF = Critical Finding	LRE = Load Rating Engineer		

NBIS References (see end of matrix)	FHWA Metric (see end of matrix)	Operation	Operation completed by	Operation product / result	QC of product § 650.307 (c1) § 650.313 (g) (FHWA Metric 20)	QA of product § 650.307 (c1) § 650.313 (g) (FHWA Metric 20)	Objective – Program data accuracy; Operation verification; Follow-up
§ 650.313 (e3)	18	Preparation of POA Monitoring of SC bridges	BO	POA and documents on follow-up	BIPPM	Process: independent check of BO's POA log concurrent with BO records review.	Operation verification
§ 650.313 (d)	15	Maintenance of BO's files (Key components)	BO	Quality records, accessible	BO Review	Process: independent check of file contents. Random sample drawn from list of BO in the NE bridge inventory.	
§ 650.313 (d)	15	Address non-critical findings – State	Inspector, BO	Bridge Repair Report, Bridge Maintenance Checklist (state)	BO Review	Process: Review random sample of reports.	
§ 650.313 (d)	15	Address non-critical findings – non-state	Inspector, BO	BO maintenance work orders and histories	BO Review	Process: independent check of BO's maintenance histories concurrent with BO records review.	
§ 650.313 (h)	21	Follow-up on Critical findings	Inspector, BO, BIPPM	Critical Findings Report	BIPPM	Process: Review of CFR list; BIPPM send letters to BOs; Independent inspections; Independent check of all a BO's CFs concurrent with BO records check.	Resolution of findings, repairs
§ 650.315	11, 23	Maintenance of Inventory Data	BO, BIPPM, BIPDM	NBIS Data	Checks of NBIS data	Process: on-going checks of the NBI database for apparent inconsistencies and miscoding; run Edit Check	Resolution of findings, repairs

See next page for CFR References and the associated FHWA Metric.

23 CFR Section	FHWA NBI Metrics (May 2017)
§ 650.307 Bridge inspection organization	No. 1 Bridge Inspection Organization
§ 650.309 Qualifications of personnel	No. 2 Qualification of personnel – Program Manager
	No. 3 Qualifications of personnel – Team Leader
	No. 4 Qualifications of personnel – Load Rating Engineer
	No. 5 Qualifications of personnel – UW Bridge Inspection Diver
§ 650.311 Inspection frequency	No. 6 Routine inspection frequency – Lower risk bridges
	No. 7 Routing inspection frequency – Higher risk bridges
	No. 8 Underwater inspection frequency – Lower risk bridges
	No. 9 Underwater inspection frequency – Higher risk bridges
	No 10 Inspection frequency – Fracture critical member
	No. 11 Inspection frequency – Frequency criteria
§ 650.313 Inspection procedures	No. 12 Inspection procedures – Quality Inspections
	No. 13 Inspection procedures – Load Rating
	No. 14 Inspection procedures – Post or Restrict
	No. 15 Inspection procedures – Bridge Files
	No. 16 Inspection procedures – Fracture Critical members
	No. 17 Inspection procedures – Underwater
	No. 18 Inspection procedures – Scour Critical bridges
	No. 19 Inspection Procedures – Complex Bridges
	No. 20 Inspection procedures – QC/QA
	No. 21 Inspection procedures – Critical Findings
§ 650.315 Inventory	No. 22 Inventory – Prepare and Maintain
	No. 23 Inventory – Timely Updating of Data

Program Participant Reports and Data Generated[1]				
Participant	**Qualification Specified?**	**Operation**	**Program Process Described**	**Generated Program document / product (See Chapter 3 for Database item responsibility.)**
PM	Y			Master list of FC Master list of SC Master list of UW
PM	Y			Master list of Critical Findings List of Team Leaders
PM (staff)	N	Inventory	Ch. 3 Coding	Inventory Data
BO	N	Bridge Record Maintenance	Ch. 2 Bridge Records	BO files
BO	N	Posting	Ch. 5 Load Rating	Signage documentation
BO	N	Follow-up	Ch. 5 Inspection	Maintenance/Repair records
BO	N	Prepare POA	Ch. 5 Bridge Scour	POA
BO (TL or HE)	N	Special Inspection - POA	Ch. 4 Inspection, Ch. 5 Bridge Scour	POA log
TL	Y	Inspection	Ch. 3 Coding Ch. 4 Inspection	Inspection Report – R Inspection Report – FC Critical Finding Report Maintenance/Repair Report Inventory Data
TL-UW	Y	Inspection – UW	Ch. 3 Coding Ch. 4 Inspection	Inspection Report – UW
LRE	Y	Load Rating	Ch. 3 Coding Ch. 5 Load Rating	Load Rating calculations LRSS Inventory Data
HE	Y	Scour Assessment	Ch. 3 Coding Ch. 6 Bridge Scour	Scour Assessment Report and/or BR385, 385A, 385B Suggested POA for BO Inventory Data

[1] See Chapter 3 Coding for detailed information on data generation and input into the inventory database.

1.9 QUALITY CONTROL AND QUALITY ASSURANCE, GENERAL

23 CFR § 650.313(g), Quality Control and Quality Assurance, requires each state to assure that systematic Quality Control (QC) and Quality Assurance (QA) procedures are being used to maintain a high degree of accuracy and consistency in the inspection program. Accuracy and consistency of the data is important since the bridge inspection process is the foundation of the entire bridge management operation and bridge management systems. Information obtained during the inspection is used for determining needed maintenance and repairs, for prioritizing rehabilitations and replacements, for allocating resources, and for evaluating and improving design for new bridges. The accuracy and consistency of the inspection and documentation is vital because it not only impacts programming and funding appropriations, it also affects public safety.

Participants in the NDOT Bridge Inspection Program must understand the difference between Quality Control (QC) and Quality Assurance (QA). QC is a check on every document or product that is prepared by an organization. QA is done to assure that QC is being done and is completed on a small percentage of randomly selected products by an independent party. QC/QA also provides continuous improvement, added value and efficiencies to the program. The findings of the QA program will be documented for future training and improvement to the Bridge Inspection Program. The next sections provide information that is more specific.

QUALITY CONTROL (QC)	**QUALITY ASSURANCE (QA)**
NBIS Definition	
"procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level."	"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."
NDOT BIP Definition	
"routine technical activities, to control the quality of the inventory data as it is being developed"	"planned system of review procedures to check that quality objectives were met in the QC process"
Application	
QC is responsibility of the consultant or agency doing the activity or preparing the program product	QA is the responsibility of personnel not directly involved in report, calculation or data compilation
QC is internal to the organization	QA is external to the QC organization
QC is routine checks of reports, calculations, data	QA reviews products against the expected standard
QC is done on every program product	QA is done on a random sample of all work products
QC identifies/corrects errors/omissions	QA identifies quality lapses
QC, when complete, the program product is ready for delivery	QA, when complete, is a measure of QC and improves program
QC revises internal processes	QA proposes improvements

1.9.1 Quality Control (QC)

The NBIS defines 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.”

Quality Control is defined for NDOT’s program as a system of routine technical activities, to measure and control the quality of the bridge inventory data or report as it is being developed.

Products of the BIP that are subject to QC include:

- Bridge inspection reporting in BrM
- Inspection reports, such as fracture critical and underwater
- Load ratings and associated calculations, both manual and those from software
- Scour assessments
- Plans of action for scour critical bridges
- Owner bridge files and records
- Follow up on critical findings, scour critical bridge monitoring, needed maintenance, and documentation of the follow up.

Any Quality Control Plan or system should include:

- Standardized procedures for measurement, calculation, recording information and reporting general methods, for the NE BIP Program, the procedures are included in this BIP Manual.
- Standardized procedures for routine and consistent checks for products (data, documents, reports, etc.) for integrity, correctness and completeness. The objective is to identify and address any errors and/or omissions, and to modify processes to prevent the same errors/omissions in the future. Quality checks should be conducted on every product.
- Evidence of the QC activities on products of a BIP operation, typically the documents of any operation should include the identification of the originator of the product and the individual completing the Quality Control step (LRE/HE initials, Team Leader ID, etc.) as well as the date the work was completed.

Quality Control is the responsibility of the party (consultant or agency) preparing the document, data, calculations, or report. When the QC on a program product is complete, it is finished and deliverable to the Bridge Owner for their records. Examples of QC are given for each program operation in the Chapters for that operation.

Consultants providing professional services to Bridge Owners must submit a Quality Control Plan to the Bridge Owner for review and approval. QC must be done on the deliverables prior to submittal to the Bridge Owner.

1.9.2 Quality Assurance (QA)

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.”

Quality Assurance is defined for NDOT’s Program as a planned system of review procedures to check that data quality objectives were met in the QC process so that the inventory represents the best possible assessment of the current state of the structures and confirm the effectiveness of the QC program.

QA Reviews should be performed on completed inventory data and operation reports that have undergone Quality Control procedures.

Personnel not directly involved in the inventory compilation / development process should conduct Quality Assurance. Quality Assurance checks are usually conducted on a random basis so that the sample will be representative of an entire lot. The sampling will be random on the entire lot and augmented for a minimum percentage of each variable, and in some cases for specific attributes.

1.9.2.1 NDOT QA Responsibilities

NDOT conducts a QA review of the Nebraska BIP on an annual basis. Details of the program and the processes are described in this Chapter.

1.9.2.2 Program Participant QA Responsibilities

Each program participant who has been subject of QA review on a BIP operation will receive a report of the QA findings for their work and contributions to the program. These reports are for participants’ information. Their employers also receive copies of these reports.

Participants and their employers should review the QA finding reports and use these to improve their internal processes for their work and their QC. These reports should be treated as confidential within each organization that contributes to the BIP. **These reports are NOT to become part of an Owner’s Bridge File or any of their Individual Bridge Records**. NDOT recommends that each participant, Owner, and employer keep these QA finding reports in their own BIP QC/QA file for their use in improving their performance on the BIP operations.

1.10 NDOT BIP QUALITY ASSURANCE EVALUATION PROGRAM PROCESSES

Quality Assurance procedures for specific activities are generally defined in this Section. See the BIP Quality Assurance Evaluation Reports for each cycle for specific information related to each operation for each past cycle. Forms used in the QA Evaluation for this NBI cycle are included in the Appendix of this Manual.

1.10.1 BIP Operations for QA

This procedure will provide the guidelines for selecting sample sizes for conducting QA review of the BIP. QA Evaluation findings in a given cycle guide QA Evaluation procedures and sampling for the next cycle.

Several requirements of the NBIS in the CFR relate to the Program overall and generally do not change from cycle to cycle. These have been established by NDOT and FHWA have been verified as being compliant with the CFR. QA Evaluation by NDOT will not be needed unless there are major changes in the future. These include:

- Establish bridge inspection program, policies and procedures, QC/QA
- Prepare and maintain bridge inventory
- Maintain minimum BIPPM qualifications
- Identify inspection procedures and TL qualifications for complex bridges
- Inspection procedures for Fracture Critical bridges
- Inspection procedures for Underwater Inspection of bridges

The requirements of the NBIS for which the work can vary from cycle to cycle are the operations listed in the NDOT Bridge Inspection Program Operations Matrix. These operations will undergo QA Evaluations for each inspection cycle and are listed here:

- Qualifications for Inspection Team Leaders and Engineers
- Bridge inspection and reports
- Load ratings, calculations and reports
- Load posting
- Scour assessment and reports
- Scour Plans of Action on scour critical bridges
- Owner’s bridge files
- Follow-up on findings
- Inventory data maintenance

1.10.2 QA Review Schedule and Reporting

Generally, the data set that is submitted to FHWA by April of a given year includes data collected in the prior year. For example, the data collected in 2008 will be submitted to FHWA by April 2009. It is anticipated that QA activities will commence after the April submittal of the data set to FHWA. Findings from the QA program will be documented in the QA Program Report for the cycle, and the target date for the submittal of this report to NDOT is the end of November so that NDOT can submit to FHWA by the end of December, to coincide with the FHWA Metric evaluation process.

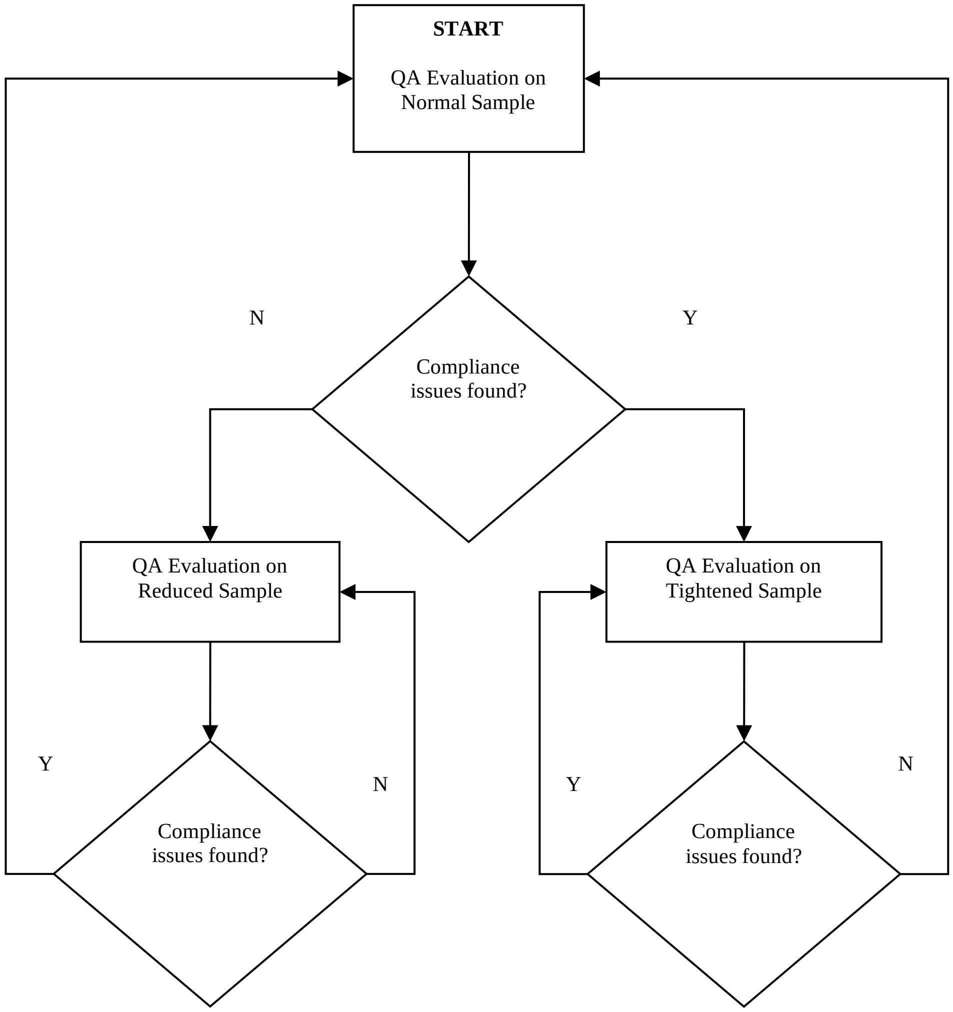
1.10.3 General

The QA Program developed for and implemented by NDOT in 2008 is a data-driven program and evaluates the same NBIS requirements evaluated by FHWA's current metrics.

The QA evaluation is derived from the Standard ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes approach. The ANSI standard and process is applicable to end items, components and raw materials, operations, material in process, supplies in storage, maintenance operations, data or records and administrative procedures. The many different activities included in the bridge inspection program could be classified under several of these groups but for the BIP QA procedures, all items will be addressed as operations.

"Inspection Level" is the standard industry term for the magnitude of a sample taken from a lot of product. For the purposes of the Nebraska Bridge Inspection Program, Evaluation Level (versus Inspection Level) will be used to avoid reuse of the term "inspection" and confusion with the Bridge Inspection Program operation of bridge inventory inspection.

The Levels presented by ANSI are Normal, Reduced and Tightened. The general methodology it to provide for random sampling with tightened sampling when there are findings of concern, and reduced sampling when acceptable quality levels are achieved. The following graphic, adapted from ANSI, illustrates changes in sampling from cycle to cycle of the QA Program.


START
QA Evaluation on
Normal Sample
N
Y
Compliance
issues found?
QA Evaluation on
Reduced Sample
QA Evaluation on
Tightened Sample
Y
N
Compliance
issues found?
Y
N
Compliance
issues found?

1.10.3.1 Definitions

The NDOT QA Evaluation Program will use these definitions and are in general conformance to ANSI/ASQ Z1.4.

1.10.3.1.1 Operation

See the BIP Operation Matrix. Samples are drawn for each of the major operation of the Nebraska BIP.

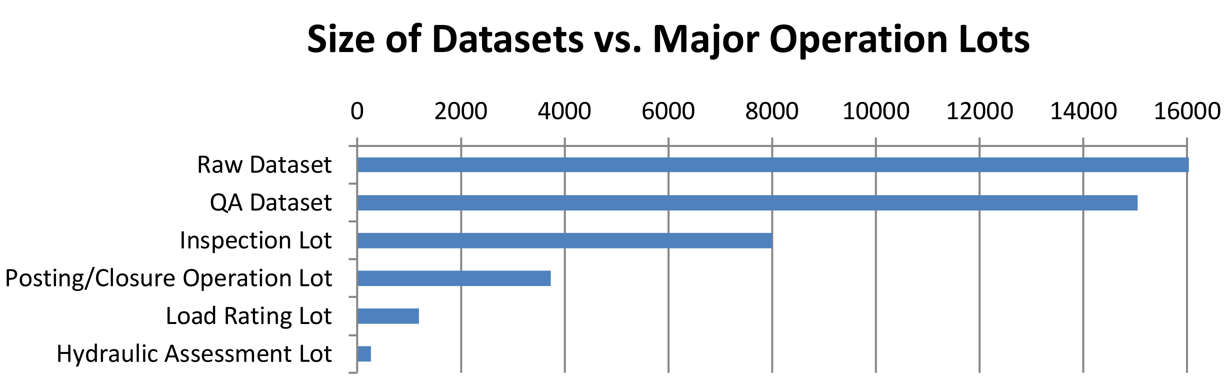
1.10.3.1.2 Operation Variable

The operation variable typically is the party who is completing the operation, because this is the source of variations in following and observing the BIP procedures. This party affects the consistency and quality of the data, reports and product of the operation.

1.10.3.1.3 Population

Population is the set of structures for which products (data, reports, etc.) were prepared and the results included in a dataset submittal to FHWA. Only those structures that are under NDOT's NBIS responsibility need to be included in this set.

The set of structures should encompass those for which work is completed or updated in the period prior to NDOT's submittal of bridge inventory dataset to FHWA. This represents work done in the prior inspection cycle. This is the QA Dataset, a subject of the Raw Dataset. The information for the 2012 NBI Dataset is shown in the following chart.



1.10.3.1.4 Lot

Lot will be a set of structures for an operation from which a sample is to be drawn to evaluate conformance with the acceptability criteria.

Inspection Lot is the largest group of structures, approximately half of the number of the structures in the inventory.

1.10.3.1.5 Sample

A sample consists of one or more subjects (structures) randomly drawn from a lot.

1.10.3.1.6 Subject

A subject is an individual structure that undergoes evaluation for a given operation.

Sample subjects can be evaluated for multiple BIP operations. For example, for the QA evaluation of the 2011 inspection cycle (2012 dataset) Load Rating subjects meeting the Lot criteria were identified in the Inspection Sample. Additional subjects needed to complete the Load Rating Sample, and those were randomly selected from the Load Rating Lot. Note that this was purposely not done for the Posting/Closure Sample due to findings from past cycles and the importance of reviewing all Bridge Owners on this operation.

1.10.3.1.7 Level

The sample size (quantity of subjects taken from the lot) for an operation that will receive a quality assurance check is based on ANSI/ASQ Z1.4 Table 1. The evaluation levels are:

- Normal, Column II, the default level used if insufficient performance data is available to justify a different level;
- Reduced, Column I, used for in areas that have a good quality trend; and
- Tightened, Column III, used for areas when problems have been identified.

The Program Manager has the authority to adjust which evaluation level will be used and, in addition, attributes of the sample to support a risk-driven approach.

Sample Size for a Given Lot (based on ANSI/ASQ Standard Z1.4-2003, Table 1)					
Lot Size			Evaluation Level I	Evaluation Level II	Evaluation Level III
			Reduced	Normal	Tightened
2	to	8	2	2	3
9	to	15	2	3	5
16	to	25	2	5	8
26	to	50	3	8	13
51	to	90	5	13	20
91	to	150	8	20	32
151	to	280	13	32	50
281	to	500	20	50	80
501	to	1200	32	80	125
1201	to	3200	50	125	200
3201	to	10000	80	200	315
10001	to	35000	125	315	500
35001	to	150000	200	500	800
150001	to	500000	315	800	1250
500001	and	over	500	1250	2000

1.10.4 QA Review of Qualifications

Operation	Qualifications Maintain Minimum Qualifications
Variable	BIPPM, TLs, LREs, HEs
Lot	N/A
Sample	All program participants associated with subjects in other operations of inspection, underwater inspection, load rating and hydraulic analysis.
Method of QA Evaluation	Inspection Team Leaders: Review the BIPPM list of certified qualified inspection Team Leaders to verify the individual is on this list. Review the list for possible errors. Underwater Inspection Team Leaders: Review the BIPPM a list of certified qualified inspection Team Leaders to verify the individual is on this list. Review their statement of qualifications for work on the NDOT consultants' contract for the inspections and verify their diver certification is current. Load Rating Engineers and Hydraulic Engineers: Review Nebraska Board of Engineers and Architects on-line data base to verify all LREs and HEs are registered in the state of NE.

1.10.5 QA Review of Inspection and Inspection Frequencies

Operation	Inspection and Inspection Frequencies Inspection – R, FC, UW, SC, CP Maintain specified inspection frequencies
Variable	Inspection Team Leader
Lot	Structures for which inspections are completed and data is included in a given NBIS dataset. This typically includes structures inspected within a given cycle and is approximately half of the population.
Sample	The quantity of subjects is based on the ANSI/ASQ Z1.4 Table 1. Subjects are randomly selected from the lot. The Program Manager, based on QA findings from prior cycle will determine the evaluation level, (I reduced, II normal or III tightened). Base Sample Weighted by Structure Attribute: Structurally Deficient (SD) The size of the base sample is determined for the size of the entire lot, but is weighted as follows. A SD subsample is randomly drawn for the quantity SD structures in the lot; the size is also based on ANSI/ASQ table. The balance of the base sample is drawn from the structures in the lot that are non-SD. Base Sample Augmentation for the Variable: From the inaugural cycle through the 2011 inspection cycle (2012 dataset), the random base sample was augmented so that each Team Leader performing inspections in the cycle would have QA Evaluation done on 2% of the structures they inspected (with a minimum of 2). The base sample was augmented if additional subjects are needed to meet these requirements. The additional subjects selected randomly from lot subset of structures inspected by the particular Team Leader and not in the base sample. NDOT may vary the sampling in future cycles based on TL performance measures.
Method of QA Evaluation	Independent inspection by the QA Evaluation Team of structure after the subject TL has concluded their inspection. The QA Team inspection coding, review of critical and non-critical findings are then compared to the subject inspection coding and reporting. Differences in NBI condition ratings of more than one will be noted. Percent agreement between subject and QA Teams coding for all items is determined, but only for applicable items. Applicable items are those that relate to the actual work of the TL. Changes that occur after the subject inspection (e.g. coding procedures, flood events that changed the site conditions) are not included in evaluation of the TL. Larger variations on all inventory items are recorded and evaluated for program improvements. Other data calculated by the QA Team includes Daily Inspection Rate. The intervals between the subject NBI inspection date and the prior NBI inspection are determined and compared to the specified not-to-exceed frequency.

1.10.6 QA Review of Underwater Inspections and Frequencies

Operation	Underwater Inspection and Frequencies
Variable	Underwater Inspection TLs
Lot	The lot is the approximately 90 bridges that require underwater inspection in the state. NDOT hires consultant(s) to complete underwater inspections for bridges in the Nebraska Bridge inventory. The interval currently is 60-months; thus, not all NBI dataset contain new UW inspection data.
Sample	The quantity of bridges according to the ANSI/ASQ Z1.4 Table 1 would be 13; however, NDOT and FHWA agreed that a minimum of 2 would be allowed for each UW TL due to the expense of UW inspection. For review of reports (without independent inspection, a random sample will be drawn from the entire lot.
Method of QA Evaluation	Independent inspection by the QA Evaluation Team of structure after the subject TL has concluded their inspection. The QA Team inspection coding, review of critical and non-critical findings are then compared to the subject inspection coding and reporting. Differences in NBI condition ratings of more than one will be noted. Percent agreement between subject and QA Teams coding for all items is determined, but only for applicable items. Applicable items are those that relate to the actual work of the TL. Changes that occur after the subject inspection (e.g. coding procedures, flood events that changed the site conditions) are not included in evaluation of the TL. Larger variations on all inventory items are recorded and evaluated for program improvements. Report Review will consist of checks for consistency with the UW inspection procedures for that specific bridge. The intervals between the subject UW inspection date and the prior UW inspection are determined and compared to the specified not-to-exceed frequency.

1.10.7 QA Review of Load Ratings

Operation	Load Rating Rate each bridge as to its safe load carrying capacity
Variable	Load Rating Engineer
Lot	Structures for which load ratings are completed and data is included in a given NBIS dataset. This typically includes structures load rated within a given cycle, and must be determined from the load rating date shown in NDOT's database.
Sample	The quantity of subjects is based on the ANSI/ASQ Z1.4 Table 1. The Program Manager, based on QA findings from prior cycle will determine the evaluation level, (I reduced, II normal or III tightened). <u>Base Sample Augmentation for the Variable:</u> From the inaugural cycle through the 2011 inspection cycle (2012 dataset), the random base sample was augmented so that for each LRE performing ratings in the cycle would have QA Evaluation done on 2% of the structures they rated (with a minimum of 2). The base sample was augmented if additional subjects are needed to meet these requirements. The additional subjects selected randomly from lot subset of structures inspected by the particular LRE and not in the base sample.

Method of QA Evaluation	The following methods will be utilized:
	<u>Standard Review</u>
	• Review of the Load Rating Summary Sheet (LRSS) for each subject.
	• AASHTOWare BrR software reports: Review report for completeness, input values and that the results are consistent with the bridge inspection report; each report to show evidence of QC check; each report is sealed and signed by a PE.
	• Non-BrR reports
	    • Reports using spreadsheets, a sample calculation will be conducted for each field to verify that the correct formula has been entered.
	    • Hand calculations will be reviewed to check that the correct formulas are used and one calculation for each formula will be completed by the QA Engineer to verify the accuracy of the results.
	<u>Extensive review</u>
	An extensive review, in addition to a standard review, includes an independent load rating or complete check of the load rating calculations and analysis. Extensive review is completed for the following:
	• First QA review of a LRE or
	• First QA review of a specific bridge type or
	• Non-BrR rating method has been employed.

1.10.8 QA Review of Load Postings

Operation	Posting Closure Post or restrict the bridge
Variable	Bridge Owner
Lot	All bridges in the population with NBI Item 41 coded: B - Open, posting recommended but not legally implemented (all signs not in place or not correctly implemented) D - Open, would be posted or closed except for temporary shoring, etc. to allow for unrestricted traffic E - Open, temporary structure in place to carry legal loads while original structure is closed and awaiting replacement or Rehabilitation G - New structure not yet open to traffic K - Bridge closed to all traffic P - Posted for load (may include other restrictions such as temporary bridges which are load posted) R - Posted for other load-capacity restriction (speed, number of vehicles on bridge, etc.)
Sample	The quantity of subjects is based on the ANSI/ASQ Z1.4 Table 1. Subjects are randomly selected from the lot. The Program Manager, based on QA findings from prior cycle will determine the evaluation level (I reduced, II normal or III tightened). The level has varied between normal and tightened since the Inaugural cycle due to the high number of bridges found posted/restricted incorrectly
Method of QA Evaluation	The QA Team will check each bridge site to verify signs have been posted or that closure barricades are in place.

1.10.9 QA Review of Scour Analysis

Operation	Scour Analysis Scour Analysis for Scour Condition
Variable	Hydraulic Engineer
Lot	Structures for which hydraulic analysis reports are completed and data is included in a given NBIS dataset. This typically includes structures with a Scour code of 3 for Item 113, analyzed within a given cycle, and must be determined from the hydraulic assessment date shown in NDOT's database.
Sample	The quantity of subjects is based on the ANSI/ASQ Z1.4 Table 1. Subjects are randomly selected from the lot. The Program Manager, based on QA findings from prior cycle will determine the evaluation level, (I reduced, II normal or III tightened). Base Sample Augmentation for the Variable: From the inaugural cycle through the 2011 inspection cycle (2012 dataset), the random base sample was augmented so that for each HE performing analysis in the cycle would have QA Evaluation done on 2% of the structures they reviewed (with a minimum of 2). The base sample was augmented if additional subjects are needed to meet these requirements. The additional subjects selected randomly from lot subset of structures analyzed by the particular HE and not in the base sample.
Method of QA Evaluation	The QA evaluation methods for scour assessments are described in NDOT's Hydraulic Analysis Guidelines.

1.10.10 QA Review of Follow Up on Scour Critical Monitoring

Operation	Scour Critical Monitoring Monitoring Scour Critical Bridges with Plans of Action
Variable	Bridge Owner
Lot	All non-state Bridge Owners – See Owner Records
Sample	The sample is the same as Owner Records. For each Owner two of their scour critical bridges are randomly selected.
Method	The QA review will check scour plans of action for scour critical structures under the jurisdiction of the Bridge Owner to see that the monitoring is being done. Typically, Bridge Owners keep a log of action completed for each action in the POA, which may vary for each structure.

1.10.11 QA Review of Bridge Owner Files

Operation	Owner Records Maintain key record components in the Bridge File
Variable	Bridge Owner
Lot	All non-state Bridge Owners who have bridges under their jurisdiction
Sample	The quantity of subjects is based on the ANSI/ASQ Z1.4 Table 1. Subjects are randomly selected from the lot. The Program Manager will determine the appropriate evaluation level. For each BO, the sample of structures has varied over cycles. At a minimum one of each of the following from the BOs Bridge File, selected randomly from the particular Bridge Owner's bridge inventory, should be reviewed: Fracture Critical Bridge, Bridge under a Scour Plan of Action, Bridge with Maintenance Flag. See additional notes under Method.
Method of QA Evaluation	The following methods have been utilized for cycles through the 2011 Inspection Cycle (2012 Dataset). QA Team visits to the Owners' offices served two purposes: (1) to review organization of the BO Bridge File and Individual Bridge Records, (2) to answer questions regarding NDOT's procedures in the Manual, and explain best practices being used by other BOs. Evaluation tasks include: • BO personnel is interviewed to determine how the Bridge File and Individual Bridge Records are currently organized • Records are checked for the mandatory components of BIP Manual Chapter 2 Additional files may be checked at the discretion of the QA reviewer. Each file should be representative of the level of care exhibited by the Bridge Owner since all files should be maintained in the same manner. If the QA reviewer determines that files are being maintained differently for different types of structures, then a sample of each filing system should be checked.

1.10.12 QA Review of Follow Up on Critical Findings

Operation	Follow-up on Critical Findings
Variable	Bridge Owner
Lot	All non-state Bridge Owners – See Owner Records.
Sample	The sample is the same as Owner Records. For each Owner two of their bridges with Critical Findings are randomly selected from NDOT's Master List.
QA Method	The QA will review structures under the jurisdiction of the Bridge Owner to see that the Critical Finding process is being followed and that closure is being attained.

1.10.13 QA Review of Repair or Maintenance Activities

Operation	Follow-up on Non-critical Findings
Variable	Bridge Owner
Lot	All Bridge Owners – See Owner Records.
Sample	The sample is the same as Owner Records. For each Owner two of their bridges with Maintenance Flags (NE Item) are randomly selected.
QA Method	The QA will review structures under the jurisdiction of the Bridge Owner to see that these are being followed up on and documentation is in the Bridge File or Individual Bridge Record. The QA review will check the non-state Owners' records for structures maintenance history for documentation in the files of the bridges that are included in the subject Owners random sample for records review. There is a wide variety of processes being used.

1.10.14 QA Review of Inventory Data

Operation	Inventory Data
Lot	N/A
Sample	All subjects for the current cycle are checked for data issues. This activity will not be done using a defined sampling plan. NDOT is responsible for maintaining data as defined by the NBIS program. It is important that this data be entered into the bridge inventory database accurately. The sample will be the data contained in reports selected for quality assurance review of reports.
Method of QA Evaluation	• The NDOT Data Manager runs the NBIS Edit Check prior to any submittal to FHWA and resolves errors found. • Subjects are reviewed for data inconsistencies or apparent miscoding will be reviewed. • Upon completion of the QA review of reports, the bridge inventory database will be checked to verify that the data for that specific activity has been correctly entered into the database.

1.11 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1
2	2013 March 04	Revision 2
3	2015 March 15	Revision 3
4	2016 March 11	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

1.12 FORMS

Name	DR Form
Nebraska Bridge Inspector Information Form	DR 97
QA Review of Inspection	N/A
QA Review of Load Posting	N/A
QA Review of Load Rating	N/A
Bridge File Index	N/A
Individual Bridge Record Checklist	N/A
QA Review of Bridge Scour	N/A

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2.1 GENERAL

Complete Owner Bridge Records are essential for the protection of public safety and for cost-effective management of bridges. Bridges are a significant investment of public funds in capital assets.

The National Bridge Inspection Standards (NBIS) require that records be kept on each bridge. This Chapter documents specific expectations regarding Bridge Records for the Nebraska Bridge Inspection Program.

The NBIS incorporates by reference the *AASHTO Manual for Bridge Evaluation* (MBE) which outlines expectations for Bridge Records. Some of this information is included herein for the convenience of the Bridge Owners, but all Owners should familiarize themselves with the requirements of the MBE. It is recognized that in many cases only a portion of the components recommended in the MBE may be available or needed for managing a specific bridge or types of bridges.

This Chapter describes the NE Bridge Inspection Program expectations for the basic components that Nebraska Bridge Owners should maintain for each Bridge Record in their Bridge File. Some of the components are deemed by NDOT to be mandatory for an Individual Bridge Record; a table of these items is provided herein. Components of Bridge Records should always be dated and include the identification of the individual who prepared the information.

Bridge Owners must keep a Bridge File that includes an Individual Bridge Record with essential components for each bridge under their jurisdiction. The Bridge File must be accessible to the Owner's staff involved with bridge inspection and management, local officials, NDOT and FHWA, and shall be kept in a logical order to allow efficient retrieval, typically by Nebraska Inventory ID.

The Bridge File components may be maintained in individual records or in a group. Components may be in hardcopy or electronic format.

NDOT requires in the *Policy for Design, Load-Rating and Inspection of Public Road Bridges, May 24, 2010* (See Chapter 1 Bridge Inspection Program Requirements) that Owners send hydraulic design reports, bridge design plans, bridge load rating reports and inspection reports for their bridges to the Bridge Division. NDOT requests that these are sent as electronic files. NDOT will place a copy in the Bridge Document Management System folder on the Bridge Division ftp site. Owners may utilize this location as a back-up for the files they must keep on their own servers and computers. NDOT is not responsible for ensuring that Owners' information on this ftp site is up to date and current.

2.2 REFERENCES

The information in this Bridge Inspection Program Manual supplements requirements, and procedures and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP).

The References list of applicable documents is included in the Manual Appendix. The National Bridge Inspection Standards are also included in the Manual.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in National Bridge Inspection Standards, the *AASHTO Manual for Bridge Evaluation*, and FHWA publications, technical advisories and publications related to the NBIS.

2.3 RESPONSIBILITIES

2.3.1 Nebraska Department of Transportation

NDOT is responsible for:

- Providing procedures and guidance regarding Bridge Owners' Bridge File.
- Provide access to BrM to all Nebraska Bridge Owners for use and inputting inspection information.
- Maintaining the inventory database for National Bridge Inventory and Nebraska Inventory Items.
- Providing consultants to complete the underwater inspections and reports for each bridge requiring underwater inspection in Nebraska, and providing the Owner with a copy of the inspection report.

NDOT holds some Bridge Owner Record information on their ftp site such as bridge plans, load rating information and inspection reports. Owner's may use the ftp site as a location for backup and are responsible for ensuring the data held there is current.

2.3.2 Bridge Owners

Bridge Owners are responsible for:

- Maintaining a Bridge File that includes Individual Bridge Records for all of the bridges under the jurisdiction of the Bridge Owner.
- Providing bridge management staff access to the Bridge File and all Individual Bridge Records, whether they are electronic or hard copy, for their use.
- Keeping their Bridge File at their site or office.
- Keeping back-up of their electronic documents, either at their site or on the NDOT ftp site.
- Storing component documents in either hardcopy or electronic format, organized in a system that is uniform for all their bridges.
- Educating their local officials and their staff of the requirements of the NBIS and the MBE.
- Being familiar with the records and information generated by their engineering consultants.
- Complying with NDOT Bridge Division *Policy for Design, Load-Rating and Inspection of Public Road Bridges, May 24, 2010* for submittal of bridge plans, hydraulics analyses, load ratings and inspections. (See Chapter 1 Bridge Inspection Program Requirements.)
- Having their bridges load rated when required by this Manual.
- Follow up on and resolution for Critical Findings and reporting closure to NDOT.

2.3.3 Engineering Consultants

Engineering Consultants are responsible for:

- Being familiar with the requirements of NBIS and the MBE.
- Providing professional services contract deliverables which constitute a component of a Bridge Record (inspection report, SI&A, load rating summary sheet, load rating reports, hydraulic analysis reports, etc.) directly to Bridge Owners.
- Being familiar with NDOT Bridge Division *Policy for Design, Load-Rating and Inspection of Public Road Bridges, May 24, 2010* for submittal of bridge plans, hydraulics analyses, load ratings and inspections. (See Chapter 1 Bridge Inspection Program Requirements.) This information is not to be transmitted directly to NDOT, except at the request of NDOT.
- Complying with the Bridge File and Bridge Record organization used by the Owner.

Consultants may assist Bridge Owners with their Bridge File and Records assembly and maintenance, but consultants cannot permanently house, possess or store an Owners Bridge File and Individual Bridge Records.

2.4 DEFINITIONS

2.4.1 AASHTO MBE Definitions

2.4.1.1 Bridge File

A Bridge File describes all of the bridges under the jurisdiction of the Bridge Owner. It contains one Individual Bridge Record for each bridge. The Bridge File can include group files for information that applies to more than one bridge.

2.4.1.2 Bridge Record

A Bridge Record contains the cumulative information about an **individual** bridge. It should provide a full history of the structure, including details of any damage and all strengthening and repairs made to the bridge. The Bridge Record should report data on the capacity of the structure, including the computations substantiating reduced load limits, if applicable, and the hydraulic analysis report or BR385 forms that substantiates a scour critical condition.

2.4.1.3 Base Data

Base data is information for a bridge-specific item that is normally not subject to change. Example of this data would include items such as structure number, year built, location, and dimensions.

2.4.1.4 Inspection Data

Field inspection data is modified with each inspection. Examples of this type of data would include routine inspection (NBI) reports, fracture critical inspection reports, underwater inspection reports, special inspection reports, general assessment of the waterway and scour status, changes in the structures section properties (section loss), changes to items that are dead load on the structure such as gravel or additional utilities.

2.4.1.5 Derived Data

Derived data is information that is derived from the base and inspection data. Examples of derived data would be condition ratings, recommendation for maintenance or repair, scour critical code and the calculated load rating for a structure.

2.4.2 NE BIP Implementation and Definitions

2.4.2.1 Bridge File

The Bridge File includes all documents for each Individual Bridge Record, whether hardcopy or electronic format, and whether they are kept in a group or individually. Owners must provide information regarding the location of the documents to their staff, LPA officials, NDOT, and FHWA. Owners may keep their bridge files in either electronic or hard copy form, but should be consistent in storage methods.

2.4.2.2 Individual Bridge Record

The Individual Bridge Record is a file kept at the Owners' facilities that will contain all components of each Bridge Record, in either hard copy or electronic format. The Individual Bridge Record must be readily retrieved by Local Public Agency (LPA) officials. Together, the Individual Bridge Records make up the Owner's Bridge File.

2.4.2.3 BrM

AASHTOWare's Bridge Management (BrM) software is NDOT's current inspection and data management system. BrM replaced Pontis in 2014, and is an web based system that can be accessed from anywhere a connection to the internet is available using the following link: https://brm.nebraska.gov/

2.4.2.4 PONTIS

Pontis was the inspection and data management system used by Nebraska prior to the adoption of BrM in 2014. Pontis was in use from 2008 until 2014.

2.4.2.5 BISON

Bridge Inspection System of Nebraska (BISON) was the inspection and data management system used in Nebraska prior to the adoption Pontis in 2008. This system was used for inspection reporting from 2003 through 2007.

2.4.2.6 BRIN

Bridge Inspection Nebraska (BRIN) was the inspection and data management system used in Nebraska prior to the adoption of BISON. This system was used for inspection reporting from 1997 through 2002.

2.4.2.7 Site Photos

Site photos are those taken once, typically at the inventory inspection and provide a pictorial record of the site. Site photos are only required again when conditions at the site have changed. Guidance on this can be found in the Chapter 4, Bridge Inspection. See the guide for taking site photos in the Appendix.

2.4.2.8 Inspection Photos

Inspection photos are those necessary to document major defects or other conditions. Examples would be cracked timber stringers, significant section loss of any member and scour related issues. Inspection photos are typically required to document the condition of an item rated 5 (Fair) or lower, more guidance can be found in Chapter 4, Bridge Inspection.

2.5 MANDATORY COMPONENTS OF EACH INDIVIDUAL BRIDGE RECORD

The following table lists the components of Bridge Records from the MBE, in the order shown in the MBE. NDOT guidance for each component follows the table. Each item is required if it is available.

Component from MBE	Nebraska Mandatory Item
Plans	• Construction plans or measurements • Shop drawings
Specifications	Special Provisions or other specifications covering the construction of custom, unique elements or features of the bridge. These records are sometimes necessary for load rating. If these are in the construction project file, indicate the location on the Individual Bridge Record (IBR).
Pile Driving Records	These records are sometimes necessary for load rating. If these are in the construction project file, indicate the location on the IBR.
Correspondence	NDOT correspondence to the Bridge Owner regarding the bridge
Photographs	• Site photos • Inspection photos (required for items rated 5 or lower)
Maintenance and Repair History	• Critical Finding Reports • Maintenance, Repair and Reconstruction documentation • Maintenance of Coatings
Accident History	Documentation of accident damage to load bearing elements of the superstructure or substructure
Inspection Requirements	• Procedures for Fracture Critical (FC) bridges, bridges with fatigue-prone details and complex bridges must be kept in the Owner's Bridge Record • List of FC members
SI&A	The most current Structure Inventory & Appraisal (SI&A) report
Inventories and Inspections	All inspection documents and reports
Load Rating and Posting	Current signed Load Rating Summary Sheet (LRSS)
Permit Load History	Any records of loads that exceeded the bridge load limits
Scour Assessment and POA	• Hydraulic assessment and/or BR385 forms for scour documentation • Plan of Action (POA) • POA Log

2.5.1 Plans and Measurements

The record for each bridge must contain the bridge's construction plans with as-built information if they are available. If plans are not available, detailed measurement sheets should be included in the Bridge Record, such as for timber and steel stringer structures. If detailed measurements are not possible and plans are not available, such as for concrete structures, a note should be placed in the Bridge Record to this effect. This is a mandatory component of the Bridge Record.

Shop drawings, if available, should also be included in the Bridge Record.

2.5.2 Specifications

Bridges in Nebraska are typically built with the governing NDOT specification for highway and bridge construction. The plans typically will specify the specification edition that was in force at the time of construction.

Structures often have Special Provisions detailing unique features that should be included in the Bridge Record.

2.5.3 Correspondence

The MBE recommends that this component include all correspondence related to the structure from construction to the present. NDOT requires that Bridge Owners keep a copy of all correspondence, including emails, from NDOT pertaining to the bridge.

An example would include a copy of the letter NDOT mailed to Bridge Owners regarding excess gravel. Correspondence from NDOT regarding the specifics of this structure is a mandatory component of the Bridge Record.

Some correspondence from NDOT might pertain to several individual bridges. It is recommended that a copy of the correspondence should be included in each Bridge Record.

2.5.4 Photographs

NDOT requires that Owners maintain two sets of photos for each bridge – site photos and inspection photos. Both sets are mandatory components of the Bridge Record. See Chapter 4, Bridge Inspection for procedures related to processing and filing photos.

2.5.5 Materials and Tests

Any materials data from the construction of the bridge is typically included in the construction file, such as pile driving logs, concrete tests, mill certifications and the like. These typically are in the construction file, and the location should be referenced on the IBR.

In rare instances in Nebraska, a bridge may have been load tested and those records should be included.

2.5.6 Maintenance, Repair and Reconstruction History

Each Bridge Record should include a chronological record of maintenance and repairs, Critical Findings Reports and their resolution. Records on any coatings or other protective membranes should be included in the Maintenance and Repair history. Some bridges may have been reconstructed and these plans should be in the IBR.

Critical Findings Reports are a mandatory component of a Bridge Record, if this situation is applicable.

Records on follow-up on any inspection findings are required by the NBIS.

2.5.7 Accident Records

Details of damage from accident or other damage should be included the Bridge Record. Accident information involving bridges is often maintained by and can be obtained from local law enforcement. If an accident resulted in repairs to the bridge, documentation of accident caused-damage to any load bearing element of the superstructure or substructure is a mandatory component of a Bridge Record.

2.5.8 Posting

Each Bridge Record must include the history of all load restrictions and postings for a structure, if this situation is applicable for the individual bridge. A copy of all load rating summaries in the Records is sufficient if they are combined in the file. If all load rating summaries are combined and kept in the file, old summary sheets should have “void” written on them to avoid any confusion about which is the most current. Some Owners have sign inventories that provide a record of load posting at a particular structure.

2.5.9 Permit Loads

NDOT uses the Superload software to issue permits for oversized loads on the state highway system. This system is capable of issuing permits based on the load capacity of every structure on a hauler-selected route.

Parties needing to haul oversize loads over local roads should contact the Local Public Agency to obtain permission to use the hauler-selected route. It is highly advised by NDOT that Local Public Agency Bridge Owners issue permits for these types of loads. Permit applications typically include documentation of vehicle loads and axle configurations that differ from the Nebraska Legal Truck configuration and the route the vehicle will take. The information should include dates and any computations completed to issue the permit for the oversized load. Local Public Agencies often can issue a permit these based on Load Rating Summary Sheets included in the Bridge Record and/or by consulting their Load Rating Engineer.

2.5.10 Storm Event History

The Bridge Record for structures over waterways should include a history of storm events, flooding events, recording high-water marks and observed scour. Documentation of flooding events and observations are a mandatory component of a Bridge Record for a Scour Critical Bridge and should be recorded in the POA monitoring log. See also the Section on Scour Records.

2.5.11 Traffic Data

Traffic volumes will vary with time and are updated as follows, depending on the Federal Functional Classification.

2.5.11.1 Arterials or Collectors

The NDOT Planning Section periodically updates state and regional traffic data, Average Daily Traffic (ADT) and Average Daily Truck Traffic (ADTT). Local Owners may have other data in their files.

2.5.11.2 Local Roads and Streets

The Bridge Owner is responsible for traffic data on local roads and streets and they should review the data with each routine inspection.

2.5.12 Inspection History

Each Bridge Record should include a history of all inspections performed on the bridge. These could include routine (NBI), fracture critical, underwater, special and other inspection types described in Chapter 4, Bridge Inspection.

2.5.13 Inspection Procedure Requirements

Each bridge requiring non-routine inspection techniques (fracture critical, complex and underwater) should include inspection procedures. These would describe a list of specialized tools and equipment needed to complete the inspection.

Fracture critical bridges must have a list of all known FC members in the record. This documentation is a mandatory component of a Bridge Record for inspections.

The LPA Bridge Owners are required to have a copy of the underwater inspection procedures in the records.

2.5.14 Structure Inventory and Appraisal Sheets

The Bridge Record should contain a copy of the SI&A sheet from the latest inspection. The SI&A sheet is typically printed and stored with the Bridge Record upon completion of data entry, however, it is acceptable if the SI&A sheet is not printed as long as the Owner has access to BrM to view the inspection record from the office where the Bridge Record is kept.

2.5.15 Inventories and Inspections

The records should contain all inspection reports completed as part of the Nebraska Bridge Inspection Program. See Chapter 4, Bridge Inspection for definitions and further information. These would include, as they pertain to each bridge:

- Routine Inspections (inspection reports are created for Routine Inspections only in unusual situations)
- Underwater inspection reports
- Fracture Critical inspection reports
- Special Inspections
  - Initial inspections
  - Post-repair inspections completed after repairs made to address Critical Findings
  - Other inspections related to monitoring the general or a specific condition.

NDOT utilizes engineering consultants under a statewide program to complete underwater (UW) inspections in Nebraska. The LPA Bridge Owners must have a copy of the latest underwater inspection report in their Bridge Record. When UW inspections are completed, the consultant will send a copy of the reports to the LPA Bridge Owners.

NDOT had been utilizing engineering consultants under a statewide program to complete fracture critical inspections in Nebraska. The LPA Bridge Owners must have a copy of the latest fracture critical inspection report in their Bridge Record. The consultants were instructed to provide a copy directly to the Bridge Owners. **Fracture critical bridges are no longer being inspected by NDOT under a statewide program. As of January 1, 2020, all LPA Bridge Owners with fracture critical bridges in their inventory will be responsible for completing these inspections.**

All inspection documents and reports are mandatory components of a Bridge Record.

2.5.16 Load Rating Records

The Bridge Record must include the complete Load Rating Report that includes documentation of calculations for a bridge's load rating. It is mandatory that all bridges have a Load Rating Summary Sheet (LRSS), signed by the Load Rating Engineer. Calculations made to arrive at the load rating are often done using computer programs. If this is the case the calculations need not be kept in the Bridge Record. If calculations are completed by NDOT they are stored on the ftp site in the bridge folder. If calculations are completed by the Owner or the Owner's consultant, they should be similarly uploaded to NDOT's ftp site for storage. Original, signed LRSSs should be in the possession of the Owner and included in the Bridge Record.

2.5.17 Scour Records

All bridges over waterways are required to be assessed for scour. New bridges should not be designed so that they are scour critical. Scour status of existing bridges may change over time.

NDOT hired engineering consultants in 2007 and 2008 to evaluate selected bridges that were coded for Item 113 as 6 or U for scour in Nebraska. This effort was completed in 2010. For these bridges, a hydraulic study and assessment was completed by an Interdisciplinary Hydraulic Assessment Team and a bridge may have been determined to be scour critical (Item 113 is 3 or less) or the bridge has an unknown foundation (Item 113 is U). The Bridge Division Hydraulic Section screens inspection data for structures that may have scour issues and will provide the Owner the documents for any hydraulic reanalysis.

The Bridge Record should include the complete Hydraulic Analysis Report and/or BR385 forms. The structure may, as a result, have been determined to need a scour Plan of Action (POA), and this is also required to be part of the record. Scour assessments and POAs if required, are mandatory components of a Bridge Record. The Record for bridges with a POA must contain a POA Log that documents activities related to the POA, such as installation of countermeasures or monitoring.

Scour assessment and/or BR385 forms, POA and the POA Log are mandatory components of the Bridge Record for scour critical bridges (Item 113 is 3 or less) or if the bridge has an unknown foundation (Item 113 is U).

NDOT recommends that Owners prepare POA Logs in a format that is portable to the field for scour monitoring and reporting. It is the Owners decision how to maintain a POA Log, however, the Log must include the date, observations made and the status of the bridge.

NDOT also requires the bridge owner to perform field review of the Scour Critical structures annually. If scour monitoring is not required in a calendar year due to lack of events, a note should be placed on the POA Log to document this.

Examples of POA Logs used by NE Owners include:

- Three ring binder(s) that include(s) copies of Owners POAs and the NDOT form POA Logs for each structure.
- One county map is prepared for each storm event that documents the rainfall total amounts across the county with post-event observations on the back of the map. All event maps and recorded observations are kept in a group hardcopy file at the Owner’s office.
- The POA form reproduced on a photocopier and provided to maintenance personnel who complete the monitoring tasks and document the date and their observations. The hardcopy is then filed in the hardcopy Bridge Record at the Owner’s office.

2.6 QUALITY CONTROL

Quality Control (QC) for this program is the responsibility of the consultant or agency actually conducting the activity. Quality Control checks are conducted on every product of a program operation, and thus at a much higher frequency than quality assurance checks. When the QC on a program product is complete, it is finished and deliverable to the Bridge Owner for their records. The QC expectations are described in more detail in Chapter 1, Bridge Inspection Program Requirements.

2.7 QUALITY ASSURANCE

NDOT or their selected agent will perform Quality Assurance (QA) of all activities of the Bridge Inventory. The QA program activities are described in Chapter 1 of this Manual.

2.8 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Add POA Log, Bridge File Index, Individual Bridge Record Checklist; Miscellaneous clarifications
2	2013 March 04	Revision 2
3	2015 March 15	Revision 3
4	2016 March 11	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

2.9 FORMS

Forms used in completing activities mentioned in this Chapter are listed below. Participants and contributors to the Nebraska Bridge Inspection Program are advised to go to the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/ for the current list of applicable forms and the most recent versions of each form.

Name	DR Form
Plan of Action (POA) Log	N/A

2.10 APPENDIX

Memos and other guidance that may have been issued after the issuance of the current revision of this Chapter can be found at the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/.

Participants are urged to check this site to ensure they have all the most current information and forms.

3-NBI.1 GENERAL

The FHWA database includes Items from Item 1 through Item 116. The descriptions and guidance for use of these are shown in FHWA's Coding Guide. They are also herein and are shown in *Calibri Italic* font. The FHWA's Coding Guide descriptions and tables are in the International System of Units (SI); they have been converted to English units in this Manual and shown in *Calibri Italic* font to convey to the Manual user the source of the information. This Chapter also provides NDOT commentary or supplemental guidance on these Items where necessary.

The 200 series Items are Nebraska custom data fields used by NDOT and are not submitted to the FHWA. These items do not print on a structure's Structural Inventory and Appraisal (SI&A) report.

The 300 series Items are Nebraska custom fields used by NDOT and are not submitted to the FHWA. These items do not print on the SI&A report. These were developed by the NDOT Bridge Division and are used for bridge maintenance and bridge management purposes. The assignment of a particular rating or code to any item will only indicate that action is required or desired, but will not imply that action will be taken or is pending.

3-NBI.2 REFERENCES

The information in this Bridge Inspection Program Manual supplements requirements, and procedures and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP).

The References list of applicable documents is included in the Manual Appendix. The National Bridge Inspection Standards are also included in the Manual.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in National Bridge Inspection Standards, the AASHTO *Manual for Bridge Evaluation*, and FHWA publications, technical advisories and publications related to the NBIS

3-NBI.3 FHWA CODING MANUAL DEFINITIONS

The definitions of terms used in the Guide are provided below.

Term	***Definition***
Bridge	*The National Bridge Inspection Standards published in the Code of Federal Regulations (23 CFR § 650.3) give the following definition: 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. See Item 112 for illustration.*
Culvert	*A structure designed hydraulically to take advantage of submergence to increase hydraulic capacity. Culverts, as distinguished from bridges, are usually covered with embankment and are composed of structural material around the entire perimeter, although some are supported on spread footings with the streambed serving as the bottom of the culvert. Culverts may qualify to be considered "bridge" length.*
Inventory Route	*The route for which the applicable inventory data is to be recorded. The inventory route may be on the structure or under the structure. Generally inventories along a route are made from west to east and south to north.*
National Bridge Inventory (NBI)	*The aggregation of structure inventory and appraisal data collected to fulfill the requirements of the National Bridge Inspection Standards. Each State shall prepare and maintain an inventory of all bridges subject to the NBIS.*
National Bridge Inventory (NBI) Record	*Data which has been coded according to the Guide for each structure carrying highway traffic or each inventory route which goes under a structure. These data are furnished and stored in a compact alphanumeric format on magnetic tapes or disks suitable for electronic data processing.*
National Bridge Inspection Standards (NBIS)	*Federal regulations establishing requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of a State bridge inventory. The NBIS apply to all structures defined as bridges located on all public roads.*
Public Road	*Any road under the jurisdiction of and maintained by a public authority and open to public travel.*
Structure Inventory and Appraisal (SI&A) Sheet	*The graphic representation of the data recorded and stored for each NBI record in accordance with this Guide.*
Strategic Highway Corridor Network (STRAHNET)	*A system of highways which are strategically important to the defense of the United States. It includes the Interstate Highways and 25,215 kilometers of other non-interstate highways. The Military Traffic Management Command Report SE 89-4b-27, Strategic Highway Corridor Network, January 1991, contains additional information on STRAHNET.*
STRAHNET Connectors	*STRAHNET Connectors are roads that connect military installations and ports of embarkation to the STRAHNET. The connector routes represent about 3,042 kilometers of roads that complement STRAHNET.*

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Term	Definition
Indian Reservation Road (IRR)	*A public road that is located within or provides access to an Indian reservation as described in Title 23, U.S.C., Sect.101. The terminus of a road providing access to an Indian reservation or other Indian land is defined as the point at which the road intersects with a road functionally classified as a collector or higher classification (outside the reservation boundary) in both urban and rural areas. In the case of access from an Interstate Highway, the terminus is the first interchange outside the reservation.*
Land Management Highway System (LMHS)	*Consists of adjoining state and local public roads that provide major public access to Bureau of Land Management administered public lands, resources and facilities.*
Forest Highway (FH)	*A road, under the jurisdiction of, and maintained by, a public authority and open to public travel; wholly or partly within, or adjacent to, and serving the National Forest System (NFS) and which is necessary for the protection, administration, and utilization of the NFS and the use and development of its resources. (23 CFR § 660).*
Forest Service Development Road	*A forest road wholly under the jurisdiction of the Forest Service, which may be "open to public travel". Bridges on Forest Service Development Roads which are "open to public travel" are subject to the NBIS.*
Base Highway Network	*The Base Highway Network includes the through lane (mainline) portions of the NHS, rural/urban principal arterial system and rural minor arterial system. Ramps, frontage roads and other roadways are not included in the Base Network.*
Highway Performance Monitoring System	*The Highway Performance Monitoring System (HPMS) is a database of universe and sample data that describes the nation's public road mileage. The data are annually updated and submitted to FHWA by the State Highway Agencies, Puerto Rico and the District of Columbia. The universe data provides some basic characteristics of all public road mileage while the sample of the arterial and collector systems allows for assessment of the condition, performance, usage and additional characteristics of the nation's major highway systems.*
Rounding and Truncating of Numerical Data	*All numeral values in this Guide, except as specifically noted, will follow standard rounding criteria, that is, 5 and above will be rounded up to the next higher unit and 4 and below will be rounded down to the next lower unit. This is applicable to all decimal rounding. In certain items where rounding may cause a safety hazard for clearance, the numeric measurements will be truncated at the appropriate decimal place. This means that a fractional portion less than a whole unit will be dropped to the lower whole number, for example 2.88 would be truncated to 2.8 when using tenth of a meter accuracy. All decimal points are assumed in the locations as specified in the Guide.*
Commonly Recognized (CoRe) Structural Elements)	*A group of structural elements endorsed by AASHTO as a means of providing a uniform basis for data collection for any bridge management system, to enable the sharing of data between States, and to allow for a uniform translation of data to NBI Items 58, 59, 60 and 62.*
Bridge management System (BMS)	*A system designed to optimize the use of available resources for the inspection, maintenance, rehabilitation and replacement of bridges.*

3-NBI.4 NATIONAL BRIDGE INVENTORY DATA ITEMS

3-NBI.4.1 NBI Items – Numerical Order

The NBI Items are shown in the following table in the order shown in the NBI. Responsibility for entry into the NE database is shown as guidance of participants, but can vary for each structure.

NBI ITEMS SHOWN IN NUMERICAL ORDER

S = static item – typically don't change each inspection cycle
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P = provides data

Item No.	Item Name	SI&A Category	Code Length /Type	Sufficiency	Static/ Dynamic	PM Staff	Owner	TL	HE	LRE
1	State Code	Identification	3/N		S	I				
2	Highway Agency District	Identification	2/AN		S	I				
3	County (Parish) Code	Identification	3/N		S	I				
4	Place Code	Identification	5/N		S	I				
5	Inventory Route	Identification	9/AN		S	I				
5A	Record Type	Identification	1/AN		S	I				
5B	Route Signing Prefix	Identification	1/N		S	I				
5C	Designated Level of Service	Identification	1/N		S	I				
5D	Route Number	Identification	5/AN		S	I				
5E	Directional Suffix	Identification	1/N		S	I				
6	Features Intersected	Identification	25/AN		S	I				
6A	Features Intersected	Identification	24/AN		S	I				
6B	Critical Facility Indicator	Identification	1/AN		S	I				
7	Facility Carried By Structure	Identification	18/AN		S	I				
8	Structure Number	Identification	15/AN		S	I				
9	Location	Identification	25/AN		S	I				
10	Inventory Rte, Min Vertical Clearance	Geometric Data	4/N		S	I				
11	Milepoint	Identification	7/N		S	I				
12	Base Highway Network	Identification	1/N		S	I				
13	Inventory Route, Subroute Number	Identification	12/AN		S	I				
13A	LRS Inventory Route	Identification	10/AN		S	I				
13B	Subroute Number	Identification	2/N		S	I				
16	Latitude	Identification	8/N		S	I		V		
17	Longitude	Identification	9/N		S	I		V		

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Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**	**Sufficiency**	**Static/ Dynamic**	**PM Staff**	**Owner**	**TL**	**HE**	**LRE**
19	Bypass/Detour Length	Age and Service	3/N	S[3], S[4]	S[1]	I, E		V		
20	Toll	Classification	1/N		S	I				
21	Maintenance Responsibility	Classification	2/N		S	I				
22	Owner	Classification	2/N		S	I				
26	Functional Class Of Inventory Rte.	Classification	2/N	S[2]	S[1]	I, E				
27	Year Built	Age and Service	4/N		S	I				
28	Lanes On/Under Structure	Age and Service	4/N		S	I		V		
28A	Lanes On Structure	Age and Service	2/N		S	I		V		
28B	Lanes Under Structure	Age and Service	2/N		S	I		V		
29	Average Daily Traffic	Age and Service	6/N	S[2]	S[1]	I, E	P	V		
30	Year Of Average Daily Traffic	Age and Service	4/N		S[1]	I, E		V		
31	Design Load	Load Rating and Posting	1/N		S	I				
32	Approach Roadway Width	Geometric Data	4/N	S[2]	S	I		V		
33	Bridge Median	Geometric Data	1/N		S	I		V		
34	Skew	Geometric Data	2/N		S	I				
35	Structure Flared	Geometric Data	1/N		S	I				
36	Traffic Safety Features	Appraisal	4/AN	S[4]	D	I		E		
36A	Bridge Railings	Appraisal	1/AN		D	I		E		
36B	Transitions	Appraisal	1/AN		D	I		E		
36C	Approach Guardrail	Appraisal	1/AN		D	I		E		
36D	Approach Guardrail Ends	Appraisal	1/AN		D	I		E		
37	Historical significance	Classification	1/N		S	I				
38	Navigation Control	Navigational Data	1/AN		S	I		V		
39	Navigation Vertical Clearance	Navigational Data	4/N		S	I		V		

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Item No.	Item Name	SI&A Category	Code Length /Type	Sufficiency	Static/	PM Staff	Owner	TL	HE	LRE
40	Navigation Horizontal Clearance	Navigational Data	5/N		S	I		V		
41	Structure Open/Posted/Closed	Load Rating and Posting	1/AN		D	I, E		E		
42	Type of Service	Age and Service	2/N		S	I		V		
42A	Type of Service On Bridge	Age and Service	1/N		S	I		V		
42B	Type of Service Under Bridge	Age and Service	1/N		S	I		V		
43	Structure Type, Main	Structure Type and Material	3/N	S2	S[2]	I, E		V		
43A	Kind of Material/Design	Structure Type and Material	1/N		S[2]	I, E		V		
43B	Type of Design/Construction	Structure Type and Material	2/N		S[2]	I, E		V		
44	Structure Type, Approach Spans	Structure Type and Material	3/N		S[2]	I, E		V		
44A	Kind of Material/Design	Structure Type and Material	1/N		S[2]	I, E		V		
44B	Type of Design/Construction	Structure Type and Material	2/N		S[2]	I, E		V		
45	Number Of Spans In Main Unit	Structure Type and Material	3/N		S[2]	I, E		V		
46	Number Of Approach Spans	Structure Type and Material	4/N		S[2]	I, E		V		
47	Inventory Rte Total Horizontal Clearance	Geometric Data	3/N		S1	I, E		V		
48	Length Of Maximum Span	Geometric Data	5/N		S	I		V		
49	Structure Length	Geometric Data	6/N		S	I		V		
50	Curb/Sidewalk Widths	Geometric Data	6/N		S	I		V		
50A	Left Curb/Sidewalk Width	Geometric Data	3/N		S	I		V		
50B	Right Curb/Sidewalk Width	Geometric Data	3/N		S	I		V		

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Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**	**Sufficiency**	**Static/ Dynamic**	**PM Staff**	**Owner**	**TL**	**HE**	**LRE**
51	Bridge Roadway Width Curb-To-Curb	Geometric Data	4/N	S2	S	I		V		
52	Deck Width, Out-To-Out	Geometric Data	4/N		S	I		V		
53	Min Vertical Clear Over Bridge Roadway	Geometric Data	4/N	S[2]	S	I		V		
54	Minimum Vertical Underclearance	Geometric Data	5/AN		D	I		E		
54A	Reference Feature	Geometric Data	1/AN		D	I		E		
54B	Minimum Vertical Underclearance	Geometric Data	4/N		D	I		E		
55	Min Lateral Underclear On Right	Geometric Data	4/AN	S[2]	D	I		E		
55A	Reference Feature	Geometric Data	1/AN		D	I		E		
55B	Minimum Lateral Underclearance	Geometric Data	3/N		D	I		E		
56	Min Lateral Underclear On Left	Geometric Data	3/N	S[2]	D	I		E		
58	Deck	Condition	1/AN	S[2]	D			E		
59	Superstructure	Condition	1/AN	S[1]	D			E		
60	Substructure	Condition	1/AN	S[1]	D			E		
61	Channel/Channel Protection	Condition	1/AN		D			E		
62	Culverts	Condition	1/AN	S[1]	D			E		
63	Method Used To Determine Operating Rating	Load Rating and Posting	1/N		D	E				P
64	Operating Rating	Load Rating and Posting	3/N		D	E				P
65	Method Used To Determine Inventory Rating	Load Rating and Posting	1/N		D	E				P
66	Inventory Rating	Load Rating and Posting	3/N	S[1]	D	E				P
67	Structural Evaluation	Appraisal	1/AN	S[2]	D[3]					
68	Deck Geometry	Appraisal	1/AN	S[2]	D[3]					
69	Underclear, Vertical & Horizontal	Appraisal	1/AN	S[2]	D[3]					

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Item No.	Item Name	SI&A Category	Code Length /Type	Sufficiency	Static/	PM Staff	Owner	TL	HE	LRE
70	Bridge Posting	Load Rating and Posting	1/N		D	E				
71	Waterway Adequacy	Appraisal	1/AN	S[2]	D	E			P	
72	Approach Roadway Alignment	Appraisal	1/AN	S[2]	S	I		V		
75	Type of Work	Proposed Improvements	3/N		S[4]	E	P			
75A	Type of Work Proposed	Proposed Improvements	2/N		S[4]	E	P			
75B	Work Done By	Proposed Improvements	1/AN		S[4]	E	P			
76	Length Of Structure Improvement	Proposed Improvements	6/N		S[4]	E	P			
90	Inspection Date	Inspections	4/N		D			E		
91	Designated Inspection Frequency	Inspections	2/N		D[4]		V	E		
92	Critical Feature Inspection	Inspections	9/AN		D[4]			E		
92A	Fracture Critical Details	Inspections	3/AN		D[4]			E		
92B	Underwater Inspection	Inspections	3/AN		D[5]	E				
92C	Special Inspection	Inspections	3/AN		D			E		
93	Critical Feature Inspection Dates	Inspections	12/AN		D			E		
93A	Fracture Critical Details Date	Inspections	4/AN		D			E		
93B	Underwater Inspection Date	Inspections	4/AN		D[5]	E				
93C	Special Inspection Date	Inspections	4/AN		D			E		
94	Bridge Improvement Cost	Proposed Improvements	6/N		D[4]	E	P			
95	Roadway Improvement Cost	Proposed Improvements	6/N		D[4]	E	P			
96	Total Project Cost	Proposed Improvements	6/N		D[4]	E	P			
97	Year Of Improvement Cost Estimate	Proposed Improvements	4/N		D[4]	E	P			
98	Border Bridge	Identification	5/AN		S	I				

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Item No.	Item Name	SI&A Category	Code Length /Type	Sufficiency	Static/	PM Staff	Owner	TL	HE	LRE
98A	Neighboring State Code	Identification	3/AN		S	I				
98B	Percent Responsibility	Identification	2/N		S	I				
99	Border Bridge Structure Number	Identification	15/AN		S	I				
100	STRAHNET Highway Designation	Classification	1/N	S[2], S[3]	S	I				
101	Parallel Structure Designation	Classification	1/AN		S	I				
102	Direction Of Traffic	Classification	1/N		S	I				
103	Temporary Structure Designation	Classification	1/AN		S	I				
104	Highway System Of Inventory Route	Classification	1/N		S	I				
105	Federal Lands Highways	Classification	1/N		S	I				
106	Year Reconstructed	Age and Service	4/N		S[1]	I		V		
107	Deck Structure Type	Structure Type and Material	1/AN		S	I		V		
108	Wearing Surface/Protective System	Structure Type and Material	3/AN		S	I		V		
108A	Type of Wearing Surface	Structure Type and Material	1/AN		S	I		V		
108B	Type of Membrane	Structure Type and Material	1/AN		S	I		V		
108C	Deck Protection	Structure Type and Material	1/AN		S	I		V		
109	Average Daily Truck Traffic	Age and Service	2/N		S	I	P	V		
110	Designated National Network	Classification	1/N		S	I				
111	Pier/Abutment Protection	Navigational Data	1/N		S	I		V		
112	NBIS Bridge Length	Classification	1/AN		S	I		V		
113	Scour Critical Bridges	Appraisal	1/AN		D		E		P	
114	Future Average Daily Traffic	Proposed Improvements	6/N		S	I, E	P			

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NBI ITEMS SHOWN IN NUMERICAL ORDER										
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Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**	**Sufficiency**	**Static/ D...**	**PM Staff**	**Owner**	**TL**	**HE**	**LRE**
115	Year Of Future Avg. Daily Traffic	Proposed Improvements	4/N		S	I, E	P			
116	Minimum Navigation Vertical Clearance Vertical Lift Bridge	Navigational Data	4/N		S	I		V		
[1] TL shall verify and notify BIPPM of changes. [2] These items may change if the structure is rehabilitated or retrofit. [3] These items are calculated by the NBI Edit/Update Program. [4] Bridge Owners and their Engineer should determine these. [5] NDOT is responsible for these items for Underwater Inspection.										

3-NBI.4.2 NBI Items – Inventory Order

NBI ITEMS IN ORDER SHOWN IN THE NBI			
Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**
1	State Code	Identification	3/N
8	Structure Number	Identification	15/AN
5	Inventory Route	Identification	9/AN
5A	Record Type	Identification	1/AN
5B	Route Signing Prefix	Identification	1/N
5C	Designated Level of Service	Identification	1/N
5D	Route Number	Identification	5/AN
5E	Directional Suffix	Identification	1/N
2	Highway Agency District	Identification	2/AN
3	County (Parish) Code	Identification	3/N
4	Place Code	Identification	5/N
6	Features Intersected	Identification	25/AN
6A	Features Intersected	Identification	24/AN
6B	Critical Facility Indicator	Identification	1/AN
7	Facility Carried By Structure	Identification	18/AN
9	Location	Identification	25/AN
10	Inventory Rte, Min Vertical Clearance	Geometric Data	4/N
11	Milerpoint	Identification	7/N
12	Base Highway Network	Identification	1/N
13	Inventory Route, Subroute Number	Identification	12/AN
13A	LRS Inventory Route	Identification	10/AN
13B	Subroute Number	Identification	2/N
16	Latitude	Identification	8/N
17	Longitude	Identification	9/N
19	Bypass/Detour Length	Age and Service	3/N
20	Toll	Classification	1/N
21	Maintenance Responsibility	Classification	2/N
22	Owner	Classification	2/N
26	Functional Class Of Inventory Rte.	Classification	2/N
27	Year Built	Age and Service	4/N
28	Lanes On/Under Structure	Age and Service	4/N
28A	Lanes On Structure	Age and Service	2/N
28B	Lanes Under Structure	Age and Service	2/N
29	Average Daily Traffic	Age and Service	6/N
30	Year Of Average Daily Traffic	Age and Service	4/N
31	Design Load	Load Rating and Posting	1/N
32	Approach Roadway Width	Geometric Data	4/N
33	Bridge Median	Geometric Data	1/N
34	Skew	Geometric Data	2/N
35	Structure Flared	Geometric Data	1/N
36	Traffic Safety Features	Appraisal	4/AN
36A	Bridge Railings	Appraisal	1/AN

NBI ITEMS IN ORDER SHOWN IN THE NBI			
Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**
36B	Transitions	Appraisal	1/AN
36C	Approach Guardrail	Appraisal	1/AN
36D	Approach Guardrail Ends	Appraisal	1/AN
37	Historical significance	Classification	1/N
38	Navigation Control	Navigational Data	1/AN
39	Navigation Vertical Clearance	Navigational Data	4/N
40	Navigation Horizontal Clearance	Navigational Data	5/N
41	Structure Open/Posted/Closed	Load Rating and Posting	1/AN
42	Type of Service	Age and Service	2/N
42A	Type of Service On Bridge	Age and Service	1/N
42B	Type of Service Under Bridge	Age and Service	1/N
43	Structure Type, Main	Structure Type and Material	3/N
43A	Kind of Material/Design	Structure Type and Material	1/N
43B	Type of Design/Construction	Structure Type and Material	2/N
44	Structure Type, Approach Spans	Structure Type and Material	3/N
44A	Kind of Material/Design	Structure Type and Material	1/N
44B	Type of Design/Construction	Structure Type and Material	2/N
45	Number Of Spans In Main Unit	Structure Type and Material	3/N
46	Number Of Approach Spans	Structure Type and Material	4/N
47	Inventory Rte Total Horizontal Clearance	Geometric Data	3/N
48	Length Of Maximum Span	Geometric Data	5/N
49	Structure Length	Geometric Data	6/N
50	Curb/Sidewalk Widths	Geometric Data	6/N
50A	Left Curb/Sidewalk Width	Geometric Data	3/N
50B	Right Curb/Sidewalk Width	Geometric Data	3/N
51	Bridge Roadway Width Curb-To-Curb	Geometric Data	4/N
52	Deck Width, Out-To-Out	Geometric Data	4/N
53	Min Vertical Clear Over Bridge Roadway	Geometric Data	4/N
54	Minimum Vertical Underclearance	Geometric Data	5/AN
54A	Reference Feature	Geometric Data	1/AN
54B	Minimum Vertical Underclearance	Geometric Data	4/N
55	Min Lateral Underclear On Right	Geometric Data	4/AN
55A	Reference Feature	Geometric Data	1/AN
55B	Minimum Lateral Underclearance	Geometric Data	3/N
56	Min Lateral Underclear On Left	Geometric Data	3/N
58	Deck	Condition	1/AN
59	Superstructure	Condition	1/AN
60	Substructure	Condition	1/AN
61	Channel/Channel Protection	Condition	1/AN
62	Culverts	Condition	1/AN
63	Method Used To Determine Operating Rating	Load Rating and Posting	1/N
64	Operating Rating	Load Rating and Posting	3/N

NBI ITEMS IN ORDER SHOWN IN THE NBI			
Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**
65	Method Used To Determine Inventory Rating	Load Rating and Posting	1/N
66	Inventory Rating	Load Rating and Posting	3/N
67	Structural Evaluation	Appraisal	1/AN
68	Deck Geometry	Appraisal	1/AN
69	Underclear, Vertical & Horizontal	Appraisal	1/AN
70	Bridge Posting	Load Rating and Posting	1/N
71	Waterway Adequacy	Appraisal	1/AN
72	Approach Roadway Alignment	Appraisal	1/AN
75	Type of Work	Proposed Improvements	3/N
75A	Type of Work Proposed	Proposed Improvements	2/N
75B	Work Done By	Proposed Improvements	1/AN
76	Length Of Structure Improvement	Proposed Improvements	6/N
90	Inspection Date	Inspections	4/N
91	Designated Inspection Frequency	Inspections	2/N
92	Critical Feature Inspection	Inspections	9/AN
92A	Fracture Critical Details	Inspections	3/AN
92B	Underwater Inspection	Inspections	3/AN
92C	Other Special Inspection	Inspections	3/AN
93	Critical Feature Inspection Dates	Inspections	12/AN
93A	Fracture Critical Details Date	Inspections	4/AN
93B	Underwater Inspection Date	Inspections	4/AN
93C	Other Special Inspection Date	Inspections	4/AN
94	Bridge Improvement Cost	Proposed Improvements	6/N
95	Roadway Improvement Cost	Proposed Improvements	6/N
96	Total Project Cost	Proposed Improvements	6/N
97	Year Of Improvement Cost Estimate	Proposed Improvements	4/N
98	Border Bridge	Identification	5/AN
98A	Neighboring State Code	Identification	3/AN
98B	Percent Responsibility	Identification	2/N
99	Border Bridge Structure Number	Identification	15/AN
100	STRAHNET Highway Designation	Classification	1/N
101	Parallel Structure Designation	Classification	1/AN
102	Direction Of Traffic	Classification	1/N
103	Temporary Structure Designation	Classification	1/AN
104	Highway System Of Inventory Route	Classification	1/N
105	Federal Lands Highways	Classification	1/N
106	Year Reconstructed	Age and Service	4/N
107	Deck Structure Type	Structure Type and Material	1/AN
108	Wearing Surface/Protective System	Structure Type and Material	3/AN
108A	Type of Wearing Surface	Structure Type and Material	1/AN
108B	Type of Membrane	Structure Type and Material	1/AN
108C	Deck Protection	Structure Type and Material	1/AN
109	Average Daily Truck Traffic	Age and Service	2/N
110	Designated National Network	Classification	1/N

NBI ITEMS IN ORDER SHOWN IN THE NBI			
Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**
111	Pier/Abutment Protection	Navigational Data	1/N
112	NBIS Bridge Length	Classification	1/AN
113	Scour Critical Bridges	Appraisal	1/AN
114	Future Average Daily Traffic	Proposed Improvements	6/N
115	Year Of Future Avg. Daily Traffic	Proposed Improvements	4/N
116	Minimum Navigation Vertical Clearance Vertical Lift Bridge	Navigational Data	4/N

3-NBI.4.3 NBI Items – Alphabetical Order

NBI ITEMS IN ALPHABETICAL ORDER		
Item No.	**Item Name**	**Code Length/Type**
36C	Approach Guardrail	1/AN
36D	Approach Guardrail Ends	1/AN
72	Approach Roadway Alignment	1/AN
32	Approach Roadway Width	4/N
29	Average Daily Traffic	6/N
109	Average Daily Truck Traffic	2/N
12	Base Highway Network	1/N
98	Border Bridge	5/AN
99	Border Bridge Structure Number	15/AN
94	Bridge Improvement Cost	6/N
33	Bridge Median	1/N
70	Bridge Posting	1/N
36A	Bridge Railings	1/AN
51	Bridge Roadway Width Curb-To-Curb	4/N
19	Bypass/Detour Length	3/N
61	Channel/Channel Protection	1/AN
3	County (Parish) Code	3/N
6B	Critical Facility Indicator	1/AN
92	Critical Feature Inspection	9/AN
93	Critical Feature Inspection Dates	12/AN
62	Culverts	1/AN
50	Curb/Sidewalk Widths	6/N
58	Deck	1/AN
68	Deck Geometry	1/AN
108C	Deck Protection	1/AN
107	Deck Structure Type	1/AN
52	Deck Width, Out-To-Out	4/N
31	Design Load	1/N
91	Designated Inspection Frequency	2/N
5C	Designated Level of Service	1/N
110	Designated National Network	1/N
102	Direction Of Traffic	1/N
5E	Directional Suffix	1/N
7	Facility Carried By Structure	18/AN
6	Features Intersected	25/AN
6A	Features Intersected	24/AN
105	Federal Lands Highways	1/N
92A	Fracture Critical Details	3/AN
93A	Fracture Critical Details Date	4/AN
26	Functional Class Of Inventory Rte.	2/N
114	Future Average Daily Traffic	6/N
2	Highway Agency District	2/AN

FHWA Coding Guide content is shown in Calibri italic font.

NBI ITEMS IN ALPHABETICAL ORDER		
Item No.	**Item Name**	**Code Length/Type**
104	Highway System Of Inventory Route	1/N
37	Historical significance	1/N
90	Inspection Date	4/N
66	Inventory Rating	3/N
5	Inventory Route	9/AN
13	Inventory Route, Subroute Number	12/AN
47	Inventory Rte Total Horizontal Clearance	3/N
10	Inventory Rte, Min Vertical Clearance	4/N
11	Milepoint	7/N
43A	Kind of Material/Design	1/N
44A	Kind of Material/Design	1/N
28A	Lanes On Structure	2/N
28	Lanes On/Under Structure	4/N
28B	Lanes Under Structure	2/N
16	Latitude	8/N
50A	Left Curb/Sidewalk Width	3/N
48	Length Of Maximum Span	5/N
76	Length Of Structure Improvement	6/N
9	Location	25/AN
17	Longitude	9/N
13A	LRS Inventory Route	10/AN
21	Maintenance Responsibility	2/N
65	Method Used To Determine Inventory Rating	1/N
63	Method Used To Determine Operating Rating	1/N
56	Min Lateral Underclear On Left	3/N
55	Min Lateral Underclear On Right	4/AN
53	Min Vertical Clear Over Bridge Roadway	4/N
55B	Minimum Lateral Underclearance	3/N
116	Minimum Navigation Vertical Clearance Vertical Lift Bridge	4/N
54	Minimum Vertical Underclearance	5/AN
54B	Minimum Vertical Underclearance	4/N
38	Navigation Control	1/AN
40	Navigation Horizontal Clearance	5/N
39	Navigation Vertical Clearance	4/N
112	NBIS Bridge Length	1/AN
98A	Neighboring State Code	3/AN
46	Number Of Approach Spans	4/N
45	Number Of Spans In Main Unit	3/N
64	Operating Rating	3/N
92C	Other Special Inspection	3/AN
93C	Other Special Inspection Date	4/AN
22	Owner	2/N
101	Parallel Structure Designation	1/AN
98B	Percent Responsibility	2/N

NBI ITEMS IN ALPHABETICAL ORDER		
Item No.	**Item Name**	**Code Length/Type**
111	Pier/Abutment Protection	1/N
4	Place Code	5/N
5A	Record Type	1/AN
54A	Reference Feature	1/AN
55A	Reference Feature	1/AN
50B	Right Curb/Sidewalk Width	3/N
95	Roadway Improvement Cost	6/N
5D	Route Number	5/AN
5B	Route Signing Prefix	1/N
113	Scour Critical Bridges	1/AN
34	Skew	2/N
1	State Code	3/N
100	STRAHNET Highway Designation	1/N
67	Structural Evaluation	1/AN
35	Structure Flared	1/N
49	Structure Length	6/N
8	Structure Number	15/AN
41	Structure Open/Posted/Closed	1/AN
44	Structure Type, Approach Spans	3/N
43	Structure Type, Main	3/N
13B	Subroute Number	2/N
60	Substructure	1/AN
59	Superstructure	1/AN
103	Temporary Structure Designation	1/AN
20	Toll	1/N
96	Total Project Cost	6/N
36	Traffic Safety Features	4/AN
36B	Transitions	1/AN
43B	Type of Design/Construction	2/N
44B	Type of Design/Construction	2/N
108B	Type of Membrane	1/AN
42	Type Of Service	2/N
42A	Type of Service On Bridge	1/N
42B	Type of Service Under Bridge	1/N
108A	Type of Wearing Surface	1/AN
75	Type of Work	3/N
75A	Type of Work Proposed	2/N
69	Underclear, Vertical & Horizontal	1/AN
92B	Underwater Inspection	3/AN
93B	Underwater Inspection Date	4/AN
71	Waterway Adequacy	1/AN
108	Wearing Surface/Protective System	3/AN
75B	Work Done By	1/AN
27	Year Built	4/N
30	Year Of Average Daily Traffic	4/N

FHWA Coding Guide content is shown in Calibri italic font.

NBI ITEMS IN ALPHABETICAL ORDER		
Item No.	**Item Name**	**Code Length/Type**
115	Year Of Future Avg. Daily Traffic	4/N
97	Year Of Improvement Cost Estimate	4/N
106	Year Reconstructed	4/N

3-NBI.5 NBI SUFFICIENCY RATING

Sufficiency Rating is a number representing the structure's overall evaluation based on its structural adequacy and safety, serviceability and functional obsolescence and essentiality for public use. This is an Item in the NBIS Inventory and is calculated. The FHWA Coding Guide Appendix describes the rating and provides an example calculation in metric units. The BIP Manual Appendix includes an example calculation in English units.

Item No.	Item Name	Condition	S1 Structural Adequacy (Max 55%)	S2 Serviceability & Functional Obsolescence (Max 30%)	S3 Essentiality for Public Use (Max 15%)	S4 Special Reductions (Max - 13%)	Static/ Dynamic	PM Staff	TL	HE	LRE
19	Bypass/Detour Length				19	19	S[1]	I, E	V		
26	Functional Classification			26 (68 & 69)							
28	Lanes On/Under Structure			28			S	I	V		
29	Average Daily Traffic			29	29		S[1]	I, E	V[2]		
32	Approach Roadway Width			32			S	I	V		
36	Traffic Safety Features					36	D	I	V		
43	Structure Type, Main			43		43	S[2]	I, E	V[2]		
51	Bridge Roadway Width Curb-To-Curb			51			S	I	V		
53	Min Vert. Clear Over Bridge Roadway			53			S	I	V		
54	Min Vertical Underclearnce			54 (69)					E		
55	Min Lateral Underclearnce Right			55 (69)					E		
56	Min Lateral Underclearnce Left			56 (69)					E		
58	Deck	Y		58			D		E		
59	Superstructure	Y	59				D		E		
60	Substructure	Y	60				D		E		
62	Culverts	Y	62				D		E		
66	Inventory Rating		66				D				E
67	Structural Evaluation (from Items 29, 59, 60, 62, 66)			67			D[3]				
68	Deck Geometry (from Items 26, 28, 29, 51, 53)			68			D[3]				

FHWA Coding Guide content is shown in Calibri italic font.

Item No.	Item Name	Condition	S1 Structural Adequacy (Max 55%)	S2 Servicea-bility & Functional Obsole-scence (Max 30%)	S3 Essenti-ality for Public Use (Max 15%)	S4 Special Reduc-tions (Max - 13%)	Static/ Dynamic	PM Staff	TL	HE	LRE
69	Underclear, Vertical & Horizontal (from Items 26, 54, 55, 56)			69			D[3]				
71	Waterway Adequacy	Y		71			D			E	
72	Approach Roadway Alignment	Y		72			S	I	V		
100	STRAHNET Highway Designation			100	100		S	I			

Items shown in italics affect other Items for the Sufficiency calculation.
S = static items that typically don't change on an inspection cycle, D = dynamic
I = initial entry; V = verify; E = entry when changed
See footnotes at end of table.

[1] BO determines and shall notify BIPPM of changes.
[2] These items may change if the structure is rehabilitated or retrofit.
[3] These items are calculated by the NBI Edit/Update Program.

3-NBI.6 NBI BRIDGE STATUS: STRUCTURALLY DEFICIENT OR FUNCTIONALLY OBSOLETE

General NBI Bridge Qualifications	
NBI Item	**Code**
Item 5A – Inventory Route Record Type	1 – Route carried on the structure
Item 42A – Type of Service on bridge	One of the following: 1 – Highway 4 – Highway-railroad 5 – Highway-pedestrian 6 – Overpass structure at an interchange or second level of a multilevel interchange 7 – Third level (Interchange) 8 – Fourth level (Interchange)
Item 112 – NBIS Bridge Length	Y (yes)

Item STATUS – Structurally Deficient or Functionally Obsolete

1 digit

Status	*Code*
Structurally Deficient	*1*
Functionally Obsolescent	*2*

Any bridge classified as structurally deficient is excluded from the functionally obsolete category.

Structurally Deficient Bridges meet the General Qualifications above and meet at least one of the following qualifications:

Table 6-A Structurally Deficient Qualifications

Structurally Deficient Qualifications		
Case	**NBI Item**	**Code**
1	Item 58 – Deck	4 or less
2	Item 59 – Superstructure	4 or less
3	Item 60 – Substructures	4 or less
4	Item 62 – Culvert and Retaining Walls Item 43B – Structure Main, Type of design and/or construction	4 or less One of the following: 19 - Culvert
5	Item 67 – Structural Condition	2 or less
6	Item 71 – Waterway Adequacy Item 42B – Service under bridge	2 or less One of the following: 5 - Waterway 6 - Highway-waterway 7 - Railroad-waterway 8 - Highway-waterway-railroad 9 - Relief for waterway 0 - Other

Functionally Obsolete bridges meet the general qualifications and meet at least one of the following qualifications:

Functionally Obsolete Qualifications		
Case	**NBI Item**	**Code**
1	Item 68 – Deck Geometry	3 or less
2	Item 69 – Underclearances Item 42B – Structure Main, Type of design and/or construction	3 or less One of the following: 1 - Highway, with or without pedestrian 2 - Railroad 4 - Highway-railroad 6 - Highway-waterway 7 - Railroad-waterway 8 - Highway-waterway-railroad 0 - Other
3	Item 72 – Approach Roadway alignment	3 or less
4	Item 67 – Structural Condition	3 or less
6	Item 71 – Waterway Adequacy Item 42B – Service under bridge	3 or less One of the following: 5 - Waterway 6 - Highway-waterway 7 - Railroad-waterway 8 - Highway-waterway-railroad 9 - Relief for waterway 0 - Other

3-NBI.7 NBI DATA ITEMS – ITEMS 1 THROUGH 57

Item 1 – State Code

3 digits

The first two digits are the Federal Information Processing Standards (FIPS) code for States, and the third digit is the FHWA region code. (New Jersey and New York will retain an FHWA region code of 2.)

Code	State
014	Alabama
020	Alaska
049	Arizona
056	Arkansas
069	California
088	Colorado
091	Connecticut
103	Delaware
113	District of Columbia
124	Florida
134	Georgia
159	Hawaii
160	Idaho
175	Illinois
185	Indiana
197	Iowa
207	Kansas
214	Kentucky
226	Louisiana
231	Maine
243	Maryland
251	Massachusetts
265	Michigan
275	Minnesota
284	Mississippi
297	Missouri

Code	State
308	Montana
317	Nebraska
329	Nevada
331	New Hampshire
342	New Jersey
356	New Mexico
362	New York
374	North Carolina
388	North Dakota
395	Ohio
406	Oklahoma
410	Oregon
423	Pennsylvania
441	Rhode Island
454	South Carolina
468	South Dakota
474	Tennessee
486	Texas
498	Utah
501	Vermont
513	Virginia
530	Washington
543	West Virginia
555	Wisconsin
568	Wyoming
721	Puerto Rico

Item 2 – State Highway Department District

2 digits

The NDOT District in which the bridge is located shall be represented by a two digit code. Existing district numbers shall be used.

Item 3 – County Code

2 digits

Counties shall be identified using the Federal Information Processing Standards (FIPS) codes given in the current version of the Census of Population and Housing - Geographic Identification Code Scheme.

The FHWA Coding Guide description above only applies to the dataset NDOT submits each year to FHWA.

In the NE Inventory database, this is the Nebraska county number. This is a two digit numerical code taken from the NE Local Public Agency Codes list that is in the BIP Manual Appendix.

Item 4 – Urban/Municipal Code

4 digits

Cities, towns, townships, villages and other census-designated places shall be identified using the Federal Information Processing Standards (FIPS) codes given in the current version of the Census of Population and Housing - Geographic Identification Code Scheme. If there is no FIPS place code, then code all zeros.

The FHWA Coding Guide description above only applies to the dataset NDOT submits each year to FHWA. This code shall be in accordance with the *U.S. Census of Population and Housing - 1970*.

In the NE Inventory database, this is the Nebraska city or municipality number. This is a four digit numerical code taken from the NE Local Public Agency Codes list that is in the BIP Manual Appendix.

Item 5 – Inventory Route

9 digits

The inventory route is a nine digit code composed of five segments.

Item	*Description*	*Length*
5A	*Record Type*	*1 digit*
5B	*Route Signing Prefix*	*1 digit*
5C	*Designated Level of Service*	*1 digit*
5D	*Route Number*	*5 digits*
5E	*Directional Suffix*	*1 digit*

Item 5A – Record Type

1 digit

There are two (2) types of National Bridge Inventory records: "on" and "under". Code the first digit (leftmost) using one of the following codes:

Code	*Description*
1	*Route carried "on" the structure*
2	*Single route goes "under" the structure*
A through Z	*Multiple routes go "under" the structure.* *A signifies the first of multiple routes under the structure.* *B signifies the second of multiple routes under the structure.* *Z signifies 26 routes under the structure.*

"On" signifies that the inventory route is carried "on" the structure. Each bridge structure carrying highway traffic must have a record identified with a type code = 1 (numeric). All of the NBI data items must be coded, unless specifically excepted, with respect to the structure and the inventory route "on" it.

"Under" signifies that the inventory route goes "under" the structure. If an inventory route beneath the structure is a Federal-aid highway, is a STRAHNET route or connector or is otherwise important, a record must be coded to identify it. The type code must be 2 or an alphabetic letter A through Z. Code 2 for a single route under the structure. If 2 or more routes go under a structure on separate roadways, the code of 2 shall not be used. Code A, B, C, D, etc. consecutively for multiple routes on separate roadways under the same structure. STRAHNET routes shall be listed first. When this item is coded 2 or A through Z, only the following items must be coded: Items 1, 3-11, 16, 17, 19, 20, 26-30, 42, 43, 47-49, 100-104, 109 and 110. All other items may remain blank.

It cannot be overemphasized that all route-oriented data must agree with the coding as to whether the inventory route is "on" or "under" the structure.

Tunnels shall be coded only as an "under" record; that is, they shall not be coded as a structure carrying highway traffic.

There are situations of a route "under" a structure, where the structure does not carry a highway, but may carry a railroad, pedestrian traffic, or even a building. These are coded the same as any other "under" record and no "on" record shall be coded.

Item 5B – Route Signing Prefix

1 digit

In the second position, identify the route signing prefix for the inventory route using one of the following codes:

Code	**Description**
1	*Interstate highway*
2	*U.S. numbered highway*
3	*State highway*
4	*County highway*
5	*City street*
6	*Federal lands road*
7	*State lands road*
8	*Other (include toll roads not otherwise indicated or identified above)*

When two or more routes are concurrent, the highest class of route will be used. The hierarchy is in the order listed above.

Item 5C – Designated Level of Service

1 digit

In the third position, identify the designated level of service for the inventory route using one of the following codes:

Code	**Description**
0	*None of the below*
1	*Mainline*
2	*Alternate*
3	*Bypass*
4	*Spur*
6	*Business*
7	*Ramp, Wye, Connector, etc.*
8	*Service and/or unclassified frontage road*

Item 5D – Route Number

5 digits

Code the route number of the inventory route in the next five positions. This value shall be right justified in the field with leading zeros filled in. If concurrent routes are of the same hierarchy level, denoted by the route signing prefix, the lowest numbered route shall be coded. Code 00000 for bridges on roads without route numbers.

Item 5E – Directional Suffix

1 digit

In the last position, code the directional suffix to the route number of the inventory route when it is part of the route number, using one of the following codes:

Code	***Description***
0	*Not applicable*
1	*North*
2	*East*
3	*South*
4	*West*

In some cases, letters may be used with route numbers and as part of the route numbers and not to indicate direction. In such cases, the letter should be included in the five position route number field.

Examples:

Route Description	***Record***	***Code***
Interstate 95, on	*1 1 1 00095 0*	*111000950*
Interstate 70S, under	*2 1 1 00070 3*	*211000703*
State Spur S10A, under	*2 3 4 0S10A 0*	*2340S10A0*
U.S. 30E Bypass, on	*1 2 3 00030 2*	*123000302*
City street, on	*1 5 0 00000 0*	*150000000*
Ramp from I-81, under	*2 1 7 00081 0*	*217000810*
County Highway 173, on	*1 4 1 00173 0*	*141001730*
Interstate 84, under	*2 1 1 00084 0*	*211000840*
Interstate 495, on	*1 1 1 00495 0*	*111004950*
State Hwy. 120 (STRAHNET), under	*A 3 1 00120 0*	*A31001200*
Alternate State Hwy. 130, under	*B 3 2 00130 0*	*B32001300*
Tunnel on Interstate 70	*2 1 1 00070 0*	*211000700*

Item 6 – Features Intersected

25 digits

This item contains a description of the features intersected by the structure and a critical facility indicator. When Item 5A indicates an "under" record, this item describes the inventory route and/or features under the structure. There are 25 digits divided into two segments.

Item	***Description***	***Length***
6A	*Features Intersected*	24 digits
6B	*Critical Facility Indicator*	1 digit

The information to be recorded for this item in the first 24 digits shall be the name or names of the features intersected by the structure. When one of the features intersected is another highway, the signed number or name of the highway shall appear first (leftmost) in the field. The names of any other features shall follow, separated by a semicolon or a comma. Parentheses shall be used to provide a second identification of the same feature (see third example). Abbreviations may be used where necessary, but an effort shall be made to keep them meaningful. The data in this segment shall be left justified in the first 24 positions without trailing zeros.

A structure on a designated STRAHNET or STRAHNET Connector highway and considered to be a critical facility shall be identified by an asterisk in the 25th position. A non-critical facility shall have the digit blank.

Examples:

*I 81, US 51, MILL ROAD **

MISSISSIPPI RIVER

SR 42 (POND ROAD)

Item 7 – Facility Carried by Structure

18 digits

The facility being carried by the structure shall be recorded and coded. In all situations, this item describes the use "on" the structure. This item shall be left justified without trailing zeros.

Examples:

US 66

MAIN STREET

C & O RAILROAD (appropriate for "under" record only)

PEDESTRIAN BRIDGE (appropriate for "under" record only)

Item 8 – Structure Number (ID)

15 /AN characters

It is required that the official structure number be recorded. It is not necessary to code this number according to an arbitrary national standard. Each agency should code the structure number according to its own internal processing procedures. When recording and coding for this item and following items, any structure or structures with a closed median should be considered as one structure, not two. Closed medians may have either mountable or non-mountable curbs or barriers.

The structure number must be unique for each bridge within the State, and once established should preferably never change for the life of the bridge. If it is essential that a structure number(s) must be changed, all 15 digits are to be filled. For any structure number changes, a complete cross reference of corresponding "old" and "new" numbers must be provided to the FHWA Bridge Division.

The identical structure number must appear on the "on" and all "under" records associated with a particular structure. (Refer to Item 5 Inventory Route).

The Nebraska Department of Transportation structure numbers are 10 or 11 characters and use this general format. For the purposes of the FHWA data submittal structure numbers are left justified in the required 15 character field with additional spaces remaining empty.

Item	Description	Length
8A	Bridge Owner	1 character
8B	Location Number	4 digits
8C	Unique Identifier	5 to 6 A/N characters

Item 8A – Bridge Owner Type

Item 8A Code	Description (one character)
S	State of Nebraska
C	County Owner
M	Municipality Owner
U	Urban Owner (municipality that is classified as a NE "first-class city")
F	Federal Lands

Item 8B – Bridge Owner Location Code

Item 8A Code	8B Code Description (4 A/N characters)
S	NE highway number followed by underscore or space
C	NDOT Code for the county (this is not the same as FHWA codes for the same county). See list in Manual Appendix.
M	NDOT Code for the municipality (this is not the same as FHWA codes for the same municipality) See list in Manual Appendix.
U	NDOT Code for the municipality (this is not the same as FHWA codes for the same municipality) See list in Manual Appendix.

Item 8C – Bridge Location ID

Item 8A Code	8C Code Description (5 to 6 A/N characters)
S	NE highway number reference post number. The last character may be one of the following letters: “R” or “L” which indicate position of the structure, such as a pair of twin bridges on expressway and interstate routes.
C	five digits that are a unique identifier
M	five digits that are a unique identifier
U	five digits that are a unique identifier

State Example:	S	002	28242
County Example:	C	0085	00805P
Municipal Example:	M	2415	M2205
Urban Example:	U	1425	D4225

Item 9 – Location

25 digits

This item contains a narrative description of the bridge location. It is recommended that the location be keyed to a distinguishable feature on an official highway department map such as road junctions and topographical features. This item shall be left justified without trailing zeros.

Examples:

6 MI. SW. OF RICHMOND

3.5 MI. S. OF JCT. SR 69

Item 10 – Inventory Route, Minimum Vertical Clearance

4 digits (XX feet XX inches)

Code the minimum vertical clearance over the inventory route identified in Item 5, whether the route is "on" the structure or "under" the structure. The minimum clearance for a 10-foot width of the pavement or traveled part of the roadway where the clearance is the greatest shall be recorded and coded in feet and inches. For structures having multiple openings, clearances for each opening shall be recorded, but only the greatest of the minimum clearances for the two or more openings shall be coded regardless of the direction of travel. This would be the practical maximum clearance. When no restriction exists, code 9999.

Item 11 – Milepoint

6 digits (XXX.XXX miles)

If a milepoint location reference system is being used in the State, code a six digit number to represent the milepoint to thousandths of a mile (with an assumed decimal point). If mileage is coded to the hundredth, it may be used and the item zero filled. The milepoint shall reference the beginning (or other point the State uses) of the structure in the direction of increasing mileage of the inventory route identified in Item 5.

Code all zeros if a milepoint location cannot be determined or is not appropriate. If the milepoint location of the structure is at the beginning of the route mileage, code with a nominal value of 000001 rather than 000000.

Item 12 – Base Highway Network

1 digits

This item is to be coded for all records in the inventory. The Base Highway Network includes the through lane (mainline) portions of the NHS, rural/urban principal arterial system and rural minor arterial system. Ramps, frontage roads and other roadways are not included in the Base Network. For the inventory route identified in Item 5 – Inventory Route, indicate whether the inventory route is on the Base Highway Network or not on that network. Use one of the following codes:

Code	Description
0	Inventory Route is not on the Base Network
1	Inventory Route is on the Base Network

Item 13 – LRS Inventory Route, Subroute Number

12 digits

If Item 12 Base Highway Network has been coded 1, the information to be recorded for this item is the inventory route for the State's linear referencing system (LRS). If Item 12 has been coded 0, this entire item should be left blank. This item is a 12-digit code composed of two segments.

Item	Description	Length
13A	LRS Inventory Route	10 digits
13B	Subroute Number	2 digits

The LRS inventory route and subroute numbers to be reported in this item must correspond to the LRS inventory route and subroute numbers reported by the State for the HPMS. The LRS inventory route number is coded in the ten positions of segment 13A, right justified and zero filled. The subroute number, if it exists, is coded in the two positions of segment 13B, right justified and zero filled.

The LRS inventory route number can be alphanumeric, but must not contain blanks. The LRS inventory route number is not necessarily the same as that posted along the roadway, but is a number used to uniquely identify a route within at least a county and perhaps throughout the State.

The subroute number is a number that uniquely identifies portions of an inventory route section where duplicate mile points occur. These subroute numbers, if they exist, are identified in the State's HPMS-LRS records. If there is no subroute number, code 00 in this segment.

Examples:

Route	Code
Inventory Route 2775, Subroute Number 0	000000277500
Inventory Route 2775, Subroute Number 3	000000277503

Item 14 – Reserved (by FHWA)

Item 15 – Reserved (by FHWA)

Item 16 – Latitude

8 digits (XX degrees XX minutes XX.XX seconds)

For bridges on STRAHNET and STRAHNET Connector highways and on the NHS, record and code the latitude of each in degrees, minutes and seconds to the nearest hundredth of a second (with an assumed decimal point). The point of the coordinate may be the beginning of the bridge in the direction of the inventory or any other consistent point of reference on the bridge which is compatible with the LRS. If the bridge is not on a STRAHNET highway or the NHS, a code of all zeros is acceptable, but it is preferable to code the latitude if available.

The reason for the increased precision is to facilitate the use of Global Positioning System (GPS) data directly into this item. The increased precision is not currently mandatory and, if GPS readings are not available, the current measuring methods and level of precision may continue to be used. The minimum precision should be to the nearest minute, but the preferred precision is to the nearest hundredth of a second using GPS methods.

Examples:

Latitude		***Code***
35°27.3'	*(current precision)*	*35271800*
	(acceptable coding)	*35270000*
35°27’18.55”	*(GPS reading)*	*35271855*

Item 17 – Longitude

9 digits (XXX degrees XX minutes XX.XX seconds)

For bridges on STRAHNET and STRAHNET Connector highways and on the NHS, record and code the longitude of each in degrees, minutes and seconds to the nearest hundredth of a second (with an assumed decimal point). A leading zero shall be coded where needed. The point of the coordinate may be the beginning of the bridge in the direction of the inventory or any other consistent point of reference on the bridge which is compatible with the LRS. If the bridge is not on a STRAHNET highway or the NHS, a code of all zeros is acceptable, but it is preferable to code the longitude if available.

The reason for the increased precision is to facilitate the use of Global Positioning System (GPS) data directly into this item. The increased precision is not currently mandatory and, if GPS readings are not available, the current measuring methods and level of precision may continue to be used. The minimum precision should be to the nearest minute, but the preferred precision is to the nearest hundredth of a second using GPS methods.

Examples:

Longitude		***Code***
81°5.8'	*(current precision)*	*081054800*
	(acceptable coding)	*081060000*
81°5’50.65”	*(GPS reading)*	*081055065*

Inspection Team Leader needs to verify at each routine inspection.

Item 18 – Reserved (by FHWA)

Item 19 – Bypass, Detour Length

2 (XX miles)

Indicate the actual length to the nearest mile of the detour length. The detour length should represent the total additional travel for a vehicle which would result from closing of the bridge. The factor to consider when determining if a bypass is available at the site is the potential for moving vehicles, including military vehicles, around the structure. This is particularly true when the structure is in an interchange. For instance, a bypass likely would be available in the case of diamond interchanges, interchanges where there are service roads available, or other interchanges where the positioning and layout of the ramps is such that they could be used without difficulty to get around the structure. If a ground level bypass is available at the structure site for the inventory route, record and code the detour length as 00.

If the bridge is one of twin bridges and is not at an interchange, code 01 where the other twin bridge can be used as a temporary bypass with a reasonable amount of crossover grading. In other cases, indicate the actual length to the nearest mile of the detour length. Code 99 for 99 miles or more.

The detour route will be established following allowable criteria determined by the governing authority. (Some authorities will not allow a designated detour over a road or bridge of lesser "quality.")

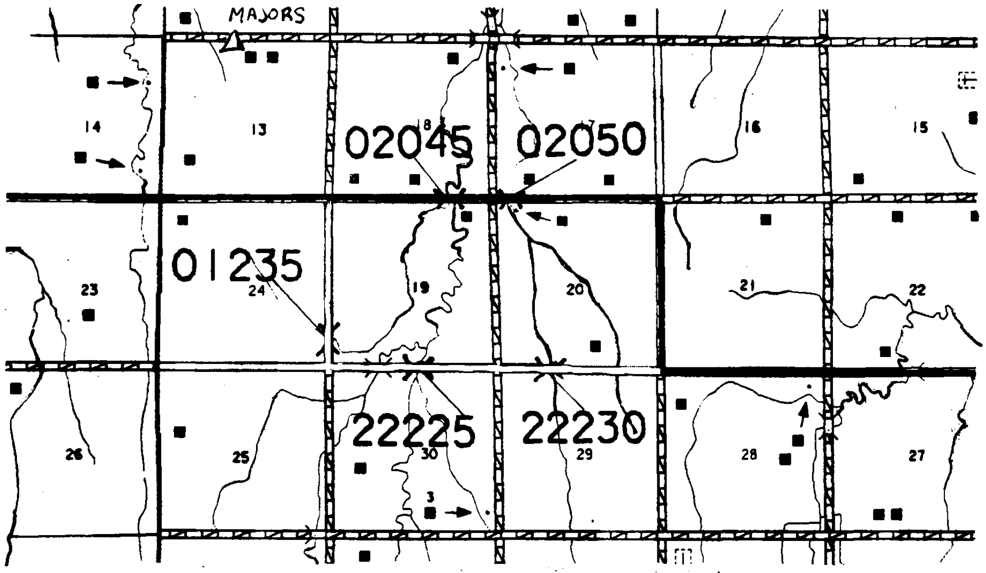
Examples:

Situation	***Code***
Diamond interchange, structure bypassable	*00*
Cloverleaf, not bypassable; 8-mile detour	*08*
Structure over river; 121-mile detour	*99*
Structure over highway, no interchange, bypassable at ground level	*00*
Structure on dead end road	*99*

Detour routes should be established using roads and bridges of similar type and quality. For example, a detour route for a State highway should utilize on-system roads with equivalent roadway, bridges and shoulders. If the route to be detoured is an off-system gravel road, an equivalent roadway of approximately equal width and quality shall be chosen. If the road being detoured contains no posted bridges the detour route selected should also contain no posted bridges, if possible. Minimum maintenance roadways should not be used as detour routes.

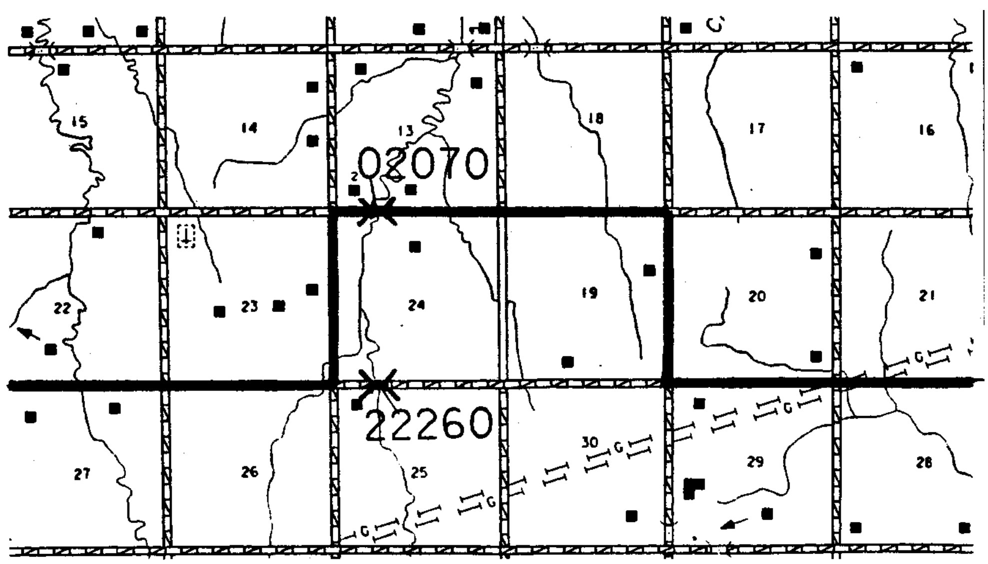
Detour lengths should be calculated for through vehicles using a route, not local vehicles. For example, a homeowner living immediately east of Bridge 22260 in the second example below may have a detour length of over 3 miles, however the actual detour length for the route is 2 miles for through traffic.

Additional examples:



Bridge Numbers 01235, 22225, and 22230 are closed. Detour route on Bridge Nos. 02045 and 02050. Bypass Detour Length = 0 miles

.



Bridge No. 22260 is closed. Detour route on Bridge No. 02070. Bypass Detour Length = 2 miles.

Item 20 – Toll

1 digit

The toll status of the structure is indicated by this item. Interstate toll segments under Secretarial Agreement (Title 23 – United States Code – Highways Section 129 as amended by 1991 ISTEA and prior legislation) shall be identified separately. Use one of the following codes:

Code	***Description***
1	*Toll bridge. Tolls are paid specifically to use the structure.*
2	*On toll road. The structure carried a toll road, that is, tolls are paid to use the facility, which includes both the highway and the structure.*
3	*On free road. The structure is toll-free and carries a toll-free highway.*
4	*On Interstate toll segment under Secretarial Agreement. Structure functions as a part of the toll segment.*
5	*Toll bridge is a segment under Secretarial Agreement. Structure is separate agreements from highway segment.*

Item 21 – Maintenance Responsibility

2 digits

The actual name(s) of the agency(s) responsible for the maintenance of the structure shall be recorded. The codes below shall be used to represent the type of agency that has primary responsibility for maintaining the structure. If more than one agency has equal maintenance responsibility, code one agency in the hierarchy of State, Federal, county, city, railroad and other private.

Code	***Description***
01	*State Highway Agency*
02	*County Highway Agency*
03	*Town or Township Highway Agency*
04	*City or Municipal Highway Agency*
11	*State Park, Forest, or Reservation Agency*
12	*Local Park, Forest, or Reservation Agency*
21	*Other State Agencies*
25	*Other Local Agencies*
26	*Private (other than railroad)*
27	*Railroad*
31	*State Toll Authority*
32	*Local Toll Authority*
60	*Other Federal Agencies (not listed below)*
62	*Bureau of Indian Affairs*
63	*Bureau of Fish and Wildlife*
64	*U.S. Forest Service*
66	*National Park Service*
67	*Tennessee Valley Authority*
68	*Bureau of Land Management*
69	*Bureau of Reclamation*
70	*Corps of Engineers (Civil)*
71	*Corps of Engineers (Military)*
80	*Unknown*

Item 22 – Owner

2 digits

The actual name(s) of the owner(s) of the bridge shall be recorded. The codes used in Item 21 Maintenance Responsibility shall be used to represent the type of agency that is the primary owner of the structure. If more than one agency has equal ownership, code one agency in the hierarchy of State, Federal, county, city, railroad and other private.

Item 23 – Reserved (by FHWA)

Item 24 – Reserved (by FHWA)

Item 25 – Reserved (by FHWA)

Item 26 – National Functional Classification of Inventory Route

2 digits

For the inventory route, code the functional classification using one of the following codes:

Code	***Description***	
01	*Rural*	*Principal Arterial – Interstate*
02	*Rural*	*Principal Arterial – Other*
06	*Rural*	*Minor Arterial*
07	*Rural*	*Major Collector*
08	*Rural*	*Minor Collector*
09	*Rural*	*Local*
11	*Urban*	*Principal Arterial - Interstate*
12	*Urban*	*Principal Arterial - Other Freeways or Expressways*
14	*Urban*	*Other Principal Arterial*
16	*Urban*	*Minor Arterial*
17	*Urban*	*Collector*
19	*Urban*	*Local*

The bridges shall be coded rural if not inside a designated urban area. The urban or rural designation shall be determined by the bridge location and not the character of the roadway.

Item 27 – Year Built

4 digits

Record and code the year of construction of the structure. Code all four digits of the year in which construction of the structure was completed. If the year built was unknown, provide a best estimate. Initially 1935 was used as the best estimate in the original inventory. See also Item 106 – Year Reconstructed.

Examples:

Construction completed	Code
1956	1956
1892	1892

Item 28 – Lanes On and Under the Structure

4 digits

Record and code the number of lanes being carried by the structure and being crossed over by the structure as a four digit number composed of two segments. The number of lanes should be right justified in each segment with leading zero(s) codes as required.

Segment	Description	Length
28A	Lanes on the structure	2 digits
28B	Lanes under the structure	2 digits

Include all lanes carrying highway traffic (i.e., cars, trucks, buses) which are striped or otherwise operated as a full width traffic lane for the entire length of the structure or under the structure by the owning/maintaining authority. This shall include any full width merge lanes and ramp lanes, and shall be independent of directionality of usage (i.e., a one-lane bridge carrying two-directional traffic is still considered to carry only one lane on the structure). It should be noted here that for the purpose of evaluating the Deck Geometry – Item 68, any "one-lane" bridge, not coded as a ramp (Item 5C = 7), which has a Bridge Roadway Width, Curb-to-Curb – Item 51 coded 16 feet or greater shall be evaluated as two lanes.

When the inventory route is "on" the bridge (the first digit of Item 5 Inventory Route is coded 1), the sum of the total number of lanes on all inventoried routes under the bridge shall be coded. When the inventory route is "under" the bridge (the first digit of Item 5 Inventory Route is coded 2 or A through Z), only the number of lanes being identified by that "under" record shall be coded in Item 28B.

When the inventory route is "under" the structure, the obstruction over the inventory route may be other than a highway bridge (railroad, pedestrian, pipeline, etc.). Code 00 for these cases if there are no highway lanes on the obstructing structure.

Double deck bridges may be coded as 1 or 2 structures as noted in the examples on the next page. Either method is acceptable; however, all related data must be compatible with the method selected.

FHWA Coding Guide content is shown in Calibri italic font.

Examples:

Situation	***Code***
1 lane on, 0 lanes under	*0100 **
3 lanes on, 1 lane under	*0301*
8 lanes on 2-way, 12 lanes under	*0812 ***
5 lanes on double deck each direction, 2 lanes under *5 lanes on double deck each direction, 2 lanes under*	*1002 **** *0502 *****
Railroad and pedestrian on, 4 lanes under	*0004*

*	*For the inventory route on the bridge, the first digit of Item 5 Inventory Route is coded 1.*
**	*This example has three inventory routes under the bridge of six, four and two lanes of two-way traffic respectively. When coding an "under" record for each of these inventory routes, the first digit of Item 5 - Inventory Route is coded A, B, and C, and Item 28 is coded 0806, 0804, and 0802 respectively for the three required records.*
***	*Acceptable if coded as one bridge. However, other data such as ADT, curb-to-curb width, etc., must be for both decks.*
****	*Acceptable if coded as two separate bridges. However, other data such as ADT, curb-to-curb width, etc., must be for a single deck.*

Item 29 – Average Daily Traffic

6 digits

This code shows the average daily traffic volume for the inventory route identified in Item 5. Make certain the unit's position is coded even if estimates of ADT are determined to tens or hundreds of vehicles; that is, appropriate leading zeros shall be coded. The ADT coded should be the most recent ADT counts available. Included in this item are the trucks referred to in Item 109 Average Daily Truck Traffic. If the bridge is closed, code the actual ADT from before the closure occurred.

The ADT must be compatible with the other items coded for the bridge. For example, parallel bridges with an open median are coded as follows: if Item 28 - Lanes On and Under the Structure and Item 51 Bridge Roadway Width, Curb-to-Curb are coded for each bridge separately, then the ADT must be coded for each bridge separately (not the total ADT for the route).

Examples:

Average Daily Traffic	***Code***
540	*000540*
15,600	*015600*
24,000	*024000*

The ADT is the total for both directions, unless a structure is one of a set of twins, such as on a divided highway.

Traffic volumes will vary with time and are updated as follows, depending on the Federal Functional Classification.

Federal Functional Classification	**Data Provider**
Arterials or Collectors	• NDOT Planning Section provides state and regional traffic data, Average Daily Traffic (ADT) and Average Daily Truck Traffic (ADTT). • BIP Data Manager uploads this data periodically. • Data should be reviewed at each routine inspection. Bridge Owner may have traffic data from counts taken. In this case, the mark revisions on a copy of SI&A and sent to the BIP Data Manager
Local	• Bridge Owner provides traffic data on Local roads and streets. • Data should be reviewed at each routine inspection. Mark revisions on a copy of SI&A and sent to the BIP Data Manager.

Item 30 – Year of Average Daily Traffic

4 digits

Record the year represented by the ADT in Item 29. Code the four digits of the year so recorded.

Example: *Year of ADT is 1988. Code = 1988.*

Item 31 – Design Load

1 digit

Use the codes below to indicate the live load for which the structure was designed.

Code	*Metric Description*	*English Description*
0	*Unknown*	*Unknown*
1	*M 9*	*H 10*
2	*M 13.5*	*H 15*
3	*MS 13.5*	*HS 15*
4	*M 18*	*H 20*
5	*MS 18*	*HS 20*
6	*MS 18 + Mod*	*HS 20+Mod*
7	*Pedestrian*	*Pedestrian*
8	*Railroad*	*Railroad*
9	*MS 22.5 or greater*	*HS 25 or greater*
A	*HL 93*	*HL93*
B	*Greater than HL93*	*Greater than HL93*
C	*Other*	*Other*

Code other H, M, HS, or MS design live loads using the nearest equivalent of the numerical portion of the loading.

Code 0 refers to situations where the design live load is unknown due to the absence of plans, design calculations, or other information.

Code 0 formerly was used for both, but now has been modified to only describe "Unknown" situations. This code is to be used where the design live load is unknown due to the absence of plans, design calculations, or other information.

Code 6 references MS 18 + Mod (HS20+Mod). In this context 'Mod' indicates the inclusion of military loading.

Use Code 9 in situations where the design live load is MS 22.5 (HS 25) or greater.

Code 9 has been modified from "MS 22.5" or "HS 25" to "MS 22.5 or greater" or "HS 25 or greater" and is to be used for increased design loads which are based on those configurations.

Code A refers to the standard AASHTO LRFD HL 93 design live load.

Code A is to be used only for HL93 AASHTO design load configurations.

Code B refers to the standard AASHTO LRFD HL 93 configuration modified to be greater than the standard HL 93 design live load.

Code B is to be used only for increased design loads which are based on the HL93 AASHTO design load configuration. As of Revision 1 of this Manual, NDOT does not use any design loading greater than HL-93.

Code C refers to other situations where the design live load is not based upon AASHTO design live load configurations, such as designs based on specific truck loads.

Code C for "Other" has been added for situations which increase the design load but are not based upon AASHTO design trucks. State specific design trucks that exceed AASHTO loading would be reported as a "C".

Item 32 – Approach Roadway Width

3 digits (XXX feet)

Code to the nearest foot a three digit number that represents the normal width of usable roadway approaching the structure. Usable roadway width will include the width of traffic lanes and the widths of shoulders.

Shoulders are defined as follows: shoulders must be constructed and normally maintained flush with the adjacent traffic lane, and must be structurally adequate for all weather and traffic conditions consistent with the facility carried.

Unstabilized grass or dirt, with no base course, flush with and beside the traffic lane is not to be considered a shoulder for this item.

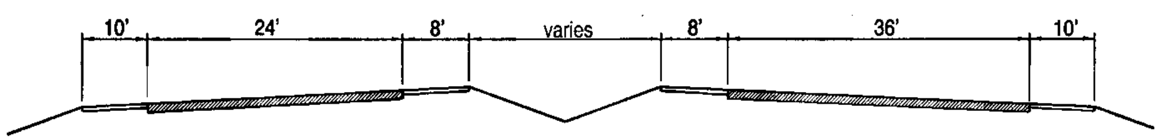
For structures with medians of any type and double-decked structures, this item should be coded as the sum of the usable roadway widths for the approach roadways (i.e., all median widths which do not qualify as shoulders should ***not*** *be included in this dimension).*

When there is a variation between the approaches at either end of the structure, record and code the most restrictive of the approach conditions.

Examples:

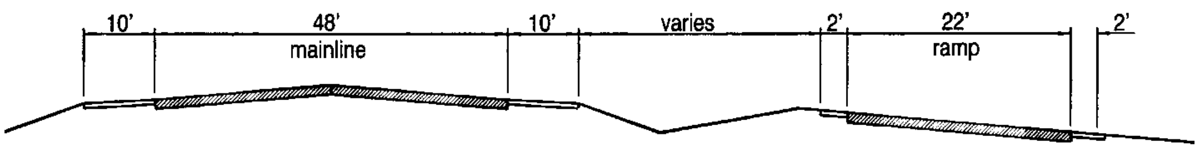
Left Shoulder	*Left Roadway*	*Median Shoulders*	*Right Roadway*	*Right Shoulder*	*Code*
4.0	*--*	*--*	*16*	*6.0*	*026*
6.0	*--*	*--*	*36*	*12.0*	*054*
12.0	*48.0*	*30.0*	*48.0*	*12.0*	*150*
10.0	*24.0*	*16.0*	*36.0*	*10.0*	*096*

The last example above represents the coding method for a structure in which the most restrictive approach has the cross-section shown below:



Regardless of whether the median is open or closed, the data coded must be compatible with the other related route and bridge data (i.e., if Item 51 Bridge Roadway Width, Curb-to-Curb is for traffic in one direction only, then Items 28, 29, 32, etc., must be for traffic in one direction only).

If a ramp is adjacent to the through lanes approaching the structure, it shall be included in the approach roadway width. The total approach roadway width for the example below is 94 feet (a code of 094).



In the situation where the approach roadway width varies, it should be measured near both ends. The smallest measurement should be recorded.

The above photo shows a tapered structure. The approach roadway width on the north end (~36ft) is the recorded value.

Gravel roadways shall be measured from edge to edge of normally maintained roadway.

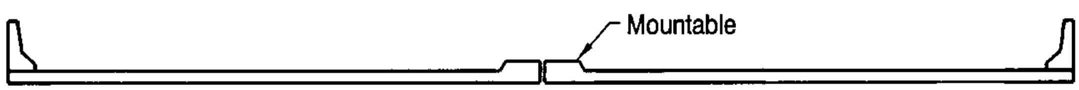
Item 33 – Bridge Median

1 digit

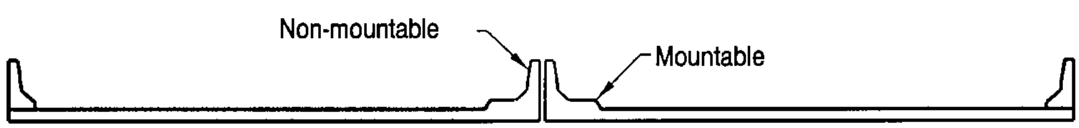
Indicate with a one digit code if the median is non-existent, open or closed. The median is closed when the area between the two roadways at the structure is bridged over and is capable of supporting traffic. All bridges that carry either one-way traffic or two-way traffic separated only by a centerline will be coded 0 for no median.

Code	***Description***
0	*No median*
1	*Open median*
2	*Closed median (no barrier)*
3	*Closed median with non-mountable barriers*

Open Median



Closed Median



Closed Median with Non-mountable Barrier

Item 34 – Skew

2 digits (XX degrees)

The skew angle is the angle between the centerline of substructure units and a line normal to the roadway centerline. When plans are available, the skew angle can be taken directly from the plans. If no plans are available, the angle is to be field measured if possible. Record the skew angle to the nearest degree. If the skew angle is 0°, it should be so coded. When the structure is on a curve or if the skew varies for some other reason, the average skew should be recorded, if reasonable. Otherwise, record 99 to indicate a major variation in skews of substructure units. A two digit number should be coded.

Examples:

Skew angle	***Code***
0°	*00*
10°	*10*
8°	*08*
29°	*29*

Item 35 – Structure Flared

1 digit

This code is a one digit and is used to indicate if the structure is flared (i.e., the width of the structure varies). Generally, such variance will result from ramps converging with or diverging from the through lanes on the structure, but there may be other causes. Minor flares at ends of structures should be ignored.

Code	***Description***
1	*Yes, flared*
0	*No flare*

Item 36 – Traffic Safety Features

4 digits

Bridge inspection shall include the recording of information on the following traffic safety features so that the evaluation of their adequacy can be made.

The data collected shall apply only to the route on the bridge. Collision damage or deterioration of the elements are not considered when coding this item. Traffic safety features is a four digit code composed of four segments reported as follows and described below.

Segment	***Description***	***Length***
36A	*Bridge railings*	*1 digit*
36B	*Transitions*	*1 digit*
36C	*Approach guardrail*	*1 digit*
36D	*Approach guardrail ends*	*1 digit*

Code	***Description****
0	*Inspected feature does not meet currently acceptable standards or a safety feature is required and none is provided.*
1	*Inspected feature meets currently acceptable standards.*
N	*Not applicable or a safety feature is not required.*
*	*For structures on the NHS, national standards are set by regulation. For those not on the NHS, it shall be the responsibility of the highway agency (state, county, local or federal) to set standards.*

Examples:

Situation	***Code***
All features meet currently acceptable standards except transition	*1011*

This item has not been coded consistently in Nebraska. Inspectors should carefully review the BIRM, the descriptions and pictorial guidance in this section, and then contact the Program Manager if they have questions.

Item 36A – Bridge Railings

1 digit

Some factors that affect the proper functioning of bridge railing are height, material, strength and geometric features. Railings must be capable of smoothly redirecting an impacting vehicle.

Traffic railings should provide a smooth, continuous face of rail on the traffic side with the posts set back from the face of rail. Structural continuity in the rail members, including anchorage of ends, is essential. The railing system shall be able to resist the applied loads at all locations.

Bridge railings should be evaluated by using the following guidelines.

Materials for traffic railings can be concrete, metal, timber or a combination thereof.

Careful attention must be given to the treatment of railings at the bridge ends. Collision damage or deterioration of the elements are not considered when coding this item.

Transition

- A “smooth transition” by means of a continuation of the bridge barrier, guard rail anchored to the bridge end, or other effective means, protects the traffic from direct collision with the bridge rail ends.
- Exposed rail ends, posts and sharp changes in the alignment of the railing should be rated zero.

Height

- The heights of rails shall be measured relative to the reference surface which shall be the top of the roadway, the top of the future overlay if resurfacing is anticipated, or the top of curb when the curb projection is greater than 9 inches from the traffic face of the railing.
- Traffic railings and traffic portions of combination railings shall not be less than 2 feet 3 inches from the top of the reference surface.
- Parapets designed with sloping traffic faces intended to allow vehicles to ride up them under low angle contacts shall be at least 2 feet 8 inches in height.

Multi-element Rails

- For traffic railings composed of multiple horizontal elements, the maximum clear opening below the bottom rail shall not exceed 17 inches and the maximum opening of upper rails shall not exceed 15 inches.

Item 36B – Transitions

1 digit

The transition from approach guardrail to bridge railing requires that the approach guardrail be firmly attached to the bridge railing. It also requires that the approach guardrail be gradually stiffened as it comes closer to the bridge railing. The ends of curbs and safety walks need to be gradually tapered out or shielded.

Post spacing at the bridge rail end needs to be 1'-6 ¾" or less.

Post spacing in the next section before the standard guard rail needs to be 3'-1½" or less.

Concrete tapers used in urban areas shall have a minimum length of 20'-0" to be considered adequate.

Item 36C – Approach Guardrail

1 digit

The structural adequacy and compatibility of approach guardrail with transition designs should be determined. Rarely does the need for a barrier stop at the end of a bridge. Thus, an approach guardrail with adequate length and structural qualities to shield motorists from the hazards at the bridge site needs to be installed. In addition to being capable of safely redirecting an impacting vehicle, the approach guardrail must also facilitate a transition to the bridge railing that will not cause snagging or pocketing of an impacting vehicle. Acceptable guardrail design suggestions are contained in the AASHTO Guide for Selecting, Locating, and Designing Traffic Barriers.

Item 36D – Approach Guardrail Ends

1 digit

As with guardrail ends in general, the ends of approach guardrails to bridges should be flared, buried, made breakaway, or shielded. Design treatment of guardrail ends is given in the AASHTO Guide for Selecting, Locating, and Designing Traffic Barriers.

Inspectors should consult the Nebraska Board of Public Roads Classifications and Standard for the specified fixed obstacle clearances for each structure. The fixed obstacle clearance is dependent on type of road (interstate, urban, rural, etc.), roadway classification and ADT. The fixed obstacle clearance, depending on the individual site circumstances, varies from 5 feet to 12 feet.

State Highway		
Item	**Code**	**Comment**
36A – Rail	1	
36B – Transition	0	Post spacing incorrect; one post appears to be missing.
36C – App. guardrail	1	Not pictured.
36D – Guardrail ends	1	Not pictured.

Interstate Bridge		
Item	**Code**	**Comment**
36A – Rail	1	
36B – Transition	1	
36C – App. guardrail	1	
36D – Guardrail ends	1	

Rural road, single span bridge		
Item	**Code**	**Comment**
36A – Rail	0	Standards are not anchored to top of deck. Horizontal wide-flange missing behind thrie beam
36B – Transition	0	No transition present.
36C – App. guardrail	0	No approach guardrail.
36D – Guardrail ends	0	No approach guardrail end.

Rural paved road, single span bridge		
Item	**Code**	**Comment**
36A – Rail	1	
36B – Transition	0	Post spacing is too wide. W beam only, no thrie beam.
36C – App. guardrail	1	
36D – Guardrail ends	1	Approach guardrail end is "boxing glove" is outside the lateral obstacle clearance.

Rural paved road		
Item	**Code**	**Comment**
36A – Rail	1	
36B – Transition	0	Post spacing is too wide.
36C – App. guardrail	1	
36D – Guardrail ends	1	Approach guardrail end is SKR-350 is outside the clear zone.

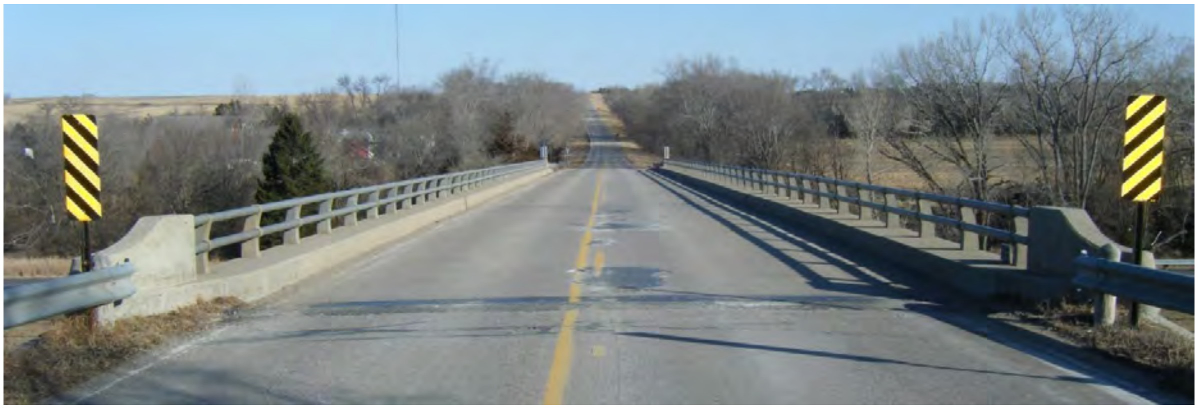
State Highway (built to standards at that time)		
Item	**Code**	**Comment**
36A – Rail	1	
36B – Transition	0	Post spacing is too wide, no rub rail, no W beam to thrie beam transition.
36C – App. guardrail	1	
36D – Guardrail ends	1	Not pictured.

Rural Road, two bridges		
Item	**Code**	**Comment**
36A – Rail	1	Bridge rail too short.
36B – Transition	0	Post spacing incorrect; one post appears to be missing.
36C – App. guardrail	1	
36D – Guardrail ends	0	For first bridge, buried ends are not standard.
36D – Guardrail ends	N	For truss bridge since approach rail extends over the first bridge.

FHWA Coding Guide content is shown in Calibri italic font.

Rural road over culvert		
Item	**Code**	**Comment**
36A – Rail	N	Culvert has no bridge rail; guardrail continued across
36B – Transition	N	No transition because there is no bridge rail.
36C – App. guardrail	1	
36D – Guardrail ends	1	Approach guardrail end outside of clear zone.

Rural road over interstate (built to standards of the time)		
Item	**Code**	**Comment**
36A – Rail	0	
36B – Transition	0	No W-beam to thrie beam transition, post spacing too wide.
36C – App. guardrail	0	Approach guardrail not standard
36D – Guardrail ends	0	End section not standard.



FHWA Coding Guide content is shown in Calibri italic font.

Urban road		
Item	**Code**	**Comment**
36A – Rail	1	
36B – Transition	1	Concrete Tapers must be 20’ long or greater
36C – App. guardrail	N	
36D – Guardrail ends	N	

Item 37 – Historical Significance

1 digit

The historical significance of a bridge involves a variety of characteristics: the bridge may be a particularly unique example of the history of engineering; the crossing itself might be significant; the bridge might be associated with a historical property or area; or historical significance could be derived from the fact the bridge was associated with significant events or circumstances. Use one of the following codes:

Code	***Description***
1	*Bridge is on the National Register of Historic Places.*
2	*Bridge is eligible for the National Register of Historic Places.*
3	*Bridge is possibly eligible for the National Register of Historic Places (requires further investigation before determination can be made) or bridge is on a state or local historical register.*
4	*Historical significance is not determinable at this time.*
5	*Bridge is not eligible for the National Register of Historic Places.*

Item 38 – Navigation Control

1 digit

Indicate for this item whether or not navigation control (a bridge permit for navigation) is required. Use one of the following codes:

Code	***Description***
N	*Not applicable, no waterway*
0	*No navigation control on waterway (bridge permit not required)*
1	*Navigation control on water (bridge permit required)*

Item 39 – Navigation Vertical Clearance

3 digits (XXX feet)

If Item 38 Navigation Control has been coded 1, record in feet the minimum vertical clearance imposed at the site as measured above a datum that is specified on a navigation permit issued by a control agency. The measurement shall be coded as a three digit number rounded down to the nearest foot. This measurement will show the clearance that is allowable for navigational purposes. In the case of a swing or bascule bridge, the vertical clearance shall be measured with the bridge in the closed position (i.e., open to vehicular traffic). The vertical clearance of a vertical lift bridge shall be measured with the bridge in the raised or open position. Also, Item 116 Minimum Navigation Vertical Clearance Vertical Lift Bridge shall be coded to provide clearance in a closed position. If Item 38 - Navigation Control has been coded 0 or N, code 000 to indicate not applicable.

Examples:

Measured Vertical Clearance	***Code***
150.0	*150*
20.6	*020*
24.2	*024*

Item 40 – Navigation Horizontal Clearance

4 digits (XXXX feet)

If Item 38 Navigation Control has been coded 1, record for this item the minimum horizontal clearance in feet. This measurement should be that shown on the navigation permit and may be less than the structure allows. If a navigation permit is required but not available, use the minimum horizontal clearance between fenders, if any, or the clear distance between piers or bents. Code the clearance as a four digit number. Code 0000 if Item 38 Navigation Control is coded 0 or N.

Examples:

Horizontal Clearance	***Code***
95 feet	*0095*
538 feet	*0538*
1,200 feet	*1200*

Item 41 – Structure Open, Posted, or Closed to Traffic

1 digit

This item provides information about the actual operational status of a structure. The field review could show that a structure is posted, but Item 70 Bridge Posting may indicate that posting is not required. This is possible and acceptable coding since Item 70 is based on the operating stress level and the governing agency's posting procedures may specify posting at some stress level less than the Operating Rating. One of the following codes shall be used:

Code	***Description***
A	*Open, no restriction*
B	*Open, posting recommended but not legally implemented (all signs not in place or not correctly implemented)*
D	*Open, would be posted or closed except for temporary shoring, etc. to allow for unrestricted traffic*
E	*Open, temporary structure in place to carry legal loads while original structure is closed and awaiting replacement or Rehabilitation*
G	*New structure not yet open to traffic*
K	*Bridge closed to all traffic*
P	*Posted for load (may include other restrictions such as temporary bridges which are load posted)*
R	*Posted for other load-capacity restriction (speed, number of vehicles on bridge, etc.)*

Code B includes any bridge that is not posted but is required to be posted according to the most current Load Rating Summary Sheet (LRSS).

Team Leaders must report these Critical Findings related to this Item:

- Postings greater than the most current LRSS.
- Missing posting signs, for example if they are stolen or vandalized.
- Bridges shown to be closed, but found open to traffic, often due to the public removing or moving the barricades.

The Program Manager will update Item 41 after the Owner has completed any action needed to address a Critical Finding and has completed the Critical Finding Form.

Item 42 – Type of Service

2 digit

The type of service on the bridge and under the bridge is indicated by a two-digit code composed of two segments.

Segment	*Description*	*Length*
42A	*Type of service on bridge*	*1 digit*
42B	*Type of service under bridge*	*1 digit*

The first digit indicates the type of service "on" the bridge and shall be coded using one of the following codes:

Code	*Description*
1	*Highway*
2	*Railroad*
3	*Pedestrian/Bicycle*
4	*Highway-railroad*
5	*Highway-pedestrian*
6	*Overpass structure at an interchange or second level of a multilevel interchange*
7	*Third level (Interchange)*
8	*Fourth level (Interchange)*
9	*Building or plaza*
0	*Other*

The second digit indicates the type of service "under" the bridge and shall be coded using one of the following codes:

Code	*Description*
1	*Highway, with or without pedestrian*
2	*Railroad*
3	*Pedestrian/Bicycle*
4	*Highway-railroad*
5	*Waterway*
6	*Highway-waterway*
7	*Railroad-waterway*
8	*Highway-waterway-railroad*
9	*Relief for waterway*
0	*Other*

Item 43 – Structure Type, Main

3 digits

Record the description on the inspection form and indicate the type of structure for the main span(s) with a three digit code composed of two segments.

Segment	*Description*	*Length*
43A	*Kind of material and/or design*	*1 digit*
43B	*Type of design and/or construction*	*2 digits*

The first digit indicates the kind of material and/or design and shall be coded using one of the following codes:

Code	*Description*
1	*Concrete*
2	*Concrete continuous*
3	*Steel*
4	*Steel continuous*
5	*Prestressed concrete **
6	*Prestressed concrete continuous **
7	*Wood or Timber*
8	*Masonry*
9	*Aluminum, Wrought Iron, or Cast Iron*
0	*Other*
**Post-tensioned concrete should be coded as prestressed concrete.*	

The second and third digits indicate the predominant type of design and/or type of construction and shall be coded using one of the following codes:

Code	***Description***
01	*Slab*
02	*Stringer/Multi-beam or Girder*
03	*Girder and Floor beam System*
04	*Tee Beam*
05	*Box Beam or Girders – Multiple*
06	*Box Beam or Girders – Single or Spread*
07	*Frame (except frame culverts)*
08	*Orthotropic*
09	*Truss – Deck*
10	*Truss – Thru*
11	*Arch – Deck*
12	*Arch – Thru*
13	*Suspension*
14	*Stayed Girder*
15	*Movable – Lift*
16	*Movable – Bascule*
17	*Movable – Swing*
18	*Tunnel*
19	*Culvert (includes frame culverts)*
*20**	*Mixed types*
21	*Segmental Box Girder*
22	*Channel Beam*
00	*Other*
**Applicable only to approach spans – Item 44*	

Examples:

Material and Construction	***Code***
Timber Girders	*702*
Simple Span Concrete Slab	*101*
Simple Span Steel Girders	*302*
Simple prestressed concrete I-beam	*502*
Continuous concrete T-beam	*204*
Continuous steel deck truss	*409*

NDOT considers structures without decks, i.e. filled arch structures to be culvert and not bridges. They should be coded with Item 43B as 19.

NDOT uses the FHWA method of coding this data field and does not have custom codes for this data item. One border bridge included in the NDOT Bridge Inventory uses a code not shown in the FHWA Coding Guide. This bridge is under the jurisdiction of the State of Iowa which uses an Iowa code of 423, a welded I-girder with diaphragms in a system with more than two girders.

Item 44 – Structure Type, Approach Spans

3 digits

Indicate with a three digit code compose of two segments, the type of structure for the approach spans to a major bridge or for the spans where the structural material is different. The codes are the same as for Item 43 preceding. However, code 000 if this item is not applicable. Use code 20 (Item 44B) when no one type of design and/or construction is predominate for the approach units. If the kind of material (Item 44A) is varied, code the most predominant.

See Examples under Item 43.

Segment	***Description***	***Length***
44A	*Kind of material and/or design*	*1 digit*
44B	*Type of design and/or construction*	*2 digits*

Item 45 – Number of Spans in Main Unit

3 digits

Record the number and indicate with a three digit code the number of spans in the main or major unit. This item will include all spans of most bridges, the major unit only of a sizable structure, or a unit of material or design different from that of the approach spans.

Item 46 – Number of Approach Spans

4 digits

Record the number and indicate with a four digit code the number of spans in the approach spans to the major bridge, or the number of spans of material different from that of the major bridge.

Item 47 – Inventory Route, Total Horizontal Clearance

3 digits (XX.X feet)

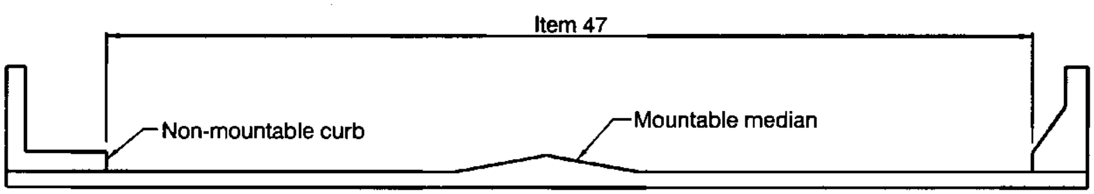
The total horizontal clearance for the inventory route identified in Item 5 should be measured and recorded. The clearance should be the available clearance measured between the restrictive features -- curbs, rails, walls, piers or other structural features limiting the roadway (surface and shoulders). The measurement should be recorded and coded as a three digit number truncated to the nearest tenth of a meter (with an assumed decimal point). When the restriction is 100 meter or greater, code 999.

The NE Inventory is in English units and this item is coded in feet. When the horizontal clearance restriction is 100 feet or greater, code 99.9.

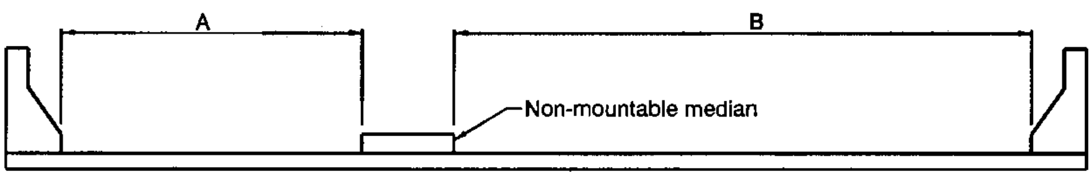
The purpose of this item is to give the largest available clearance for the movement of wide loads. Flush and mountable medians are not considered to be restrictions. This clearance has been identified in two ways; use the most applicable:

1. *Clear distance between restrictions of the inventory route either "on" or "under" the structure.*
2. *Roadway surface and shoulders – when there are no restrictions.*

For a divided facility with a raised or non-mountable median, or an "under" route divided by piers, record the greater of the restricted widths in either direction, not both directions.



No Median or Flush or Mountable Median



Raised Median or Non-mountable Median
B > A Item 47 = B

FHWA Coding Guide content is shown in Calibri italic font.

Item 48 – Length of Maximum Span

4 digits (XXXX feet)

The length of the maximum span shall be recorded. It shall be noted whether the measurement is center to center of bearing points or clear open distance between piers, bents or abutments. The measurement shall be along the centerline of the bridge.

For this item, code a four digit number to represent the measurement to the nearest foot. (XXXX feet)

Examples:

Length of Maximum Span	***Code***
50 feet	*0050*
117 feet	*0117*
1,050 feet	*1050*

Item 49 – Structure Length

6 digits (XXXXXX feet)

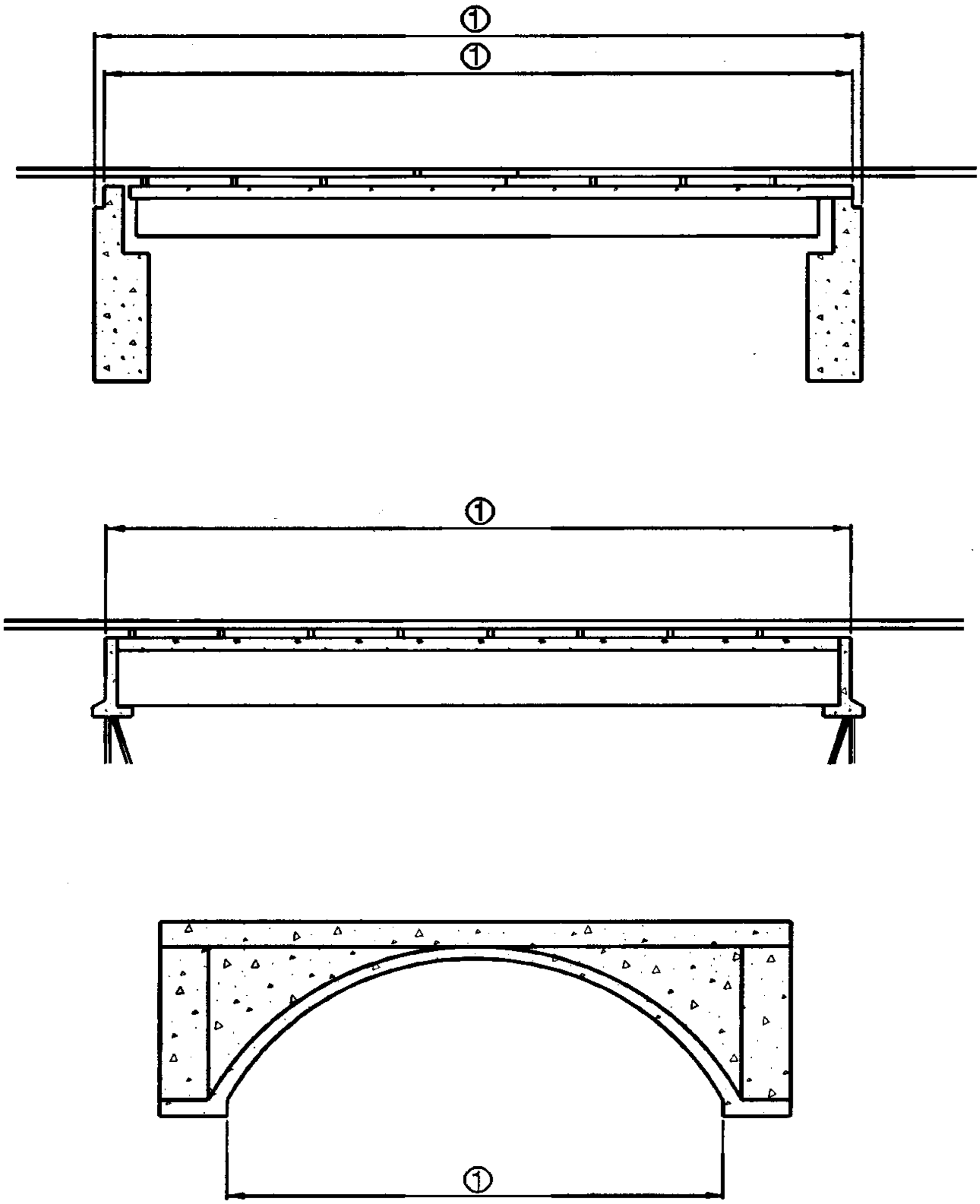
Record and code a six digit number (XXXXXX feet) to represent the length of the structure to the nearest foot. This shall be the length of roadway which is supported on the bridge structure.

The length should be measured from end-to-end of floor.

Culvert lengths should be measured along the center line of roadway regardless of their depth below grade. Measurement should be made between inside faces of exterior walls.

Examples:

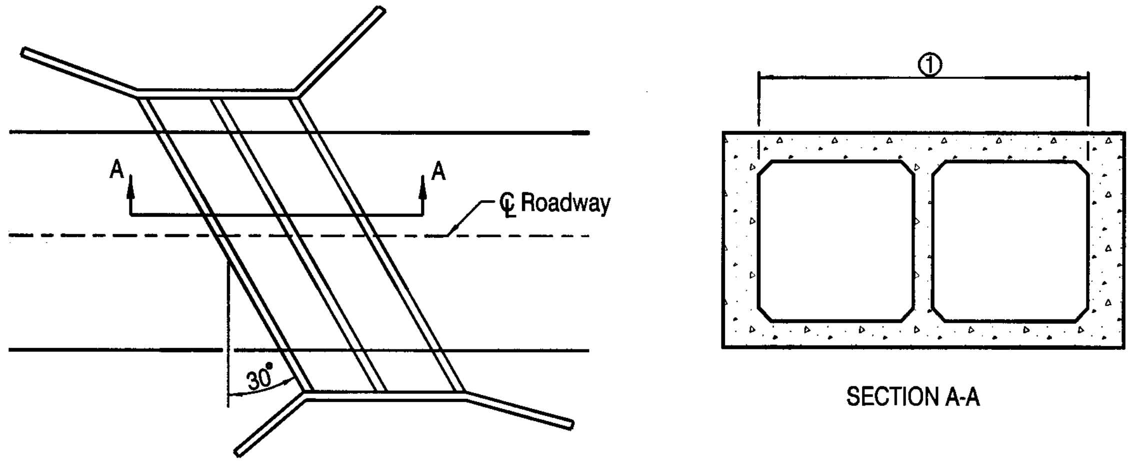
Structure Length	***Code***
50 feet	*000050*
5,421 feet	*005421*
333 feet	*000333*
101,235 feet	*101235*



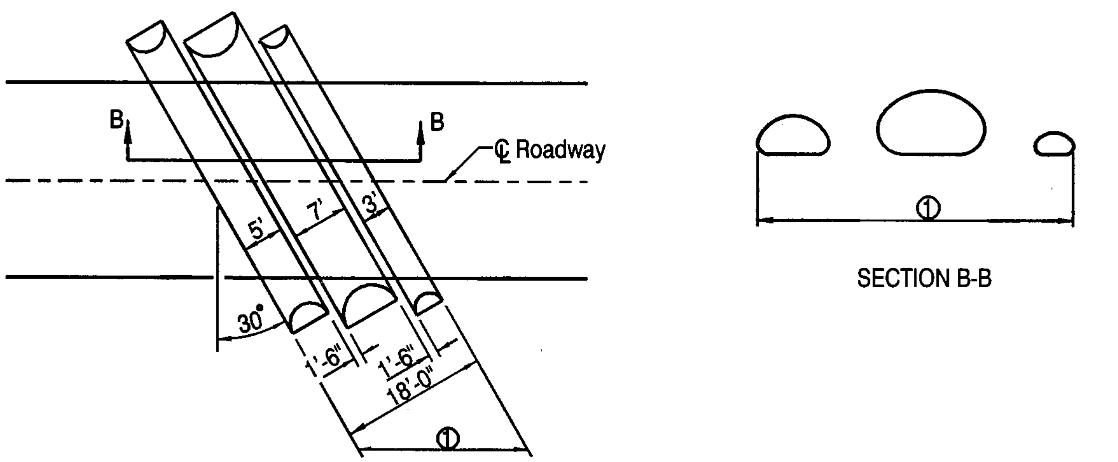
① Item 49 - Structure Length

(Length or Roadway Supported on Structure)

FHWA Coding Guide content is shown in Calibri italic font.



1 Item 49 – Structure Length



1 Item 49 – Structure Length = 18’/cos (30) = 20.78’

(Length or Roadway Supported on Structure)

Item 50 – Curb or Sidewalk Widths

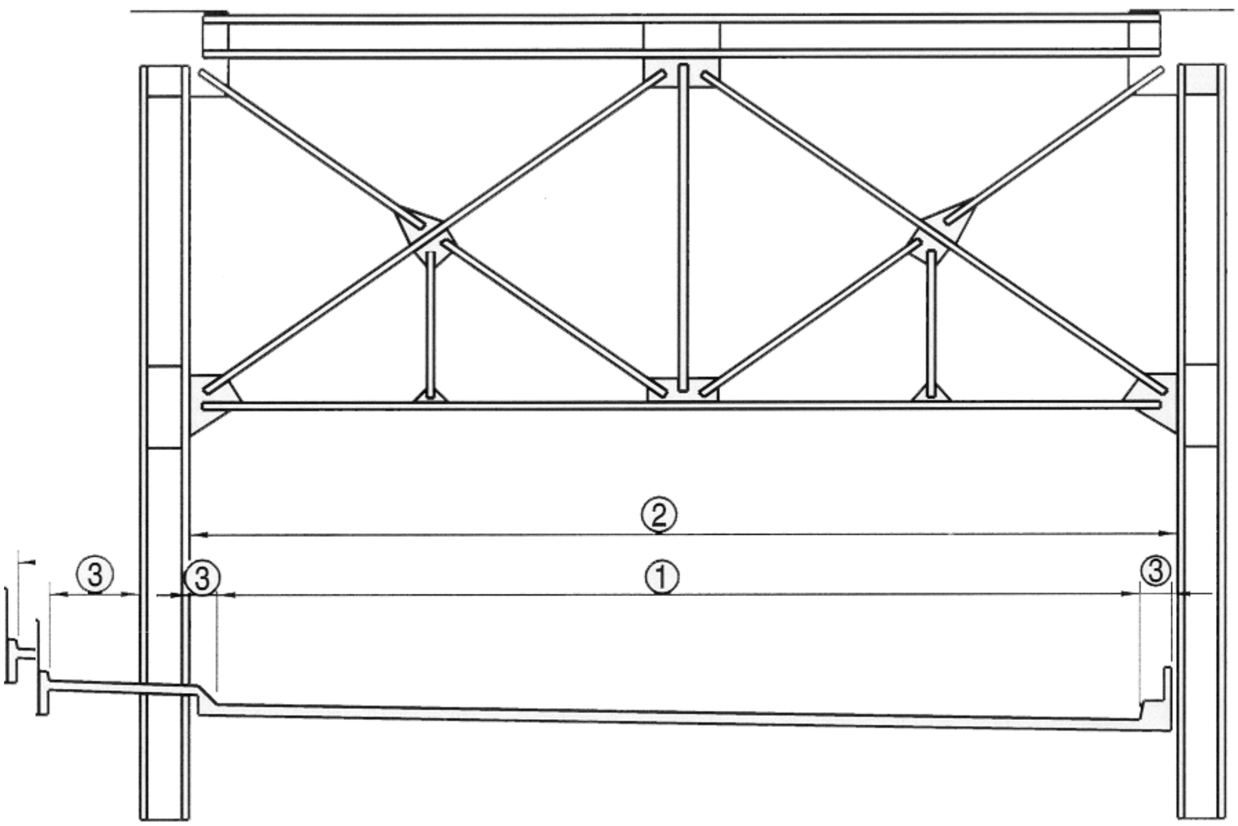
6 digits

Record and code two contiguous three digit numbers (XX.X feet, XX.X feet) to represent the widths of the left and right curbs or sidewalks to nearest tenth of a foot (with assumed decimal points). This is a six digit number composed of two segments, with the leftmost three digits representing the left curb or sidewalk and the rightmost three digits representing the right curb or sidewalk. "Left" and "Right" should be determined on the basis of direction of the inventory.

Segment	***Description***	***Length***
50A	Left curb or sidewalk width	*3 digits*
50B	Right curb or sidewalk width	*3 digits*

Examples:

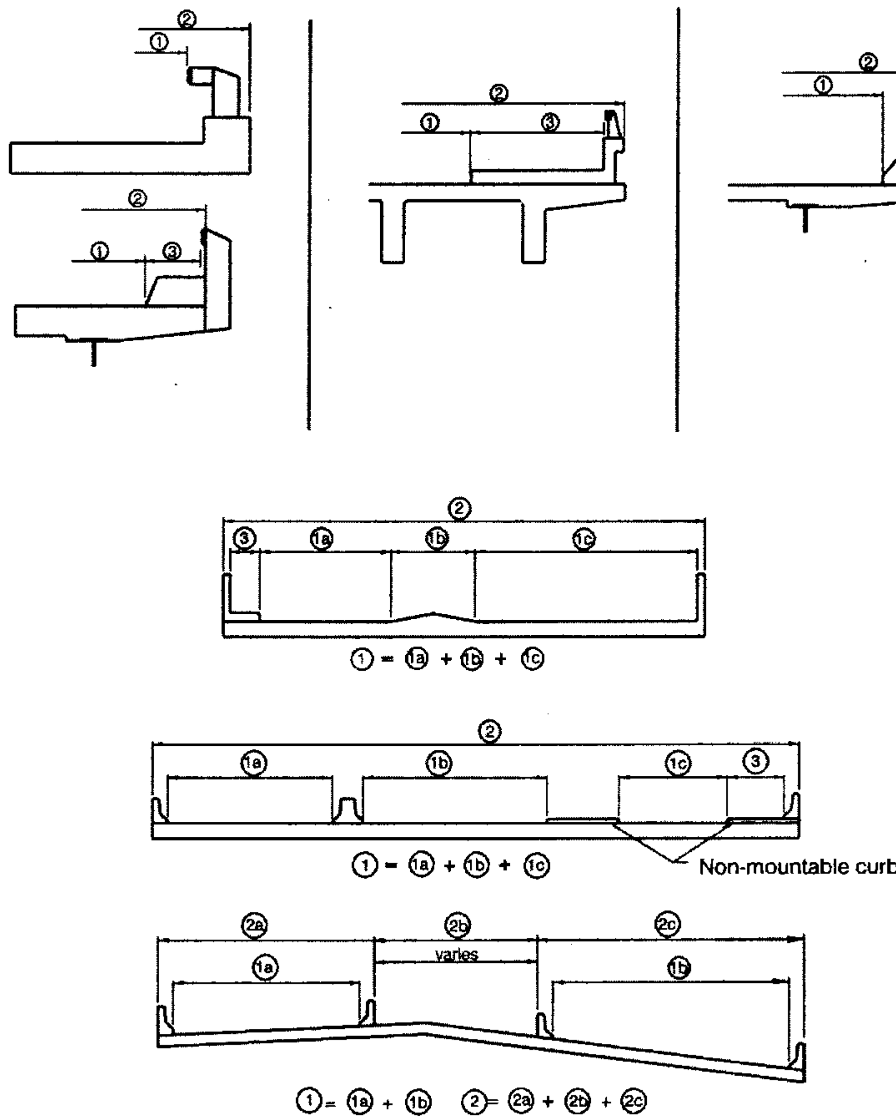
Curb or sidewalk Left Side	***Curb or sidewalk Right Side***	***Code***
None	*8.3'*	*000083*
10.0'	*4.1'*	*100041*
8.3'	*None*	*083000*
12.1'	*11.5'*	*121115*
None	*None*	*000000*
0.6'	*1.5'*	*006015*



1 Item 51 – Bridge Roadway Width, Curb-to-Curb

2 Item 52 – Deck Width, Out-to-Out

3 Item 50 – Curb or Sidewalk Width



① Item 51 - Bridge Roadway Width, Curb-to-Curb
② Item 52 - Deck Width, Out-to-Out
③ Item 53 - Curb or Sidewalk Width

FHWA Coding Guide content is shown in Calibri italic font.

Item 51 – Bridge Roadway Width, Curb-to-Curb

4 digits (XXX.X feet)

The information to be recorded is the most restrictive minimum distance between curbs or rails on the structure roadway. For structures with closed medians and usually for double decked structures, coded data will be the sum of the most restrictive minimum distances for all roadways carried by the structure. The data recorded for this item must be compatible with other related route and bridge data (i.e., Items 28, 29, 32, etc.). The measurement should be exclusive of flared areas for ramps. A four digit number should be used to represent the distance to the nearest tenth of a foot (with an assumed decimal point).

See illustrations under Item 50 Curb or Sidewalk Widths.

Where traffic runs directly on the top slab (or wearing surface) of a culvert-type structure, e.g. an R/C box without fill, code the actual roadway width (curb-to-curb or rail-to-rail). This will also apply where the fill is minimal and headwalls or parapets affect the flow of traffic.

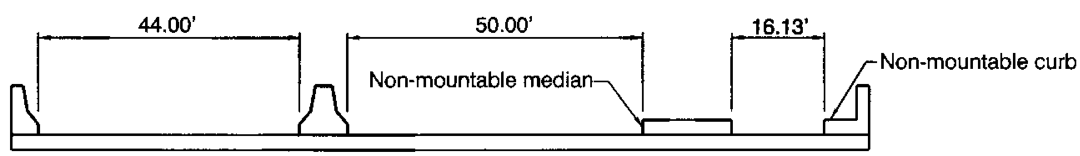
Where the roadway is on fill carried across a structure and the headwalls or parapets do not affect the flow of traffic, code 0000. This is considered proper inasmuch as a filled section simply maintains the roadway cross-section.

Raised or non-mountable medians, open medians and barrier widths are to be excluded from the summation along with barrier-protected bicycle and equestrian lanes.

Examples:

Bridge Roadway Width	***Code***
36.00' wide	*0360*
66.37' wide	*0664*
110.13' wide	*1101*

The last example above would be the coded value for the deck section shown below.



Item 52 – Deck Width, Out-to-Out

4 digits (XXX.X feet)

Record the out-to-out width to the nearest tenth of a foot (with an assumed decimal point). If the structure is a through structure, the number to be coded will represent the lateral clearance between superstructure members. The measurement should be exclusive of flared areas for ramps.

See illustrations under Item 50 Curb or Sidewalk Widths.

Where traffic runs directly on the top slab (or wearing surface) of the culvert (e.g., an R/C box without fill) code the actual width (out-to-out). This will also apply where the fill is minimal and the culvert headwalls affect the flow of traffic.

Where the roadway is on a fill carried across a pipe or box culvert and the culvert headwalls do not affect the flow of traffic, code 0000. This is considered proper inasmuch as a filled section over a culvert simply maintains the roadway cross-section.

Item 53 – Minimum Vertical Clearance Over Bridge Roadway

4 digits (XX feet. XX inches)

The information to be recorded for this item is the actual minimum vertical clearance over the bridge roadway, including shoulders, to any superstructure restriction, rounded down to the nearest hundredth of a meter. When no superstructure restriction exists above the bridge roadway, or when a restriction is 30 meters or greater, code 9999.

The NE Inventory is in English units and this item is coded in feet as four digit number to represent feet and inches. When a restriction is 100 feet or greater, code 99.99.

Examples:

Minimum Vertical Clearance	***Code***
17'-3"	*17.03*
75'-11"	*75.11*
No restriction	*99.99*
115'-6"	*99.12*

Item 54 – Minimum Vertical Underclearance

5 digits (X code, XX feet, XX inches)

Using a one digit code and a four digit number, record and code the minimum vertical clearance from the roadway (travel lanes only) or railroad track ***beneath*** *the structure to the underside of the superstructure. (When both a railroad and highway are under the structure, code the most critical dimension.)*

Segment	***Description***	***Length***
54A	*Reference feature*	*1 digit*
54B	*Minimum Vertical Underclearance*	*4 digits*

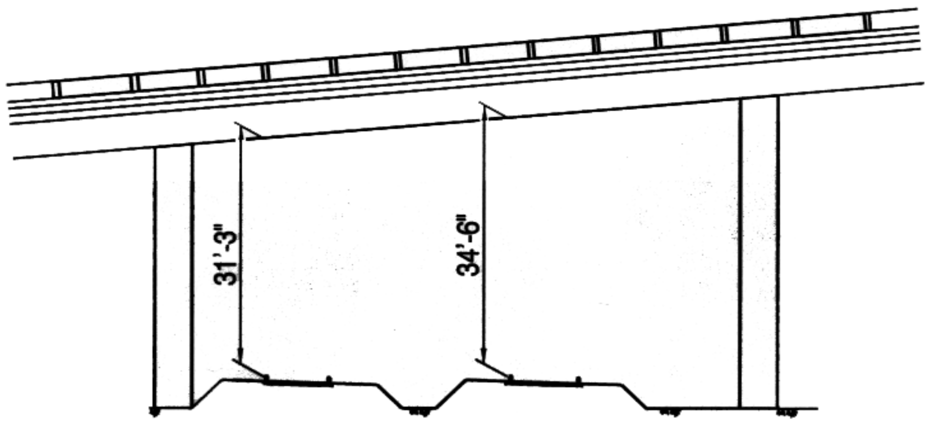
Any revision made which will alter the clearances, such as addition of surfacing to the roadway, will necessitate re-measurement of the clearances and correction of the signs and records to reflect the change.

Using one of the codes below, code in the first position, the reference feature from which the clearance measurement is taken:

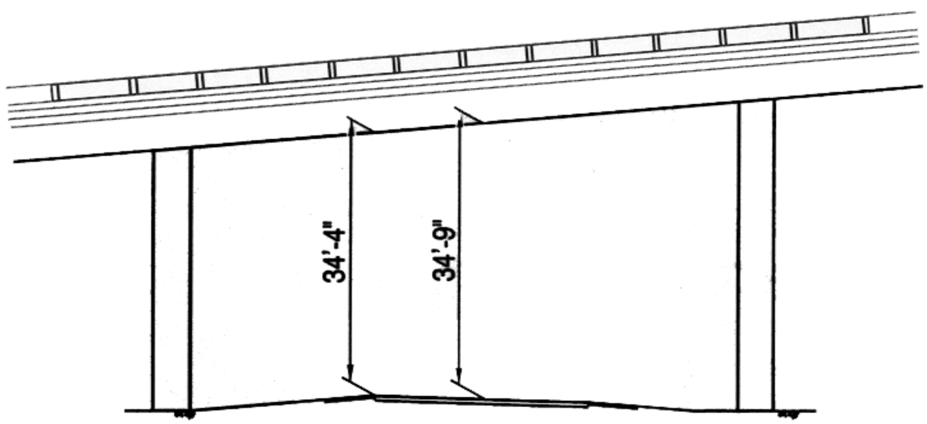
Code	***Description***
H	*Highway beneath structure*
R	*Railroad beneath structure*
N	*Feature not a highway or railroad*

In the next four positions, code a four digit number to represent the minimum vertical clearance from that feature to the structure. If the feature is not a highway or railroad, code the minimum vertical clearance 0000.

EXAMPLES:	CODE:
Railroad 31'-3" beneath structure	R3103



Highway 34'-4" beneath Structure	H3404



Item 55 – Minimum Lateral Underclearance on Right

4 digits (X code, XX.X feet)

Using a one digit code and a three digit number, record and code the minimum lateral underclearance on the right to the nearest tenth of a foot (with an assumed decimal point). When both a railroad and highway are under the structure, code the most critical dimension.

Segment	***Description***	***Length***
55A	*Reference feature*	*1 digit*
55B	*Minimum Lateral Underclearance*	*3 digits*

Using one of the codes below, code in the first position the reference feature from which the clearance measurement is taken:

Code	***Description***
H	*Highway beneath structure*
R	*Railroad beneath structure*
N	*Feature not a highway or railroad*

In the next three positions, code a three digit number to represent the minimum lateral underclearance on the right. The lateral clearance should be measured from the right edge of the roadway (excluding shoulders) or from the centerline (between rails) of the right-hand track of a railroad to the nearest substructure unit (pier, abutment, etc.), to a rigid barrier, or to the toe of the slope steeper than 1 to 3. The clearance measurements to be recorded will be the minimum after measuring the clearance in both directions of travel. In the case of a dual highway this would mean the outside clearance of both roadways should be measured and the smaller distance recorded and coded.

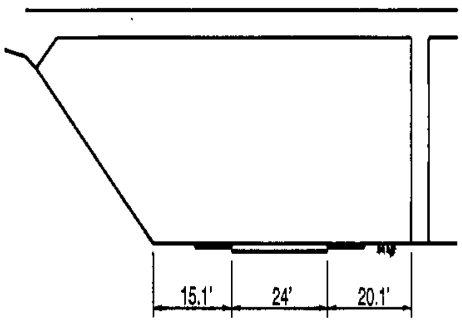
If two related features are below the bridge, measure both and record the lesser of the two. An explanation should be written as to what was recorded. If the feature beneath the structure is not a railroad or highway, code 000 to indicate not applicable.

The presence of ramps and acceleration or turning lanes is not considered in this item; therefore, the minimum lateral clearance on the right should be measured from the right edge of the through roadway.

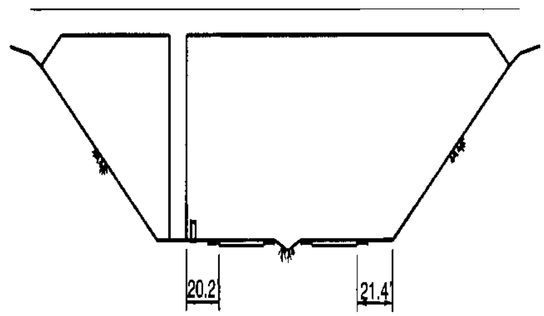
Examples:

Description	***Code***
Railroad 20.4' centerline to pier	*R204*
Highway 20.2' edge of pavement to pier	*H202*
Creek beneath structure	*N000*

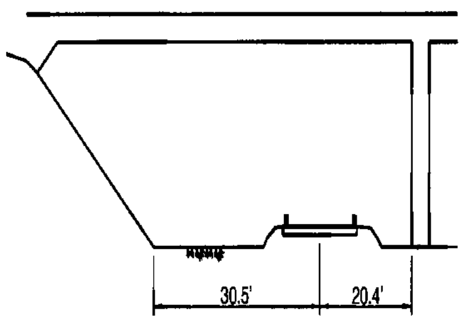
Examples: Item 55 – Minimum Lateral Underclearance on Right (cont’d)



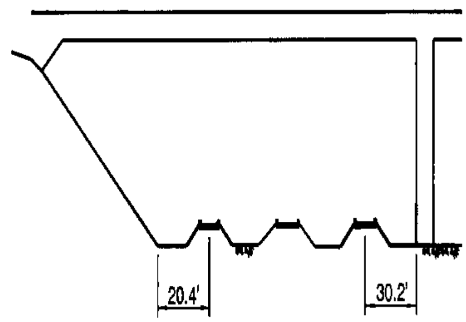
-- Lt. 15.1' Rt. for 2-way Traffic
15.1' Lt. 20.1' Rt. for 1-way Traffic



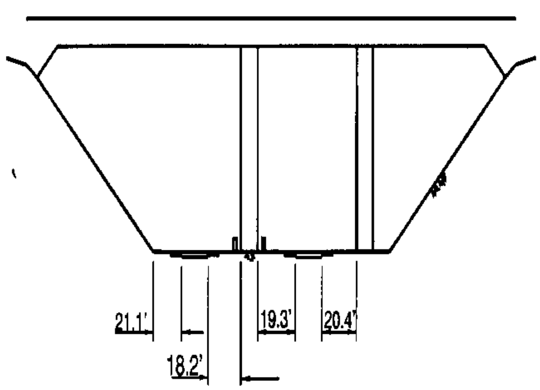
OPEN Lt. 20.2' Rt.



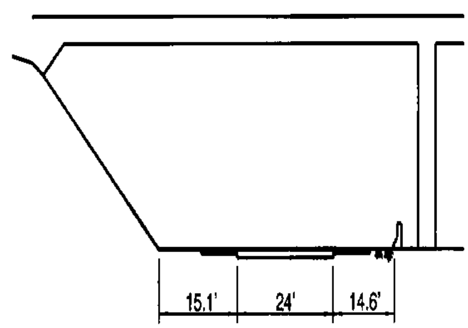
--Lt. 20.4' Rt.



-- LT. 20.4' Rt.



18.2' Lt. 20.4' Rt.



-- Lt. 14.6' Rt. for 2-way Traffic
15.1' Lt. 14.6' Rt. for 1-way traffic

Item 56 – Minimum Lateral Underclearance on Left

3 digits (XX.X feet)

(Code only for divided highways, one-way streets, and ramps; not applicable to railroads.)

Using a three digit number, record and code the minimum lateral underclearance on the left (median side for divided highways) to the nearest tenth of a foot (with an assumed decimal point). The lateral clearance should be measured from the left edge of the roadway (excluding shoulders) to the nearest substructure unit, to a rigid barrier, or to the toe of slope steeper than 1 to 3. Refer to examples under Item 55 - Minimum Lateral Underclearance on Right.

In the case of a dual highway, the median side clearances of both roadways should be measured and the smaller distance recorded and coded. If there is no obstruction in the median area, a notation of "open" should be recorded and 999 should be coded. For clearances greater than 99.8 feet, code 998. Code 000 to indicate not applicable.

Item 57 – Reserved (by FHWA)

3-NBI.8 NBI DATA ITEMS – CONDITION RATINGS, ITEMS 58 THROUGH 62

*Condition ratings are used to describe the existing, in-place bridge as compared to the as-built condition. Evaluation is for the materials related, physical condition of the deck, superstructure and substructure components of a bridge. The condition evaluation of channels and channel protection and culverts is also included. Condition codes are **properly used** when they provide an overall **characterization** of the general condition of the **entire component** being rated. Conversely, they are **improperly used** if they attempt to describe **localized** or nominally occurring instances of deterioration or disrepair. Correct assignment of a condition code must, therefore, consider both the severity of the deterioration or disrepair and the extent to which it is widespread throughout the component being rated.*

The load-carrying capacity will not be used in evaluating condition items. The fact that a bridge was designed for less than current legal loads and may be posted shall have no influence upon condition ratings.

Portions of bridges that are being supported or strengthened by temporary members will be rated based on their actual condition; that is, the temporary members are not considered in the rating of the item. (See Item 103 Temporary Structure Designation for the definition of a temporary bridge.)

Completed bridges not yet opened to traffic, if rated, shall be coded as if open to traffic.

The following table contains the condition codes for FHWA Item 58 Deck, Item 59 Superstructure and Item 60 Substructure. The following general condition ratings are **also** used as a guide in evaluating several Nebraska Inventory Database Items.

In January of 2001, the FHWA completed a comprehensive study to examine the reliability of visual inspections as it is currently practiced in the United States. The conclusion of this study was that because the ratings are assigned after a visual inspection and rely heavily on subjective assessments made by bridge inspectors, there is no single “correct” rating value the group of inspectors could agree on. A single condition description in the table may not exactly match existing bridge condition; thus the Inspector should consider the condition to be in a range of two or three rating values from which the Inspector, based on their experience and knowledge of the structure, can select one to represent the element. The condition codes should describe the general condition of the entire component being rated; however, the Inspector must not hesitate to use ratings of 0, 1 or 2 in cases where a localized deterioration endangers the whole structure.

Code	***Description***
N	*NOT APPLICABLE*
9	*EXCELLENT CONDITION*
8	*VERY GOOD CONDITION - no problems noted.*
7	*GOOD CONDITION - some minor problems.*
6	*SATISFACTORY CONDITION - structural elements show some minor deterioration.*
5	*FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.*
4	*POOR CONDITION - advanced section loss, deterioration, spalling or scour.*
3	*SERIOUS CONDITION - loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.*
2	*CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.*
1	*"IMMINENT" FAILURE CONDITION - major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.*
0	*FAILED CONDITION - out of service beyond corrective action.*

NDOT's policy is that a code of 2 or less on one or more of the following condition ratings is a Critical Finding and requires immediate action.

- Item No. 58, Deck
- Item No. 59, Superstructure
- Item No. 60, Substructure
- Item No. 61, Channel and Channel Protection
- Item No. 62, Culvert
- NE Item No. 320 Piling

When a condition rating is deemed to be 2 it is a Critical Finding, and NDOT **requires** that the structure be closed. This requirement is more conservative than general condition description shown in the recording guide above. The intent is that if the Owner wishes to open the bridge, then a bridge engineer will review the structure (typically, an inspector is not a bridge engineer). After the review, the bridge can be opened if structural review and analysis allows or the engineer's opinion is that the bridge can be opened. A Critical Finding Report must show and document the decisions. See Chapter 4 Bridge Inspection for instructions on notifications and filing this report.

Item 58 – Deck

1 digit

This item describes the overall condition rating of the deck. Rate and code the condition ratings as summarized on the following tables.

All decks should be examined for slipperiness to determine if a hazard exists. Also, check drainage to see that the decks are well drained with no areas where water will pond and produce a hazard to traffic. Check drains and scuppers to see that they are open and clear. Check to see that drain outlets do not discharge water where it may be detrimental to other members of the structure, cause fill and bank erosion, or spill onto a traveled way below.

*Decks integral with the superstructure will be rated as a **deck only** and not how they may influence the superstructure rating.*

Situation	Code
Bridges with a gravel overlay where half or more of the concrete deck is not visible	5 maximum
Bridges that have received an asphalt overlay between the last inspection and the current inspection (i.e. within the last 2 years)	No higher than previous inspection rating
Bridges with an asphalt overlay and membrane or concrete overlay that had concrete deck repairs done under a contract.	Code as maximum of 2 points higher than Condition Code before overlay.
Bridges with a concrete overlay where the original concrete deck is not visible	Rate as if it is a single-course integral deck

Previous policy was to code all bridge with an asphalt overlay no higher than 5. This coding unfairly penalized bridges with decks coded higher than 5 prior to an asphalt overlay and decks that received contracted repairs that are covered with a protective surface. Bridges with an existing asphalt overlay that have been coded as 5 per previous policy shall remain as 5 until condition of the deck warrants further reduction.

The condition of the wearing surface/protective system, joints, expansion devices, curbs, sidewalks, parapets, fascias, bridge rail and scuppers shall not be considered in the overall deck evaluation. However, their condition should be documented.

Element	
Curbs	Examine concrete curbs for cracks, spalls and deterioration. Note any loss of height resulting from building-up surfacing on the deck. Timber wheel guards, including scupper blocks, should be checked for splits, checks and decay. Check to determine if they are bolted securely in place.
Sidewalks	Examine concrete sidewalks for cracks, scaling potholing, spalling or other deterioration. Note condition at joints, especially at the abutments, for differential movement, which could open the joint or make an offset which would be a hazard to pedestrians. All sidewalks should be examined for proper drainage and to see that the surface is not excessively rough. Any item which constitutes a hazard for pedestrians should be noted and corrected.
Bridge Railings	Concrete rails are to be examined for cracks, spalls, scaling or other deterioration of the concrete. Metal handrails should be checked for condition of paint and corrosion. All rails should be checked for any damage from traffic. Note the vertical and horizontal alignment. Settlement in the substructure or deficiencies in the bearings may show in the railings. Examine the joints to see that they are open and functioning as designed. Also, see that railings are secure, and that they are relatively free of slivers or any projections which could be hazardous to pedestrians.
Expansion Joints	Examine the underside of the expansion joints as far as possible to detect any impending problem. Lack of adequate room for expansion, especially in small areas of the joints, will concentrate thermal expansion stresses causing the concrete to shear and spall. This is a serious hazard in structures which cross over roadways, walkways, or any occupied areas.

Concrete Deck		
Item 58 Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the deck.
8	VERY GOOD CONDITION	No spalling, scaling or delamination. Minor hairline transverse cracking.
7	GOOD CONDITION	Deck cracks with or without efflorescence (cracks are sealable). Light scaling (1/4" depth or less). Visible tire wear in the wheel lines. Area of the deck has been repaired or is deteriorating, 5% or less. No spalling.
6	SATISFACTORY CONDITION	2% or less of the deck spalled. Medium scaling (1/4" - 1/2" in depth). Area of the deck has been repaired or is deteriorating, less than 10%. Excessive number of open cracks (excessive being at 5' intervals or less over the entire deck) with or without efflorescence.
5	FAIR CONDITION	Less than 5% of the deck spalled. Excessive cracking resulting in spalling. Heavy scaling (1/2" - 1" in depth). Area of the deck has been repaired or is deteriorating, 10% - 29% including any repaired areas and/or areas in need of repair.
4	POOR CONDITION	Area of the deck has been repaired or is deteriorating, 30% - 60 % including any repaired areas and/or areas in need of repair. Area of the deck that is spalled, more than 5%.
3	SERIOUS CONDITION	Area of the deck has been repaired or is deteriorating, more than 60 %.
2*	CRITICAL CONDITION	Advanced deterioration of primary structural elements. The need for repair is urgent. Bridge must be closed to traffic until the condition is reviewed by an engineer.
1*	IMMINENT FAILURE CONDITION	Major deterioration of deck. Bridge is closed to traffic, but redecking may put it back in service.
0*	FAILED CONDITION	Out of service - beyond correction action.
* Requires a Critical Finding		

Concrete decks must be checked for cracking, leaching, scaling, pot-holing, spalling and other evidence of deterioration. Each item must be evaluated to determine its effect on the structure and the work required to restore the loss of structural integrity and maintain a smooth riding surface. Evidence of deterioration in the reinforcing steel must be examined closely to determine its extent. Decks which are treated with deicing salts or are located in a salt air environment are especially apt to be affected.

For additional information on deck evaluation, see Chapter 4 Bridge Inspection in this Manual.

Asphaltic or other type wearing surface on a deck may hide defects in the deck until they are well advanced. The surfacing must be examined very carefully for evidence of deterioration in the deck. Such defects may show as cracking or breaking up of the surfacing or in excessive deflection. The underside of the deck slab should always be examined for indications of deterioration or distress. Note any evidence of water passing through cracks in the slab

Steel Deck		
Item 58 Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the deck.
8	VERY GOOD CONDITION	No rusting of steel decking. Steel decking tightly secured to floor system.
7	GOOD CONDITION	Minor surface rusting of steel deck. Steel deck a little loose at some connections.
6	SATISFACTORY CONDITION	Considerable rusting of steel deck with indications of initial section loss. Steel deck is loose at many locations.
5	FAIR CONDITION	Heavy rusting of steel decking with areas of section loss. Steel deck is loose at numerous locations.
4	POOR CONDITION	Heavy rusting of steel decking resulting in considerable section loss and some holes through deck. Necessitating the replacement of the entire deck.
3	SERIOUS CONDITION	Steel decking should be replaced before reaching this condition.
2*	CRITICAL CONDITION	Advanced deterioration of primary structural elements. Fatigue cracks in steel may be present. Bridge must be closed to traffic until the condition is reviewed by an engineer.
1*	IMMINENT FAILURE CONDITION	Major deterioration of deck. Bridge is closed to traffic, but redecking action may put it back in service.
0*	FAILED CONDITION	Out of service - beyond correction action.
* Requires a Critical Finding		

Steel decks should be checked for corrosion and unsound welds. It is important to maintain an impervious surface over a steel plate deck to protect against corrosion of the steel, especially in a salt air environment and in areas where deicing salts are used.

Timber Plank Deck		
Item 58 Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the deck.
8	VERY GOOD CONDITION	No rotten or crushed wood. No splitting of timber planks. Timber planks tightly secured to floor system.
7	GOOD CONDITION (see guide photos)	Minor cracking or splitting of wood. Planks a little loose at some locations.
6	SATISFACTORY CONDITION (see guide photos)	A number of rotten or crushed planks in need of replacement. Many planks cracked or split. Planks are loose at many locations.
5	FAIR CONDITION (see guide photos)	Numerous rotten or crushed planks in need of replacement. Numerous planks cracked or split. Majority of planks are loose.
4	POOR CONDITION (see guide photos)	Majority of the planks are rotten, crushed and/or splitting, necessitating the replacement of the entire deck.
3	SERIOUS CONDITION	More than 60% of the deck is deteriorating. This area would include any repaired areas and/or areas in need of repair. Timber decking should be replaced before reaching this condition.
2*	CRITICAL CONDITION	Advanced deterioration of primary structural elements. Bridge must be closed to traffic until the condition is reviewed by an engineer.
1*	IMMINENT FAILURE CONDITION	Major deterioration of deck. Bridge is closed to traffic, but redecking action may put it back in service.
0*	FAILED CONDITION	Out of service - beyond correction action.
Requires a Critical Finding		

Timber decks are to be examined for decay at their contact surfaces where they bear on the stringers and between layers of planking or laminated pieces. Note any looseness which may have developed from inadequate nailing or where the spikes have worked loose. Observation under passing traffic will reveal looseness or excessive deflection in the members.

Item 58 - Timber Plank Deck		
Code	**Condition**	**Description**
7	GOOD CONDITION	Minor cracking or splitting of wood. Planks a little loose at some locations.

Item 58 - Timber Plank Deck		
Code	**Condition**	**Description**
6	SATISFACTORY CONDITION	A number of rotten or crushed planks in need of replacement. Many planks cracked or split. Planks are loose at many locations.

Item 58 - Timber Plank Deck		
Code	**Condition**	**Description**
5	FAIR CONDITION	Numerous rotten or crushed planks in need of replacement. Numerous planks cracked or split. Majority of planks are loose.

Item 58 - Timber Plank Deck		
Code	**Condition**	**Description**
4	POOR CONDITION	Majority of the planks are rotten, crushed and/or splitting, necessitating the replacement of the entire deck.

Item 59 – Superstructure

1 digit

This item describes the physical condition of all structural members. Rate and code the condition in accordance with the previously described general condition ratings. Code N for all culverts.

Additional guidance for coding for various types of structures is given in this section.

The structural member should be inspected for signs of distress which may include cracking, deterioration, section loss, and malfunction and misalignment of bearings.

The condition of bearings, joints, paint system, etc. shall not be included in this rating, except in extreme situations, but should be noted on the inspection form.

On bridges where the deck is integral with the superstructure, the superstructure condition rating may be affected by the deck condition. The resultant superstructure condition rating may be lower than the deck condition rating where the girders have deteriorated or been damaged.

Fracture critical components should receive careful attention because failure could lead to collapse of a span or the bridge.

The inspection should include, but not necessarily be limited to, the following observations.

Superstructure Condition Rating

Where the deck is an integral part of the superstructure, as for concrete slab bridges (both cast-in-place and deck panel-type bridges), the superstructure rating and the deck rating should be the same.

Where the deck is not an integral part of the superstructure but contributes to the structural capacity of the superstructure, as for steel or concrete girder bridges with composite decks, the superstructure condition rating may be different than the deck rating. The superstructure condition rating, however, may be affected by the deck condition.

Steel Stringers and Girders

Examine steel stringers and girders for cracking and corrosion at bearings where they support the deck and at connections.

Inspect weld areas for cracks, especially at re-entrant corners and copes and where vibration and movement could produce fatigue. A likely place would be flange to web welds close to separator or cross frame connections.

Each hanger assembly must be accessed by any means necessary for a close visual inspection to detect any misalignment of link bars, pins or other parts, looseness of pin nuts, etc.

Measure across the expansion gap at expansion hanger devices. Mark for reference, record the distance, ambient temperature and date. This information may be used for movement in the device.

Any pins with abnormal indications should be further investigated internally by ultrasound methods. Written comments shall document all defects.

Trusses

Examination of any truss will normally begin with sighting along the truss chord members to determine any misalignment either vertical or horizontal. Any deviation from the normal alignment must, of course, be fully investigated to determine its cause.

Examine truss and bracing members for traffic damage. Portal bracing usually is the most restrictive overhead clearance and consequently is most susceptible to damage from over height loads.

Check the conditions of the pins at the connections and see that the nuts and keys are in place. Also, see that spacers on the pins are holding eye-bars and looped rods in their proper position.

Check rivets and bolts to see that none are loose, worn or sheared.

Concrete Superstructure

Cast-in-place concrete beams are to be checked for cracking and any disintegration of the concrete, especially over bearings. Girders over a traveled way must be checked for any damage resulting from being struck by over height loads passing under the bridge.

Prestressed concrete girders are to be examined for alignment, cracking and deterioration of the concrete. Check for cracking or spalling in the area around the bearings, and at cast-in-place diaphragms where creep and humping of the girders may have had an effect.

When cracking is found, locations of the cracks and their size should be carefully noted for future reference and comparison.

Concrete slabs may be inspected similar to concrete decks.

Timber Stringers

Check bridging for soundness and tightness.

Examine timber stringers for splitting, cracking, and excessive deflection. Look for crushing and evidence of decay where they bear on the bent caps or abutment seats and at their top edge where the floor is supported.

See Chapter 5 Load Rating material specific considerations for timber for the definition of common defects.

ITEM 59 – CONCRETE SLAB BRIDGES		
Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the structure.
8	VERY GOOD CONDITION	No scaling, spalling, or delamination, top and/or bottom Only minor hairline cracking.
7	GOOD CONDITION	Open cracks without disintegration. Light scaling. Visible wear in wheel lines. Ponding water. Rust stains on surface. Cracks with or without efflorescence, top and/or bottom.
6	SATISFACTORY CONDITION	Area of deck spalled, 2% or less. Medium scaling (1/4" - 1/2" in depth). Raveling of joints. Area of top surface that has been repaired or shows signs of deterioration, less than 10%. Cracks with or without efflorescence, top and/or bottom.
5	FAIR CONDITION	Area of top surface that has been repaired or shows signs of deterioration,10% - 29%. Cracks with or without efflorescence, top and/or bottom.
4	POOR CONDITION	Area of top surface that has been repaired or shows signs of deterioration, 30% - 60%. Cracks with or without efflorescence, top and/or bottom.
3	SERIOUS CONDITION	Area of top surface that has been repaired or shows signs of deterioration, more than 60%. Cracks with or without efflorescence, top and/or bottom.
2*	CRITICAL CONDITION	Need for repair or rehabilitation is urgent. Facility must be closed until the indicated repair is complete.
1*	IMMINENT FAILURE CONDITION	Facility is closed. Study should determine the feasibility for repair.
0*	FAILED CONDITION	Facility is closed and is beyond repair.
*Requires Critical Finding		

ITEM 59 – CONCRETE GIRDER BRIDGES		
Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the structure.
8	VERY GOOD CONDITION	Minor collision damage involving chipped or spalled concrete.
7	GOOD CONDITION	Hairline cracks in concrete girders without disintegration.
6	SATISFACTORY CONDITION	Minor cracking. Deterioration of structural elements.
5	FAIR CONDITION	Substantial but not critical collision damage to concrete girders exposing reinforcing or prestressing Deterioration of deck girder ends, slab ends, precast ends, etc.
4	POOR CONDITION	Critical collision damage sustained to concrete girders with severed reinforcing or prestressing. Precautionary measures such as traffic restrictions or temporary shoring may be needed. Substantial disintegration of deck girder, slab, precast units, etc.
3	SERIOUS CONDITION	Disintegration of or damage condition of a structural member which requires traffic restriction or shoring.
2*	CRITICAL CONDITION	The need for repair or rehabilitation is urgent. Facility must be closed until the indicated repair is complete.
1*	IMMINENT FAILURE CONDITION	Facility is closed. Study should determine the feasibility for repair.
0*	FAILED CONDITION	Facility is closed and is beyond repair.
*Requires Critical Finding		

ITEM 59 – STEEL		
Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the structure.
8	VERY GOOD CONDITION	Bent steel or slight misalignment, not requiring repairs.
7	GOOD CONDITION	Surface rust in localized areas without any section loss.
6	SATISFACTORY CONDITION	Initial section loss (heavy rust) in localized areas of structural steel members in non-critical stress areas.
5	FAIR CONDITION	Substantial but not critical collision damage to structural support elements, steel girders, trusses, etc. Initial section loss (heavy rust) in localized areas of structural steel members in critical stress areas.
4	POOR CONDITION	Critical collision damage sustained to structural support elements. Precautionary measures such as traffic restrictions or temporary shoring may be needed. Significant section loss (heavy rust) of structural steel girder in critical stress areas. (More than 30% section loss).
3	SERIOUS CONDITION	Disintegration of or damage condition of a structural member which requires traffic restriction or shoring. Severe section loss (heavy rust) or structural steel member in critical stress areas requiring immediate repairs. (More than 50% loss of section).
2*	CRITICAL CONDITION	The need for repair or rehabilitation is urgent. Facility must be closed until the indicated repair is complete.
1*	"IMMINENT" FAILURE CONDITION	Facility is closed. Study should determine the feasibility for repair.
0*	FAILED CONDITION	Facility is closed and is beyond repair.
*Requires Critical Finding		

ITEM 59 – TIMBER		
Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the structure.
8	VERY GOOD CONDITION	Insignificant cracking or splitting of timber beams or stringers at insignificant locations.
7	GOOD CONDITION	Minor decay, cracking, splitting, or crushing of timber beams or stringers.
6	SATISFACTORY CONDITION	Some decay, cracking, splitting, or crushing of timber beams or stringers.
5	FAIR CONDITION	Substantial decay, cracking, splitting or crushing of timber beams or stringers.
4	POOR CONDITION	Extensive decay, cracking, splitting, or crushing of timber beams or stringers. Damage by insects such as termites or carpenter ants.
3	SERIOUS CONDITION	Severe decay, cracking, splitting, or crushing of timber beams or stringers. Closing of bridge should be considered.
2*	CRITICAL CONDITION	The need for repair or rehabilitation is urgent. Facility must be closed until the indicated repair is complete.
1*	IMMINENT FAILURE CONDITION	Facility is closed. Study should determine the feasibility for repair.
0*	FAILED CONDITION	Facility is closed and is beyond repair.
*Requires Critical Finding		

Item 60 – Substructure

1 digit

This item describes the physical condition of piers, abutments, piles, footings or other components. Rate and code the condition in accordance with the previously described general condition ratings and the summarized condition ratings shown in this section. Code N for all culverts.

All substructure elements should be inspected for visible signs of distress including evidence of cracking, section loss, settlement, misalignment, scour, collision damage and corrosion. ***The rating factor given by Item 60 should be consistent with the one given to Item 113 whenever a rating factor of 2 or below is determined for Item 113 Scour Critical Bridges.***

It is NDOT's policy, to provide consistency between Items 60 and 113 as noted above, to code Item 60 as follows:

Item 113 Code	Item 60 Code
3, bridge is scour critical	5 or less
2, bridge is scour critical, or 1, bridge is scour critical	4 or less

The substructure condition rating shall be made independent of the deck and superstructure.

Integral-abutment wingwalls to the first construction or expansion joint shall be included in the evaluation. For non-integral superstructure and substructure units, the substructure shall be considered as the portion below the bearings. For structures where the substructure and superstructure are integral, the substructure shall be considered as the portion below the superstructure.

Piers and Abutments

Investigate the footings for evidence of significant scour or undercutting. Conducting the inspection at the season of lowest water elevation will facilitate this work.

Particular attention should be given to foundations on spread footings where scour or erosion can be much more critical than a foundation on piles. However, be aware that scour and undercutting of a pier or abutment on piles can also be quite serious.

Any exposed piling must be inspected.

If erosion has occurred on one face of a pier only, leaving solid material on the opposite face, or if earth or rock fills have been piled against substructure units, such unbalanced loading must be recorded and reported.

Examine all exposed concrete for the existence and severity of cracks and any deterioration of the concrete itself. The horizontal surfaces of the tops of the piers and abutments are particularly vulnerable.

Bents

Bents are substructures where the bearing piles are the vertical columns supporting the superstructure. This category includes timber, concrete and steel pile bents, plus frameworks founded on piles or spread footings.

There are situations where the loss of even one pile may overstress the abutment or bent cap, thus adversely affecting the structural stability of the entire bridge. Examples of this situation include where two deteriorated pile next to each other in a row, or a deteriorated end pile supporting an overhanging pile cap. Inspectors should not hesitate to use a low rating for the substructure.

Timber piles must be checked for the following:

- General decay and section loss, especially in areas where they are alternately wet and dry. The most likely place for this condition to be found is at the ground line. Hammer sounding will many times reveal an unsound area.
- Internal decay and section loss - Although piles may appear sound on the outer surface, some may contain advanced interior decay. Creosoted piles, for example, may decay in the core area where the preservative treatment has not penetrated, even though the outside surface shows no evidence of deterioration. Hammer sounding will many times reveal an unsound pile. Boring will allow measurement of the decay in the center. Holes made for testing which might promote decay shall be filled with treated wooden plugs.
- Decay at locations where timber pile contact another element such as the top of piles and where the bracing members are fastened are very susceptible to decay.
- Decay at locations where timber piles are in contact with earth or other accumulated material.
- Decay at locations where timber pile are in contact with earth or other extraneous material that may have accumulated against the pile.

Inspect all submerged piles for deterioration and loss of section.

All damage and section loss must be recorded.

If the estimated individual pile area loss exceeds 10%, it must be reported on the BrM comment field.

Pile group collective section area loss (for a group of piles in a single substructure) shall be calculated as follows:

$$\text{Pile group collective section area loss} = \frac{\text{Sum of individual pile section area loss}}{\text{Sum of individual pile section area, original}}$$

Underwater Inspection

Underwater inspection is described in the Chapter on Bridge Inspection in this Manual.

ITEM 60 – CONCRETE		
Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the structure. Insignificant damage caused by drift or collision (e.g. scrape marks on concrete).
8	VERY GOOD CONDITION	Near new condition with only hairline shrinkage cracking.
7	GOOD CONDITION	Small (less than 1/16") cracks in abutment backwalls (not shrinkage cracks). Spalls around bearing devices not affecting the devices. Minor collision damage to piling or bracing. Repairs not required. Minor spalling of concrete pile.
6	SATISFACTORY CONDITION	Cracks (greater than 1/16") in abutment backwalls, leaching showing rust stains. Collision damage. Bracing severely damaged or torn off. Pier columns show map cracking that should be sealed. (Less than 10% spalling or cracking of concrete pile). No reinforcing visible. Moderate scouring, no action needed.
5	FAIR CONDITION	Leaching through abutment backwall. Significant spalling of concrete. Abutments leaning in because of settlement or earth load. Spalls around bearing devices, concrete deteriorating, bearing affected. Reinforcing may be visible. Pile collective area loss on any one substructure unit, 10% to 19% Significant scouring and undermining of spread footings, between 10%-20%.
4	POOR CONDITION	Major spalling or concrete deteriorating around bearing devices affecting bearing. Need for repairs is urgent. Pile collective area loss on any one substructure unit, 20% to 29%. Extensive scouring and undermining of spread footings, between 20% and 30%affecting stability. Rehabilitation urgently needed.
3	SERIOUS CONDITION	Integral wings separated from abutment. Dirt spilling through back wall. Girder seats breaking up. Shoring recommended. Pile collective area loss on any one substructure unit, 30% to 49%. Two adjacent pile (next to each other in one bent or one abutment) have advanced section loss. End pile under pile cap has section loss. Spread footings undermined between 30% and 50%. Rehabilitation is urgent. Traffic restrictions should be considered.

FHWA Coding Guide content is shown in Calibri italic font.

ITEM 60 – CONCRETE		
Code	**Condition**	**Description**
2*	CRITICAL CONDITION	The need for repair or rehabilitation is urgent. Facility must be closed until the indicated repair is complete. On the verge of collapse, backwall disintegrating, girder seats breaking up. Shoring required. Pile collective area loss on any one substructure unit, 50% or more. Spread footings undermined more than 50%. Immediate rehabilitation required.
1*	IMMINENT FAILURE CONDITION	Facility is closed. Study should determine the feasibility for repair.
0*	FAILED CONDITION	Facility is closed and is beyond repair.

*Requires Critical Finding

ITEM 60 – STEEL		
Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the structure. Insignificant damage caused by drift or collision (e.g. scrape marks on steel).
8	VERY GOOD CONDITION	Near new condition.
7	GOOD CONDITION	Minor surface rusting of steel pile or backwall.
6	SATISFACTORY CONDITION	Heavy rusting of backwall with initial section loss. Pile collective section area loss on any one substructure unit, less than 10%.
5	FAIR CONDITION	Heavy rusting of backwall with localized significant section loss. Pile collective section area loss on any one substructure unit, 10% to 19%.
4	POOR CONDITION	Heavy rusting of backwall with widespread significant section loss. Need for repairs is urgent. Pile collective section area loss on any one substructure unit, 20% to 29%. Extensive scouring and undermining of backwall affecting stability of fill. Rehabilitation urgently needed.
3	SERIOUS CONDITION	Integral wings separated from abutment. Dirt spilling through holes in backwall. Shoring recommended. Pile collective section area loss on any one substructure unit, 30% to 49%. Two adjacent piles (next to each other in one bent or abutment) have greater than 30% section loss. End pile under pile cap has greater than 30% section loss. Rehabilitation is urgent. Traffic restrictions should be considered.
2*	CRITICAL CONDITION	The need for repair or rehabilitation is urgent. Facility must be closed until the indicated repair is complete. On the verge of collapse, backwall is disintegrating. Shoring required. Pile collective section area loss on any one substructure unit, 50% or more. Backwall completely undermined, affecting approach fill. Immediate rehabilitation required.
1*	IMMINENT FAILURE CONDITION	Facility is closed. Study should determine the feasibility for repair.
0*	FAILED CONDITION	Facility is closed and is beyond repair.

*Requires Critical Finding

ITEM 60 – TIMBER		
Code	**Condition**	**Description**
N	NOT APPLICABLE	For example, a culvert.
9	EXCELLENT CONDITION	No noticeable or noteworthy deficiencies that affect the condition of the structure. Insignificant damage caused by drift or collision (e.g. scrape marks on timber)
8	VERY GOOD CONDITION	Near new condition.
7	GOOD CONDITION	Insignificant decay, cracking, spitting or crushing of timber.
6	SATISFACTORY CONDITION	Widespread minor decay, cracking, splitting or crushing of timber. A few timber members may need replacement in abutment back walls and wings. Pile collective section area loss on any one substructure unit, less than 10%.
5	FAIR CONDITION	Substantial decay, cracking, spitting or crushing of timber members requiring some replacement. Pile collective section area loss on any one substructure unit, 10% to 19%.
4	POOR CONDITION	Significant decay, cracking, splitting or crushing of timber members requiring widespread replacement. Need for repairs is urgent. Pile collective section area loss on any one substructure unit, 20% to 29%. Extensive scouring or undermining of backwall affecting stability of fill. Rehabilitation urgently needed.
3	SERIOUS CONDITION	Wings separated from abutment. Dirt spilling through deteriorated backwall timbers. Shoring recommended. Pile collective section area loss on any one substructure unit, 30% to 49%. Two adjacent pile (next to each other in one bent or abutment) have greater than 30% section loss. End pile under pile cap has greater than 30% section loss. Rehabilitation is urgent. Traffic restrictions should be considered.
2*	CRITICAL CONDITION	The need for repair or rehabilitation is urgent. Facility must be closed until the indicated repair is complete. On the verge of collapse, backwall is disintegrating. Shoring required. Pile collective section area loss on any one substructure unit, 50% or more. Backwall completely undermined, affecting approach fill. Immediate rehabilitation required.
1*	IMMINENT FAILURE CONDITION	Facility is closed. Study should determine the feasibility for repair.
0*	FAILED CONDITION	Facility is closed and is beyond repair.

*Requires Critical Finding

Item 61 – Channel and Channel Protection

1 digit

This item describes the physical conditions associated with the flow of water through the bridge such as stream stability and the condition of the channel, riprap, slope protection or stream control devices including spur dikes. The inspector should be particularly concerned with visible signs of excessive water velocity which may result in immediate or potential problems. Accumulation of drift and debris on the superstructure and substructure should be noted on the comment file but not included in the condition rating.

Inspectors must observe the adequacy of the waterway opening under the structure. See that the waterway is not obstructed, but that it affords free flow of water. Obstructions such as debris or growth may contribute to scour and may be a potential fire hazard to the structure. Watch for sand and gravel bars deposited in the channel which may direct stream flow in such a manner as to cause harmful scour at piers and abutments.

In addition to observing the effect the waterway is having on the bridge and its approaches, observe the surrounding area to see if the bridge and its approaches are causing any problems or potential problems. Items to look for will include possible flooding from inadequate openings at the structure, erosion of banks or levees from improper protection, or skew of the piers or abutments.

Rate and code the condition in accordance with the previously described general condition ratings and the following descriptive codes:

Code	*Description*
N	*Not applicable. Use when bridge is not over a waterway.*
9	*There are no noticeable or noteworthy deficiencies which affect the condition of the channel.*
8	*Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.*
7	*Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel have minor amounts of drift.* Bank vegetation largely intact.
6	*Banks are beginning to slump. River control devices and embankment protection have widespread minor damage. There is minor stream bed movement evident. Debris is restricting the waterway slightly.* Trees lean into channel. Vegetation largely removed from banks.
5	*Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.* Lateral stream bed movement and/or degradation is evident.
4	*Bank and embankment protection is severely undermined. River control devices have severe damage. Large deposits of debris are in the waterway.* Active lateral stream bed movement and/or degradation has exposed substructure piling or footings.
3	*Bank protection has failed. River control devices have been destroyed. Stream bed aggradations, degradation or lateral movement has changed the waterway to now threaten the bridge and/or approach roadway.*
*2**	*The waterway has changed to the extent the bridge is near a state of collapse.*
*1**	*Bridge closed because of channel failure. Corrective action may put back in light service.*
*0**	*Bridge closed because of channel failure. Replacement necessary.*

**Requires Critical Finding*

Item 62 – Culverts

1 digit

This item evaluates the alignment, settlement, joints, structural condition, scour, and other items associated with culverts. The rating code is intended to be an overall condition evaluation of the culvert. Integral wingwalls to the first construction or expansion joint shall be included in the evaluation. For a detailed discussion regarding the inspection and rating of culverts, consult Report No. FHWA-IP-86-2, CULVERT INSPECTION MANUAL, July 1986.

Item 58 Deck, Item 59 Superstructure, and Item 60 Substructure shall be Coded N for all Culverts. Rate and code the condition in accordance with the previously described general condition ratings and the following descriptive codes:

ITEM 62 - CULVERTS	
Code	***Description***
N	*Not applicable. Use if structure is not a culvert.*
9	*No deficiencies.*
8	*No noticeable or noteworthy deficiencies which affect the condition of the culvert. Insignificant scrape marks caused by drift.*
7	*Shrinkage cracks, light scaling, and insignificant spalling which does not expose reinforcing steel. Insignificant damage caused by drift with no misalignment and not requiring corrective action. Some minor scouring has occurred near curtain walls, wingwalls or pipes. Metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting.*
6	*Deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls or pipes. Metal culverts have a smooth curvature, non-symmetrical shape, significant corrosion or moderate pitting.*
5	*Moderate to major deterioration or disintegration, extensive cracking and leaching, or spalls on concrete or masonry walls and slabs. Minor settlement or misalignment. Noticeable scouring or erosion at curtain walls, wingwalls or pipes. Metal culverts have significant distortion and deflection in one section, significant corrosion or deep pitting.*
4	*Large spalls, heavy scaling, wide cracks, considerable efflorescence or opened construction joint permitting loss of backfill. Considerable scouring or erosion at curtain walls, wingwalls or pipes. Metal culverts have significant distortion and deflection throughout, extensive corrosion or deep pitting.*
3	*Any condition described in Code 4, but which is excessive in scope. Severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe scour or erosion at curtain walls, wingwalls or pipes. Metal culverts have extreme distortion and deflection in one section, extensive corrosion or deep pitting with scattered perforations.*
*2**	*Integral wingwalls collapsed severe settlement of roadway due to loss of fill. Section of culvert may have failed and can no longer support embankment. Complete undermining at curtain walls and pipes. Metal culverts have extreme distortion and deflection throughout with extensive perforations and deflection throughout with extensive perforations due to corrosion. Structure must be closed until corrective action taken.*
*1**	*Bridge closed. Corrective action may put back in light service.*

ITEM 62 - CULVERTS	
Code	***Description***
*0**	*Bridge closed. Replacement necessary.*

**Requires Critical Finding*

Arch structures with no structural deck shall be coded as culverts.

Item 63 – Method Used to Determine Operating Rating

1/AN character

This is determined by the Load Rating Engineer and provided on the Load Rating Summary Sheet, then entered in BrM by the Program Manager Staff.

NDOT beginning in 2012 will report load ratings by rating factor only to FHWA. In prior years, load ratings were reported in Tons. Nebraska SI&A sheets will show Tons.

For additional information see

FHWA Policy Memorandum Load and Resistance Factor Design, June 28, 2000

FHWA Memorandum Revisions to Items 63-66 to Support Load Reporting by Rating Factor, March 22, 2004

FHWA Memorandum Bridge Load Ratings for the National Bridge Inventory, October 30, 2006

FHWA Memorandum Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges (Coding Guide) – Item 31, Design Load, and Items 63 and 65, Method Used to Determine Operation and Inventory Ratings, February 2, 2011.

FHWA Memorandum Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges (Coding Guide) Items 63 and 65, Method Used to Determine Operating and Inventory Ratings, November 15, 2011

The FHWA June 28, 2000 Policy Memorandum required that all new bridges be designed by the LRFD Specifications after October 1, 2007. Load ratings for bridges designed by Load and Resistance Factor Design (LRFD), are governed by the FHWA October 30, 2006 Memorandum and summarized in the following table. FHWA supports Load and Resistance Factor Rating (LRFR) moving forward, but continues to accept Load Factor (LFR) for the large inventory of in-service bridges that have been designed by methods other than LRFD they do not intent to mandate re-rating of existing bridges by LRFR if the bridge has an existing, valid load rating.

Design Date	Design Method	Load Rating Method
Prior to October 1, 2010	LRFD	LRFR or LFR
On or after October 1, 2010	LRFD	LRFR only

FHWA added the alpha codes in 2011 to properly identify Assigned Load Ratings

Use one of the codes below to indicate which load rating method was used to determine the Operating Rating coded in Item 64 for this structure.

Code	Description
0	*Field evaluation and documented engineering judgment*
1	*Load Factor (LF)*
2	*Allowable Stress (AS)*
3	*Load and Resistance Factor (LRFR)*
4	*Load Testing*
5	*No rating analysis or evaluation performed*
6	*Load Factor (LF) rating reported by Rating Factor (RF) method using MS18 loading*
7	*Allowable Stress (AS) rating reported by Rating Factor (RF) method using MS18 loading*
8	*Load and Resistance Factor Rating (LRFR) rating reported by Rating Factor (RF) method using MS18 loading*
A	*Assigned rating based on Load Factor Design (LFD) reported in metric tons*
B	*Assigned ratings based on Allowable Stress Design (ASD) reported in metric tons*
C	*Assigned ratings based on Load and Resistance Factor Design (LRFD) reported in metric tons*
D	*Assigned ratings based on Load Factor Design (LFD) reported by rating factor (RF) using MS18 loading*
E	*Assigned rating based on Allowable Stress Design (ASD) reported by rating factor (RF) using MS18 loadings*
F	*Assigned ratings based on Load and Resistance Factor Design (LRFD) reported by rating factor (RF) using HL93 loadings*

Code 0 is to be used when the load rating is determined by field evaluation and documented engineering judgment, typically done when plans are not available or in cases of severe deterioration. Field evaluation and engineering judgment ratings must be documented.

Code 5 is to be used when the bridge has not been load rated or load rating documentation does not exist.

Existing code 5 is clarified to only be used for bridges that have not been load rated or load rating documentation does not exist. Code 0 has been added for use when the load rating is determined by field evaluation and documented engineering judgment, typically done when plans are not available or severe deterioration exists. Field evaluation and engineering judgment ratings must be documented. Bridges that are currently coded 5 must be reviewed to determine if code 0 or 5, or another code, is appropriate.

Item 64 – Operating Rating

3 digits

This is determined by the Load Rating Engineer and provided on the Load Rating Summary Sheet, then entered into BrM by the Program Manager Staff.

Beginning in 2012, NDOT reported load ratings by rating factor only to FHWA. In prior years, load ratings were reported in Tons. Nebraska SI&A sheets will show Tons.

For additional information see FHWA Memorandum Revisions to Items 63-66 to Support Load Reporting by Rating Factor, March 22, 2004 and Memorandum Bridge Load Ratings for the National Bridge Inventory, October 30, 2006. FHWA has not yet reissued the Coding Guide.

This capacity rating, referred to as the Operating Rating, will result in the absolute maximum permissible load level to which the structure may be subjected for the vehicle type used in the rating. Code the Operating Rating as a two digit code (XX tons) to represent the total weight in tons of the entire vehicle measured to the nearest ton.

It should be emphasized that only HS loading shall be used to determine the Operating Rating. The total mass in tons of the entire vehicle should be coded; that is, HS20 which has a weight of 36 tons shall be coded '36', and likewise, a HS13 shall be coded '24'.

The MBE provides a choice of load rating methods, such as the new load and resistance factor (LRFR) rating method, in addition to the traditional allowable stress (AS) and load factor (LF) methods. Of the three rating methods, the LF method is the most suitable for use as a national standard, therefore, the FHWA has chosen the LF method as the standard for computing inventory and Operating Ratings reported to the NBI. The highway agencies may, however, elect to use LF, AS or LRFD to establish load limits for purposes of load posting.

If the bridge will not carry a minimum of three tons of live load, the Operating Rating shall be coded '00'; and consistent with the direction of the AASHTO Manual, it shall be closed.

The use or presence of a temporary bridge requires special consideration in coding. In such cases, since there is no permanent bridge, Items 64 and 66 should be coded as 00 even though the temporary structure is rated for as much as full legal load.

A bridge shored up or repaired on a temporary basis is considered a temporary bridge and the inventory and Operating Rating shall be coded as if the temporary shoring were not in place. See Item 103 Temporary Structure Designation for definition of a temporary bridge.

Examples:

	Code
HS20	*36*
Temporary bridge	*00*
Shored-up bridge	*30**

** load capacity without shoring.*

FHWA Coding Guide content is shown in Calibri italic font.

Item 65 – Method Used to Determine Inventory Rating

1 digit

See Item 63 – Method Used to Determine Operation Rating.

Item 66 – Inventory Rating

3 digits

This is determined by the Load Rating Engineer and provided on the Load Rating Summary Sheet, then entered in BrM by the Program Manager Staff.

NDOT beginning in 2012 will report load ratings by rating factor only to FHWA. In prior years, load ratings were reported in Tons. Nebraska SI&A sheets will show Tons.

For additional information see FHWA Memorandum Revisions to Items 63-66 to Support Load Reporting by Rating Factor, March 22, 2004 and Memorandum Bridge Load Ratings for the National Bridge Inventory, October 30, 2006. FHWA has not yet reissued the Coding Guide.

This capacity rating, referred to as the Inventory Rating, will result in a load level which can safely utilize an existing structure for an indefinite period of time. Only the HS loading shall be used to determine the Inventory Rating. Code the Inventory Rating as a two-digit number to represent the total weight in tons of the entire vehicle measured to the nearest ton. The statements in Item 64 Operating Rating apply to this item also.

3-NBI.9 NBI DATA ITEMS – APPRAISAL RATINGS, ITEMS 67, 68, 69, 71, 72

The items in the Appraisal section are used to evaluate a bridge in relation to the level of service which it provides on the highway system of which it is a part. The structure will be compared to a new one which is built to current standards for that particular type of road as further defined in this section except for Item 72 Approach Roadway Alignment. See Item 72 for special criteria for rating that item.

Items 67, 68, 69, 71 and 72 will be coded with a one digit code that indicates the appraisal rating for the item. The ratings and codes are as follows:

APPRAISAL RATINGS, ITEMS 67, 68, 69, 71, 72	
Code	***Description***
N	*Not applicable*
9	*Superior to present desirable criteria*
8	*Equal to present desirable criteria*
7	*Better than present minimum criteria*
6	*Equal to present minimum criteria*
5	*Somewhat better than minimum adequacy to tolerate being left in place as is*
4	*Meets minimum tolerable limits to be left in place as is*
3	*Basically intolerable requiring high priority of corrective action*
2	*Basically intolerable requiring high priority of replacement*
1	*This value of rating code not used*
0	*Bridge closed*

The FHWA Edit/Update computer program calculates values for Items 67, 68 and 69 according to the tables provided in this manual. These tables and the table for Item 71 shall be used by all evaluators to rate these items. They have been developed to closely match the descriptions for the appraisal evaluation codes of 0 to 9. The tables shall be used in all instances to evaluate the item based on the designated data in the inventory, even if a table value does not appear to match the descriptive codes. For unusual cases where the site data does not exactly agree with the table criteria, use the most appropriate table to evaluate the item. The code of N is not valid for use with Items 67 and 72.

Completed bridges not yet opened to traffic, if rated, shall be appraised as if open to traffic. Design values, for example ADT, shall be used for the evaluation. The data provided will include a code of G for Item 41 Structure Open, Posted, or Closed to Traffic.

Item 67 – Structural Evaluation

1 digit

This item is calculated by the Edit/Update Program based on Table 1, and need not be coded by the bridge inspector. The following specifications are used by the Edit/Update Program:

- *For structures other than culverts, the lowest of the codes obtained from Item 59 Superstructure, Item 60 Substructure, or Table 1 is used.*
- *For culverts, the lowest of the codes obtained from Item 62 Culverts, or Table 1 is used.*
- *If Item 59, Item 60 or Item 62 is coded 1, then Item 67 is equal to zero (0), regardless of whether the structure is actually closed. However, if the structure is closed, it does not mean that this value is zero (0) unless the overall condition and appraisal ratings indicate that a code of 0 is appropriate.*

TABLE 1
RATING BY COMPARISON OF ITEM 29 ADT AND ITEM 66 INVENTORY RATING

Structural Evaluation Rating Code	***Inventory Rating***		
	Average Daily Traffic (ADT)		
	0-500	***501-5000***	***>5000***
9	*>36* (HS20)***	*>36 (HS20)*	*>36 (HS20)*
8	*=36 (HS20)*	*=36 (HS20)*	*=36 (HS20)*
7	*≥31 (HS17)*	*≥31 (HS17)*	*≥31 (HS17)*
6	*≥23 (HS13)*	*≥25 (HS14)*	*≥27 (HS15)*
5	*≥18 (HS10)*	*≥20 (HS11)*	*≥22 (HS12)*
4	*≥12 (HS7)*	*≥14 (HS8)*	*≥18 (HS10)*
3	*Inventory Rating less than value in rating code of 4 and requiring corrective action.*		
2	*Inventory Rating less than value in rating code of 4 and requiring replacement.*		
0	*Bridge closed.*		
** Coded HS rating load (typical) ** HS Designation (typical)*			
Notes: 1. Use the lower rating code for values between those listed in the table. 2. All bridges on the Interstate system shall be evaluated using the ADT column of >5000 regardless of the actual ADT on the bridge.			

Item 68 – Deck Geometry

1 digit

This item is calculated by the Edit/Update Program and need not be coded by the bridge inspector.

The overall rating for deck geometry will include two evaluations: (a) the curb-to-curb or face to face of rail bridge width using Table 2A, B, C or D and (b) the minimum vertical clearance over the bridge roadway using Table 2E. The lower of the codes obtained from these tables is used by the Edit/Update Program. When an individual table lists several deck geometry rating codes for the same roadway width under a specific ADT, the lower code is used. (For example, Table 2A lists deck geometry rating codes of 6, 7 and 8 for a 44 foot roadway width and an ADT of >5000. Use the code of 6.) For values between those listed in the tables, the lower code is used.

The curb-to-curb or face-to-face of rail dimension shall be taken from Item 51 - Bridge Roadway Width, Curb-to-Curb. Item 53 - Minimum Vertical Clearance Over Bridge Roadway is used to evaluate the vertical clearance.

For culverts which have Item 51 – Bridge Roadway Width coded 0000, the Deck Geometry codes will be equal to N.

The values provided in the tables are for rating purposes only. Current design standards must be used for structure design or rehabilitation.

TABLE 2A & 2B
RATING BY COMPARISON OF ITEM 29 ADT AND ITEM 51 BRIDGE ROADWAY WIDTH, CURB-TO-CURB

Deck Geometry Rating Code	***TABLE 2A*** ***Bridge Roadway Width 2 Lanes; 2 Way Traffic***						***TABLE 2B*** ***Bridge Roadway Width 1 Lane; 2-Way Traffic***	
	ADT (Both Directions)						***ADT (Both Direct.)***	
	0-100	***101-400***	***401-1000***	***1001-2000***	***2001-5000***	***>5000***	***0-100***	***>100***
9	*>32*	*>36*	*>40*	*>44*	*>44*	*>44*	*--*	*--*
8	*=32*	*=36*	*=40*	*=44*	*=44*	*=44*	*<15’-11”*	*--*
7	*≥28*	*≥32*	*≥36*	*≥40*	*≥44*	*≥44*	*≥15*	*--*
6	*≥24*	*≥28*	*≥30*	*≥34*	*≥40*	*≥44*	*≥14*	*--*
5	*≥20*	*24*	*26*	*28*	*34*	*38*	*13*	*--*
4	*≥18*	*≥20*	*≥22*	*≥24*	*≥28*	*≥32 (28)**	*≥12*	*--*
3	*≥16*	*≥18*	*≥20*	*≥22*	*≥26*	*≥30 (26)**	*≥11*	*<15’-11”*
2	*Any width less than required for a rating code of 3 and structure is open.*							
0	*Bridge closed.*							

** Use value in parentheses for bridges longer than 200 feet.*

Notes:
1. *Use the lower rating code for values between those listed in the table.*
2. *Dimensions are in feet.*
3. *For 1 lane of one-way traffic, Table 2A is used.*
4. *For 3 or more undivided lanes of two-way traffic, use Table 2C, Other Multilane Divided Facilities.*
5. *Do not use Table 2B for Code 9 and for Codes 8 through 4 inclusive when the ADT >100. Single lane bridges less than 16 feet wide carrying two-way traffic are always appraised at 3 or below if they carry more than an ADT of 100.*
6. *One-lane bridges 16 feet and greater in roadway width, which are not ramps, are evaluated as a two-lane bridge using Table 2A.*

TABLE 2C & 2D RATING BY COMPARISON OF ITEM 28 NUMBER OF LANES AND ITEM 51 BRIDGE ROADWAY WIDTH, CURB-TO-CURB						
	TABLE 2C				***TABLE 2D***	
Deck Geometry Rating Code	***Bridge Roadway Width 2 or More Lanes Each Direction***				***Bridge Roadway Width 1-Way Traffic***	
	Interstate and Other Divided Freeways		***Other Multilane Divided Facilities***		***Ramps Only***	
	2 Lanes	***3 or more Lanes***	***2 Lanes***	***3 or more Lanes***	***1 Lane***	***2 or more Lanes***
9	*>42*	*>12N+24*	*>42*	*>12N+18*	*>26*	*>12N+12*
8	*=42*	*=12N+24*	*=42*	*=12N+18*	*=26*	*=12N+12*
7	*≥40*	*≥12N+20*	*≥38*	*≥12N+15*	*≥24*	*≥12N+10*
6	*≥38*	*≥12N+16*	*≥36*	*≥12N+12*	*≥22*	*≥12N+8*
5	*≥36*	*≥12N+14*	*≥33*	*≥11N+10*	*≥20*	*≥12N+6*
4	*≥34(29)**	*≥11N+12 (11N+7)**	*≥30*	*≥11N+6*	*≥18*	*≥12N+4*
3	*≥33(28)**	*≥11N+11 (11N+6)**	*≥27*	*≥11N+5*	*≥16*	*≥12N+2*
2	*Any width less than required for a rating code of 3 and structure is open.*					
0	*Bridge closed.*					
** Use value in parentheses for bridges longer than 200 feet.* *N = number of lanes of traffic.*						
Notes: *1. Use the lower rating code for values between those listed in the tables.* *2. Dimensions are in feet.* *3. Use Table 2C, other Multilane Divided Facilities, for 3 or more undivided lanes of two-way traffic.*						

TABLE 2E
RATING BY COMPARISON OF ITEM 53 MINIMUM VERTICAL CLEARANCE OVER BRIDGE ROADWAY AND ITEM 26 FUNCTIONAL CLASSIFICATION

Minimum Vertical Clearance			
Deck Geometry Rating Code	***Functional Class***		
	Interstate and Other Freeway	***Other Principal and Minor Arterials***	***Major and Minor Collectors and Locals***
9	*>17’-0”*	*>16’-6”*	*>16’-6”*
8	*=17’-0”*	*=16’-6”*	*=16’-6”*
7	*≥16’-9”*	*≥15’-6”*	*≥15’-6”*
6	*≥16’-6”*	*≥14’-6”*	*≥14’-6”*
5	*≥15’-9”*	*≥14’-3”*	*≥14’-3”*
4	*≥15’-0”*	*≥14’-0”*	*≥14’-0”*
3	*Vertical clearance less than value in rating code of 4 and requiring corrective action.*		
2	*Vertical clearance less than value in rating code of 4 and requiring replacement.*		
0	*Bridge closed.*		

Note:
1. Use the lower rating code for values between those listed in the table.

Item 69 – Underclearances, Vertical and Horizontal

1 digit

This item is calculated by the Edit/Update Program and need not be coded by the bridge inspector.

Vertical and horizontal underclearances are measured from the through roadway to the superstructure or substructure units, respectively. Code "N" is used unless the bridge is over a highway or railroad.

The vertical underclearance is evaluated using Table 3A. The horizontal underclearance is evaluated using Table 3B. The lower of the codes obtained from Table 3A and Table 3B is used by the Edit/Update Program.

Bridges seldom are closed due to deficient underclearances, however, these bridges may be good candidates for rehabilitation or replacement.

Item 54 - Minimum Vertical Underclearance, Item 55 - Minimum Lateral Underclearance on Right, and Item 56 - Minimum Lateral Underclearance on Left shall be used to evaluate this item.

The functional classification used in the table is for the underpassing route. Therefore, the functional classification is obtained from the record for the route "under" the bridge (see Item 5 - Inventory Route).

If the underpassing route is not on a Federal-aid system, is not STRAHNET route, or is not otherwise important, an "under" record may not be available. If no "under" record exists, it is assumed that the route under the bridge is a major or minor collector or a local road for the purpose of using Tables 3A and 3B.

TABLE 3A
RATING BY COMPARISON OF ITEM 54 MINIMUM VERTICAL UNDERCLEARANCE AND FUNCTIONAL CLASSIFICATION OF UNDERPASSING ROUTE

Minimum Vertical Underclearance				
	Functional Class			
Under-clearance Rating Code	***Interstate and Other Freeway***	***Other Principal and Minor Arterials***	***Major and Minor Collectors and Locals***	***Railroad***
9	*>17’-0”*	*>16’-6”*	*>16’-6”*	*>23’-0”*
8	*=17’-0”*	*=16’-6”*	*=16’-6”*	*=23’-0”*
7	*≥16’-9”*	*≥15’-6”*	*≥15’-6”*	*≥22’-6”*
6	*≥16’-6”*	*≥14’-6”*	*≥14’-6”*	*≥22’-0”*
5	*≥15’-9”*	*≥14’-3”*	*≥14’-3”*	*≥21’-0”*
4	*≥15’-0”*	*≥14’-0”*	*≥14’-0”*	*≥20’-0”*
3	*Underclearance less than value in rating code of 4 and requiring corrective action.*			
2	*Underclearance less than value in rating code of 4 and requiring replacement.*			
0	*Bridge closed.*			

Notes:
1. *Use the lower rating code for values between those listed in the tables.*
2. *The functional classification of the underpassing route shall be used in the evaluation. If an "under" record is not coded, the underpassing route shall be considered a major or minor collector or a local road.*

TABLE 3B
RATING BY COMPARISON OF ITEMS 55 & 56 MINIMUM LATERAL UNDERCLEARANCES RIGHT & LEFT AND FUNCTIONAL CLASSIFICATION OF UNDERPASSING ROUTE

Minimum Lateral Underclearance							
	Functional Class						***Railroad***
Under-clearance Rating Code	***1-Way Traffic***				***2-Way Traffic***		
	Principal Arterials – Interstate, Freeways or Expressways				***Other Principal and Minor Arterials***	***Major and Minor Collectors and Locals***	
	Mainline		***Ramp***				
	Left	***Right***	***Left***	***Right***			
9	*>30*	*>30*	*>4*	*>10*	*>30*	*>12*	*>20*
8	*30*	*30*	*4*	*10*	*30*	*12*	*20*
7	*18*	*21*	*3*	*9*	*21*	*11*	*17*
6	*6*	*12*	*2*	*8*	*12*	*10*	*14*
5	*5*	*11*	*2*	*6*	*10*	*8*	*11*
4	*4*	*10*	*2*	*4*	*8*	*6*	*8*
3	*Underclearance less than value in rating code of 4 and requiring corrective action.*						
2	*Underclearance less than value in rating code of 4 and requiring replacement.*						
0	*Bridge closed.*						

Notes:
1. *Use the lower rating code for values between those listed in the tables.*
2. *Dimensions are in feet.*
3. *When acceleration or deceleration lanes or ramps are provided under two-way traffic, use the value from the right ramp column to determine code.*
4. *The functional classification of the underpassing route shall be used in the evaluation. If an "under" record is not coded, the underpassing route shall be considered a major or minor collector or a local road.*

Item 70 – Bridge Posting

1 digit

This is determined by the Load Rating Engineer and provided on the Load Rating Summary Sheet, then entered into BrM by the Program Manager Staff.

The National Bridge Inspection Standards require the posting of load limits only if the maximum legal load configurations in the State exceeds the load permitted under the Operating Rating. If the load capacity at the Operating Rating is such that posting is required, this item shall be coded 4 or less. If no posting is required at the Operating Rating, this item shall be coded 5.

This item evaluates the load capacity of a bridge in comparison to the State legal load. It differs from Item 67 - Structural Evaluation in that Item 67 uses Item 66 – Inventory Rating, while the bridge posting requirement is based on Item 64 – Operating Rating.

Although posting a bridge for load-carrying capacity is required only when the maximum legal load exceeds the Operating Rating, highway agencies may choose to post at a lower level. This posting practice may appear to produce conflicting coding when Item 41 - Structure Open, Posted or Closed to Traffic is coded to show the bridge as actually posted at the site and Item 70 - Bridge Posting is coded as bridge posting is not required. Since different criteria are used for coding these 2 items, this coding is acceptable and correct when the highway agency elects to post at less than the Operating Rating. Item 70 shall be coded 4 or less only if the legal load of the State exceeds that permitted under the Operating Rating.

The use or presence of a temporary bridge affects the coding. The actual Operating Rating of the temporary bridge should be used to determine this item. However, the highway agency may choose to post at a lower level. This also applies to bridges shored up or repaired on a temporary basis.

Code	***Description***
4 or less	*Posting required*
5	*No posting required*

The degree that the Operating Rating is less than the maximum legal load level may be used to differentiate between codes. As a guide and for coding purposes only, the following values may be used to code this item:

Code	***Relationship of Operating Rating to Maximum Legal Load***
5	*Equal to or above legal loads*
4	*0.1 - 9.9% below*
3	*10.0 - 19.9% below*
2	*20.0 - 29.9% below*
1	*30.0 - 39.9% below*
0	*> 39.9% below*

For posting purposes, all bridges in Nebraska are load rated at operating level for AASHTO rating truck axle spacing with Nebraska legal axle loads and the four special haul vehicles. See Chapter 5 for details of AASHTO and Nebraska legal trucks:

- Type 3 straight truck – gross weight 25 tons
- Single Unit-4 axles – gross weight 27 tons
- Single Unit-5 axles – gross weight 31 tons
- Single Unit-6 axles – gross weight 34.75 tons
- Single Unit-7 axles – 38.75 tons
- Type 3S2 semi-trailer truck – gross weight 37 tons
- Type 3-3 truck trailer unit – gross weight 43 tons

The load rating of a bridge is based on the actual condition of the components of the bridge. Inspectors should note in the inspection report factors such as a bad bridge deck substructure, or badly deteriorated piling in abutments that may reduce the capacity of the bridge.

Concrete slab bridges and culverts without plans are load rated based on the condition ratings for the bridge. Inspectors should carefully inspect these types of bridges and thoroughly document any deterioration, cracking or other issues for the Load Rating Engineer's evaluation.

Load rating is completed by a Load Rating Engineer thoroughly familiar with bridge types, the principles of structural design, materials and stress analysis using the MBE and NDOT Load Rating policy.

If the recommended load rating for any of the load rating trucks is **less than** the truck's gross weight, the bridge must be posted at the recommended value on the LRSS. **Bridges may not be posted for less than 3 Tons**. Such a bridge must be closed because it would be unsafe even for passenger cars. An Owner with such a bridge may have their Load Rating Engineer determine if a load rating could be improved with strengthening of the critical members.

If the load ratings for all rating trucks are **higher than** the gross weight of the respective rating truck, the bridge does not need to be load posted. However, if an Owner chooses to load post such a bridge, the **bridge shall not be posted over the legal limit given above.**

Item 71 – Waterway Adequacy

1 digit

This item appraises the waterway opening with respect to passage of flow through the bridge. The following codes shall be used in evaluating waterway adequacy. Site conditions may warrant somewhat higher or lower ratings than indicated by the table (e.g., flooding of an urban area due to a restricted bridge opening).

Inspectors should also review guidance in Chapter 6 Scour. If the inspector has further questions, they should consult the Owner's Hydraulic Engineer.

Where overtopping frequency information is available, the descriptions given in the table for chance of overtopping mean the following:

Remote	*greater than 100 years*
Slight	*11 to 100 years*
Occasional	*3 to 10 years*
Frequent	*less than 3 years*

Adjectives describing traffic delays mean the following:

Insignificant	*Minor inconvenience. Highway passable in a matter of hours.*
Significant	*Traffic delays of up to several days.*
Severe	*Long term delays to traffic with resulting hardship.*

ITEM 71 WATERWAY ADEQUACY			
Functional Classification			***Description***
Principal Arterials – Interstates, Freeways, or Expressways	***Other Principal and Minor Arterials and Major Collectors***	***Minor Collectors, Locals***	
Code			
N	*N*	*N*	*Bridge not over a waterway.*
9	*9*	*9*	*Bridge deck (low superstructure) and roadway approaches above flood water elevations (high water). Chance of overtopping is remote.*
8	*8*	*8*	*Bridge deck above roadway approaches. Slight chance of overtopping roadway approaches.*
6	*6*	*7*	*Slight chance of overtopping bridge deck and roadway approaches.*
4	*5*	*6*	*Bridge deck above roadway approaches. Occasional overtopping of roadway approaches with insignificant traffic delays.*
3	*4*	*5*	*Bridge deck above roadway approaches. Occasional overtopping of roadway approaches with significant traffic delays.*
2	*3*	*4*	*Occasional overtopping of bridge deck and roadway approaches with significant traffic delays.*
2	*2*	*3*	*Frequent overtopping of bridge deck and roadway approaches with significant traffic delays.*
2	*2*	*2*	*Occasional or frequent overtopping of bridge deck and roadway approaches with severe traffic delays.*
0	*0*	*0*	*Bridge closed.*

Item 72 – Approach Roadway Alignment

1 digit

Code this rating based on the adequacy of the approach roadway alignment. This item identifies those bridges which do not function properly or adequately due to the alignment of the approaches. It is not intended that the approach roadway alignment be compared to current standards but rather to the existing highway alignment. This concept differs from other appraisal evaluations. The establishment of set criteria to be used at all bridge sites is not appropriate for this item. The basic criteria is how the alignment of the roadway approaches to the bridge relate to the general highway alignment for the section of highway the bridge is on.

The individual structure shall be rated in accordance with the general appraisal rating guide in lieu of specific design values. The approach roadway alignment will be rated intolerable (a code of 3 or less) only if the horizontal or vertical curvature requires a substantial reduction in the vehicle operating speed from that on the highway section. A very minor speed reduction will be rated a 6, and when a speed reduction is not required, the appraisal code will be an 8. Additional codes may be selected between these general values.

For example, if the highway section requires a substantial speed reduction due to vertical or horizontal alignment, and the roadway approach to the bridge requires only a very minor additional speed reduction at the bridge, the appropriate code would be a 6. This concept shall be used at each bridge site.

Speed reductions necessary because of structure width and not alignment shall not be considered in evaluating this item.

The alignment of the approach road should be compared to the overall roadway alignment. A slight speed reduction at the bridge due to a curve in the roadway may not necessarily result in a code of 6 if the general alignment of the roadway through the area is similar.

A code of 3 is appropriate when the approaches require a significant decrease in speed and the roadway otherwise is straight.

3-NBI.10 NBI DATA ITEMS – ITEMS 73 THROUGH 116

Item 73 – Reserved (by FHWA)

Item 74 – Reserved (by FHWA)

Item 75 – Type of Work

3 digits

The information to be recorded for this item will be the type of work proposed to be accomplished on the structure to improve it to the point that it will provide the type of service needed and whether the proposed work is to be done by contract or force account. Code a three digit number composed of two segments.

Segment	*Description*	*Length*
75A	*Type of Work Proposed*	*2 digits*
75B	*Work Done by*	*1 digit*

This item must be coded for bridges eligible for the Highway Bridge Replacement and Rehabilitation Program. To be eligible, a bridge must carry highway traffic, be deficient and have a sufficiency rating of 80.0 or less. This item may be coded for other bridges at the option of the highway agency. Use one of the following codes to represent the proposed work type, otherwise leave blank:*

Code 75A	*Description*
31	*Replacement of bridge or other structure because of substandard load carrying capacity or substandard bridge roadway geometry.*
32	*Replacement of bridge or other structure because of relocation of road.*
33	*Widening of existing bridge or other major structure without deck rehabilitation or replacement; includes culvert lengthening.*
34	*Widening of existing bridge with deck rehabilitation or replacement.*
35	*Bridge rehabilitation because of general structure deterioration or inadequate strength.*
36	*Bridge deck rehabilitation with only incidental widening.*
37	*Bridge deck replacement with only incidental widening.*
38	*Other structural work.*

*Eligibility requirements mentioned here are no longer applicable for use of federal funds.

If segment A is blank, leave segment B blank. Otherwise, the third digit shall be coded using one of the following codes to indicate whether the proposed work is to be done by contract or by force account:

Code 75B	***Description***
1	*Work to be done by contract*
2	*Work to be done by owner's forces*

Examples:

Type of Work Description	***Item 75 Code***
A bridge is to be replaced by contract because it has deteriorated to the point that it can no longer carry legal loads. The same code should be used if the bridge is replaced because it is now too narrow or the original design was too light to accommodate today's legal loads.	*311*
A bridge is to be replaced because the roadway must be straightened to eliminate a dangerous curve. The work will be done by contract.	*321*
A bridge is to be widened to increase shoulder width or the number of traffic lanes. The existing deck is in good condition and will be incorporated as is into the new structure. The work is to be done by contract.	*331*
A culvert is to be extended by contract to accommodate additional roadway width as part of a reconstruction contract to improve the safety of the adjacent slopes.	*331*
A deck is to be rehabilitated and the bridge widened to provide a full 12-foot shoulder. The existing shoulder is only 4 feet wide and an extra line of girders with appropriate substructure widening must be added. The work will be done by contract.	*341*
A bridge superstructure and substructure are to be rehabilitated by State forces to increase the bridge's load capacity.	*352*
A bridge deck is to be rehabilitated by contract and a safety curb to be removed which results in incidental widening of 2 feet.	*361*
A bridge deck is to be replaced by contract and the deck cantilever overhang extended 2 feet, which is the maximum that can be done without adding another line of stringers or girders to the superstructure.	*371*
A bridge which is no longer needed is to be demolished and an at-grade crossing built by State forces. (This code could also be used to designate incidental safety work on a bridge such as bridge-rail upgrading or replacement.)	*382*

Item 76 – Length of Structure Improvement

6 digits (XXXXXX feet)

Code a six digit number (XXXXXX feet) that represents the length of the proposed bridge improvement to the nearest foot. For replacement or rehabilitation of the entire bridge, the length should be back to back of backwalls of abutments or from pavement notch to pavement notch. For replacement or rehabilitation of only part of the structure, use the length of the portion to be improved.

This item must be coded for bridges eligible for the Highway Bridge Replacement and Rehabilitation Program. It may be coded for other bridges at the option of the highway agency.

For culvert improvements, use the proposed length measured along the centerline of the barrel regardless of the depth below grade. The measurement should be made between the inside faces of the top parapet or edge-stiffening beam of the top slab.

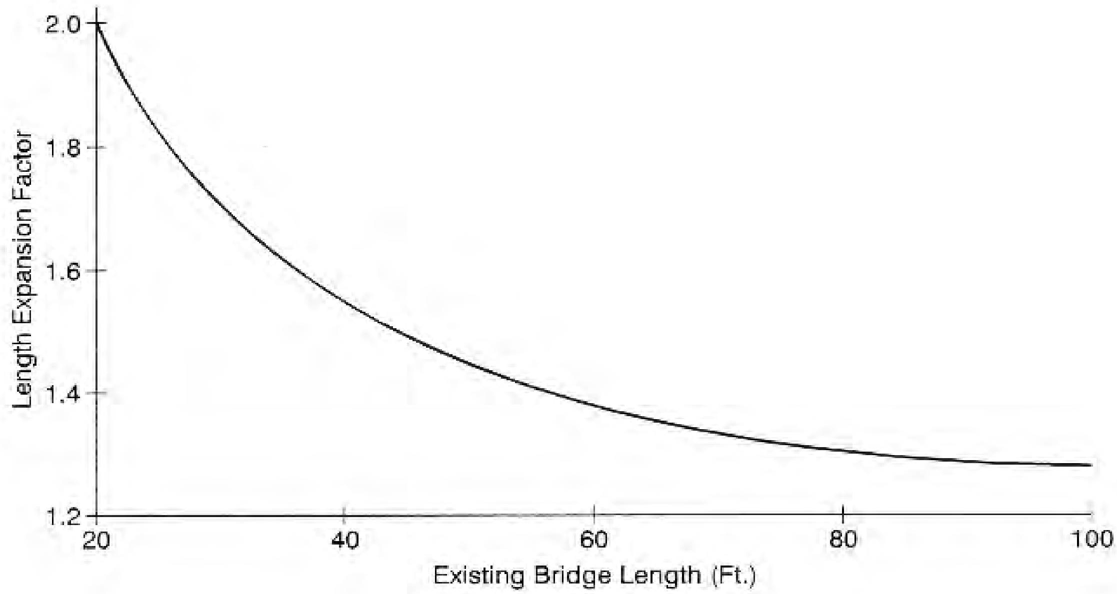
Examples:

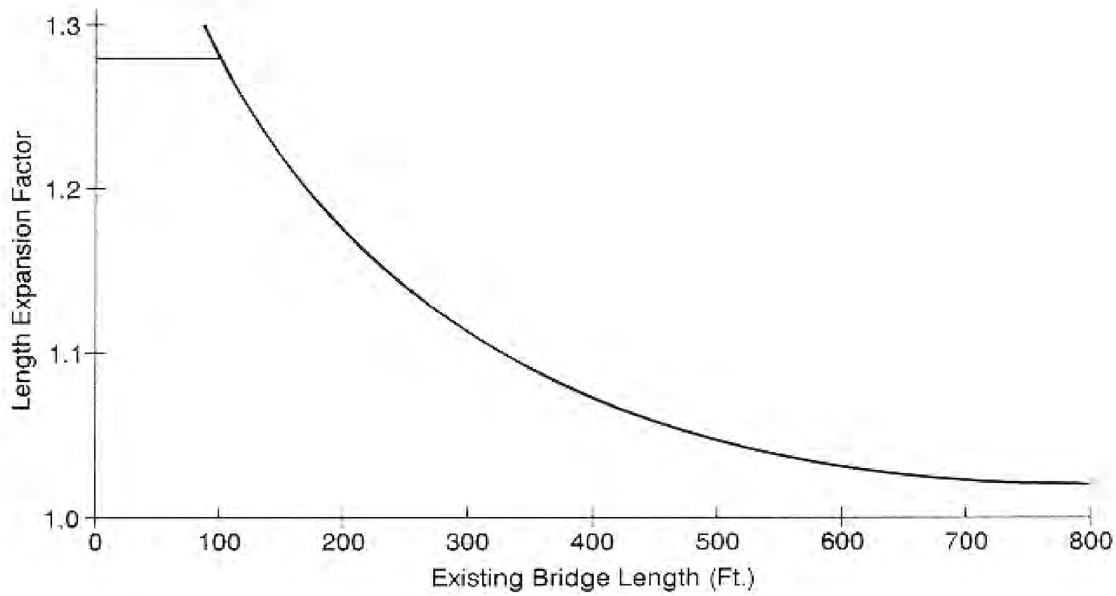
Length of Structure Improvement	***Code***
250 feet	*000250*
1,200 feet	*001200*
12,345 feet	*012345*

For substructure or channel work only, code the length of superstructure over, or supported by, the substructure or channel.

Typically, a replacement bridge is longer than the existing bridge. Nationwide averages for the increase in bridge length with replacement as a function of the existing length are given in the following figure. The length-expansion factors represent data for the years 1981 to 1985. Where site-specific data is lacking, these factors are suggested for estimating the length of replacement bridges. For exceedingly long bridges (i.e., 1000 feet or more) the length expansion factor approaches 1.0.

INCREASED LENGTH OF REPLACED BRIDGES





Replaced Bridge Length = Existing Bridge Length x Length Expansion Factor

Item 77 through Item 89 – Reserved (by FHWA)

Item 90 – Inspection Date

8 digits

Record the month, day and year that the last routine inspection of the structure was performed. This inspection date may be different from those recorded in Item 93 Critical Feature Inspection Date. Code an eight digit number to represent the month, day and year. The number of the month should be coded in the first two digits, the day in the next two digits with leading zeros as required and the year in the last four digits.

Examples:

Inspection date	***Code***
November 3, 1999	*11-03-1999*
March 15, 2000	*03-15-2000*

Item 91 – Designated Inspection Frequency

2 digits

Two digits shall be used to code the number of months between established routine bridge inspections. A leading zero (0) shall be used if necessary. The Program Manager usually determines the routine inspection interval.

The inspection interval will not be based solely on such things as the bridge type or posting. Bridges found to have a defect in a specific element(s), or having the potential to become structurally deficient within the established routine inspection interval, may be deemed to require Special Inspection. A Special Inspection shall be independent of the routine inspection. Bridges placed on the Special Inspection list shall have only the noted elements (s) inspected on the special inspection interval and shall continue to have the routine inspection on its established interval. The Special Inspection interval will not be coded in Item 91.

Examples:

Description	***Code***
Posted bridge with heavy truck traffic and questionable structural details which is designated to be inspected each month	*01*
Bridge is scheduled to be inspected every 24 months	*24*

It should be noted that bridges will also require special non-scheduled inspections after unusual physical traumas such as floods, earthquakes, fires or collisions. These special inspections may range from a very brief visual examination to a detailed in-depth evaluation depending upon the nature of the trauma. For example, when a substructure pier or abutment is struck by an errant vehicle, in most cases only a visual examination of the bridge is necessary. After major collisions or earthquakes, in-depth inspections may be warranted as directed by the engineer in overall charge of the program. After and during severe floods, the stability of the substructure of bridges may have to be determined by probing, underwater sensors or other appropriate measures. Underwater inspection by divers may be required for some scour critical bridges immediately after floods. See Item 113 Scour Critical Bridges.

Item 92 – Critical Feature Inspection

9 digits

Using a series of three-digit code segments, denote critical features that need special inspections or special emphasis during inspections and the designated inspection interval in months as determined by the individual in charge of the inspection program. The designated inspection interval could vary from inspection to inspection depending on the condition of the bridge at the time of inspection.

Segment	***Description***	***Length***
92A	*Fracture Critical Details*	*3 digits*
92B	*Underwater Inspection*	*3 digits*
92C	*Other Special Inspection*	*3 digits*

For each of 92A, B and C, code the first digit Y for special inspection or emphasis needed and code N for not needed. The first digit of 92A, B and C must be coded for all structures to designate either a yes or no answer. Those bridges coded with a Y in Item 92A or B should be the same bridges contained in the Master Lists of fracture critical and special underwater inspection bridges. In the second and third digits of each segment, code a two-digit number to indicate the number of months between inspections only if the first digit is coded Y. If the first digit is coded N, the second and third digits are left blank.

Current guidelines for the maximum allowable interval between inspections can be summarized as follows:

Fracture Critical Details	*24 months*
Underwater Inspection	*60 months*
Other Special Inspections	*60 months*

Examples:

Description	***Item***	***Code***
A 2-girder system structure which is being inspected yearly and no other inspections are required.	*92A* *92B* *92C*	*Y12* *N__* *N__*
A structure where both fracture critical and underwater inspection are being performed on a 1-year interval. Other inspections are not required.	*92A* *92B* *92C*	*Y12* *Y12* *N__*
A structure has been temporarily shored and is being inspected on a 6-month interval. Other inspections are not required.	*92A* *92B* *92C*	*N__* *N__* *Y06*

Item 93 – Critical Feature Inspection Date

18 digits

Code only if the first digit of Item 92A, B, or C is coded Y for yes. Record as a series of six-digit code segments, the month and year that the last inspection of the denoted critical feature was performed.

Segment	***Description***	***Length***
93A	*Fracture Critical Details*	*6 digits*
93B	*Underwater Inspection*	*6 digits*
93C	*Other Special Inspection*	*6 digits*

For each segment of this item, when applicable, code a six-digit number to represent the month and the year. The number of the month should be coded in the first two digits with a leading zero as required and the last four digits of the year coded as the last four digits in the field. If the first digit of any part of Item 92 is coded N, then the corresponding part of this item shall be blank.

Examples:

Description	***Item***	***Code***
A structure has fracture critical members which were last inspected in March 1986. It does not require underwater or other special feature inspections.	*93A*	*031986*
	93B	*(blank)*
	93C	*(blank)*
A structure has no fracture critical details, but requires underwater inspection and has other special features (for example, a temporary support) for which the State requires special inspection. The last underwater inspection was done in April 1986 and the last special feature inspection was done in November 1985.	*93A*	*(blank)*
	93B	*041986*
	93C	*111985*

Item 94 – Bridge Improvement Cost

6 digits

*Code a six digit number to represent the cost of the proposed bridge or major structure improvements in thousands of dollars. This cost shall include only bridge construction costs, **excluding** roadway, right of way, detour, demolition, preliminary engineering, etc. Code the base year for the cost in Item 97 Year of Improvement Cost Estimate. Do not use this item for estimating maintenance costs.*

This item must be coded for bridges eligible for the Highway Bridge Replacement and Rehabilitation Program. It may be coded for other bridges at the option of the highway agency.

Examples:

Bridge Improvement Cost	***Code***
$ 55,850	*000056*
$ 250,000	*000250*
$ 7,451,233	*007451*

Nationally, the deck area of replaced bridges is averaging 2.2 times the deck area before replacement. The deck area of rehabilitated bridges is averaging 1.5 times the deck area before rehabilitation. Widening square foot costs are typically 1.8 times the square foot cost of new bridges with similar spans. For example, if the average cost of a new bridge is $50 per square foot, the average cost of the widened area would be $90 per square foot.

Each highway agency is encouraged to use its best available information and established procedures to determine bridge improvement costs. In the absence of these procedures, the highway agency may wish to use the following procedure as a guide in preparing bridge improvement cost estimates.

Apply a construction unit cost to the proposed bridge area developed by using (1) current State deck geometry design standards and (2) proposed bridge length from Item 76 Length of Structure Improvement.

Item 95 – Roadway Improvement Cost

6 digits

Code a six digit number to represent the cost of the proposed roadway improvement in thousands of dollars. This shall include only roadway construction costs, excluding bridge, right-of-way, detour, extensive roadway realignment costs, preliminary engineering, etc. Code the base year for the cost in Item 97 Year of Improvement Cost Estimate. Do not use this item for estimating maintenance costs.

This item must be coded for bridges eligible for the Highway Bridge Replacement and Rehabilitation Program. It may be coded for other bridges at the option of the highway agency.

In the absence of a procedure for estimating roadway improvement costs, a guide of 10 percent of the bridge costs is suggested.

Item 96 – Total Project Cost

6 digits

Code a six digit number to represent the total project cost in thousands of dollars, ***including*** *incidental costs not included in Items 94 and 95. This item should include* ***all*** *costs normally associated with the proposed bridge improvement project. The Total Project Cost will therefore usually be greater than the sum of Items 94 and 95. Code the base year for the cost in Item 97 - Year of Improvement Cost Estimate. Do not use this item for coding maintenance costs.*

This item must be coded for bridges eligible for the Highway Bridge Replacement and Rehabilitation Program. It may be coded for other bridges at the option of the highway agency.

In the absence of a procedure for estimating the total project cost, a guide of 150 percent of the bridge cost is suggested.

Item 97 – Year of Improvement Cost Estimate

4 digits

Record and code the year that the costs of work estimated in Item 94 Bridge Improvement Cost, Item 95 Roadway Improvement Cost, and Item 96 Total Project Cost were based upon. This date and the data provided for Item 94 through Item 96 must be current; that is, Item 97 shall be no more than eight years old.

Examples:

Year of Cost Estimate	***Code***
1988 costs	*1988*
2010 costs	*2010*

FHWA Coding Guide content is shown in Calibri Italic font.

Item 98 – Border Bridge

5 digits

Use this item to indicate structures crossing borders of States. Code a five-digit number composed of two segments specifying the percent of responsibility for improvements to the existing structure when it is shared with a neighboring State. Code the first three digits with the neighboring State code using State codes listed in Item 1 State Code. Code the fourth and fifth digits with the percentage of total deck area of the existing bridge that the neighboring State is responsible for funding.

Segment	***Description***	***Length***
98A	*Neighboring State Code*	*3 digits*
98B	*Percent Responsibility*	*2 digits*

If a neighboring State codes the structure and accepts 100% of the responsibility, but your State still codes a record for the structure, then Item 98B in your State's record should be coded 99 to represent that your State has no responsibility for the structure.

If structure is not on a border, leave blank.

Nebraska Neighboring State	**Code**
Colorado	088
Iowa	197
Kansas	207
Missouri	297
South Dakota	468
Wyoming	568

Examples:

Description	**Code**
A structure connects Nebraska with Iowa and Iowa is responsible for funding 45 percent of future improvement costs.	19745

Item 99 – Border Bridge Structure Number

15 digits

Code the neighboring State's 15-digit National Bridge Inventory structure number for any structure noted in Item 98 Border Bridge. This number must match exactly the neighboring State's submitted NBI structure number. The entire 15-digit field must be accounted for including zeros and blank spaced whether they are leading, trailing, or embedded in the 15-digit field. If Item 98 is blank, this item is blank.

Item 100 – STRAHNET Highway Designation

1 digit

This item shall be coded for all records in the inventory. For the purposes of this item, the STRAHNET Connectors are considered included in the term STRAHNET. For the inventory route identified in Item 5, indicate STRAHNET highway conditions using one of the following codes:

Code	***Description***
0	*The inventory route is not a STRAHNET highway.*
1	*The inventory route is on a STRAHNET highway.*
2	*The inventory route is on a STRAHNET highway that goes over or under a STRAHNET highway.*
3	*The inventory route is on a STRANET connector route.*

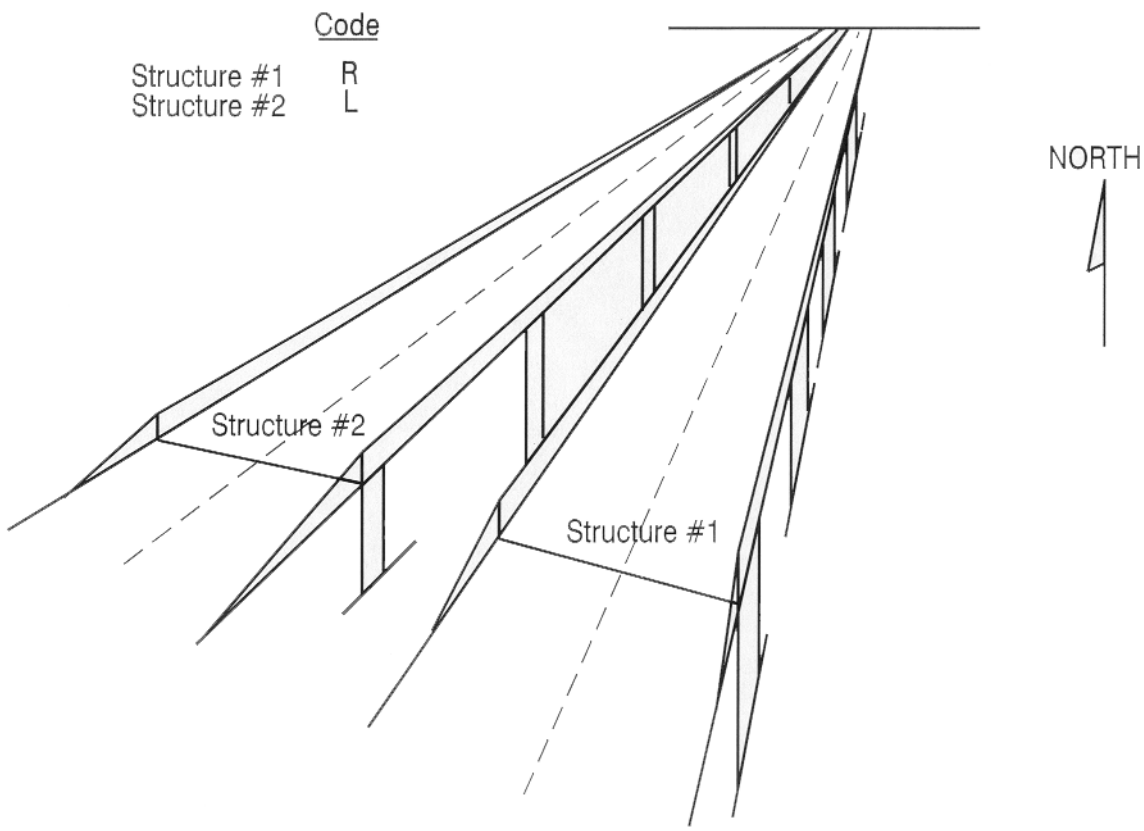
Item 101 – Parallel Structure Designation

1 digit

Code this item with a one digit code and to indicate situations where separate structures carry the inventory route in opposite directions of travel over the same feature. The lateral distance between structures has no bearing on the coding of this item. One of the following codes shall be used:

Code	***Description***
R	*The right structure of parallel bridges carrying the roadway in the direction of the inventory. (For a STRAHNET highway, this is west to east and south to north.)*
L	*The left structure of parallel bridges. This structure carries traffic in the opposite direction.*
N	*No parallel structure exists.*

Example:


Code
Structure #1 R
Structure #2 L
NORTH
Structure #2
Structure #1

Item 102 – Direction of Traffic

1 digit

Code the direction of traffic of the inventory route identified in Item 5 as a one digit number using one of the codes below. This item must be compatible with other traffic-related items such as Item 28A Lanes on the Structure, Item 29 Average Daily Traffic, Item 47 Total Horizontal Clearance and Item 51 Bridge Roadway Width, Curb-to-Curb.

Code	***Description***
0	*Highway traffic not carried*
1	*1-way traffic*
2	*2-way traffic*
3	*One lane bridge for 2-way traffic*

Item 103 – Temporary Structure Designation

1 digit

Code this item with a one digit code and to indicate situations where temporary structures or conditions exist. This item should be blank if not applicable.

Code	***Description***
T	*Temporary structure(s) or conditions exist*

Temporary structure(s) or conditions are those which are required to facilitate traffic flow. This may occur either before or during the modification or replacement of a structure found to be deficient. Such conditions include the following:

1. *Bridges shored up, including additional temporary supports.*
2. *Temporary repairs made to keep a bridge open.*
3. *Temporary structures, temporary runarounds or bypasses.*
4. *Other temporary measures, such as barricaded traffic lanes to keep the bridge open.*

Any repaired structure or replacement structure which is expected to remain in place without further project activity, other than maintenance, for a significant period of time shall not be considered temporary. Under such conditions, that structure, regardless of its type, shall be considered the minimum adequate to remain in place and evaluated accordingly.

If this item is coded T, then all data recorded for the structure shall be for the condition of the structure without temporary measures, except for the following items which shall be for the temporary structure:

Item	***Item Description***
10	*Inventory Route, Minimum Vertical Clearance*
41	*Structure Open, Posted, or Closed to Traffic*
47	*Inventory Route, Total Horizontal Clearance*
53	*Minimum Vertical Clearance Over Bridge Roadway*
54	*Minimum Vertical Underclearance*
55	*Minimum Lateral Underclearance on Right*
56	*Minimum Lateral Underclearance on Left*
70	*Bridge Posting*

Item 104 – Highway System of the Inventory Route

1 digit

*This item is to be coded for all records in the inventory. For the inventory route identified in Item 5, indicate whether the **inventory route** is on the National Highway System (NHS) or not on the system. Use one of the following codes:*

Code	***Description***
0	*Inventory Route is not on the NHS.*
1	*Inventory Route is on the NHS.*

Item 105 – Federal Lands Highways

1 digit

Structures owned by State and local jurisdictions on roads which lead to and traverse through federal lands sometimes require special coded unique identification because they are eligible to receive funding from the Federal Lands Highway Program. One of the following codes shall be used:

Code	***Description***
0	*Not applicable*
1	*Indian Reservation Road (IRR)*
2	*Forest Highway (FH)*
3	*Land Management Highway System (LMHS)*
4	*Both IRR and FH*
5	*Both IRR and LMHS*
6	*Both FH and LMHS*
9	*Combined IRR, FH and LMHS*

Item 106 – Year Reconstructed

4 digits

Record and code the year of reconstruction of the structure. Code all four digits of the latest year in which reconstruction of the structure was completed. If there has been no reconstruction code 0000.

For a bridge to be defined as reconstructed, the type of work performed, whether or not it meets current minimum standards, must have been eligible for funding under any of the Federal-aid funding categories. The eligibility criteria would apply to the work performed regardless of whether all State or local funds or Federal-aid funds were used. What this means is that all bridge repairs and any reconstruction not qualified for Federal-aid can be classified as a maintenance activity.

Some types of eligible work not to be considered as reconstruction are listed:

- *Safety feature replacement or upgrading (for example, bridge rail, approach guardrail or impact attenuators).*
- *Painting of structural steel.*
- *Overlay of bridge deck as part of a larger highway surfacing project (for example, overlay carried across bridge deck for surface uniformity without additional bridge work).*
- *Utility work.*
- *Emergency repair to restore structural integrity to the previous status following an accident.*

- *Retrofitting to correct a deficiency which does not substantially alter physical geometry or increase the load-carrying capacity.*
- *Work performed to keep a bridge operational while plans for complete rehabilitation or replacement are under preparation (for example, adding a substructure element or extra girder).*

Item 107 – Deck Structure Type

1 digit

Record the type of deck system on the bridge with a one digit code. If more than one type of deck system is on the bridge, code the most predominant. Code N for a filled culvert or arch with the approach roadway section carried across the structure. Use one of the following codes:

Code	***Description***
1	*Concrete Cast-in-Place*
2	*Concrete Precast Panels*
3	*Open Grating*
4	*Closed Grating*
5	*Steel plate (includes orthotropic)*
6	*Corrugated Steel*
7	*Aluminum*
8	*Timber*
9	*Other*
N	*Not applicable*

Item 108 – Wearing Surface/Protective System

3 digits

Information on the wearing surface and protective system of the bridge deck shall be coded using a three-digit code composed of three segments.

Segment	***Description***	***Length***
108A	*Type of Wearing Surface*	*1 digit*
108B	*Type of Membrane*	*1 digit*
108C	*Deck Protection*	*1 digit*

Item 108A – Type of Wearing Surface

1 digit

Code 108A	***Description***
1	*Concrete*
2	*Type 47BD-SF (Silica Fume)*
3	*Latex Concrete*
4	*Low Slump Concrete*
5	*Epoxy Overlay*
6	*Bituminous*
7	*Timber*
8	*Gravel*
9	*Other*
0	*None (no additional concrete thickness or wearing surface is included in the bridge deck)*
N	*Not Applicable (applies only to structures with no deck.)*

Item 108B – Type of Membrane

1 digit

Code 108B	***Description***
*1**	*Built-up*
2	*Preformed Fabric*
3	*Epoxy*
8	*Unknown*
*9***	*Other*
0	*None*
N	*Not Applicable (applies only to structures with no deck.)*

*Code cold liquid applied waterproofing membranes as 1 – Built-up

**Code hot liquid applied waterproofing membrane and other approved waterproofing membrane types as 9 - Other

Item 108C – Deck Protection

1 digit

Code 108C	***Description***
1	*Epoxy Coated Reinforcing*
2	*Galvanized Reinforcing*
3	*Other Coated Reinforcing*
4	*Cathodic Protection*
6	*Polymer Impregnated*
7	*Internally Sealed*
8	*Unknown*
9	*Other*
0	*None*
N	*Not Applicable (applies only to structures with no deck.)*

Item 109 – Average Daily Truck Traffic

2 digits

Code a two-digit percentage (XX percent) that shows the percentage of Item 29 Average Daily Traffic that is truck traffic. Do not include vans, pickup trucks and other light delivery trucks in this percentage.

If this information is not available, an estimate which represents the average percentage for the category of road carried by the bridge may be used. Leave blank if Item 29 - Average Daily Traffic is not greater than 100.

Examples:

Average Daily Traffic	***Code***
7% trucks	*07*
12% trucks	*12*

Item 110 – Designated National Network

1 digit

The national network for trucks includes most of the Interstate System and those portions of the Federal-Aid Highways identified in the Code of Federal Regulations (23 CFR § 658). The national network for trucks is available for use by commercial motor vehicles of the dimensions and configurations described in these regulations. For the inventory route identified in Item 5, indicate conditions using one of the following codes:

Code	***Description***
0	*The inventory route is not part of the national network for trucks.*
1	*The inventory route is part of the national network for trucks.*

Item 111 – Pier or Abutment Protection (for Navigation)

1 digit

If Item 38 Navigation Control has been coded 1, use the codes below to indicate the presence and adequacy of pier or abutment protection features such as fenders, dolphins, etc. The condition of the protection devices may be a factor in the overall evaluation of Item 60 Substructure. If Item 38 Navigation Control has been coded 0 or N, leave blank to indicate not applicable.

Code	***Description***
1	*Navigation protection not required*
2	*In place and functioning*
3	*In place but in a deteriorated condition*
4	*In place but reevaluation of design suggested*
5	*None present but reevaluation suggested*

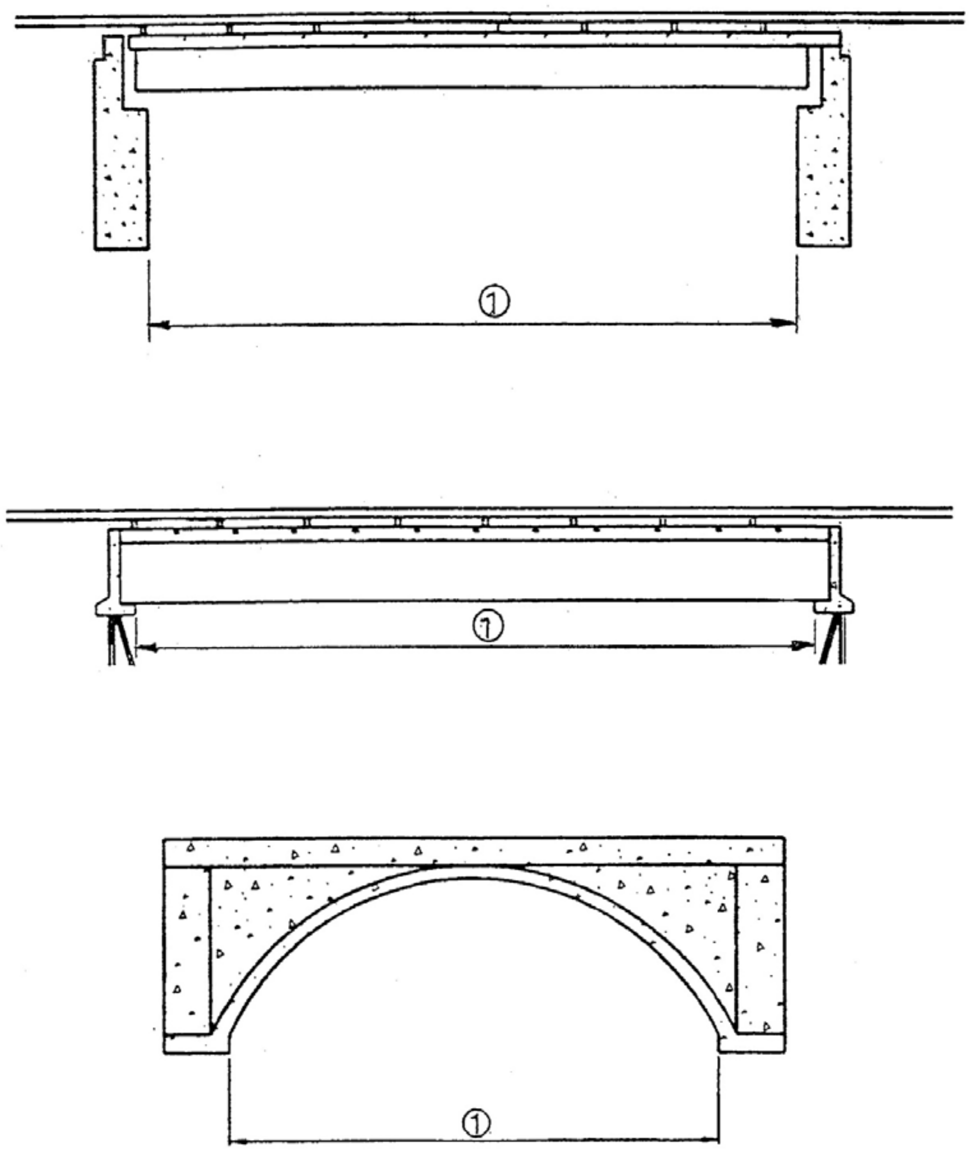
Item 112 – NBIS Bridge Length

1 digit

Does this structure meet or exceed the minimum length specified to be designated as a bridge for National Bridge Inspection Standards purposes? The following definition of a bridge is used (from AASHTO and given in the NBIS, 23 CFR § 650.3):

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 (or equal to) half of the smaller contiguous opening.

Code	***Description***
Y	*Yes*
N	*No*
R	*Removed*

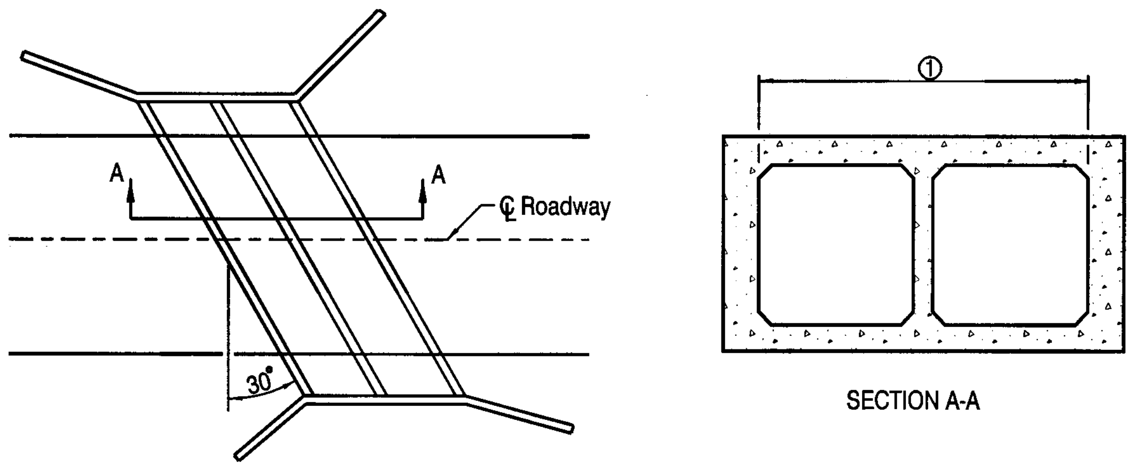


(1) Item 112 – Bridge Length

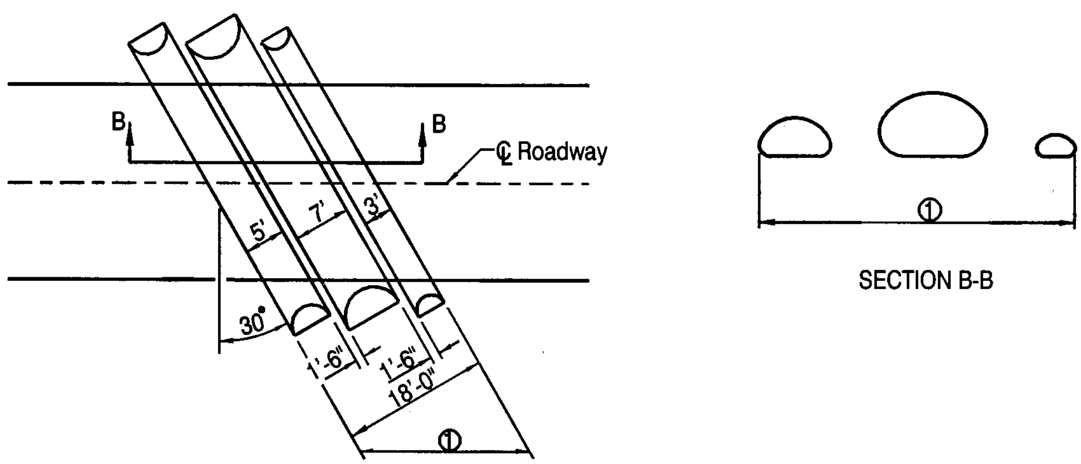
(NBIS Bridge Length is greater than 20 feet between under copings.)

Item 112 – NBIS Bridge Length (cont'd)

Examples:



1 Item 112 – Bridge Length



1 Item 112 – Bridge Length = 18'/ cos (30) = 20.78'

Item 113 – Scour Critical Bridges

1 digit

Use a single-digit code as indicated below to identify the current status of the bridge regarding its vulnerability to scour. Scour analyses shall be made by hydraulic/geotechnical/structural engineers. Details on conducting a scour analysis are included in the FHWA Technical Advisory 5140.23 titled, "Evaluating Scour at Bridges." Whenever a rating factor of 2 or below is determined for this item, the rating factor for Item 60 - Substructure may need to be revised to reflect the severity of actual scour and resultant damage to the bridge. A scour critical bridge is one with abutment or pier foundations which are rated as unstable due to (1) observed scour at the bridge site or (2) a scour potential as determined from a scour evaluation study.

All bridges over waterways are to be evaluated for scour vulnerability by an interdisciplinary scour assessment team to determine their vulnerability to failure during flood events. Scour assessment is completed following FHWA Technical Advisory T 5140.23 and Hydraulic Engineering Circular (HEC) 18. The assessment is for all substructure elements of the abutments and wings, including but not limited to, steel and concrete piling, timber planking, and poured concrete walls.

A plan of action must be developed for each scour critical bridge (see FHWA Technical Advisory T 5140.23, HEC 18 and HEC 23).

The interdisciplinary scour assessment team (ISAT) assigns a code for Item 113. The FHWA Recording and Coding Guide codes from the Errata are repeated in the following table. The inspector for each routine inspection of a bridge over water does not assign a code for Item 113; however, they will assign/review codes for the scour-related 300 series data items which record conditions found by the inspector and flags scour issues for the ISAT. These are described later in this Chapter.

Whenever a rating factor of 3 or below is determined for this item, the rating factor for Item 60 Substructure and other affected Items (i.e., load ratings, superstructure rating) should be revised to be consistent with the severity of observed scour and resultant damage to the bridge.

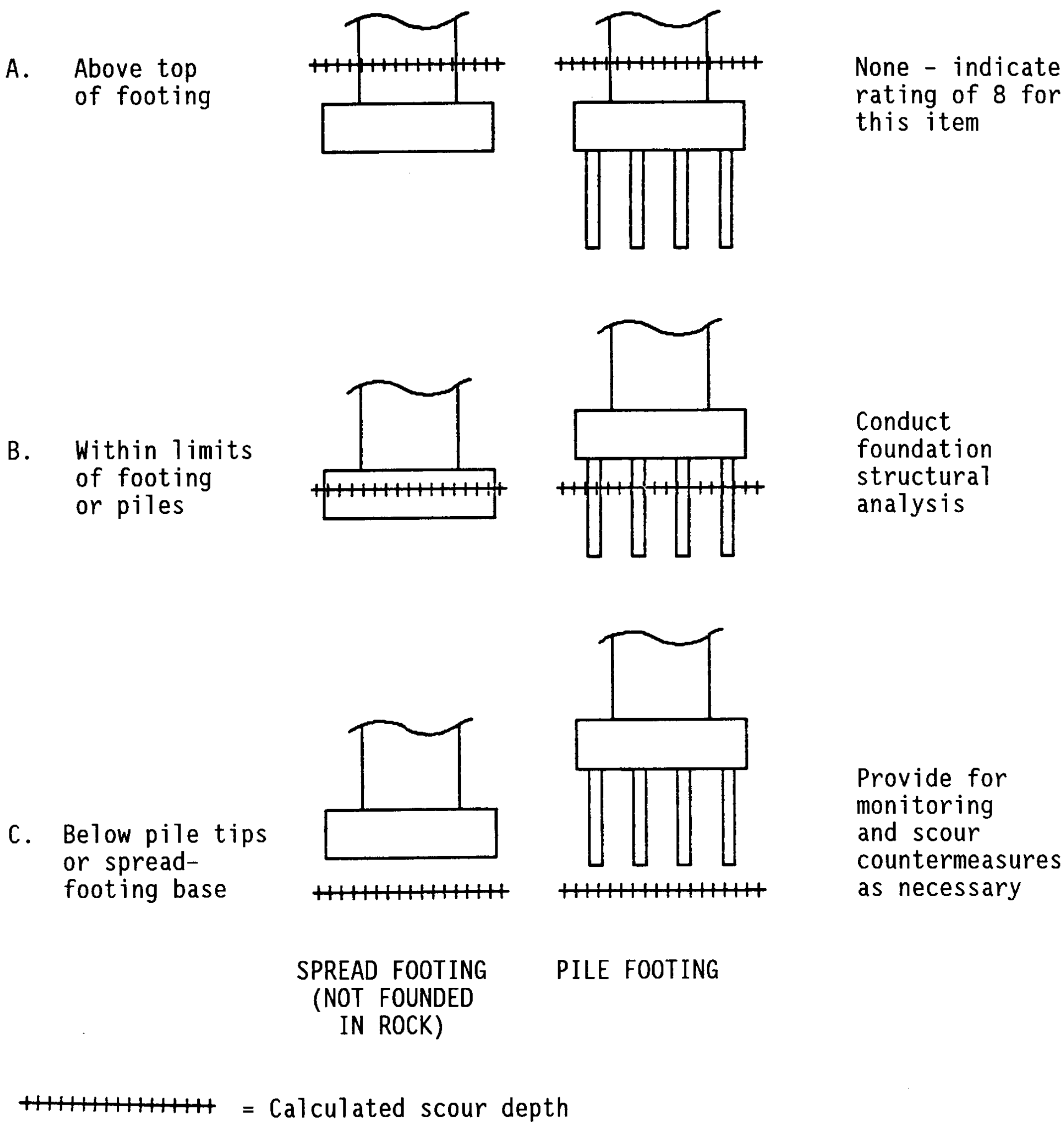
A scour critical bridge is one with abutment or pier foundation rated as unstable due to

(1) observed scour at the bridge site (rating factor of 2, 1, or 0) or

(2) a scour potential as determined from a scour evaluation study (rating factor of 3).

Item 113 Code	*Description*
N	*Bridge not over waterway.*
U	*Bridge with "unknown" foundation that has not been evaluated for scour. Until risk can be determined, a plan of action should be developed and implemented to reduce the risk to users from a bridge failure during and immediately after a flood event (see HEC 23).*
T	*Bridge over "tidal" waters that has not been evaluated for scour, but considered low risk. Bridge will be monitored with regular inspection cycle and with appropriate underwater inspections until an evaluation is performed ("Unknown" foundations in "tidal" waters should be coded U.)*
9	*Bridge foundations (including piles) on dry land well above flood water elevations.*
8	*Bridge foundations determined to be stable for the assessed or calculated scour condition. Scour is determined to be above top of footing (Example A) by assessment (i.e., bridge foundations are on rock formations that have been determined to resist scour within the service life of the bridge), by calculation or by installation of properly designed countermeasures (see HEC 23).*
7	*Countermeasures have been installed to mitigate an existing problem with scour and to reduce the risk of bridge failure during a flood event. Instructions contained in a plan of action have been implemented to reduce the risk to users from a bridge failure during or immediately after a flood event.*
6	*Scour calculation/evaluation has not been made. (Use only to describe case where bridge has not yet been evaluated for scour potential.)*
5	*Bridge foundations determined to be stable for assessed or calculated scour condition. Scour is determined to be within the limits of footing or piles (Example B) by assessment (i.e. bridge foundations are on rock formations that have been determined to resist scour within the service life of the bridge), by calculations or by installation of properly designed countermeasures (see HEC 23).*
4	*Bridge foundations determined to be stable for assessed or calculated scour conditions; field review indicates action is required to protect exposed foundations (see HEC 23).*
3	*Bridge is scour critical.* *Bridge foundations determined to be unstable for assessed or calculated scour conditions:* *- Scour within limits of footing or piles. (Example B)* *- Scour below spread-footing base or pile tips. (Example C)*
2	*Bridge is scour critical.* *Field review indicates that extensive scour has occurred at bridge foundations, which are determined to be unstable by:* *- a comparison of calculated scour and observed scour during the bridge inspection, or* *- an engineering evaluation of the observed scour condition reported by the bridge inspector in Item 60.*
1	*Bridge is scour critical.* *Field review indicates that failure of piers/abutments is imminent. Bridge is closed to traffic. Failure is imminent based on:* *- a comparison of calculated and observed scour during the bridge inspection, or* *- an engineering evaluation of the observed scour condition reported by the bridge inspector in Item 60.*

Item 113 Code	***Description***
0	*Bridge is scour critical.* *Bridge has failed and is closed to traffic.*



Scour Foundation Examples

Item 114 – Future Average Daily Traffic

6 digits

Code for all bridges the forecasted average daily traffic (ADT) for the inventory route identified in Item 5. This shall be projected at least 17 years but no more than 22 years from the year data is submitted to the NBI. The intent is to provide a basis for a 20-year forecast. This item may be updated anytime, but must be updated when the forecast falls below the 17-year limit. If planning data is not available, use the best estimate based on site familiarity.

The future ADT must be compatible with the other items coded for the bridge. For example, parallel bridges with an open median are coded as follows: if Item 28 - Lanes On and Under the Structure and Item 51 - Bridge Roadway Width, Curb-to-Curb are coded for each bridge separately, then the future ADT must be coded for each bridge separately (not the total for the route).

Examples:

Future ADT	***Code***
540	*000540*
15,600	*015600*
240,000	*240000*

Item 115 – Year of Future Average Daily Traffic

4 digits

Record and code the year represented by the future ADT in Item 114. The projected year of future ADT shall be at least 17 years but no more than 22 years from the year of inspection.

Example: Year of Future ADT is 2020. Code = 2020.

Item 116 – Minimum Navigation Vertical Clearance

3 digits (XXX feet)

Record to the nearest foot (rounding down) the minimum vertical clearance imposed at the site as measured above a datum that is specified on a navigation permit issued by a control agency. Code this item only for vertical lift bridges in the dropped or closed position, otherwise leave blank.

Examples:

Vertical Clearance	***Code***
20.6	*020*
24.2	*024*

3-NBI.11 QUALITY CONTROL

The NBIS defines 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."

Quality Control is defined for NDOT's program as a system of routine technical activities, to measure and control the quality of the bridge inventory data or report as it is being developed. The QC system is designed to include general methods such as accuracy checks on data acquisition and calculations, and the use of approved standardized procedures for measurement, calculation, recording information and reporting. QC activities include:

- Documents, data, or calculations signed by a PE, must have QC completed by an individual of equivalent or better qualifications than the originator (this is typically documented when the QC individual signs or initials the documents);
- See that the technical activity has followed procedures set by NDOT;
- Providing routine and consistent checks for data integrity, correctness and completeness;
- Identifying and address errors and/or omissions;
- Documenting inventory data;
- Recording all QC activities.

Quality Control for this program is the responsibility of the consultant or agency actually conducting the activity. Quality Control checks are conducted on every product of a program operation, and thus at a much higher frequency than quality assurance checks. When the QC on a program product is complete, it is finished and deliverable to the Bridge Owner for their records.

Consultants providing professional services to Bridge Owners must submit a Quality Control plan to the Bridge Owner for review and approval. QC must be done on the deliverables prior to submittal to the Bridge Owner.

NDOT completes QC on data that has been entered into the BrM database on a continual basis.

3-NBI.12 QUALITY ASSURANCE

Quality Assurance (QA) of all load rating data in the Bridge Inventory will be performed by NDOT or their selected agent. The QA program activities are described in Chapter 1 of this Manual.

3-NBI.13 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1
2	2013 March 04	Revision 2
3	2015 March 15	Revision 3
4	2016 March 11	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

3-NBI.14 FORMS

Forms used in completing inspections that are mentioned in this Chapter are listed below. Participants and contributors to the Nebraska Bridge Inspection Program are advised to go to the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/ for the current list of applicable forms and the most recent versions of each form.

Name	DR Form
Structural Inventory and Appraisal	N/A

3-NBI.15 APPENDIX

Memos and other guidance that may have been issued after the issuance of the current revision of this Chapter can be found at the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/

Participants are urged to check this site to ensure they have all the most current information and forms.

3-NE.1 GENERAL

The FHWA National Bridge Inventory Items 1 through Item 116. The definitions, descriptions and guidance for use are in a separate chapter of the BIP Manual, Chapter 3-NBI.

The 200 series Items are Nebraska custom data fields used by NDOT and are not submitted to the FHWA. These items do not print on a structure's Structural Inventory and Appraisal (SI&A) report.

The 300 series Items are Nebraska custom fields used by NDOT and are not submitted to the FHWA. These items do not print on the SI&A report. These were developed by the NDOT Bridge Division and are used for bridge maintenance and bridge management purposes. The assignment of a particular rating or code to any item will only indicate that action is required or desired, but will not imply that action will be taken or is pending.

3-NE.2 REFERENCES

The information in this Bridge Inspection Program Manual supplements requirements, and procedures and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP).

The References list of applicable documents is included in the Manual Appendix. The National Bridge Inspection Standards are also included in the Manual.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in National Bridge Inspection Standards, the *AASHTO Manual for Bridge Evaluation*, and FHWA publications, technical advisories and publications related to the NBIS.

3-NE.3 NE ITEMS IN NUMERICAL ORDER

The following table includes the list of Nebraska Data items shown in numerical order. Responsibility for entry into the NE database is shown as guidance of participants, but can vary for each structure. A detailed description for coding of each follows. Several items were removed from NE coding in Revision 3. Those items have been stricken through.

NEBRASKA ITEMS IN NUMERICAL ORDER

S = static item – typically don't change each inspection cycle
D = dynamic item – may change each inspection cycle
I = initial entry
V = verify, notify BIP Program Manager of changes on marked up SI&A sheet
E = enter into BrM when changed
P = provides data

Item No.	Description	Category	Code Length /Type	Static/ Dynamic	PM Staff	TL	HE	LRE
200	Bridge Footage Allocation	General Bridge Information	20/N	S	I			
201	Federal-Aid Project Number	General Bridge Information	30/N	S	I			
202	Owner's Bridge Number	General Bridge Information	20/AN	S	I	V		
203	Posted Weight Limit	General Bridge Information	30/N	D		E*		
204	FIPS County Code	General Bridge Information	3/N	S	I			
205	FIPS Place Code (NBI Item 4)	General Bridge Information	3/N	S	I			
206	F.A. Route Number	General Bridge Information	4/N	S	I			
207	Highway Route Number	General Bridge Information	4/N	S	I			
208	State Classification of Inventory Route	General Bridge Information	1/N	S	I			
209	Under Facility Name	General Bridge Information	25/AN	S	I			
210	Transporter-Erector Route Bridges	General Bridge Information	1/A	S	I			
211	Priority Commercial System Bridges	General Bridge Information	1/A	S	I			
212	Bridge Rail Type	General Bridge Information	2/N	S	I			
213	Bridge Name	General Bridge Information		S	I	V		
214	School Bus Route	General Bridge Information		S	I	V		
215	Transit Bus Route	General Bridge Information		S	I	V		
216	Emergency Route	General Bridge Information		S	I	V		
301	% of Defective Deck	Bridge Deck and Approaches	2/N	D		E		
303	Roadway Fixed and Expansion Devices	Bridge Deck and Approaches	1/N	D		E		
306	Asphalt and/or Gravel on Deck	Bridge Deck and Approaches	3/AN	D		E		
311	Bearing Devices	Superstructure	1/N	D		E		
316	Condition of Abutments	Substructure	1/N	D		E		

NEBRASKA ITEMS IN NUMERICAL ORDER

S = static item – typically don't change each inspection cycle
D = dynamic item – may change each inspection cycle
I = initial entry
V = verify, notify BIP Program Manager of changes on marked up SI&A sheet
E = enter into BrM when changed
P = provides data

Item No.	Description	Category	Code Length /Type	Static/ Dynamic	PM Staff	TL	HE	LRE
317	Condition of Piers	Substructure	1/N	D		E		
320	Condition of Piling	Substructure	1/N	D		E		
321	Piling Type	Substructure	1/A	S	I			
322	Mechanically Stabilized Earth Walls	Substructure	1/A	S	I			
~~323~~	~~Culvert Barrel~~	~~Culvert~~	~~1/N~~	~~D~~		~~E~~		
324	Culvert Ends	Culvert	1/N	D		E		
~~325~~	~~Debris at Inlet~~	~~Culvert~~	~~1/N~~	~~D~~		~~E~~		
326	Embankment Erosion	Culvert	1/N	D		E		
~~327~~	~~Alignment with Structure~~	~~Culvert~~	~~1/N~~	~~D~~		~~E~~		
328	F.L. Drop at Culvert Inlet	Culvert	2/N	D		E		
329	F.L. Drop at Culvert Outlet	Culvert	2/N	D		E		
330	Silt in Barrel	Culvert	2/N	D		E		
~~335~~	~~Inspectors Opinion on Culvert Adequacy~~	~~Culvert~~	~~1/N~~	~~D~~		~~E~~		
342	Total Number of Pins	Miscellaneous	2/N	S		V		
343	Snooper Bridge	Miscellaneous	1/A	S		V		
344	Abutment walls undermined	Scour Related Routine Inspection	1/A	D		E		
~~344A~~	~~Approach Settles/Washes Out~~	~~Scour Related Routine Inspection~~	~~1/A~~	~~D~~		~~E~~		
345	Bridge Crossing a Canal	Scour Related Routine Inspection	1/A	S		E		
346	Is Stream Bed Degraded	Scour Related Routine Inspection	1/A	D		E	V**	
347	Noticeable Contraction of Stream	Scour Related Routine Inspection	1/A	D		E	V**	
348	Local Scour at Piers/Abutments	Scour Related Routine Inspection	1/A	D		E	V**	
~~349~~	~~Banks Eroding/Unstable~~	~~Scour Related Routine Inspection~~	~~1/A~~	~~D~~		~~E~~	~~V**~~	
350	Stream Shifted from Bridge Center	Scour Related Routine Inspection	1/A	D		E	V**	
~~351~~	~~Floodwater Reaches Low Superstructure~~	~~Scour Related Routine Inspection~~	~~1/A~~	~~D~~		~~E~~	~~V**~~	
~~351A~~	~~Low Road Elevation Above Low Superstructure~~	~~Scour Related Routine Inspection~~	~~1/A~~	~~D~~		~~E~~	~~V**~~	

NEBRASKA ITEMS IN NUMERICAL ORDER									
S = static item – typically don't change each inspection cycle D = dynamic item – may change each inspection cycle I = initial entry V = verify, notify BIP Program Manager of changes on marked up SI&A sheet E = enter into BrM when changed P = provides data									
Item No.	**Description**	**Category**	**Code Length /Type**	**Static/ Dynamic**	**PM Staff**	**TL**	**HE**	**LRE**	
~~352~~	~~Floodwater Over Bridge Deck or Roadway~~	~~Scour Related Routine Inspection~~	~~1/A~~	~~D~~		~~E~~	~~V**~~		
353	Potential Debris Upstream	Scour Related Routine Inspection	1/A	D		E	V**		
354	Bents/Piers in Channel	Scour Related Routine Inspection	1/A	D		E	V**		
354A	Flow Against Abutment	Scour Related Routine Inspection	1/A	D		E	V**		
355	Bridge Alignment with Flow	Scour Related Routine Inspection	1/AN	D		E	V**		
~~356~~	~~Debris Blocking Channel at Bridge~~	~~Scour Related Routine Inspection~~	~~1/A~~	~~D~~		~~E~~	~~V**~~		
357	Drop from Upstream Deck to Flowline	Scour Related Routine Inspection	2/N	D		E	V**		
357A	Drop from Upstream Deck to Ground at Abut 1	Scour Related Routine Inspection	2/N	D		E	V**		
357B	Drop from Upstream Deck to Ground at Abut 2	Scour Related Routine Inspection	2/N	D		E	V**		
358	Is There a Scour Problem	Scour Related Routine Inspection	1/A	D		E	V**		
~~358A~~	~~Significant Flood in Last Two Years~~	~~Scour Related Routine Inspection~~	~~1/A~~	~~D~~		~~E~~	~~V**~~		
~~358B~~	~~Scour Increased in Last two Years~~	~~Scour Related Routine Inspection~~	~~1/A~~	~~D~~		~~E~~	~~V**~~		
358C	Scour Plan of Action Effective Date	Scour Related Routine Inspection	1/A	S		V			
359A	Type of culvert	Culvert	1/A	S		V			
359B	Number of barrels/pipes	Culvert	1/N	S		V			
359C	Span of installation	Culvert	2/N	S		V			
359D	Height of box/pipe	Culvert	2/N	S		V			
359E	Depth of Fill	Culvert	2/N	D		E			
360	Piling	Underwater Inspection	1/N	D		E			
361	Bracing and Connectors	Underwater Inspection	1/N	D		E			
362	Columns and Wall	Underwater Inspection	1/N	D		E			
363	Footing	Underwater Inspection	1/N	D		E			
364	Scour	Underwater Inspection	1/N	D		E			
365	Debris	Underwater Inspection	1/N	D		E			
377	Maintenance Problem	Maintenance and Follow-up	1/N	D		E			
378	Date Maintenance	Maintenance and Follow-up	1/N	D		E			

NEBRASKA ITEMS IN NUMERICAL ORDER								
S = static item – typically don't change each inspection cycle D = dynamic item – may change each inspection cycle I = initial entry V = verify, notify BIP Program Manager of changes on marked up SI&A sheet E = enter into BrM when changed P = provides data								
Item No.	**Description**	**Category**	**Code Length /Type**	**Static/ Dynamic**	**PM Staff**	**TL**	**HE**	**LRE**
	Flagged							
379	Recommendations	Maintenance and Follow-up	1/N	D		E		
380	Critical Finding Outstanding	Maintenance and Follow-up	1/AN	D	E			
381	Rating Program Used	Load Rating	1/N	D				E
384	HS Inventory Rating	Load Rating	1/N	D				E
385	HS Operating Rating	Load Rating	1/N	D				E
386	Office Calculated Posting	Load Rating	1/N	D				E
na	Inspection Team Leader ID	Program	/AN	D		E		
na	Asst. Team Leader ID, 1	Program	/AN	D		E		
na	Asst. Team Leader ID, 2	Program	/AN	D		E		
na	Asst. Team Leader ID, 3	Program	/AN	D		E		
na	Asst. Team Leader ID, 4	Program	/AN	D		E		
na	Load Rating Engineer ID	Program	/AN	D	E			P
na	Load Rating Date	Program	/AN	D	E			P

* TL codes posting as found on inspection.
** Hydraulic Engineers record their opinion on these items on scour assessment forms. The BIPPM should be notified if different than values shown in the NE database.

3-NE.4 CONDITION RATINGS (NBI)

The NBI Condition ratings are used to describe the existing, in-place bridge as compared to the as-built condition. They are used for some of the NE data items. The table is repeated here for the convenience of the Manual users.

Code	Description
N	NOT APPLICABLE
9	EXCELLENT CONDITION
8	VERY GOOD CONDITION - no problems noted.
7	GOOD CONDITION - some minor problems.
6	SATISFACTORY CONDITION - structural elements show some minor deterioration.
5	FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
4	POOR CONDITION - advanced section loss, deterioration, spalling or scour.
3	SERIOUS CONDITION - loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	"IMMINENT" FAILURE CONDITION - major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.
0	FAILED CONDITION - out of service beyond corrective action.

3-NE.5 NE DATA ITEMS – GENERAL

Item 200 – Bridge Footage Allocation

20 digits

Nebraska Highway Trust Fund allocations are affected by the lineal feet of bridge in a political subdivision. This item is used to indicate the political subdivisions that share in the total bridge footage of a structure. Code a two or four digit number for the political subdivision and a two digit number indicating the percentage of the total length allocated. For the list of political subdivision in Nebraska, see the Appendix.

Item	Character / digits	Code
200A	2 digits	Border Bridge County
200B	2 digits	Percent Allocated
200C	2 digits	Border Bridge County
200D	2 digits	Percent Allocated
200E	4 digits	Border Bridge City
200F	2 digits	Percent Allocated
200G	4 digits	Border Bridge City
200H	2 digits	Percent Allocated

Item 201 – Federal-Aid Project Number

30 digits

If Federal funds have been used for construction or reconstruction of this structure, the Federal-Aid project number of the most recent project should be recorded, if available. (The most recent project or plan number whether it be Federal, State or county should be coded.)

Item 202 – Owner's Bridge Number

20/AN characters

This field can be used by counties and cities for their unique bridge numbers or identification, or any other data they would like on the SI&A sheet.

Item 203 – Posted Weight Limit

306 digits

This item is determined by the Inspection Team Leader during routine inspection and entered into BrM. The Inspection Team Leader must check the posted loads against the most current Load Rating Summary Sheet. Check to see that all signs required to show restricted weight limit, reduced speed limit, or impaired vertical clearance are in place per the requirements of the MUTCD..

Nebraska requires weight limits be posted for the three legal trucks in Nebraska. (See Chapter 5, Load Rating for more information on load posting.)

If the structure is posted with a three-truck sign, code the sign weight limits in tons as shown in the table, as a six-digit number, left justified. Some single weight limit signs may still be in place on local roads. If the structure is posted with a single weight limit sign, code the weight limit as a two-digit or six-digit number, left justified, that shows the sign capacity in tons. If the bridge is not posted, code all six digits of this item with zeroes.

Condition Found	**Item 203A (2 digits)**	**Item 203B (2 digits)**	**Item 203C (2 digits)**
Three-truck sign	Truck 1, first weight limit on sign	Truck 2, second weight limit on sign	Truck 3, third weight limit on sign
Single-truck sign	Weight limit shown on the sign	Code two zeroes	Code two zeroes
No Load Posting	Code two zeroes	Code two zeroes	Code two zeroes

Capacity plates found on Nebraska structures are not to be coded as weight limits for this item.

Item 204 – FIPS County Code

3 digits

Counties shall be identified using the Federal Information Processing Standards (FIPS) codes given in the current version of the Census of Population and Housing – Geographic Identification Code Scheme. (Note: The FHWA records this information as Item 3 in their Inventory database. Numerically, equals the NE numeric code multiplied by 2 minus 1.)

Item 205 – FIPS Place Code

3 digits

Cities, towns, townships, villages, and other census-designated places shall be identified using the Federal Information Processing Standards (FIPS) codes given in the current version of the Census of Population and Housing - Geographic Identification Code Scheme. If there is no FIPS place code, then code all zeros. (Note: The FHWA records this information as Item 3 in their Inventory database.)

Item 206 – Federal Aid Route Number

4 digits

This is a code used in recording the federal-aid route number, prefixing with zeroes as applicable. If the route is not on the F.A. System, this field will be blank.

Item 207 – Highway Route Number

4 digits

This is a code used in recording route numbers contained in the IHI master file. These route numbers are used to automatically update Item 29, ADT. If the route is not on the IHI master file, this field will be blank.

Item 208 – State Classification of Inventory Route

1 digit

This is a one-digit code used to indicate the state classification of the inventory route.

Code	Description
1	Interstate
2	Expressway
3	Major Arterial – Principal
4	Major Arterial – Intermediate
5	Major Arterial – Non-Continuous
6	Major Arterial – Scenic Recreation
7	Other Arterials
8	Collectors
9	Local Minimum Maintenance Under Construction

Item 209 – Under Facility Name

25/AN characters

This is a 25-character field used to code the name of the facility for which the "under" structure measurements were taken.

Item 210 – Transporter-Erector Route Bridges

1 character

Record if the Transporter-Erector route is carried by the bridge or is a feature under the bridge at grade separations.
Code = M when the route is carried by the bridge or
Code = U when the route is running under the bridge. Leave this item blank when the bridge is not on the Transporter-Erector Route system.

Item 211 – Priority Commercial System Bridges

1 character

Code = Y if the route carried by the bridge is on the Priority Commercial System network.
Leave this item blank if the route carried is not on the network.

Item 212 – Bridge Rail

2 digits

Code	Description
01	New Jersey
02	Modified New Jersey
03	Concrete
04	Safety Curb – Aluminum Rail
05	Safety Curb – Steel Rail
06	Concrete Block
07	Two-Step Curb – Steel Rail
08	Guard Rail
09	Other
00	None

3-NE.6 NE DATA ITEMS – BRIDGE DECK AND APPROACHES

All of these Items that apply to a bridge must be coded by inspection Team Leaders on every routine inspection.

Item 301 – Percent of Defective Deck

2 digits

Code = the percentage of the curb-to-curb area of deck that is defective.
Concrete decks: Determine the percentage of the total deck area that is spalled and/or delaminated by chain dragging or sounding the deck area.
Timber decks: Determine the percentage of the total deck area that has loose or damaged planks.
Asphalt overlay or dirt/gravel cover: If the deck has been covered with asphalt, dirt or gravel so that the deck is not accessible for evaluations, the percent defective is to remain the same (not coded zero) regardless of the smoothness of the driving surface.
Concrete overlay: Determine the percentage of the total deck area that is spalled and/or delaminated by chain dragging or sounding the deck area.

Item 303 – Roadway Fixed and Expansion Devices (Condition)

1 digit

Code this item using the FHWA Condition Ratings Table codes. Bridge joints are found at the ends of the decks or at the grade beams. These joints can deteriorate to the point where storm water can cause extensive damage on the superstructure and substructure elements below the deck or create erosion or pressure on the abutment walls. The joint does not require a metal device to be considered a bridge joint. Any break in the riding surface that allows rotation or translation of the deck/slab is considered a bridge joint. Construction joints that are not permitted to move or rotate are not included in this item.

Item 306 – Asphalt and/or Gravel on Deck

3/AN characters

Record the average depth of asphalt and/or dirt on the deck in inches. A change in gravel or asphalt depth changes the load capacity. An increase can substantially decrease the available load capacity and a revised load rating is required.

Item	Character / digits	Code
306	2 digits	Average depth of asphalt and/or dirt on the deck in inches
306A	1 character	A = asphalt G = gravel

3-NE.7 NE DATA ITEMS – SUPERSTRUCTURE

Item 311 – Bearing Devices (Condition)

1 digit

Bearings devices are a separate structural device that transmit loads from the superstructure to the substructure. Bearing devices accommodate physical movement and/or thermal expansion and contraction of the superstructure. These devices also accommodate rotation of the superstructure caused by loads on the superstructure in the spans adjacent to the substructure. A superstructure stringer (steel or timber) setting on a pile cap does not have a bearing, though a steel-to-steel connection may be welded.

Photos guidance is provided for some common situations in Nebraska. Inspectors should review the BIRM for complete descriptions of bearing types.

Coding is based on the FHWA Condition Ratings codes and records the overall condition. Some examples are given.

Code	Condition	Comments
N	NOT APPLICABLE	For example: steel plates, bearing on pile cap.
9	EXCELLENT CONDITION	Functioning as intended. Alignment within design limits and appropriate for current conditions. Free of debris.
5	FAIR CONDITION	Functioning slightly restricted Alignment at or near design limits. Extensive corrosion/covered with debris
3	POOR CONDITION	No longer functioning as intended. In need of repair. Alignment beyond design limits. Primary bearing components have severe section loss.

Inspection notes should include information on the condition such as:

- The relative horizontal position between the superstructure and the substructure of bearing device and the ambient temperature at the time of the measurements.
- The condition of anchor bolts, such as rust, distortion or being sheared off.
- Any evidence that the bearing device has frozen and is not allowing deflection and rotation.

Item 311 Code: N not applicable
Description: Steel plates here are shims, not a bearing device

Item 311 Code: N not applicable
Description: Stringer is welded to cap. There is no bearing device

Item 311 Code: 5 FAIR
Description: Bearing has sole plate on cap and rocker plate under beam.

Item 311 Code: 6 SATISFACTORY CONDITION
Description: Pad appears to be functioning properly, concrete spall and bent anchor bolt appears to be due to slot being too short

Item 311 Code: 4 POOR
Description: Rocker has been pushed off sole plate, is off of center, and likely not functioning correctly, minor rust

3-NE.8 NE DATA ITEMS – SUBSTRUCTURE

Item 316 – Condition of Abutments

1 digit

Code this item using the FHWA Condition Ratings codes with NDOT guidance for Item 60 Substructure.
Abutments older than ten years, may, but typically won't be coded 9, especially if cracking in concrete is found.

Item 317 – Condition of Piers

1 digit

Code this item using the FHWA Condition Ratings codes with NDOT guidance for Item 60 Substructure.
Piers older than ten years, may, but typically won't be coded 9, especially if cracking in concrete is found.

Item 320 – Condition of Piling

1 digit

Code this item using the FHWA Condition Ratings codes with NDOT guidance for Item 60 Substructure.
If the pile is not visible, code this item "N".
If the pile condition warrants a Condition Rating of 2, this is a Critical Finding, and a Critical Finding Report must be filed and the bridge closed.
Pile condition can dramatically affect the calculated load rating for a bridge thus this item is also reported on the Load Rating Summary Sheet.

Item 321 – Piling Type

1 character

This item typically is coded in office from the plans, and not during a field inspection. Typically in Nebraska, piles are used to transfer loads from the bridge structure to the geological elements below. Some structures may have more than a single type of pile; in this case code the pile type for the longest span.

Code	Material Type	Comments
C	Concrete	Types of concrete pile used in Nebraska include prestressed pile and auger cast pile.
D	Drilled Shaft	Bridge is built on drilled shafts, typically founded on bedrock.
S	Steel	Some steel pile are encased in concrete and the steel portion will not be visible. This is determined from bridge plans.
T	Timber	
N	None	Bridge is built on spread footings which typically are founded on bedrock.

Item 322 – Mechanically Stabilized Earth Walls

1 character

Code = B for wall constructed with rectangular concrete panels.
Code = P for wall constructed with cruciform concrete panels.
Code = M for wall constructed with modular block units.
Code = N if no MSE walls are used on this structure.

3-NE.9 NE DATA ITEMS – CULVERT ITEMS

Inspectors should also review guidance in Chapter 6 Scour. If there are further questions, consult the Owner's Hydraulic Engineer or NDOT Bridge Hydraulics Manager.
The following list is a summary of items related to culverts. See the detailed description for each item.

Several items have been removed from NE Culvert coding in Revision 3. Those items have been stricken through.

Item No.	Description	Code
~~323~~	~~Culvert Barrel~~	~~0-9~~
324	Culvert Ends	0-9
~~325~~	~~Debris at Inlet~~	~~0-9~~
326	Embankment Erosion	0-9
~~327~~	~~Alignment with Structure~~	~~0-9~~
328	Flowline Drop at Culvert Inlet	Ft
329	Flowline Drop at Culvert Outlet	Ft
330	Silt in Barrel	Ft
~~335~~	~~Inspectors Opinion on Culvert Adequacy~~	~~Y,N~~
345	Structure Crosses a Canal	Y,N
346	Is Stream Bed Degraded	Y,N
347	Noticeable Contraction of Stream	Y,N
350	Stream Shifted from Center	Y,N
353	Potential Debris Upstream	Y,N
355	Structure Alignment with Flow	0-9
358	Is there a Scour (Hydraulic) Problem?	Y,N

Item 323 – Culvert Barrel – This Item has been removed, covered by Item 62

1 digit

Code this item using the FHWA Condition Ratings codes and Item 62 coding descriptions for hydraulic observations the barrel portion.

Item 323 Code: 9 EXCELLENT CONDITION
Description: No deficiencies

Item 323 Code: 7 GOOD CONDITION
Description: Minor cracking, Light Scaling

Item 323 Code: 5 FAIR CONDITION
Description: Distortion in the far upper left end section of culvert

Item 323 Code: 4 POOR CONDITION
Description: Wide Crack

Item 324 – Culvert Ends

1 digit

Culvert ends include the wing walls, headwalls and aprons. Code this item using the FHWA Condition Ratings codes and Item 62 coding descriptions for structural observations in culvert ends, wings, and aprons.

Item 324 Code: 9 EXCELLENT CONDITION
Description: No deficiencies

Item 324 Code: 4 POOR CONDITION
Description: Large spall, Exposed Rebar

Item 324 Code: 3 SERIOUS CONDITION
Description: Settlement of wing footing and undermining

Item 324 Code: 3 SERIOUS CONDITION
Description: Wingwall nearly severed

Item 325 – Debris at Inlet – This Item has been removed, covered by Item 61

1 digit

Code this item using the FHWA Condition Ratings codes and Item 61 coding descriptions for hydraulic observations for debris blocking the channel.

Item 325 Code: 8 VERY GOOD CONDITION
Description: Good open channel approach, No debris

Item 325 Code: 8 VERY GOOD CONDITION
Description: Barrels open to full flow

Item 325 Code: 5 FAIR CONDITION
Description: Trees and brush restrict the channel

Item 325 Code: 4 POOR CONDITION
Description: Large deposits of debris in the waterway blocking inlet

Item 326 – Embankment Erosion

1 digit

Code this item using these coding descriptions for erosion on the roadway embankment and around the wings. Erosion is caused by runoff around the structure, not by stream action.

Code	Description
N	Not applicable. Use when structure is not over waterway
9	There are no noteworthy deficiencies which affect the condition of the structure
8	Minor erosion adjacent to the structure
7	Minor erosion at wings
6	Embankment beginning to slump
5	Severe erosion at the wings
4	Shoulder compromised
3	Erosion at the roadway edge
2	Roadway compromised (Not severe)
1*	Structure closed – correct deficiencies
0*	Structure closed/failed - replace

*Requires Critical Finding

Item 326 Code: 9 EXCELLENT CONDITION
Description: No noticeable roadway embankment issues

Item 326 Code: 6 SATISFACTORY CONDITION
Description: Embankment is beginning to slump, protection is strained

Item 326 Code: 4 POOR CONDITION
Description: Shoulder compromised, roadway embankment is being eroded

Item 326 Code: 4 POOR CONDITION
Description: Shoulder compromised, roadway embankment is being eroded

Item 327 – Alignment with Structure – This Item has been removed, use Item 355

1 digit

Code this item using the FHWA Condition Ratings codes and Item 355. Inspectors should also review guidance in Chapter 6 Scour.

Item 327 Code: 9 EXCELLENT CONDITION
Description: Channel perpendicular to roadway

Item 327 Code: 3 SERIOUS CONDITION
Description: Poor alignment even with skewed barrels

Item 328 – Flowline Drop at Culvert Inlet

2 digits

Record the depth of drop in feet, right justified. Measure the deepest drop from the barrel floor to ground at the upstream edge of the culvert (to the nearest foot).

Item 327 Code: 5
Description: Tape shows close to 5 feet drop at inlet

Item 327 Code: 0
Description: Smooth entrance into culvert, Drop less than 6 inches

Item 329 – Flowline Drop at Culvert Outlet

2 digits

Record the depth of drop in feet, right justified. Measure the deepest drop from the barrel floor to ground at the downstream end of the culvert (to the nearest foot).

Item 329 Code: 4
Description: 4 feet drop at outlet

Item 329 Code: 0
Description: Smooth transition out of culvert, No drop at outlet

Item 330 Code – Silt in Barrel

2 digits

Record the average depth of silt in feet, right justified.

Item 330 Code: 5
Description: 5 feet average opening height in a 10 feet high box

Item 330 Code: 0
Description: Both barrels are clean

Item 335 – Inspectors Opinion on Culvert Adequacy – <u>This Item has been removed, use Item 358</u>

1 digit

This item is intended to indicate when a culvert needs a more in-depth hydraulic assessment. Code this item using the FHWA Condition Ratings codes and Item 62 coding descriptions for hydraulic observations. Inspectors opinion – Are there hydraulic issues?

Item 335 Code: Y
Description: Culvert ends are undermined, Stream flowing under the culvert

Item 335 Code: N
Description: No major issues evident

Item 359 – Size of Culvert and Other Data

8/AN characters

This is an eight-digit code made up of the following:

Item	Character / digits	Code
Item 359A	1 character	Code = B if structure is a box culvert. Code = P if structure is steel or concrete pipes. Code = F if structure is a frame-type culvert.
Item 359B	1 digit	Number of barrels or pipes.
Item 359C	2 digits	Span length measured perpendicular to culvert walls in feet of one box or pipe
Item 359D	2 digits	Height of box/pipe in feet
Item 359E	2 digits	This is the depth between the roadway surface and the top of the culvert's top slab. Record the depth of fill over the culvert which would represent the worst case condition for load rating the culvert, typically where the depth of fill is the **least** under the travelled way of the roadway surface, for example, at the edge of the travelled way. Each site is unique; inspectors should consider the slope of the top of the culvert and the cross slope of the roadway surface when recording the depth for this Item.

3-NE.10 NE DATA ITEMS – MISCELLANEOUS ITEMS

Item 342 – Total Number of Pins

2 digits

Record the total number of pins on the structure. All pins should be included, such as:

- Pins of pin-connected trusses
- Pins at both fixed and expansion bearing devices
- Pins in pin and hanger bridges

Item 343 – Snooper Bridge

1 character

Code = Y if snooper truck is needed for complete bridge inspection.
Code = N if inspection can be performed without the use of snooper.

3-NE.11 NE DATA ITEMS – BRIDGE SCOUR RELATED

The following list is a summary of items related to bridge scour. Inspectors should also review guidance in Chapter 6 Scour. If there are further questions, consult the Owner's Hydraulic Engineer or NDOT Bridge Hydraulics Manager.
See the detailed description for each item.

Several items have been removed from NE Bridge Scour coding in Revision 3. Those items have been stricken through.

Item No.	Description	Code
326	Embankment Erosion	0 – 9
344	Abutment Walls Undermined	Y, N
~~344A~~	~~Approach Settles/Washes Out~~	~~Y, N~~
345	Structure Crosses a Canal	Y, N
346	Is Stream Bed Degraded	Y, N
347	Noticeable Contraction of Stream	Y, N
348	Local Scour at Piers/Abutments	See detail
~~349~~	~~Banks Eroding/Unstable~~	~~Y, N~~
350	Stream Shifted from Bridge Center	Y, N
~~351~~	~~Floodwater Reaches Low Superstructure~~	~~Y, N~~
~~351A~~	~~Low Road Elevation Above Low Superstructure~~	~~Y, N~~
~~352~~	~~Floodwater Over Bridge Deck or Roadway~~	~~Y, N~~
353	Potential Debris Upstream	Y, N
354	Bents/Piers in Channel	Y, N
354A	Flow Against Abutment	Y, N
355	Structure Alignment with Flow	0 – 9
~~356~~	~~Debris Blocking Channel at Bridge~~	~~Y, N~~
357	Drop from Upstream Deck to Flowline	Ft.
357A	Drop from Upstream Deck to Ground at Abutment 1	Ft.
357B	Drop from Upstream Deck to Ground at Abutment 2	Ft.
358	Is there a Scour Problem	Y, N
~~358A~~	~~Significant Flood in Last Two Years~~	~~See detail~~
~~358B~~	~~Scour Increased in Last Two Years~~	~~See detail~~
358C	Scour Plan of Action Effective Date	See detail

Item 344 – Abutment Walls Undermined

1 character

Code = Y if embankment has been scoured out from under the abutment or the wingwalls.
Code = N if there is no evidence of undermining present.

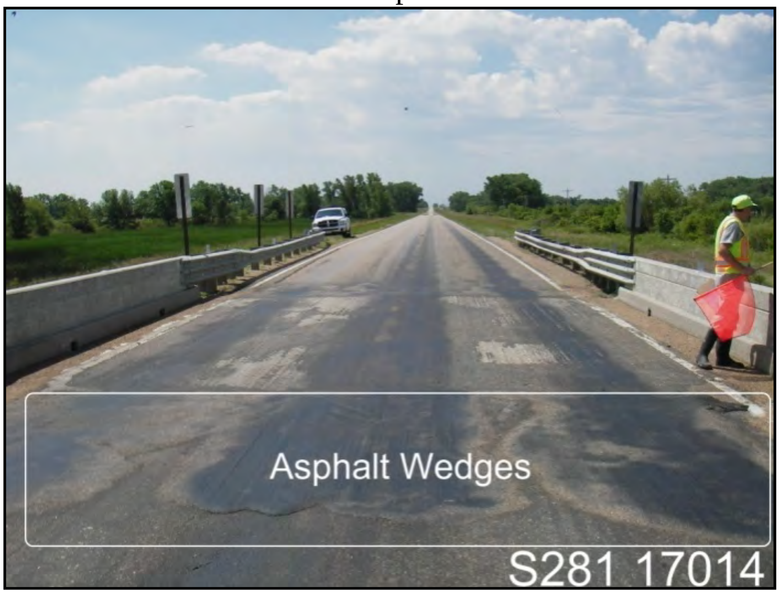
Item 344 Code: Y
Description: The bottom of the abutment wall is exposed.

Item 344 Code: N
Description: The bottom of the abutment is not exposed.

Item 344A – Approach Settles/Washes out – <u>This Item has been removed</u>

1 character

Code = Y if there is evidence observed that the approach embankment has settled or appears to have washed out due to stream flow.
Code = N if there are no clues present.



Item 344A Code: Y
Description: The approach is settled or asphalt wedge indicates past settlement.

Item 344A Code: Y
Description: Evidence the abutment wall has washed out from a past flood.

Item 345 – Structure Crosses a Canal

1 character

This item is included to separate waterways with controlled stream flow from natural rivers and streams which can have uncontrolled, variable flow. In Nebraska canals are used for power generation and for irrigation.
Code = Y if the bridge crosses a canal.
Code = N if not.

Item 345 Code: Y
Description: The bridge is over a canal.

Item 345 Code: N
Description: The bridge is over a natural channel.

Item 346 – Is Stream Bed Degraded

1 character

This item may be completed by comparing field measurements to dimensions on plans, or by noting past soil marks on substructure. Stream degradation is common on streams where the channel has been straightened. Streambed degradation that is localized in nature is better coded as Scour, Item 348.
Code = Y if stream bed degradation is noticeable.
Code = N if there are no clues present.

Item 346 Code: Y
Description: The channel has degraded. Degraded channels typically have a secondary berm below the high bank, channel banks have sloughed, the trunks of trees are not vertical due to bank sloughing and channel head cutting may be evident.

Item 346 Code: N
Description: The channel has not degraded. Typically natural channels only have the capacity for a 2 year flood.

Item 347 – Noticeable Contraction of Stream

1 character

Bridges should span over the channel with abutments above the high bank of the stream. It is common that the distance between abutments is less than top width of typical channel. When stream flow contracts to flow through an opening, berms below the abutment typically are washed out.
Code = Y if bridge constricts channel flood flows.
Code = N if bridge length is greater than top of channel width

Item 347 Code: Y
Description: Bridge is shorter than the top of channel with no berms at abutments.

Item 347 Code: N
Description: Bridge is longer than the top of channel. Note: Channel shifted into an abutment is **not** an indication the bridge is too short. A typical bridge spans the berms and channel.

Item 348 – Local Scour at Piers/Abutments

1 character

Note if local scour hole(s) is/are observed near any of the substructures.
Code = A if berm scour is present at either abutment.
Code = B if scour holes are present at bents or piers.
Code = C if scour holes are present at both locations.
Code = N if no is evident.

Item 348 Code: A
Description: Berm scour is evident at an abutment.

Item 348 Code: B
Description: Scour holes are evident at the bents/piers.


Item 348 Code: C
Description: Scour is evident at an abutment and bent/pier.

Item 348 Code: N
Description: No evidence of Scour. Note: Channel degradation is not considered Local/Contraction Scour.

Item 349 – Banks Eroding/Unstable – This Item has been removed, covered by Item 61

1 character

Code = Y if the banks are eroding or unstable.
Code = N if banks are stable and vegetated.

Item 349 Code: Y
Description: The channel's bank is eroding and unstable.

Item 349 Code: N
Description: The channel's bank is stable and vegetated.

Item 350 – Stream Shifted from Center

1 character

Code = Y if the main channel is not centered with the bridge
Code = N if the main channel is centered with the bridge.

Item 350 Code: Y
Description: There is a significant shift of the channel from the bridge center.

Item 350 Code: N
Description: The channel is aligned with the center of the bridge.

Item 351 – Floodwater Reaches Low Superstructure – <u>This Item has been removed, covered by Item 71</u>

1 character

Code = Y if there is evidence of floodwater reaching superstructure.
Code = N if no evidence flood water reaching superstructure.

Item 351 Code: Y

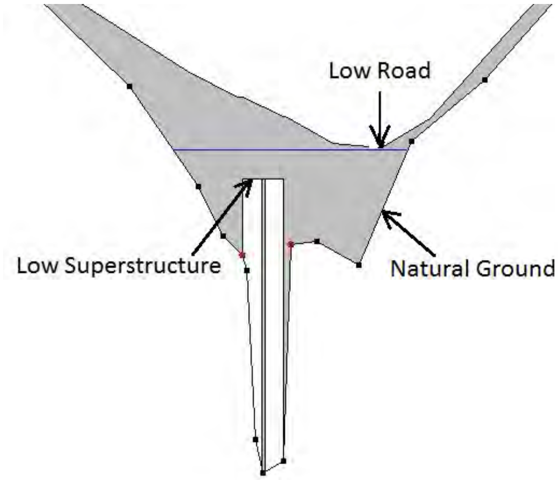
Description: Evidence of debris in the superstructure and/or the low superstructure is below the channel high bank elevation. Indicating floodwater can get to and above low superstructure.

Item 351 Code: N
Description: No evidence floodwater reaches low superstructure.

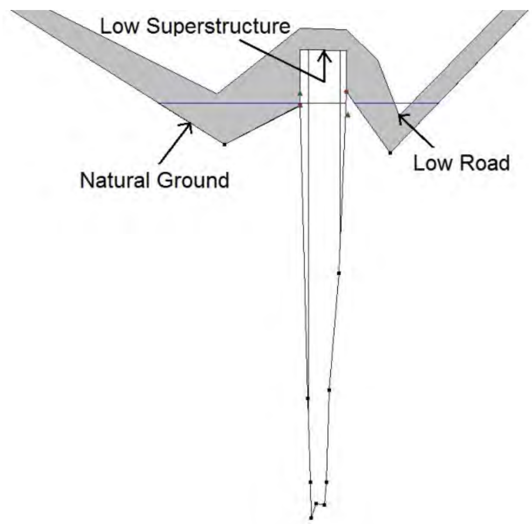
Item 351A – Low Road Elevation Above Low Superstructure – <u>This Item has been removed, covered by Item 71</u>

1 character

Code = Y if low road grade, within floodplain, is above low superstructure elevation.
Code = N if low road grade, within floodplain, is below low superstructure elevation.



Item 351A Code: Y
Description: Low Road (within floodplain) is at a higher elevation than the low superstructure. Indicating floodwater can reach the superstructure should road overflow occur. Floodwater reaches the low superstructure before road overflow occurs; this creates pressure flow through the bridge opening and increases the scour until road overflow occurs.



Item 351A Code: N
Description: Low Road sag elevation is below the low superstructure elevation. Adjacent roadway is below the low superstructure allowing flood relief and minimizing scour.

Item 352 – Floodwater Over Bridge Deck or Roadway – <u>This Item has been removed, covered by Item 71</u>

1 character

Code = Y if there is evidence of flood water over road.
Code = N if there is no evidence of flood water over road.

Item 352 Code: Y
Description: Floodwater can go over the roadway at any location.

Item 352 Code: N
Description: Floodwater does not go over the roadway at any location.

Item 353 – Potential Debris Upstream

1 character

Code = Y if there are established trees, bushes or other woody debris in the upstream channel.
Code = N if there is no evidence of significant debris upstream

Item 353 Code: Y
Description: Upstream view indicates significant debris in and along channel bank can wash down during a flood and restricting flow through the bridge opening.

Item 353 Code: N
Description: Upstream view indicates minimal amounts of debris along channel bank and restricting flow through the bridge opening is unlikely.

Item 354 – Bents/Piers in Channel

1 character

Code = Y if piers or bents are located in the main channel. At high water conditions this may create a scour problem.
Code = N if piers and bents are outside of the main channel and clear of the water.

Item 354 Code: Y
Description: Bents/piers are located within the main channel banks.

Item 354 Code: N
Description: Bents/piers are not located within the main channel banks

Item 354A – Flow Against Abutment

1 character

Code = Y if the stream flows against one or both abutments. This creates a problem for inspection and may also be hiding evidence of undermining. If the depth of the abutment wall is unknown, then it may need to be coded Scour Critical.
Code = N if the stream does not flow against either abutment.

Item 354A Code: Y
Description: The stream flows against one or both abutments.

Item 354A Code: N
Description: The stream flow is away from both abutments.

Item 355 – Structure Alignment with Flow

1/AN character

Observe and record the direction of the approaching stream flow during high water relative to the substructure of the bridge. Note that the direction of the approaching stream may be different during high water than during normal flow. Flow parallel to the substructure will cause minimal local scour. As the approach angle of flow increases, the amount of local scour increases. Code this item from 0 to 9 based on the approach angle of stream flow during high water relative to substructure.

Code = 9 when stream flow is parallel to substructure. Stream flow approach angle is 0°.

Code = 0 when stream flow is perpendicular to substructure. Stream flow approach angle is 90° (typically impossible).

Code	Stream approach angle relative to substructure
9	0°
8	5°
7	10°
6	15°
5	20°
4	30°
3	45°
2	60°
1	70°
0	90°
N	Not applicable

Item 355 Code: 4

Description: Direction of approaching stream flow relative to the piers of the bridge is approximately 30 degrees.

Item 356 – Debris Blocking Channel at Bridge – <u>This Item has been removed, covered by Item 61</u>

1/AN character

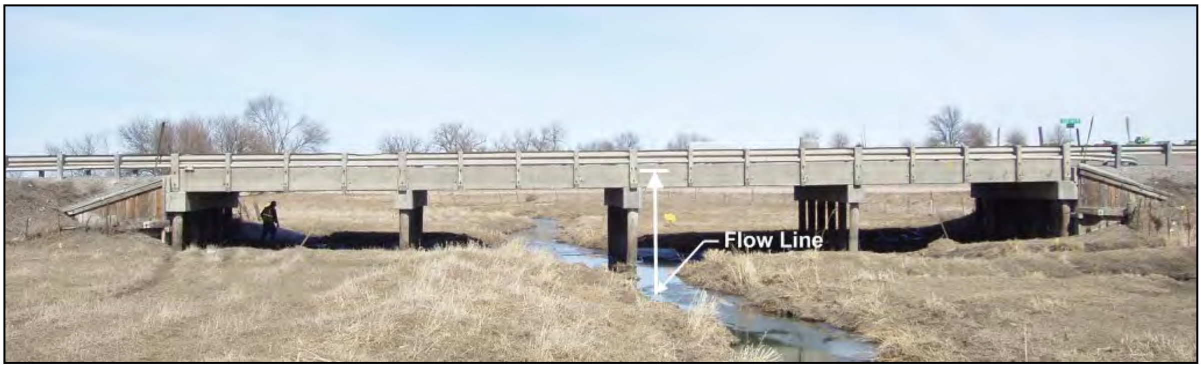
Code = Y if a significant amount of debris is lodged against structure.
Code = N if no significant debris lodged against structure.

Item 356 Code: Y
Description: Significant amount of debris is lodge under bridge.

Code	Description
N	No Significant debris is lodged under bridge.

Item 357 – Drop from Upstream Deck to Flowline

2 digits



Item 357 Code: Distance in feet.

Item 357A – Drop from Upstream Deck to Ground at Abutment No. 1

2 digits

Item 357A Code: Distance in feet.

Item 357B – Drop from Upstream Deck to Ground at Abutment No. 2

2 digits

Item 357B Code: Distance in feet.

Item 358 – Is There a Scour Problem

1 character

Code = Y if it appears a scour problem exists
Code = N if scour problem does not exist
The following questions should be reviewed by the inspector:

- Does the stream flow against only one abutment?
- Does the stream flow against both abutments?
- Does the stream have a sharp bend just upstream?
- Is the bottom of the abutment wall visible?
- Has the channel degraded (lowered) significantly?
- Does it appear that rip-rap has been installed for more than a single event?
- Does debris build-up upstream redirect flow toward an abutment?

Item 358 Code: Y
Description: When there is visual indication the substructure is in danger of washing out. This includes but not limited to channel shift against abutments, berm washed out and abutment undermined.

Item 358 Code: N (No Picture Shown.)
Description: When there is visual indication the substructure will remain stable during large floods. This includes but not limited to channel centered through bridge, stable berms, and counter measures in place.

Item 358A – Significant Flood in the Last Two Years – <u>This Item has been removed</u>

1 character

Code = A if there was significant flood with flow over road. This includes but not limited to high water marks above road and flood reports from the public.
Code = B if there was a significant flood without flow over road. This includes but not limited to high water marks below road and flood reports from the public.
Code = N if there is no evidence of significant flood. This includes but not limited to high water marks below road and no flood reports from the public.

Item 358B – Scour Increased in the Last Two Years – <u>This item has been removed</u>

1 character

Code = Y if scour conditions under the bridge are worse than conditions at the last inspection
Code = N if scour conditions are not worse

Item Code: Y
Description: There is evidence that the bridge water way area has scoured, from a flood, within the last two years. Compare with photos from previous inspection.

Item Code: N (No Picture Shown.)
Description: The water way area has not changed within the last two years. Compare with photos from previous inspection.

Item 358C – Scour Plan of Action Effective Date

See description

Record the effective date of the most current Scour Plan of Action. The format is mm/dd/yyyy.

3-NE.12 NE DATA ITEMS – UNDERWATER INSPECTION

Rate the condition of the underwater items with the NBI condition ratings.

Item 360 – Piling

1 digit

All piling should be inspected for signs of distress including evidence of cracking, checking, splitting, section loss, settlement, misalignment, scour, collision damage, abrasion and corrosion.

Item 361 – Bracing and Connectors

1 digit

All bracing and connectors should be inspected for signs of distress. The inspector should note missing, bent or corroded connectors, as well as any loss of section in the connector due to corrosion, decay or deterioration.

Item 362 – Columns and Wall

1 digit

Concrete columns and walls should be inspected for signs of misalignment, cracking, scaling, spalling, abrasion or chemical attack.

Item 363 – Footing

1 digit

Footings should be inspected for signs of misalignment, cracking, scaling, spalling, abrasion and scour.

Item 364 – Scour - This Item has been removed

1 digit

Rating for scour should include the type of material on the bottom of the waterway, its relative density, and the presence and condition of riprap.

Item 365 – Debris

1 digit

Channel bottom should be inspected for any material that will cause physical damage to the integrity of the structure.

3-NE.13 NE DATA ITEMS – MAINTENANCE AND FOLLOW-UP

Item 377 – Maintenance Problem

25 digits

This item is used to flag problems found during inspection. This can be minor maintenance to major repair. It is up to the bridge owner to determine the type of problems to be flagged. Note that missing posting signs or closure barricades are a critical finding.

Item 378 – Date Maintenance Flagged

4 digits

Record as a series of 4-digit code segments, the month and year, (MMYY), that the maintenance problem was flagged. The number of the month should be coded in the first 2 digits with leading zeros as required and the last 2 digits of the year coded as the third and fourth digits of the field.

Item 379 – Recommendations

25/AN characters

This item is used to record recommendations for the maintenance flag. Examples are "do nothing" or "replace structure." Notes should be as specific as possible.

Item 380 – Critical Finding Outstanding

1/AN character

This item is used by NDOT to track the status of Critical Findings.
Code = Y if there is a reported Critical Findings that is still outstanding and awaiting closure.
Code = N if prior known Critical Finding is closed.

3-NE.14 NE DATA ITEMS – LOAD RATING

Item 380 – Percent of Stress Reduction

2 digits

This item is not used. This item is shown in this section only to inform Manual users that this item is no longer used in the Nebraska Bridge Inventory. Historically, this was the amount the stresses have been reduced due to superstructure damage or deterioration.

Item 381 – Load Rating Program Used

1 digit

This is determined by the Load Rating Engineer and provided on the Load Rating Summary Sheet, then entered in BrM by the Program Manager Staff. Record the rating method used to determine Inventory and Operating Ratings.

Code	Program Used	Load Rating Method
01	BARS P.C.	Load Factor
02	BARS Mainframe	Load Factor
03	BRASS	Load Factor
04	VIRTIS	Load Factor
05	Hand Calculation	Load Factor
06	BARS P.C.	Working Stress
07	BARS Mainframe	Working Stress
08	BRASS	Working Stress
09	VIRTIS	Working Stress
10	NDOT Timber Program	Working Stress
11	NDOT Steel Program	Working Stress
12	Consultant Program	Working Stress
13	Hand Calculation	Working Stress
14	Not used	
15	LARS	Load Factor
16	LARS	Load & Resistance Factor Rating
36	NDOT internal use only	Assigned Rating
37	na	NDOT Policy
38	na	Engineering Judgment
99		

Item 384 – HS Inventory Rating

This item is not used. This item is shown in this section only to inform Manual users that this item is no longer used in the Nebraska Bridge Inventory.

Item 385 – HS Operating Rating

This item is not used. This item is shown in this section only to inform Manual users that this item is no longer used in the Nebraska Bridge Inventory.

Item 386 – Calculated Load Rating for Nebraska Legal Trucks

6 digits

This is determined by the Load Rating Engineer and provided on the Load Rating Summary Sheet, then entered in BrM by the Program Manager Staff. If these calculated tonnage values are less than the Gross Legal Weight for any of these trucks, then the bridge must be load posted. The load posting values recommended by the LRE shall be used on the posting sign. This is a six-digit code made up of the following:

Item	Truck	Gross Legal Weight	Character / digits	Item 386 Code
386A	Type 3	25 Tons	2 digits	LRE recommended tonnage
	SU4	27 Tons		
	SU5	31 Tons		
	SU6	34.75 Tons		
	SU7	38.75 Tons		
386B	Type 3S2	37 Tons	2 digits	LRE recommended tonnage
386C	Type 3-3	43 Tons	2 digits	LRE recommended tonnage

Item LOD_RAT_D – Load Rating Date_<u>This item has been removed</u>

6/AN characters

This date is gathered by BIP Staff from the Load Rating Summary Sheet.

Item LOD_RAT_N – Load Rating Engineer ID_<u>This item has been removed</u>

6 digits

The Load Rating Engineer inputs their own NE Professional Engineer License number (excluding the “E” shown at the beginning of a NE engineering license number) in the Load Rating Summary Sheet. This data is gathered by BIP Staff from the Load Rating Summary sheet.

3-NE.15 NE DATA ITEMS – INSPECTION STAFF

Item	Description	Code Length /Type
BIR_RAT_INSPECTOR	Inspection Team Leader ID	6 A/N characters
BRG_INSP_1	Assistant Inspector 1 ID	6 A/N characters
BRG_INSP_2	Assistant Inspector 2 ID	6 A/N characters
BRG_INSP_3	Assistant Inspector 3 ID	6 A/N characters
BRG_INSP_4	Assistant Inspector 4 ID	6 A/N characters

A Team Leader or Assistant Inspector ID consists of the person's initials from their first and last names followed by the last four digits of their Social Security Number.

All Team Leaders are required to have an inspector ID prior to completing any inspections in Nebraska. An inspector ID is recommended for Assistant Inspectors but is not required.

3-NE.16 QUALITY CONTROL

The NBIS defines 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."

Quality Control is defined for NDOT's program as a system of routine technical activities, to measure and control the quality of the bridge inventory data or report as it is being developed. The QC system is designed to include general methods such as accuracy checks on data acquisition and calculations, and the use of approved standardized procedures for measurement, calculation, recording information and reporting. QC activities include:

- Documents, data, or calculations signed by a PE, must have QC completed by an individual of equivalent or better qualifications than the originator (this is typically documented when the QC individual signs or initials the documents).
- See that the technical activity has followed procedures set by NDOT.
- Providing routine and consistent checks for data integrity, correctness and completeness.
- Identifying and address errors and/or omissions.
- Documenting inventory data.
- Recording all QC activities.

Quality Control for this program is the responsibility of the consultant or agency actually conducting the activity. Quality Control checks are conducted on every product of a program operation, and thus at a much higher frequency than quality assurance checks. When the QC on a program product is complete, it is finished and deliverable to the Bridge Owner for their records.

Consultants providing professional services to Bridge Owners must submit a Quality Control plan to the Bridge Owner for review and approval. QC must be done on the deliverables prior to submittal to the Bridge Owner.

NDOT completes QC on data that has been entered into the BrM database on a continual basis.

3-NE.17 QUALITY ASSURANCE

Quality Assurance (QA) of all load rating data in the bridge inventory will be performed by NDOT or their selected agent. The QA program activities are described in Chapter 1 of this Manual.

3-NE.18 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1
2	2013 March 04	Revision 2
3	2015 March 15	Revision 3
4	2016 March 11	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

3-NE.19 FORMS

Forms used in completing inspections that are mentioned in this Chapter are listed below. Participants and contributors to the Nebraska Bridge Inspection Program are advised to go to the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/ for the current list of applicable forms and the most recent versions of each form.

Name	DR Form
Structural Inventory and Appraisal	N/A

3-NE.20 APPENDIX

Memos and other guidance that may have been issued after the issuance of the current revision of this Chapter can be found at the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/.
Participants are urged to check this site to ensure they have all the most current information and forms.

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3-EI.1 GENERAL

The Moving Ahead for Progress in the 21st Century Act (MAP-21) required each state and appropriate Federal agencies to report bridge element level data to the US Department of Transportation Secretary. The Federal Highway Administration (FHWA) will use the data to review condition of bridges on the National Highway System (NHS) for evaluation of state transportation agency results as part of MAP-21 required National Highway Performance Program.

More importantly, gathering Element Inspection (EI) data provides Bridge Owners with a more detailed picture of the health of their bridges than the broad Nattional Bridge Inventory (NBI) Condition ratings (superstructure, substructure, deck and culvert) that have been collected for all bridges, both on and off the NHS since the National Bridge Inspection Standards (NBIS) were established in the 1970s. Condition ratings and other functional and geometric data for bridges allowed FHWA to use the Sufficiency Rating for funding prioritization.

The overall condition ratings have not allowed Owners to identify localized problems (i.e. issues with protective systems such as paint, or failure of bridge joints and the resultant damage to major elements), identify repairs, or develop actions needed to preserve their assets.

Detailed data from EI allows Owners to manage their bridge inventory more effectively, allowing them to:

- Quantify and describe element condition observed during inspection and the extent of deterioration.
- Identify candidates for preservation, maintenance, rehabilitation, improvement (i.e. widening, raising, strengthening) and replacement practices/strategies.
- Predict future deterioration of bridge elements for schedule purposes.
- Manage their budgets for bridge preservation.

FHWA is working with state agencies nationwide to help them improve their Bridge Management Systems “to do the right activity, to the right bridge, at the right time and at the right cost.”

Bridge EI has been in use by other state transportation agencies since the 1990s. NDOT will begin use of EI beginning in 2014. Local Bridge Owners are encouraged, but not required to use EI to help them manage and preserve their bridges.

3-EI.2 REFERENCES

The information in the NDOT's Bridge Inspection Program Manual supplements requirements, procedures, and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP)

The References list of documents applicable to bridge inspection is included in the Manual Appendix. The current National Bridge Inspection Standards (NBIS) are also included in the Appendix. FHWA anticipates these will be revised.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in National Bridge Inspection Standards, the AASHTO *Manual for Bridge Element Inspection*, the AASHTO *Manual for Bridge Evaluation*, and FHWA publications, technical advisories and publications related to the NBIS.

The NBIS takes precedence over any material contained in the reference manuals i.e. AASHTO Manual. Where there may be implied or conflicting language between the documents, the nationwide direction provided by the NBIS will always govern.

3-EI.2.1 Element Inspection

Element Inspection in this Chapter is based on The AASHTO *Manual for Bridge Element Inspection*, First Edition, 2013, and current interims. The condition reporting is based on standard National Bridge Elements (NBEs), standard Bridge Management Elements (BMEs) and Agency Defined Elements (ADEs). AASHTO has also defined standard defects for four condition states (Good, Fair, Poor, Severe). An agency can also define Agency Defined Defects (ADDs) using the four condition states. ADEs may also be sub-elements of NBEs or BMEs.

The following publications are the background and early information on Element Inspection:

- 1985 – NCHRP Project 12-28: Bridge and Pontis Management software
- 1987 – NCHRP Report 300: Element based Bridge Management Systems (BMS)
- 1993 – FHWA CoRe Element Report recommendations
- 1996 – AASHTO CoRe Element Guidelines adopted (2002 & 2010 Interim Revisions)
- 2011 – AASHTO Guide Manual for Bridge Element Inspection, First Edition

3-EI.2.2 NBI and Other Inspection Data

The FHWA National Bridge Inventory includes Item 1 through Item 116. The definitions, descriptions and guidance for use are in a separate chapter of the BIP Manual, Chapter 3-NBI, these items print on a structure's Structural Inventory and Appraisal (SI&A) report.

The 200 series and 300 series NE custom data fields used by NDOT are not submitted to the FHWA. The NE items do not print on a structure's Structural Inventory and Appraisal (SI&A) report.

These were developed by the NDOT Bridge Division and are used for bridge maintenance and bridge management purposes. The assignment of a particular rating or code to any item will only indicate that action is required or desired, but will not imply that action will be taken or is pending.

The following list is a summary of NE items related to hydraulic waterway evaluation for bridges that still need to be recorded with element inspection.

NE Item No.	Description	EI Inspection
344	Abutment Walls Undermined	Defect Flag (6000)
344A	Approach Settles/Washes Out	Deleted
345	Crossing a Canal	See Ch 3-NE
346	Stream Bed Degradation	See Ch 3-NE
347	Noticeable Contraction of Stream	See Ch 3-NE
348	Local Scour at Piers/Abutments	Defect Flag (6000)
349	Banks Eroding/Unstable	Deleted – covered by Item 61
350	Stream Shifted from Center	See Ch 3-NE
351	Floodwater Reaches Low Superstructure	Deleted – covered by Item 71
351A	Low Road Elevation Above Low Superstructure	Deleted - covered by Item 71
352	Floodwater Over Bridge Deck or Roadway	Deleted – covered by Item 71
353	Potential Debris Upstream	See Ch 3-NE
354	Bents/Piers in Channel	See Ch 3-NE
355	Alignment with Flow	See Ch 3-NE
356	Debris Blocking Channel at Bridge	NDOT BME 9552
357	Drop from Upstream Deck to Flowline	See Ch 3-NE
357A	Drop from Upstream Deck to Ground at Abutment 1	See Ch 3-NE
357B	Drop from Upstream Deck to Ground at Abutment 2	See Ch 3-NE
358	Is there a Scour Problem	Defect Flag (6000)
358A	Significant Flood in Last Two Years	Deleted
358B	Scour Increased in Last Two Years	Defect Flag (6000)
358C	Scour Plan of Action Effective Date	See Ch 3-NE

The following list is a summary of NE items related to culverts that still need to be recorded with element inspection.

NE Item No.	Description	EI Inspection
323	Culvert Barrel	Deleted – covered by Item 62
324	Culvert Ends	EI Element Wingwall & Headwall
325	Debris at Inlet	NDOT BME 9552
326	Embankment Erosion	See Ch. 3-NE.
327	Alignment with Structure	Deleted – utilize Item 355 for both Bridges & Culverts
328	Flowline Drop at Culvert Inlet	See Ch. 3-NE
329	Flowline Drop at Culvert Outlet	See Ch. 3-NE
330	Culvert Silt in Barrel	NDOT BME - 9553
335	Inspectors Opinion on Culvert Adequacy	Defect Flag (6000)

3-EI.3 ELEMENT INSPECTION BASICS

NDOT uses AASHTOWare BrM Software for recording all bridge inspection data, both element inspections and non-element inspections.

There are approximately 3,600 bridges in Nebraska that are State owned or on the National Highway System (NHS). The majority of NHS bridges are owned by the State.

3-EI.3.1 Structural Span Units – Basics

Structure Units are used to group and organize elements. A bridge may have one or more structure span units, and these may correspond to spans, or groups of spans.

The superstructure material, design, and construction affect reporting of element inspection data. NBI Items 43 A & B report material/design/construction (MDC) for a bridge; Items 44 A & B report the MDC for approach spans, if different from the main span.

Generally, bridges with a single material/design/construction will be reported as a single structural span unit in BrM and recorded with the total quantity of each element on the bridge. For example, a 200-foot, three-span, prestressed concrete continuous beam bridge with four girder lines will have 800 linear feet of the element Prestressed Concrete Girder/Beam, NBE 109.

If an inspector has questions concerning how to determine the structure span unit for major highway bridges with joints or interchange bridges with ramps/gores, they should contact the Bridge Division and review bridge plans for direction.

3-EI.3.2 Elements – Basics

Elements are quantified from the plans prior to the inspection. If plans are not available, field measurements will be the source of the information to develop the elements and their quantities. There are some elements that can only be identified correctly from plans, such as pier pile that are surrounded by concrete for protection.

A typical bridge is composed of a deck, substructure and a superstructure. The substructure is the portion of the bridge that supports the superstructure and distributes all bridge loads to the ground. It includes spread footings, piles, pile caps, pier columns, pier walls, and abutments or beam seats. The superstructure is the portion of the bridge that supports the deck and connects one substructure element to another. It includes bearings, girders, diaphragms and bracing, decks, deck overlays, and railing/parapets. The deck is the surface on which vehicles drive and/or pedestrians walk and transferes the loads to the superstructure.

NBEs are the primary load-carrying components of bridges needed to determine the overall condition and safety of the structure. BMEs are secondary features that owners typically monitor and manage because they can affect the long-term durability of the primary load-carrying elements. These BMEs include protective systems such as paint, deck overlays, and deck joints.

Element quantities are reported in set units of measure (SF, LF, EA). A simple average bridge made of the same MDC may have three to ten elements. A more complex bridge may have up to 20 elements.

The total quantity of the element is reported, as well as the quantity of the element in each of the four condition states.

3-EI.3.3 Environment – Basics

Elements are assigned an environment which indicates the likelihood that the element may deteriorate. AASHTO has defined four environments: Benign, Low, Moderate, and Severe. NDOT has defined a fifth environment: Hidden.

Environment states are for:

1) Capturing environmental conditions that an element must function.
2) The likelihood of failure during service.

3-EI.3.4 Defects and Condition States – Basics

The AASHTO standard defects are included in this Chapter for the convenience of the inspector.

NDOT has also defined defects for state use that are in addition to the standard defects. For each defect, the four condition states are described in detail.

All elements shall have associated defects (unless element determined to be in condition state 1). Defects are unique to the element and element material (i.e. concrete, steel, timber, etc.). It is the inspector's responsibility to determine the appropriate defects per unit of measure of the element to be listed under the element on the report.

Given that all elements are three diminsional, where multiple condition states exist within a unit of measure only the predominant defect in severity and extent is recorded. Given multiple defects of the same condition state within a unit of measure, the inspector will determine the defect that is controlling the deterioration and shall be the only defect reported for that unit of measure. The other overlapping defects located within the unit of measure shall be captured by the inspector under the element note or appropriate defect notes. The sum of all of the reported quantities in each condition state must equal the total quantity of the element. This will quantify the element's condition state.

Additional element condition language is referenced in Section 3-EI.6 Element Condition Language.

3-EI.4 ELEMENT INSPECTION INPUT INTO BRM

EI data is input by the Program Management (PM) Staff and TLs.

The PM Staff inputs those types that are typically static type items (total quantities for each element).

The TL inputs quantities of each element in the condition state noted during inspection.

TL also must provide notes related to their inspection.

Element Inspection comments are required for any element rated in Condition State (CS)-3 or CS-4. These comments shall be recorded as element level comments on the elements grid of the BrM.

Inspection level notes shall be recorded on the notes summary tab.

When a condition state is deemed to be a CS-4 it is a Critical Finding and NDOT requires that the structure be closed. The intent is that if the Owner wishes to open the bridge, then a bridge engineer will review the structure (typically, an inspector is not a bridge engineer). After the review, the bridge can be opened if the structural review and analysis allows or the engineer’s opinion is that the bridge can be opened. A Critical Finding Report must show and document the decisions. See Chapter 4 Bridge Inspection for instructions on notifications and filing this report.

3-EI.5 SPAN UNITS/ENVIRONMENTAL STATES

3-EI.5.1 Span Units

The inventory of elements and conditions will need to be completed, identified and grouped by spans. Currently there are two acceptable methods for grouping bridge elements:

By each physical span of the bridge (i.e. span-by-span) or,

By elements grouped by common design and material superstructure combinations.

Based on the following information, the NDOT decided to group their bridge elements by common design and material superstructure combinations and not by each physical span of the bridge.

For each grouping method, element records were created from the information contained in the NDOT bridge asset management database. After analyzing the results for each grouping method, the following conclusions were derived:

- Regardless of the grouping method selected, the number of records that will be required for describing a bridge increases exponentially as the number of span groups increases.
- The span-by-span data set had a significant increase in the number of base elements by a factor of nearly 4-to-1 over the design and material superstructure combination data sets. Please note that the increased number of elements did not provide enough additional information in order to allow project development and maintenance activities to pinpoint future project needs based on element data alone.
- Notes on defects and/or future project needs would not be reduced by collecting the additional data required by the span-by-span method.
- Regardless of the grouping method utilized, picture and defect locations are still required as part of the inspection and the number of notations would still be the same.
- By utilizing a smaller dataset, data accuracy would be increased.
- By utilizing a smaller dataset, the amount of effort required to perform data management would be reduced.

The span unit code and sequence number will have a specific designation and is based on the following:

- Units and elements will be numbered increasing from the south to the north or from the west to the east (see following examples).
- Elements will be assigned a span unit type based on the span hierarchy that is defined in NBI Items 43 and 44. In addition, an NDOT span type has been defined to account for the paving section that leads to the beginning of the bridge. The span unit hierarchy types are:
    - Main Span – This span is defined in NBI Item 43, is the highest within the hierarchy and will have a span starting sequence number of “1” with a span unit code of “M”.
    - Approach Spans – These spans are defined in NBI Item 44 or as additional spans that were not defined in either NBI Items 43 or 44 and will be assigned the next sequence number after the main span with a span unit code of “A”. Each additional approach span will be assigned the next sequence number but retain the same span unit code of “A”.
    - Paving Spans – These spans are defined as the spans that approach the bridge and are comprised of grade beams, grade beam piles and/or paving slabs. Paving spans will be assigned the next sequence number after the main span and/or approach spans in conjunction with a span unit code of “P”. Each additional paving span will be assigned the next sequence number but retain the same span unit code of “P”.

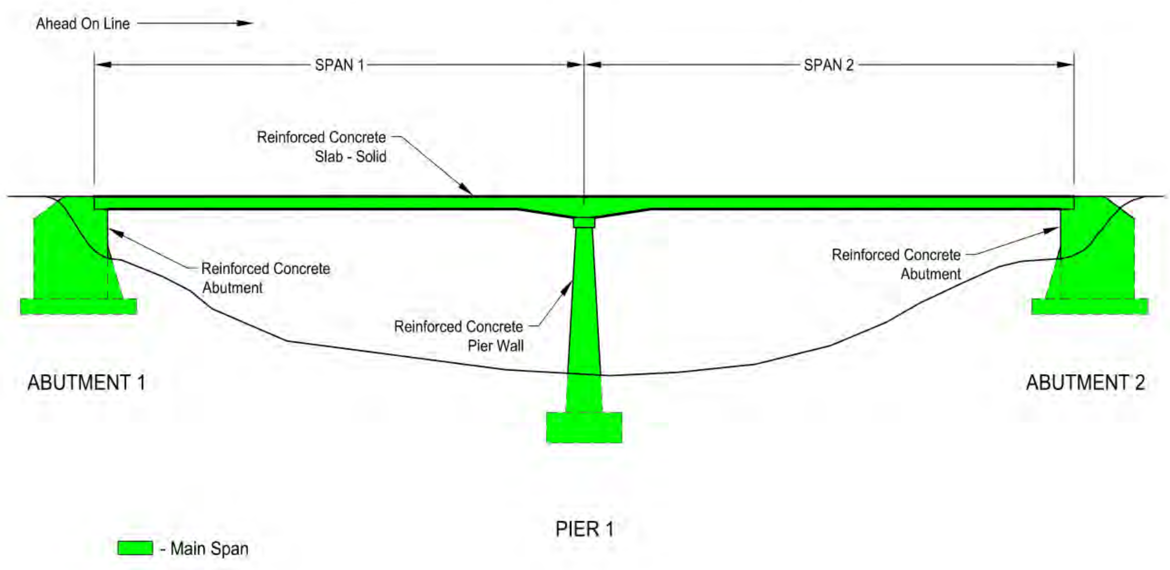
- Elements that share multiple spans with the same span unit type will be assigned to the span that has the lower span sequence (i.e. if two main spans share a pier cap, the pier cap will be assigned to the first main span unit).
- Elements that share multiple spans that have different span unit types will be assigned as follows:
  - Main Span/Approach Span element will be assigned to the Main Span.
  - Approach Span/Paving Span element will be assigned to the Approach Span.
  - Main Span/Paving Span element will be assigned to the Main Span.

Group designations for the various span unit types are as follows:

Code	Description
M	Main Units – This section will contain all of the elements that are part of the major bridge but are not part of the Paving Units or the Approach Units.
A	Approach Units – This section will contain all of the elements that are a part of the designated approach, are a part of the major structure and are leading to the main span.
P	Paving Units – This section will contain all of the elements that are not part of the major structure but are an integral part of the structure: • Paving Slabs • Grade Beams • Grade Beam Piles

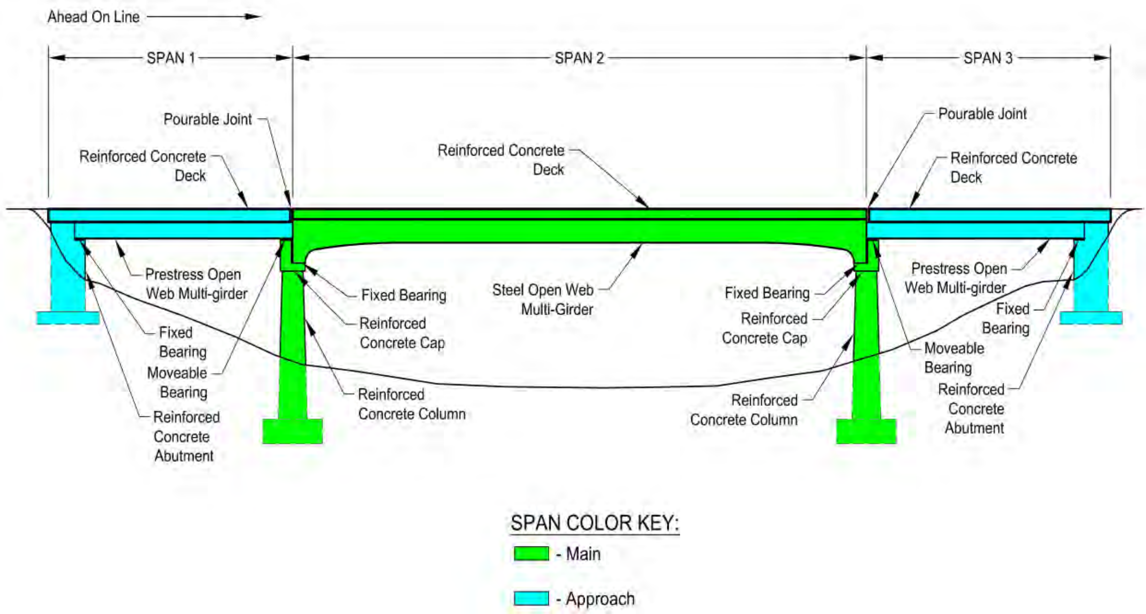
The following are general examples of how elements will be assigned based on bridge configuration:

Two Span Slab



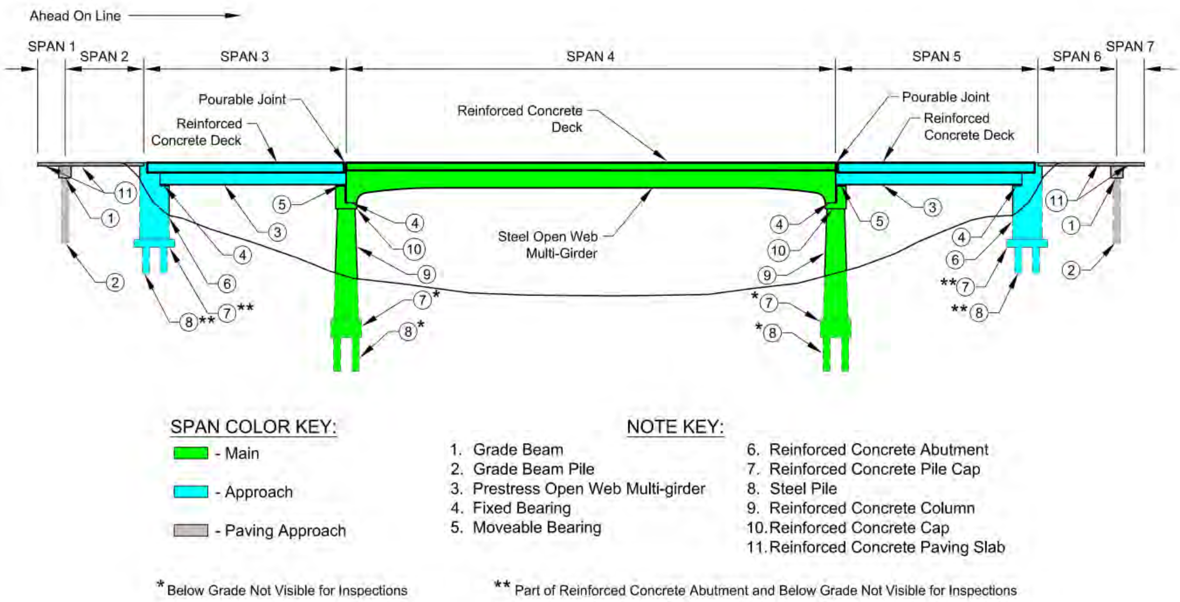
Span Unit Type	Span Unit Number	Element Number
Main	1	38 - R/C Slab - Solid (x2) (Span 1 and Span 2)
Main	1	210 - R/C Pier Wall (Between Span 1 and Span 2)
Main	1	215 - R/C Abutment (x2) (Span 1 and Span 2)

Approach & Main Spans



Span Unit Type	Span Unit Number	Element Number
Main	1	12 - R/C Deck (Span 2)
Main	1	301 - Pourable Joint Seal (x2) (Span 2)
Main	1	107 - Steel Open Girder/Beam (Span 2)
Main	1	9304 - Fix Plate Bearing (x2) (Span 2)
Main	1	205 - R/C Column (x2) (Span 2)
Main	1	234 - R/C Pier Cap (x2) (Span 2)
Approach	2	12 - R/C Deck (x2) (Span 1 and 3)
Approach	2	109 - Prestressed Concrete Open Girder/Beam (x2) (Span 1 and 3)
Approach	2	9304 - Fix Plate Bearing (x2) (Span 1 and 3)
Approach	2	9228 - Roller Bearing (x2) (Span 1 and 3)
Approach	2	215 - R/C Abutment (x2) (Span 1 and 3)

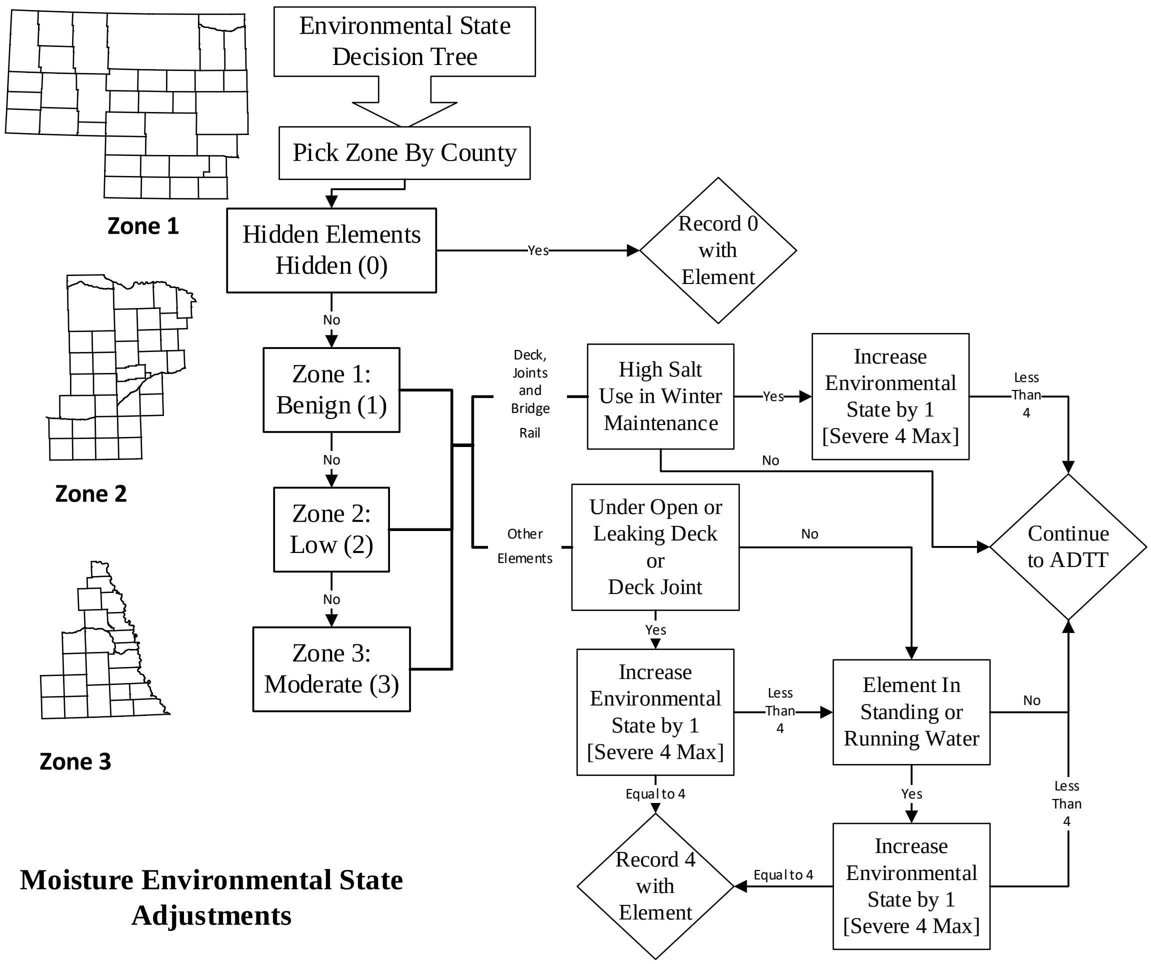
Paving, Approach & Main Spans



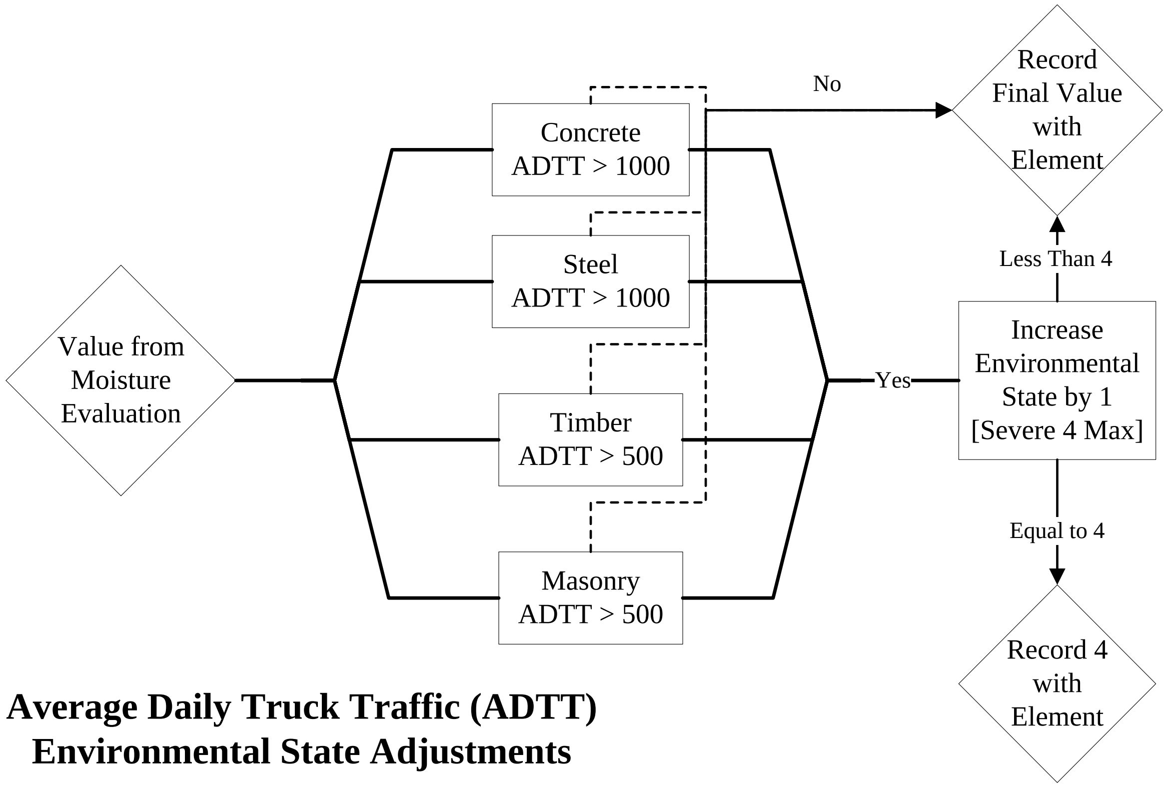
Span Unit Type	Span Unit Number	Element Number
Main	1	12 - R/C Deck (Span 4)
Main	1	301 - Pourable Joint Seal (x2) (Span 4)
Main	1	107 - Steel Open Girder/Beam (Span 4)
Main	1	9304 - Fix Plate Bearing (x2) (Span 4)
Main	1	205 - R/C Column (x2) (Span 4)
Main	1	234 - R/C Pier Cap (x2) (Span 4)
Approach	2	12 - R/C Deck (x2) (Span 3 & 5)
Approach	2	109 - Prestressed Concrete Open Girder/Beam (x2) (Span 3 & 5)
Approach	2	9304 - Fix Plate Bearing (x2) (Span 3 & 5)
Approach	2	9228 - Roller Bearing (x2) (Span 3 & 5)
Approach	2	215 - R/C Abutment (x2) (Span 3 & 5)
Paving	3	321 - R/C Paving Slab (x4) (Span 1, 2, 6 & 7)
Paving	3	9230 - Grade Beam Cap (x2) (Span 1, 2, 6 & 7)
Paving	3	9234 - R/C Grade Beam Pile (x2) (Span 1, 2, 6 & 7)
		**R/C Pile Cap and Steel Pile not included from Span 4 because the elements are not visible for inspection.* ***R/C Pile Cap and Steel Pile not included from Span 3 and 5 because the elements are included in the abutment quantity and the elements are not visible for inspection.* ****Grade Beam Cap and R/C Grade Beam Pile are included in the element list for Span Unit 3 for Bridge Management purposes even though they are not visible for inspection. These elements will be identified as an Environment State "0".*

3-EI.5.2 Environmental States

Environmental states will be utilized for both project development and deterioration modeling. Regardless, if an element possesses one environmental state or if an element possesses multiple environmental states, the element will need to be divided into the appropriate environmental state, quantity and quantity condition states. Based on the "Environmental States Development Flowcharts", the appropriate environmental state will need to be assessed based on the conditions outlined below:



Moisture Environmental State Adjustments



Average Daily Truck Traffic (ADTT) Environmental State Adjustments

3-EI.6 ELEMENT CONDITION LANGUAGE

Element numbers above 9000 are defined as NDOT specific elements. Element classification indicates whether the specific element is:

- NBE – AASHTO National Bridge Element.
- NDOT NBE – AASHTO National Bridge Element with NDOT Name and Number (element to be rolled into the parent NBE).
- BME – AASHTO Bridge Management Element.
- NDOT BME – NDOT Bridge Management Element (element to be rolled into the parent AASHTO BME if applicable).

As a direct result of the October 3, 2013 release of the FHWA publication “Specification for the National Bridge Inventory Bridge Elements”, specific AASHTO Elements are required to be submitted to FHWA as part of their annual update. NDOT NBE and NDOT BME elements will be denoted under the “Element Classification” category below each appropriate element description throughout Chapter 3 – EI. These elements are Agency Defined Elements (ADEs) unique only to the NDOT Bridge Inspection Program. In addition, NDOT specific NBEs and BMEs that are associated with this FHWA specification will be required to be combined together into the specific AASHTO Elements. Those ADEs that are to be rolled into a parent element will be denoted as such under the “NBE Parent” or “BME Parent” category located under each appropriate element description throughout Chapter 3-EI Element Inspection Coding. Those NBEs and BMEs that are to be submitted to the FHWA include:

- NBE (elements that are designated as NBEs in the AASHTO *Bridge Element Inspection Manual*, First Edition 2013).
- Joints (Elements 300 through 306).
- Wearing Surfaces (Element 510).
- Steel Protective Coatings (Element 515).
- Concrete Protective Coatings (Element 521).

Please note that the remaining NDOT BME elements will not be reported to FHWA but will be used to manage the NDOT bridge inventory.

3-EI.7 DECKS AND SLABS

3-EI.7.1 General

The deck/top flange/slab evaluation is captured using the defined condition states and is three-dimensional in nature with the defects observed on the top surface, the bottom surface, or both. Deck/top flange/slab top or bottom surfaces that are not visible for inspection shall be assessed based on the available visible surface. If both the top and bottom surfaces are not visible, the condition shall be assessed based on destructive testing, nondestructive testing, or indicators in the materials covering the surfaces.

Quantity Calculation:
The quantity for this element includes the area of the deck/top flange/slab from the end of floor to end of floor length by the out to out deck width, including any median areas and accounting for any flares or ramps present.

Unit of Measure: Square Feet

3-EI.7.2 Reinforced Concrete

All elements are constructed of mild reinforced concrete regardless of the wearing surface or protective system used.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
			* 	
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

12 Reinforced Concrete Deck

Description:
This element defines all bridge decks.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

16 Reinforced Concrete Top Flange

Description:
This element defines all bridge girder top flanges where traffic rides directly on the structural element. These bridge types include tee-beams, box girders, and girders that require traffic to ride on the top flange.

Element Classification: NBE

NBE Parent: N/A

Commentary:
This quantity is for the top flange riding surface only. Girder web and bottom flange are to be evaluated by the appropriate girder element.

38 Reinforced Concrete Slab – Solid

Description:
This element defines all bridge slabs that have a solid cross section.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9038 Reinforced Concrete Slab – Voided

Description:
This element defines all bridge slabs that have a voided cross section.

Element Classification: NDOT NBE

NBE Parent: 38 Reinforced Concrete Slab – Solid

Commentary:
None.

3-EI.7.3 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned concrete regardless of the wearing surface or protective system used.

Condition State Definitions:

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	*			
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

13 Prestressed Concrete Deck

Description:
This element defines all bridge decks.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

15 Prestressed Concrete Top Flange

Description:
This element defines all bridge girder top flanges where traffic rides directly on the structural element. These bridge types include bulb-tees, box girders and girders that require traffic to ride on the top flange.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.7.4 Steel

All elements are constructed of steel regardless of the wearing surface or protective system used.

When the steel grid deck has concrete fill in the wheel tracks only, use Element 29 for the concrete filled portion and Element 28 for the unfilled portion of the deck.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

28 Steel Deck with Open Grid

Description:
This element defines all open grid bridge decks with no fill.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

29 Steel Deck with Concrete Filled Grid

Description:
This element defines bridge decks with concrete fill either in all of the openings or within the wheel tracks.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

30 Steel Deck Corrugated/Orthotropic/Etc.

Description:
This element defines those bridge decks constructed of corrugated metal filled with Portland cement, asphaltic concrete or other riding surfaces. Orthotropic steel decks are also included.

Element Classification: NBE

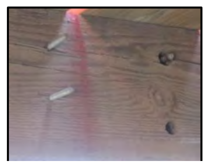
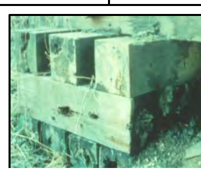
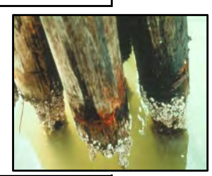
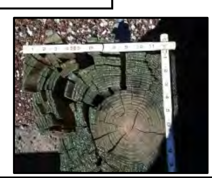
NBE Parent: N/A

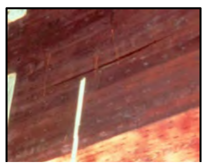
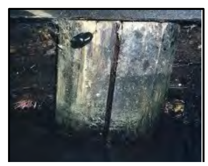
Commentary:
None.

3-EI.7.5 Timber

All elements are constructed of timber regardless of the wearing surface or protective system used. Timber running planks shall be included under the wearing surface assessment.

Condition State Definitions:

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Decay/ Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
	* 			
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5% to 50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Crack (Timber) (1160)	None.	Crack that has been arrested through effective Measures.	Identified crack that is not arrested but does not require structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Split/ Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
	* 			
Abrasion/ Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

31 Timber Deck

Description:
This element defines all bridge decks.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

54 Timber Slab

Description:
This element defines all bridge slabs.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.7.6 Other

All elements are constructed of composite materials, or other materials, that cannot be classified using any other defined elements of other material types and regardless of the wearing surface or protective system used.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.	
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

60 Other Deck

Description:
This element defines all bridge decks not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

65 Other Slab

Description:
This element defines all slabs not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.8 RAILINGS

3-EI.8.1 General

Consider only the condition of the bridge, transition, approach and terminal section. The evaluations of the rails that are to crash or design standard shall be coded with NBI Items 36 A through D, Traffic Safety Features.

Record the predominant rail element at the rail location. For example, if the:

- Concrete rail is 2 feet 6 inches tall and the metal rail is 1 foot tall, code only the concrete rail element and record the cumulative rail height in inches in the element's scale attribute (i.e. 3 feet 6 inches).
- Concrete rail is 1 foot tall and the metal rail is 2 feet 6 inches tall, code only the metal rail element and record the cumulative rail height in inches in the element's scale attribute (i.e. 3 feet 6 inches).

Bridge Rail
A bridge commonly has only two rows of rail, one on each side of the traveled way. But in some cases, a bridge may have more than two rows of rail when it has a center median or protected pedestrian/bicycle lanes.

Approach Rail
When the approach rail extends beyond 100 feet from the end of the bridge, consider only the first 100 feet.

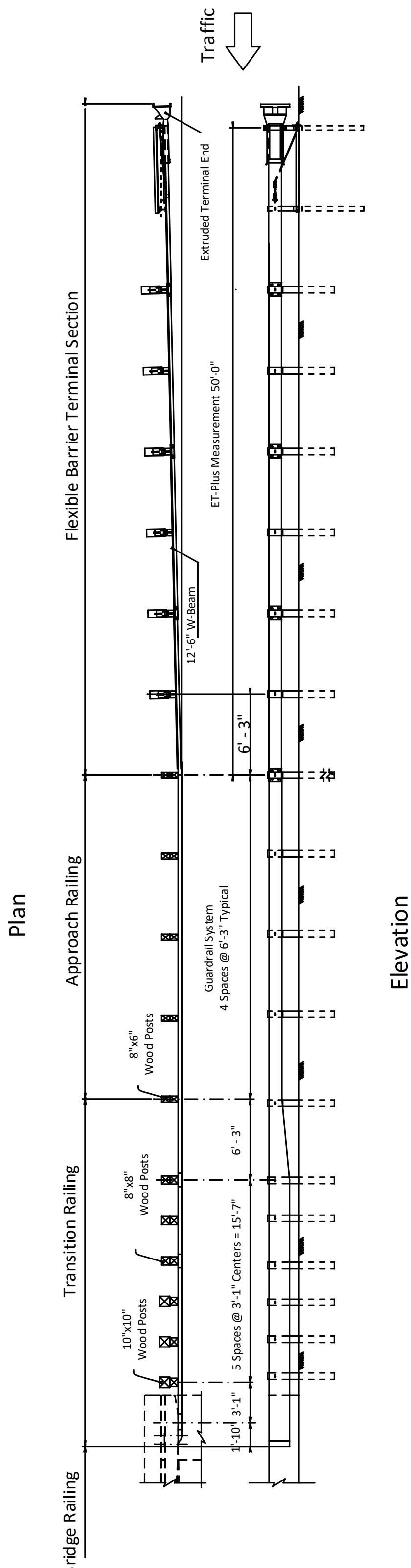
Quantity Calculation:

Bridge Rail
The quantity for this element is the sum of the number of rows of bridge rail times the length of the bridge and only includes the rail on the bridge. (See Sketch)

Approach Rail
The quantity for this element is the length of the rail approaching the bridge within the clear zone that is not a part of the transition rail or the end section attenuators. (See Sketch)

Transition Rail
The quantity for this element is the length of the transition rail between the bridge rail and the approach rail or end section attenuators that is within the clear zone that is not a part of the bridge rail or the end section attenuators. (See Sketch)

Unit of Measure: Feet

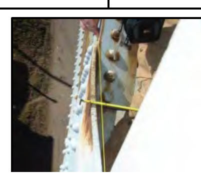


Element	Quantity
9343 Flexible Barrier Terminal Section	50 ft
9333 Metal Approach Railing	25 ft
9338 Metal Transition Railing	25 ft

3-EI.8.2 Metal Rail

All elements pertain to metal rail that is associated with the bridge. Refer to the other bridge rail material elements (concrete, timber, masonry, other) for specific defects for assessing the condition of posts, blocking and curbs that may be constructed of materials other than metal.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

330 Metal Bridge Railing

Description:
This element defines all types and shapes of metal bridge railing which includes steel, aluminum, metal beam, rolled shapes, etc. Also included in this element are the posts (i.e. metal, timber or concrete), blocking and curb.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9333 Metal Approach Railing

Description:
This element defines all types and shapes of metal approach railing which includes steel, aluminum, metal beam, rolled shapes, etc. Also included in this element are the posts (i.e. metal, timber or concrete), blocking and curb.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9338 Metal Transition Railing

Description:
This element defines all types and shapes of metal transition railing which includes steel, aluminum, metal beam, rolled shapes, etc. Also included in this element are the posts (i.e. metal, timber or concrete), blocking and curb.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9343 Flexible Barrier Terminal Section

Description:
This element defines flexible barrier terminal sections located on the shoulder of a roadway or in the median and its condition evaluation includes the terminal end, posts, guardrail and connection hardware. These types of terminal sections (i.e. ET-2000, ET-Plus, SKT-350 and similar products) absorb energy by coiling the attached guardrail.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
Quantity is the number of rows of end treatment that is connected to the approach or transition rail times the length. Typical lengths are 50 feet or 75 feet depending on the offset from the roadway. End sections that have one foot or less offset have a 75 foot length while offsets of 4 or more feet have a 50 foot length.

Terminal Types	Standard Lengths
BCT (Breakaway Cable Terminal)	37’ – 6”
MELT (Modified Eccentric Loader Terminal)	37’ – 6”
SRT (Slotted Rail Terminal) - Rural	37’ – 6”
SRT (Slotted Rail Terminal) - Urban	25’
BEST (Beam Eating Steal Terminal)	50’
ET-2000	50’ or 62’ – 6”
SKT-350 (Sequential Kinking Terminal)	50’

Breakaway Cable Terminal

Modified Eccentric Loader Terminal

Slotted Rail Terminal

Beam Eating Steel Terminal

ET-2000 Family

SKT-350

9344 Crash Cushions Terminal Section

Description:
This element defines terminal sections for blunt ends of rigid barriers and fixed objects located in the median or on the shoulder and utilizes internal self-contained energy absorption systems. Examples include "TRACC", "CAT-350", "ADIEM", and "Universal TAU-II".

Element Classification: NDOT BME

BME Parent: N/A

Quantity Calculation:
Quantity is the total length of the crash cushion and includes the transition plus the cushion. Typical lengths are 14, 21, 25 and 30 feet.

Commentary:
None.

TRACC Family

CAT-350

ADIEM

Universal TAU-II

3-EI.8.3 Reinforced Concrete Rail

All elements of the railing must be constructed of reinforced concrete regardless of the protective system used.

Condition State Definitions:

	Condition States			
	1	2	3	4
Defects	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	* 			
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

331 Reinforced Concrete Bridge Railing – Closed

Description:
This element defines all closed types and shapes of bridge railing.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9331 Reinforced Concrete Bridge Railing – Open

Description:
This element defines all open types and shapes of bridge railing.

Element Classification: NDOT NBE

NBE Parent: 331 Reinforced Concrete Bridge Railing

Commentary:
None.

9334 Reinforced Concrete Approach Railing – Closed

Description:
This element defines all closed types and shapes of approach railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9335 Reinforced Concrete Approach Railing – Open

Description:
This element defines all open types and shapes of approach railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9336 Reinforced Concrete Approach Rail On Wingwall

Description:
This element defines all approach railing that is mounted directly to a wingwall.

Element Classification: NDOT NBE

NBE Parent: N/A

Commentary:
None.

9339 Reinforced Concrete Transition Railing – Closed

Description:
This element defines all closed types and shapes of transition railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9340 Reinforced Concrete Transition Railing – Open

Description:
This element defines all open types and shapes of transition railing.

Element Classification: NDOT BME

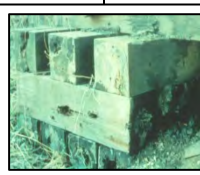
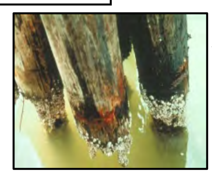
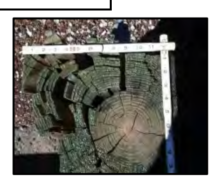
BME Parent: N/A

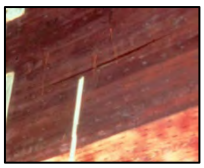
Commentary:
None.

3-EI.8.4 Timber Rail

All elements are for timber rail that is associated with the bridge. Refer to the other bridge rail material elements (concrete, timber, masonry, other) for specific defects for assessing the condition of posts, blocking and curbs that may be constructed of materials other than timber.

Condition State Definitions:

	Condition States			
	1	**2**	**3**	**4**
Defects	**GOOD**	**FAIR**	**POOR**	**SEVERE**
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Decay/ Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
	* 			
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5% to 50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Crack (Timber) (1160)	None.	Crack that has been arrested through effective Measures.	Identified crack that is not arrested but does not require structural review.	
	* 			The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Split/ Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
	* 			
Abrasion/ Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

332 Timber Bridge Railing

Description:
This element defines all bridge railing.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9332 Timber Approach Railing

Description:
This element defines all approach railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9341 Timber Transition Railing

Description:
This element defines all transition railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.8.5 Masonry Rail

All elements of the railing must be constructed of masonry block or stone and are for all types and shapes of rail that is associated with the bridge.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	* 			
Mortar Breakdown (Masonry) (1610)	None.	Cracking or voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

334 Masonry Bridge Railing

Description:
This element defines all bridge railing.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9345 Masonry Approach Railing

Description:
This element defines all approach railing.

Element Classification: NDOT BME

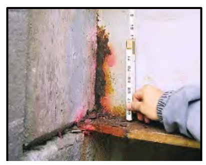
BME Parent: N/A

Commentary:
None.

3-EI.8.6 Other

All elements pertain to types and shapes of railing that are constructed of composite materials, or other materials, that cannot be classified using any other defined rail elements of other material types (i.e. metal, concrete, timber, or masonry).

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	**FAIR**	**POOR**	**SEVERE**
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts rivets, broken welds, or fasteners, or pack rust with distortion but does not warrant a structural review.	
	*			
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.	

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td rowspan="2">Efflorescence/ Rust Staining (1120)</td><td>None.</td><td>Surface white without build-up or leaching without rust staining.</td><td>Heavy build-up with rust staining.</td><td rowspan="6">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>* </td><td></td><td></td></tr>
<tr><td>Cracking (RC and Other) (1130)</td><td>Width less than 0.012 in. or spacing greater than 3.0 ft.</td><td>Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.</td><td>Width greater than 0.05 in. or spacing of less than 1 ft.</td></tr>
<tr><td>Deterioration (Other) (1220)</td><td>None.</td><td>Initiated breakdown or deterioration.</td><td>Significant deterioration or breakdown but does not warrant structural review.</td></tr>
<tr><td rowspan="2">Distortion (1900)</td><td>None.</td><td>Distortion not requiring mitigation or mitigated distortion.</td><td>Distortion that requires mitigation that has not been addressed but does not warrant structural review.</td></tr>
<tr><td>* </td><td></td><td></td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.</td></tr>
</table>

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

333 Other Bridge Railing

Description:
This element defines all bridge railing not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9337 Other Approach Railing

Description:
This element defines all approach railing not otherwise defined.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9342 Other Transition Railing

Description:
This element defines all transition railing not otherwise defined.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.9 SUPERSTRUCTURE

3-EI.9.1 General

Condition evaluation of girder elements includes the web face along with the top and bottom faces of the flange. In addition, the box girder evaluation is three-dimensional in nature with the observed defects on both the interior and exterior surfaces being used to capture the condition states.

Observed distress pertaining to trusses and arches are located in the panel diagonals and vertical members (including spandrel columns) and are reported as measured length along the panel. These elements do not include the condition of the panel cross frame (Element 9152), floor beams (spandrel caps), and gusset plates (Element 162). But for filled arches, the arch quantity shall be measured from spring line to spring line with the length below the spring line being considered the substructure.

Record the web or panel height in the scale factor for the element.

The length of beams, girders, stringers and floor beams that are under a deck joint or a deck drain that outlets storm water onto these features is at the discretion of the inspector to determine the length that is being influenced by the Environment. These elements should follow the flowchart for Environment.

Quantity Calculation:

Girder/Stringer
Quantity for this element is the number of girders multiplied by the span length.

Box Sections
Quantity for this element is the number of visible web faces divided by two and multiplied by the appropriate length.

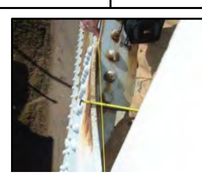
Truss and Arches
Quantity for this element is the sum of all of the lengths of each truss or arch panel measured longitudinally along the travel way.

Unit of Measure: Feet

3-EI.9.2 Steel

All elements are constructed of steel regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Corrosion (1000)	None.	Freckled Rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack exists that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners or pack rust with distortion but do not warrant a structural review.	
	*			
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
	*			
Load Capacity (5000)	No reduction.	No reduction.	No reduction.	

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 SEVERE
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

102 Steel Closed Web/Box Girder

Description:
This element defines all box girders or closed web girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
Does not include girders that are constructed of high performance steel.

9102 High Performance Steel Closed Web/Box Girder

Description:
This element defines all box girders or closed web girders that were constructed with high performance steel or a combination of high performance and non-high performance steel.

Element Classification: NDOT NBE

NBE Parent: 102 Steel Closed Web/Box Girder

Commentary:
Record the strength of the high performance steel in the element description.

107 Steel Open Girder/Beam

Description:
This element defines all open girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
Does not include girders that have cover plates or are constructed of high performance steel.

9101 Steel Open Girder/Beam With Cover Plate

Description:
This element defines all open girders with cover plates.

Element Classification: NDOT NBE

NBE Parent: 107 Steel Open Girder/Beam

Commentary:
None.

9107 High Performance Steel Open Girder/Beam

Description:
This element defines all open girders that were constructed with high performance steel or a combination of high performance and non-high performance steel.

Element Classification: NDOT NBE

NBE Parent: 107 Steel Open Girder/Beam

Commentary:
Record the strength of the high performance steel in the element description.

113 Steel Stringer

Description:
This element defines all members that support the deck in a stringer floor beam system.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

120 Steel Truss

Description:
This element defines all truss elements including all tension and compression members for through and deck trusses.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

141 Steel Arch

Description:
This element defines all steel arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

152 Steel Floor Beam

Description:
This element defines all floor beams that typically support stringers.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9152 Cross Frame

Description:
This element defines all single member (floor beam) or built-up members (truss panel) such as sway frames on trusses, two girder systems that are not floor beams and diaphragms on multi-girder curve steel structures.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
For two girder systems and deck trusses, when the deck and/or the stringers are attached to the cross frame, floor beams should be used.

147 Steel Main Cables

Description:
This element defines all cable stay or main suspension cables not embedded in concrete.

Element Classification: NBE

NBE Parent: N/A

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each main cable measured longitudinally along the travel way.

Commentary:
Use for main cables in suspension bridges or main cable stays in cable stayed bridges. Suspender cables or other smaller cables shall be captured using the secondary cable element.

148 Secondary Steel Cables

Description:
This element defines all suspender cables not embedded in concrete.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the individual cable or cable groups carrying the load from the superstructure to the main cable/arch elements.

Commentary:
Use for suspender cables, other smaller cables or groups of cables in one location acting as a system to carry loads from the superstructure to the main cable/arch. Suspension bridge main cables or cable stays shall be captured using the steel main cable element.

161 Steel Pin and Pin & Hanger Assembly or Both

Description:
This element defines all pins and pin & hanger assemblies.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of pins, pin & hanger assemblies or both.

Commentary:
Distress observed on either the hanger assembly or plate should be considered in the condition assessment.

162 Steel Gusset Plate

Description:
This element defines only those gusset plate(s) connections that are on truss/arch panel(s). These connections can be constructed with one or more plates that may be bolted, riveted or welded.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of primary load path gusset plate assemblies. For multiple plate gusset connections at a single panel point, the quantity shall be one gusset plate regardless of the number of individual plates at the single connection point.

Commentary:
Gusset plates that are part of secondary elements such as cross frames are not considered.

For built-up gusset plates, distress observed on any plate should be considered in the condition assessment.

3-EI.9.3 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned steel reinforced concrete regardless of the protective system.

Where traffic rides directly on the structural element regardless of the wearing surface, evaluation of the top flange above the fillet is considered with Element 15.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

104 Prestressed Concrete Closed Web/Box Girder

Description:
This element defines all closed web girders or box girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

109 Prestressed Concrete Open Girder/Beam

Description:
This element defines all open web girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
Code this element for all open web girders except for Inverted T (9104), NU (9106) and Double T (9109).

9104 Prestressed Concrete Inverted T Girder

Description:
This element defines all open web Inverted T Beams.

Element Classification: NDOT NBE

NBE Parent: 109 Presetrssed Concrete Open Girder/Beam

Commentary:
These elements do not have a top flange.

9106 Prestressed Concrete NU Girder

Description:
This element defines all open web NU Girders.

Element Classification: NDOT NBE

NBE Parent: 109 Presetrssed Concrete Open Girder/Beam

Commentary:
None.

9109 Prestressed Concrete Double T Beam

Description:
This element defines all open web Double T Beams.

Element Classification: NDOT NBE

NBE Parent: 109 Presetrssed Concrete Open Girder/Beam

Commentary:
If traffic rides directly on the top flange or on a non-structural wearing surface over the top flange, this element would be used to assess the girder web only of each Double T Beam. If a structural deck has been placed over the top flange, the girder web and top flange will be assessed as one unit. The girder count is both stems from longitudinal joint to longitudinal joint of each, not the individual stems.

115 Prestressed Concrete Stringer

Description:
This element defines all members that support the deck in a stringer floor beam system.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

143 Prestressed Concrete Arch

Description:
This element defines all prestressed concrete arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
For filled arches, the quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

154 Prestressed Concrete Floor Beam

Description:
This element defines all floor beams that typically support stringers.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.9.4 Reinforced Concrete

All elements are constructed of mild steel reinforced concrete regardless of the protective system.

Where traffic rides directly on the structural element regardless of the wearing surface, evaluation of the top flange above the fillet is considered with Element 16.

Condition State Definitions:

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td>Delamination/ Spall/ Patched Area (1080)</td><td>None.</td><td>Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.</td><td>Spall greater than 1 in. deep or greater than6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.</td><td rowspan="5">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>Exposed Rebar (1090)</td><td>None.</td><td>Present without measurable section loss.</td><td>Present with measurable section loss but does not warrant structural review.</td></tr>
<tr><td rowspan="2">Efflorescence /Rust Staining (1120)</td><td>None.</td><td>Surface white without build-up or leaching without rust staining.</td><td>Heavy build-up with rust staining.</td></tr>
<tr><td colspan="3">*   </td></tr>
<tr><td>Cracking (RC and Other) (1130)</td><td>Width less than 0.012 in. or spacing greater than 3.0 ft.</td><td>Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.</td><td>Width greater than 0.05 in. or spacing of less than 1 ft.</td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.</td></tr>
</table>

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

105 Reinforced Concrete Closed Web/Box Girder

Description:
This element defines all box girders or closed web girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

110 Reinforced Concrete Open Girder/Beam

Description:
This element defines all open web girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

116 Reinforced Concrete Stringer

Description:
This element defines all members that support the deck in a stringer floor beam system.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

144 Reinforced Concrete Arch

Description:
This element defines all reinforced concrete arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
For filled arches, the arch quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

155 Reinforced Concrete Floor Beam

Description:
This element defines all floor beams that typically support stringers.

Element Classification: NBE

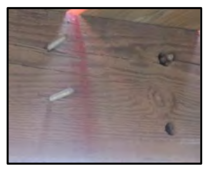
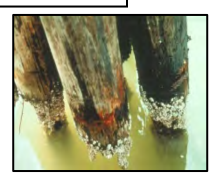
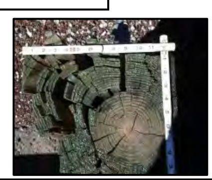
NBE Parent: N/A

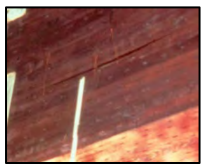
Commentary:
None.

3-EI.9.5 Timber

All elements are constructed of timber regardless of the protective system and condition evaluation includes all of the timber surfaces.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Decay/ Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
	* 			
Check/ Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5% to 50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Crack (Timber) (1160)	None.	Crack that has been arrested through effective Measures.	Identified crack that is not arrested but does not require structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Split/ Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
	* 			
Abrasion/ Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness	Section loss 10% or more of the member thickness but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

111 Timber Open Girder/Beam

Description:
This element defines all open girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

117 Timber Stringer

Description:
This element defines all members that support the deck in a stringer floor beam system.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

135 Timber Truss

Description:
This element defines all truss elements including all tension and compression members for through and deck trusses.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

146 Timber Arch

Description:
This element defines all timber arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

156 Timber Floor Beam

Description:
This element defines all floor beams that typically support stringers.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.9.6 Masonry

All elements are constructed of block or stone and may be placed with or without mortar regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	* 			The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Mortar Breakdown (Masonry) (1610)	None.	Cracking or voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound Patch.	Unsound Patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

145 Masonry Arch

Description:
This element defines all masonry arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
For filled arches, the arch quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

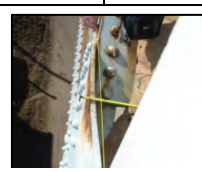
3-EI.9.7 Other

All elements are constructed of composite materials, or other materials, that cannot be classified using any other defined elements of other material types regardless of the protective system.

Where traffic rides directly on the structural element regardless of the wearing surface, evaluation of the top flange above the fillet is considered with Element 15 or 16.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

106 Other Closed Web/Box Girder

Description:
This element defines all box girders or closed web girders not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

112 Other Open Girder/Beam

Description:
This element defines all open girders not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

118 Other Stringer

Description:
This element defines all stringers not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

136 Other Truss

Description:
This element defines all truss elements including all tension and compression members and through and deck trusses not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

142 Other Arch

Description:
This element defines all arches not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
For filled arches, the arch quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

157 Other Floor Beam

Description:
This element defines all floor beams that typically support stringers not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

149 Other Secondary Cable

Description:
This element defines all suspender cables not embedded in concrete not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the individual cable or cable groups carrying the load from the superstructure to the main cable/arch elements.

Commentary:
Use for suspender cables, other smaller cables or groups of cables in one location acting as a system to carry loads from the superstructure to the main cable/arch. Suspension bridge main cables or cable stays shall be captured using the steel main cable element.

3-EI.10 BEARINGS

3-EI.10.1 General

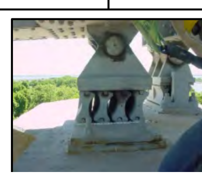
Bearings that cannot be visibly inspected should not be collected.

Quantity Calculation:
Quantity for this element is the sum of each bearing.

Unit of Measure: Each

3-EI.10.2 Elastomeric Bearings

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	*			
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
	*			
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Bulging, Splitting, or Tearing (2230)	None.	Bulging less than 15% of the thickness.	Bulging 15% or more of the thickness. Splitting or tearing. Bearing's surfaces are not parallel. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

310 Elastomeric Bearing

Description:
This element defines only those bridge bearings that are constructed primarily of elastomers with or without fabric or metal reinforcement.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.10.3 Movable Bearings

All elements define only those bridge bearings which provide for both rotation and longitudinal movement.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

311 Movable Bearing

Description:
This element defines only those bridge bearings that provide movement by other mechanisms that are not covered in Rocker with Pin (9311), Roller (9312), or Sliding Plate (9313) bearings.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9311 Rocker With Pin Bearing

Description:
This element defines only those bridge bearings which provide movement by means of a rocker with pin mechanism.

Element Classification: NDOT NBE

NBE Parent: 311 Moveable Bearing

Commentary:
None.

9312 Roller Bearing

Description:
This element defines only those bridge bearings which provide movement by means of a roller mechanism.

Element Classification: NDOT NBE

NBE Parent: 311 Moveable Bearing

Commentary:
None.

9313 Sliding Plate Bearing

Description:
This element defines only those bridge bearings which provide movement by means of a sliding plate mechanism.

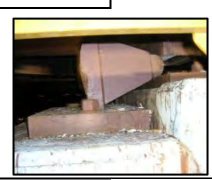
Element Classification: NDOT NBE

NBE Parent: 311 Moveable Bearing

Commentary:
None.

3-EI.10.4 Enclosed/Concealed Bearings

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	
	* 			
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
	* 			
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

312 Enclosed/Concealed Bearing

Description:
This element defines only those bridge bearings that are enclosed (i.e. not open for detailed inspection).

Element Classification: NBE

NBE Parent: N/A

Commentary:
Should be used for box girder hinges and in cases where the bearing material is not visible. The inspector shall assess the condition based on alignment, grade across the joint, persistence of debris or other indirect indicators of the condition.

3-EI.10.5 Fixed Bearings

All elements define only those bridge bearings which provide for rotation movement only (no longitudinal movement).

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

313 Fixed Bearing

Description:
This element defines only those bridge bearings that are not covered in the Fixed Pinned (9303) or Fixed Plate (9304) bearings.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9303 Fixed Pinned Bearing

Description:
This element defines only those bridge bearings that are pinned.

Element Classification: NDOT NBE

NBE Parent: 313 Fixed Bearings

Commentary:
None.

9304 Fixed Plate Bearing

Description:
This element defines only those bridge bearings that have a plate and bolt connection.

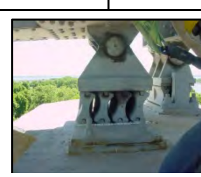
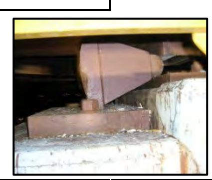
Element Classification: NDOT NBE

NBE Parent: 313 Fixed Bearings

Commentary:
None.

3-EI.10.6 Pot Bearings

Condition State Definitions:

Defects	Condition States 1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	*			
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
	*			
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the Bearing but does not warrant a structural review.	
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Bulging, Splitting or Tearing (2230)	None.	Bulging less than 15% of the thickness.	Bulging 15% or more of the thickness. Splitting or tearing. Bearing's surfaces are not parallel. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

314 Pot Bearing

Description:
This element defines all high load bearings with confined elastomer. This bearing may be fixed against horizontal movement, guided to allow sliding in one direction or floating to allow sliding in any direction.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.10.7 Disk Bearings

Condition State Definitions:

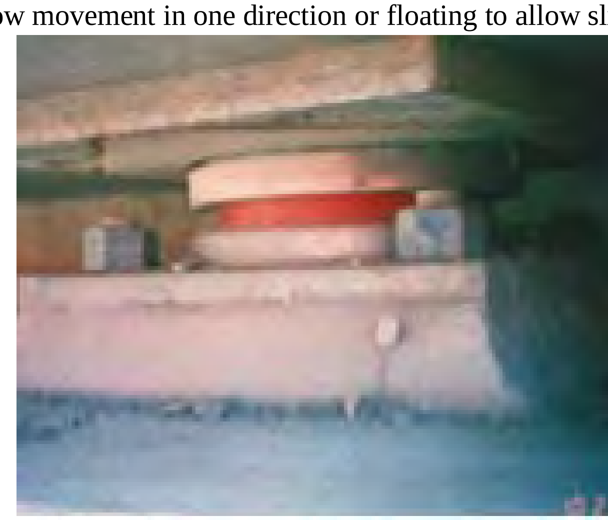
Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	*			
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
	*			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

315 Disk Bearing

Description:
This element defines all high load bearings with a hard plastic disk. This bearing may be fixed against horizontal movement, guided to allow movement in one direction or floating to allow sliding in any direction.



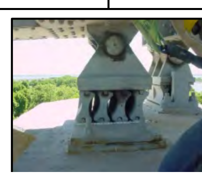
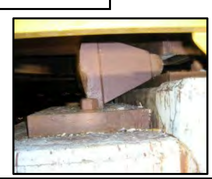
Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.10.8 Other Bearings

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
	* 			
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

316 Other Bearing

Description:
This element defines all other material bridge bearings regardless of translation or rotation constraints.

Element Classification: NBE

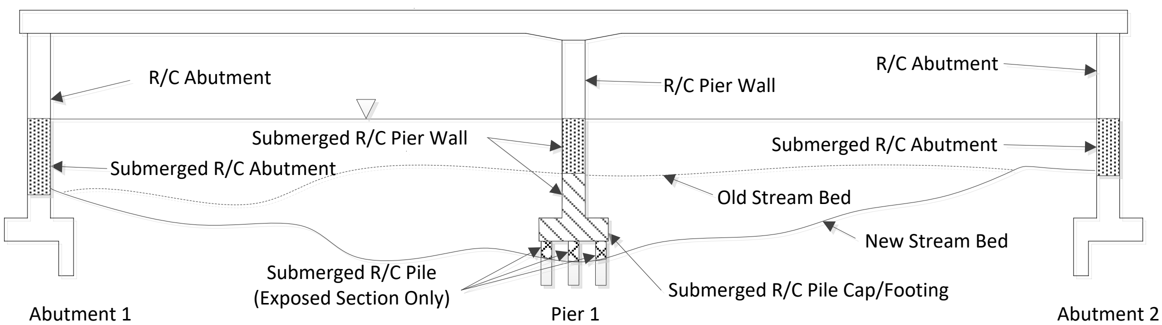
NBE Parent: N/A

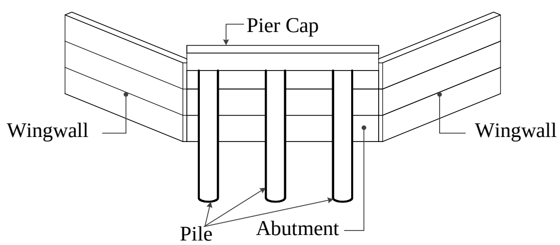
Commentary:
Intended for bearings constructed of materials that cannot be classified using any other defined bearing element.

3-EI.11 SUBSTRUCTURE

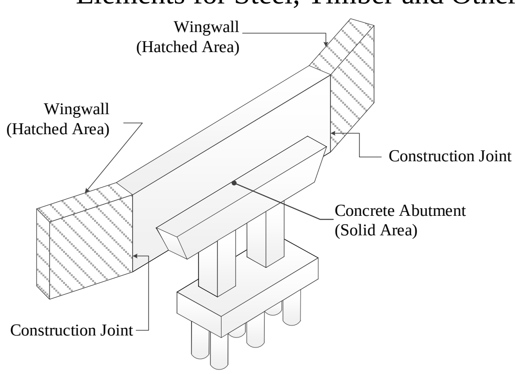
3-EI.11.1 General

Substructure elements are divided into two groups. The first group is the elements that are collected by the inspectors that are not associated with underwater or diving inspections and will be collected through the normal inspection process. The second group is the submerged elements which are to be collected during the underwater inspection process by divers or inspectors. The element condition reported will be comprised of both the above waterline and below waterline conditions.





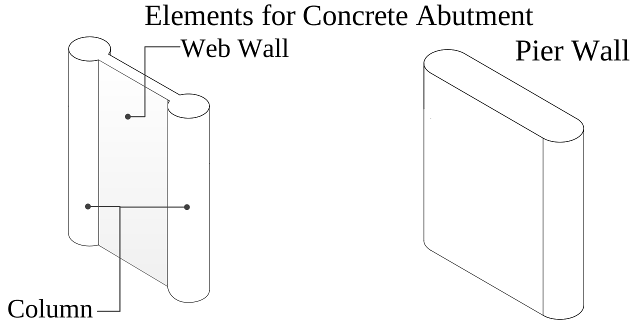
Elements for Steel, Timber and Other Abutments



Elements for Concrete Abutment

Abutment assessment has two different groupings dependent on the type of material:

- Steel, timber, and other materials abutments shall be divided into abutment, wingwall (if appropriate), pile and pier cap elements.
- Concrete abutments will have only the abutment element and wingwall element (if appropriate).



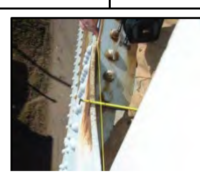
Pier walls have a consistent size from the beginning to the end of the wall. When reviewing the substructure, columns that have an enclosed area that is smaller in size than the supporting columns consider the enclosed area a web wall and assess the columns only.

Columns and Web Wall Pier Wall

Steel

All elements are constructed of steel regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	**FAIR**	**POOR**	**SEVERE**
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	
	* 			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	**FAIR**	**POOR**	**SEVERE**
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

202 Steel Column

Description:
This element defines all visable columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9202 Submerged Steel Column

Description:
This element defines all submerged columns and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 202 Steel Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

207 Steel Tower

Description:
This element defines all built-up or framed tower supports.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the heights of the built-up or framed tower supports.

Commentary:
Intended to be used for truss framed tower supports or built-up steel towers in order to capture large supports and towers associated with suspension bridges, cable stayed bridges, moveable bridges or similar structural configurations.

9207 Submerged Steel Tower

Description:
This element defines all built-up or framed tower supports and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 207 Steel Tower

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the heights of the built-up or framed tower supports below the waterline.

Commentary:
Intended to be used for truss framed tower supports or built-up steel towers in order to capture large supports and towers associated with suspension bridges, cable stayed bridges, moveable bridges or similar structural configurations.

219 Steel Abutment

Description:
This element defines all abutments and includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions but does not include the supporting piles.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet pile joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9219 Submerged Steel Abutment

Description:
This element defines all abutments, includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions but does not include the supporting piles and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 219 Steel Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet pile joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9248 Steel Grade Beam Cap

Description:
This element defines all grade beam caps.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the length of the grade beam caps.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

225 Steel Pile

Description:
This element defines all piles that are visible for inspection. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9225 Submerged Steel Pile

Description:
This element defines all piles that are visible for inspection and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 225 Steel Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9231 Steel Grade Beam Pile

Description:
This element defines all grade beam piles. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state "0".

231 Steel Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

9237 Steel Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (sheet pile joint, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:
For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9243 Steel Headwall

Description:
This element defines all headwalls and includes the sheet material retaining the embankment.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without wingwalls.

Commentary:
Used with culverts only. Monolithic headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment.

3-EI.11.3 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned steel reinforced concrete regardless of the protective system.

Condition State Definitions:

	Condition States			
	1	2	3	4
Defects	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	* 			
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

204 Prestressed Concrete Column

Description:
This element defines all visable columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9204 Submerged Prestressed Concrete Column

Description:
This element defines all submerged columns and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 204 Prestressed Concrete Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

226 Prestressed Concrete Pile

Description:
This element defines all piles that are visible for inspection. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9226 Submerged Prestressed Concrete Pile

Description:
This element defines all piles that are visible for inspection and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 226 Prestressed Concrete Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9232 Prestressed Concrete Grade Beam Pile

Description:
This element defines all grade beam piles. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

233 Prestressed Concrete Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

3-EI.11.4 Reinforced Concrete

All elements are constructed of mild reinforcing steel and concrete regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	* 			
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

205 Reinforced Concrete Column

Description:
This element defines all visable columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9205 Submerged Reinforced Concrete Column

Description:
This element defines all submerged columns and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 205 Reinforced Concrete Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

210 Reinforced Concrete Pier Wall

Description:
This element defines all pier walls.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

9210 Submerged Reinforced Concrete Pier Wall

Description:
This element defines all submerged pier walls and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 210 Reinforced Concrete Pier Wall

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle below the waterline.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

215 Reinforced Concrete Abutment

Description:
This element defines all abutments and includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9215 Submerged Reinforced Concrete Abutment

Description:
This element defines all abutments, includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 215 Reinforced Concrete Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

220 Reinforced Concrete Pile Cap/Footing

Description:
This element defines all pile caps/footings that are visible for inspection. Pile caps/footings exposed from erosion or scour are included and the exposure may be intentional or caused by erosion or scour.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the length of the footings or pile caps along the skew angle.

Commentary:
None.

9220 Submerged Reinforced Concrete Pile Cap/Footing

Description:
This element defines all pile caps/footings that are visible for inspection and is used for underwater inspections. Pile caps/footings exposed from erosion or scour are included and the exposure may be intentional or caused by erosion or scour.

Element Classification: NDOT NBE

NBE Parent: 220 Reinforced Concrete Pile Cap/Footing

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the length of footings or pile caps along the skew angle below the waterline.

Commentary:
None.

9230 Reinforced Concrete Grade Beam Cap

Description:
This element defines all grade beam caps.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the length of the grade beam caps.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

227 Reinforced Concrete Pile

Description:
This element defines all piles that are visible for inspection. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9227 Submerged Reinforced Concrete Pile

Description:
This element defines all piles that are visible for inspection and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 227 Reinforced Concrete Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9234 Reinforced Concrete Grade Beam Pile

Description:
This element defines all grade beam piles. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

234 Reinforced Concrete Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

9238 Reinforced Concrete Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (cold joint, water stop, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:
For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9244 Reinforced Concrete Headwall

Description:
This element defines all headwalls and includes the sheet material retaining the embankment.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

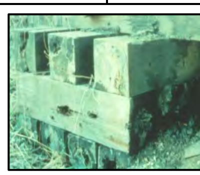
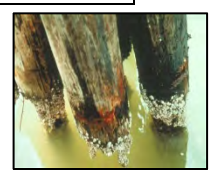
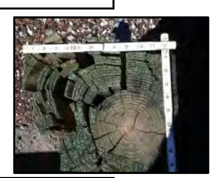
Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without wingwalls.

Commentary:
Used with culverts only. Monolithic headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment.

3-EI.11.5 Timber

All elements are constructed of timber regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
Decay/ Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5% to 50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
	* 			
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
	* 			

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td rowspan="2">Split/ Delamination (Timber) (1170)</td><td>None.</td><td>Length less than the member depth or arrested with effective actions taken to mitigate.</td><td>Length equal to or greater than the member depth but does not require structural review.</td><td rowspan="5">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>* </td><td></td><td></td></tr>
<tr><td>Abrasion/ Wear (Timber) (1180)</td><td>None or no measurable section loss.</td><td>Section loss less than 10% of the member thickness.</td><td>Section loss 10% or more of the member thickness but does not warrant structural review.</td></tr>
<tr><td>Settlement (4000)</td><td>None.</td><td>Exists within tolerable limits or arrested with no observed structural distress.</td><td>Exceeds tolerable limits but does not warrant structural review.</td></tr>
<tr><td>Scour (6000)</td><td>None.</td><td>Exists within tolerable limits or has been arrested with effective countermeasures.</td><td>Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.</td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.</td></tr>
</table>

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

206 Timber Column

Description:
This element defines all visable columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9206 Submerged Timber Column

Description:
This element defines all submerged columns and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 206 Timber Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

208 Timber Trestle

Description:
This element defines all built-up or framed tower supports.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the heights of the built-up or framed tower supports.

Commentary:
Intended to be used for truss framed trestle or tower supports in order to capture large supports and towers associated with large deck truss bridges.

9208 Submerged Timber Trestle

Description:
This element defines all built-up or framed tower supports and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 208 Timber Trestle

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the heights of the built-up or framed tower supports below the waterline.

Commentary:
Intended to be used for truss framed trestle or tower supports in order to capture large supports and towers associated with large deck truss bridges.

212 Timber Pier Wall

Description:
This element defines all pier walls that include pile, sheet material and filler.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

9212 Submerged Timber Pier Wall

Description:
This element defines all submerged pier walls that include pile, sheet material and filler and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 212 Timber Pier Wall

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle below the waterline.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

216 Timber Abutment

Description:
This element defines all abutments and includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions but does not include the supporting piles.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet material joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9216 Submerged Timber Abutment

Description:
This element defines all abutments, includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions but does not include the supporting piles and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 216 Timber Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet material joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

228 Timber Pile

Description:
This element defines all piles that are visible for inspection. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9228 Submerged Timber Pile

Description:
This element defines all piles that are visible for inspection and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 228 Timber Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9235 Timber Grade Beam Pile

Description:
This element defines all grade beam piles. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

235 Timber Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

9240 Timber Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (sheet material joint, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:
For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9245 Timber Headwall

Description:
This element defines all headwalls and includes the sheet material retaining the embankment.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without wingwalls.

Commentary:
Used with culverts only. Monolithic headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment.

3-EI.11.6 Masonry

All elements are constructed of block or stone and may be placed with or without mortar regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Mortar Breakdown (Masonry) (1610)	None.	Cracking or voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
	*			
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

213 Masonry Pier Wall

Description:
This element defines all pier walls.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

9213 Submerged Masonry Pier Wall

Description:
This element defines all submerged pier walls and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 213 Masonry Pier Wall

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle below the waterline.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

217 Masonry Abutment

Description:
This element defines all abutments and includes the material retaining the embankment, monolithic wingwalls and abutment extensions.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9217 Submerged Masonry Abutment

Description:
This element defines all abutments, includes the material retaining the embankment, monolithic wingwalls and abutment extensions and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 217 Masonry Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9261 Rectangular Mechanically Stabilized Earth Abutment

Description:
This element defines all abutments constructed of mechanically stabilized earth systems that are rectangular concrete panels including integral wingwalls and abutment extensions.

Element Classification: NDOT NBE

NBE Parent: 217 Masonry Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with integral wingwalls and abutment extensions measured along the skew angle.

Commentary:
Integral wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not integral to the abutment shall not be included in the quantity or assessment of the abutment element.

9262 Cruciform Mechanically Stabilized Earth Abutment

Description:
This element defines all abutments constructed of mechanically stabilized earth systems that are cruciform concrete panels including integral wingwalls and abutment extensions.

Element Classification: NDOT NBE

NBE Parent: 217 Masonry Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with integral wingwalls and abutment extensions measured along the skew angle.

Commentary:
Integral wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not integral to the abutment shall not be included in the quantity or assessment of the abutment element.

9263 Block Mechanically Stabilized Earth Abutment

Description:
This element defines all abutments constructed of mechanically stabilized earth systems that are modular block units including integral wingwalls and abutment extensions.

Element Classification: NDOT NBE

NBE Parent: 217 Masonry Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with integral wingwalls and abutment extensions measured along the skew angle.

Commentary:
Integral wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not integral to the abutment shall not be included in the quantity or assessment of the abutment element.

9241 Masonry Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (cold joint, water stop, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:
For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9246 Masonry Headwall

Description:
This element defines all headwalls and includes the material retaining the embankment.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without wingwalls.

Commentary:
Used with culverts only. Integral headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.11.7 Other

All elements are constructed of composite materials, or other materials, that cannot be classified using any other defined elements of other material types regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	*			
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
	* 			
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

203 Other Column

Description:
This element defines all visable columns not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9203 Submerged Other Column

Description:
This element defines all submerged columns not otherwise defined and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 203 Other Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

211 Other Pier Wall

Description:
This element defines all pier walls not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

9211 Submerged Other Pier Wall

Description:
This element defines all submerged pier walls not otherwise defined and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 211 Other Pier Wall

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle below the waterline.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

218 Other Abutments

Description:
This element defines all abutments and includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions not otherwise defined but does not include the supporting piles.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet pile joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9218 Submerged Other Abutments

Description:
This element defines all abutments, includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions not otherwise defined but does not include the supporting piles and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 218 Other Abutments

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet pile joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

229 Other Pile

Description:
This element defines all piles that are visible for inspection not otherwise defined. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9229 Submerged Other Pile

Description:
This element defines all piles that are visible for inspection not otherwise defined and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 229 Other Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9236 Other Grade Beam Pile

Description:
This element defines all grade beam piles not otherwise defined. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

236 Other Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

9242 Other Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems not otherwise defined.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (sheet pile joint, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:

For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9247 Other Headwall

Description:
This element defines all headwalls and includes the sheet material retaining the embankment not otherwise defined.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without win walls.

Commentary:
Used with culverts only. Monolithic headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment.

3-EI.12 CULVERTS

3-EI.12.1 General

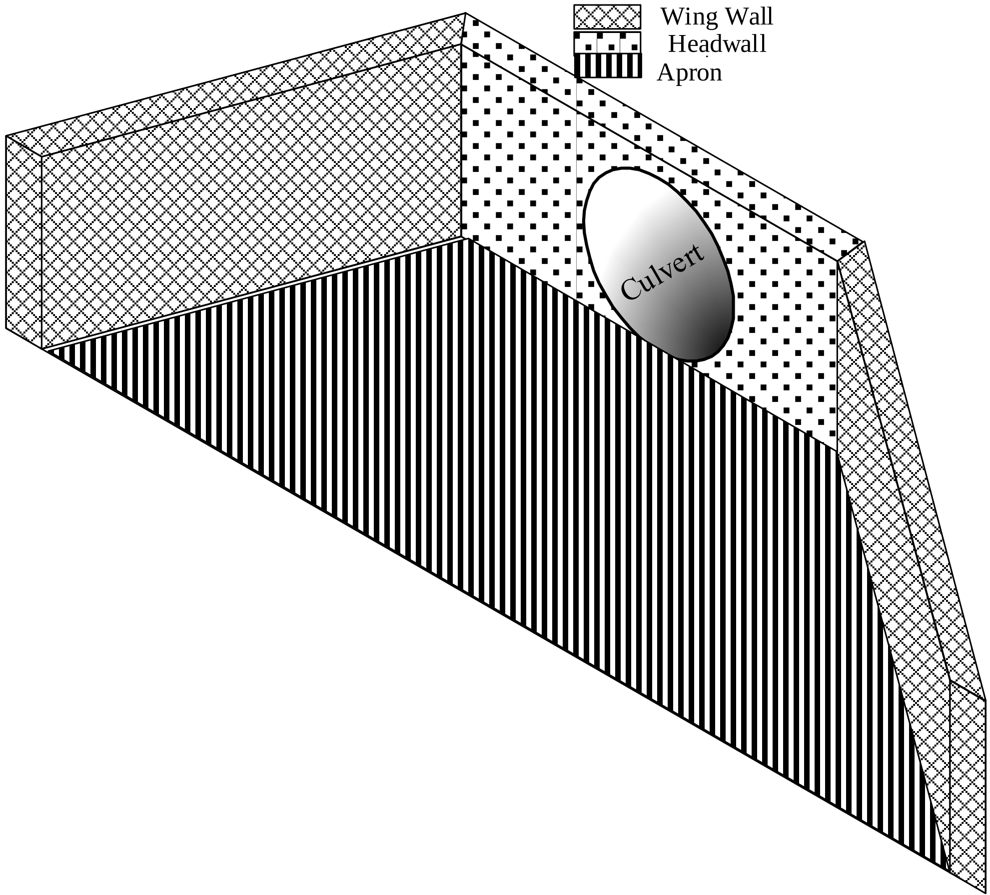
The distortion defect is contingent on a number of factors such as site, wall thickness, fill depth, etc. The inspector shall use such factors to assess the proper condition state.

Record the culvert size in the element description.

Record the number of culvert barrels in the scale field.

If the culvert has a headwall and associated wingwall(s), record the appropriate element. Types and descriptions are listed in the Substructure Element Section of this chapter.

Inspectors should also review guidance in Chapter 6 Scour. If there are further questions, consult the Owner's Hydraulic Engineer or NDOT BIP Bridge Hydraulics Manager.



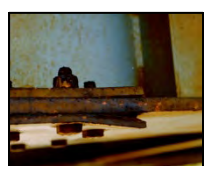
Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the barrel flow line lengths.

3-EI.12.2 Steel

All elements are constructed of steel regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	*			
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

240 Steel Culvert

Description:
This element defines all culverts that are arched, round or elliptical shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9270 Steel Arpon

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.12.3 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned steel reinforced concrete regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	* 			
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	

Defects	Condition States			
	1	2	3	4
	GOOD	**FAIR**	**POOR**	**SEVERE**
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

245 Prestressed Concrete Culvert

Description:
This element defines all culverts that are primarily box shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.12.4 Reinforced Concrete

All elements are constructed of mild steel reinforced concrete regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	* 			
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	

Defects	Condition States			
	1	2	3	4
	GOOD	**FAIR**	**POOR**	**SEVERE**
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

241 Reinforced Concrete Culvert

Description:
This element defines all culverts that are box, arched, round or elliptical shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9271 Reinforced Concrete Apron

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

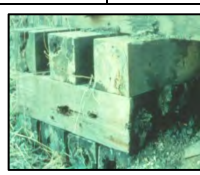
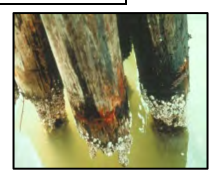
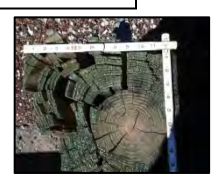
Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.12.5 Timber

All elements are constructed of timber regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Decay/ Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
	* 			
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5% to 50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
	* 			
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Split/ Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Abrasion/ Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

242 Timber Culvert

Description:
This element defines all culverts that are primarily box shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9272 Timber Arpon

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.12.6 Masonry

All elements are constructed of block or stone and may be placed with or without mortar regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	* 			
Mortar Breakdown (Masonry) (1610)	None.	Cracking or voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
	* 			
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

244 Masonry Culvert

Description:
This element defines all culverts that are primarily box and arched shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9273 Masonry Apron

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.12.7 Other

All elements are constructed of composite materials, or other materials, that cannot be classified using any other defined elements of other material types regardless of the protective system.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
	*			
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	*			
Delamination /Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
	*			

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td>Cracking (RC and Other) (1130)</td><td>Width less than 0.012 in. or spacing greater than 3.0 ft.</td><td>Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.</td><td>Width greater than 0.05 in. or spacing of less than 1 ft.</td><td rowspan="6">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>Deterioration (Other) (1220)</td><td>None.</td><td>Initiated breakdown or deterioration.</td><td>Significant deterioration or breakdown but does not warrant structural review.</td></tr>
<tr><td rowspan="2">Distortion (1900)</td><td>None.</td><td>Distortion not requiring mitigation or mitigated distortion.</td><td>Distortion that requires mitigation that has not been addressed but does not warrant structural review.</td></tr>
<tr><td>* </td><td></td><td></td></tr>
<tr><td>Settlement (4000)</td><td>None.</td><td>Exists within tolerable limits or arrested with no observed structural distress.</td><td>Exceeds tolerable limits but does not warrant structural review.</td></tr>
<tr><td>Scour (6000)</td><td>None.</td><td>Exists within tolerable limits or has been arrested with effective countermeasures.</td><td>Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.</td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.</td></tr>
</table>

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

243 Other Culvert

Description:
This element defines all culverts that are box, arched, round or elliptical shaped not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9274 Other Apron

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity not otherwise defined.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.13 JOINTS

3-EI.13.1 General

Joint configurations consist of expansion, pourable, compression and assembly joints.

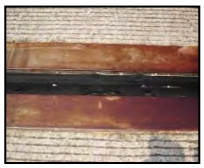
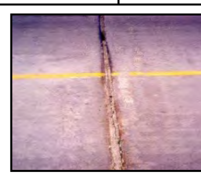
Unit of Measure: Feet

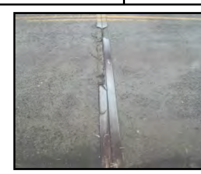
Quantity Calculation:
Quantity for these elements is the sum of the lengths of the joint measured along the skew angle.

3-EI.13.2 Strip Seal Joints

These elements define all expansion joint devices which utilize a waterproof gland with some type of metal extrusion or other system to anchor the gland.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
	* 			
Seal Adhesion (2320)	Fully adhered.	Adhered for more than 50% of the joint height.	Adhered 50% or less of joint height but still some adhesion.	Complete loss of adhesion.
Seal Damage (2330)	None.	Seal abrasion without punctures.	Punctured or ripped or partially pulled out.	Punctured completely through, pulled out, or missing.
Seal Cracking (2340)	None.	Surface crack.	Crack that partially penetrates the seal.	Crack that fully penetrates the seal.
	* 			
Debris Impaction (2350)	No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Adjacent Deck or Header (2360)	Sound. No spall, delamination or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended.
	* 			
Metal Deterioration or Damage (2370)	None.	Freckled rust, metal has no cracks, or impact damage. Connection may be loose but functioning as intended.	Section loss, missing or broken fasteners, cracking of the metal, or impact damage but joint still functioning.	Metal cracking, section loss, damage, or connection failure that prevents the joint from functioning as intended.
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

300 Strip Seal Expansion Joint

Description:
This element defines all joint devices which utilize a neoprene type waterproof gland.

Element Classification: BME

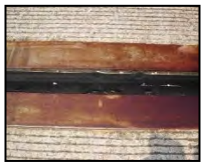
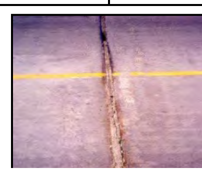
BME Parent: N/A

Commentary:
None.

3-EI.13.3 Pourable Seal Joints

These elements define all joints that have a pourable sealer.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
	* 			
Seal Adhesion (2320)	Fully adhered.	Adhered for more than 50% of the joint height.	Adhered 50% or less of joint height but still some adhesion.	Complete loss of adhesion.
Seal Damage (2330)	None.	Seal abrasion without punctures.	Punctured or ripped or partially pulled out.	Punctured completely through, pulled out, or missing.
Seal Cracking (2340)	None.	Surface crack.	Crack that partially penetrates the seal.	Crack that fully penetrates the seal.
	* 			
Debris Impaction (2350)	No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
	*			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

301 Pourable Seal Joint

Description:
This element defines all joints with or without a backer.

Element Classification: BME

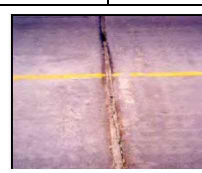
BME Parent: N/A

Commentary:
None.

3-EI.13.4 Compression Seal Joints

These elements define all joints filled with a preformed compression type seal and may or may not have an anchored system to confine the seal.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
	*			
Seal Adhesion (2320)	Fully adhered.	Adhered for more than 50% of the joint height.	Adhered 50% or less of joint height but still some adhesion.	Complete loss of adhesion.
Seal Damage (2330)	None.	Seal abrasion without punctures.	Punctured or ripped or partially pulled out.	Punctured completely through, pulled out, or missing.
Seal Cracking (2340)	None.	Surface crack.	Crack that partially penetrates the seal.	Crack that fully penetrates the seal.
	*			
Debris Impaction (2350)	No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

302 Compression Seal Joint

Description:
This element defines all joints filled with a preformed compression type seal that are not preformed silicone.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

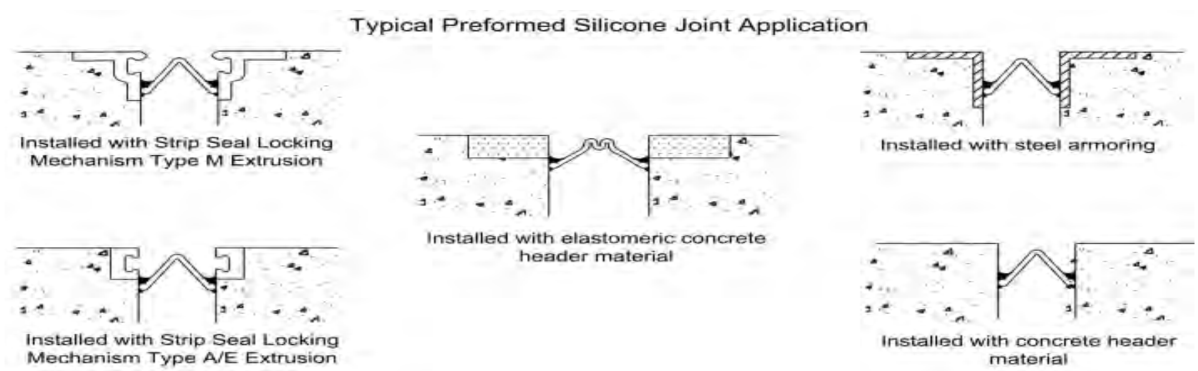
9401 Preformed Silicone Joint

Description:
This element defines all joints that consist of a preformed silicone joint gland and will not have an anchored system to confine the seal.

Element Classification: NDOT BME

BME Parent: 302 Compression Seal Joint

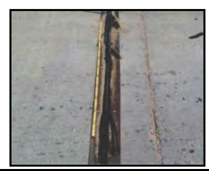
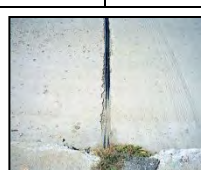
Commentary:
None.



3-EI.13.5 Assembly Joints

These elements define all joints that have an assembly mechanism that may or may not have a seal.

Condition State Definitions:

	Condition States			
	1	2	3	4
Defects	**GOOD**	**FAIR**	**POOR**	**SEVERE**
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
	*			
Seal Adhesion (2320)	Fully adhered.	Adhered for more than 50% of the joint height.	Adhered 50% or less of joint height but still some adhesion.	Complete loss of adhesion.
Seal Damage (2330)	None.	Seal abrasion without punctures.	Punctured or ripped or partially pulled out.	Punctured completely through, pulled out, or missing.
Seal Cracking (2340)	None.	Surface crack.	Crack that partially penetrates the seal.	Crack that fully penetrates the seal.
	*			
Debris Impaction (2350)	No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
	*			
Metal Deterioration or Damage (2370)	None.	Freckled rust, metal has no cracks, or impact damage. Connection may be loose but functioning as intended.	Section loss, missing or broken fasteners, cracking of the metal or impact damage but joint still functioning.	Metal cracking, section loss, damage, or connection failure that prevents the joint from functioning as intended.
	*			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

303 Assembly Joint With Seal

Description:
This element defines all joints that have a seal.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

305 Assembly Joint Without Seal

Description:
This element defines all joints that are open, not sealed and include finger and sliding plate joints.

Element Classification: BME

BME Parent: N/A

Commentary:
Include open joints with or without a drainage trough below the joint.

3-EI.13.6 Open Joints

These elements define all joints that are designed as open joints but not those joints that were designed to have a seal that is currently missing.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Debris Impaction (2350)	No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
	* 			
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

304 Open Expansion Joint

Description:
This element defines all joints that are open but not sealed.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

3-EI.13.7 Other Joints

These elements define all joints constructed of materials that cannot be classified using any other defined joint element.

Condition State Definitions:

	Condition States			
	1	2	3	4
Defects	**GOOD**	**FAIR**	**POOR**	**SEVERE**
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
	*			
Debris Impaction (2350)	No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
	*			
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Metal Deterioration or Damage (2370)	None.	Freckled rust, metal has no cracks, or impact damage. Connection may be loose but functioning as intended.	Section loss, missing or broken fasteners, cracking of the metal, or impact damage but joint still functioning.	Metal cracking, section loss, damage, or connection failure that prevents the joint from functioning as intended.
	*			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

306 Other Joint

Description:
This element defines all joints that cannot be described by any other joint element category.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

3-EI.14 PAVING SLABS

3-EI.14.1 General

Bridge paving slabs are structural sections between the abutment and the roadway pavement that are constructed with mild, prestressed or post-tensioned steel reinforcement and concrete. The presence of the paving slab will require the Grade Beam Caps and Grade Beam Piles elements to be coded but may not be visible for inspection. Types and descriptions are listed in the Substructure Element Section of this chapter.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for this element is the area of the paving slab(s) from edge to edge including any median areas and accounting for any flares or ramps that are present.

3-EI.14.2 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned steel reinforced concrete regardless of the protective system.

Condition State Definitions:

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td>Delamination/ Spall/ Patched Area (1080)</td><td>None.</td><td>Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.</td><td>Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.</td><td rowspan="4">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>Exposed Rebar (1090)</td><td>None.</td><td>Present without measurable section loss.</td><td>Present with measurable section loss but does not warrant structural review.</td></tr>
<tr><td>Exposed Prestressing (1100)</td><td>None.</td><td>Present without section loss.</td><td>Present with section loss but does not warrant structural review.</td></tr>
<tr><td>Cracking (PSC) (1110)</td><td>Width less than 0.004 in. or spacing greater than 3 ft.</td><td>Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.</td><td>Width greater than 0.009 in. or spacing less than 1 ft.</td></tr>
<tr><td>Abrasion/ Wear (PSC/RC) (1190)</td><td>No abrasion or wearing.</td><td>Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.</td><td>Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.</td><td rowspan="2">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>Settlement (4000)</td><td>None.</td><td>Exists within tolerable limits or arrested with no observed structural distress.</td><td>Exceeds tolerable limits but does not warrant structural review.</td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.</td></tr>
</table>

320 Prestressed Concrete Paving Slab

Description:
This element defines all structural paving slab sections.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

3-EI.14.3 Reinforced Concrete

All elements are constructed of mild steel reinforced concrete regardless of the protective system.

Condition State Definitions:

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td>Delamination/ Spall/ Patched Area (1080)</td><td>None.</td><td>Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.</td><td>Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.</td><td rowspan="5">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>Exposed Rebar (1090)</td><td>None.</td><td>Present without measurable section loss.</td><td>Present with measurable section loss but does not warrant structural review.</td></tr>
<tr><td>Cracking (RC and Other) (1130)</td><td>Width less than 0.012 in. or spacing greater than 3.0 ft.</td><td>Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.</td><td>Width greater than 0.05 in. or spacing of less than 1 ft.</td></tr>
<tr><td>Abrasion/ Wear (PSC/RC) (1190)</td><td>No abrasion or wearing.</td><td>Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.</td><td>Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.</td></tr>
<tr><td>Settlement (4000)</td><td>None.</td><td>Exists within tolerable limits or arrested with no observed structural distress.</td><td>Exceeds tolerable limits but does not warrant structural review.</td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.</td><td>The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.</td></tr>
</table>

321 Reinforced Concrete Paving Slab

Description:
This element defines all structural paving slab sections.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

3-EI.15 WEARING SURFACES

3-EI.15.1 General

Deck and slab wearing surfaces consist of asphalt, epoxy/polyester or cementitious materials.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for these elements is the area of the deck/slab that is protected by the wearing surface.

3-EI.15.2 Asphalt Overlays

All elements define the wearing surfaces that consist of flexible asphaltic concrete.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Raveling (9905)	The aggregate and/or binder has started to wear away but has not progressed significantly. The pavement only appears slightly aged and slightly rough.	The aggregate and/or binder have worn away and the surface texture is moderately rough and pitted. Loose particles may be present, and fine aggregate is partially missing from the surface.	The aggregate and/or binder have worn away significantly, and the surface texture is deeply pitted and very rough. Fine aggregate is essentially missing from the surface, and pitting extends to a depth approaching one half the coarse aggregate size.	The wearing surface is no longer effective.
	* 			
Rutting (9906)	No rutting.	Rutting depth 0.25 in to 0.50 in.	Rutting depth 0.50 in. to 0.75 in.	
	* 			
Cracking (AC) (9907)	No Cracking of Asphalt Surface.	The cracks have very little or no spalling along the edges and are less than 0.25 in. in width, Spacing 1 to 4 cracks per 100 ft.	The cracks have little or no spalling but they are greater than 0.25 in. in width. There may be a few randomly spaced low severity connecting cracks near the main crack or at the corners of intersecting cracks, Spacing 5 to 9 cracks per 100 ft.	The wearing surface is no longer effective.
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	The wearing surface is no longer effective.
	*			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9511 Asphalt Overlay

Description:
This element defines all decks/slabs that have a flexible material overlay but without a waterproof membrane.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9512 Asphalt Overlay with Membrane

Description:
This element defines all decks/slabs that have a flexible material overlay with an unkown type of waterproof membrane but may or may not have drain tubes.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9513 Asphalt Overlay with Preformed Fabric Membrane

Description:
This element defines all decks/slabs that have a flexible material overlay with a preformed fabric waterproof membrane but may or may not have drain tubes.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9514 Asphalt Overlay with Cold Liquid Applied Membrane

Description:
This element defines all decks/slabs that have a flexible material overlay with cold liquid applied polyuria waterproof membrane but may or may not have drain tubes.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9515 Asphalt Overlay with Hot Liquid Applied Membrane

Description:
This element defines all decks/slabs that have a flexible material overlay with hot liquid applied asphaltic waterproof membrane but may or may not have drain tubes.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

3-EI.15.3 Thin Lift Overlays

All elements define the wearing surfaces that consist of epoxy/polyester material.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination / Spall / Patched Area / Pothole (Wearing Surfaces) (3210)	None.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched Area that is sound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Patched Area that is unsound or showing distress. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width of more than 0.05 in. or spacing of less than 1.0 ft.	The wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	The wearing surface is no longer effective.
	*			
Damage (7000)	Not applicable	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9514 Multilayer-Polymer Overlay (Epoxy and/or Polyester)

Description:
This element defines all decks/slabs that have a multilayer epoxy and/or polyester material overlay with broadcast aggregate.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

3-EI.15.4 Thick Lift Overlays

All elements define the wearing surfaces that consist of cementitious material.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination / Spall / Patched Area / Pothole (Wearing Surfaces) (3210)	None.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched Area that is sound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Patched Area that is unsound or showing distress. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width of more than 0.05 in. or spacing of less than 1.0 ft.	The wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	The wearing surface is no longer effective.
	* 			
Damage (7000)	Not applicable	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9516 Concrete Overlay (HDLS)

Description:
This element defines all Portland cement low slump and cements without additives.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9517 Latex Modified Overlay

Description:
This element defines all Portland cement overlays that contain latex additives.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9518 Silica Fume Overlay

Description:
This element defines all Portland cement overlays that contain silica fume additives.

Element Classification: NDOT BME

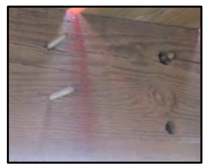
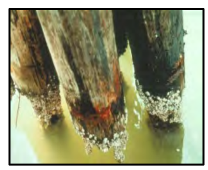
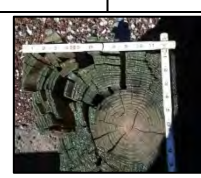
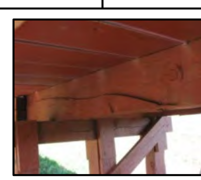
BME Parent: 510 Wearing Surfaces

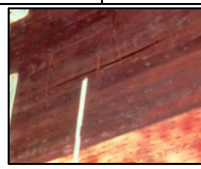
Commentary:
None.

3-EI.15.5 Timber Planks

All elements define the wearing surfaces that consist of timber material.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	The wearing surface is no longer effective.
	* 			
Decay/ Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	The wearing surface is no longer effective.
	* 			
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5% to 50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	The wearing surface is no longer effective.
	* 			
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	The wearing surface is no longer effective.
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Split/ Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	The wearing surface is no longer effective.
	*			
Abrasion/ Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	The wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	The wearing surface is no longer effective.
	*			
Damage (7000)	Not applicable	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9519 Timber Running Planks

Description:
This element defines all decks/slabs that have timber running planks.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

3-EI.15.6 Other Overlays

All elements define the wearing surfaces that consist of other overlays that are not covered in asphalt, epoxy/polyester or cementitious materials.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area/Pothole (Wearing Surfaces) (3210)	None.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched area that is sound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Patched area that is unsound or showing distress. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width of more than 0.05 in. or spacing of less than 1.0 ft.	The wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	The wearing surface is no longer effective.
	* 			
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9515 Other Overlay

Description:
This element defines all other overlays not otherwise defined.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surface

Commentary:
None.

3-EI.15.7 Stay-in-Place Form

All elements define the forms that remain-in-place after the deck has been placed and the bridge is open for service.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Corrosion (1000)	None.	Freckled Rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a review to determine the effect on serviceability of the element or bridge. The condition is beyond the limits established in Condition State 3.
				
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack exists that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, broken welds, fasteners or pack rust with distortion but do not warrant a structural review.	
	* 			
Damage (7000)	Not applicable	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9530 Steel Stay-in-Place Forms (SIP)

Description:
This element defines all soffit stay-in-place forms and does include the protective system of paint or galvanization.

Element Classification: NDOT BME

BME Parent: N/A

Quantity Calculation:
Quantity for this element includes the area between the girder lines only.

Commentary:
None.

3-EI.16 PROTECTIVE SYSTEMS

3-EI.16.1 General

Protective systems consist of materials that protect the parent element.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for these elements is the area of the entire protected parent element surface.

3-EI.16.2 Sealers / Water Proofers

All elements define the sealers/water proofers that are applied to concrete surfaces but the application is not limited to just the decks.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Textured Surface (9900)	Friction course intact.	Less than 10% has been worn off.	10% to 25% has been worn off.	More than 25% has been worn off.
Wear (Concrete Protective Coatings) (3510)	None.	Underlying concrete not exposed, coating shows wear from UV exposure, friction course missing.	Underlying concrete is not exposed; thickness of the coating is reduced.	Underlying concrete exposed. Protective coating no longer effective.
Effectiveness (Concrete Protective Coatings) (3540)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

9521 Healer/Sealers

Description:
This element defines all concrete elements that have a crack healer/sealer applied to them such as High Molecular Weight Methacrylate (HMWM).

Element Classification: NDOT BME

BME Parent: 521 Concrete Protective Coating

Commentary:
None.

9522 Silane/Siloxane Water Proofers

Description:
This element defines all concrete elements that have a water proofer applied to them such as silane/siloxane.

Element Classification: NDOT BME

BME Parent: 521 Concrete Protective Coating

Commentary:
None.

3-EI.16.3 Steel Protective Coatings

All elements define steel protective coatings.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for these elements is the area of the entire protected steel element surface. The element quantity can be estimated utilizing the following methodology:

- Steel beams that are rolled or built-up sections: length (feet) X web height (feet) X 2.9.
- Trusses and arches: length (feet) X panel height (feet) X 0.6.
- Round culverts: length (feet) X 3.14 X diameter (feet).
- Oval culverts: length (feet) X 6.28 X $\sqrt{\frac{\left(\frac{\text{Diameter 1}}{2}\right)^2+\left(\frac{\text{Diameter 2}}{2}\right)^2}{2}}$.

Commentary:
Used on structural elements only such as deck, girders, trusses, columns, abutments and culverts but not applicable to traffic rails or other non-structural elements.

3-EI.16.4 Weathering Patina

All elements define the weathering steel protective coating.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Oxide Film Degradation Color / Texture Adherence (Steel Protective Coatings) (3430)	Yellow-orange or light brown for early development. Chocolate-brown to purple-brown for fully developed. Tightly adhered, capable of withstanding hammering or vigorous wire brushing.	Granular texture.	Small flakes, less than 0.50 in. diameter.	Dark black color. Large flakes, 0.50 in. diameter or greater or laminar sheets or nodules.
	* 			
Effectiveness (Steel Protective Coatings) (3440)	Fully effective.	Substantially effective.	Limited effectiveness.	Failed, no protection of the underlying metal.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9541 Weathering Steel Protective Coating

Description:
This element defines all steel elements that have a patina protective coating.

Element Classification: NDOT BME

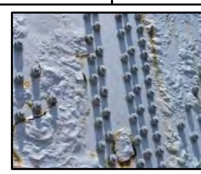
BME Parent: 515 Steel Protective Coating

Commentary:
None.

3-EI.16.5 Other Steel Coatings

All elements define the protective paint systems that consist of single and multi-coat systems as well as organic and inorganic systems.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Chalking (Steel Protective Coatings) (3410)	None.	Surface dulling.	Loss of pigment.	Not applicable.
Peeling / Bubbling / Cracking (Steel Protective Coatings) (3420)	None.	Finish coats only.	Finish and primer coats.	Exposure of bare metal.
	* 			
Effectiveness (Steel Protective Coatings) (3440)	Fully effective.	Substantially effective.	Limited effectiveness.	Failed, no protection of the underlying metal.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9540 Steel Paint Protective Coating

Description:
This element defines all steel elements that have a paint protective coating.

Element Classification: NDOT BME

BME Parent: 515 Steel Protective Coating

Commentary:
None.

9542 Galvanized Steel Protective Coating

Description:
This element defines all steel elements that have a galvanized protective coating.

Element Classification: NDOT BME

BME Parent: 515 Steel Protective Coating

Commentary:
None.

9543 Other Steel Protective Coating

Description:
This element defines all steel elements that have other top coat steel corrosion inhibitors that are not paint or galvanized.

Element Classification: NDOT BME

BME Parent: 515 Steel Protective Coating

Commentary:
None.

3-EI.16.6 Concrete Reinforcing Steel Protective Systems

All elements define situations where the concrete element may be expected to deteriorate at a rate that is slower than an unprotected situation. Protective systems include rebar coatings, cathodic protection or other similar protective methods.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Effectiveness - Protective System (e.g. cathodic) (3600)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

520 Concrete Reinforcing Steel Protective System

Description:
This element defines all concrete reinforcing steel corrosion protective systems.

Element Classification: BME

BME Parent: N/A

Commentary:
Do not use if a wearing surface but address the wearing surface utilizing the appropriate wearing surface element.

3-EI.17 COUNTERMEASURES

3-EI.17.1 General

Countermeasures consist of various types of slope protection that includes riprap, A-Jack, spur dikes, gabions, articulating blocks and concrete slope protection and need to be assessed based on their effectiveness.

Unit of Measure: Feet

Quantity Calculation:
Quantity for these elements is the sum of the length along the channel.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Effectiveness (Countermeasures) (9901)	Countermeasure shows no signs of deterioration. There are signs of scour repair and installation of the countermeasure. Scour has been stabilized.	Countermeasure has some signs of deterioration, minor shifting, and/or movement of the countermeasure, but there are no signs of additional scour at the countermeasure location. Scour is stabilized.	The countermeasure shows signs of deterioration. The installed countermeasure has been compromised and there are signs of new or recurring scour.	The countermeasure is no longer effective. There is little or no sign of the countermeasure. There are signs that scour is affecting the substructure elements of the bridge. Damage is significant enough to warrant analysis of the bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

9250 Riprap

Description:
This element defines all placed material of broken stone/concrete to protect the foundations and/or revetments of embankments.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9251 A-Jack

Description:
This element defines all precast geometric shapes that are interlocked with each other to protect the substructure element.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9252 Spur Dikes

Description:
This element defines all placed material in a jetty for guiding overbank flow through the adjacent structure.

Element Classification: NDOT BME

BME Parent: N/A

Quantity Calculation:
Quantity for this element is the sum of the length along the jetty.

Commentary:
None.

9253 Gabions

Description:
This element defines all wire baskets filled with non-erosive material.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9254 Articulating Blocks

Description:
This element defines all tied and/or interlocking precast blocks.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9255 Concrete Slope Protection

Description:
This element defines all poured concrete placed armoring around substructure elements.

Element Classification: NDOT BME

BME Parent: N/A

Quantity Calculation:
Quantity for this element is the sum of the length along the abutment.

Commentary:
None.

9256 Other Slope Protection

Description:
This element defines all other slope protection that is not covered in other countermeasure elements.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.18 OTHER CONDITION ASSESSMENT MARKERS

3-EI.18.1 General

The purpose of "Other Condition Assessment Markers" is to enhance the assessment of the parent element and can be utilized in other project level activities but not within the deterioration models.

3-EI.18.2 Chloride Contamination

All elements define the chloride contamination data that will be populated based on a deck survey. As part of the element notes, record the date and concentration of the in-depth deck evaluation.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for this element is the area of the deck from edge to edge including any median areas and accounting for any flares or ramps present.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Chloride Concentration (9902)	0 to 0.5 lbs./cu.yd.	0.5 to 1 lbs./cu.yd.	1 to 2 lbs./cu.yd.	Greater than 2 lbs./cu.yd.

9550 Deck Chlorides at Reinforcement Level

Description:
This element defines all deck chloride concentrations at the rebar level from in-depth deck testing and investigation. The supporting data for this element shall be documented in the deck survey results.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.18.3 Electrical Potentiality

All elements define the electrical potential data that will be populated based on a deck survey. As part of the element notes, record the date and electrical potential of the in-depth deck evaluation.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for these elements include the area of the deck from edge to edge including any median areas and accounting for any flares or ramps present.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Half-Cell Potential (CSE - Copper-Copper Sulfate Electrode) (9903)	-0.00 to -0.20 V CSE.	-0.20 to -0.35 V CSE.	-0.35 to -0.40 V CSE.	Greater than -0.40 V CSE.

9551 Electrical Potential at Reinforcement Level

Description:
This element defines all deck electrical potential at the rebar level from in-depth deck testing and investigation. The supporting data for this element shall be documented in the deck survey results.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.18.4 Flow Restrictions

All elements define the flow restrictions applicable to both bridges and culverts.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Debris/Silt Blocking Flow on Hydraulic Structure (9904)	No significant debris/silt lodged against structure.	Debris/silt has started building but has not restricted flow <10%.	Debris/silt has built-up and has started to restrict flow <50%.	Debris/silt has blocked flow through the structure ≥50%.

9552 Debris Blocking Flow

Description:
This element defines the aproximate amount of debris that is accumulating in the stream at a structure.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is "Each" and only one element per span group is allowed.

Commentary:
Do not code until debris level has reached Condition State 2 (Fair).

9553 Silt in Culvert Barrel

Description:
This element defines the aproximate amount of silt that is accumulating in the culvert barrel.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Calculation:
Quantity for this element is "Each" and only one element per span group is allowed.

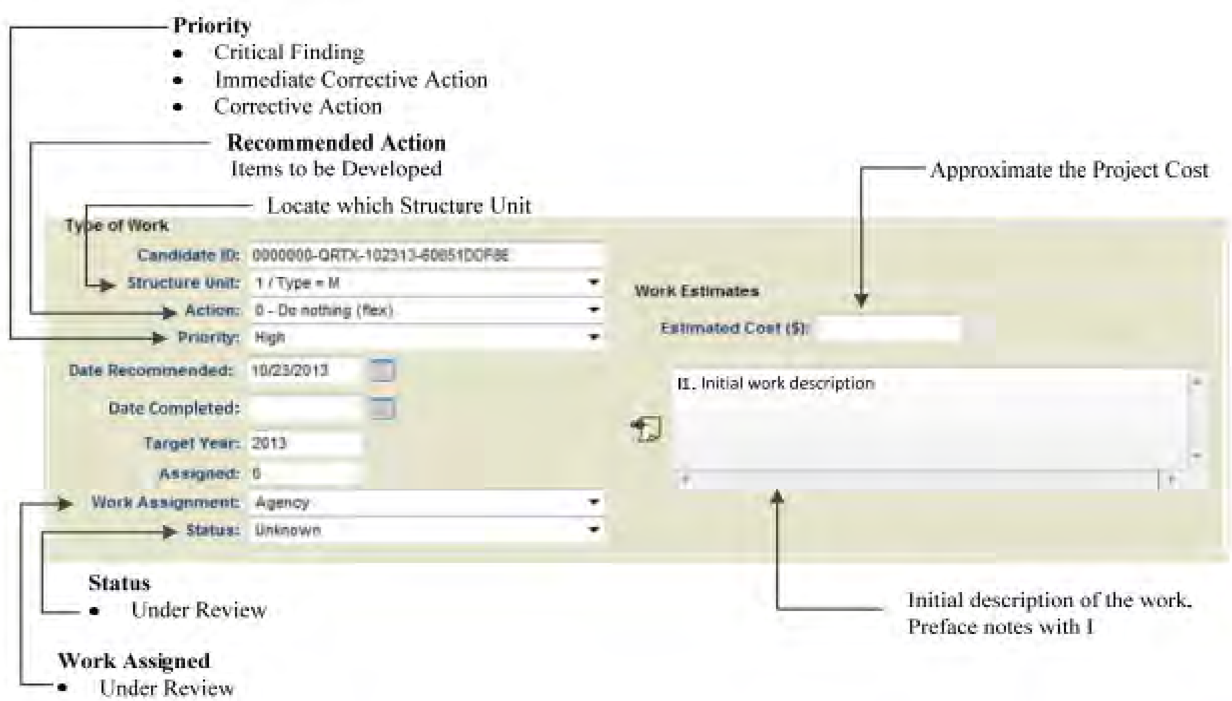
Commentary:
Do not code until silt level has reached Condition State 2 (Fair).

3-EI.19 INSPECTOR WORK FINDINGS/STRUCTURE REPAIR/CRITICAL FINDING REPORTS

The work flow developed to document the process pertaining to the initial findings, progress update and closeout action is as follows:

Inspector Initiates Work:
The inspector initiates the work from the inspection and also records the following:

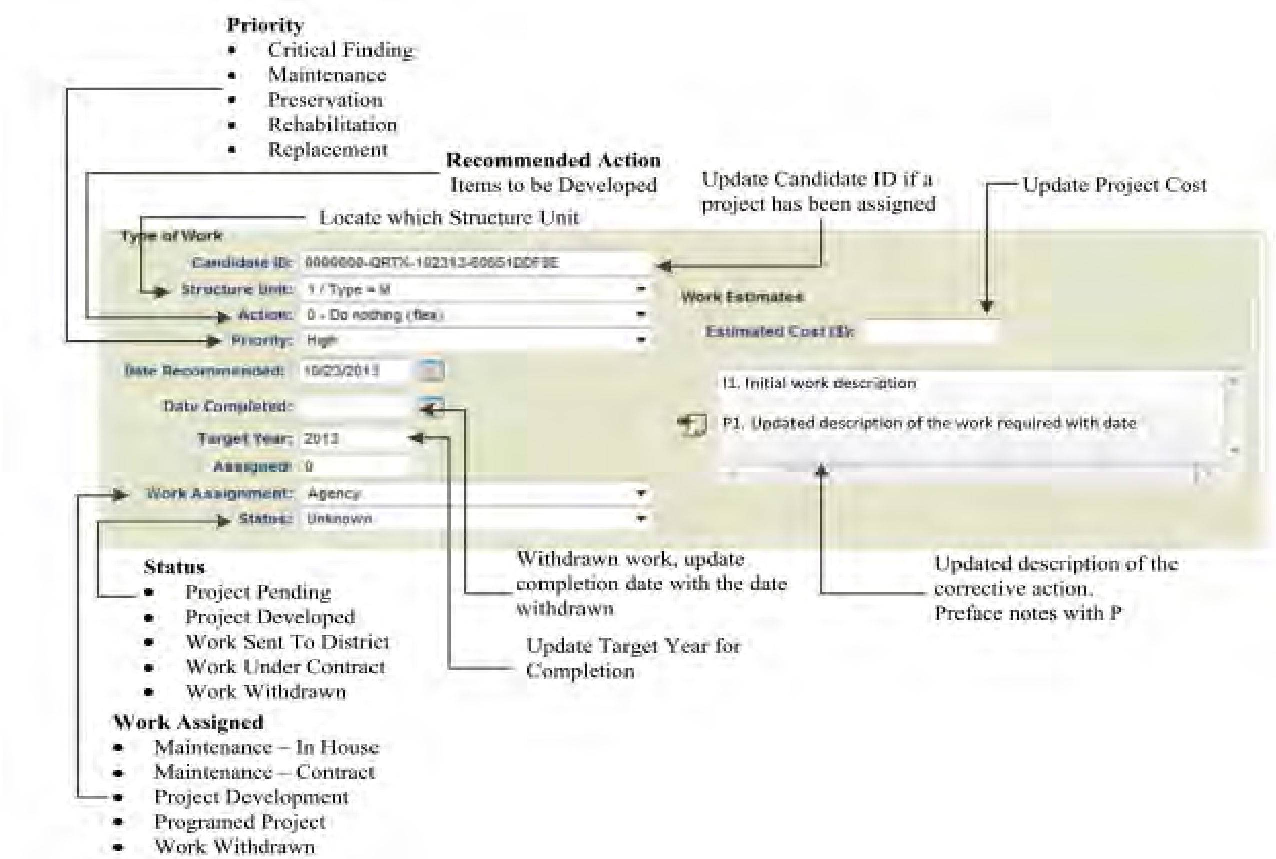
- Structure Unit were the defect was located.
- Recommended action.
- Priority – Critical Finding or Structure Repair.
- Status – "Under Review" will be the only option for this stage.
- Action type.
- Approximate cost of the action.
- Description of the corrective action. Notes will be prefixed with an "I".
- Work Assigned will be "Under Review".



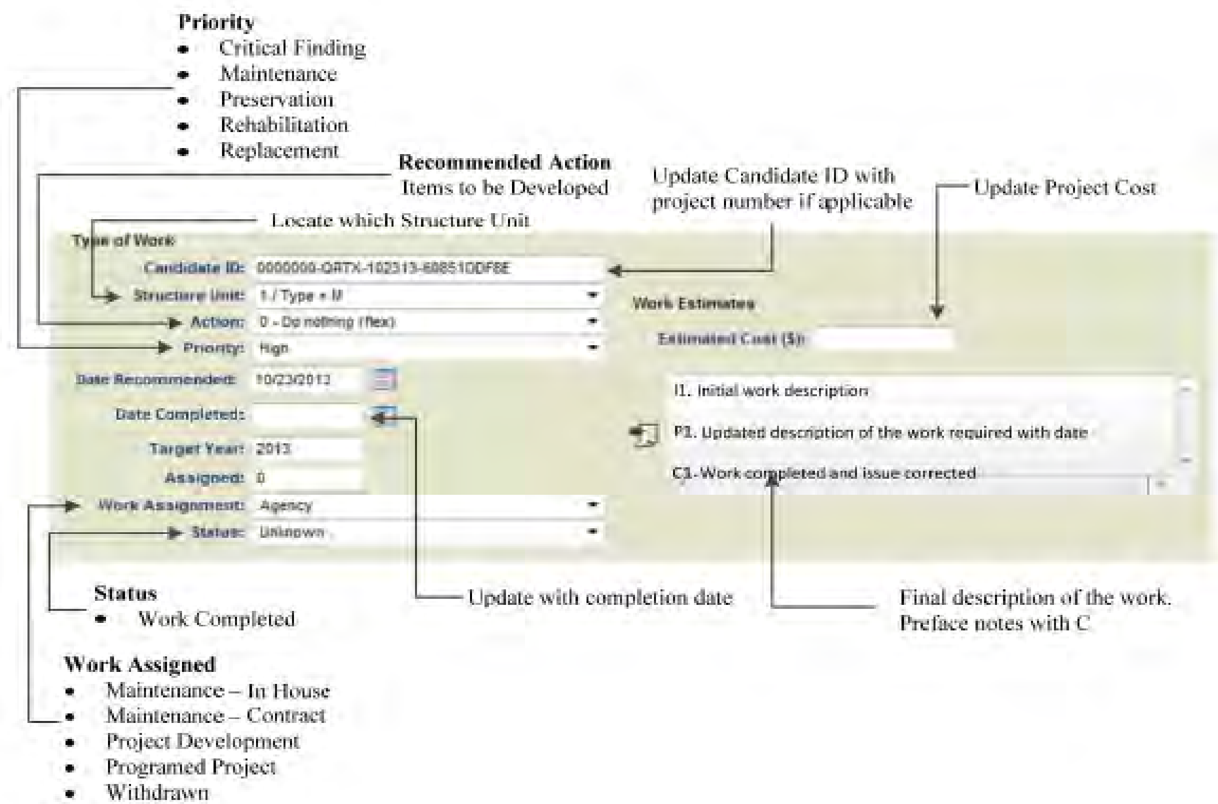
Work Under Review and Assignment (Progress):
The work candidate will be reviewed by the appropriate oversight committee for action and assigned as either a District Maintenance action or a Project Development action which will also require an update to its status in the work flow process. It should be noted that if a proposed project already exists that will address the assigned corrective action, the corresponding project identification will be required to be placed in the "Candidate ID" field.

In addition, the work candidate's Priority, Action, Estimated Cost, Target Completion Year and Action Description will have to be updated accordingly and any information added to the Action Description Field will be prefaced with a "P".

Work candidates that were reviewed and deemed not feasible or were withdrawn, will be marked as such in the Status and Work Assigned fields along with updating the Date Completed with the date that the action was withdrawn.



Project Completed:
When a project has been completed and the improvement has been confirmed by inspection, the Bridge Owner or their representative will update the status, insert the date the action was completed, insert the final cost of the project and insert any additional relevant comments. All comments added at this step will be prefaced with a "C".



3-EI.20 QUALITY CONTROL

The NBIS defines 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.”

Quality Control is defined for NDOT’s program as a system of routine technical activities, to measure and control the quality of the bridge inventory data or report as it is being developed. The QC system is designed to include general methods such as accuracy checks on data acquisition and calculations, and the use of approved standardized procedures for measurement, calculation, recording information and reporting. QC activities include:

- Documents, data, or calculations signed by a PE, must have QC completed by an individual of equivalent or better qualifications than the originator (this is typically documented when the QC individual signs or initials the documents).
- See that the technical activity has followed procedures set by NDOT.
- Providing routine and consistent checks for data integrity, correctness and completeness.
- Identifying and addressing errors and/or omissions.
- Documenting inventory data.
- Recording all QC activities.

Quality Control for this program is the responsibility of the consultant or agency actually conducting the activity. Quality Control checks are conducted on every product of a program operation, and thus at a much higher frequency than quality assurance checks. When the QC on a program product is complete, it is finished and deliverable to the Bridge Owner for their records.

Consultants providing professional services to Bridge Owners must submit a Quality Control plan to the Bridge Owner for review and approval. QC must be done on the deliverables prior to submittal to the Bridge Owner.

NDOT completes QC on data that has been entered into the BrM database on a continual basis.

3-EI.21 QUALITY ASSURANCE

Quality Assurance (QA) of all load rating data in the Bridge Inventory will be performed by NDOT or their selected agent. The QA program activities are described in Chapter 1 of this Manual.

3-EI.22 REVISION HISTORY

Rev	Date	Description
0	2014 May 16	Initial Issue of Chapter
1		
2		
3	2015 March 15	Revision 3
4	2016 March 11	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

3-EI.23 FORMS

Forms used in completing inspections that are mentioned in this Chapter are listed below. Participants and contributors to the Nebraska Bridge Inspection Program are advised to go to the NDOT Bridge Inspection Program website http://dot.nebraska.gov/business-center/bridge/forms/ for the current list of applicable forms and the most recent versions of each form.

Name	DR Form
Structural Inventory and Appraisal	N/A

3-EI.24 APPENDIX A: INSPECTION EXAMPLES

3-EI.24.1 General

Memos and other guidance that may have been issued after the issuance of the current revision of this Chapter can be found at the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/

Participants are urged to check this site to ensure they have all the most current information and forms.

The element level inspection allows for a more acute evaluation of bridge components by breaking out the standard NBI Structural Categories (i.e. deck, superstructure, substructure, etc.) into the specific components, or elements that comprise those categories.

While this may appear cumbersome at first, the element level inspection allows the inspector to view the structure more intently and may provide the inspector with more information to determine the most appropriate NBI coding.

Included with all elements is an Environmental State. This state is used for project development and deterioration modeling. Those elements exposed to deicing agents, located at or under deck joints, or exposed to standing or running water are subjected to harsher conditions. Referring to Section 3-EI.5.2 Element Inspection Coding of Chapter 3, the inspector will notice a flow chart that determines the Environmental State that shall be applied to all elements. The inspector will also note that there is a “hidden elements” branch in the flow chart which equates to an element that has never been exposed, or was exposed and then covered. These elements should be coded “0” under the environmental state. Grade beam piling and grade beams are the only “hidden” elements. Once the grade beam caps or piling become exposed they shall be evaluated and recorded under the appropriate environmental state.

This Appendix is intended to provide the reader with several examples that detail the element break down of typical bridge structures seen throughout the Nebraska roadway system. The examples provide an appropriate amount of information for an inspector to assemble the primary elements for each structure. After a total quantity is determined, it is the inspector’s responsibility to evaluate each element by its assigned unit of measure and determine and record the appropriate defects within each unit of measure.

Please note, that while the Appendix is an aid, no two structures are the same. Consequently, this Appendix does not include every possible element listed within Chapter 3-EI Element Inspection Coding. It is the inspector’s responsibility to accurately determine the appropriate elements and defects that make up a particular structure.

Refer to the AASHTO *Manual for Bridge Element Inspection*, 1st Edition 2013, Appendix B for specific examples of determining defects and the appropriate Condition State on bridge elements.

3-EI.24.2 Simple Span Concrete Slab

Superstructure: 30'-0 simple span concrete slab

Structure located in Environmental Zone 2

ADTT = 10 and low salt use

Substructure: Steel sheet piling supported by wide flange walers and H-piles

Traffic Appurtenances: W-beam rail supported by steel wide flange posts

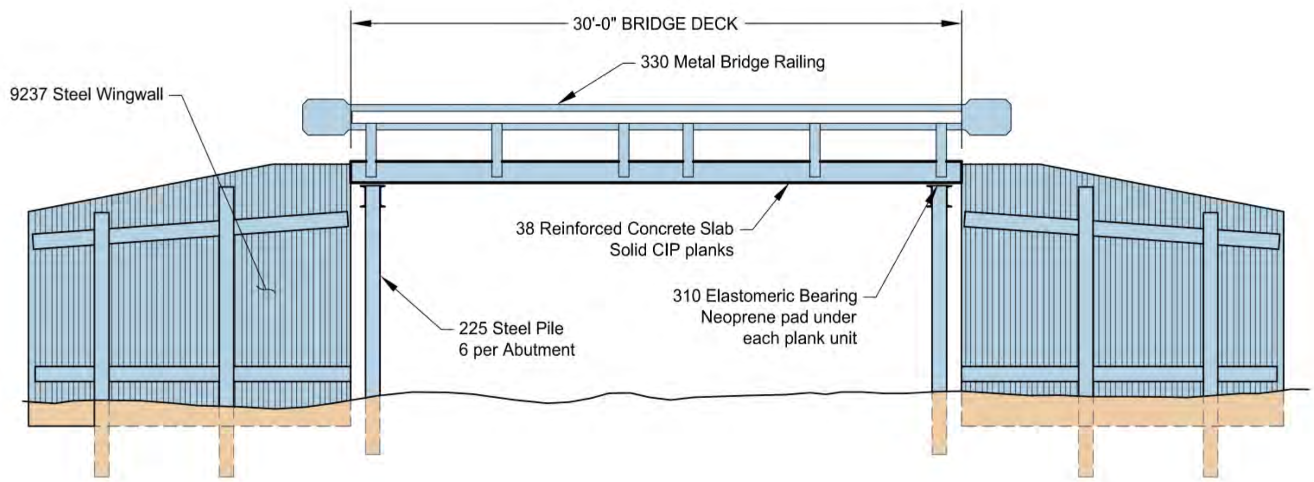


Figure 3-EI.24.2-1: Elevation view of simple concrete slab bridge

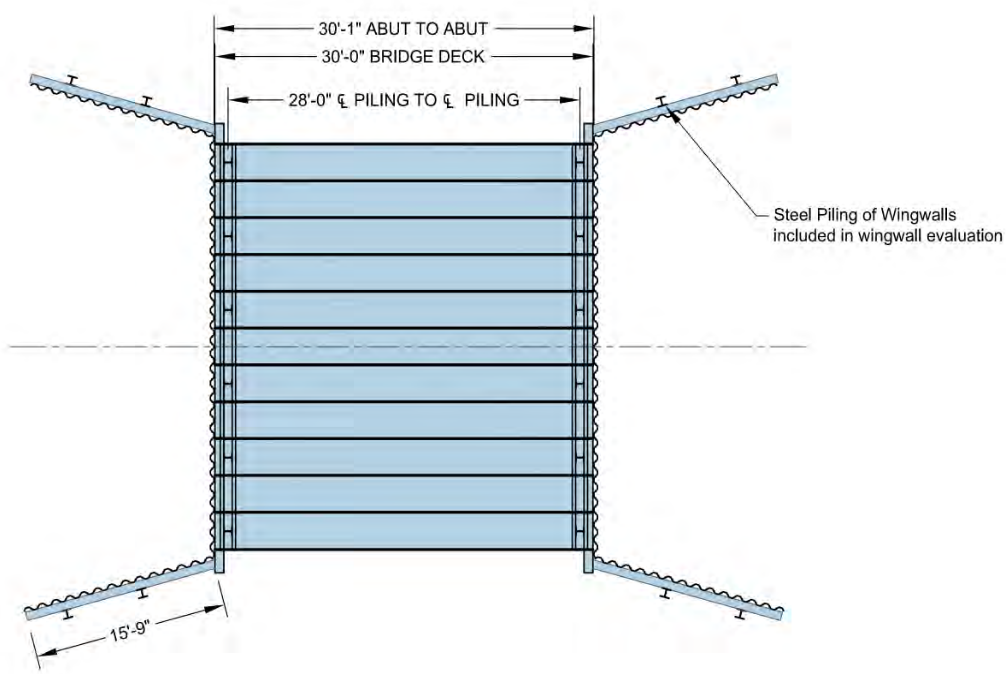


Figure 3-EI.24.2-2: Plan view of simple concrete slab bridge

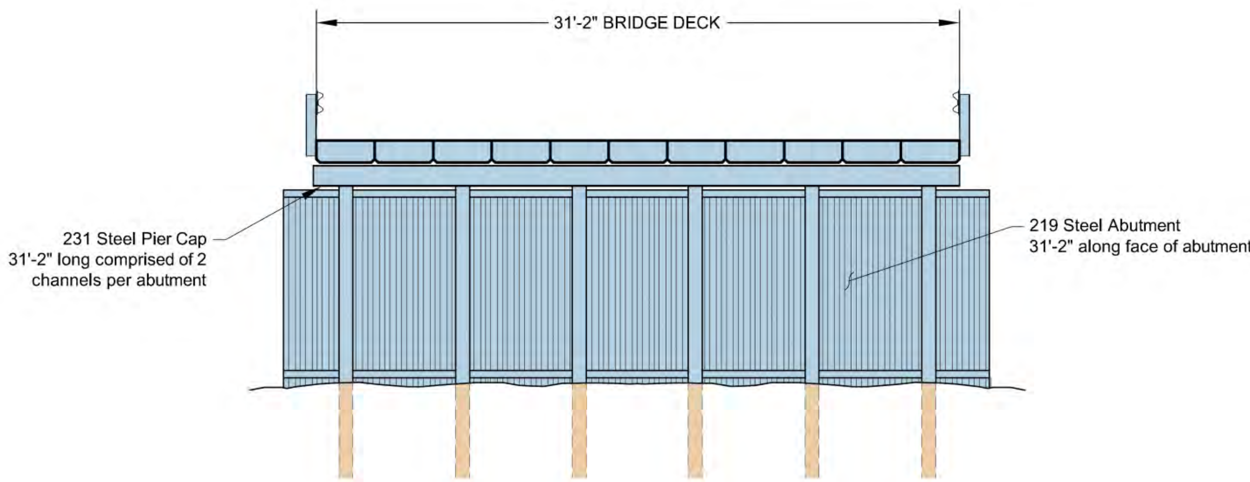


Figure 3-EI.24.2-3: Cross section half-view of simple concrete slab bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume Deck joints are not leaking.

Deck and elements under joints: Environmental State = 2 (for zone 2) + 0 (for low salt use) + 0(for ADTT < 1000) = 2

Super and substructure elements not under joints: Environmental State = 2 (for zone 2) + 0(for salt use) + 0(for ADTT< 1000) = 2

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	38	Reinforced Conc. Slab		SF	936	2
Quantity Calculation		*Span 1*	*30.0' x 31.2' = 936*			
M	310	Elastomeric Bearing		EA	22	2
Quantity Calculation		*Span 1*	*11 x 2 = 22*			
M	330	Metal Bridge Railing		FT	60	2
Quantity Calculation		*Span 1*	*30.0 x 2 = 60*			

Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	219	Steel Abutment		FT	63	2
Quantity Calculation		*Span 1*	*31.2 x 2 = 63*			
M	225	Steel Pile		EA	12	2
Quantity Calculation		*Span 1*	*6 x 2 = 12*			
M	231	Steel Pier Cap		FT	63	2
Quantity Calculation		*Span 1*	*31.2' x 2 = 63*			
M	9237	Steel Wingwall		FT	63	2
Quantity Calculation		*Span 1*	*15.75' x 4 = 63*			

Element Commentary – Simple Span Concrete Slab

38 Reinforced Concrete Slab – Solid

Use slab element when girder elements are not present. This slab bridge was constructed using precast concrete units. The units act as one which is most similar to a slab.

Rate each square foot of the slab using the condition state definitions. The assessment represents the worst condition stated of each square foot, which includes the top, bottom, and edges of the slab when visible.

Assess overlays and forms using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or stay-in-place forms to assess the slab when no surfaces of the slab are visible. Do not include the condition of the rail or curb in the assessment of the slab.

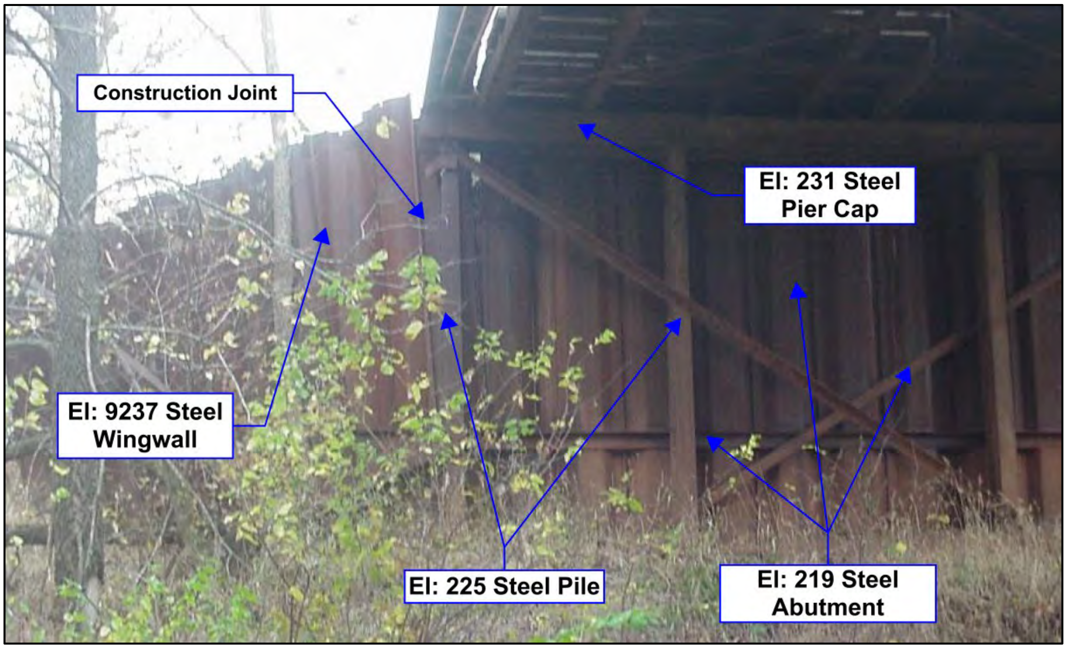
219 Steel Abutment

Use when the piling is comprised of steel and/or when steel sheet piling is used as the primary component to retain roadway fill. Wingwalls are included in the abutment element when they are integral or if they are not independent of one another. Steel sheet piling, for example, that continues beyond the limits of the superstructure is assessed under the abutment element so long as the sheet piling is interlocked continuously.

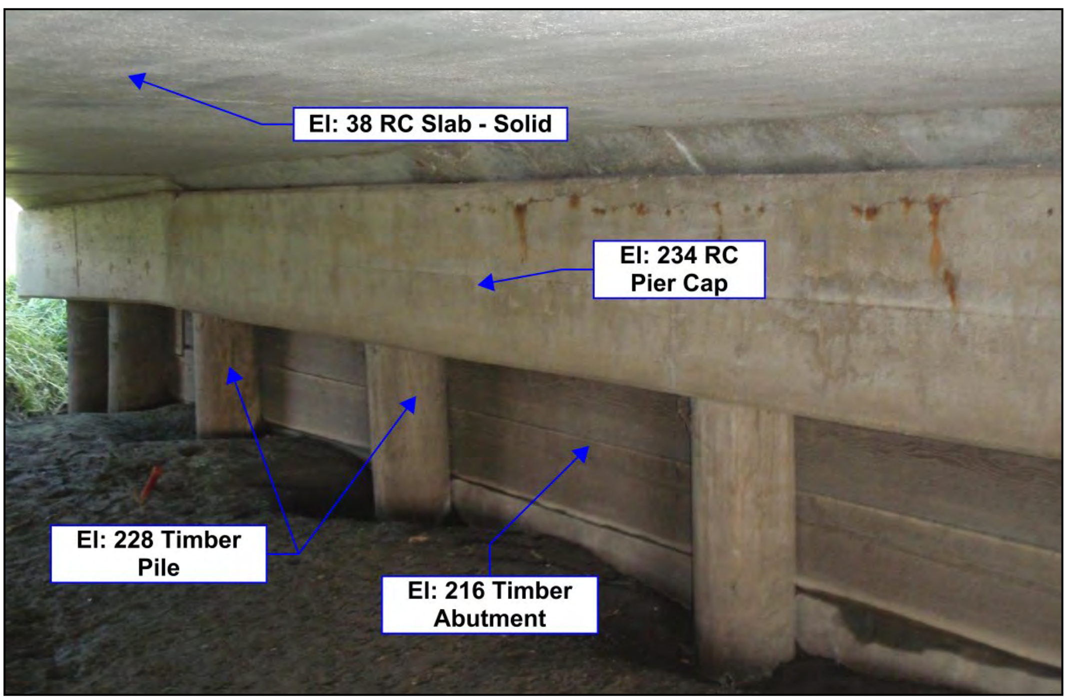
Rate each linear foot of the abutment using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes the full height of the abutment.

Wingwalls parallel to the abutment should be included in the length of the abutment. Wingwalls that are flared or perpendicular to the abutment are assessed under another NDOT BME. Element 9237 Steel Wingwall would be used when steel sheeting is used.

Steel Abutment Example



Timber Abutment Example (for Comparison)



225 Steel Pile

Assess each exposed steel pile supporting the abutment quantity using condition state definitions. Assign the overall condition state per exposed pile.

Include wingwall piles if the wing is included in the abutment quantity. Do not include piling for wingwall elements, as they are included in the wingwall assessment.

Only those piles that are exposed and visible shall be inspected and quantified and assigned the appropriate Environmental State. Hidden piles are not quantified on the inspection report and thus will not have an Environmental State associated with them. The only exceptions to this rule are the Grade Beam Pile elements. These piling shall be quantified, regardless if exposed or not. Hidden grade beam piling will have an Environmental State of "0" assigned to them. Exposed grade beam piling shall be evaluated using the appropriate Environmental State.

Piles may be exposed due to scour, erosion, settlement, etc. and then filled back in or repaired. If piling originally exposed had been inspected and subsequently buried, the inspector shall keep the piling quantity on the inspection report and note the piling has been buried, whether by natural or manmade countermeasures.

231 Steel Pier Cap

Use when the superstructure bears along a cap on a pile bent, regardless if an abutment or pier.

Rate each linear foot of the steel cap using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes all sides of the cap element. In this example the cap is constructed of two steel channels separated between the piling. Both channels are assessed as one element. The inspector should record the worst condition of either channel along each foot.

310 Elastomeric Bearing

Use when the slab bears on a pad of elastomeric material (a simple pad or reinforced with steel plate).

Rate each bearing using the condition state definitions. The assessment represents the worst condition found on each bearing.

330 Metal Bridge Railing

Use when metal rail beam and posts are used as the traffic appurtenances on the bridge structure. The element does not include the portions of the rail that extend beyond the limits of the bridge or abutment onto the roadway approaches.

Rate each linear foot of the metal rail using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes all sides of the bridge railing, posts, and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects.

Remaining portions of rail off the bridge are assessed under an NDOT BME in element level inspection. For this example all railing components are to be assessed under element 330. There is no approach rail.

9237 Steel Wingwall

Use when steel sheet piling and piling are used to retain roadway fill beyond the extents of the steel abutment sheeting under the superstructure. While steel sheeting is typically “locked” together, the joint created acts more as a hinge, thus making steel sheet piling in essence not integral.

Rate each linear foot of the steel wingwall using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes the full height of the steel sheeting, steel piling, and steel waling, if present. Since piling condition is included with this element, do not include wing piling within the piling element.

3-EI.24.3 Continuous Concrete Slab

Superstructure: 92'-0 continuous concrete slab

Structure located in Environmental Zone 3

ADTT = 500 and low salt use

Substructure: Semi-integral concrete abutment supported by steel piling

Traffic Appurtenances: Concrete open rail supported by concrete posts

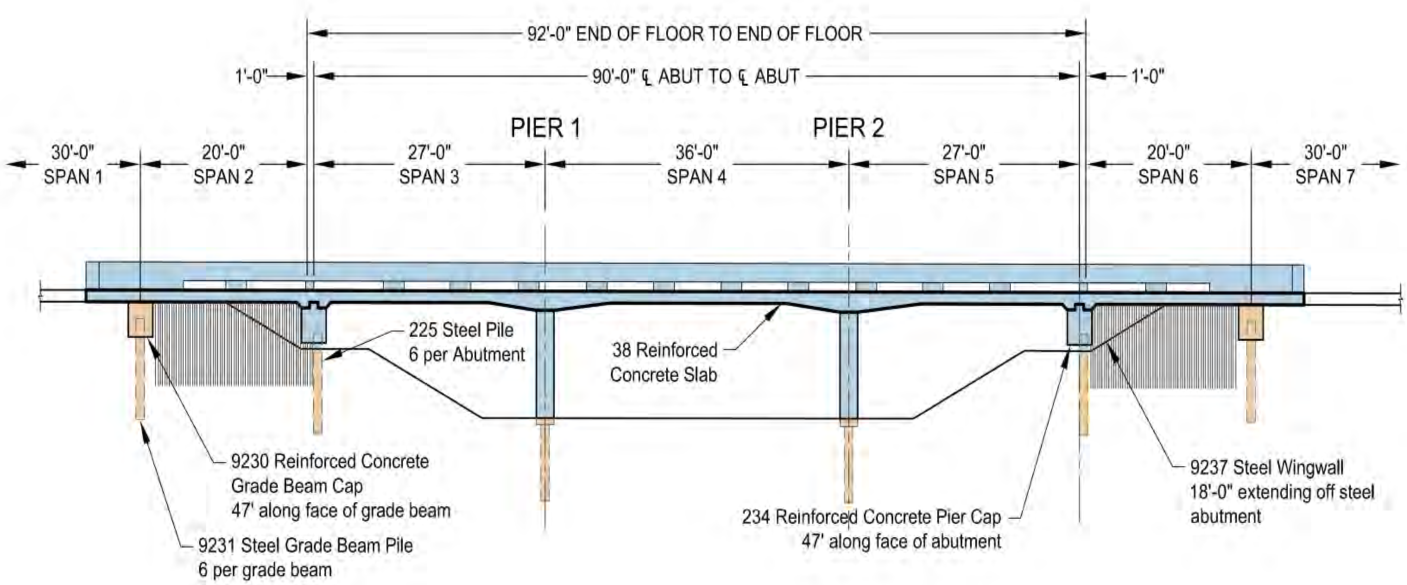


Figure 3-EI.24.3-1: Elevation view of continuous concrete slab bridge

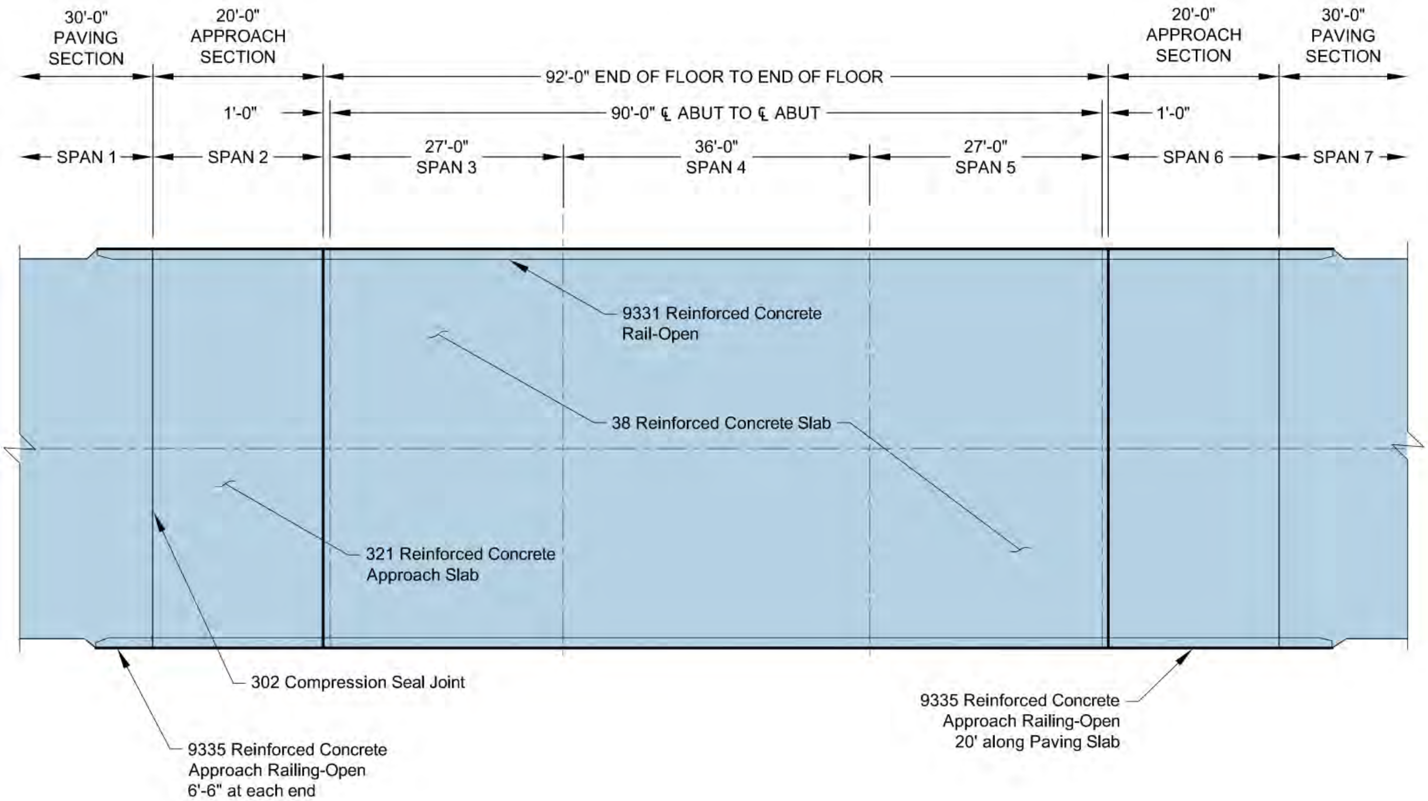


Figure 3-EI.24.3-2: Plan view of continuous concrete slab bridge

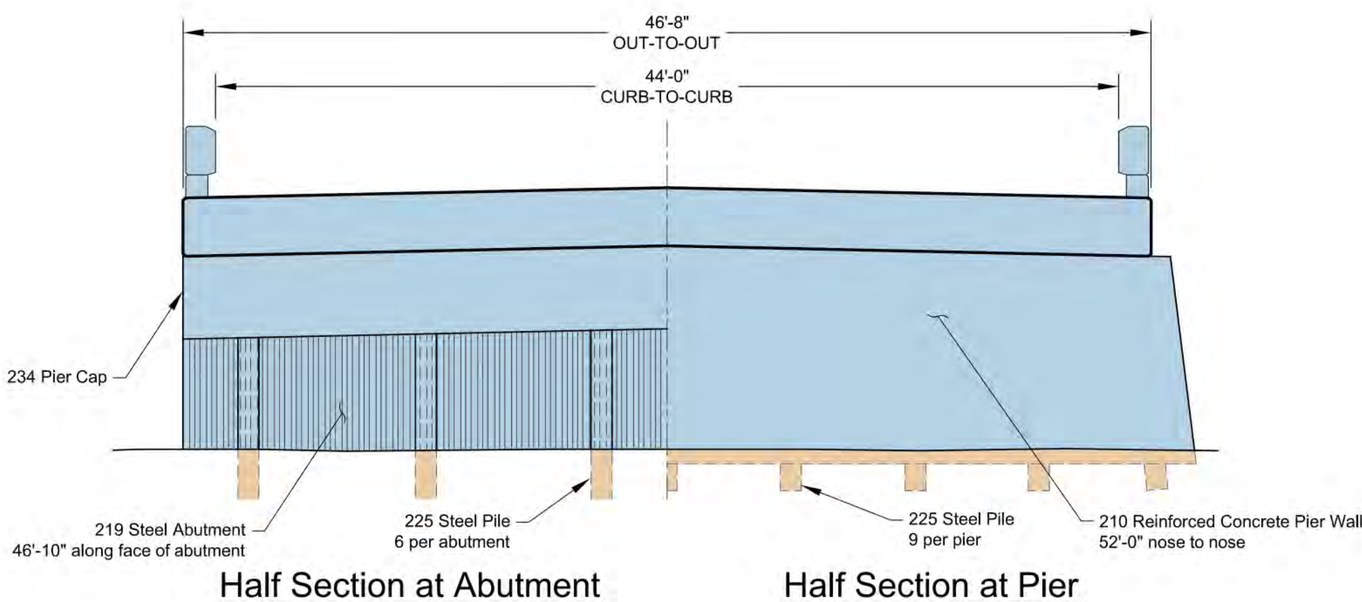


Figure 3-EI.24.3-3: Cross section view of continuous concrete slab superstructure

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 3 (for zone 3) + 0 (for low salt use) + 0(for ADTT < 1000) = 3

Super and substructure elements not under joints: Environmental State = 3 (for zone 3) + 0 (for no leakage) + 0 (for ADTT < 1000) = 3

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	38	RC Slab - Solid		SF	4,294	3
Quantity Calculation		*Span 3*	*28' x 46.67' = 1,307*			
		Span 4	*36' x 46.67' = 1,680*			
		Span 5	*28' x 46.67' = 1,307*			
M	9331	RC Bridge Railing - Open		FT	184	3
Quantity Calculation		*Span 3*	*28' x 2 = 56*			
		Span 4	*36' x 2 = 72*			
		Span 5	*28' x 2 = 56*			

Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	210	RC Pier Wall		FT	104	3
Quantity Calculation		*Span 3*	*52'*			
		Span 4	*52'*			
M	219	Steel Abutment		FT	94	3
Quantity Calculation		*Span 3*	*46.83'*			
		Span 5	*46.83'*			
M	225	Steel Pile		EA	12	3
Quantity Calculation		*Span 3*	*6*			
		Span 3	*9 (unexposed)*			
		Span 4	*9 (unexposed)*			
		Span 5	*6*			
M	234	RC Pier Cap		FT	94	3
Quantity Calculation		*Span 3*	*47'*			
		Span 5	*47'*			

Approach						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
P	302	Compression Seal Joint		FT	93	3
Quantity Calculation		*Span 2*	*46.7'*			
		Span 6	*46.7'*			
P	321	RC Paving Slab		SF	4,320	3
Quantity Calculation		*Span 1*	*30' x 44' = 1320*			
		Span 2	*20' x 44' = 840*			
		Span 6	*20' x 44' = 840*			
		Span 7	*30' x 44' = 1320*			
P	9230	RC Grade Beam Cap		FT	94	0
Quantity Calculation		*Span 2*	*47' (unexposed)*			
		Span 6	*47' (unexposed)*			
P	9231	Steel Grade Beam Pile		EA	12	0
Quantity Calculation		*Span 2*	*6 (unexposed)*			
		Span 6	*6 (unexposed)*			
P	9237	Steel Wingwall		FT	72	3
Quantity Calculation		*Span 2*	*18' X 2 = 36*			
		Span 6	*18' X 2 = 36*			
P	9335	RC Approach Railing - Open		FT	106	3
Quantity Calculation		*Span 2*	*(20' + 6.5') x 2 = 53*			
		Span 6	*(20' + 6.5') x 2 = 53*			

Element Commentary – Continuous Concrete Slab

38 Reinforced Concrete Slab – Solid

Use solid slab element when no voids are present within the superstructure. The slab element is used when girder elements are not present.

Rate each square foot of the slab using the condition state definitions. The assessment represents the worst condition stated of each square foot, which includes the top, bottom, and edges of the slab when visible.

Assess overlays using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or stay-in-place forms to assess the slab when no surfaces of the slab are visible.

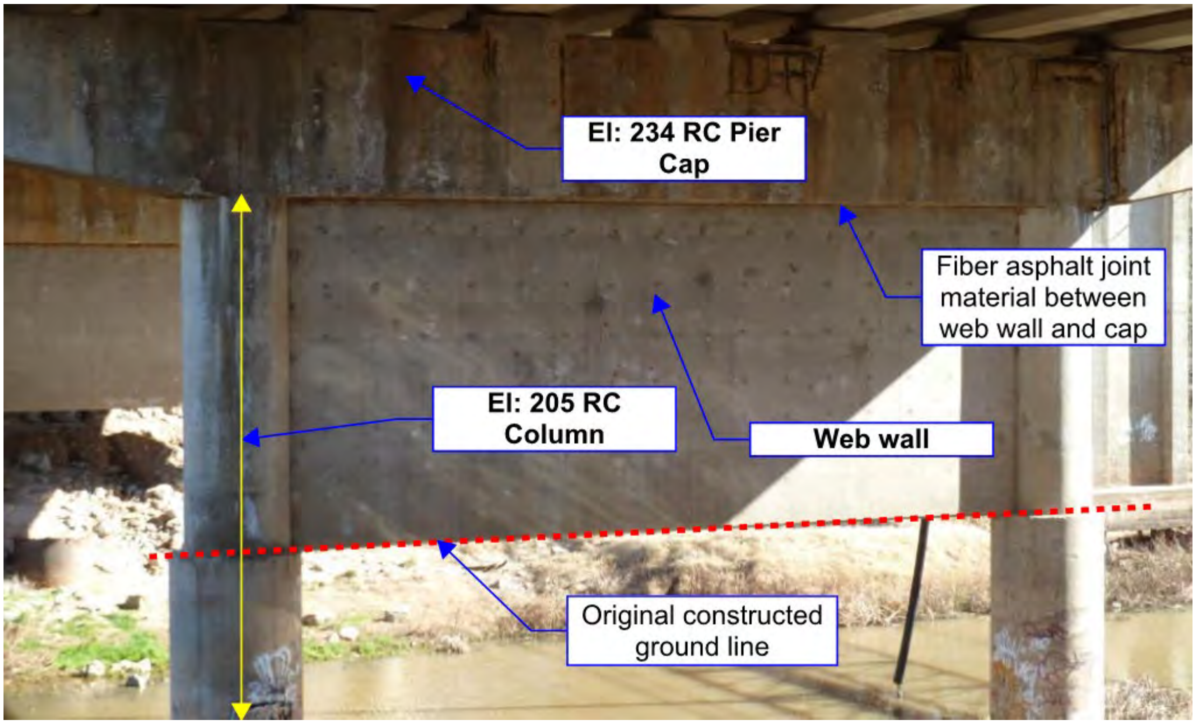
210 Reinforced Concrete Pier Wall

Use when the substructure unit is not comprised of piling or columns and directly supports the superstructure (a cap may also be part of a pier wall).

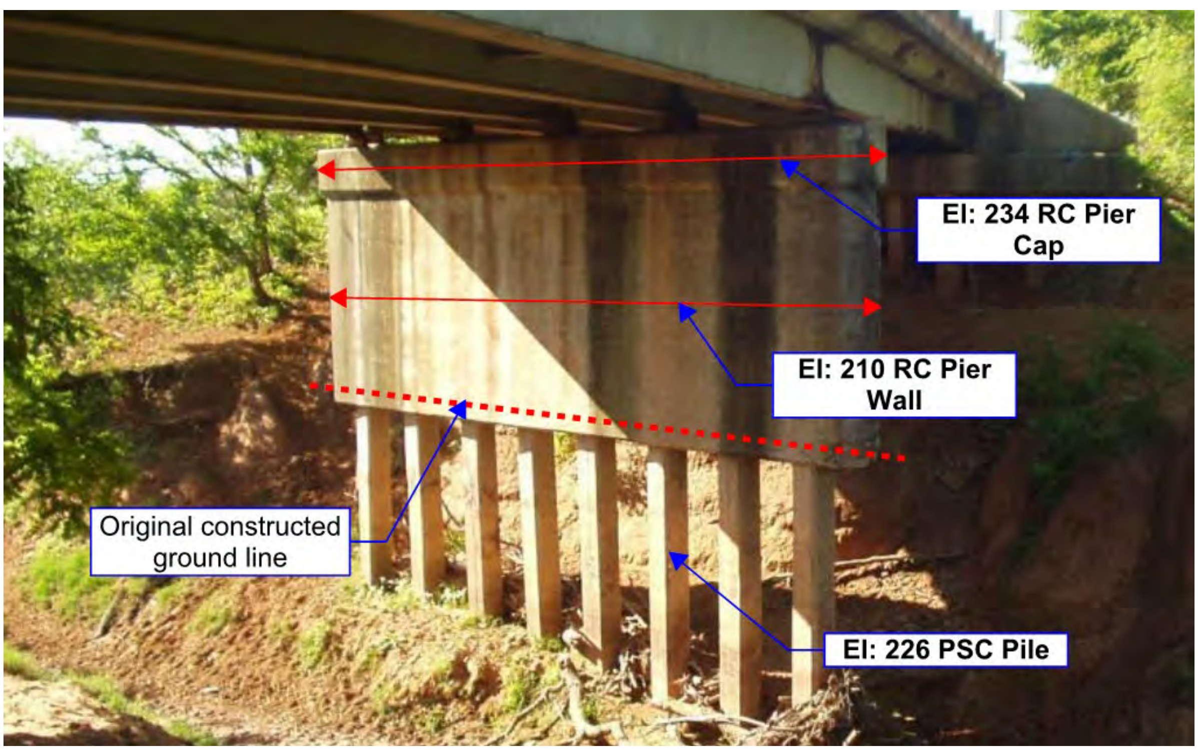
Rate each linear foot of the pier wall using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes the full height of the pier wall, both sides, and top when there is no cap.

Piers with columns and intermediate web walls, or diaphragms may look like pier walls. These components are commonly seen on solid piers; however web walls are noticeably thinner than the columns within the pier. While these components may extend the same height as the columns, their main purpose is to support the columns. The web walls or diaphragms are not intended to support the superstructure loading and are secondary members. See examples below:

Pier Web Wall Example



Pier Cap and Pier Wall Example



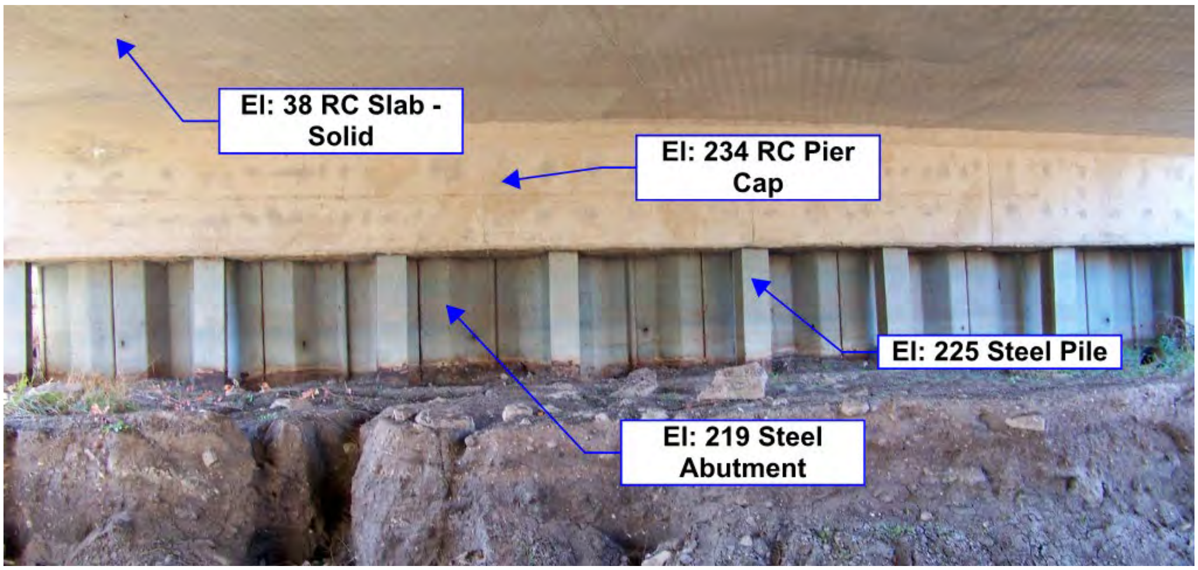
219 Steel Abutment

Refer to example 3-EI.24.2 Simple Concrete Slab for further discussion on this element.

Use element 219 for the steel sheet piling retaining the fill in this example where steel sheet piling is used under the concrete cap at the abutment.

If the sheet piling was concrete, then element 215 Reinforced Concrete Abutment would be used to assess sheet pile and abutment cap.

Steel Abutment Example



225 Steel Pile

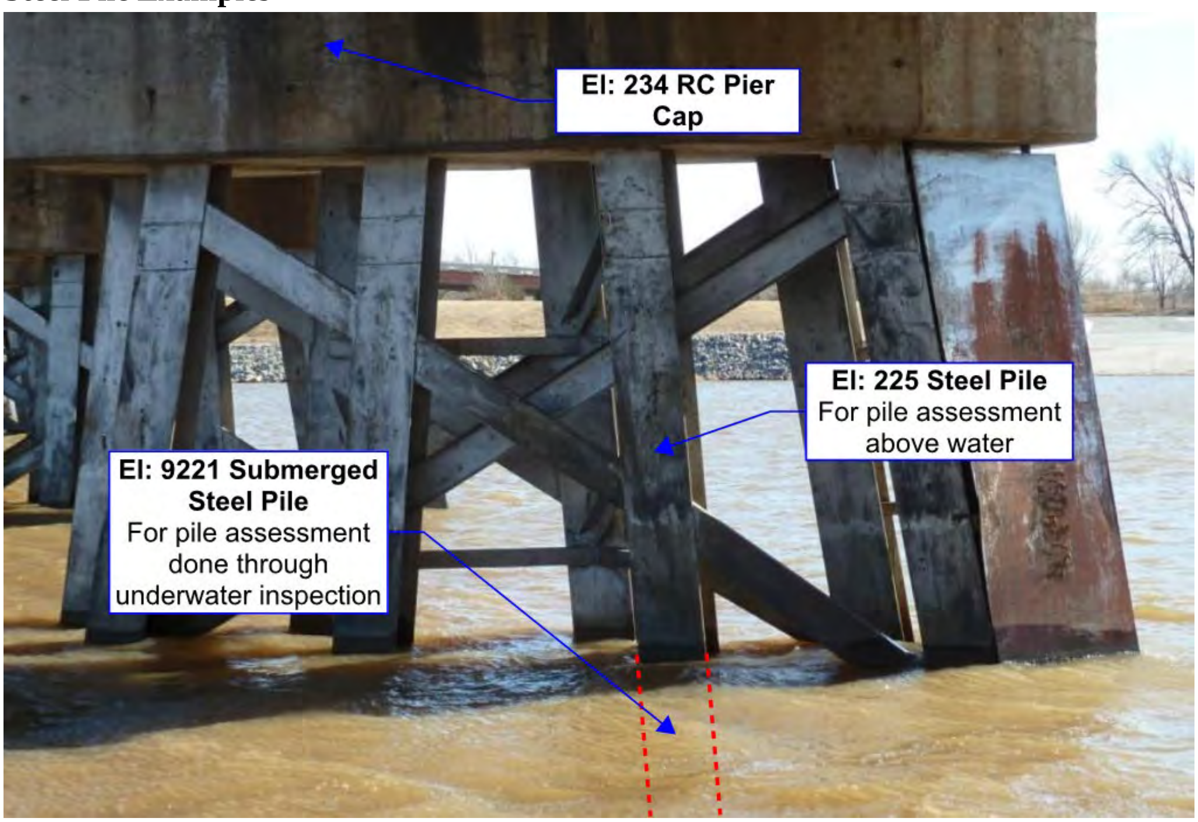
Refer to example 3-EI.24.2 Simple span Concrete Slab for further discussion on this element.

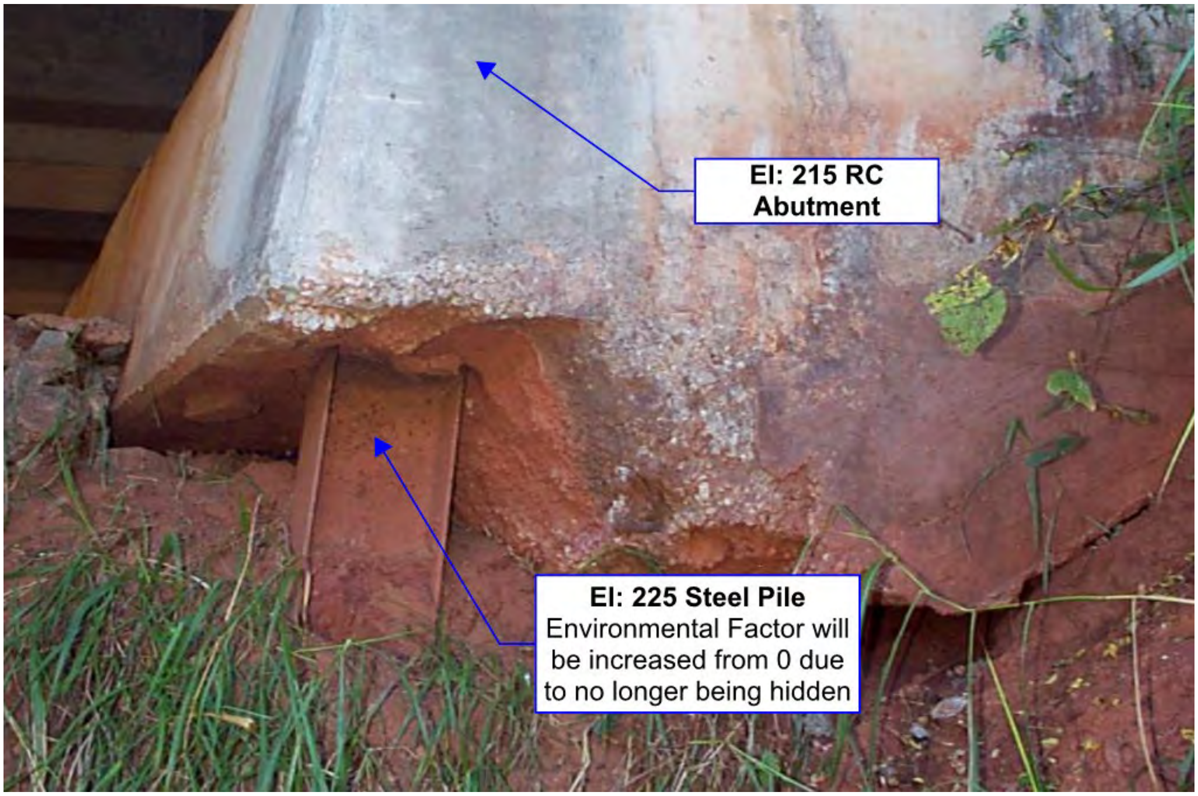
In this example, the steel piling at the abutment are exposed while the pier wall piling is hidden. Only those piles that are exposed and visible shall be inspected and quantified and assigned the appropriate Environmental State. Hidden piles are not quantified on the inspection report and thus will not have an Environmental State associated with them. The only exceptions to this rule are the Grade Beam Pile elements. These piling shall be quantified, regardless if exposed or not. Hidden grade beam piling will have an Environmental State of "0" assigned to them. Exposed grade beam piling shall be evaluated using the appropriate Environmental State.

Piles may be exposed due to scour, erosion, settlement, etc. and subsequently filled back in or repaired. If piling originally exposed had been inspected and subsequently buried, the inspector shall remove the piling quantity that was buried from the inspection report. If the exposed piling (prior to being buried) is in poor condition, the inspector shall fill out a work candidate form. If buried, the appropriate piling quantity will be removed from the inspection report, however the work candidate form will ensure that the Department is aware of the piling in poor condition.

Divers will use element 9225 Submerged Steel Pile to rate steel piles below the normal pool elevation. Other inspectors will use element 225 Steel Pile to rate steel piles above the normal pool elevation and for steel piles submerged in water but not inspected by divers. Some piles may be completely submerged. In this instance only use element 9225. Partially submerged piles that undergo underwater inspection will use elements 9225 and 225 for each pile. The purpose for this is to assure that piles above the waterline are inspected and rated on the proper frequency. See example below:

Steel Pile Examples





When element 225 becomes exposed:

1) Rate the condition of the exposed pile.
2) Assign the appropriate Environtmental State to the exposed pile.
3) For grade beam piling, quantify the piling and assign an Environmental State of "0"

If the pile becomes hidden/buried:

1) Remove the unexposed piling quantity from the inspection report.

234 Reinforced Concrete Pier Cap

Use when abutment is comprised of a pile bent and cap, with sheeting or lagging located within the cap and exposed to retain roadway fill. In this example the abutment is comprised of exposed steel sheeting, steel piling and a concrete cap. The steel sheeting is considered the abutment as it retains the fill qualifying the abutment cap as element 234.

Rate each linear foot of the cap at the abutment using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes all exposed sides of the cap element.

302 Compression Seal Joint

Use when a preformed polyurethane or other similar material is located within a deck or approach slab joint. Typically steel headers will be located on either side of the seal to keep the material protected and secure.

Rate each linear foot of the joint using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

321 Reinforced Concrete Paving Slab

Use when roadway approaches immediately adjacent to bridge structure are composed of reinforced concrete. When the approach slab spans between the bridge abutment and a grade beam, the paving slab beyond the approach slab shall also be included within the evaluation of this element. If no grade beam is present, only the paving slab immediately adjacent to the bridge shall be evaluated.

Rate each square foot of the approach using the condition state definitions. The assessment represents the worst condition stated of each square foot, which includes only the top of the approach.

Assess overlays using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface to assess the approach when the top surface is not visible.

9230 Reinforced Concrete Grade Beam Cap

Use this element when a grade beam is supported by piling and supports the approach slabs adjacent to the bridge structure.

For hidden grade beams code the Environment State “0” and the Condition State 1. For exposed grade beams change the environment to the appropriate 1 to 4 rating and assess the condition of each exposed linear foot of the concrete grade beam using the condition state definitions. If the grade beam is hidden in future inspections change the environment back to “0”, but maintain the exposed condition state unless repairs were made. The assessment is three dimensional in nature. Each linear foot shall be represented by the worst condition state defect.

9231 Steel Grade Beam Pile

Use this element for the approach grade beam.

For hidden grade beams piles code the Environment State “0” and the Condition State 1. For exposed grade beams change the environment to the appropriate rating and rate the condition of each exposed pile using the condition state definitions. If the grade beam pile is hidden in future inspections change the environment back to “0”, but maintain the exposed condition state unless repairs were made. The assessment should represent the worst condition state of each pile.

9237 Steel Wingwall

Use this element for the exposed steel sheet pile wingwalls. If the soil of the embankment covers this element, it should not be recorded during an inspection and the wingwall would then be considered the cap located on top of the sheet piling (most likely comprised on reinforced concrete).

Rate the worst condition found in the exposed height of each linear foot of wingwall using the condition state definitions.

9331 Reinforced Concrete Bridge Railing – Open

Use when reinforced concrete rail beam and posts are used as the traffic appurtenances on the bridge structure. The element does not include the portions of the rail that extend beyond the abutments.

Rate the worst condition found for each linear foot of the concrete rail using the condition state definitions. Each linear foot includes all sides of the bridge railing, posts and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects.

Element 331 – Reinforced Concrete Bridge Railing Example

Typical Approach:

*Use Element 9336 when concrete rail is attached to the wingwall.

**Use Element 9334 when concrete rail is attached to the approach slab

9335 Reinforced Concrete Approach Railing – Open

Use this element for the portions of element reinforced concrete railing attached to the approach slab that has openings and extends from the end of the bridge (edge of paving notch) or beyond the abutment. This element should not be used for portions of rail on top of wingwall.

Use element 9336 Reinforced Concrete Approach Rail on Wingwall, if the rail is integral with the wingwalls rather than the approach slab.

Use element 9339 and 9340 Reinforced Concrete Transition Railing – Closed and Open, respectively when the rail (not on the bridge) tapers down to the roadway. The transition rail element would be most likely encountered in urban bridge structures.

Rate each linear foot of the concrete rail using the condition state definitions. Measure transition rail from the joint at the abutment to the joint that separates the transition portion of rail from the approach rail, unless element 9336 is used. The assessment should represent the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects. For example a timber curb located in front of a reinforced concrete bridge rail would be assessed under the bridge railing element, however the material defects for timber would be incorporated under the element.

3-EI.24.4 Concrete Frame (Not Box Culvert)

Superstructure: 180’-10 concrete rigid frame

Structure located in Environmental Zone 2

ADTT = 1200 with high salt use in winter

Substructure: Stub and full height concrete abutments. The pier legs are concrete columns rigidly connected to the superstructure beams.

Traffic Appurtenances: Metal railing supported by metal posts

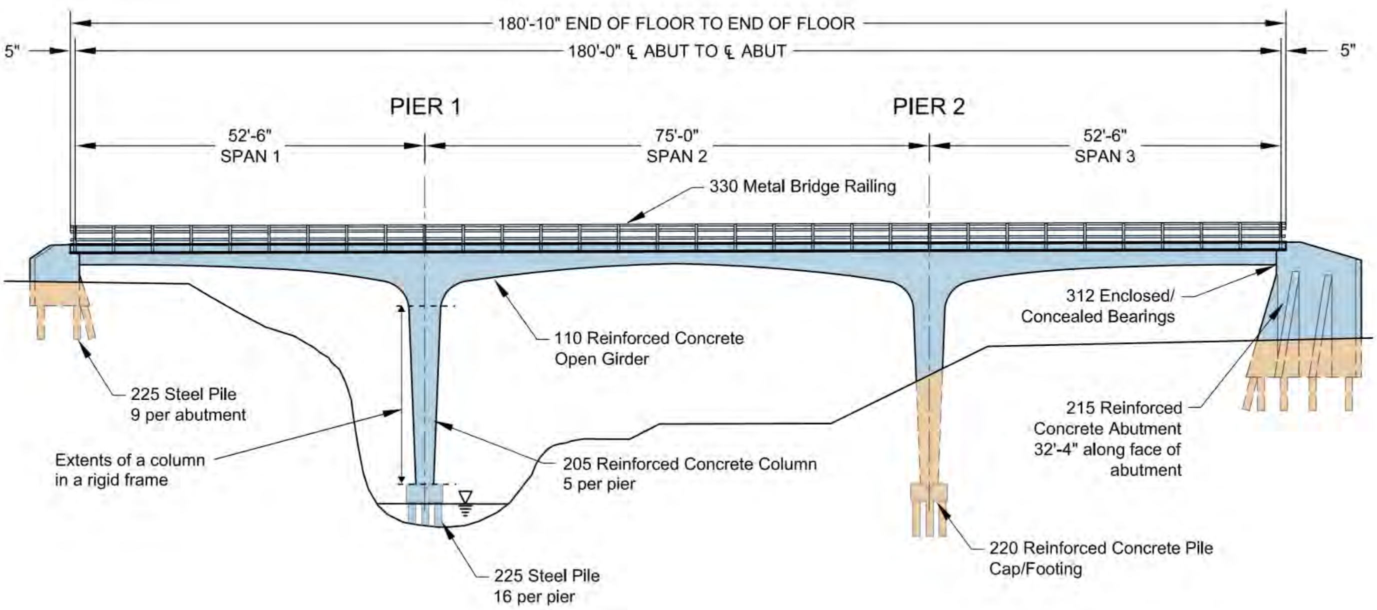


Figure 3-EI.24.4- 1: Elevation view of concrete rigid frame

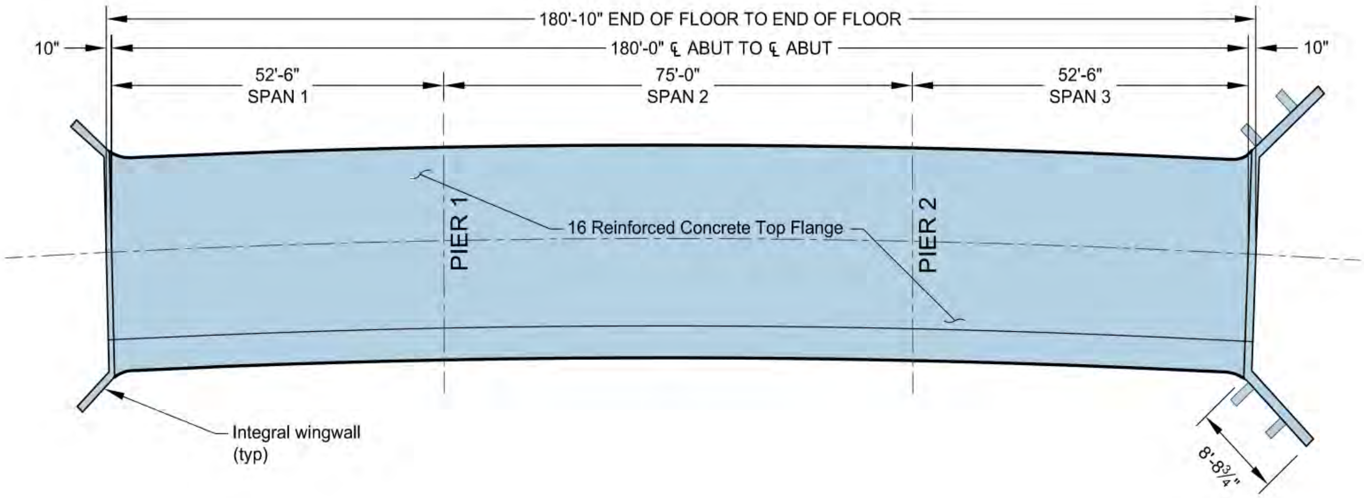


Figure 3-EI.24.4- 2: Plan view of concrete rigid frame

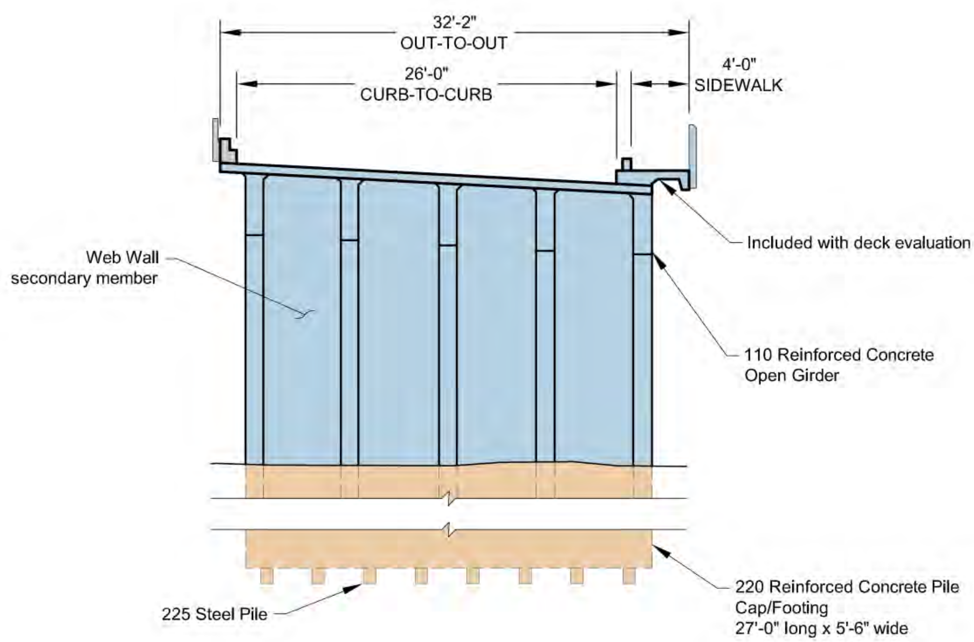


Figure 3-EI.24.4- 3: Cross section of superstructure near centerline pier

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each Deck joint in not leaking.

Deck and elements under joints: Environmental State = 2 (for zone 2) + 1 (for high salt use) + 1(for ADTT > 1000) = 4

Super and substructure elements not under joints: Environmental State = 2 (for zone 2) + 0 (for no joint leakage) + 1(for ADTT> 1000) = 3

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	16	RC Top Flange		SF	5,822	4
Quantity Calculation		*Span 1*	*52.9' x 32.2' = 1703.38*			
		Span 2	*75' x 32.2' = 2415*			
		Span 3	*52.9' x 32.2' = 1703.38*			
M	110	RC Open Girder		FT	904	3
Quantity Calculation		*Span 1*	*52.9' x 5 = 264.5*			
		Span 2	*75' x 5 = 375*			
		Span 3	*52.9' x 5 = 264.5*			
M	312	Enclosed/Concealed Bearing		EA	10	3
Quantity Calculation		*Span 1*	*5*			
		Span 3	*5*			
M	330	Metal Bridge Railing		FT	362	4
Quantity Calculation		*Span 1*	*52.9' x 2 = 105.8'*			
		Span 2	*75' x 2 = 150'*			
		Span 3	*52.9' x 2 = 105.8'*			

Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	205	RC Column		EA	10	3
Quantity Calculation		*Span 2*	*5 x 2 = 10*			
M	215	RC Abutment		FT	99	3
Quantity Calculation		*Span 1*	*32.3' +(8.7' x 2) = 49.7'*			
		Span 3	*32.3' +(8.7' x 2) = 49.7'*			
M	220	RC Pile Cap/Footing		FT	27	3
Quantity Calculation		*Span 2*	*27'*			
		Span 2	*27 (unexposed)*			
M	225	Steel Pile		EA	16	3
Quantity Calculation		*Span 1*	*9 (unexposed)*			
		Span 2	*16*			
		Span 2	*16 (unexposed)*			
		Span 3	*9 (unexposed)*			

Element Commentary – Concrete Rigid Frame Bridge

Rigid frames in general are unique structures in relation to element level inspection. The superstructure and legs act as one unit. The bearings are at the base of the legs. Therefore, anything above the bearing is rated with the superstructure.

16 Reinforced Concrete Top Flange

Use the top flange element when the top flange acts as the driving surface for vehicles (even if overlay is present). The superstructure in this example can be viewed as a reinforced concrete tee beam. The top flange, while integral with the girder, also acts as the deck. For this type of superstructure (similar prestressed concrete layouts included) is essentially broken into two components where the top flange is separated from the web and assessed as a deck component and the leg or stem of the beam is assessed as a beam component. Therefore top flange defects will have no bearing on the condition of the beam component.

Rate each square foot of the top flange using the condition state definitions. The assessment represents the worst condition stated of each square foot, which includes the top, bottom, and edges of the flange when visible.

Assess overlays or wearing surfaces using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or wearing surface to assess the top surface of the top flange when the top surfaces of the top flange are not visible.

110 Reinforced Concrete Open Girder

Use when beam component of superstructure is composed of reinforced concrete. For this example, this element is used for assessing the webs and bottom flange of the tee-beams. The top flange is assessed under element 16 Reinforced Concrete Top Flange as the flange acts as both the beam flange and the driving surface.

Rate each linear foot of the beam using the condition state definitions. The assessment represents the worst condition stated of each linear foot, which include the web and bottom flange for this particular example.

Rigid frames consist of components that split where a portion (leg) turns down from the deck to a pier bearing while the remaining portion continues to an abutment or other bearing. In this situation the component above the fillet from the legs shall be evaluated under a superstructure component while the portion below shall be evaluated as a column element. Note that girder portions are evaluated per linear foot while the leg (column) portion is evaluated as an each measurement.

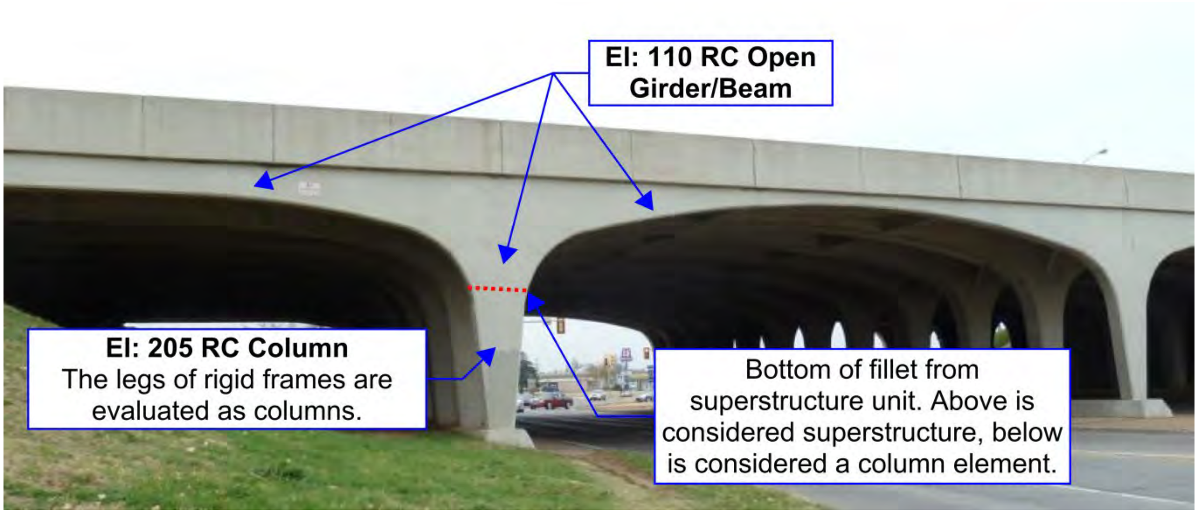
205 Reinforced Concrete Column

Use this element for those legs of a rigid frame. The legs of a steel rigid frame shall be evaluated similarly using element 202 Steel Column.

Rate each column using the condition state definitions. The assessment should represent the worst condition stated on the column. For a rigid frame, the column extents are from the bearing on the substructure to the bottom of the fillet from the superstructure element.

Assess piles under the appropriate elements. Piles, in contrast to columns, are driven to bearing.

Element 210 reinforced concrete pier wall would not be an applicable element for the piers in this example. While web walls are present between the columns, these act as diaphragms providing lateral resistance for the columns. Furthermore, a pier wall would not have isolated rectangular pile footings as foundations.



*Legs of Rigid Frames should be assessed under the appropriate column element. This is valid for any construction material.

215 Reinforced Concrete Abutment

Use when concrete abutment is the primary component supporting superstructure load and retaining roadway fill. Stub abutment and full height concrete abutments fall under this element.

Rate each linear foot of the abutment along the skew using the condition state definitions. Include wingwall lengths in the abutment quantity when there are no construction joints between the abutment and wingwalls to the first joint in the wing. The assessment represents the worst condition state of each linear foot, which includes the full height of the abutment and wingwalls (if present).

220 Reinforced Concrete Pile Cap/Footing

Use when pile cap or footings are exposed and capable of being inspected. Spread footings will fall under this element. Commonly, columns may be placed on a pile cap or footing as the foundation. Typically these elements are intentionally buried, however they may become exposed.

Divers will use element 9220 Submerged RC Cap/Footing to rate concrete cap/footing foundations underwater. Other inspectors will use element 220 RC Cap/Footing to rate concrete cap/footing foundations and for concrete caps/footing foundations submerged in water but not inspected by divers. The purpose for this is to assure that concrete cap/footing foundations are inspected and rated on the proper frequency.

Only Pile Cap/Footings that are exposed and visible shall be inspected and quantified and assigned the appropriate Environmental State. Hidden elements are not quantified on the inspection report and thus will not have an Environmental State associated with them (with the exception of Grade Beam Caps and Piling).

Pile Caps and Footings may be exposed due to scour, erosion, settlement, etc. and then filled back in or repaired. If a cap or footing, originally exposed, has been inspected and subsequently buried, the inspector shall keep the quantity on the inspection report and note the cap or footing has been buried, whether by natural or manmade countermeasures. If it is exposed or becomes exposed rate the element with the appropriate 1 to 4 environment state and condition state.

225 Steel Pile

Refer to example on 3-EI.24.2 Simple Span Concrete Slab for discussion on this element.

312 Enclosed/Concealed Bearing

Use when bearings are hidden, concealed or unknown. Concrete structures will commonly have full height abutments or pier diaphragms that make it difficult to distinguish bearing material or type.

Rate each bearing using the condition state definitions. The assessment should represent the worst condition found on each bearing.

Assess the bearing by looking for evidence around the bearing for signs of bearing deterioration such as cracking, spalling, rust staining or leaching of the surrounding material. For this example the bearings are concealed by the concrete abutment and therefore fall under this element.

330 Metal Railing

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

Note that the curbs are also assessed under this element even when comprised of different construction material. In this instance, the defects associated with concrete should be used under the metal bridge railing element when assessing the curb.

3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder

Superstructure: 122'-0 7/8 single span prestressed concrete girder

Structure located in Environmental Zone 2

ADTT = 900 with high salt use

Substructure: Concrete pile bent abutments. The lower portions of the abutments are comprised of steel piling to retain approach roadway fill.

Traffic Appurtenances: Reinforced concrete open railing with approach and transition sections.

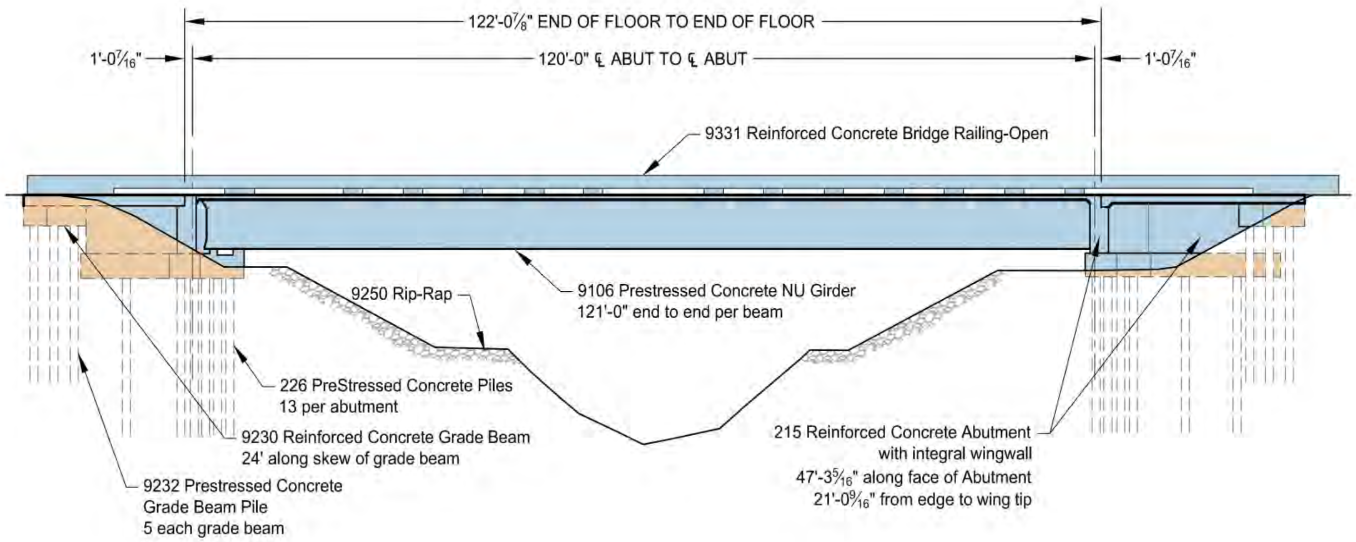


Figure 3-EI.24.5- 1: Elevation view of simple prestressed concrete beam bridge

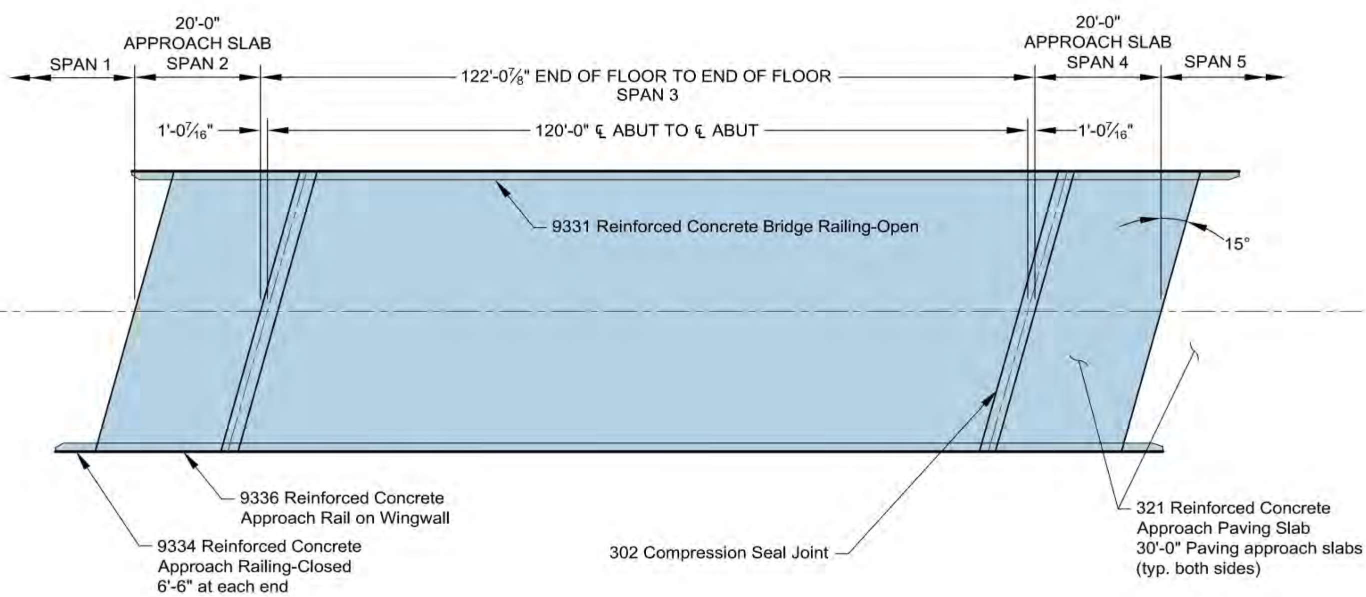


Figure 3-EI.24.5- 2: Plan view of simple prestressed concrete beam bridge

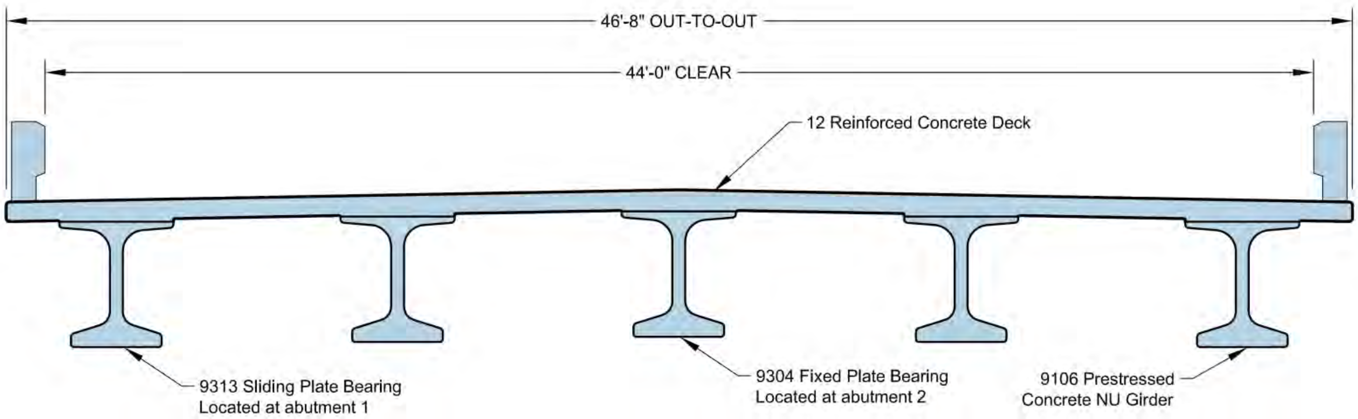


Figure 3-EI.24.5- 3: Cross section view of prestressed concrete beam bridge superstructure

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each Deck joint is not leaking.

Deck and elements under joints: Environmental State = 2 (for zone 2) + 1 (for high salt use) + 0 (for ADTT < 1000) = 3

Super and substructure elements not under joints: Environmental State = 2 (for zone 2) + 0 (for no leakage) + 0 (for ADTT < 1000) = 2

Superstructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	12	RC Deck	SF	5,702	3
Quantity Calculations		*Span 3*	*122.1' x 46.7' = 5702.1*		
P	302	Compression Seal Joint	FT	97	3
Quantity Calculation		*Span 2*	*46.7' / cos(15 deg) = 48.3'*		
		Span 5	*46.7' / cos(15 deg) = 48.3'*		
M	9106	PSC NU Girder	FT	605	2
Quantity Calculations		*Span 3*	*121' x 5 = 605*		
M	9304	Fixed Plate Bearing	EA	5	2
Quantity Calculations		*Span 3*	*5*		
M	9313	Sliding Plate Bearing	EA	5	2
Quantity Calculations		*Span 3*	*5*		
M	9331	RC Concrete Bridge Railing - Open	FT	244	3
Quantity Calculations		*Span 3*	*122.1' x 2 = 244.2'*		

Substructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	215	RC Abutment	FT	179	2
Quantity Calculations	*Span 3*	*[47.3' +(21.0' x 2)] x 2 = 178.6'*			
M	226	PSC Pile	EA	Not Reported	-
Quantity Calculations	*Span 3*	*13 x 2 = 26 (unexposed)*			
M	9250	Riprap	FT	Field Measurement	2
Quantity Calculations	*Span 3*	*Field Measurement*			

Paving Approach					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
P	321	RC Paving Slab	SF	4,508	3
Quantity Calculation	*Span 1*	*30' x 44' = 1320*			
	Span 2	*20' x 46.7' = 934*			
	Span 4	*20' x 46.7' = 934*			
	Span 5	*30' x 44' = 1320*			
P	9230	RC Grade Beam Cap	FT	97	0
Quantity Calculation	*Span 2*	*46.76' / cos(15 deg) = 48.3' (unexposed)*			
	Span 5	*46.76' / cos(15 deg) = 48.3' (unexposed)*			
P	9232	PSC Grade Beam Pile	EA	10	0
Quantity Calculation	*Span*	*5 (unexposed)*			
	Span	*5 (unexposed)*			
P	9334	RC Approach Railing - Closed	FT	26	3
Quantity Calculations	*Span 1*	*6.5' x 2 = 13*			
	Span 5	*6.5' x 2 = 13*			
P	9336	RC Approach Rail on Wingwall	LF	80	3
Quantity Calculations	*Span 2*	*20' x 2 = 40*			
	Span 4	*20' x 2 = 40*			

Element Commentary Simple Span Prestressed Concrete Beam Bridge

12 Reinforced Concrete Deck

Use deck element when bridge superstructure component is supported by beams.

Rate each square foot of the deck using the condition state definitions. The assessment should represent the worst condition stated of each square foot, which includes the top, bottom, and edges of the deck when visible.

Assess overlays and steel stay-in-place forms using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or stay-in-place forms to assess the slab when no surfaces of the slab are visible.

215 Reinforced Concrete Abutment

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion of this element.

In this example, element 215 should be used because the concrete sill abutment is the intended member used to retain fill. Even though steel sheet piling is located under the concrete abutment, the berm elevation is above the bottom of the concrete abutment indicating the concrete abutment is retaining the embankment fill. If in the future, an event exposes the steel sheeting below the concrete abutment an argument could be made to include element 219 Steel Abutment. However, in its current state the sheeting shall not be recorded on the inspection report.

The integral wingwalls shown in this example would also be evaluated under the Reinforced Concrete Abutment element.

226 Prestressed Concrete Pile

Use when prestressed concrete piling supports the abutment cap, pier cap or footing.

Rate each exposed pile using the condition state definitions. The assessment should represent the worst condition found on each pile. In this example none of the piling is exposed, therefore the piling element would not be found on the inspection report.

PSC piling is typically square. While reinforced concrete piling does exist, prestressed piling is much more common and should be assumed unless found to be otherwise (existing plans, etc.).

302 Compression Seal Joint

Use when a preformed polyurethane or other similar material is located within a deck or approach slab joint. Typically steel headers will be located on either side of the seal to keep the material protected and secure.

Rate each linear foot of the joint using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

321 Reinforced Concrete Paving Slab

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9106 Prestressed Concrete NU Girder

Use when prestressed concrete beam used as superstructure component. This element should not be used for prestressed box beams or other superstructure components that contain enclosed spaces. The NU girder is unique in design and resembles a bulb-tee girder. These girders were originally designed for Nebraska use. The inspector may need to refer to the bridge plans to verify the type of prestressed concrete girder encountered in the field.

Rate each linear foot of the beam using the condition state definitions. The assessment should represent the worst condition stated of each linear foot.

9230 Reinforced Concrete Grade Beam Cap

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9232 Prestressed Concrete Grade Beam Pile

Use this element for the approach grade beam.

For hidden concrete grade beams piles code the Environment State “0” and the Condition State 1. For exposed grade beams change the environment to the appropriate 1 to 4 rating and rate the condition of each exposed pile using the condition state definitions. If the grade beam pile is hidden in future inspections change the environment back to “0”, but maintain the exposed rating unless repairs were made. The assessment should represent the worst condition state of each pile.

9250 Riprap

Use for slope protection along banks in immediate vicinity of bridge.

Rate each linear foot of the riprap along the abutment length to its extents using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

It is not practical to measure the length of riprap for situations where the protection continues up and downstream. Measure the quantity along the channel from edge to edge of rip rap, edge to edge of deck plus the distance that would be affected by deck drainage, or to Right-of-Way lines. Capture the distance that maintenance would be responsible for.

9304 Fixed Plate Bearing

Use when bearing assembly allows for only rotational movement and is comprised of simply a metal plate(s). This is commonly achieved through an anchor bolt through the assembly into the substructure.

Rate each bearing using the condition state definitions. The assessment should represent the worst condition found on each bearing.

Often in concrete bridges the bearings are concealed or difficult to inspect due to full height concrete diaphragms. When this is the case, the inspector should inspect as much of the exposed portion of the bearing as possible and look for evidence of other deterioration such as cracking, spalling, rust staining or leaching around the bearing.

9313 Sliding Plate Bearing

Use when bearing assembly allows for translational and rotational movement and is comprised of a metal plate(s).

Rate each bearing using the condition state definitions. The assessment should represent the worst condition found on each bearing.

Often in concrete bridges the bearings are concealed or difficult to inspect due to full height concrete diaphragms. When this is the case, the inspector should inspect as much of the exposed portion of the bearing as possible and look for evidence of other deterioration such as cracking, spalling, rust staining or leaching around the bearing.

9331 Reinforced Concrete Bridge Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9334 Reinforced Concrete Approach Railing – Closed

Use this element for the portions of reinforced concrete railing attached to the slab that has no openings and extend off the length of the bridge or beyond the abutment. This railing is not attached to the wingwall. Use element 9336 Reinforced Concrete Approach Rail on Wing, if it is constructed on the wingwalls rather than the slab or its own foundation.

Rate each linear foot of the concrete rail using the condition state definitions. Measure approach rail from the joint at the abutment to the joint that separates the transition portion of rail from the approach rail unless element 9336 is used. In this case the measurement is taken from the end of element 9336 to the end of the concrete rail away from the bridge. The assessment represents the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects.

This element is typically used in conjunction with elements 9335 Reinforced Concrete Approach Railing – Open and 9331 Reinforced Concrete Bridge Rail – Open.

9336 Reinforced Concrete Approach Rail on Wingwall

Use this element for the portions of reinforced concrete approach railing attached directly to the wingwalls. The approach rail extends from the end of the bridge rail (typically the joint in the paving notch).

Rate each linear foot of the concrete rail using the condition state definitions. Measure length of approach rail on the wingwalls from the joint over the abutment. The assessment represents the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects.

This element is typically used in conjunction with elements 9335 Reinforced Concrete Approach Railing – Open and 9331 Reinforced Concrete Bridge Rail – Open.

3-EI.24.6 Prestressed Concrete Double T Beam

Superstructure: 33'-10 prestressed concrete double T Beam bridge

Structure located in Environmental Zone 1

ADTT = 100 and low salt use

Substructure: Concrete pile bent abutments with integral concrete wingwalls

Traffic Appurtenances: Open concrete bridge railing

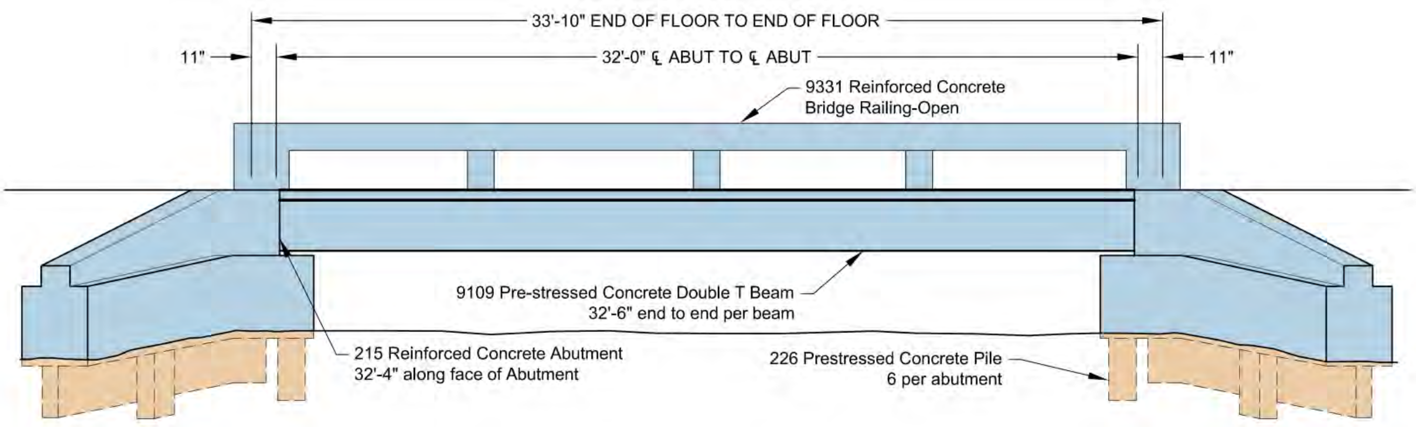


Figure 3-EI.24.6- 1: Elevation view of prestressed concrete double T Beam bridge

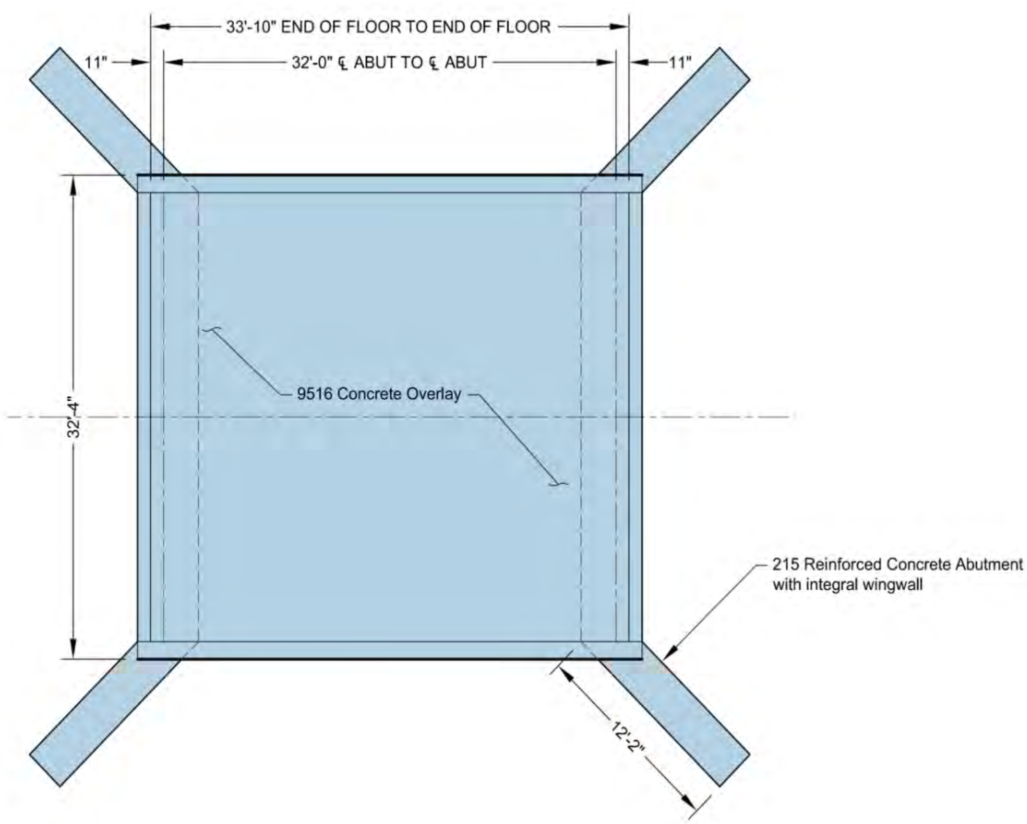


Figure 3-EI.24.6- 2: Plan view of prestressed concrete double T Beam bridge

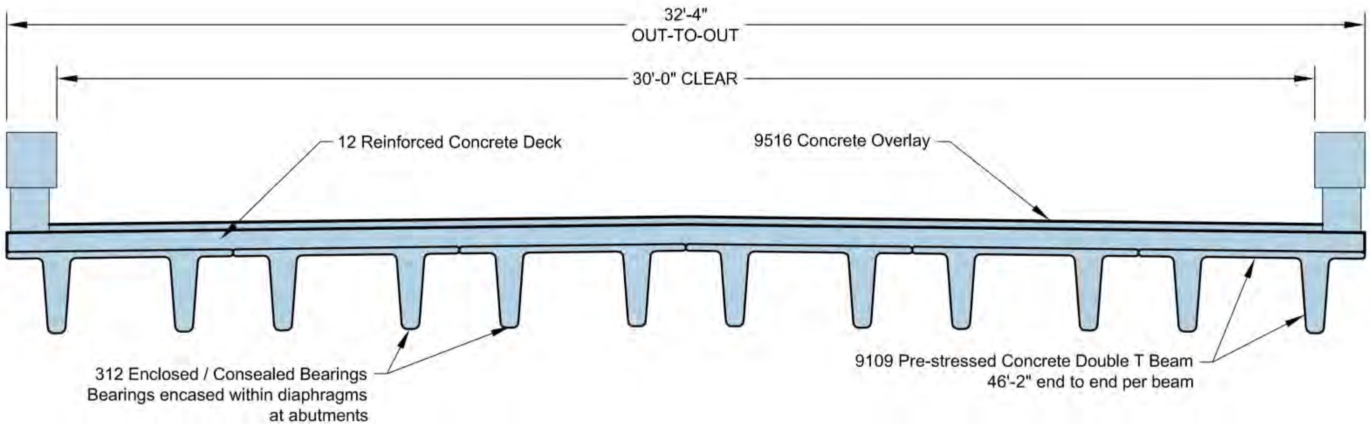


Figure 3-EI.24.6- 3: Cross section view of prestressed concrete double T Beam bridge superstructure

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each Deck joint is not leaking.

Deck and elements under joints: Environmental State = 1 (for zone 1) + 0 (for low salt use) + 0 (for ADTT < 1000) = 1

Super and substructure elements not under joints: Environmental State = 1 (for zone 1) + 0 (for leakage) + 0 (for ADTT< 1000) = 1

Superstructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	12	RC Deck	SF	1,092	1
Quantity Calculations		*Span 1*	*33.8' x 32.3' = 1091.74*		
M	312	Enclosed/Concealed Bearing	EA	24	1
Quantity Calculations		*Span 1*	*12 x 2 = 24*		
M	9109	PC Double T Beam	FT	195	1
Quantity Calculations		*Span 1*	*32.5' x 6 = 195'*		
M	9331	RC Concrete Bridge Railing - Open	FT	68	1
Quantity Calculations		*Span 1*	*33.8' x 2 = 67.6'*		
M	9516	Concrete Overlay	SF	1,014	1
Quantity Calculations		*Span 1*	*33.8' x 30' = 1014*		

Substructure						
Group	EI No.	Element Description		Unit	Element Quantity	Environ. State
M	215	RC Abutment		FT	113	1
Quantity Calculations		Span 1	(32.3' + 12.2' x 2) X 2 = 113.4'			

Element Commentary – Simple Span Prestressed Concrete Double T Beam Bridge

12 Reinforced Concrete Deck

In this case the deck is hidden by a concrete overlay on top and the T Beam top flanges on the bottom. Therefore, the assessment of the deck would include reviewing past ratings, assessment of the elements covering the top and bottom for indications of the condition of the deck, and/or destructive or nondestructive tests of the deck.

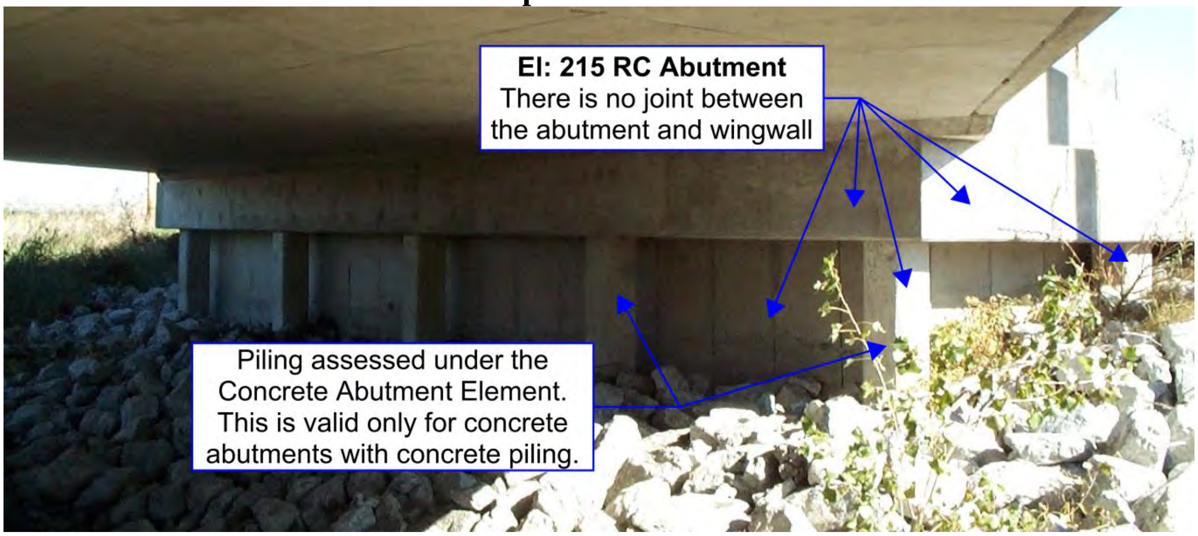
215 Reinforced Concrete Abutment

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion on this element.

Concrete abutments are all inclusive. That is, the concrete sheet piling behind the concrete piles and the concrete piles should be included in the assessment of the abutment element. Include wingwalls in the abutment quantity since there are no joints between the wingwalls and abutment. These wingwalls are integral.

Rate each linear foot of the abutment along the skew using the condition state definitions. The length should also take into account those wings that are integral (not separated by a joint) with the abutment. The assessment should represent the worst condition state of each linear foot, which includes the full height of the abutment and sheet piling.

Reinforced Concrete Abutment Example



Since there is no joint between the abutment and the wingwall, the wingwall length is included in the abutment quantity and the PSC pile in the wing is included under the 215 Reinforced Concrete Abutment.

312 Enclosed/Concealed Bearing

Use when bearings are hidden, concealed or unknown. Concrete structures will commonly have full height abutment or pier diaphragms that make it difficult to distinguish bearing material or type.

Rate each bearing using the condition state definitions. The assessment should represent the worst condition found on each bearing.

Assess the bearing by looking for evidence around the bearing for signs of bearing deterioration such as cracking, spalling, rust staining or leaching of the surrounding material. For this example the bearings are concealed by the concrete diaphragms and therefore fall under this element.

9109 Prestressed Concrete Double T Beam

Use the top flange element 15 Prestressed Concrete Top Flange when the top flange acts as driving surface for vehicles or includes an asphalt or thin concrete overlay. In this example, there is a concrete deck over the T Beams, so Element 12 is used instead of element 15 and the entire Double T Beam is assessed as one unit (legs and top flange).

When the Double T Beams have a structural deck placed over them, use element 9109 prestressed concrete Double T Beam to assess the legs and top flange of the T Beams. If the top flange is the riding surface, or only an overlay (~2" thick) or other wearing surface covers the top surface, the top flange is assessed separately from the beam component using element 16 Reinforced Concrete Top Flange or 15 Prestressed Concrete Top Flange, depending on the beam material. Only the legs of the Double T Beam would be assessed under element 9109 when a top flange element is used. Moreover, regardless of the number of legs per girder unit, that is the number of legs between longitudinal joint to longitudinal joint, the legs are evaluated as one girder, not each leg as an individual girder.

Rate each linear foot of the tee beam using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top flange for T Beams.

9331 Reinforced Concrete Bridge Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9516 Concrete Overlay (HDLS)

Used when the overlay is comprised of concrete. An overlay or wearing surface is typically placed over the top surface of T Beam top flanges. However, in this case the bridge already had a concrete deck and a concrete overlay was placed on top of it.

Rate each square foot of the wearing surface using the condition state definitions. The assessment should represent the worst condition stated of each square foot, which only includes the top surface.

3-EI.24.7 Continuous Prestressed Concrete Double T Beam

Superstructure: 141'-0 continuous prestressed concrete double T Beam bridge

Structure located in Environmental Zone 1

ADTT = 2000 and high salt use

Substructure: Full height concrete abutments. Concrete pile pier bents.

Traffic Appurtenances: Open concrete bridge railing

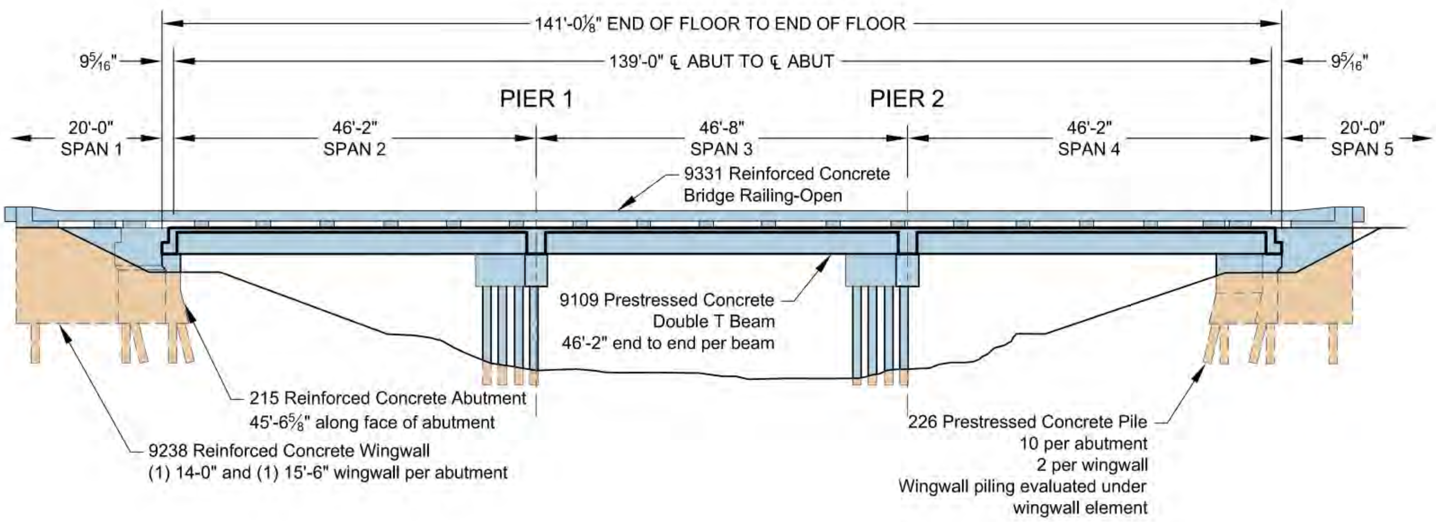


Figure 3-EI.24.7- 1: Elevation view of continuous prestressed concrete Double T Beam bridge

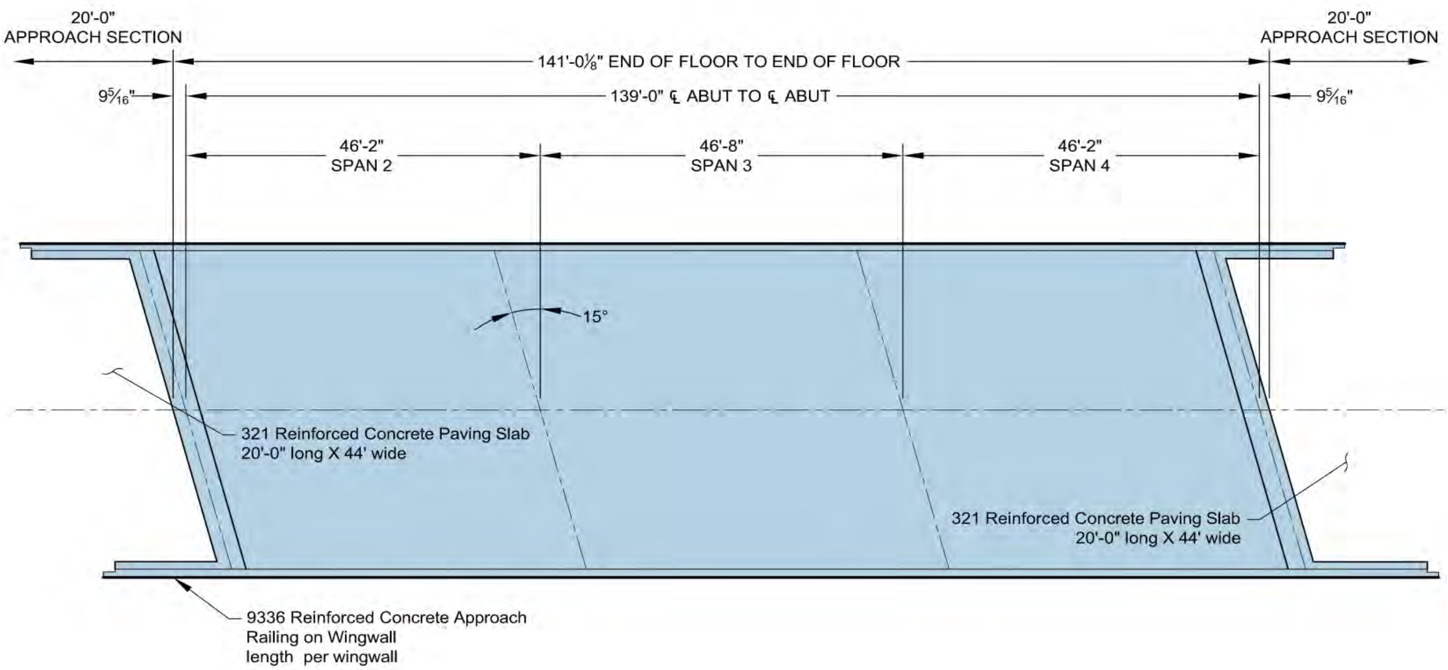


Figure 3-EI.24.7- 2: Plan view of continuous prestressed concrete Double T Beam bridge

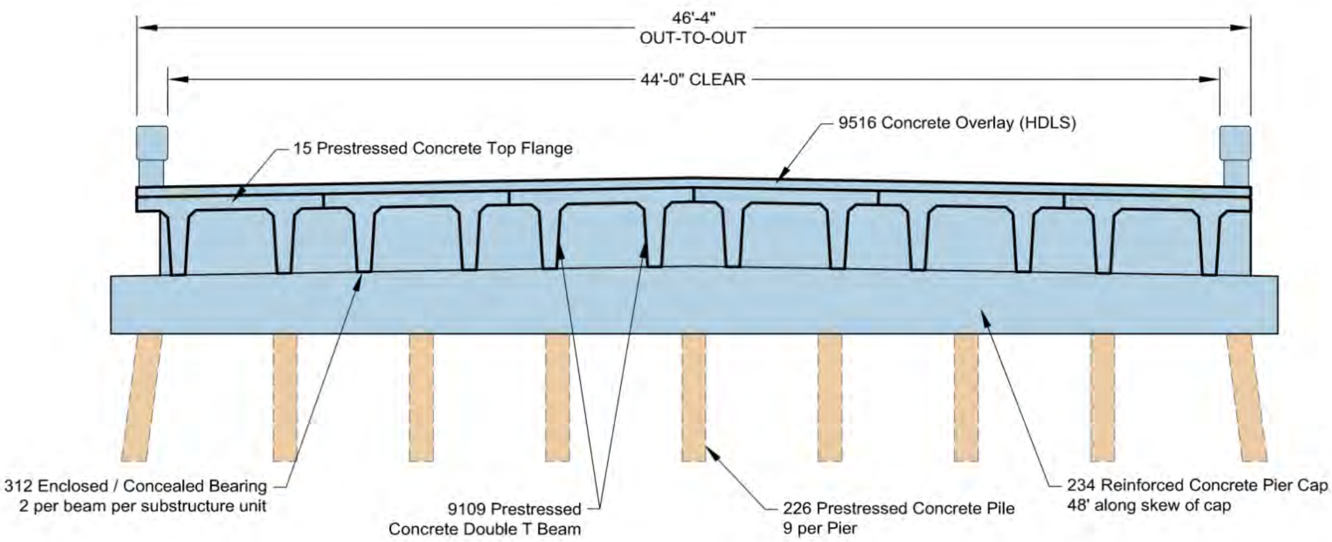


Figure 3-EI.24.7- 3: Cross section view of superstructure for continuous prestressed concrete Double T Beam bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 1 (for zone 1) + 1 (for high salt use) + 1(for ADTT > 1000) = 3

Super and substructure elements not under joints: Environmental State = 1 (for zone 1) + 0(for no leakage) + 1(for ADTT > 1000) = 2

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	15	PSC Top Flange		SF	6,514	3
Quantity Calculations		*Span 2*	*(46.2' + 0.8') x 46.3' = 2176.1*			
		Span 3	*46.7' x 46.3' = 2162.2*			
		Span 4	*(46.2' + 0.8') x 46.3' = 2176.1*			
M	312	Enclosed/Concealed Bearing		EA	96	2
Quantity Calculations		*Span 2*	*12 x 2 = 24*			
		Span 3	*12 x 2 = 24*			
		Span 4	*12 x 2 = 24*			
		Span 4	*12 x 2 = 24*			
M	9109	PSC Double T Beam		FT	832	2
Quantity Calculations		*Span 2*	*46.2' x 6 = 277.2'*			
		Span 3	*46.2' x 6 = 277.2'*			
		Span 4	*46.2' x 6 = 277.2'*			
M	9331	RC Concrete Bridge Railing - Open		FT	281	3
Quantity Calculations		*Span 2*	*(46.2' + 0.8') x 2 = 94'*			
		Span 3	*46.7' x 2 = 93.4'*			
		Span 4	*(46.2' + 0.8') x 2 = 94'*			
M	9336	RC Approach Rail on Wingwall		FT	59	3
Quantity Calculations		*Span 1*	*14'*			
		Span 1	*15.5'*			
		Span 3	*14'*			
		Span 3	*15.5'*			

Substructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	215	RC Abutment	FT	91	2
Quantity Calculations		*Span 2*	*45.6'*		
		Span 4	*45.6'*		
M	226	PSC Pile	EA	18	2
Quantity Calculations		*Span 2*	*14 (unexposed)*		
		Span 3	*9*		
		Span 4	*9*		
		Span 4	*14 (unexposed)*		
M	234	RC Pier Cap	FT	96	2
Quantity Calculations		*Span 3*	*48'*		
		Span 4	*48'*		
M	9238	RC Wingwall	FT	59	2
Quantity Calculations		*Span 2*	*14' x 2 = 28*		
		Span 4	*15.5' x 2 = 31*		

Approach					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
P	321	RC Paving Slab	SF	1760	3
Quantity Calculations		*Span 1*	*20' x 44' = 880*		
		Span 5	*20' x 44' = 880*		

Element Commentary – Continuous Prestressed Concrete Double T Beam

15 Prestressed Concrete Top Flange

Use the top flange element when the top flange acts as the driving surface for vehicles. The top flange, while integral with the legs of the girder unit, acts as the deck, even when covered with an overlay. Overlays are simply protective coatings for a deck or slab. The girder unit is essentially broken into two components where the top flange is separated from the web and assessed as a deck component and the legs or stems of the beam are assessed as the beam or superstructure component. Therefore top flange defects will have no bearing on the condition of the beam component.

Rate each square foot of the top flange using the condition state definitions. The assessment represents the worst condition stated of each square foot, which include the top, bottom, and edges of the flange when visible.

Assess overlays or wearing surfaces using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or wearing surface to assess the top surface of the top flange when the top surfaces of the top flange are not visible.

215 Reinforced Concrete Abutment

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion of this element.

For this example, the wingwalls are not integral and are therefore not included within the assessment of the abutment element. The wingwall shall be assessed as element 9238 Reinforced Concrete Wingwall.

226 Prestressed Concrete Pile

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

Wingwall piling, regardless of whether if integral or not, is assessed with the wingwall and therefore should not be included within the piling quantity.

Element 9226 Submerged Prestressed Concrete Pile should only be used for Underwater Inspections and inspected by Divers. During Routine Inspections, the inspector may be able to visually observe piling below the water line. In this case, element 226 Prestressed Concrete Pile should still be used.

312 Enclosed/Concealed Bearings

Refer to example 3-EI.24.6 Prestressed Concrete Double T Beam for further discussion on this element.

321 Reinforced Concrete Paving Slab

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

In this example, no grade beam is present, therefore only the paving slab immediately adjacent to the bridge on either side is evaluated under this element.

9109 Prestressed Concrete Double T Beam

Refer to example 3-EI.24.6 Prestressed Concrete Double T Beam for further discussion of this element.

For this example, a concrete overlay tops the Double T Beams. Where traffic rides directly on the top flange or a wearing surface (not a structural deck with reinforcing steel) over the top flange, element 15 Prestressed Concrete Top Flange is used to assess the top flange and element 9109 Prestressed Concrete Double T Beam is used to assess only the legs of the Double T Beam. In this case, the legs of each unit, that is the number of legs located between longitudinal joint to longitudinal joint, are evaluated as one girder. Therefore the worst condition state from only one leg per linear foot shall be recorded on the inspection report.

9238 Reinforced Concrete Wingwall

Use when a non-integral reinforced concrete wingwall is used to retain roadway fill beyond the extents of the abutment. In this example the concrete wingwalls are supported by two piles and a joint between the wing and abutment can be observed.

Rate each linear foot of the reinforced concrete wingwall using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes the full height of the wingwall and any exposed wingwall piling.

If piling were to be exposed under the wingwalls, the piling would be assessed under the wingwall element.

9331 Reinforced Concrete Bridge Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9335 Reinforced Concrete Approach Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9336 Reinforced Concrete Approach Rail on Wingwall

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion of this element.

9516 Concrete Overlay (HDLS)

Use when the overlay or wearing surface is comprised of concrete. An overlay or wearing surface is typically placed over the top surface of T Beam top flanges, as is the case in this example.

Rate each square foot of the wearing surface using the condition state definitions. The assessment should represent the worst condition stated of each square foot, which only includes the top surface.

The wearing surface or overlay measurements should be from the extents of the surface. Typically, an overlay is placed only between the inside faces of the parapets and thus will have a total measurement less than the deck, slab, or top flange total area. In this example, however, the overlay was placed from out to out of the top flange limits and appropriately has the same total area as the top flange quantity.

3-EI.24.8 Simple Span Steel Stringer/Multi-beam or Girder

Superstructure: 46’-10 simple steel girder bridge. The girders are painted.

Structure located in Environmental Zone 3

ADTT = 10 and low salt use

Substructure: Full height steel pile bent abutments

Traffic Appurtenances: Metal bridge railing

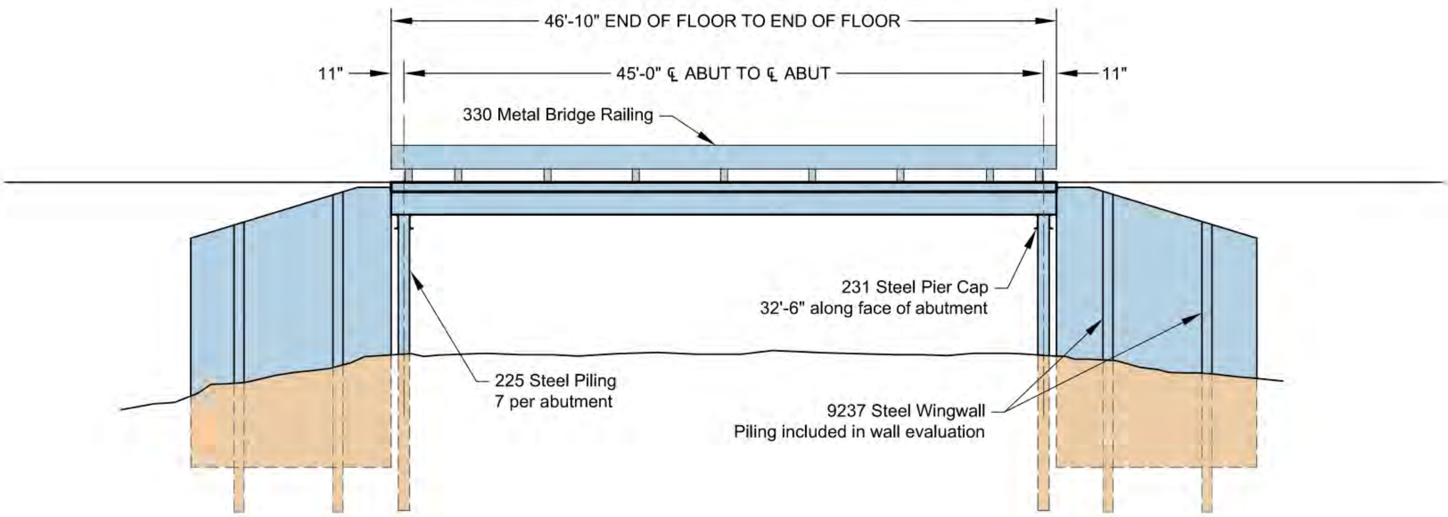
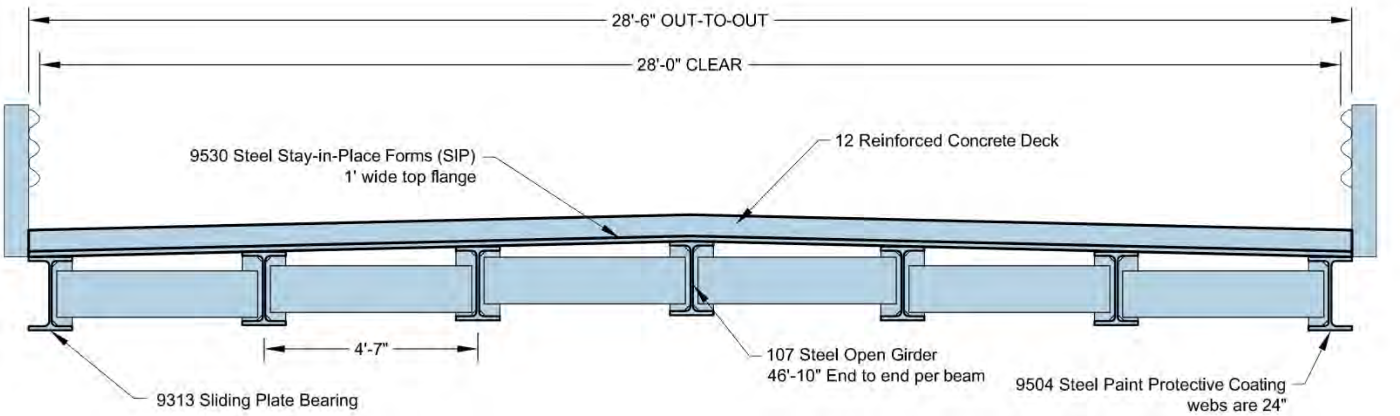


Figure 3-EI-24.8- 1: Elevation view of simple span steel girder bridge



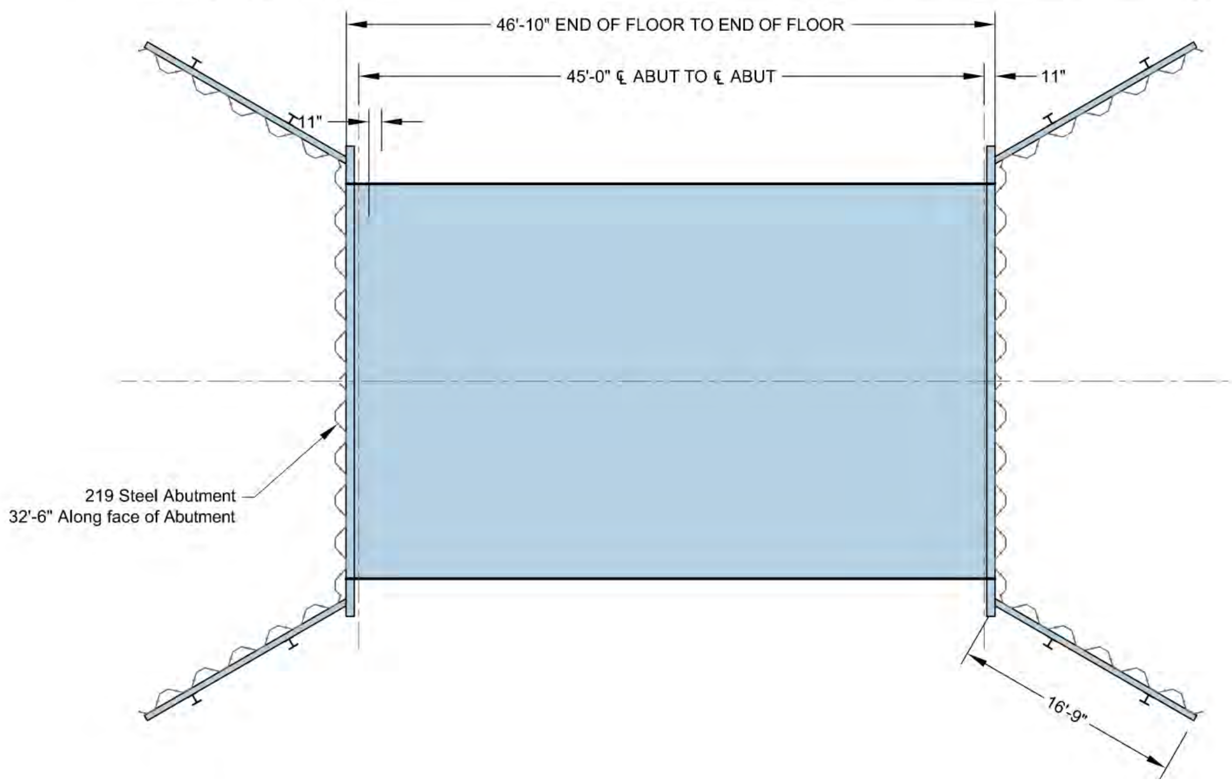


Figure 3-EI-24.8- 2: Plan view of simple span steel girder bridge

Figure 3-EI-24.8- 3: Cross section view of superstructure of simple steel girder bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 3 (for zone 3) + 0 (for low salt use) + 0 (for ADTT < 1000) = 3

Super and substructure elements not under joints: Environmental State = 3 (for zone 3) + 0 (for no leakage) + 0 (for ADTT < 1000) = 3

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	12	RC Deck		SF	1,334	3
Quantity Calculations		*Span 1*	*46.8' x 28.5' = 1333.8*			
M	107	Steel Open Girder		FT	328	3
Quantity Calculations		*Span 1*	*46.8' x 7 = 327.6'*			
M	9540	Steel Paint Protective Coating		SF	1,900	3
Quantity Calculations		*Span 1*	*7 x 2'* x 46.8' x 2.9 = 1900.1*			
M	330	Metal Bridge Railing		FT	94	3
Quantity Calculations		*Span 1*	*46.8' x 2 = 93.6'*			
M	9313	Sliding Plate Bearing		EA	14	3
Quantity Calculations		*Span 1*	*7 x 2 = 14*			
M	9530	Stay-in-Place Form		SF	1,006	3
Quantity Calculations		*Span 1*	*46.8' x (28.5' – 7 x 1'**) = 1006*			
M	9542	Galvanized Steel Protective Coating		SF	1,006	3
Quantity Calculations		*Span 1*	*46.8' x (28.5' – 7 x 1'**) = 1006*			

*W24 (2 ft tall beam height).

**1 ft wide top flange.

Substructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	219	Steel Abutment	FT	65	3
Quantity Calculations		*Span 1*	*32.5' x 2 = 65'*		
M	225	Steel Pile	EA	14	3
Quantity Calculations		*Span 1*	*7 x 2 = 14*		
M	231	Steel Pier Cap	FT	65	3
Quantity Calculations		*Span 1*	*32.5' x 2 = 65'*		
M	9237	Steel Wingwall	FT	67	3
Quantity Calculations		*Span 1*	*16.8' x 4 = 67.2'*		

Element Commentary – Simple Span Steel Girder

12 Reinforced Concrete Deck

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

107 Steel Open Girder/Beam

Use when deck is structurally supported by steel beam components oriented longitudinally along roadway. In a floor system these are the primary structural components, and the beam components bear directly on the substructure.

Rate each linear foot of the open girder using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top and bottom flanges.

219 Steel Abutment

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

225 Steel Pile

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

231 Steel Pier Cap

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

330 Metal Bridge Railing

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

Note that the curbs are also assessed under this element even when comprised of different construction material. In this instance, the defects associated with concrete should be used under the metal bridge railing element when assessing the curb.

9237 Steel Wingwall

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

9313 Sliding Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

9530 Steel Stay-in-Place Forms (SIP)

Use when steel forms remain in place under structural concrete decks.

Rate each square foot of stay-in-place formwork using the condition state definitions. The area of assessment is only from flange to flange between girders.

This element should not be used in the instance when steel supports only gravel. In this case element 30 Steel Deck Corrugated/Orthotropic/Etc. should be used. Stay-in-Place forms are not structural once the concrete deck has cured. The forms can be a method by which to assess the underside of the deck through indirect means. If heavy corrosion is evident in the center of a span, this may be an indication that water has been allowed to seep through the concrete deck. Other methods of testing should be used if heavy deck deterioration is suspected.

9540 Steel Paint Protective Coating

Use on all steel primary structural members that are coated in paint or other similar coating.

Rate each square foot of the protective coating using the condition state definitions. The area of assessment is all exposed surfaces.

This element is evaluated separately from the actual bridge member it protects. That is the protective coating should not be evaluate with the member but evaluated by its own defect condition states. For example, the protective coating may be in Condition State 4 (no effectiveness, failed and exposing bare steel beneath) while the exposed steel underneath is in Condition State 1 (no corrosion).

9542 Galvanized Steel Protective Coating

Use when the protective coating on a structural steel member is comprised of galvanization. In this example the Stay-in-Place forms are protected with a galvanized coating.

Rate each square foot of the protective coating using the condition state definitions. The area of assessment is all exposed surfaces.

This element is evaluated separately from the actual bridge member it protects. That is the protective coating should not be evaluate with the member but evaluated by its own defect condition states. For example, the protective coating may be in Condition State 4 (no effectiveness, failed and exposing bare steel beneath) while the exposed steel underneath is in Condition State 1 (no corrosion).

3-EI.24.9 Continuous Steel Stringer/Multi-beam or Girder

Superstructure: 253'-2 continuous steel girder bridge. Girders are comprised of weathering steel.

Structure located in Environmental Zone 3

ADTT = 5000 and high salt use

Substructure: Full height concrete abutments with hammerhead piers

Traffic Appurtenances: Reinforced concrete open bridge railing

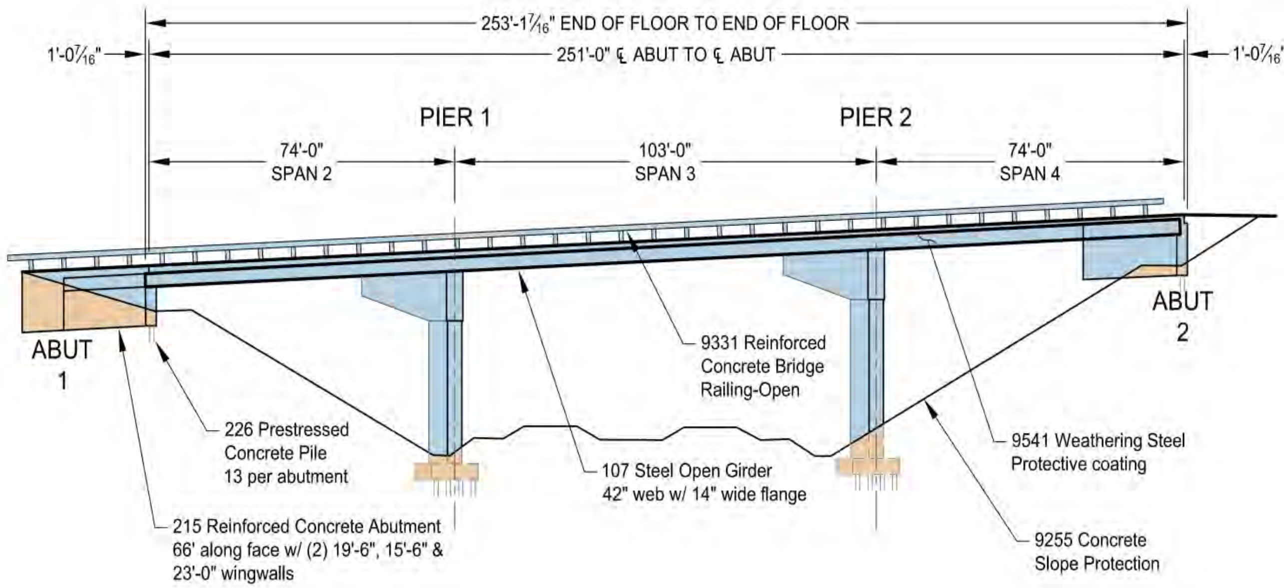


Figure 3-EI.24.9- 1: Elevation view of continuous steel girder bridge

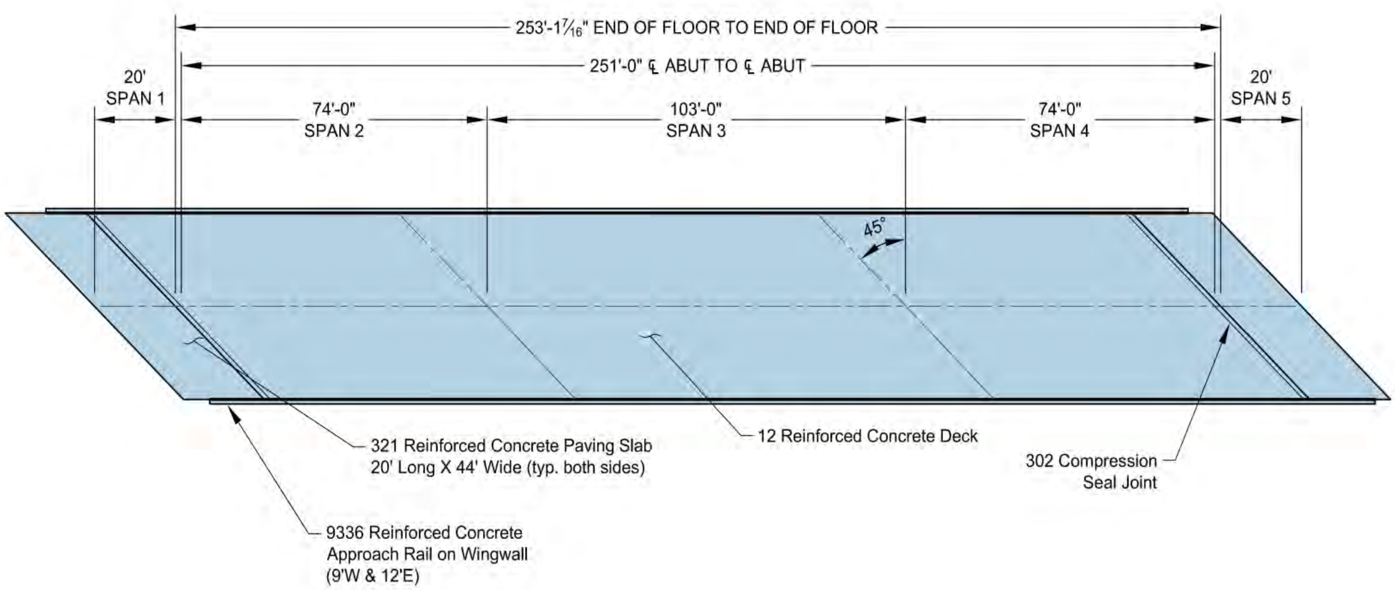


Figure 3-EI.24.9- 2: Plan view of continuous steel girder bridge

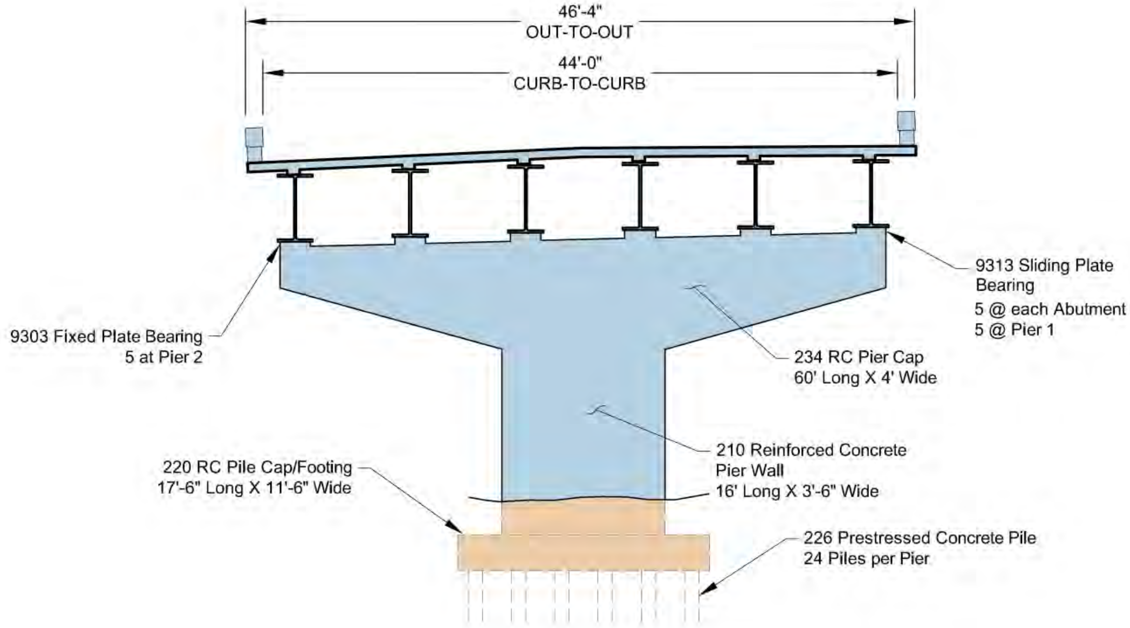


Figure 3-EI.24.9- 3: Cross section view of superstructure of continuous steel girder bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 3 (for zone 3) + 1 (for high salt use) + 1 (for ADTT > 1000) = 4

Super and substructure elements not under joints: Environmental State = 3 (for zone 3) + 0 (for no leakage) + 1 (for ADTT > 1000) = 4

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	12	RC Deck		SF	11,719	4
Quantity Calculations		*Span 2*	*75.0' x 46.3' = 3474.8*			
		Span 3	*103' x 46.3' = 4768.9*			
		Span 4	*75.0' x 46.3' = 3474.8*			
M	107	Steel Open Girder/Beam		FT	1,510	4
Quantity Calculations		*Span 2*	*74.3'* x 6 = 445.8'*			
		Span 3	*103' x 6 = 618*			
		Span 4	*74.3'* x 6 = 445.8'*			
M	9313	Sliding Plate Bearing		EA	18	4
Quantity Calculations		*Span 2*	*5*			
		Span 2	*5 x 2 = 10*			
M	9304	Fixed Plate Bearing		EA	6	4
Quantity Calculations		*Span 2*	*5*			
M	9331	RC Concrete Bridge Railing - Open		FT	506	4
Quantity Calculations		*Span 2*	*75.0' x 2 = 150'*			
		Span 3	*103' x 2 = 206'*			
		Span 4	*75.0' x 2 = 150'*			
M	9336	RC Approach Rail on Wingwall		FT	42	4
Quantity Calculations		*Span 2*	*9' +9' = 18'*			
		Span 4	*12' + 12' = 24'*			
M	9541	Weathering Steel Protective Coating		SF	15,323	4
Quantity Calculations		*Span 4*	*6 x 42"/12 x 74.3' x 2.9 = 4524.9*			
		Span 4	*6 x 42"/12 x 103' x 2.9 = 6272.7*			
		Span 4	*6 x 42"/12 x 74.3' x 2.9 = 4524.9*			

*When no lengths for a girder can be located, it is safe to assume (for quantity calculation purposes) the girder extends 4"-6" beyond the centerline of bearing.

Substructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	210	RC Pier Wall	EA	32	4
Quantity Calculations		*Span 3* — *16'* *Span 4* — *16'*			
M	215	RC Abutment	FT	210	4
Quantity Calculations		*Span 2* — *66' + 19.5' + 15.5' = 101'* *Span 4* — *66' + 19.5' + 23' = 108.5'*			
M	220	RC Pile Cap/ Footing	FT	Not Reported	-
Quantity Calculations		*Span 3* — *17.5' (unexposed)* *Span 4* — *17.5' (unexposed)*			
M	226	PSC Pile	EA	Not Reported	-
Quantity Calculations		*Span 2* — *13 (unexposed)* *Span 3* — *24 (unexposed)* *Span 4* — *24 (unexposed)* *Span 4* — *13 (unexposed)*			
M	234	RC Pier Cap	FT	120	4
Quantity Calculations		*Span 3* — *60'* *Span 4* — *60'*			
M	9255	Concrete Slope Protection	FT	Field Measurement	4
Quantity Calculations		*Span 2* — *Field Measurement* *Span 4* — *Field Measurement*			

Approach					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
P	321	RC Paving Slab	SF	1760	4
Quantity Calculations		*Span 1* — *20' x 44' = 880* *Span 5* — *20' x 44' = 880*			
P	302	Compression Seal Joint	FT	124	4
Quantity Calculations		*Span 1* — *44' / cos (45 deg) = 62.2'* *Span 5* — *44' / cos (45 deg) = 62.2'*			

Element Commentary – Continuous Steel Stringer / Multi-beam or Girder Bridge

12 Reinforced Concrete Deck

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

107 Steel Open Girder/Beam

Use when deck is structurally supported by steel beam components oriented longitudinally along roadway. In a floor system these are the primary structural components, and the beam component bear directly on the substructure.

Rate each linear foot of the open girder using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top and bottom flanges.

When a built-up or rolled girder contains a cover plate, the member should be assessed under element 9101 Steel Open Girder/Beam with Cover Plate.

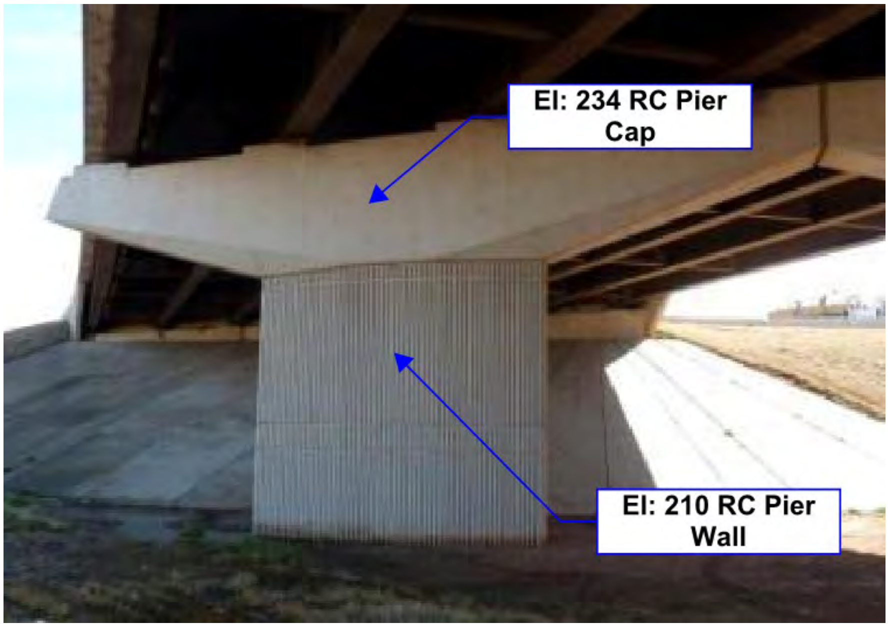
210 Reinforced Concrete Pier Wall

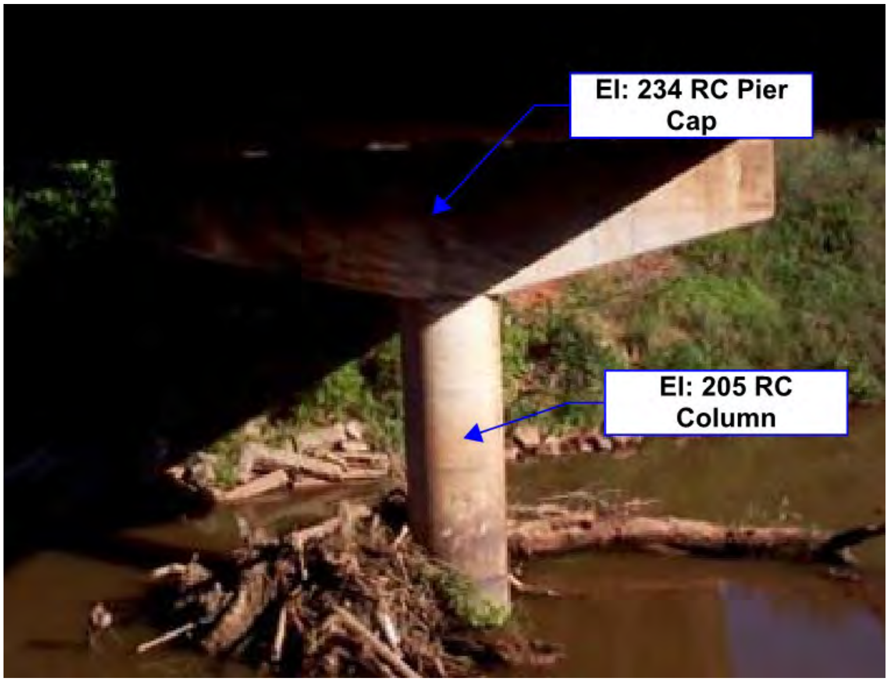
Use for substructure elements that are stems or shafts and shaped longer than wide. For this example, a column is not used as the stem below the pier cap is longer than it is wide.

Rate each linear foot of the wall using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes both sides and the full height of the wall.

Had the stem been a round or square shape, element 205 Reinforced Concrete Column would be applicable for this example.

Hammerhead Pier Element Identification Example





Use element 210 – Reinforced Concrete Pier Wall when the base is rectangular.

Use element 205 – Reinforced Concrete Column when the base is round or square.

215 Reinforced Concrete Abutment

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion of this element.

220 Reinforced Concrete Pile Cap/Footing

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion on this element.

226 Prestressed Concrete Pile

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

234 Reinforced Concrete Pier Cap

Use when substructure unit, abutment or pier, is comprised of a pile bent with superstructure bearing on cap, or when component length is greater than length of a pier. For this example, hammerhead piers consist of a pier cap with a stem/shaft support.

Rate each linear foot of the cap using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes all sides of the cap element.

302 Compression Seal Joint

Use when a preformed polyurethane or other similar material is located within a deck or approach slab joint. Typically steel headers will be located on either side of the seal to keep the material protected and secure.

Rate each linear foot of the joint using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

9230 Reinforced Concrete Grade Beam Cap

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9255 Concrete Slope Protection

Use for slope protection along banks in immediate vicinity of bridge.

Rate each linear foot of the concrete slope protection taken along the abutment using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

It is not practical to measure the length of riprap for situations where the protection continues up and downstream. The inspector should measure the riprap to a maximum length of the bridge length along either bank under the structure.

9304 Fixed Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

9313 Sliding Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

9331 Reinforced Concrete Bridge Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9336 Reinforced Concrete Approach Rail on Wingwall

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion of this element.

9541 Weathering Steel Protective Coating

Use when the steel member is comprised of weathering steel and has a protective patina across the surface.

Rate each square foot of the protective system using the condition state definitions. The assessment should represent the worst condition state of each square foot of the protective coating.

When portions of the weathering steel member are painted, i.e. the patina has been effectively removed and the bare steel painted, element 9540 Steel Paint Protective Coating should be used for the area of painted protective coating and the remaining of the coating as element 9541.

This element is evaluated separately from the actual bridge member it protects. That is the protective coating should not be evaluate with the member but evaluated by its own defect condition states. For example, the protective coating may be in Condition State 4 (no effectiveness, failed and exposing bare steel beneath) while the exposed steel underneath is in Condition State 1 (no corrosion).

3-EI.24.10 Steel Truss

Superstructure: 253'-2 steel truss with steel girder approach spans

Structure located in Environmental Zone 1

ADTT = 10 and low salt use

Substructure: Full height concrete abutments with RC column piers

Traffic Appurtenances: Reinforced concrete and metal bridge railing

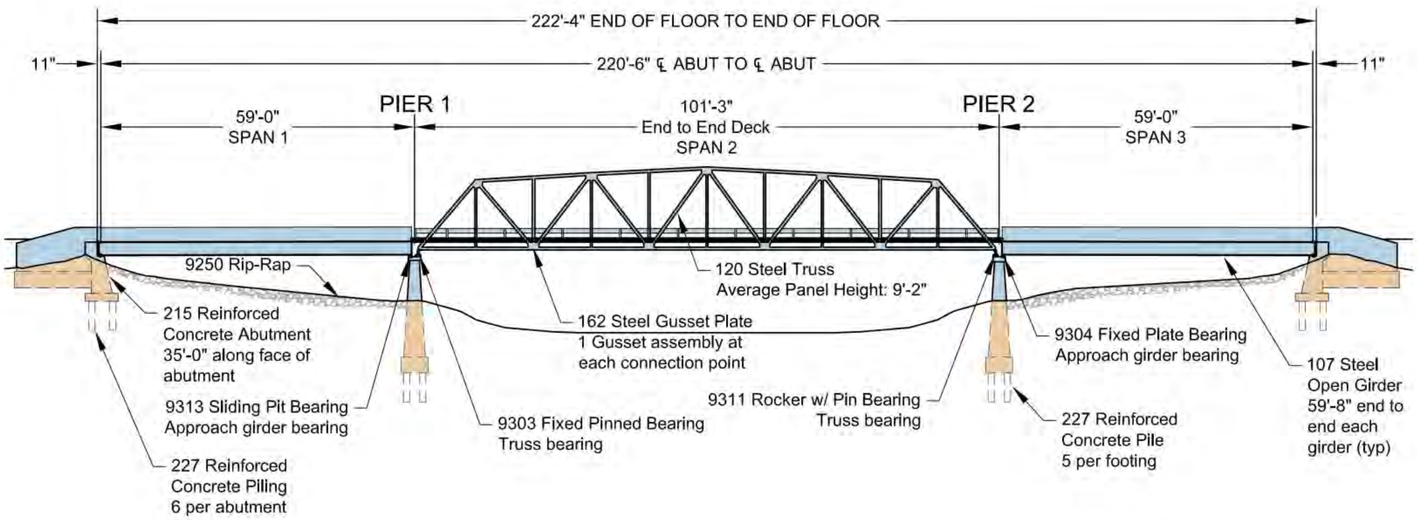


Figure 3-EI.24.10- 1: Elevation view of steel truss bridge

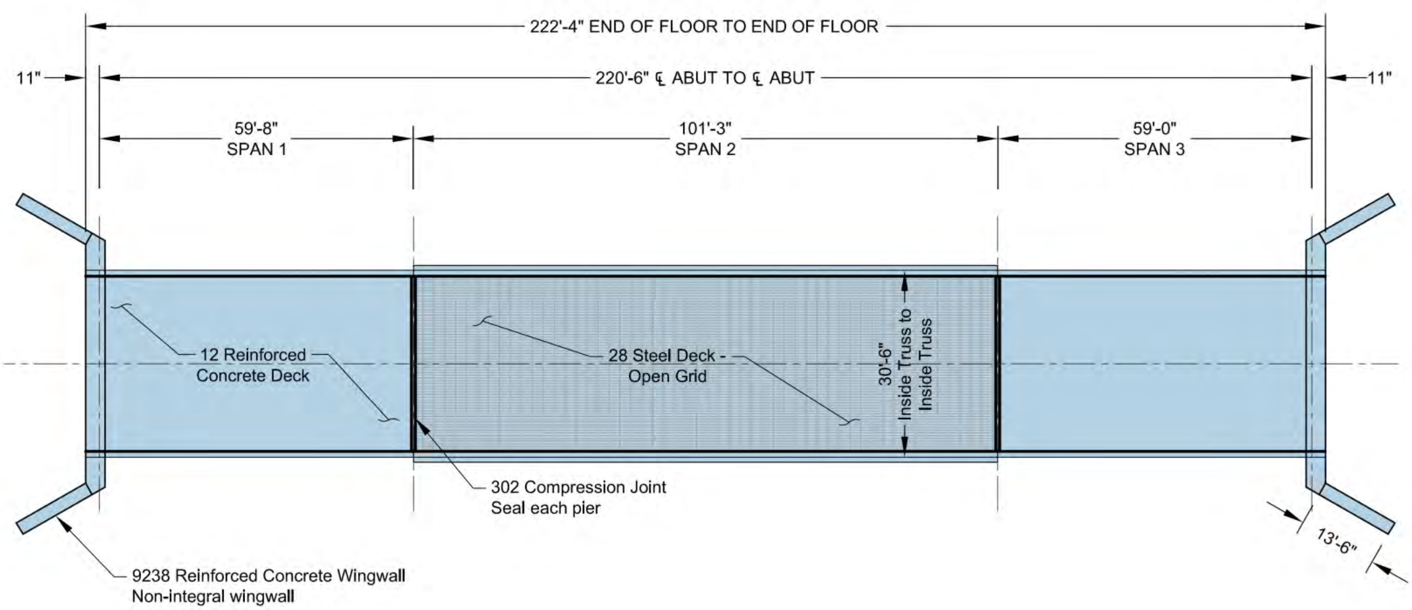


Figure 3-EI.24.10- 2: Plan view of steel truss bridge

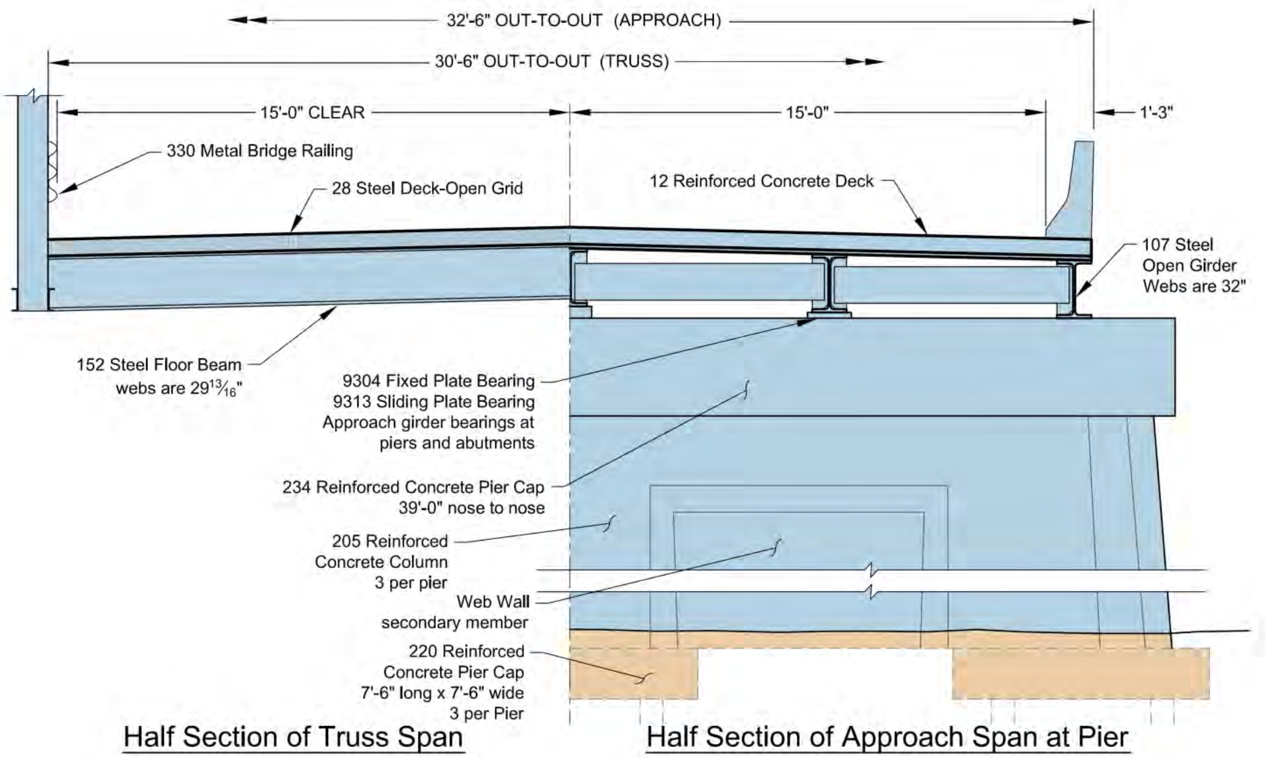


Figure 3-EI.24.10- 3: Cross section view of superstructure of steel truss bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 1 (for zone 1) + 0 (for low salt use) + 0 (for ADTT < 1000) = 1

Super and substructure elements not under joints: Environmental State = 1 (for zone 1) + 0 (for no leakage) + 0 (for ADTT < 1000) = 1

Main - Superstructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	28	Steel Deck with Open Grid	SF	3,090	1
Quantity Calculations	*Span 2*	*101.3' x 30.5' = 3089.7*			
M	120	Steel Truss	FT	203	1
Quantity Calculations	*Span 2*	*101.3' x 2 = 202.6'*			
M	9540	Steel Paint Protective Coating	SF	1121	1
Quantity Calculations	*Span 2*	*203' x 9.2' x 0.6 = 1120.6*			
M	152	Steel Floor Beam	FT	336	1
Quantity Calculations	*Span 2*	*30.5' x 11 = 335.5'*			
M	9540	Steel Paint Protective Coating	SF	1855	1
Quantity Calculations	*Span 2*	*257.4' x (29 $^{13}/_{16}$")/ 12 x 2.9 = 1854.5*			
M	162	Gusset Plate	EA	40	1
Quantity Calculations	*Span 2*	*20 x 2 = 40*			
M	302	Compression Seal Joint	FT	60	1
Quantity Calculations	*Span 1*	*30' x 2 = 60'*			
M	330	Metal Bridge Railing	FT	203	1
Quantity Calculations	*Span 2*	*101.3' x 2 = 202.6'*			

Main - Substructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	205	RC Column	EA	6	1
Quantity Calculations	*Span 2*	*3 x 2 = 6*			
M	220	RC Pile Cap/Footing	FT	Not Reported	-
Quantity Calculations	*Span 2*	*7.5' x 3 x 2 = 45' (unexposed)*			
M	227	RC Pile	EA	Not Reported	-
Quantity Calculations	*Span 2*	*5 x 3 x 2 = 30 (unexposed)*			
M	234	RC Pier Cap	FT	78	1
Quantity Calculations	*Span 2*	*39' x 2 = 78'*			
M	9303	Fixed Pinned Bearing	EA	2	1
Quantity Calculations	*Span 2*	*2*			
M	9311	Rocker with Pin Bearing	EA	2	1
Quantity Calculations	*Span 2*	*2*			

Approach - Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
A	12	RC Deck		SF	3,887	1
Quantity Calculations		*Span 1*	*59.8' x 32.5' = 1943.5*			
		Span 3	*59.8' x 32.5' = 1943.5*			
A	107	Steel Open Girder		FT	590	1
Quantity Calculations		*Span 1*	*59' x 5 = 295*			
		Span 3	*59' x 5 = 295*			
A	9540	Steel Paint Protective Coating		SF	4,563	1
Quantity Calculations		*Span 1*	*295' x 32"/12 x 2.9 = 2,281.3*			
		Span 3	*295' x 32"/12 x 2.9 = 2,281.3*			
A	331	RC Concrete Bridge Railing - Closed		FT	239	1
Quantity Calculations		*Span 1*	*59.8' x 2 = 119.6'*			
		Span 3	*59.8' x 2 = 119.6'*			
A	9304	Fixed Plate Bearing		EA	10	1
Quantity Calculations		*Span 1*	*5*			
		Span 3	*5*			
A	9313	Sliding Plate Bearing		EA	10	1
Quantity Calculations		*Span 1*	*5*			
		Span 3	*5*			

Approach - Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
A	215	RC Abutment		FT	70	1
Quantity Calculations		*Span 1*	*35'*			
		Span 3	*35'*			
A	227	RC Pile		EA	Not Reported	-
Quantity Calculations		*Span 1*	*6 (unexposed)*			
		Span 3	*6 (unexposed)*			
A	9238	RC Wingwall		FT	54	1
Quantity Calculations		*Span 1*	*13.5' x 2 = 27'*			
		Span 3	*13.5' x 2 = 27'*			
A	9250	Riprap		FT	Field Measurement	1
Quantity Calculations		*Span 1*	*Field Measurement*			
		Span 3	*Field Measurement*			

Element Commentary – Steel Thru Truss

12 Reinforced Concrete Deck

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

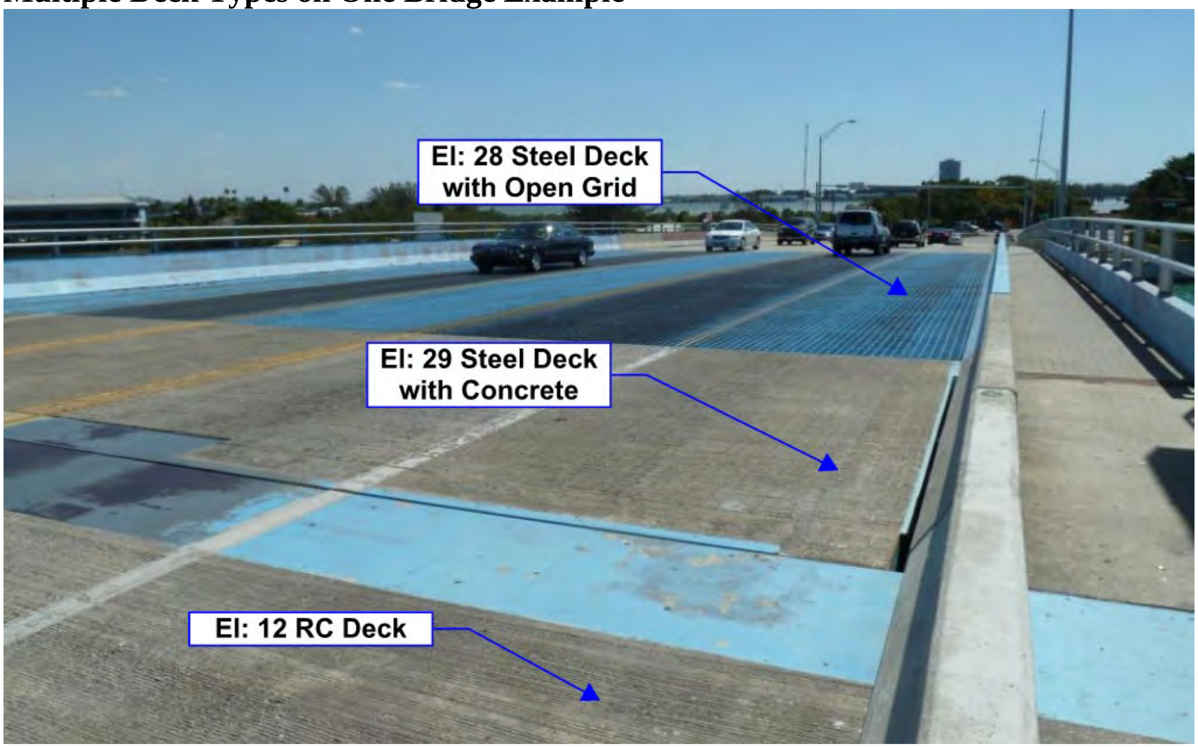
28 Steel Deck with Open Grid

Use for grid decks constructed of steel that are not filled allowing the passage of deck runoff and smaller debris down to the superstructure members below the deck.

Rate each square foot of the deck using the condition state definitions. The assessment should represent the worst condition stated of each square foot, which includes the top, bottom, and edges of the deck when visible.

Assess filled grids under element 29.

Multiple Deck Types on One Bridge Example



Record and assess each deck type under the appropriate element:

107 Steel Open Girder/Beam

Use when deck is structurally supported by beam components oriented longitudinally along roadway. In a floor system these are the primary structural components, that is the beam component that directly bears on the substructure.

Rate each linear foot of the open girder using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top and bottom flanges.

Element 113 Steel Stringer would not be used to assess these beams. Stringers are smaller flexural members oriented longitudinal to the roadway and found in superstructure floor systems. A floor system is an assembly of girders/trusses, floor beams and stringers, where the stringers run parallel to the girders/trusses and tie into the floor beams.

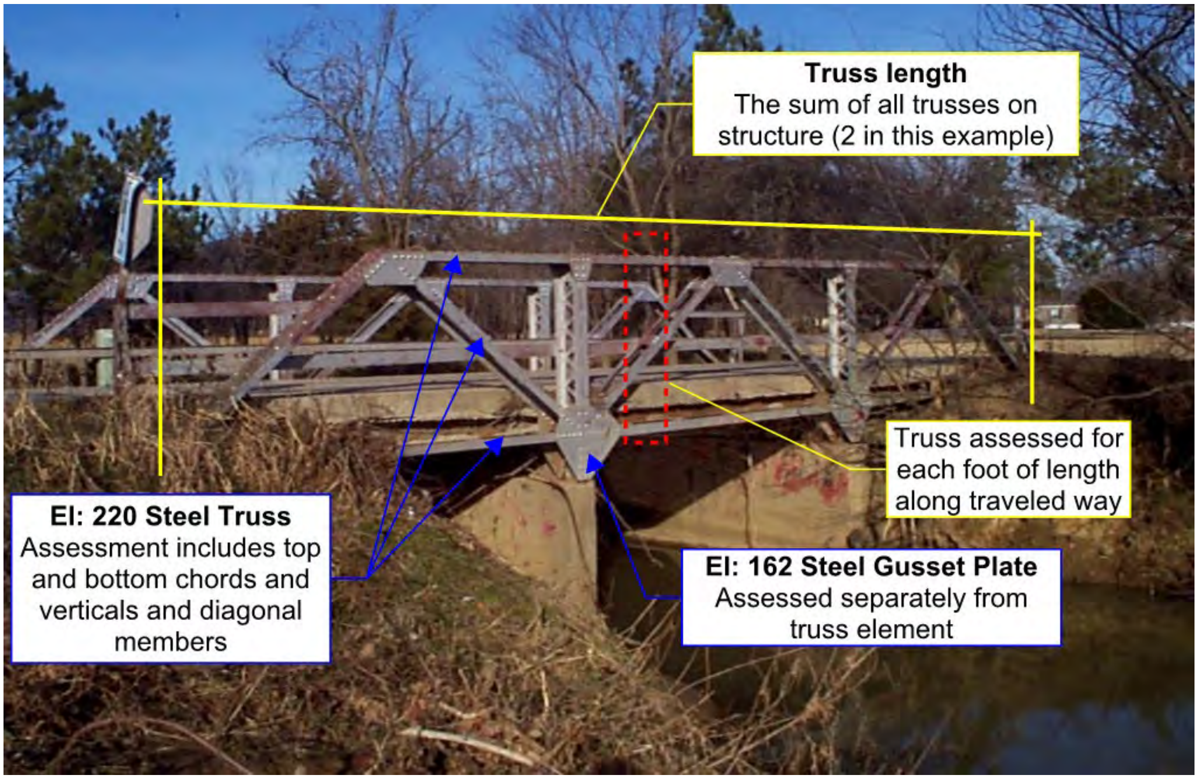
120 Steel Truss

Use to assess all primary truss elements. This includes all vertical, diagonal, upper and bottom chord members. This element is inclusive of all steel trusses. The truss in this example is relatively shallow and does not require vertical sway bracing. On taller trusses where vertical sway bracing is present, these secondary members shall not be evaluated under the truss element but under element 9152 Cross Frame.

Rate each linear foot of the truss using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the horizontal projected length of all diagonal and vertical members along the length of the truss.

Assess gusset plates under element 162 Steel Gusset Plate. Lower lateral bracing is not assessed in element inspection. Lower lateral bracing are secondary members. Deficiencies may be noted under the truss element; however there is no element to track their condition state.

Steel Truss Example



152 Steel Floor Beam

Use for beams that run transverse to the roadway and transfer loading to girders/trusses running perpendicular to the floor beams.

Rate each linear foot of the floor beam using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top and bottom flanges.

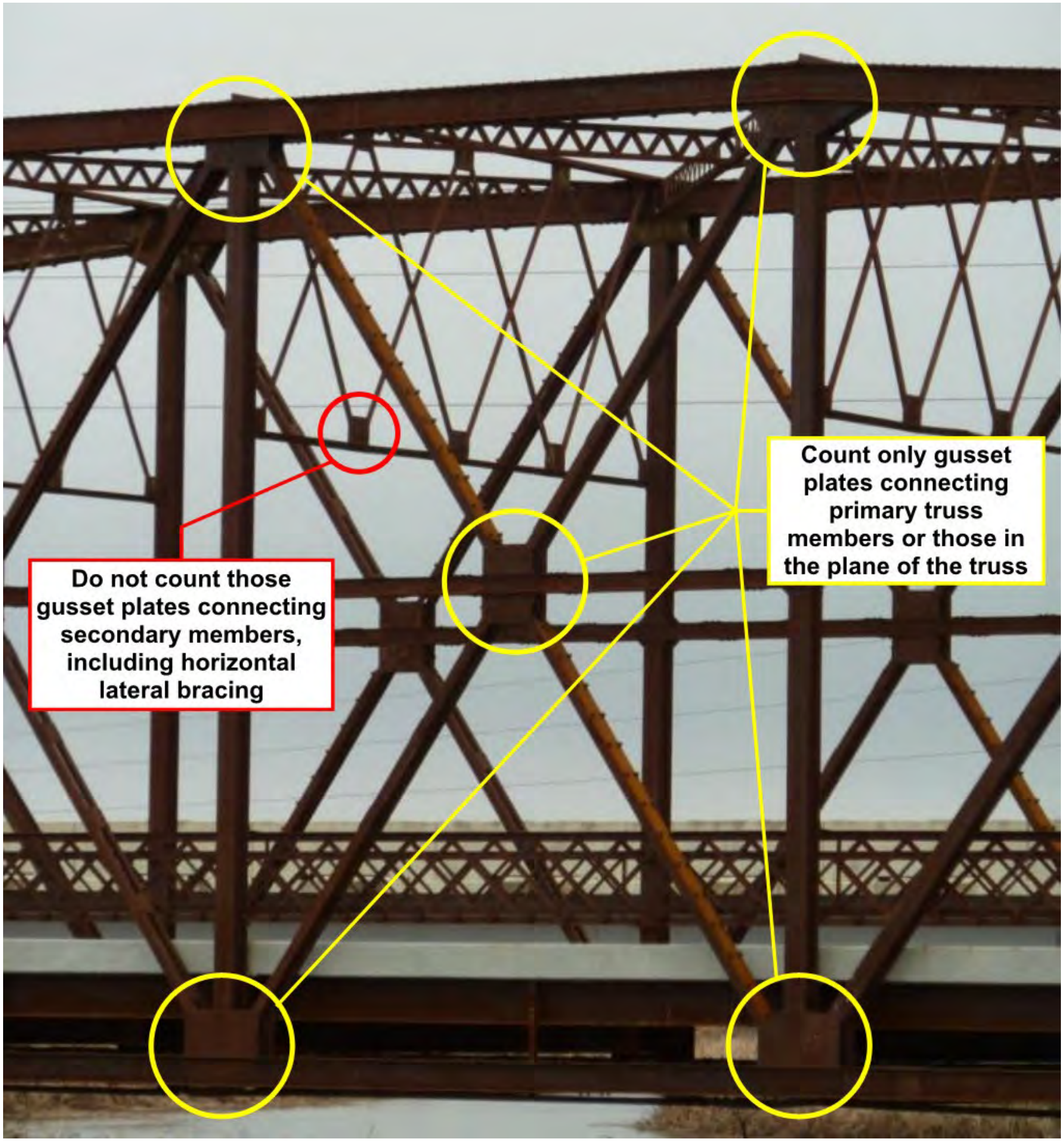
162 Steel Gusset Plate

Use for steel gusset plates that join primary truss members together.

Rate each gusset plate assembly using the condition state definitions. The assessment should represent the worst condition found on each gusset plate assembly. An assembly is comprised of all the gusset plates located at one panel point connection.

Lateral bracing gussets, or other gussets not in the plane of the truss are not assessed under element 162 Steel Gusset Plate.

Steel Gusset Plate Connections Example



Assess each gusset plate in primary load path member connections. Look for plate distortion, corrosion (pack rust) distorting plates, or causing section loss, and loose or missing rivets or bolts.

Count 1 EA at each connection point. Regardless if the gusset plates are built up sections, the quantity to assess would be 1 EA at that point.

Rate the worst condition per connection.

205 Reinforced Concrete Column

Use for those substructure elements that are drilled or placed and support either a cap or the superstructure itself.

Rate each column using the condition state definitions. The assessment should represent the worst condition stated on the column, which includes the full height and length of the column.

Assess piles under the appropriate elements. Piles, in contrast to columns, are driven to bearing.

Element 210 reinforced concrete pier wall would not be an applicable element for the piers in this example. While web walls are present between the columns, they essentially act as diaphragms providing lateral resistance for the pier. A pier wall would not have isolated rectangular pile footings as foundations.

215 Reinforced Concrete Abutment

Use when a stub or full height abutment is used or when concrete sheet piling is used as the primary component to retain roadway fill. Wingwalls are included in the abutment element when they are integral, which is they are not independent of one another. In this example there is a joint between the abutment and wingwall. Therefore they are not integral.

Rate each linear foot of the abutment along the skew using the condition state definitions.

220 Reinforced Concrete Pile Cap/Footing

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion on this element.

227 Reinforced Concrete Pile

Use when reinforced concrete piling supports a cap or footing.

Rate each exposed pile using the condition state definitions. The assessment should represent the worst condition found on each pile.

Reinforced Concrete piling is typically square. Prestressed piling is much more common and should be assumed unless found to be otherwise (existing plans, etc.). In this case the plans indicate concrete piling.

234 Reinforced Concrete Pier Cap

Use when substructure unit, abutment or pier, is comprised of a pile bent with superstructure bearing on cap, or when top portion of pier supporting the superstructure is greater than the length of the pier bent.

Rate each linear foot of the cap using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes all sides of the cap element.

Element 220 Reinforced Concrete Pile Cap/Footing is not used in this instance as the bridge component is located at the pier and directly supports the superstructure.

302 Compression Seal Joint

Use when a preformed polyurethane or other similar material is located within a deck or approach slab joint. Typically steel headers will be located on either side of the seal to keep the material protected and secure.

Rate each linear foot of the joint using the condition state definitions. The assessment should represent the worst condition found along each foot of the joint.

Compression seal joints are not to be confused with a strip seal joint. Strip seal joints are typically composed of steel extrusion anchors located on either side of the joint that firmly hold a simple neoprene seal.

330 Metal Bridge Railing

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

331 Reinforced Concrete Bridge Railing – Closed

Use when solid reinforced concrete rail is used as the traffic appurtenances on the bridge structure. The element does not include the portions of the rail that extend beyond the limits of the bridge onto the roadway approaches.

Rate each linear foot of the concrete rail using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. The curb condition should be assessed based on the defects appropriate for its material type.

Remaining portions of rail not on the bridge are assessed under an NDOT BME in element level inspection.

9238 Reinforced Concrete Wingwall

Use when a non-integral reinforced concrete wingwall is used to retain roadway fill beyond the extents of the abutment. In this example the concrete wingwalls are supported by two piles and a joint between the wing and abutment can be observed.

Rate each linear foot of the reinforced concrete wingwall using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes the full height of the wingwall and any exposed wingwall piling.

If piling were to be exposed under the wingwalls, the piling would be assessed under the wingwall element.

9250 Riprap

Use for slope protection along banks in immediate vicinity of bridge.

Rate each linear foot of the riprap using the condition state definitions. The assessment should represent the worst condition stated of each linear foot.

It is not practical to measure the length of riprap for situations where the protection continues up and downstream. The inspector should measure the riprap to a maximum length of the bridge length along either bank under the structure.

9303 Fixed Pinned Bearing

Use on bearings that allow rotational movement by utilizing a pin. In this example the truss bears on a pinned bearing. The assembly is anchored to the concrete pier cap however the truss is able to rotate about the bearing at the pin connection.

Rate each pinned bearing using the condition state definitions. The assessment should represent the worst condition found on each fixed pinned bearing.

9304 Fixed Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

9311 Rocker with Pin Bearing

Use on bearings that allow rotational and translational movement by utilizing a pin. In this example the truss bears on a pinned bearing. The assembly bears on the concrete pier cap however the truss is able to rotate about the bearing at the pin and translate through the rocker.

Rate each pinned bearing using the condition state definitions. The assessment should represent the worst condition found on each rocker with pinned bearing.

9313 Sliding Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

3-EI.24.11 Reinforced Concrete Box Culvert

Superstructure: 6 - 10’-0 span reinforced concrete box culvert

Structure located in Environmental Zone 3

ADTT = 10 and low salt use

Substructure: N/A

Traffic Appurtenances: Closed reinforced concrete bridge railing.

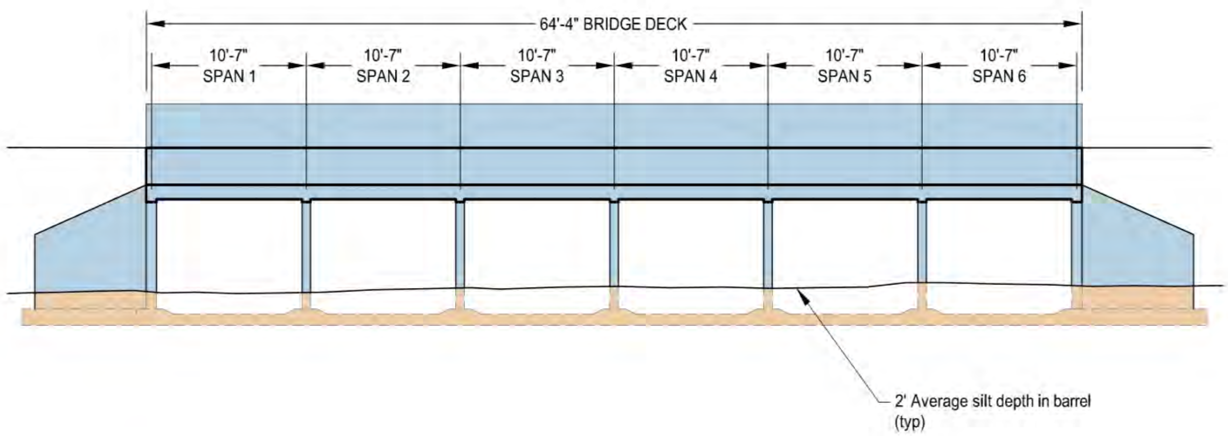


Figure 3-EI.24.11- 1: Elevation view of a multi-cell reinforced concrete culvert.

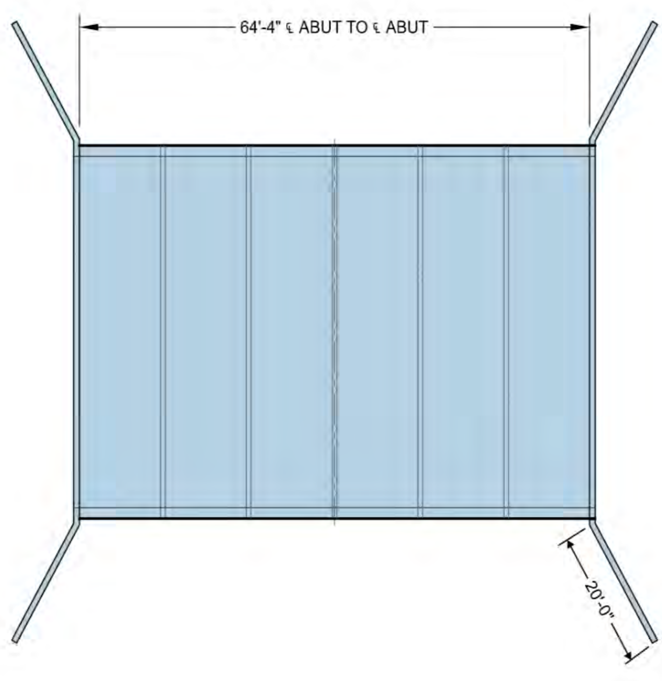


Figure 3-EI.24.11- 2: Plan view of a multi-cell reinforced concrete culvert.

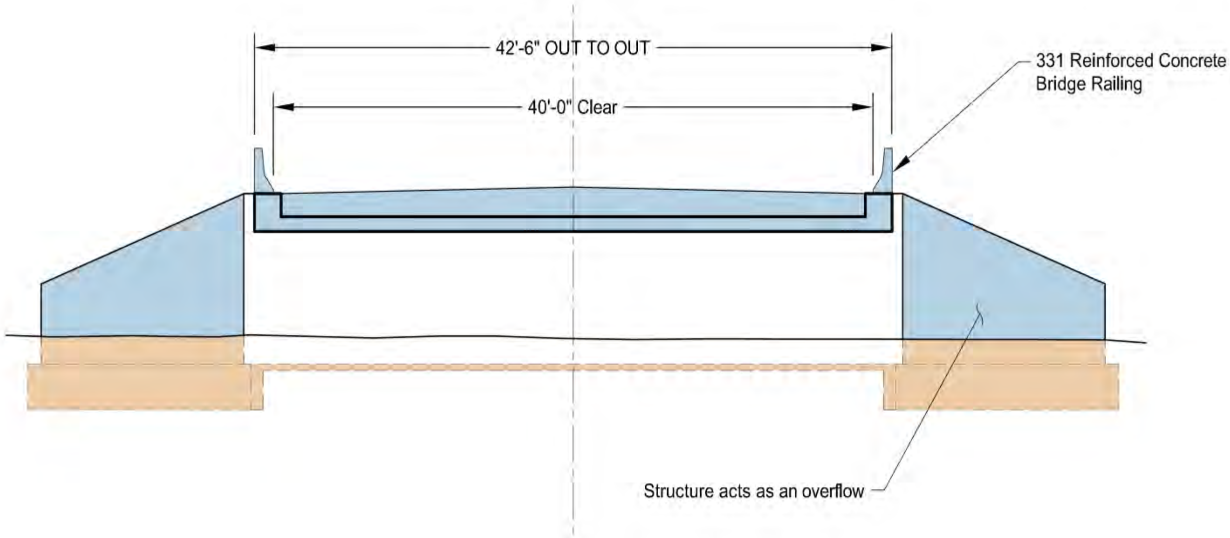


Figure 3-EI.24.11- 3: Roadway view of a multi-cell reinforced concrete culvert.

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Culvert elements: Environmental State = 3 (for zone 3) + 0 (for low salt use) + 0 (for ADTT < 1000) = 3

Superstructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	241	RC Culvert	FT	255	3
Quantity Calculations	*Span 1*	*42.5' x 6 = 255'*			
M	9238	RC Wingwall	FT	80	3
Quantity Calculations	*Span 1*	*20.0' x 4 = 80'*			
M	331	RC Bridge Railing - Closed	LF	129	3
Quantity Calculations	*Span 1*	*64.3' x 2 = 129'*			
M	9553	Silt in Culvert Barrel	EA	1	-
Quantity Calculations	*Span 1*	*1*			

Element Commentary – Reinforced Concrete Box Culvert

241 Reinforced Concrete Culvert

Use this element for standard culvert structures comprised of reinforced concrete or those larger structures that contain a structural floor between abutments. A structural floor ties into the walls of the structure essentially creating a rigid frame along the bottom of the structure. A concrete lined channel through the underside of a bridge does not constitute a structural floor.

Rate this element per linear foot along each barrel. The assessment should represent the worst condition state of each linear foot, which includes both walls, the ceiling and the floor of each barrel. The linear foot is taken circumferentially around the barrel.

331 Reinforced Concrete Bridge Railing – Closed

Use when solid reinforced concrete rail is used as the traffic appurtenances on the structure. The element does not include the portions of the rail that extend beyond the limits of the structure onto the roadway approaches. In this example a closed concrete bridge rail is located and tied into the culvert parapet wall. To capture any deficiencies with this wall, the bridge railing element shall be used. If the bridge railing were free standing or part of the roadway over structure, this element would not be associated with the culvert.

Rate each linear foot of the concrete rail using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. The curb condition should be assessed based on the defects appropriate for its material type.

Remaining portions of rail not on the bridge are assessed under an NDOT BME in element level inspection.

9238 Reinforced Concrete Wingwall

Use this element for concrete wingwalls of culverts whether integral or otherwise.

Rate this element per linear foot along each wing. The assessment should represent the worst condition state of each linear foot, which takes into account the full height of the each linear foot.

9244 Reinforced Concrete Headwall

Use this element for concrete headwalls of culverts. A culvert headwall will typically be found at the ends of steel culverts. In this example the wall above the barrels is considered a parapet wall, not a headwall. Parapet walls are evaluated with each appropriate culvert barrel.

Rate this element per linear foot along each headwall. The assessment should represent the worst condition state of each linear foot. This includes taking into account the full height of each linear foot.

9553 Silt in Culvert Barrel

Use this element to capture silt within culvert barrels. Only 1 EA may be used per span group. In this example all 6 barrels constitute the main span group.

Rate this element as an each item for every span group with accumulated silt. The assessment should represent the worst condition state found within each span group. For example, there may be some silt deposits at the inverts of the culvert however walking through the barrel, the silt depth rises which impedes flow. The condition state would be based on the area restricting flow.

This element should not be confused with element 9552 Debris Blocking Flow. Element 9552 should be used when large objects (logs, branches, trash, etc.) become lodged at the invert of a culvert.

3-EI.25 APPENDIX B: NDOT NBE AND NDOT BME GROUPINGS

3-EI.25.1 General

The charts on the following pages organize the Nebraska Elements defined in Chapter 3-EI Element Inspection Coding into the NDOT NBEs and the NDOT MBEs. For each element, the name, identifier, and units of measure are shown and elements are grouped by major bridge assembly and material type.

Charts for National Bridge Elements (NBEs) and Bridge Management Elements (BMEs) as defined in the AASHTO Manual for Bridge Element Inspection, First Edition 2013, can be referenced in Appendix C of said manual.

3-EI.25.2 NDOT NBE Groupings Chart

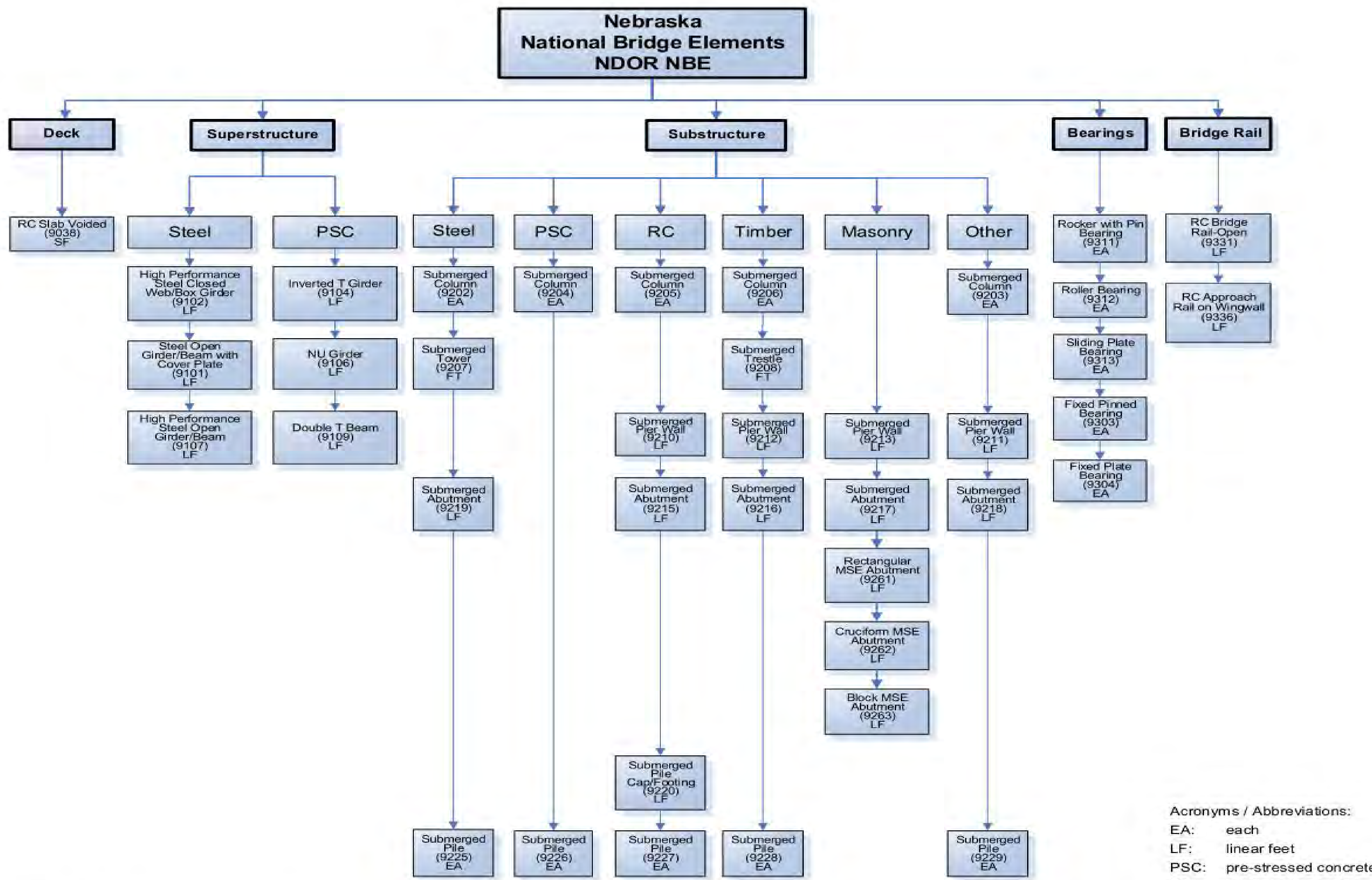


Figure B-1: Nebraska Department of Road National Bridge Elements

3-EI.25.3 NDOT BME Groupings Chart

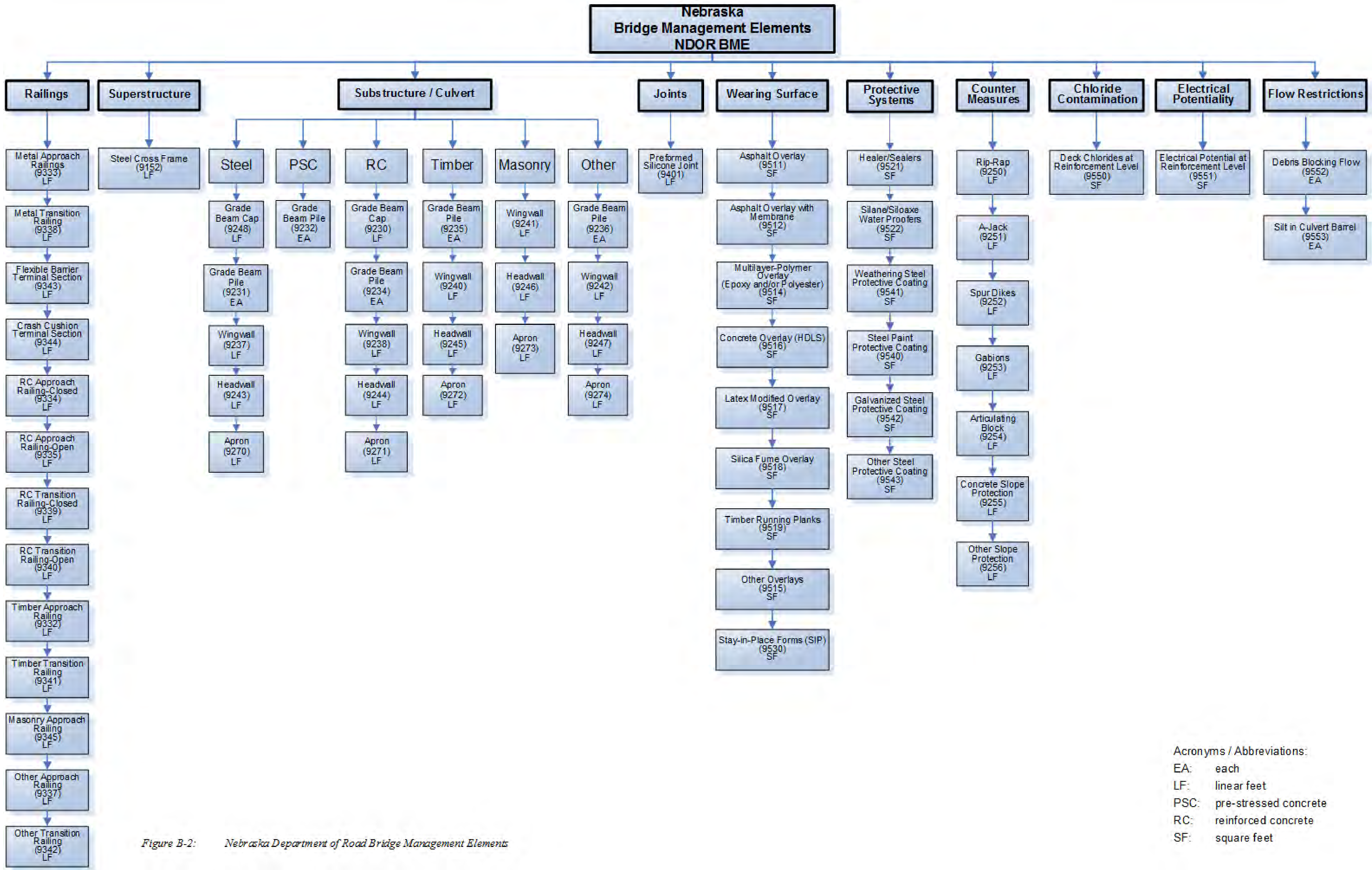


Figure B-2: Nebraska Department of Road Bridge Management Elements

3-EI.26 APPENDIX C: NEBRASKA MATERIAL DEFECT GROUPINGS

3-EI.26.1 General

The chart on the following page organizes the Nebraska Material Defects defined in Chapter 3-EI Element Inspection Coding. For each defect, the name, and identifier are shown and defects are grouped by material type.

A chart for AASHTO Material Defects as defined in the AASHTO Manual for Bridge Element Inspection, First Edition 2013, can be referenced in Appendix D of said manual.

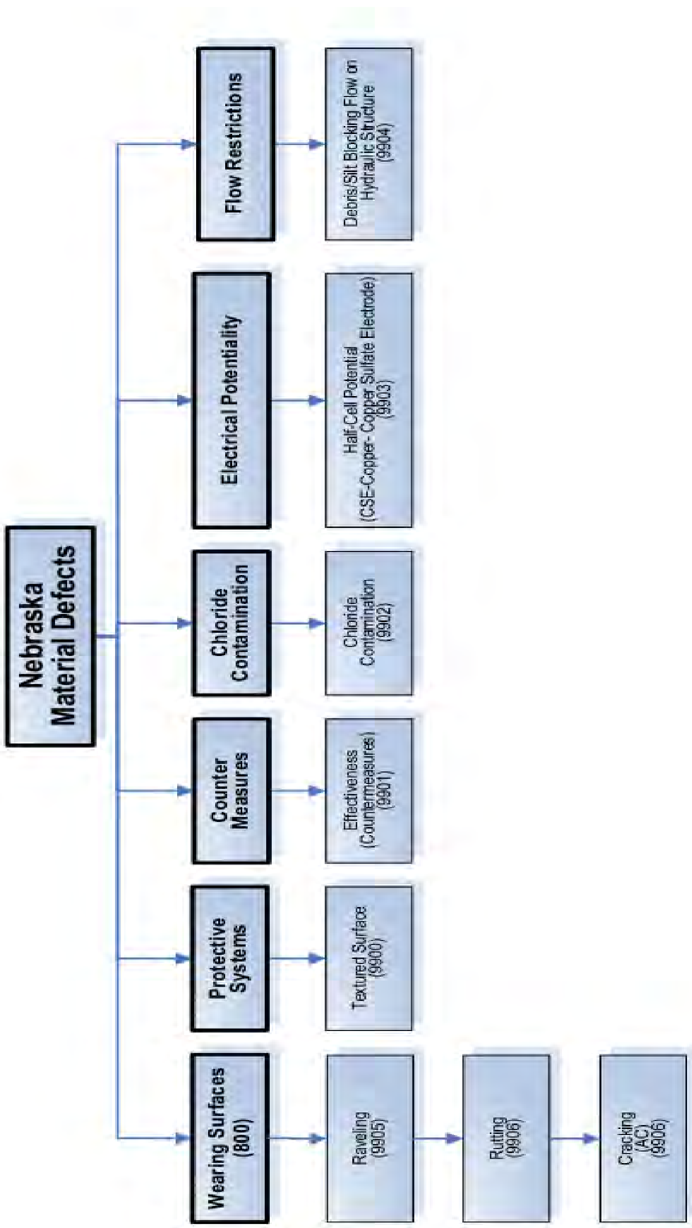


Figure C-1: Nebraska Department of Road Material Defects

3-EI.26.2 Nebraska Material Defect Groupings Chart

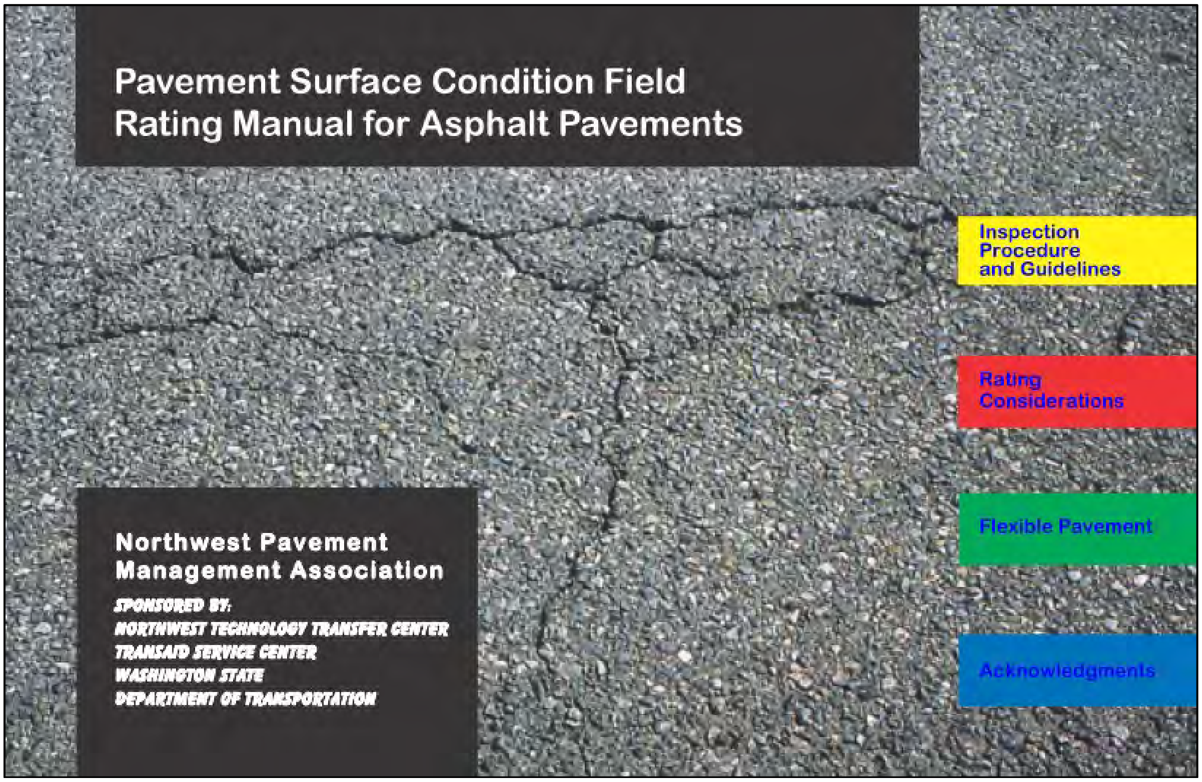
3-EI.27 APPENDIX D: ASPHALT PAVEMENT FIELD RATING MANUAL

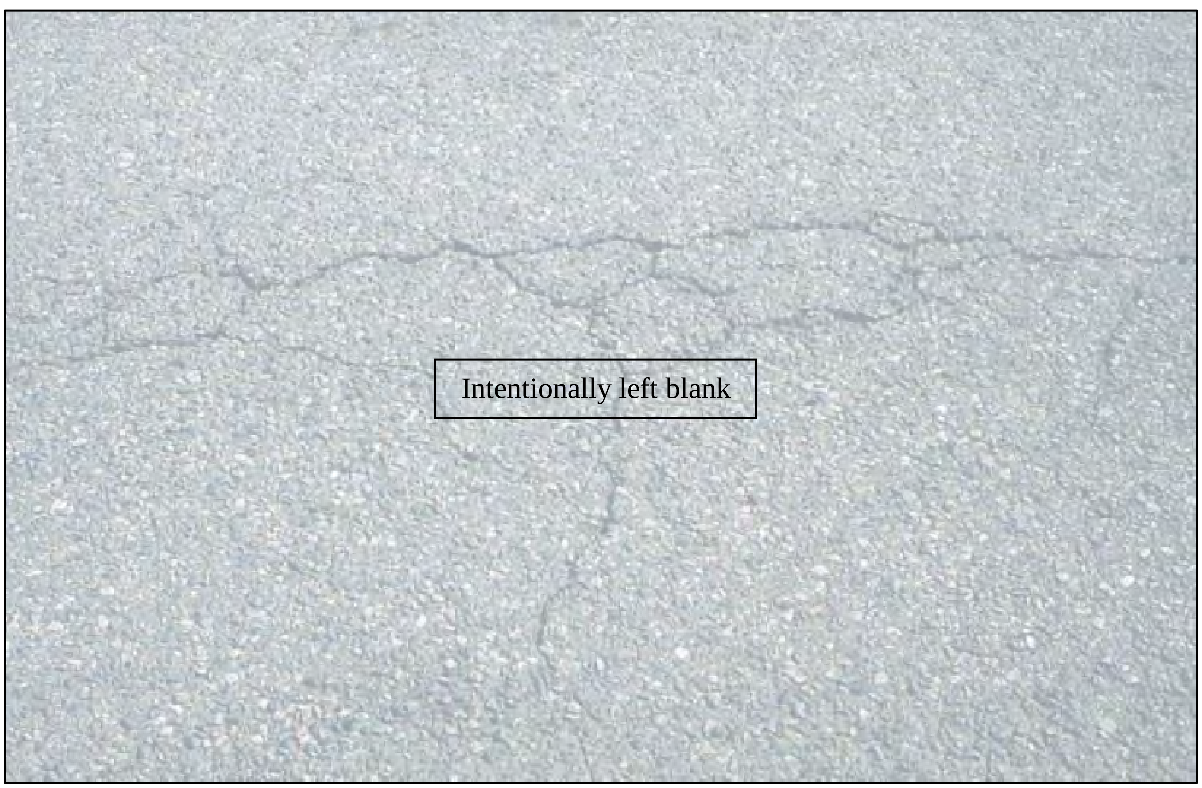
3-EI.27.1 General

The field rating manual for asphalt pavements in Appendix D is to be used as a reference guide for assessing the condition state of NDOT BME 9511 – Asphalt Overlay and NDOT BME 9512 – Asphalt Overlay with Membrane as defined in Chapter 3-EI Element Inspection Coding.

The Pavement Surface Condition Field Rating Manual for Asphalt Pavements was published by the Northwest Pavement Management Association.

3-EI.27.2 Field Rating Manual





Pavement Surface Condition Field Rating Manual for Asphalt Pavements

Northwest Pavement Management Association

SPONSORED BY:
NORTHWEST TECHNOLOGY TRANSFER CENTER
TRANSAID SERVICE CENTER
WASHINGTON STATE
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CONTENTS

Inspection Procedure and Guidelines

These inspection procedures offer a method of determining pavement condition through observing and recording the presence of specific types and severities of defects or distresses in the pavement surface.

The elements of pavement condition rating are as follows:

1. The type of defect.
2. The severity of the defect.
3. The extent to which the road surface is affected by the defect.

There are several types of defects and several possible severities and extents for each defect. These are described and illustrated for flexible pavements in the following pages of this manual.

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Rating Considerations

Listed below are important factors to consider when you collect pavement condition data.

- Each agency must decide whether to record the extent of the **predominant severity** of each defect type or to record the extent of **each severity** of each defect type. The agency must also decide whether to estimate/measure and record these extents using finite values or standardized ranges of values.

  *If the **predominate severity** procedure is used for each type of defect observed*, you should record only one severity, the **predominant severity**. Always record the higher rated severity if approximately equal proportions of more than one severity exist. The purpose is to establish a severity that represents the typical condition of the roadway segment. The extent you record is always the overall extent associated with all levels of severity for a given distress type. *This extent may be a range of values or it may be a finite value*. Your individual agency may wish to note (in the comments section of the form) the occurrence of any level of severity that is significantly higher than what you have recorded in the rating.

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*If you are recording the extent associated with **each severity** of each distress type*, then instead of recording the total extent and the **predominant severity**, you will record the extent of **each severity** of each type of defect. It is recommended that a finite value (the actual percentage or count) of the extent is recorded for each of the severity categories as use of ranges will probably result in too large an extent for the total of the severities.

- Roads can be rated on foot or by vehicle. In urban areas, rating is frequently done on foot. The best driving speeds for observing the defects range from 2 to 5 miles per hour. A single lane is generally used, but if time and funds allow, an agency can measure more than one lane.

  ***Note:** Different values will likely be obtained in walking vs. driving and the agency needs to be aware of possible problems in comparing results obtained by using more than one technique.*

- The relative sun angle and direction of viewing the roadway surface will greatly affect your visual observation. Be sure to view the pavement from more than one direction occasionally during the survey to assure the true nature of the pavement surface is being observed.

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- The time of year and weather (moisture and temperature) conditions over a given time period can also affect the severity and visibility of certain distresses. If at all possible, rate the roadway network at a similar time of the year and only while the pavement is dry.
- When rating a roadway, you must observe the entire area of the traveled roadway segment or sample and determine the defect severities and extents over this full pavement surface area.
- When rating composite pavements (such as asphalt over rigid pavement), classify cracks that may correspond with the concrete joints as distresses and rate these, and other cracks, as the type of crack they represent (transverse or longitudinal).
- When rating the width of cracks, use the average width, not the extremes. Cracks often vary in width and the intent is to rate the overall severity of the crack.

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- Condition ratings apply only to the traveled surface of a road. Do not include the conditions of shoulders or other adjacent areas. Shoulder condition, drainage information, or other items may be accounted for and collected separately from or with the pavement rating data.
- Areas within the curb returns are considered a part of the intersection for rating purposes. Intersections are generally rated with a higher functional class street or in a given direction. Intersections may also be separately rated and recorded. Each agency needs to develop its own policy.
- If opposite sides of the roadway or individual lanes are rated separately, use separate forms and enter the data into the database as separate multilane segments.
- When any type of defect is not observed, write an "N" in the first space on the field form for that defect. The "N" indicates clearly that a defect was not present and reduces the potential for confusion when the data are entered into the database.
- Your PMS manager may wish you to observe and collect additional information during the survey. This might include such things as historical and physical information, documenting new segments, or noting items needing repair.
- It is important that you receive clear direction from the PMS manager on all details related to data collection prior to beginning the survey project.

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Flexible Pavement Distresses

1. *Rutting and Wear*

Rutting is a surface depression within the wheel path. Rutting results from a permanent deformation in any of the pavement layers or subgrades, usually caused by consolidation or lateral movement of the materials due to traffic loads. When the upper pavement layers are severely rutted, the pavement along the edges of the rutted area may be raised. Usually, the rutting occurs gradually across the wheel path, reaching a maximum depth in the center of the wheel path. Ruts are most obvious after rainfall when they are full of water.

Wear is surface depression in the wheel path resulting from tire abrasion.

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Measurement for Rutting

Severity: The average rut depth in the wheel path for the segment or sample.

Recommended ranges for estimated severity.

Low — 1/4-inch to 1/2-inch

Medium — 1/2-inch to 3/4-inch

High — over 3/4-inch

Extent: The extent of rutting is assumed to be the full length of the segment in the wheel path.

Measure: Take measurements in as many locations as is practical and average them.

Rutting

2. *Alligator Cracking*

Alligator fatigue cracking is associated with loads and is usually limited to areas of repeated traffic loading. The cracks surface initially as a series of parallel longitudinal cracks within the wheel path that progresses with time and loads to a more branched pattern that begins to interconnect. The stage at which several discontinuous longitudinal cracks begin to interconnect, is defined as alligator cracking. Eventually the cracks interconnect sufficiently to form many pieces, resembling the pattern of an alligator.

On narrow, two-lane roads, alligator cracking may form along the center line rather than in the customary wheel paths.

Almost always, the pattern of the cracking (the longer dimension of the connected cracks) is parallel to the roadway or direction of vehicle travel. However, alligator cracking occasionally occurs in a pattern transverse to the roadway direction because of poor trench compaction, settlement, or frost action.

Pot holes and other occurrences of destroyed or missing pavement are accumulated as high severity alligator cracking and may also be noted in the comments area of the field form.

Severity:

Low — Branched, longitudinal, discontinuous thin cracks are beginning to interconnect and form the typical alligator pattern with no spalling.

Medium — Cracking is completely interconnected and has fully developed an alligator pattern. Some spalling may appear at the edges of cracks. The cracks may be greater than 1/4-inch wide, but the pavement pieces are still in place.

High — The pattern of cracking is well developed. Spalling is very apparent at the crack. Individual pieces may be loosened and may rock under traffic. Pieces may be missing. Pumping of fines up through the cracks may be evident.

Low

Medium

High

Option A — Measurement for Alligator Cracking

Extent: The extent of alligator cracking is related to the length of wheel paths. There are two wheel paths in every lane. Therefore, a 100-foot lane has 200 feet of wheel paths. Accurate measurement and recording as a percentage of wheel path length is preferable.

Recommended ranges for estimated extent.

1 percent to 9 percent of both wheel paths
10 percent to 24 percent of both wheel paths
25 percent to 49 percent of both wheel paths
50 percent to 100 percent of both wheel paths

Measure: Accumulate the lengths along the surveyed lane of each severity of the alligator cracking as it occurs in both wheel paths. Divide the accumulated lengths by twice the length of the segment (two wheel paths per lane). Multiply by 100 to get percent, and round to a whole number.

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Option B — Measurement for Alligator Cracking

Extent: The extent of alligator cracking is related to the entire survey area.

Measure: Alligator Cracking is measured in square feet. The major difficulty in measuring this type of distress is that two or three levels of severity often exist within one distressed area. If these portions can be easily distinguished from each other, they should be measured and recorded separately. However, if the different levels of severity cannot be divided easily, the entire area should be rated at the highest severity level present.

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3. *Longitudinal Cracking*

Longitudinal cracks run roughly parallel to the roadway center line. Longitudinal cracks associated with the beginning of alligator cracking are generally discontinuous, broken, and occur in the wheel path. However, any longitudinal crack that is clearly within the wheel path should be rated.

Note: Do not include cracks which reside only within 6 inches of a lane edge. These cracks are assumed to be caused by, or related to, a paving construction joint and should be rated as nonwheel path longitudinal cracking. If your survey includes an item for joint or crack seal condition, you should include the seal condition of these lane edge construction joints in that survey item.

Severity:

Low — The cracks have very little or no spalling along the edges and are less than 1/4-inch in width. If the cracks are sealed and the width of the crack prior to sealing is invisible, they should be classified as Low Severity.

Medium — The cracks have little or no spalling but they are greater than 1/4-inch in width. There may be a few randomly spaced low severity connecting cracks near the main crack or at the corners of intersecting cracks.

High — Cracks are spalled and there may be several randomly spaced cracks near the main crack or at the corners of intersecting cracks. Pieces are visibly missing along the crack. At some point, this longitudinal cracking becomes alligator cracking.

Low *Medium* *High*

Option A — Measurement for Longitudinal Cracking

Extent: The extent of longitudinal cracking is recorded as a percent of the length of the surveyed segment.

Recommended ranges for estimated extent.

1 percent to 99 percent of length of segment
100 percent to 199 percent of length of segment
200 percent or more of length of segment

Measure: Accumulate the lengths along the surveyed lane of each severity of the longitudinal cracking as it occurs. Divide the accumulated lengths by the length of the segment. Multiply by 100 to get percent, and round to a whole number.

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Option B — Measurement for Longitudinal Cracking

Extent: The extent of longitudinal cracking is related to the entire survey area.

Measure: Longitudinal cracks are measured in linear feet. The length and severity of each crack should be recorded after identification.

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4. Nonwheel Path Longitudinal Cracking

Nonwheel path longitudinal cracks run roughly parallel to the roadway center line. They may be caused by a poorly constructed paving joint, a reflective crack caused by joints and cracks beneath the surface course, including joints and cracks near the edge of the pavement. These types of cracks are not load-associated.

Low severity nonwheel path longitudinal cracking looks very similar to low severity alligator cracking; however, low severity alligator cracking always occurs in the wheel path and should be rated as alligator cracking.

Severity:

Low — The cracks have very little or no spalling along the edges and are less than 1/4-inch in width. If the cracks are sealed and the width of the crack prior to sealing is invisible, they should be classified as Low Severity.

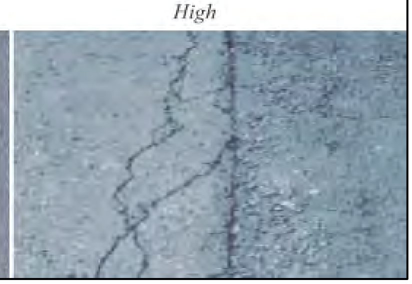
Medium — The cracks have little or no spalling but they are greater than 1/4-inch in width. There may be a few randomly spaced low severity connecting cracks near the main crack or at the corners of intersecting cracks.

High — Cracks are spalled and there may be several randomly spaced cracks near the main crack or at the corners of intersecting cracks. Pieces are visibly missing along the crack.

Low

Medium

High



Option A — Measurement for Nonwheel Path Longitudinal Cracking

Extent: The extent of nonwheel path longitudinal cracking is recorded as a percent of the length of the surveyed segment.

Recommended ranges for estimated extent.

1 percent to 99 percent of length of segment
100 percent to 199 percent of length of segment
200 percent or more of length of segment

Measure: Accumulate the lengths along the surveyed lane of each severity of the nonwheel path longitudinal cracking as it occurs. Divide the accumulated lengths by the length of the segment. Multiply by 100 to get percent, and round to a whole number.

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Option B — Measurement for Nonwheel Path Longitudinal Cracking

Extent: The extent of nonwheel path longitudinal cracking is related to the entire survey area.

Measure: Nonwheel path longitudinal cracks are measured in linear feet. The length and severity of each crack should be recorded after identification.

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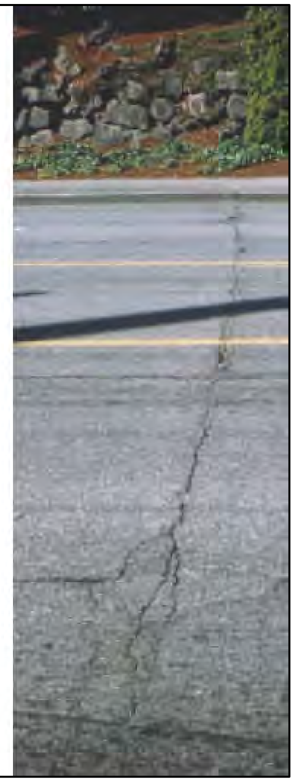
5. *Transverse Cracking*

Transverse cracks run roughly perpendicular to the roadway center line. They may be caused by surface shrinkage due to low temperatures, hardening of the asphalt, or cracks in underlying pavement layers such as PCCP slabs. They may extend partially or fully across the roadway.

Consider only those transverse cracks that are a minimum of two feet in length.



Severity:

Low — The cracks have very little or no spalling along the edges and are less than 1/4-inch in width. If the cracks are sealed and the width of the crack prior to sealing is invisible, they should be classified as Low Severity.

Medium — The cracks have little or no spalling but they are greater than 1/4-inch in width. There may be a few randomly spaced low severity connecting cracks near the main crack or at the corners of intersecting cracks.

High — Cracks are spalled and there may be several randomly spaced cracks near the main crack or at the corners of intersecting cracks. Pieces are visibly missing along the crack.

Low

Medium

High

Option A — Measurement for Transverse Cracking

Extent: The extent of transverse cracking is quantified as a frequency of occurrence expressed as a count per 100 feet of lane length.

Recommended ranges for estimated extent.

1 to 4 cracks per 100 feet
5 to 9 cracks per 100 feet
10 or more cracks per 100 feet

Measure: Accumulate the count along the surveyed lane of each severity of transverse crack as it occurs. Divide the accumulated counts by the length of the segment. Multiply by 100 to get the frequency, and round to a whole number.

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Option B — Measurement of Transverse Cracking

Extent: The extent of transverse cracking is related to the entire survey area.

Measure: Transverse cracks are measured in linear feet. The length and severity of each crack should be recorded after identification.

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6. *Raveling and Aging*

Raveling and aging are pavement surface deterioration that occurs when aggregate particles are dislodged (raveling) or oxidation causes loss of the asphalt binder (aging). An ACP loses its smooth surface and begins to appear very open and rough.

The severity is rated by the degree of aggregate and binder loss. Rate the overall severity within the segment as the most predominate observed level.

This distress is measured or observed differently depending on whether the road surface is BST or ACP. Care should be exercised when rating chip sealed pavements, as they tend to look raveled because of the inherent nature of the chip seal surface. However, raveling in chip sealed pavements (loss of aggregate) actually results in a condition of excess asphalt, and should be rated as flushing (see next distress, Flushing/Bleeding).

Severity:

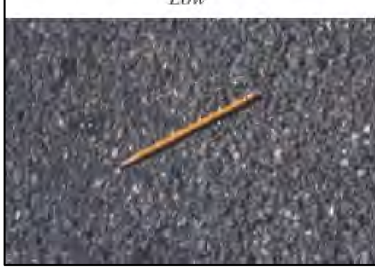
Low — The aggregate and/or binder has started to wear away but has not progressed significantly. The pavement only appears slightly aged and slightly rough.

Medium — The aggregate and/or binder has worn away and the surface texture is moderately rough and pitted. Loose particles may be present, and fine aggregate is partially missing from the surface.

High — The aggregate and/or binder have worn away significantly, and the surface texture is deeply pitted and very rough. Fine aggregate is essentially missing from the surface, and pitting extends to a depth approaching one half the coarse aggregate size.

High

Low



Medium

High

Extent: The extent of raveling is estimated and expressed relative to the surface area of the surveyed lane.

Recommended ranges for estimated extent.

Localized — Patchy areas, usually in the wheel paths.

Wheel Path — Majority of wheel tracks are affected, but little or none elsewhere in the lane.

Entire Lane — Most of the lane is affected.

Measure: Estimate the severity and extent.

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7. *Flushing/Bleeding*

Flushing and bleeding is indicated by an excess of bituminous material on the pavement surface which presents a shiny, glass-like reflective surface that may become sticky in hot temperatures.

At the lower severity levels, the extents "localized" and "wheel path" may be difficult to differentiate; however, as the severity increases, "wheel path" becomes more well defined. Wheel path refers to tire tracking area and may be used to represent the condition of only one wheel track being heavily involved.

This distress is measured or observed differently depending on whether the road surface is BST or ACP. In BST pavements, loss of aggregate (raveling), commonly referred to as "chip loss", leaves the binder exposed. This condition looks like flushing, and should be rated as flushing.

Severity:

Low — Minor amounts of the aggregate have been covered by excess asphalt but the condition has not progressed significantly.

Medium — Significant quantities of the surface aggregate have been covered with excessive asphalt. However, much of the coarse surface aggregate is exposed, even in those areas showing flushing.

High — Most of the aggregate is covered by excessive asphalt in the affected area. The area appears wet and is sticky in hot weather.

Low

Medium

High

Extent: The extent of flushing is estimated and expressed relative to the surface area of the surveyed lane.

Recommended ranges for estimated extent.

Localized — Patchy areas, usually in the wheel paths.

Wheel Path — Majority of wheel tracks are affected, but little or none elsewhere in the lane.

Entire Lane — Most of the lane is affected.

Measure: Estimate the severity and extent.

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8. Patching

A patch is an area of pavement which has been replaced with new material to repair the existing pavement or access the utility.

A patch is considered a defect no matter how well it is performing (a patched area or adjacent area usually does not perform as well as an original pavement section). Generally, some roughness is associated with this distress. In general, a patch is less than a typical rehabilitation in size and scope. They are less than full roadway width and/or are less than project length. Some agencies may have patches as long as the work defined by another agency as a rehabilitation.

Temporary patches, as well as localized permanent repairs (dig-out repair), are included in this distress category. Utility cut patches are also included as part of the patching values.

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Low — Patch has at most low severity distress of any type.

Medium — Patch has medium severity distress of any type.

High — Patch has high severity distress of any type.

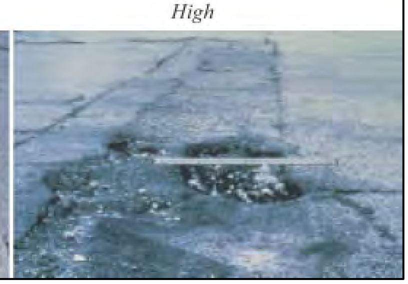
low

Medium

Low

Medium

High



Option A — Measurement for Patching

Extent: The extent of patching is related to the length of wheel paths. Each half of the lane is considered one wheel path.

Recommended ranges for estimated extent.

1 percent to 9 percent of both wheel paths
10 percent to 24 percent of both wheel paths
25 percent or more of both wheel paths.

Option B — Measurement for Patching

Extent: The extent of patching is related to the entire survey area.

Measure: Patching is measured in square feet of entire inspection area. No other distresses (e.g., rutting or cracking) are recorded within a patch. Other distresses in the patch area are used to determine the severity level of the patch.

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9. *Original WSDOT Patching*

In general, a patch is less than a typical rehabilitation in size and scope. They are less than full roadway width and/or are of less than project length. Some agencies may have patches as long as the work defined by another agency as a rehabilitation. WSDOT defines a lane with "new surfacing" as a patch if it is less than about half a mile in length. Definition of minimum rehabilitation vs. maximum patch length is a matter of agency policy.

Temporary patches, as well as localized permanent repairs (dig-out repair), are included in this distress category. The patches or repairs which are obviously the result of utility work are the exception, and are not included as part of the patching values.

While appropriately done repairs are an asset rather than a liability to the life of a segment of pavement, the fact that they were required (other than for utility work) generally indicates some failure in the pavement structure.

If any patch (including a utility patch) shows surface defects, such as alligator cracking, accumulate those defects also, and include them in the overall segment rating.

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Patching

Severity: Severity of patching is defined in three categories which are most easily recognized by the method of construction.

Low — The lowest severity is BST patching or chip seal patching. It is constructed by spraying hot asphalt onto the roadway (usually using a truck with a spray bar) and then spreading and rolling crushed stone onto the surface. It is identified by its nearly straight edges, rough texture, and surface contours which mimic the surface below. This is assumed to cover low severity cracking or raveling.

Medium — Blade patching is the medium severity patching. It has edges shaped to the contours of the surrounding pavement and is of variable thickness with feathered edges. This type is assumed to cover (or replace) medium to severe alligator cracking, pot holes, rutting, or other significant pavement defects. Cold patches are of this type.

High — Dig-Out or Full Depth patching is the most severe of the types rated. A patch (or repair) of this type is constructed by neatly cutting out a full depth portion of the pavement, removing all disturbed materials, and refilling the void with an appropriate pavement section. This appropriately reconstructed section should be as strong as the original pavement section, perhaps even stronger. This type of patch is assumed to replace severe alligator cracking.

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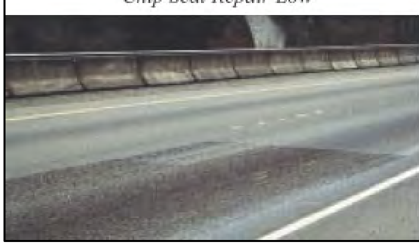
Chip Seal Repair Low



Blade Repair Medium

Dig Out High

Extent: The extent of patching is related to the length of wheel paths. Accurate measurement expressed as a percentage of wheel path length is preferable. Each half of the lane is considered one wheel path. This form of measurement is identical to that of alligator cracking because the general assumption is that patching replaces alligator cracking.

Recommended ranges for estimated extent.

1 percent to 9 percent of both wheel paths
10 percent to 24 percent of both wheel paths
25 percent or more of both wheel paths

Note: Patching was included in the WSPMS because without a deduction for patching, a roadway which is virtually made of patches would appear to be a "perfect" segment or project. This would result in the segment or project never being included in a prioritized list of pavements needing rehabilitation.

If an agency has separate maintenance districts, or crews assigned to specific areas, the more efficient crew/district can be penalized by the pavement management system for doing a better job. If its roadways rate higher as a result of better maintenance operations, those roadways might not receive repair and rehabilitation funds as a result.

The way in which the PMS uses these distress severities can vary, and the desired effect can be accommodated by using different deduct values to reflect the needs of the agency. If patching and/or repairs are

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not deemed a serious issue within your agency, then reduce or remove the optional local deducts associated with the patching severities.

Measure: Accumulate the lengths along the surveyed lane of each severity (type) of patching as it occurs in both wheel paths. Divide the accumulated lengths by twice the length of the segment (two wheel paths per lane). Multiply by 100 to get percent, and round to a whole number.

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10. Corrugation and Waves

This distress category covers a general form of surface distress which is not limited to the wheel path, although they may occur in the wheel path. The distress may occur in isolated areas, such as at intersections, or it may occur over a large part of the roadway surface.

Corrugations and waves are regularly occurring transverse undulations in the pavement surface. Corrugations occur as closely spaced ripples, while waves are undulations whose distance from peak to valley is more than 3 feet.

Severity: The severity of corrugation is defined as the maximum vertical deviation from a 10-foot straightedge placed on the pavement parallel to the center line of the roadway.

Low — 1/8-inch to 2 inches per 10 feet.

Medium — 2 inches to 4 inches per 10 feet.

High — Over 4 inches per 10 feet.

Option A — Measurement of Corrugation and Waves

Extent: The extent of corrugations is expressed in percent of the lane area affected.

1 percent to 9 percent of the area of the segment
10 percent to 24 percent of the area of the segment
25 percent or more of the area of the segment

Measure: Determine severity by measuring the maximum difference in elevation that occurs within a 10-foot straightedge length centered over the area of displacement. Rate the overall distress by using the highest observed level.

Option B — Measurement of Corrugation and Waves

Extent: The extent of corrugations is expressed in square feet of the entire survey area.

Measure: Determine severity by measuring the maximum difference in elevation that occurs within a 10-foot straightedge length centered over the area of displacement. Rate the overall distress by using the highest observed level.

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11. *Sags and Humps*

This distress category also covers forms of surface distress that are not limited to the wheel path, although they generally include the wheel paths. The distress usually occurs in isolated areas of the roadway surface.

Sags and humps are localized depressions or elevated areas of the pavement that result from settlement, pavement shoving, displacement due to subgrade swelling, or displacement due to tree roots.

Severity: The severity of sags or humps, like corrugation, is defined as the maximum vertical deviation from a 10-foot straightedge placed on the pavement parallel to the center line of the roadway.

Low — $^{1}/_{8}$-inch to 2 inches per 10 feet.

Medium — 2 inches to 4 inches per 10 feet.

High — Over 4 inches per 10 feet.

Option A — Measurement for Sags and Humps

Extent: The extent of sags and humps is expressed in percent of the lane area affected.

1 percent to 9 percent of the area of the segment
10 percent to 24 percent of the area of the segment
25 percent or more of the area of the segment

Measure: Determine severity by measuring the maximum difference in elevation that occurs within a 10-foot straightedge length centered over the area of displacement. Rate the overall distress by using the highest observed level.

Option B — Measurement for Sags and Humps

Extent: The extent of sags and humps is expressed in square feet of the entire survey area.

Measure: Determine severity by measuring the maximum difference in elevation that occurs within a 10-foot straightedge length centered over the area of displacement. Rate the overall distress by using the highest observed level.

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12. Block Cracking

Block cracks divide the pavement surface into nearly rectangular pieces with cracks that intersect at about 90 degrees. This type of distress differs from alligator cracking in that alligator cracks form smaller, irregular shaped pieces with sharp angles. Also, alligator cracks are caused by repeated traffic loadings and are, therefore, generally located in traffic areas (i.e., the wheel paths).

Block cracking is caused principally by shrinkage of the asphalt concrete and daily temperature cycling. It is not load-associated, although load can increase the severity of individual cracks. The occurrence of block cracking usually indicates that the asphalt has hardened significantly through aging. Block cracking normally occurs over a large portion of the pavement area including nontraffic areas. However, various fatigue related defects may occur in the same segment.

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Severity: The severity of block cracking is defined by the average size of the blocks and the average width of the cracks that separate them.

Block Size

Low — 9 × 9 feet or greater.

Medium — 5 × 5 feet to 8 × 8 feet blocks.

High — 4 × 4 feet blocks or less.

Crack Size

Low — Less than $^1/_4$ inch.

Medium — Over $^1/_4$ inch.

High — Spalled.

Option A — Measurement of Block Cracking

Extent: The extent of block cracking is assumed to be the full surveyed segment. If the block cracking does not extend throughout the segment, then rate the segment using longitudinal and transverse cracking.

Measure: Estimate the typical size of the blocks and select the appropriate standard block size and crack size.

Option B — Measurement of Block Cracking

Extent: The extent of block cracking is assumed to be square feet or percent of length. If the block cracking does not extend throughout the segment, then rate the segment using longitudinal and transverse cracking.

Measure: Measure the typical size of the blocks and select the appropriate standard block size and crack size.

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13. Pavement Edge Condition

Edge raveling occurs when the pavement edge breaks away from roadways without curbs or paved shoulders. However, edge conditions can still occur with paved shoulders. Edge patching is the repair of this condition. The "lane less than 10 feet" distress indicates that the edge raveling has progressed to the point where the pavement width from the center line to the outer edge of roadway has been reduced to less than 10 feet.

Severity: The severity of Pavement Edge Condition is defined as follows.

Low — Edge Raveling

Medium — Edge Patching

High — Edge lane less than 10 feet.

Measure: Accumulate the lengths along the surveyed lane of each type edge defect as it occurs. Divide the accumulated lengths by the length of the segment. Multiply by 100 to get percent, and round to a whole number.

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Extent: The extent of pavement edge conditions is recorded as a percentage of the length of the surveyed segment. Recommended ranges for estimated extent.

1 percent to 9 percent of the length of the segment
10 percent to 24 percent of the length of the segment
25 percent or more of the length of the segment

Edge Raveling

Edge Patching

14. Crack Seal Condition

Rate the condition of any existing crack (or joint) sealant. There may be separate information fields available for recording the amount (total length) of seal and the year it was installed or recording the absence of any sealant on the entire section.

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Severity:

None — There are no sealed cracks.

Low — Sealant in good to excellent condition.

Medium — Hairline failure in the sealant allows a minimal amount of water to pass.

High — The sealant is severely cracked and may allow significant quantities of water to pass. The sealant is wide open (or nonexistent) and will allow water to pass freely.

Low *Medium* *High*

Extent: The extent of crack sealing is quantified as the percent of the total length of the cracks (or joints) in the segment which exhibit the seal condition.

1 percent to 9 percent of the total length of cracks or joints
10 percent to 24 percent of the total length of cracks or joints
25 percent or more of the total length of cracks or joints

Measure: Count (or estimate) and accumulate the length of cracks and joints that exhibit each severity of seal condition. Count (or estimate) the total length of cracks and joints in the segment. Divide each of the accumulated lengths of condition by the total length of cracks and joints, multiply by 100, and round to a whole number.

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Acknowledgments to the First Revision

The revision of this manual is the result of cooperation among the members of the Northwest Pavement Management Association, their respective agencies, the County Road Administration Board, the Washington State Department of Transportation (WSDOT), and private industry. The following individuals contributed considerable time and effort in reviewing drafts.

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Tacoma	Steve Pope Dan Soderlind
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- Edmonds
- Ellensburg
- Forks
- Gig Harbor
- Lacey
- Lynden
- Moses Lake
- Normandy Park
- Olympia
- Port Angeles
- Seattle
- Shelton
- Spokane
- Sunnyside

Counties

- Ada (Idaho)
- Adams
- Asotin
- Benton
- Clallam
- Columbia
- Franklin
- Klamath (Oregon)
- Okanogan
- Pend Oreille
- San Juan
- Walla Walla
- Whatcom
- Whitman
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Association of Washington Cities

University of Washington Transportation Center (TRAC)

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Final editing for compliance with the Washington State Pavement Management System standards was done by R. Keith Kay, Pavement Management Engineer for WSDOT.

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4.1 GENERAL

The purpose of this chapter of the NDOT Bridge Inspection Program Manual is to set policy and/or provide guidance to Bridge Owners and their inspectors on inspection and inspection reporting.

County line bridges should be inspected and reported by the county that, by mutual agreement, has assumed the responsibility for them.

4.2 REFERENCES

The information in this Bridge Inspection Program Manual supplements requirements, and procedures and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP).

The References list of applicable documents is included in the Manual Appendix. The National Bridge Inspection Standards are also included in the Appendix.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in National Bridge Inspection Standards, the *AASHTO Manual for Bridge Evaluation*, and FHWA publications, technical advisories and publications related to the NBIS.

4.3 ROLES AND RESPONSIBILITIES

4.3.1 Bridge Owners

Bridge Owners in Nebraska include the Nebraska Department of Transportation, cities, municipalities and counties.

Bridge Owners are responsible for:

- Ensuring the bridges under their authority are being inspected by qualified inspectors and at the intervals complying with the NBIS, and that the data is in the Nebraska bridge inventory as specified in this Chapter.
- Ensuring bridges under their authority have a bridge load rating performed by a qualified engineer (Load Rating Engineer).
- Ensuring that required load posting or restrictions are installed in accordance with this Manual and that the signs are maintained.
- Complying with NDOT Bridge Division *Policy for Design, Load-Rating and Inspection of Public Road Bridges*, May 24, 2010 for submittal of bridge plans, hydraulics analyses, load ratings and inspections. (See Chapter 1, Bridge Inspection Program Requirements.)
- Maintaining a complete Bridge Record for each structure under their jurisdiction in their local office. (See Chapter 2, Bridge Inspection Program Records.)
- Ensuring critical findings are addressed by corrective action or permanent closure of the bridge, and the closure of the issue is documented in their Bridge File.
- Ensuring non-critical findings are addressed by corrective action (repair or maintenance), and the closure of the issue is documented in their Bridge File.
- Completing, or causing to be completed, Quality Control (QC) of the inspections, load ratings and hydraulic analyses done for bridges under their authority.
- Ensuring inventory inspections follow the stipulations of the Programmatic Agreement between FHWA-NE Division and NDOT for Visual Statewide Bridge Inspections.
- Ensuring data from each inspection in entered into BrM.

4.3.2 Nebraska Department of Transportation

NDOT is responsible for:

- Provide access to BrM for Bridge Owners and their consultants for data entry.
- Assigning inventory structure numbers.
- Maintaining the Nebraska Bridge Inventory database.
- Submitting Nebraska Bridge Inventory data to the Federal Highway Administration (FHWA) for inclusion in the National Bridge Inventory database.
- Maintaining the master lists of the following in the Nebraska Bridge Inventory:
  - Fracture critical bridges.
  - Bridges requiring underwater inspection.
  - Scour critical bridges.
  - Complex bridges.
  - Bridges with critical findings.

Developing and maintaining forms to be used in the Bridge Inspection Program for Inspection, Load Rating and other activities.

Completing Quality Assurance (QA) on the data and reports provided for the National Bridge Inventory by the Bridge Owners for compliance with Federal regulations.

4.3.3 Consultants Performing Inspections for Bridge Owners

Consultants performing inspections for Bridge Owners are responsible for:

- Being familiar with NDOT and FHWA requirements and policies on bridge inspection.
- Maintaining and updating staff qualifications required for the Nebraska Bridge Inspection Program. This includes providing NDOT with current email addresses and phone numbers for staff on the NDOT Team Leader List.
- Completing Quality Control on inspections completed for Bridge Owners.
- Completing work for Bridge Owners in a timely manner to allow the Bridge Owners sufficient time for data review prior to submittal to NDOT.
- Ensuring inventory inspections follow the stipulations of the Programmatic Agreement between FHWA-NE Division and NDOT for Visual Statewide Bridge Inspections.

4.4 QUALIFICATIONS

The NBIS qualification requirements and NDOT qualification requirements are described in Chapter 1 of this Manual. Specific qualifications are required for certain types of inspections including fracture critical inspection, underwater inspection and scour assessment inspection. NDOT qualifications are more stringent than those for NBIS for some items.

NDOT and the NBIS require that a Team Leader be present at the bridge site and actively involved at all times during any inspection. Team Leaders are critical participants in the Program and should be aware of the responsibilities of Owners, NDOT and, if applicable, their Consultant employers.

4.5 NBIS DEFINITIONS AND NDOT COMMENTARY

The NBIS definition of types of inspections and NDOT commentary on the definitions are included herein to ensure all parties involved in the Nebraska Bridge Inspection Program are clear on the extent and nature of inspection types. NDOT expectations for inspection procedures are described herein. Note that some of the terms describe the "level" or depth of inspection, but are not a type of inspection that is recorded in BrM. Later Sections of this Chapter are organized based on the four BrM inspection types. A table comparing the types of inspections is shown at the end of this Section.

4.5.1 Initial Inspection

"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." (NBIS definition)

Initial inspections are reported in BrM as a Special Inspections.

Initial Inspections must be completed by a Team Leader.

NDOT requires that new bridges, replacement bridges, existing bridges that have been significantly altered by widening/lengthening, rehabilitated after a Critical Finding, or bridges with a change in ownership receive an initial inspection. These structures have new data or significant revisions of data for the Nebraska bridge inventory database.

4.5.2 Routine Inspection

"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." (NBIS definition)

Routine inspections must be recorded in BrM as NBI (Routine) Inspections.

Routine inspections must be completed by a Team Leader.

Routine inspections may include both inspection of features of the structure and inspection of the site.

4.5.3 Fracture Critical (FC) Member Inspection

"A hands-on inspection of a fracture critical member or member components that may include visual and other nondestructive evaluation." (NBIS definition)

Fracture Critical Inspections must be recorded in BrM as Fracture Critical Inspections.

Fracture Critical Inspections must be completed by a Team Leader who is NDOT certified to complete Fracture Critical Inspections.

A Fracture Critical inspection typically is done along with the Routine Inspection. When a Routine Inspection is completed at the same time, the both Routine and Fracture Critical inspection type must be checked in BrM.

4.5.4 Underwater Inspection

"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." (NBIS definition)

Underwater Inspections must be recorded in BrM as Underwater Inspections.

Underwater Inspections must be completed by a Team Leader who is also a commercial diver and certified to complete Underwater Inspections in Nebraska.

The underwater inspection is required for structures with substructure units that are submerged in water depths greater than 4 feet (1.22 m) throughout the year

4.5.5 Special Inspection

"An inspection scheduled at the discretion of the Bridge Owner, used to monitor a particular known or suspected deficiency." (NBIS definition)

Special Inspections must be recorded in BrM as Special Inspections.

Some Special Inspections must be performed by a Team Leader; otherwise, they must be performed by a person familiar with the bridge and the deficiency/condition being inspected and available to accommodate the assigned frequency of investigation.

In 2012, NDOT initiated a policy that any inspection that changes inventory data and that is not a Routine (as defined in this Manual), Fracture Critical, or Underwater Inspection, shall be entered into the database as a Special Inspection.

Special Inspections may be scheduled or event-driven.

4.5.6 Damage Inspection

"This is an unscheduled inspection to assess structural damage resulting from environmental factors or human actions." (NBIS definition)

Damage inspections must be recorded in BrM as Special Inspections.

An initial assessment of damage to a bridge may be done by a person who is not a Team Leader. The damage should be documented (including findings, date, course of action, etc.). Depending on the severity of the damage and steps taken to address damage, a Team Leader may need to enter data into BrM as a Special Inspection and place it in the Individual Bridge Record.

Damage inspections are event-driven. Events that trigger a Damage Inspection include:

- Vehicular impact to the bridge that affects the load carrying capacity of any member or element of a bridge.
- Storm water events that adversely affect the integrity and effectiveness of scour countermeasures, or the structural stability of any substructure, or the roadway approach. Damage may be discovered on an inspection required by a Scour Plan of Action.

4.5.7 In-depth Inspection

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

In-depth inspections are not an inspection type in BrM.

In-depth inspections are done along with Routine, Fracture Critical, Underwater or Special Inspections.

4.5.8 Hands-on Inspection

"Inspection within arm's length of the component. Inspection uses visual techniques that may be supplemented by nondestructive testing." (NBIS definition)

Hands-on inspections are not an inspection type in BrM.

Hands-on inspections are done along with Routine, Fracture Critical, Underwater or Special Inspections.

Inspection Matrix					
Type (listed in MBE)	**Purpose**	**Changes NBI or NE Inventory Data?**	**Reported in BrM as**	**Timing**	**Inspection By**
Initial	1) Provide/verify all data for the SI&A 2) Determine baseline structural conditions 3) Identifies members needing Fracture Critical or Underwater inspection 4) Provide structure notes	Yes – provides baseline data for the inventory	Special – Initial	Event-driven, for New, Reconstructed, Repaired Bridges, or Owner Change	Team Leader
Routine	1) Determine the physical and functional condition of the bridge 2) Identify any changes from "Initial" or previously recorded conditions 3) Ensure that the structure continues to satisfy present service requirements.	Yes – regular updates	NBI	Scheduled	Team Leader
Fracture Critical	Inspection Fracture Critical members with appropriate methods, testing and tools. Always "hands-on" - a very detailed, close visual inspection.	Yes – regular updates	Fracture Critical	Scheduled	Team Leader
Underwater	Monitor structure features obscured by normal water elevations	Yes – regular updates	Underwater	Scheduled	Team Leader who is commercial diver
Special	Scheduled to monitor a known or suspected deficiency, such as foundation settlement or scour, member condition, and the public's use of a load posted bridge. Event-driven inspection for damage from traffic or scour.	Yes	Special – Scheduled	Scheduled or Event-driven	Team Leader or someone familiar with deficiency
Damage (See Notes below.)	Assess structural damage from environmental or human factors; possible emergency load restriction	Potentially (See Notes below.)	Special – Accident or Special – Damage	Event-driven	(See Notes below.)
In-Depth	This describes the degree, or level, that can be applied to FC, UW, Special or Damage inspections where appropriate. It is not a proper type of inspection.	N/A	N/A	Scheduled or Event-driven	N/A

Damage Inspection Notes:
Initial assessment may be done by person authorized by the BO.
If structure to be left in service, TL must inspect and record condition ratings changes, if any, as a Special Inspection.
If critical finding issue, TL will inspect after CF is addressed and record changes, if any, as a Special Inspection.

4.6 SUBMITTAL REQUIREMENTS FOR INVENTORY DATA AND OTHER RECORDS

NDOT requires that participants generating data and supporting reports submit them to NDOT as soon as QC has been completed, but within **90 days** of:

- Any inspection (Routine, Fracture Critical, Underwater and Special).
- Any inspection of new bridges or reconstructed bridges.
- Any change in inventory data for existing bridges including:
  - Revised load rating or posting/closure.
  - Revised scour condition.
  - Replacement of structure with non-bridge length structure.
  - Ownership change.

Participants need to allow sufficient time for QC to be completed prior to submittal to NDOT.

NDOT continually updates the state inventory as data is received from Bridge Owners This procedure allows data collected in a calendar year to be reviewed and entered into the database prior the April 1 deadline for inventory submittal to FHWA. NDOT and FHWA monitor compliance with the BIP submittal requirements.

If a bridge is removed without the intention to replace it the owner must notify the Bridge Division in writing. NDOT will update Item 112 (NBIS Bridge Length) to indicate removal, Item 41 (Posting Status) will be set to "closed" and Bridge Status will be set to "closed".

If a bridge is replaced with a structure less than 20 ft. in length, NDOT will update Item 112 (NBIS Bridge Length) to indicate "too short", Item 41 (Posting Status) will be set to "A Open, no restriction" and Bridge Status will be set to "active". Structures less than 20 ft. are not required to be reported to FHWA, are not required to have inspections performed per NBIS guidelines and won't appear on inspection reports.

When replacing a structure with another bridge-sized structure, the inspector must conduct an initial inspection and document the findings in BrM. Inspection photos should be included in BrM. Certain fields must be updated by NDOT and should be submitted to the Bridge Office. These fields include:

- Item 113 – Scour Critical
- Item 27 – Year Built
- Item 43a – Main Spans Material
- Item 43b – Main Spans Design
- Item 48 – Maximum Span Length
- Item 49 – Structure Length

Other documentation to submit includes bridge plans, a load rating summary sheet, and a hydrology data sheet (where applicable).

When a bridge sized structure is constructed on a new alignment or replaces a non-bridge sized structure, a new structure number must be generated. Coordinates of the location should be sent to NDOT along with a request for a new structure number. The same documents and information will be needed as when replacing a bridge.

See NDOT's *Policy for Design, Load-Rating and Inspection of Public Road Bridges*, May 24, 2010 In Chapter 1, Bridge Inspection Program Requirements for Bridge Plans, Load Rating Report, Hydraulic Design and Analysis Report submittal requirements.

4.7 ROUTINE (NBI) INSPECTIONS

4.7.1 Definition

“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.” (NBIS definition)

Structures with Fracture Critical members have inspection requirements that are in addition to those of this section.

Routine inspection of bridges over waterways includes review for potential scour issues and more information is given in this section.

Routine inspection of complex structures have additional considerations that are described in this section.

The following flowchart provides a general process for routine inspections of structures.

A “drive-by” or “walk-through” inspection is common vernacular for a review of the structure for general condition or to spot check a major issue or concern. This does NOT constitute a routine inspection of a bridge nor does this provide the level of detail required for compliance with NBIS and NDOT Bridge Inspection Program requirements.

4.7.2 BrM Recording

Routine inspections must be recorded in BrM as NBI (Routine) inspections.

4.7.3 Routine Inspection Interval

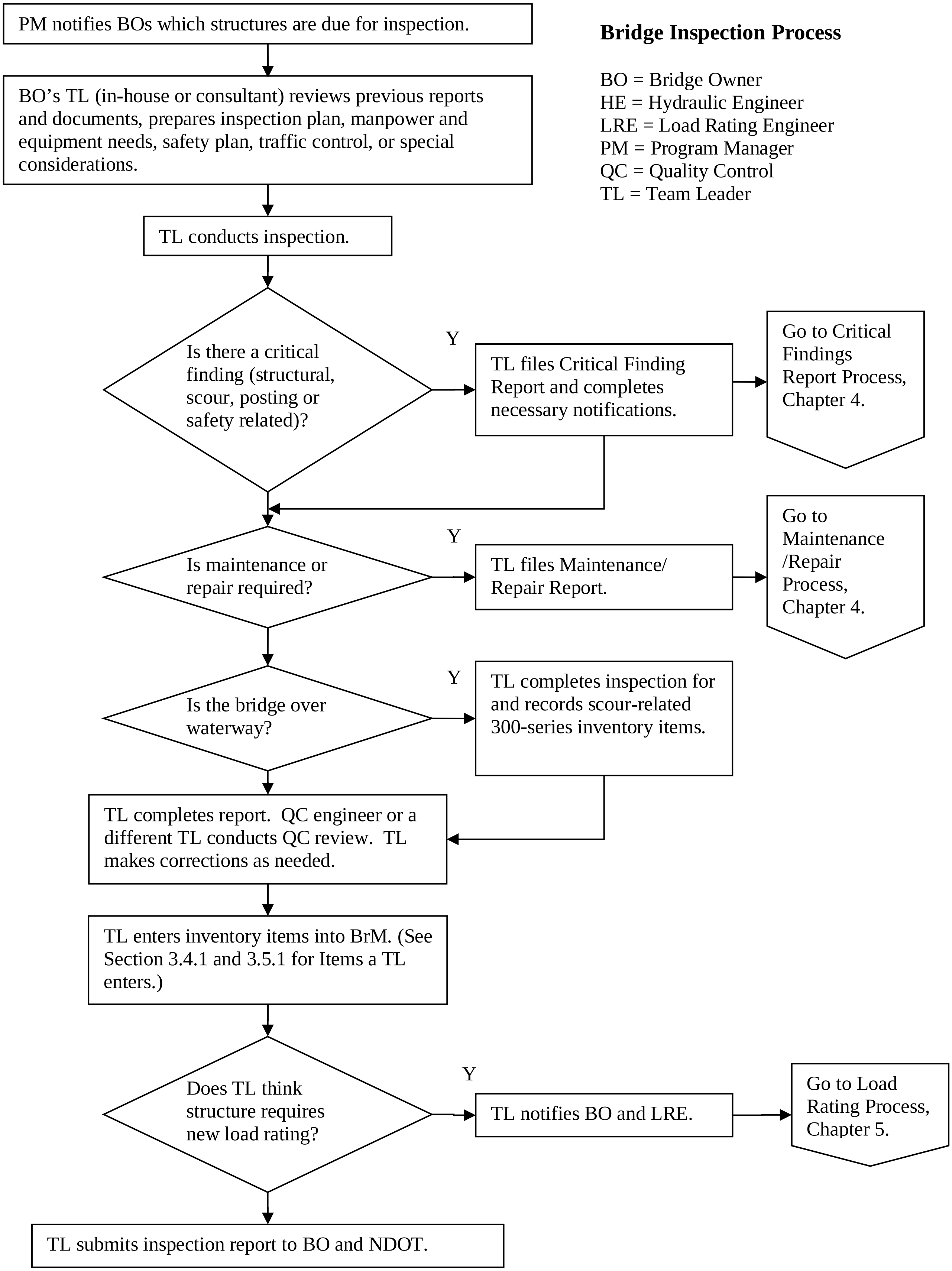
NBIS requires that bridges be routinely inspected at intervals no greater than 24 months. It also allows inspection intervals of up to 48 months with FHWA approval.

NDOT requires that all routine inspection intervals be done at intervals not exceeding 24 months. These inspections are the biennial routine inspections, and shown in BrM as NBI (Routine) inspection.

The FHWA Metric on frequency uses BrM NBI Inspection dates to calculate the actual interval. Only routine inspections should be entered into BrM as NBI (Routine) inspections. In 2012, NDOT initiated a policy that non-routine inspections that change inventory data (e.g., Initial, Feature inspection, Damage inspection) will be recorded in BrM as a Special Inspection and **not** an NBI (Routine) inspection. See Section 4.10 on Special Inspections.

Bridge Inspection Process

BO = Bridge Owner
HE = Hydraulic Engineer
LRE = Load Rating Engineer
PM = Program Manager
QC = Quality Control
TL = Team Leader



4.7.4 Parties Completing Routine Inspections

Routine inspections must be completed by a Team Leader.

4.7.5 Inspection Procedures- General

4.7.5.1 General Planning and Preparation

This section describes general office planning and preparation tasks that apply to all types of inspections. Inspectors should also review the FHWA BIRM, particularly Section 3.1.4 “Preparing for Inspection”. Unique tasks that apply to specific types of inspections, such as fracture critical inspections can be found in other sections of this Chapter. General planning and preparation includes, but may not be limited to, the following:

- File review for each bridge structure, including review of prior inspections and bridge items noted for monitoring.
- Arrangement for the provision of warning signs and other traffic control.

4.7.5.2 Safety

Before an inspection assignment, inspectors should review the FHWA BIRM Section 3.2 “Safe Practices” for thorough coverage of recommended requirements. Inspectors should also review the MBE for safeguarding personnel conducting the inspections as well as the safety of the public.

Inspectors should never work alone. Extreme caution should be exercised when using extension ladders or catwalks on bridges. They should be thoroughly inspected before any load is placed on them.

A bridge may require use of special equipment, qualification or techniques. See the sections on fracture critical and underwater inspections.

4.7.5.3 Inspection Tools

Before an inspection assignment, inspectors should review the FHWA BIRM Section 3.4 “Inspection Equipment” for thorough coverage of recommended requirements.

Inspector should have available for use the following basic tools at a minimum:

- Ladder
- Pocket tape
- Chipping hammer
- Scraper
- Calipers
- Straight edge
- 100-foot tape
- Camera
- Flashlight
- Wire brush
- Ice pick
- Level
- Mirror

Special equipment, such as a snooper truck or bucket truck, may be needed for some structures. Inspectors should consult the prior inspection report to determine the correct equipment needed for a given structure.

4.7.6 Inspection Procedures – Posting/Closure

Proper installation of bridge restrictions is a matter of public safety and a major concern of FHWA and NDOT. NDOT requires inspection Team Leaders to check the installations in the field against the most current Load Rating Summary Sheet (LRSS). Photos should be taken of the signs and closure barricades. A note should be shown in the inspection report that the TL has completed this check.

These situations are Critical Findings:

- Missing signs.
- Posting signs with values higher than those recommended on the LRSS.
- Bridge that is supposed to be closed, but is found open.

Often Owners can address these situations the same day after notification from the Team Leader.

4.7.7 Inspection Procedures – Material Considerations

The Load Rating Engineer will need detailed information on the remaining section at certain locations on the bridge for various load effects (bending moment, shear, compression and tension). The lists below are general in nature and not comprehensive. The inspection staff, while in the field, should contact the LRE if there are any questions to ensure key measurements are obtained in the field.

4.7.7.1 Steel

Corrosion and section loss can adversely affect the load capacity of a bridge.

Critical Section Loss Locations for Steel	
Load Effect	**Typical critical section**
Bending moment in beams of simple spans	Midspan; bracing spacing is also a key factor
Bending moment in beams for continuous spans	Length of beams/stringers near the midspan and the length of beams/stringers over the piers; bracing spacing is also a key factor.
Shear in beams	At the supports
Tension members, typically in trusses	The entire length of the member; gusset plates
Compression members, typically in trusses	Length of the member between bracing point or ends; gusset plates

4.7.7.2 Timber

Timber structures can, over time, exhibit deterioration and section loss. Often they are damaged due to a vehicle load that exceeded the load capacity of the structure.

Critical Section Loss Locations for Timber	
Load Effect	**Typical critical section**
Bending moment in beams of simple spans	Midspan; bracing spacing is also a key factor
Shear in beams	At the supports
Tension members, typically in trusses	The entire length
Compression members, typically the supporting pile	The entire length; bracing spacing is also a key factor (length of the member between bracing point or ends).

4.7.7.3 Concrete

Routine inspections of concrete decks should include the use of a delamination detector that will readily define the deteriorated area, such as chain drag or hammer sounding. Delamination normally indicates active corrosion of the reinforcing steel. A spall in the deck surface is the visible result of delamination at the level of reinforcing steel.

Additional testing such as electrical potential or chloride content tests are not part of routine inspections. The Bridge Owner will determine if additional testing is needed for part of an inventory, special or in-depth inspection.

<table>
<tr><th colspan="4">Concrete Bridge Deck Evaluation and Condition Coding
(Condition Indicators as % of Deck Area)</th></tr>
<tr><th>Classification</th><th>Condition Code</th><th>Spalls</th><th>Delaminations</th></tr>
<tr><td rowspan="3">Light Deterioration</td><td>9</td><td>None</td><td>None</td></tr>
<tr><td>8</td><td>None</td><td>None</td></tr>
<tr><td>7</td><td>None</td><td>< 5% of all Deck Concrete</td></tr>
<tr><td rowspan="2">Moderate Deterioration</td><td>6</td><td colspan="2">< 2% Spalls or
sum of all deteriorated Deck Concrete < 10%</td></tr>
<tr><td>5</td><td colspan="2">< 5% Spalls or
sum of all deteriorated Deck Concrete 10% to 29%</td></tr>
<tr><td rowspan="3">Extensive Deterioration</td><td>4</td><td colspan="2">> 5% Spalls or
sum of all deteriorated Deck Concrete 30% to 60%</td></tr>
<tr><td>3</td><td colspan="2">> 5% Spalls or
sum of all deteriorated Deck Concrete > 60%</td></tr>
<tr><td>2</td><td colspan="2">Deck Structural capacity grossly inadequate.</td></tr>
<tr><td rowspan="2">Structurally Inadequate Deck</td><td>1</td><td colspan="2">Holes in Deck, or danger of other sections of deck failing.</td></tr>
<tr><td>0</td><td colspan="2">Deck has failed completely.
Bridge can be repaired by deck replacement only.</td></tr>
</table>

4.7.7.4 Prestressed Concrete

Prestressed concrete has been used in Nebraska since the 1960s. Over time design codes have evolved and been amended. Some older concrete girder bridges may have been designed under codes that included less stringent shear requirements. It is important that inspectors recognize beam shear cracks and report these to the LRE.

4.7.8 Inspection Procedures – Bridges Over Waterways

Bridges over waterways are of particular concern for Owners. Scour can occur in stream crossings where debris and/or erodible soils are present. Scour is also more likely if a structure's length and its waterway opening encroach into the natural waterway of the stream resulting in high stream velocities during storm events. Some bridges have scour counter measures that must be monitored. More recent bridge design procedures result in structural elements that are resistant to failure from scour. All of these factors are taken into account during a Scour Assessment for a bridge.

Scour Assessments for all bridges over waterways with an Item 113 code of 6 or U were completed in 2010. New bridges undergo assessment during design. These scour assessments, their resultant coding for NBI Item 113, and possible Plan of Action should be in the Owner's Bridge File. They also may guide the determination of the underwater inspection interval.

4.7.8.1 Channel Behavior and Scour

Inspectors must be familiar with stream behavior, the stages of evolution, and the factors that contribute to scour. A summary of these is provided in Chapter 6 Bridge Scour.

4.7.8.2 Scour Critical Structures Plan of Action

A Plan of Action (POA) is a written document prepared by the Bridge Owner (or their Consultant) setting out specific instructions for management of a scour critical structure to protect public safety. Inspection preparation should include a review of the POA. Changes to the condition of the bridge and/or the bridge site that are noted by a bridge inspector during a routine inspection are to be documented on the POA monitoring Log and may trigger a revision to the POA.

4.7.8.3 Inspection and Reporting for Bridge over Waterways

Routine (NBI) inspections include inspection of the structure and the site. The Team Leader makes observations to monitor and document changes to the conditions related to stream behavior. Changes noted by a Team Leader on a routine inspection may trigger a hydraulic assessment or a revision to the POA.

Inspection preparation shall include a review of past inspection reports and the current POA (if the structure has one), the hydraulic analysis report and scour assessment, and countermeasure records.

The inspection will include the following:

- Identification of scour holes, soil voids and undermining of the substructures and/or approaches. Sounding and probing may be required, especially immediately upstream of the piers or bents. Document in the inspection report the depth, width and length of scour holes and undermining. Use sketches to clearly describe.
- Documentation of hydraulic observations with photos, preferably from the same location as those from the current POA or prior inspection (if there is no POA):
    - Recent high water marks.
    - Bridge deck relative to low road grade.
    - Upstream and downstream stream cross-sections.
    - Bridge side profile showing waterway area.
    - Stream profiles.
    - Wings.
    - Abutment back walls.
    - Piers or bents.
    - Berms.
    - Natural banks.
    - Scour countermeasures (rip rap, slope protection, wing dikes, etc.).
    - Scour related problems.

The Team Leader records observations using the NE scour-related 300 Item series which cover evidence of scour and flood events as well as factors that can potentially contribute to scour during flood events. See Chapter 3 for the complete list of the NE scour-related 300 Item series and guidance on coding these items.

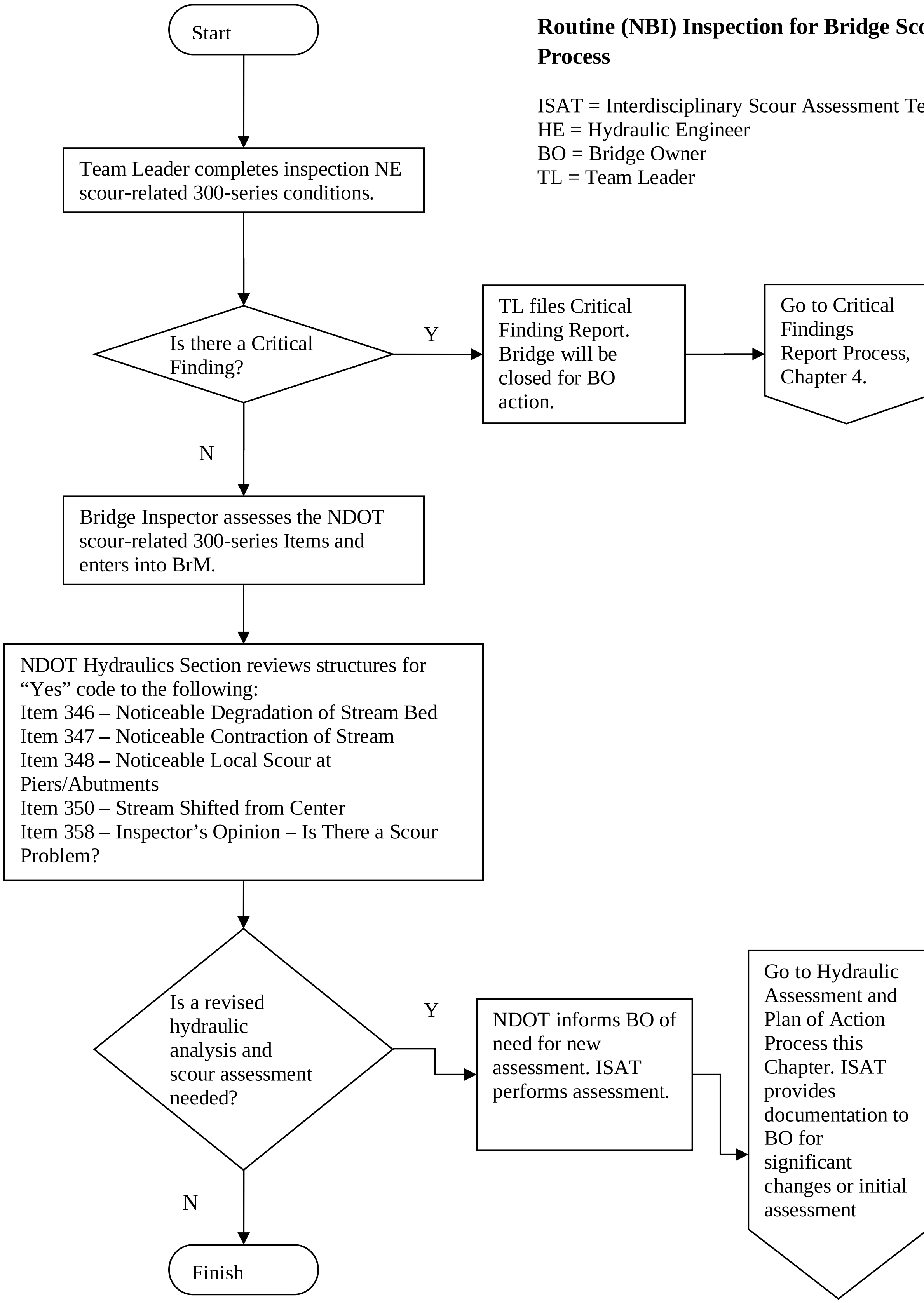
If any of the following is coded as "YES" by the inspector, the structure may need to be flagged for consideration for a scour assessment:

- Item 346 - Noticeable Degradation of Stream Bed
- Item 347 - Noticeable Contraction of Stream
- Item 348 - Noticeable Local Scour at Piers/Abutments
- Item 350 - Stream shifted from center
- Item 358 - Inspector's Opinion – Is there a Scour Problem?

The Team Leader should file a Critical Findings Report if the condition of the bridge warrants a substructure condition rating, Item 60, of 2 or less. See the following flow chart of scour related inspection follows.

Routine (NBI) Inspection for Bridge Scour Process

ISAT = Interdisciplinary Scour Assessment Team
HE = Hydraulic Engineer
BO = Bridge Owner
TL = Team Leader



4.7.9 Inspection Procedures – Complex Bridge

The NBIS defines a Complex Bridge as “a movable, suspension, cable stayed and other bridges with unusual characteristics.”

NDOT defines a Complex Bridge as “a bridge possessing unique or unusual design features not often found in Nebraska.”

Complex bridges require a unique and specific inspection procedure for each bridge. The unique or unusual structural design feature(s) of a bridge shall be identified during the bridge design stage, and the designer should prepare a draft of inspection procedures and submit to the Owner.

NDOT will review all bridges in the state and identify Complex Bridges.

Complex bridges will be designated as such by the State Bridge Engineer or the Assistant Bridge Engineers in the initial design stage. Non-State Bridge Owners shall contact the Bridge Inspection Program Manager if they have any bridges under their authority that are of unusual design for bridges in Nebraska.

Nebraska has three examples of complex bridges:

- S030 37847, Columbus, Columbus Viaduct, Steel Arch-Thru
- S068 00044, Ravenna, Ravenna Viaduct, Steel Arch-Thru
- S002 50816, Nebraska City, Concrete Continuous Segmental Box Girder

4.7.10 Inspection Reports

4.7.10.1 General

The field investigation of a bridge should be conducted in a systematic and organized way that will be efficient and minimize the possibility of any bridge item being overlooked. The field data documentation shall be completed as specified in AASHTO MBE and the FHWA BIRM.

An inspector may discover critical findings during an inspection. Reporting of critical findings is covered in Section 4.11 Critical Findings Reporting of this Chapter.

An inspector may discover non-critical findings that may need repair or maintenance. Report these in the inspection report and directly to the Bridge Owner.

Inspection reports should be clear and use sketches and photographs to document the findings. Inspection reports should include the following:

- All noteworthy findings including:
  - Any bridge component with a condition rating of 5 (fair) or less with photos and notes clearly describing the location, severity and extent of the defect or deterioration.
  - Any item in need of repair or maintenance.
  - Any evidence of a change in scour condition.
- Fracture critical members, fatigue-prone details and special feature inspections must be included in the comment file.
- Features that require close monitoring **must have** detailed documentation. A description of the problem, or potential problem, with sketches and photos must be included in the special inspection report.
- Report repairs to the structure that alter any previously recorded data.

4.7.10.2 Photographs

A minimum of 10 initial site photos are required at the inventory inspection. See the guide for taking site photos in the Appendix. After the initial 10 inventory site photos are taken, they are only required again when the site conditions have changed. Although not required, regular updating of site photos can show slowly occurring changes at the site that may not be apparent otherwise, such as lateral stream migration.

Inspection photos document particular inspection findings. The quantity of inspection photos must be sufficient to accurately document the finding(s). Inspection photos are required when a bridge component (Item 58, 59, 60, 61, or 62 falls to a condition of 5 (fair) or lower.

Known issues, such as a critical findings, or other issues of special concern.

Photographs **must have** the date and time printed on them automatically. NDOT recommends labeling with a filename that includes the structure ID followed by a sequence number or other unique identifier for that photo.

An advisory regarding photos: NDOT and Bridge Owners store photographs electronically. Large quantities of high resolution photos consume much network storage space. Photos should preferably be approximately 1 MB in size and in JPG format. There are situations where a particular feature may require high resolution photography. This is totally at the discretion of the Inspector.

4.7.10.3 BrM Input

Routine inspections must be recorded in BrM as Routine (NBI) Inspections.

The inspection data collected is input by the Inspector into BrM.

Each new NBI inspection must be entered by clicking on the **"New"** button under the inspection tab and follow through with a New Inspection. **Do not** enter a new NBI inspection using "Edit" as it will overwrite the previous inspection. Verify that a new inspection report is created for the same structure.

Inspectors must input the date of the new NBI inspection and make necessary changes in the condition ratings and other inspection items that are the responsibility of the Team Leader to enter. Inspectors are advised to carefully review the Tables of Inventory Items in Chapter 3 Inventory Coding for the specific items that Inspectors enter into the inventory (dynamic items) or should verify while they are in the field (static items).

- Dynamic items can change with each NBI (routine) inspection. It is important that Items that affect bridge Sufficiency Ratings be coded accurately.
- Static items do not change with each NBI (routine) inspection. These items, however, are verified during inspection. The Team Leader should red-line any changes to these items on a copy of the SI&A sheet and send them to the BIP Program Manager. The Program Manager is responsible for changing these items in the database.

Comments input into reports and BrM are very important. Comments must be clear and detailed to the extent that they can be fully and appropriately interpreted at a later date by a different inspector. Comments should include the Condition Code as well as justification of the Condition Codes that an Inspector assigns. When a condition code for a bridge component (Items 58, 59, 60, 61, or 62) drops to 5 (fair) or below, a note is required. Inspectors must document the type and location of defects. This is important for bridge management personnel and for load rating. Comments are also required for items that are lowered by more than one point.

Documentation in BrM of maintenance completed and repairs made is also important.

Inspectors should not copy forward inspection notes from a previous inspection. Instead, new inspection notes should be written for each inspection. Inspectors are discouraged from using “No Change” when entering notes in BrM.

4.8 FRACTURE CRITICAL INSPECTION

4.8.1 Definition

"A hands-on inspection of a fracture critical member or member components that may include visual and other nondestructive evaluation." (NBIS definition)

A hands-on inspection is defined as within the inspector's arm's length.

4.8.2 BrM Recording

Fracture Critical (FC) inspections must be recorded as Fracture Critical Inspections. Scheduled Special Inspections of fracture critical bridges shall be recorded as Special-Scheduled inspections (see Section 4.8.3). Initial inspections of fracture critical bridges shall be recorded as Special-Initial inspections.

4.8.3 Fracture Critical Inspection Interval

Fracture critical members must be inspected at intervals not to exceed 24 months in accordance with the NBIS, but may be a shorter inspection interval. NDOT urges all Bridge Owners to repair or retrofit structures that have been placed on a cycle of less than 24 months so that these structures can be placed back on a 24-month cycle.

Fracture Critical inspections are typically done along with Routine Inspections. The date of this inspection is recorded in BrM as Fracture Critical inspection date and NBI (routine) inspection date.

Note that NDOT's policy beginning in 2012 is that Fracture Critical bridges with elements requiring inspection between the Routine and Fracture Critical inspection interval shall be recorded as a Special Inspection (see Section 4.1.10.3.1). The date of this inspection is recorded in BrM as the Special Inspection date only (and **not** a Routine or Fracture Critical inspection.)

4.8.4 Parties Completing Fracture Critical Inspection

Fracture Critical inspections must be completed by a Team Leader who is NDOT Certified to complete Fracture Critical inspections.

4.8.5 Fracture Critical Inspection Procedures

4.8.5.1 Fracture Critical Structure Types and Members

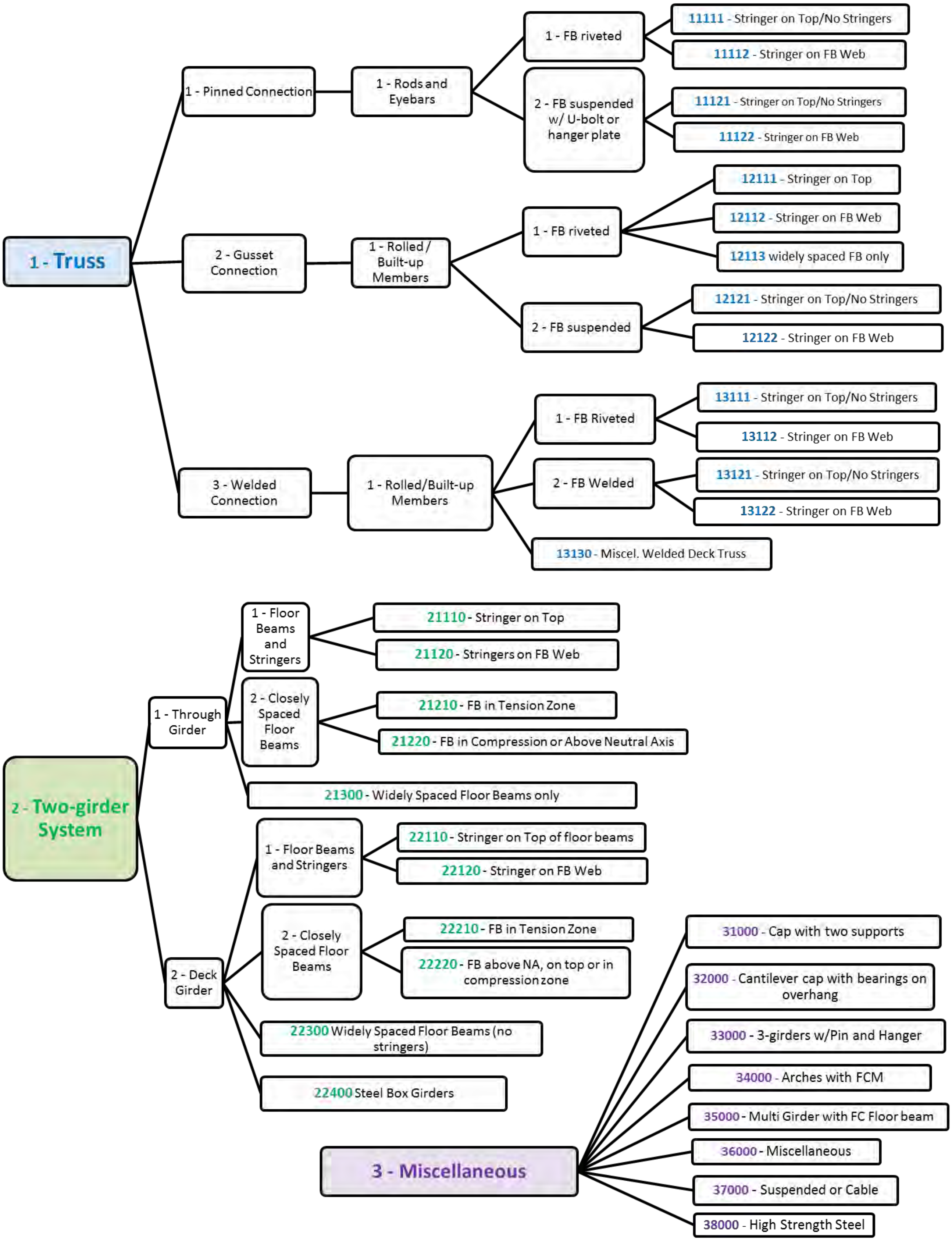
A fracture critical member is defined in the NBIS as "a steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse." Collapse is defined in the AASHTO LRFD Specifications as a "major change in geometry of a bridge rendering it unfit for use."

According to the NCHRP Synthesis 354, *Inspection and Management of Bridges with Fracture-Critical Details*, a fracture is "the rupture in tension or rapid extension of a crack leading to gross deformation, loss of function or serviceability, or complete separation of the component."

A list of common fracture critical structure types and members is shown below for the inspector's information, as well as a flow chart on the following page to determine the fracture critical type. Inspectors should also see AASHTO MBE and FHWA Report No. FHWA-IP-86-26, *Inspection of Fracture Critical Bridge Members*.

- One- or two-girder systems, including single box girders with two webs
- Suspended spans with two girders and/or two eye bar components
  - Eye bar chain
  - Hanger rods
  - Floor beams spaced more than 14ft apart
  - Cable
  - Cable stayed
- Two-truss systems
  - Eye bar members
  - Lower chord
  - Counters
  - Floor beams spaced more than 14ft apart
  - Gusset plates
  - Pins
  - Brackets holding up floor beams
- Tied arches
- Steel pier caps and cross girders with two or less supports
- Pin and hanger connections on two- or three- girder systems
  - Hanger plates
  - Pin and pin plates connecting pins to girders
    - Girder pin and hanger
    - Fixed pin and girder
    - Truss pin and hanger
- Steel pier caps without load path redundancy

TYPES OF FRACTURE CRITICAL BRIDGES



4.8.5.2 Bridge-Specific Inspection Procedures

Inspections shall be performed in accordance with the AASHTO MBE and FHWA Report No. FHWA-IP-86-26, *Inspection of Fracture Critical Bridge Members*.

Each fracture critical bridge shall have an inspection procedure prepared by an engineer that identifies each fracture critical member as well as each fatigue detail and fracture-prone detail and describes the inspection methods to be used and equipment and procedures for accessing them. Problematic details and the corresponding AASHTO categories shall be determined before the field inspection begins. If a procedure is not in the bridge file, an engineer must prepare a procedure for that structure.

Fracture critical bridge inspection procedures, once prepared, will likely be used for many inspections. Procedures will likely need revision if fracture critical member conditions change or methods of inspection change or are added.

A fracture critical inspection procedure shall include the following elements:

- Location of fracture critical members as described in writing or shown on sketches or photos.
- Method of access to fracture critical elements (i.e., ladder, platform, boat, snooper, etc.).
- Inspection method(s) to be performed on each fracture critical element. A hands-on visual inspection is required. Other methods may include:
  - Bang of the hammer/sounding
  - Magnetic-particle testing (MT)
  - Dye-penetrant testing (PT)
  - Ultrasonic testing (UT)
  - Eddy current
- Tools necessary for inspection, including any special equipment such as non-destructive testing devices.

4.8.6 Fracture Critical Inspection Reports

4.8.6.1 General

The Team Leader needs to record the date of the Fracture Critical inspection in BrM.

The inspection needs to record the status of all fracture critical members, regardless of their condition. When a crack is found, it is very likely that similar details may also be cracked; inspection of all similar details is mandatory. The inspector must report all cracks, especially in a fracture critical member, to the Bridge Owner and the Program Manager immediately. The inspector must also prepare and submit a Critical Findings Report if a critical finding is discovered.

The FC Inspection Report must include the NDOT FC inspection forms as well as a report narrative.

4.8.6.2 Report Narrative

The Fracture Critical Report shall have a narrative including these components:

- Purpose
    - Provide clear, concise backup of the field documentation
    - Provide insight about observed defects and potential problem areas
- Methodology
    - Introduction
        - Inventory data relevant to fatigue
        - Reference information
        - Site conditions
        - Inspection crew information
    - Identify Fracture Critical Member (FCM)
        - Include FCM inspection plans
            - Inventory of the FCMs
            - Identify fatigue prone details
            - Quality control tool
        - Systematic procedure for efficient inspection
    - Inspection Procedures
        - FCM inspection plan
            - General statement indicating that a hand-on visual assessment of the FCMs was performed
            - Method of access is described
            - Use of any NDT equipment is identified

- Condition Description: This is one of the most important parts of the narrative. It supports the load rating analysis and is used to evaluate the need for repairs, retrofits or replacement. Include:
  - What
    - Type of detail,
    - Type of defect
    - Extent of defect
    - Reference to sketches and photos
  - Where
    - Location of cross-section
    - Location on member
    - Reference to a detailed sketch or photo
  - Why
    - Observed reason
  - Summary and Conclusions
    - Overall condition of the FCMs
    - How individual defects affect each member as a whole
    - All defects listed and priorities for each FCM
    - Address change in condition of FCMs from the previous inspection
    - Identify any negative trends that may be developing.

4.9 UNDERWATER INSPECTION

4.9.1 Definition

"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." (NBIS definition)

The underwater inspection is required for structures with substructure units that are submerged in water depths greater than 4 feet (1.22 m) throughout the year. The underwater inspection should determine the integrity and soundness of the substructure elements and assess surrounding channel for scour. The inspection of foundation elements and determination of its on-going resistance to scour is the objective of an underwater inspection.

In Nebraska, NDOT manages and conducts all underwater inspections for efficiency, regardless of the Bridge Owner. The Bridge Owner must have the report in the bridge record.

4.9.2 BrM Recording

Underwater (UW) Inspections must be recorded in BrM as Underwater Inspections.

4.9.3 Underwater Inspection Interval

The NBIS requires that underwater inspection intervals not exceed 60 months. NDOT provides guidance for two cases.

4.9.3.1 Bridges over Natural Waterways

Underwater Inspection Intervals

NBI Item 113*	Description	Maximum Interval	Comment
U	Unknown foundation	To be determined by HE assessment	
T	Bridge over "tidal" waters	60 months	N/A in NE
9, 8, & 5	Stable for calculated scour	60 months	
4	Require countermeasures	To be determined by HE assessment	
3 or 2	Scour critical based on calculated scour	To be determined by HE assessment	Include requirement in POA.
1	Scour critical and substructure failure is imminent; bridge is closed.	Inspection not required unless bridge is reopened.	Include requirement in POA.
0	Scour critical and bridge is closed.	Inspection not required unless bridge is reopened.	

*See Chapter 3 for complete descriptions of NBI Item 113.

4.9.3.2 Bridges over Controlled-Flow Channels

Bridges over controlled-flow channels, such as power canals, shall have an underwater inspection interval not to exceed 60 months. These types of waterways typically have controlled and nearly constant stream velocities.

Some bridges cross irrigation canals, but often are dry and allow inspection without diving.

Power canal bridges that are drained during maintenance periods should be inspected by the Bridge Owners using NDOT approved Team Leaders without a need for diving. These inspections shall be identified as UW inspections in BrM, as the maintenance schedule may not correspond with the UW inspection or routine inspection schedules.

4.9.4 Parties Completing Underwater Inspections

A qualified UW Team Leader must be present on site at all UW inspections. OSHA 29 CFR Part 1910, Subpart T, *Commercial Diving Operations*, shall govern the inspections that require diving. The dive team shall be appropriate in size for the structure, but shall consist of a minimum of three team members. All team members can perform any role or responsibility of the inspection. Team member positions will include:

- Main diver who is responsible for the actual tactile and visual inspection of the structure and reporting the information.
- Safety diver who is responsible for the safety of the main diver.
- The dive tender who assists the main and safety divers when putting on their equipment, during entry into and exit from the inspection site, and visual tracking of the divers.

4.9.5 Procedures

Underwater inspection includes locating the channel bottom, probing to determine deterioration and losses at the foundation, and diving to visually and/or tactilely inspect and measure bridge components. Underwater inspection reports the current waterway cross-sections, profiles and soundings in contrast to past data.

The Underwater inspection report is an integral part of the bridge records and provides information on elements not visible during a routine inspection.

Underwater bridge inspection is a complex technical assignment requiring specialized diving skills and experience. All inspections must be conducted in a safe and thorough manner. Underwater inspections are often performed in poor visibility, fast moving rivers or canals in potentially hazardous surroundings. The diving experience of the underwater inspector is of the utmost importance. Individually, inspectors must be competent and skilled divers. At the same time, they also must be able to function and accept responsibilities as team members.

Structures requiring underwater inspection shall have individual procedures for conducting the dive. Additionally, individual procedures are required for the actual inspection. Procedures shall be included in the UW Inspection Report to benefit future inspections.

NDOT hires a consultant to complete all underwater bridge inspections for all Owners in Nebraska. NDOT has developed a standard report format for underwater inspections that consists of written descriptions of the current condition and any damage to the structure. Sketches and photographs are included as necessary to document the existing condition of the bridge.

The UW Inspection Report shall have a QC review by the consulting firm hired by NDOT to complete the UW Inspection. The results shall be discussed with the Team Leader for corrections, improvements and uniformity in the reports.

The UW Inspection Reports will have a QA review by a qualified QA consultant hired by NDOT for this purpose.

4.9.6 Inspection Preparation and Planning

4.9.6.1 General

The inspection dive team leader must complete the following:

- Schedule the inspection in a timely manner.
- Verify the qualifications of all members of the dive team.
- Review the previous inspection report, dive log, the SI&A sheet and preliminary data.
- Hold the predive meeting with the dive team.
- Verify the completeness and quality of inspection (See section 4.9.8.1).

4.9.6.2 Predive Meeting

A predive meeting will be held to review both the dive procedure and the underwater inspection procedures for the particular bridge. The meeting will address the following prior to the inspection of each structure:

- Review the structure’s established dive procedure.
- Determine the mode of underwater communication.
- Determine what team member responsibilities will be.
- Detail where the dive will begin; what needs to be inspected; the method of inspection; and when, where, and how the dive will proceed and be terminated.
- Emergency aid
    - A list shall be kept at the dive location and should have information detailing location of the nearest hospital.
    - The equipment manager is responsible for the emergency communication system, using either a cellular phone or the NDOT radio.
    - A First Aid kit appropriate for diving operations, oxygen bottle with mask and an American Red Cross handbook or equivalent, must be available at the dive location. All dive team members must be trained in supplying oxygen in case of a dive emergency.
- Safety and Health
    - Address the existing conditions above and below the water such as weather, accessibility, visibility, current, debris, etc.
    - To minimize hazards, all diving operations must be coordinated with other activities in the vicinity likely to interfere with the diving operation such as traffic, boating, adjustable current due to power plant operations, etc.
    - Review and check all diving gear to be used: regulators, masks, buoyancy compensators, tanks and fins. Also check any special equipment, communication systems, boats and their operation, thermal and pollution protective gear, etc.

- Review and check inspection equipment: hand tools, power tools, nondestructive testing and/or boring equipment and procedures, cleaning equipment, vehicles and access equipment, cameras, etc.

4.9.7 Inspection – Minimum Expectations

4.9.7.1 Scour

Probe the streambed to determine the condition and composition of the material that surrounds the substructure member. The presence of riprap should be noted as well as any debris that constricts the flow of the stream and is promoting scour.

4.9.7.2 Concrete

Note the length, width, location and orientation of cracks. Note the spalling and deterioration of the concrete members.

4.9.7.3 Steel

Check for corrosion on all structural members, noting any loss in section, its location, and document the remaining section. Check all bolts and interlocks on sheet piling, noting any missing elements, cracks in welds, corrosion and bent or missing members.

4.9.7.4 Timber

Timber members that are subject to cycles of wetting and drying are highly susceptible to deterioration. All timber pile shall be checked for areas of deterioration or section loss and note the location of the deficiency. The presence or absence of creosote on all members and the cut ends of cross bracing shall be checked. Note the location of any cracking, splitting or deterioration. Note severity and extent of deterioration or defects and remaining section.

4.9.7.5 Sounding / Channel Cross-Section

For most small inland bridges, a simple channel cross section as established by NDOT is sufficient. For wide bridges and Missouri River bridges, sounding of the channel bottom at several locations upstream and downstream is customary.

4.9.8 Inspection Reporting

4.9.8.1 Postdive Meeting and Report

The dive team leader will conduct a postdive meeting with the dive team members and should address the following points:

- Review the underwater inspection of the structure and discuss the conditions that currently exist.
- Complete the Underwater Bridge Inspection Preliminary Report and the Work Dive Log.
- Discuss any potential safety problems with the bridge inspection, or actions that should be taken to create a safer environment for the divers in the future.

4.9.8.2 Underwater Inspection Report

A preliminary Underwater Inspection Report will be updated immediately following the inspection so that if additional information is needed, the dive can be continued. The completed Report should be submitted to the Bridge Owner and NDOT. Both PDF and Word format shall be submitted following the proper naming convention as defined in the appendix of the BIPM.

4.9.8.3 Divers' Personal Dive Log

A Record of Dive Log will be completed in accordance with Code of Federal Regulations, 29 CFR 1910: Subpart T – *Commercial Diving Operations*. This Record of Dive will be completed onsite immediately following the inspection dive. This Dive Log shall be submitted as an appendix in the UW Inspection Report.

4.9.8.4 Submittal to NDOT and Other Owners

- UW Inspection Reports shall be submitted electronically via the ftp site to NDOT within 90 calendar days of the inspection date.
- BrM data shall be updated within 30 calendar days of the inspection date. Photos are submitted through BrM in addition to inclusion in the body of the report.
- At the completion of all bridge inspections in a county, the reports shall be directly submitted to the local bridge owners (Counties, Cities and Municipals) in a format that has been agreed upon.

4.10 SPECIAL INSPECTIONS

4.10.1 Definition

"An inspection scheduled at the discretion of the Bridge Owner, used to monitor a particular known or suspected deficiency." (NBIS definition)

In 2012, NDOT initiated a policy that any inspection that changes inventory data and is not a Routine (as defined in this Manual), Fracture Critical, or Underwater Inspection, shall be entered into the database as a Special Inspection.

Special Inspections may be scheduled or event-driven.

A scheduled special inspection is done on a specified date or within an interval of time to closely monitor the defect for adverse changes in its condition. It may or may not coincide with a routine bridge inspection.

An event-driven special inspection is done as needed to include changes to the inventory or for structures that have sustained damage, thus a change in condition.

4.10.2 BrM Recording

Special Inspections must be recorded as BrM Special Inspections. The following is a list of Special Inspections:

<u>Special – Initial</u>: Used when inspecting a newly constructed or reconstructed bridge.

<u>Special – In Office</u>: Used by NDOT when updating bridge data file in-house.

<u>Special – Accident Damage</u>: Used after a vehicle impact.

<u>Special – Natural Disaster Damage</u>: Used after a flood or other natural disaster.

<u>Special – Scheduled</u>: Used between the Routine Inspections due to a condition-driven circumstance (see Section 4.10.3.1 for additional detail).

<u>Special – Other</u>: Use when no other category applies. Include a note in BrM detailing why the inspection was done.

4.10.3 Special Inspection Interval or Timing

4.10.3.1 Special Inspections – Scheduled

Scheduled Special Inspections are to be done between the Routine Inspections at an interval equal to half the routine inspection interval or less (as determined by the Owner), depending on the condition being monitored. For instance, if the Routine Inspection is completed in May of odd years and is on a 24 month schedule, the Special Inspection should be conducted in May of even years and also set to a 24 month schedule. If the Routine Inspection is set to a 12 month frequency, the Other Special Inspection should be completed 6 months after the Routine and set to a 12 month schedule. NDOT recommends that Owners keep a master list of their bridges that are subject to Special Inspection.

NDOT has determined certain conditions or cases that require a Special Inspection which are shown in the following table. The purpose of the inspection is to verify the condition and the condition codes of the item requiring the Special Inspection, not to complete an entire Routine Inspection.

Scheduled Special Inspections Required by NDOT to Verify Condition Rating	
Case	**Inspection By**
Bridges with load restriction **and** A condition rating of 4 or less for **any** of the following: Item 59 Superstructure Item 60 Substructure Item 62 Culvert **and either** of the following: Item 29 ADT of 400 or more Item 208 State Classification of Route of 6 or less (arterial or higher level).	Team Leader
Bridges with a condition rating of 3 or less for **any** of the following: Item 59 Superstructure Item 60 Substructure Item 62 Culvert	Team Leader
Fracture Critical bridges with a condition rating of 3 or less for the Item 59 Superstructure due to a fracture critical element	Fracture Critical Team Leader

A Bridge Owner or their Engineer (licensed NE PE) may recommend an inspection interval shorter than a normal routine inspection interval (24 months). Factors that pose higher risk include, but are not limited to:

- Age of structure
- Traffic Characteristics (ADT and ADTT)
- Bridge condition or presence of known deficiencies
- Fatigue prone details.

Scheduled Special Inspections Examples	
Case	**Inspection By**
Inspection of a foundation settlement	Team Leader
Inspection of a member whose condition is of concern	Team Leader
Inspection of a load-posted bridge subject to heavy traffic	Team Leader
Inspection of a fracture critical element with a known issue	FC certified Team Leader

4.10.3.2 Special Inspections – Event-driven

In 2012, NDOT initiated a policy that any inspection that changes inventory data and that is not a Routine (as defined in this Manual), Fracture Critical, or Underwater Inspection, shall be entered into the database as a Special Inspection.

The initial inspection of a bridge is a Special Inspection. A Special Inspection is required for new bridges, bridges that have been reconstructed (changed in configuration e.g. widening, lengthening, supplemental bents), bridges that have been repaired and reopened to traffic, or bridges with a change in ownership. These shall be entered into BrM as an Initial Inspection and not an NBI Inspection.

New and reconstructed bridges must have their initial inspection before opening to traffic.

A Special Inspection may be required and input into BrM if a bridge has sustained damage due to environmental or human factors such as scour or vehicular impact.

Cases requiring a Special Inspection are shown in the following table.

Event-driven Special Inspections Examples		
Case	**Inspection By**	**Timing**
Recently completed bridge (Initial inspection)	Team Leader	Prior to opening to public traffic
Inspection of an altered/retrofit bridge	Team Leader	Prior to opening to public traffic
Structures retrofitted or repaired to address a particular FC issue that required a half-	FC qualified Team Leader	Prior to opening to public traffic

interval (e.g.12-month) and to be returned to the routine inspection interval (e.g. 24-month)		
Closed bridges reopened to traffic after a completed repair	Team Leader	Prior to opening to public traffic
Bridge that had a repair	Team Leader	Determined by the Owner
Structure damaged after vehicle impact that revises inventory data (condition ratings, etc.)	Team Leader	Determined by the Owner
Structure damaged after a flood event that revises inventory data (condition ratings, etc.)	Team Leader	Determined by the Owner

4.10.4 Parties Completing Special Inspections

Special Inspections that must be performed by a Team Leader include Initial Inspections and Damage Inspections.

It is preferred that a Team Leader complete all scheduled Special Inspections. A person familiar with the deficiency/condition being monitored and available to accommodate the assigned frequency of investigation may complete the inspection, except that any change in the deficiency/condition for the worse must be inspected by a Team Leader.

4.10.5 Procedures – Scheduled Special Inspections

Bridges shall be placed on a special inspections list when in the Program Manager's, Bridge Owner's or Inspector's opinion, a non-critical defect is discovered that warrants short term monitoring to ensure that the defect's condition is stable, or that repairs or replacement is made before the defect can become critical.

The scheduling, interval and procedures of a special inspection shall be determined based on the judgment of a qualified engineer or Team Leader on a case-by-case basis. An inspection report will include information specifying the exact location of the defect requiring the special inspection, an explanation of the purpose of the special inspection, the frequency and the date of the next inspection, and space for inspector comments. The Special Inspection report must be added to the Owner's Bridge Record. NDOT has provided form DR 7 to assist in logging documentation of changes in condition observed for bridges with this type of inspection.

Bridges shall be removed from the special inspections list when the defect is repaired or removed, or when it has been determined by the responsible party that the condition is stable and does not warrant additional special inspections.

4.10.6 Procedures – Event-driven Special Inspections

4.10.6.1 Initial Inspection (New or reconstructed bridge)

The initial inspection of a bridge is a Special Inspection. The procedures to be used are those used for a routine inspection that verify the condition of the structure. These shall be entered into BrM as a Special Inspection and not an NBI Inspection.

A new or reconstructed bridge must have its initial inspection prior to opening to traffic to verify or provide all data for the SI&A. This is the baseline for the structure's conditions. At this inspection, a Team Leader should also verify the need for a Fracture Critical Inspection or an Underwater Inspection.

Bridges that have been reconstructed, (changed in configuration e.g. widening, lengthening, supplemental bents) or bridges that were repaired and reopened to public traffic must have an initial inspection prior to opening to traffic to verify or provide all data for the SI&A. This is the baseline for the structure's new condition.

Bridges with a change in ownership must also have an initial inspection to establish the baseline condition for the structure under the new Owner.

4.10.6.2 Damage Inspection

Damage Inspection is an event-driven (unscheduled) inspection to assess structural damage resulting from environmental or man-inflicted causes. Examples include a large storm event that has caused scour related damage, vehicular impact to a bridge that damages its load bearing elements, or vehicular impact to a bridge that damages its traffic safety related elements. For additional information, refer to Section 4.1.1 and 4.5.6.

The Bridge Owner must determine if the damage requires an emergency load restriction, lane closure, bridge closure or if a bridge has failed. If any of those conditions exist, a qualified Team Leader must complete a Damage Inspection and a Special Inspection in BrM for accident damage or natural disaster. Bridge Owners may need to engage a consultant to assist the Bridge Owner with the Damage Inspection and to assess the immediate action needed; this may include both a qualified Team Leader and/or a Bridge Engineer if the Team Leader is not a Bridge Engineer.

The scope of 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 affect a repair.

The amount of effort expended on this type of inspection will vary significantly depending upon the extent of the damage. If major damage has occurred, inspectors must evaluate fractured members, section loss, take measurements for misalignment of members and check for any loss of foundation support. Field measurements and calculations, and perhaps a more refined analysis to establish or adjust interim load restrictions may be necessary.

The Damage Inspection may be supplemented by a timely In-Depth Inspection to document more fully the extent of damage and the urgency and magnitude of repairs.

A Damage Inspection report should be made by the Bridge Owner to include in the Bridge Record. This is a custom report, and format and extent of this report will be dependent on the extent of the damage. The Program Manager may request this report. A particular awareness of the potential for litigation must be exercised in the documentation of Damage Inspections.

Damage Inspection Reporting	
Situation	**Report**
Damage to the structure requires corrective action to safeguard public safety or to protect the integrity of the asset, **and** Closure of the bridge is required.	Critical Findings Report with Bridge Damage Inspection Report
Damage to the structure requires corrective action to safeguard public safety or to protect the integrity of the asset. Closure of the bridge is **not** required.	Structure Repair Report or Structure Maintenance Check List (NDOT) Maintenance work order (non-state)

NDOT utilizes a Structure Repair Report, DR 321, to document needed repairs. The Maintenance Check List, DR 27, is used to document minor work that is typically completed by District maintenance personnel. See Section 4.12.2 in this Chapter.

Non-state Bridge Owners have maintenance work order systems that they use to report, document and affect the work. They may also use the DR forms for this purpose.

All Bridge Owners are to keep a maintenance history for each bridge in the Bridge Record. Repair and maintenance work orders or reports should also be filed with the Bridge Record.

4.11 CRITICAL FINDING REPORTING

4.11.1 Purpose

The purpose of the Critical Finding Report is to ensure that bridges with debilitating damage or defects are repaired in a proper and timely manner and that the damage and repairs are well documented for future reference. The NBIS requires that critical findings be reported periodically to FHWA. NDOT requires the use of DR 320 Critical Findings Report for reporting them, for Owners to determine their action plan and document its completion, and for notification to NDOT that the Critical Finding is closed. BrM has been updated to accept critical findings and Owners are encouraged to utilize this tool to record and track their Critical Findings.

4.11.2 Critical Findings Definition

The NBIS defines a critical finding as “a structural or safety related deficiency that requires an immediate follow-up inspection or action”.

Parties performing bridge inspections should use their training and sound judgment to assess a structure for conditions that are unsafe for the traveling public. Critical findings may be due to damage caused by traffic or a stream.

Conditions that constitute a critical finding include, but are not limited to the following (as defined by NDOT):

Condition of Critical Finding	Typically found by
A partial or complete collapse of the bridge	Inspection
Structural or other defects that pose a definite and immediate public safety hazard	Inspection, POA inspection
A load rating of less than 3 Tons	Load Rating
Missing load restriction signs	Inspection
Load posting greater than those shown on the most current LRSS	Inspection
Bridge not completely closed but closure is required	Inspection
Bridge closed due to a hydraulic issue	Inspection
A condition rating of 2 or less for any of the following Items: Deck, Item 58 Superstructure, Item 59 Substructure, Item 60 Culvert, Item 62 Channel and Channel Protection, Item 61	Inspection

Owners often can address posting/closure issues the same day it is discovered. In this case, the discovering party should verify the Owner has completed the required actions on the day of discovery and document this for their own and the Owner's records. If the required action is not complete, the discovering party should file a Critical Findings Report and deliver to the Owner.

In cases where it is possible that the bridge might be used safely at lower posted load limit, a load rating must be completed. Prior to the completion of the revised load rating, the inspector should close the bridge in this case. Load posting without a revised load rating for the critical finding is not an option. The results of the load rating determine whether the bridge may be opened again.

4.11.3 Responsibilities for Critical Findings Reporting and Follow-Up

Critical Finding discovery, immediate actions taken, actual work performed and follow-up must be recorded. The process is described below and shown in the following flowchart.

4.11.3.1 Discovering Party

The party discovering the Critical Finding should immediately notify the Owner. Critical Findings maybe discovered by inspection Team Leaders, Bridge Owner's staff, Load Rating Engineers or Hydraulic Engineers. The discovering party should complete the appropriate sections of the Critical Finding Report (CFR) and take the required measures given on the CFR. These actions include required notifications to the Bridge Owner, NDOT Program Manager and others. The CFR must be completed and submitted to the Bridge Owner within 48 hours of the discovery of the finding.

4.11.3.2 Bridge Owners

Bridge Owners have the ultimate responsibility for management of their structures for the public safety. Owners must:

- Report to NDOT any Critical Findings. The Bridge Owner may have a consultant complete portions of the Critical Findings Report. However, it is the responsibility of the Bridge Owner to report to the Program Manager.
- Report periodically to NDOT of the current status of the resolution of the critical finding (e.g. status of repair plans, expected date of completion, status of decision to remove). For structures with an open Critical Finding Report that are awaiting funding to replace or repair bridge, Owners should send NDOT CFR updates every 6 months and notify the Program Manager when the action to address the find is completed.

4.11.3.3 Nebraska Department of Transportation

NDOT's Bridge Inspection Program Manager must report to FHWA periodically, or as requested by FHWA, all Critical Findings and the corrective action for the finding.

4.11.3.4 Consultants Performing Services for Bridge Owners

It is the responsibility of the Consultants to be familiar with NDOT and FHWA policies, and to follow procedures related to notifications and preparation of the report as described herein.

4.11.4 Procedures for the Critical Finding Report Form DR 320

DR Form 320 and the instructions for completing this form, DR 320i, are available from the State Bridge Office or may be downloaded from the NDOT web site. This form and instruction are revised periodically.

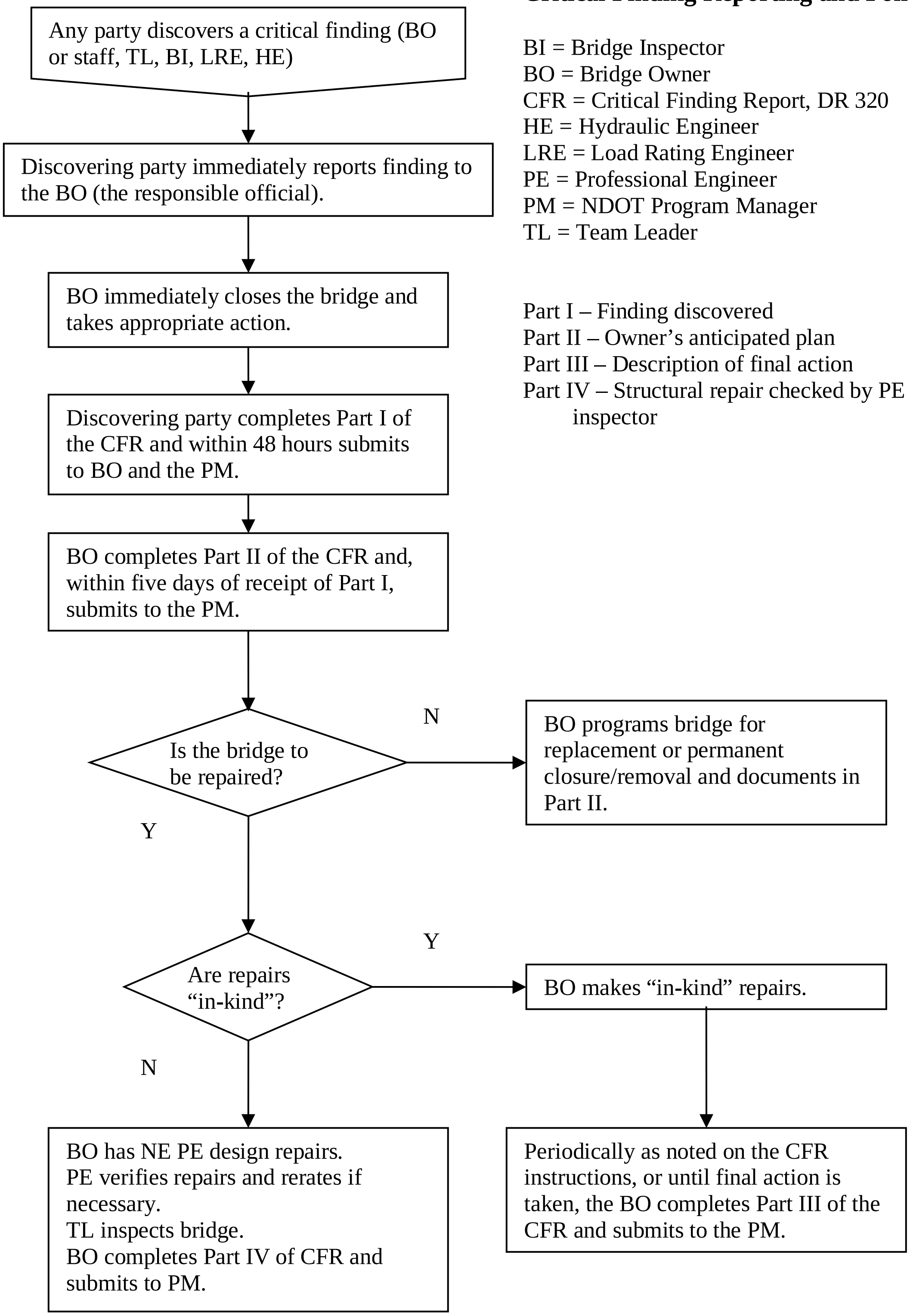
DR Form 320 includes individual parts for unique action from the discovering party and the Bridge Owner along with timeframes for completion of each part.

- Part I documents the Critical Finding and data pertinent to the finding. It is to be completed by the individual who discovers the critical finding, usually a Team Leader or a Load Rating Engineer, but may be another party who represents the Bridge Owner, such as maintenance staff.
- Part II documents the anticipated plan to address the finding and data pertinent to this plan. It is to be completed by a responsible official for the Bridge Owner
- Part III documents the action taken to address the finding and data pertinent to the final action. It is to be completed by a responsible official for the Bridge Owner.
- Part IV documents data related to structural repairs made to correct the finding. It is to be completed by a responsible official for the Bridge Owner.

Critical Finding Reporting and Follow-up

BI = Bridge Inspector
BO = Bridge Owner
CFR = Critical Finding Report, DR 320
HE = Hydraulic Engineer
LRE = Load Rating Engineer
PE = Professional Engineer
PM = NDOT Program Manager
TL = Team Leader

Part I – Finding discovered
Part II – Owner's anticipated plan
Part III – Description of final action
Part IV – Structural repair checked by PE & inspector



4.12 NON-CRITICAL FINDING REPORTING – REPAIR AND MAINTENANCE

4.12.1 Purpose

Non-critical findings include items of repair or maintenance. See Chapter 1 Bridge Program Requirements for definitions used for repair, maintenance and reconstruction. Some Nebraska Local Bridge Owners have processes and systems in place to accomplish maintenance and repair tracking and the documentation of completion. Those who do not have such a system in place are encouraged to use BrM to document and track repairs and maintenance items or to use NDOT forms.

4.12.2 Structure Maintenance Checklist Form DR 27

The Structure Maintenance Checklist includes a listing of typical maintenance work done on bridges. Examples of maintenance include wash the bridge, sweep the deck, clean dirt off bearings, or clean debris from deck expansion devices.

The Checklist is prepared by the Owner’s staff or a bridge inspector who notes the need for maintenance.

On the Checklist, the Owner records the date and details of the corrective action taken and files the Checklist in the Bridge File.

4.12.3 Structure Repair Report Form DR 321

The Structure Repair Report, DR 321, is used to document repair to a bridge that does **not** require closure and is **NOT** a critical finding. See the prior section of this Chapter.

A Structure Repair Report is prepared by the inspector, or other party that may have discovered the damage or condition needing repair. The Report alerts the Bridge Owner so that repairs can be planned and completed in a timely manner and documented for future reference. Examples of damage that require reporting include vehicular impact to traffic safety devices, serious concrete deck spalling, shoulder erosion, and damage to substructure from debris.

The Structure Repair Report includes individual sections for specific actions.

The originator of the report, typically an inspector, records the structure information and the description and the cause of the damage.

The originator sends the Report to the Bridge Owner.

The Bridge Owner assesses the reported conditions and makes an initial determination whether the corrective action will need the involvement of a Bridge Engineer and plans to complete the repairs, or if the repairs can be made by Owner's maintenance personnel. (See the Chapter 1 for guidance for situations that require the involvement of a PE.)

The Owner records on the Structure Repair Report the date and details of the corrective action taken and files the Report in the Bridge File.

4.13 BRIDGE INSPECTION AND COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT

Program participants that visit bridge sites in Nebraska should be aware that there are environmental restrictions and responsibilities that need to be adhered to at these sites.

A Programmatic Agreement (PA) between FHWA and NDOT for visual bridge inspections is agreed upon annually. The current agreement may be requested from NDOT Bridge Division.

This PA was developed to outline the policy and procedures for environmentally approved federally-funded actions that involve specific transportation improvement activities.

All questions related to visual bridge inspection and biological resources should be directed to NDOT Bridge Division.

Based on past experiences with similar actions, the FHWA has determined that visual bridge inspection activities do not involve significant environmental impacts. The PA included these two stipulations:

Stipulation 1: NDOT agrees to review actions environmentally approved by this programmatic agreement to ensure unusual circumstances as outlined by 23 CFR 771.117(b) do not exist. If an unusual circumstance is identified, NDOT will coordinate with FHWA for guidance. From 23 CFR 771.117(b),

“Such unusual circumstances include:

1. Significant environmental impacts;
2. Substantial controversy on environmental grounds;
3. Significant impact on properties protected by section 4(f) of the DOT Act or section 106 of the National Historic Preservation act; or
4. Inconsistencies with any Federal, State, or local law, requirement or administrative determination relating to the environmental aspects of the action.”

Stipulation 2: NDOT agrees to the following conditions of bridge inspection:

- During bridge inspection, noise will be kept to a minimum to avoid disturbing nesting or roosting birds.
- Any nest containing eggs or young shall be left undisturbed.
- No physical samples will be taken from the bridge, nor geotechnical samples collected.

The bridge inspection staff and/or contractor shall not store or stockpile materials and equipment in known/potential wetlands and/or known/potential streams that exhibit a clear “bed and bank” channel. Potential wetland areas consist of any area that is known to pond water, swampy areas or areas supporting known wetland vegetation (e.g. cattails, bulrush, canary reed grass, smartweed, or areas where there is a distinct difference in vegetation (at lower elevations) from the surrounding uplands areas.

4.14 MEDIA INQUIRY PROCEDURES AND CONFIDENTIALITY

Nationwide there has been increased interest in the condition of the nation's bridges. Terminology used in bridge inspection programs can and have been taken out of context in media reports and have been reported inaccurately. The media may approach inspection or other staff regarding the work they are completing for Bridge Owners (inspection, field assessments, etc.). All media inquiries made to any Owner inspector, Consultant inspector or other staff reviewing or investigating a bridge will be referred to the Owner's Public Relations Office.

Information collected and recorded by all persons participating in the Nebraska Bridge Inspection Program is for the use of the Bridge Owners, the Nebraska Department of Transportation and the Federal Highway Administration. Any information collected and recorded as part of this Bridge Inspection Program should not be released to any party not part of this program unless specifically authorized by the Bridge Owner. Program participants should contact the Program Manager for guidance if they have questions.

4.15 QUALITY CONTROL

The NBIS defines 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.”

Quality Control is defined for NDOT’s program as a system of routine technical activities, to measure and control the quality of the bridge inventory data or report as it is being developed. The QC system is designed to include general methods such as accuracy checks on data acquisition and calculations, and the use of approved standardized procedures for measurement, calculation, recording information and reporting. QC activities include:

- Documents, data, or calculations signed by a PE, must have QC completed by an individual of equivalent or better qualifications than the originator (this is typically documented when the QC individual signs or initials the documents).
- See that the technical activity has followed procedures set by NDOT.
- Providing routine and consistent checks for data integrity, correctness and completeness.
- Identifying and address errors and/or omissions.
- Documenting inventory data.
- Recording all QC activities.

Quality Control for this program is the responsibility of the consultant or agency actually conducting the activity. Quality Control checks are conducted on every product of a program operation, and thus at a much higher frequency than quality assurance checks. When the QC on a program product is complete, it is finished and deliverable to the Bridge Owner for their records.

Consultants providing professional services to Bridge Owners must submit a Quality Control plan to the Bridge Owner for review and approval. QC must be done on the deliverables prior to submittal to the Bridge Owner.

4.16 QUALITY ASSURANCE

Quality Assurance (QA) of all activities of the Bridge Inventory will be performed by NDOT or their selected agent. The QA program activities are described in Chapter 1 of this Manual.

4.17 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1
2	2013 March 04	Revision 2
3	2015 March 15	Revision 3
4	2016 March 11	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

4.18 FORMS

Forms used in completing inspections that are mentioned in this Chapter are listed below. Participants and contributors to the Nebraska Bridge Inspection Program are advised to go to the NDOT Bridge Inspection Program website for the current list of applicable forms and the most recent versions of each form. http://dot.nebraska.gov/business-center/bridge/inspection/.

Name	DR Form
Special Inspection – Bridge Report	7
Structure Maintenance Checklist	27
Complex Bridge – Unusual Feature Inspection List	29
Fracture Critical Inspection Report, Bridge Orientation/Layout	293
Fracture Critical Inspection Report, Introduction	293a
Fracture Critical Inspection Report, Identification of All Fracture Critical Member/Details	293b
Fracture Critical Procedural Report	293c
Fracture Critical Inspection Report, General Structure Condition	293d
Fracture Critical Inspection Report, Summary and Conclusions	293e
Fracture Critical Inspection Report, Follow-up Procedure	293g
Bridge Inspection Field Sketch Template	319
Critical Finding Report	320
Critical Finding Report, Instructions	320i
Structure Repair Report	321
Underwater Inspection Report	600-607
Fracture Critical Inspection Photos	293p
Fracture Critical Inspection Instructions	293i

4.19 APPENDIX

Memos and other guidance that may have been issued after the issuance of the current revision of this Chapter can be found at the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/.

Bridge Owners and Inspectors are urged to check this site to ensure they have all the most current information and forms.

i

5.1 GENERAL

The intent of these procedures is to provide guidance and direction on proper load rating and load posting of bridges.

The load rating will be an evaluation of the load carrying capacity of the entire structure; including the superstructure, deck, substructure, and their connections. Bridge conditions change over time and so will the load rating. The load rating will be determined by a professional engineer and determined by calculations, engineering judgment and/or load testing of the bridge.

Bridge Owners must have a valid, current load rating in the form of the Load Rating Summary Sheet (LRSS) in the Bridge File. A valid load rating must be prepared by a Nebraska Professional Engineer, be based on a documented condition codes at the time of the load rating, and must be supported by calculations.

Owners must install load posting signs for load restrictions shown on the LRSS.

All bridges with a load rating less than 3 tons for any legal Nebraska truck at operating level shall be closed and barricaded to all traffic. A detail for a permanent closure is in the Manual Appendix.

NOTE:

AASHTOWare Bridge Rating analytical software (AASHTOWare BrR) is a software program developed by AASHTO that allows a user to load rate a bridge superstructure in accordance with the AASHTO *Manual for Condition Evaluation of Bridges*, AASHTO *Manual for Bridge Evaluation*, AASHTO Standard Specification and AASHTO LRFD Specification.

NDOT policy requires that all load ratings for structures in Nebraska must be completed using AASHTOWare BrR, if applicable, starting January 2017.

5.2 REFERENCES

The information in this Bridge Inspection Program Manual supplements requirements, procedures and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP)

The References list of applicable documents is included in the Manual Appendix. The National Bridge Inspection Standards are also included in the Manual.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in National Bridge Inspection Standards, the AASHTO *Manual for Bridge Evaluation*, and FHWA publications, technical advisories and publications related to the NBIS.

Persons involved with load rating of structures must be knowledgeable of these references. The information in this Bridge Inspection Program Manual supplements the information in these references.

- AASHTO *Manual for Bridge Evaluation*, 2nd edition with 2010, 2011, 2013, 2014, 2015, and 2016 Interim Revisions (MBE)
- AASHTO *Standard Specifications for Highway Bridges*, 17th Edition
- AASHTO *LRFD Bridge Design Specifications*, 7th Edition with 2016 Interim Revisions

5.3 ROLES AND RESPONSIBILITIES

5.3.1 Bridge Owners

Bridge Owners in Nebraska include the Nebraska Department of Transportation, cities, municipalities, counties, and private owners of bridges being used by the public.

Bridge Owners are responsible for:

- Ensuring bridges under their authority have a current bridge load rating and a current Load Rating Summary Sheet (LRSS) in the Bridge Record.
- The Owner shall submit a copy of the signed and sealed Load Rating Summary Sheet to NDOT and retain the original signed by the LRE in the Individual Bridge Record.
- Having the bridge properly posted, if posting is required, as specified in this Chapter.
- Providing documentation of revised load posting to NDOT, as specified in this Chapter.
- Ensuring new bridges are placed into the Bridge Inventory and that the bridge data and load rating are submitted to NDOT as required in this Manual.
- Maintaining a complete Bridge File with complete Individual Bridge Records in their local office (See Chapter 2, Bridge Inspection Program, Records).
- Completing, or ensuring completion (consultant, etc.), of Quality Control (QC) of the load ratings completed for bridges under their authority.
- Closing their bridges for critical findings and maintaining the bridge closure barricades.

5.3.2 Nebraska Department of Transportation

NDOT is responsible for:

- Ensuring Bridge Owners are in compliance with the National Bridge Inspection Standards as given in Title 23 CFR Part 650 Subpart C, Bridges Structures and Hydraulics.
- Setting policy for bridge posting/closure.
- Setting policy for bridge load rating.
- Completing Quality Assurance (QA) on the data provided for the National Bridge Inventory by the Bridge Owners for compliance with Federal regulations.

The NDOT ftp site is a repository of bridge data including bridge plans, pictures and other records. This repository does not constitute the Bridge Owner's official Bridge File. Bridge Owners must maintain the official Bridge File on site (See Chapter 2, Bridge Inspection Program Records).

5.3.3 Load Rating Engineer

The Load Rating Engineer (LRE) may be an employee of the Bridge Owner's organization, or may be an engineer from a Consultant firm. LRE qualifications are described in the Chapter 1, Bridge Inspection Program. The LRE should use sound engineering judgment when completing load ratings and when using the provisions of this Manual.

The LRE is responsible for the data that is submitted to NDOT for the National Bridge Inventory and seals and signs the original LRSS with their NE Professional Engineers seal. The LRE is responsible for delivering the completed LRSS to the Owner. The LRE of record is responsible for ensuring that an engineer of equal or better qualifications than the Analyst completes QC on the load rating calculations and the LRSS prior to submittal to the Owner.

5.3.4 Consultants Performing Ratings for Bridge Owners

Consultants are responsible for being familiar with NDOT Bridge Inspection Program policies and procedures. Consultants performing load ratings for Bridge Owners are responsible for Quality Control on their work for accuracy and completeness.

5.4 DEADLINES FOR LOAD POSTING/CLOSURE AND SUBMITTAL REQUIREMENTS FOR LOAD RATINGS

5.4.1 Deadline for Posting Bridge Weight Limit Signs

Bridge Owners must **install weight limit signs as soon as possible**, but **no later than 60 days** of receipt of the Load Rating Summary Sheet from the LRE. This is very important since load postings typically drop due to deterioration or damage to the structure.

Bridge Owners must **provide documentation** of revised load postings or bridge closures to NDOT **no later than 30 days** after the load posting signs or barricades are installed. This documentation is typically in the form of photos from each end of the bridge showing the in-place load posting signs.

5.4.2 Deadline for Bridge Closures

Bridge Owner must install permanent closure barricades immediately upon notification of the need to close.

Bridge Owner must provide documentation of Closure to NDOT **within 3 days** of barricade installation. This documentation is typically in the form of photos from each end of the bridge showing the barricades in place.

5.4.3 Submittal of Load Rating Reports to NDOT

Load Ratings Reports for new or reconstructed bridges must be submitted to NDOT prior to opening the bridge to traffic.

Bridge Owners and their LRE are responsible for determining when a bridge must be re-rated, typically after a routine or special inspection of damage. Load ratings required due to damage or deterioration shall be re-load rated within 60 days of the date of bridge inspection.

NDOT requires that participants generating data and supporting reports submit them to NDOT as soon as QC has been completed, but no later than 90 days of any change in inventory data. Load Rating Reports that result in a change to any inventory data must be submitted to NDOT after they are completed.

5.5 BRIDGE PLAN INFORMATION FOR LOAD RATING

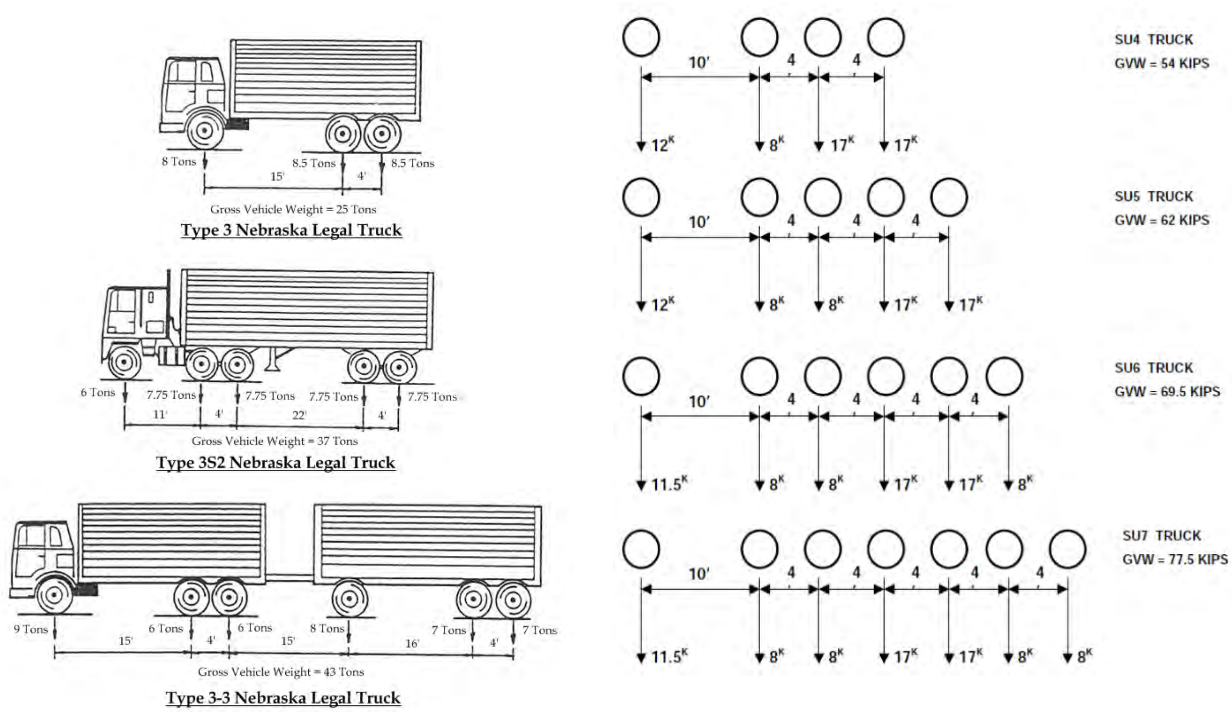
Bridge Owners must keep information needed for load rating and structural analysis for their bridges under their jurisdiction. See Chapter 2, Bridge Inspection Program Records covering Owner's records.

NDOT has developed a Bridge Document Management System (BDMS) that is an archive of data and plans that have been compiled from information available from a variety of sources for both state and non-state bridges. The BDMS contains plans, measurements, shop plans, inspection reports, inspection photos and load rating information. NDOT can only accept plans in electronic format for inclusion in the archive.

This ftp site is available for Bridge Owners, FHWA and consultants via password. Bridge Owners may use the ftp site as a location for backup of their documents. Bridge Owners must still maintain the official Bridge File on site (See Chapter 2, Bridge Inspection Program Records).

5.6 NEBRASKA LEGAL TRUCKS

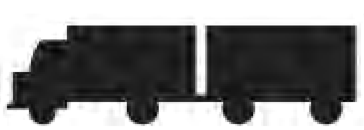
Load ratings are completed for seven types of legal trucks as well as for design loading as required by AASHTO. Type 3 and Special Hauling Vehicles (SHVs) SU4, SU5, SU6, and SU7 are all single units. Load rating vehicles are representative of trucks typically using roads in the United States.



Nebraska Legal Trucks

- Single Unit Truck: Type 3 and SU4, SU5, SU6, and SU7

- Type 3S2



- Type 3-3

Typical Truck Configurations for Posting Sign

These photos generally depict the configuration of each legal truck.

NE Type 3

NE Type 3S2

NE Type 3-3

These photos generally depict the configuration of the SHVs.

SU4

SU5

SU6

SU7

Nebraska is required to follow the Manual for Uniform Traffic Control Devices (MUTCD) to determine what signs and silhouettes are allowed for bridge posting purposes.

The symbols shown below are the only silhouettes allowed on a posting sign.

R12-5

Because every possible vehicle configuration cannot be represented on a sign, typical configurations are used to show easily recognizable vehicles. Special Hauling Vehicles (SHVs) fall under the top silhouette showing a straight single unit truck. The SHVs have 4 to 7 axels, which make interpretation of the sign essential for truck drivers and law enforcement.

The sign above represents that Single Unit Trucks (SUTs), top truck at 30 Ton are only restricted for SU5, SU6 and SU7; NE Type 3S2, middle truck is restricted at 33 Ton; NE Type 3-3, bottom truck is not restricted. However, by law, all bridges are restricted at Nebraska legal load limits whether posted or not. See Nebraska Statue 60-6,294 for more information.

Signs apply to the gross vehicle weight irrelevant of how short the bridge may be.

See examples of vehicles governed by a given silhouette and their legal maximum load limits earlier in this section.

5.7 BRIDGE LOAD POSTING

5.7.1 General

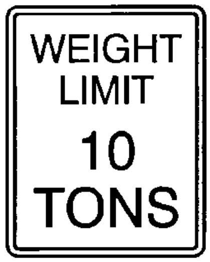
The Bridge Owner must have a current load rating in the Individual Bridge Record at the Owner's office. The load rating shall be prepared by a Load Rating Engineer and documented on the Load Rating Summary Sheet which shall be accessible to determine load capacities and postings.

As a general rule, bridges capable of carrying Nebraska legal truck loads do not require posting. A bridge shall be load posted at the Recommended Positing from the LRE shown on the LRSS for the Nebraska legal trucks. All bridges requiring posting shall be posted at the operating level or below. All bridges with a load rating less than 3 Tons at the operating level for any legal truck shall be closed and barricaded to all traffic.

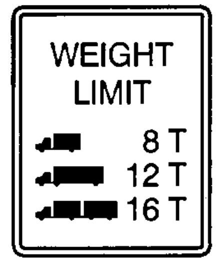
Bridge Owners or their consultant LRE are responsible for reviewing inspection reports and assessing the structures regarding the need to revise the load rating. The LRE notifies the Bridge Owners if a structure's load rating indicates load posting is required or if the bridge should be closed due to the load rating.

See Section 5.4, Deadlines for this work in this Chapter.

5.7.2 Bridge Weight Limit Signs



R12-1
24"x30"
White with black letters



R12-5
30"X36"
White with black letters

The weight limit sign shall be used to indicate restrictions pertaining to total vehicle weight including cargo.

The R12-5 three-truck sign shall be used on all Arterial and Collector Roads as classified by the NE Board of Public Roads Classifications and Standards. The R12-5 sign shall also be used on roads classified as Local Roads when the local road experiences heavy vehicles that support a site specific operation, such as a feed lot.

NDOT highly recommends that Bridge Owners use the R12-5 sign showing three truck-posting for **all** structures that require load posting. Note that on the R12-5 sign, the top line showing the Type Single Unit (TSU) tonnage is governed by the lowest of Nebraska Type 3, SU4, SU5, SU6 or SU7. The R12-1 single limit sign, which would show the lowest tonnage truck, unnecessarily limits the use of the structure.

For examples of vehicles governed by a given truck and their legal maximum load limits see Section 5.6, Nebraska Legal Trucks.

Weight limit signs should be installed in accordance with the Manual on Uniform Traffic Control Devices. NDOT also recommends that advance notice signs be installed at the intersections closest to the load posted bridge.

5.7.3 Data from the Load Rating Summary Sheet

For reference, a full Load Rating Summary Sheet (LRSS) example can be found in Section 5.11.2.

In the "Ratings and Loads" section, the "Legal" column contains the values **calculated** by the LRE for each of the Nebraska legal trucks.

The Owner shall not load post a bridge higher than values shown in the LRSS.

- **If any values shown in the LRSS are <u>less</u> than the gross vehicle weight (GVW) for the Nebraska trucks, then the bridge must be load posted.**
- The GVW for the seven truck types are as follows:

Type 3	Type 3S2	Type 3-3	
25 Tons	37 Tons	43 Tons	
SU4	**SU5**	**SU6**	**SU 7**
27 Tons	31 Tons	34.75 Tons	38.75 Tons

- If any values shown in the LRSS are **more** than the gross vehicle weight for the Nebraska trucks, no load posting is required for that vehicle.
- A value of "N/A" indicates that posting is not required for that specific truck. If a sign is installed for that truck, the gross vehicle weight for the Nebraska legal weight should be on the sign **(TSU = 25 Tons [Type 3 governs], Type N3S2 = 37 Tons, and Type N3-3 = 43 Tons).**

See the example that follows.

The LRSS shows these values.

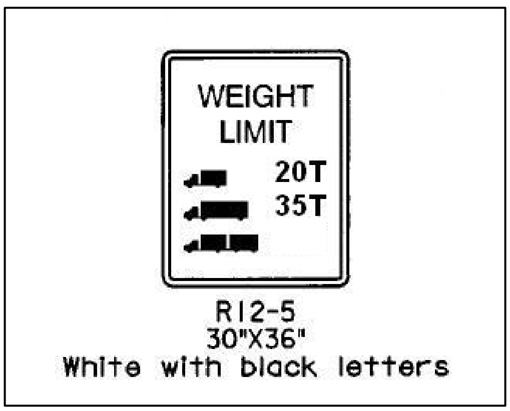
Ratings and Loads

Deck (058) : 8 Very Good Superstructure (059) : 7 Good Substru (0

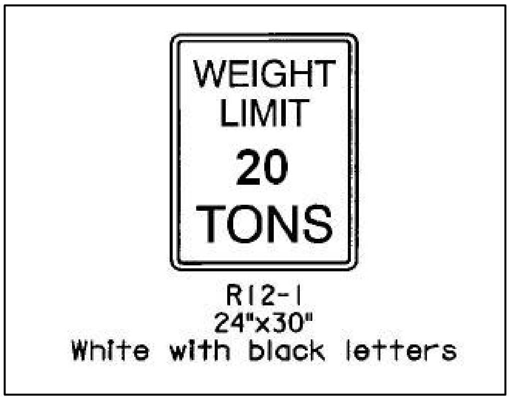
Design Load (031) : 4 M 18 (H 20)
Operating Type (063) : 1 LF Load Factor Wearing Sur
Inventory Type (065) : 1 LF Load Factor

Truck	Inventory Rating		Operating Rating		Legal		Posting Value (tons)
	Rating Factor	Tons	Rating Factor	Tons	Rating Factor	Tons	
HS-20	0.58	11.6					N/A
HS-20			0.71	25.5			N/A
SU4					0.84	20.1	-
SU5					0.76	23.5	-
SU6					0.68	23.6	-
SU7					0.64	24.8	-
NE Type 3					0.94	23.5	20
NE Type 3S2					0.97	35.8	35
NE Type 3-3					1.04	44.7	43
EV2					0.49	14.00	14
EV3					0.35	15.13	15

The three-truck posting sign would look like the following. Note the Type Single Unit is controlled by the SU4 loading and this value is placed in the “Recommended Posting” location for the Type 3 vehicle. Also, since the capacity of the bridge for the Type 3-3 vehicle exceeds the vehicles weight, the legal load is blank on the sign.



The single-truck posting sign would look like the following. Note that NDOT recommends using the three-truck sign for all roads. An Owner may use the single-truck signs, but only on local roads.



5.8 SITUATIONS REQUIRING NEW OR UPDATED LOAD RATING OR ASSESSMENT

There are certain situations where a new or revised load rating is required. There are other cases where an LRE assessment of the structure is required, and the LRE determines the need for a load rating. These cases are described in this Section.

5.8.1 New Bridges

All new bridges shall be load rated prior to opening to public traffic.

5.8.2 Reconstructed Bridges

Bridges that have been reconstructed as per BIP 1.3.3.2.3 may require load rating if the work has altered the structural or geometric capacity.

5.8.3 Repaired Bridges

Repair, in general, is work to bring the bridge back to its prior condition. Repairs are often made due to deterioration (typically section loss) for a Critical Finding found during inspection. There usually is no need for a Professional Engineer (PE) to develop plans for this work; however, repair often corrects a deficiency that, when repaired, increases load capacity and likely the load rating. In these cases a LRE must assess the structure to determine if a load rating needs to be competed.

Examples include:

- Girder end repairs
- Emergency repair consists of any repair or alteration of a damaged element (e.g. girder stuck by over-height vehicle)
- Repair to address a critical finding or another finding

5.8.4 Change in Condition Found During Inspection

Existing bridges that are found during inspection to have additional member section loss or damage affecting section properties observed as compared to the prior inspection shall be assessed by a LRE for possible rerating.

The following situations for Item 58 Deck, Item 59 Superstructure, Item 60 Substructure, Item 62 Culverts, or NE Item 320 Piling may also trigger an assessment by a LRE for possible rerating

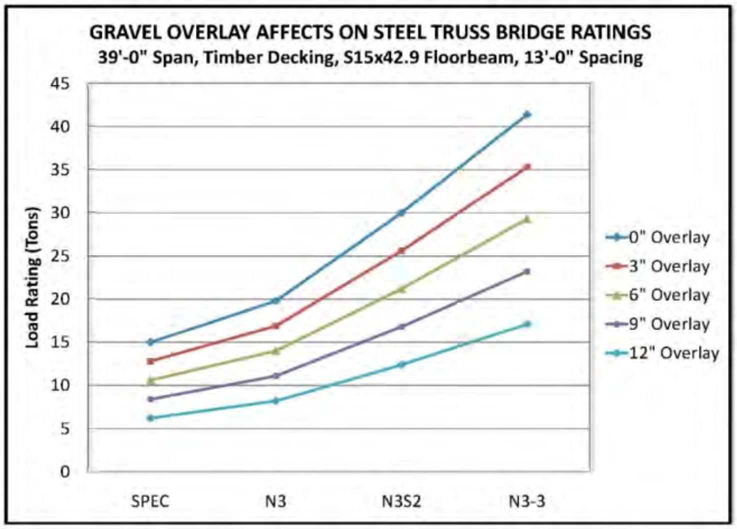
- Condition rating drops to 4, Poor Condition; or 3, Serious Condition
- In the judgment of the inspector the condition is significantly different relative to that shown on the LRSS

Note that when a bridge inspection results in the condition rating (Item 58 Deck, Item 59 Superstructure Item 60 Substructure, Item 62 Culvert, or NE Item 320 Piling) of 2 or less, the structure should be closed to traffic.

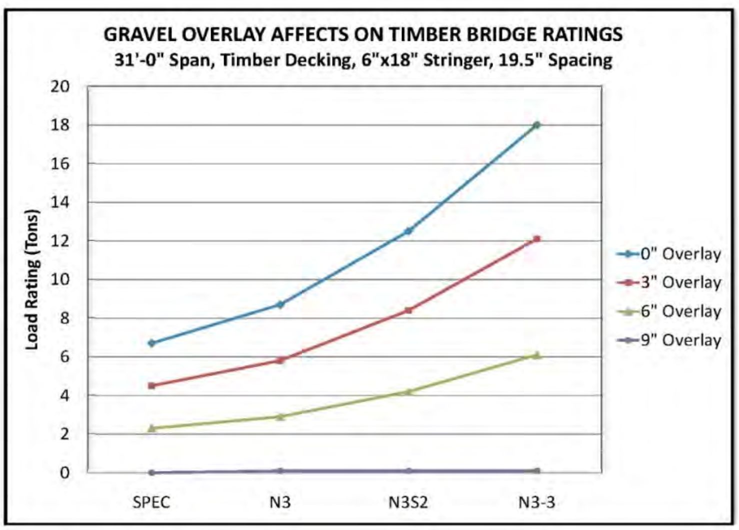
5.8.5 Change in Overburden Dead Load

Existing bridges that are found during inspection to be supporting increased dead load, such as a thicker layer of gravel, or having received an overlay of an existing deck, shall be assessed by a LRE to determine if it will be rerated. Similarly, bridges that have been cleaned of gravel should be load rated for the new conditions.

Excessive overburden of gravel significantly affects the available load capacity. The following graphs, for illustrative purposes only, show the dramatic reduction in available capacity with increasing thickness of gravel overburden for various Nebraska legal truck types and for two structure types that are typical in rural Nebraska. The Special Vehicle shown in the following graphs is a typical modern tractor pulling a grain wagon with a single 25 Ton axle.



Floor Beams of a Three-panel Pony Truss



Timber Stringer Bridge

5.9 INVENTORY ITEMS RELATED TO DESIGN LOAD, RATING AND POSTING

The LRE determines the values shown in the following table.

NBIS and NE Inventory Items related to Design Load, Load Rating and Load Posting

S = static item – typically don't change each inspection cycle
D = dynamic item – may change each inspection cycle
I = initial entry
V = verify, notify BIP Program Manager of changes on marked up SI&A sheet
E = enter into BrM when changed
P = prepared by

Item No.	Item Name	Static/	PM Staff	TL	LRE	Coding (See Chapter 3 Bridge Inventory Coding for complete detail.)
31	Design Load	S	I			
41	Structure Open/Posted/Closed	D	I	E		Actual operational as found by the inspector B – open, posting recommended but not implemented K – bridge closed P – posted
63	Method Used To Determine Operating Rating	D	E		P	
64	Operating Rating	D	E		P	Calculated (NDOT requires Rating factor)
65	Method Used To Determine Inventory Rating	D	E		P	
66	Inventory Rating	D	E		P	Calculated (NDOT requires Rating factor)
70	Bridge Posting	D	E			Office calculated for current condition 5 – no posting required 4 or less – posting required
203A	Posted Weight Limit Truck 1*	D		E		As found by the TL
203B	Posted Weight Limit Truck 2	D		E		As found by the TL
203C	Posted Weight Limit Truck 3	D		E		As found by the TL
380	Percent of Stress Reduction					Void
381	Rating Program Used		E		P	
384	HS Inventory Rating					No longer used in the NE Inventory
385	HS Operating Rating					No longer used in the NE Inventory
386A	Load Rating for NE Legal truck, Type 3, SU4, SU5, SU6 or SU7	D	E		P	Recommended for current bridge condition
386B	Load Rating for NE Legal truck, Type 3S2	D	E		P	Recommended for current bridge condition
386C	Load Rating for NE Legal truck, Type 3-3	D	E		P	Recommended for current bridge condition

* This is the governing weight limit of the following vehicles: NE Legal Truck Type 3 and SHVs SU4, SU5, SU6, and SU7

Load Rating Engineers must be familiar with FHWA Memorandum *Bridge Load Ratings for the National Bridge Inventory*, October 30, 2006. FHWA advises reporting in rating factors, versus Tons, for all structures. Coding methods were revised in 2004 to allow reporting of rating factors for all rating methods (Load and Resistance Factor, Load Factor and Allowable Stress). In 2012, NDOT began reporting rating factors to FHWA.

FHWA further made revisions to Coding for several items. See these FHWA Memorandums:

- *Bridge Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges (Coding Guide) – Item 31, Design Load, and Items 63 and 65, Method Used to Determine Operating and Inventory Ratings*, February 2, 2011.
- *Revisions to the Recording and Coding Guide for the Structure, Inventory, and Appraisal of the Nation's Bridges (Coding Guide) Items 63 and 65, Method Used to Determine Operating and Inventory Rating,* November 15, 2011.

5.10 LOAD RATING VEHICLES

Illustrations of the Nebraska legal trucks (including SHVs) are shown previously in Section 5.6. These illustrations show the axle spacing and axle loads. The following table summarizes these trucks.

Vehicle Type	Type	NE ID for load rating	AASHTO Weight	Nebraska Legal Weight	Wheel Load (half axle)
H20	Design		20 Tons	n/a	16,000 lbs
HS20	Design		36 Tons	n/a	16,000 lbs
H12.5	Design			12.5 Tons	10,000 lbs
HS12.5	Design			22.5 Tons	10,000 lbs
Type 3	Load Rtg	3*	25 Tons	25 Tons**	8,500 lbs
Type 3S2	Load Rtg	N3S2	36 Tons	37 Tons**	7,750 lbs
Type 3-3	Load Rtg	N3-3	40 Tons	43 Tons**	9,000 lbs
SHV SU4	Load Rtg	SU4	27 Tons	27 Tons**	8,500 lbs
SHV SU5	Load Rtg	SU5	31 Tons	31 Tons**	8,500 lbs
SHV SU6	Load Rtg	SU6	34.75 Tons	34.75 Tons**	8,500 lbs
SHV SU7	Load Rtg	SU7	38.75 Tons	38.75 Tons**	8,500 lbs
HL-93	Design		36 Tons***	n/a	16,000 lbs

* AASHTO Type 3 and Nebraska Type 3 have same axle weight and spacing.
** Nebraska Rating Vehicles
*** Truck Only. Consult the AASHTO MBE for lane live loads and for loading in spans greater than 200 feet.

NBIS Inventory and Operating Ratings (Items 64 and 66) must be calculated for the applicable AASHTO design truck for multiple lanes (where applicable) and impact.

Inventory (see Section 5.11.6.1) and Operating (see Section 5.11.6.2) load ratings must be calculated for the Nebraska legal trucks Type 3, Type N3S2, Type N3-3, SU4, SU5, SU6, and SU7 for multiple lanes (where applicable) and impact. Wheel loads for analysis shall be equal to half of the axle load for a given truck.

5.11 LOAD RATING DOCUMENTATION AND REPORT

It is important that the documentation of the load rating for each bridge is a complete record of the load rating. It should reference the inspection report and the inspection date that are the basis of the load rating. This will ensure that concise and complete data is available in the future should the structure need to be rerated due to structure modification or condition deterioration.

The Load Rating Report will include all load rating documentation and include the electronic file(s) used to perform the analysis. The Report will be sealed, signed and dated by the LRE, in accordance with the Nebraska Engineers and Architects Regulation Act.

5.11.1 Load Rating Report Contents

Load Rating Report at a minimum shall include the following:

- Load Rating Summary Sheet. It is recommended that the LRSS be the first page in the Report.
- The inspection report showing the inspection date and the condition that generated the need for rerating.
- AASHTOWare BrR model in .xml format.
- Any additional calculations required beyond the BrR model.
- Documentation of section reduction for members, if taken.

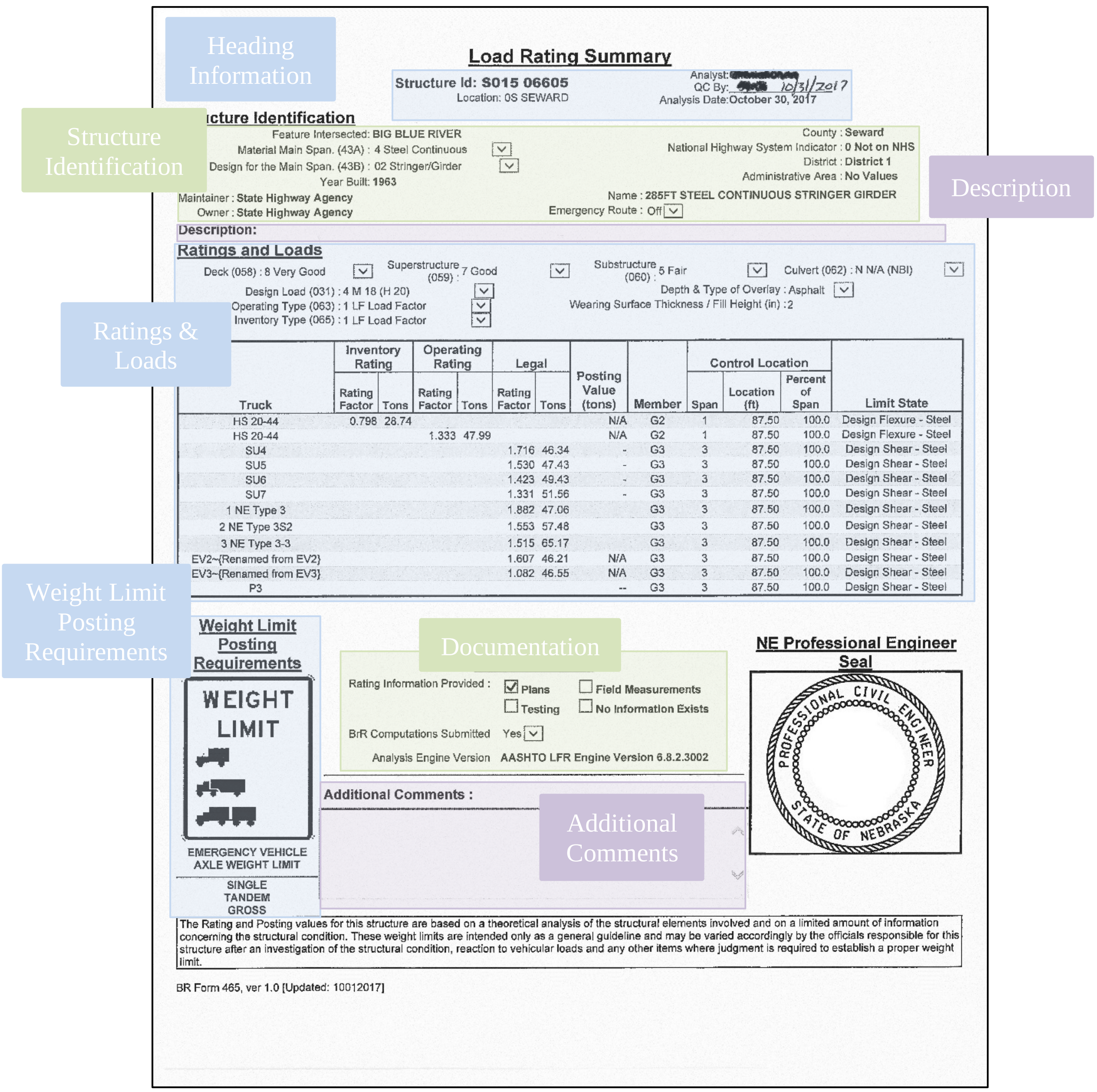
The person completing the QC shall initial and date all pages of the Report.

An electronic copy of the Report shall be submitted to NDOT. See Section 5.4, Deadlines in this Chapter. A copy must be furnished to NDOT either by the Owner or, at the direction of the Owner, by the LRE.

5.11.2 Load Rating Summary Sheet

All Nebraska bridges in the Bridge Inventory that are reported to FHWA will have a Load Rating Summary Sheet (LRSS). The LRSS includes a summary of the load rating results for AASHTO load, Nebraska legal trucks, and other general results and comments on the load rating. The LRSS summarizes key information related to the load rating and the life of the bridge. Instructions for completing the LRSS are provided with the form; additional guidance is given in this section.

The Bridge Owner retains the original sealed, signed and dated LRSS by the Load Rating Engineer in the Bridge Owner's Bridge Record.



Load Rating Summary

Structure Id: S015 06605
Location: 0S SEWARD

Analyst: [redacted]
QC By: [redacted] 10/31/2017
Analysis Date: October 30, 2017

Structure Identification

Feature Intersected: BIG BLUE RIVER
Material Main Span. (43A) : 4 Steel Continuous
Design for the Main Span. (43B) : 02 Stringer/Girder
Year Built: 1963
Maintainer : State Highway Agency
Owner : State Highway Agency

County : Seward
National Highway System Indicator : 0 Not on NHS
District : District 1
Administrative Area : No Values
Name : 285FT STEEL CONTINUOUS STRINGER GIRDER
Emergency Route : Off

Description:

Ratings and Loads

Deck (058) : 8 Very Good
Superstructure (059) : 7 Good
Substructure (060) : 5 Fair
Culvert (062) : N N/A (NBI)
Design Load (031) : 4 M 18 (H 20)
Operating Type (063) : 1 LF Load Factor
Inventory Type (065) : 1 LF Load Factor
Depth & Type of Overlay : Asphalt
Wearing Surface Thickness / Fill Height (in) : 2

	Inventory Rating		Operating Rating		Legal				Control Location			
Truck	Rating Factor	Tons	Rating Factor	Tons	Rating Factor	Tons	Posting Value (tons)	Member	Span	Location (ft)	Percent of Span	Limit State
HS 20-44	0.798	28.74					N/A	G2	1	87.50	100.0	Design Flexure - Steel
HS 20-44			1.333	47.99			N/A	G2	1	87.50	100.0	Design Flexure - Steel
SU4					1.716	46.34	-	G3	3	87.50	100.0	Design Shear - Steel
SU5					1.530	47.43	-	G3	3	87.50	100.0	Design Shear - Steel
SU6					1.423	49.43	-	G3	3	87.50	100.0	Design Shear - Steel
SU7					1.331	51.56	-	G3	3	87.50	100.0	Design Shear - Steel
1 NE Type 3					1.882	47.06		G3	3	87.50	100.0	Design Shear - Steel
2 NE Type 3S2					1.553	57.48		G3	3	87.50	100.0	Design Shear - Steel
3 NE Type 3-3					1.515	65.17		G3	3	87.50	100.0	Design Shear - Steel
EV2~{Renamed from EV2}					1.607	46.21	N/A	G3	3	87.50	100.0	Design Shear - Steel
EV3~{Renamed from EV3}					1.082	46.55	N/A	G3	3	87.50	100.0	Design Shear - Steel
P3							--	G3	3	87.50	100.0	Design Shear - Steel

Weight Limit Posting Requirements

WEIGHT LIMIT

EMERGENCY VEHICLE AXLE WEIGHT LIMIT
SINGLE
TANDEM
GROSS

Rating Information Provided : ☑ Plans ☐ Field Measurements ☐ Testing ☐ No Information Exists
BrR Computations Submitted Yes
Analysis Engine Version AASHTO LFR Engine Version 6.8.2.3002

Additional Comments :

NE Professional Engineer Seal

PROFESSIONAL ENGINEER
STATE OF NEBRASKA

The Rating and Posting values for this structure are based on a theoretical analysis of the structural elements involved and on a limited amount of information concerning the structural condition. These weight limits are intended only as a general guideline and may be varied accordingly by the officials responsible for this structure after an investigation of the structural condition, reaction to vehicular loads and any other items where judgment is required to establish a proper weight limit.

BR Form 465, ver 1.0 [Updated: 10012017]

5.11.2.1 Heading Information Section

- **Structure ID**: Enter the structure identification number.
- **Location**: Enter the bridge location.
- **Analyst**: This shall be the engineer performing the load rating. The Analyst can be the same as the Engineer of Record (the LRE) for the load rating. Enter the Analyst using the first initial and last name. For example, F. Last.
- **QC By**: This shall be an individual of equivalent or better qualifications than the analyst who has performed quality control of the load rating. Enter the QC individual using the first initial and last name. For example, F. Last. For more information on Quality Control see Section 5.12.
- **Analysis Date**: Enter the date that the load rating was performed in Month Day, Year format. For example February 22, 2017. If there are multiple days, use the latest date.

5.11.2.2 Structure Identification Section

- **Feature Intersected**: Enter the name of the major feature intersected by the structure.
- **Material Main Span**: Select the appropriate option from the dropdown menu.
- **Design for Main Span**: Select the appropriate option from the dropdown menu.
- **Year Built**: Enter the 4 digit year that the structure was built. If the year built is unknown, enter “Unknown” in the field.
- **Maintainer**: Select the appropriate option from the dropdown menu.
- **Owner**: Select the appropriate option from the dropdown menu.
- **County**: Select the appropriate option from the dropdown menu.
- **National Highway System Indicator**: Select the appropriate option from the dropdown menu.
- **District**: Select the appropriate option from the dropdown menu.
- **Administrative Area**: Select the appropriate option from the dropdown menu.
- **Name**: Enter the structure name, if applicable.

- **Emergency Route**: Select the appropriate option form the dropdown menu.

5.11.2.3 Description Section

This field should contain a brief description of the structure type and basic geometric layout. Enter information such as span lengths, continuous or simple spans, deck material and thickness, overlay material and thickness, and skew.

5.11.2.4 Ratings and Loads Section

- **Deck (058)**: Select the appropriate condition rating from the dropdown menu.
- **Superstructure (059)**: Select the appropriate condition rating from the dropdown menu.
- **Substructure (060)**: Select the appropriate condition rating from the dropdown menu.
- **Culvert (062)**: Select the appropriate condition rating from the dropdown menu.
- **Design Load (031)**: Select the appropriate option from the dropdown menu.
- **Operating Type (063)**: Select the appropriate option from the dropdown menu.
- **Inventory Type (065)**: Select the appropriate option from the dropdown menu.
- **Depth & Type of Overlay**: Enter the overlay material type. If there is no overlay, enter “None”.
- **Wearing Surface Thickness/Fill Height (in)**: Enter the thickness/height of the wearing surface or overlay in inches in decimal format. If there is no overlay, enter “None”.
- Rating Table:
    - **Truck** column: Four fields are available to the user to input AASHTO trucks evaluated during the load rating. Choose the desired truck from the dropdown menu.

- **Inventory Rating and Operating Rating** columns: These columns correspond to the AASHTO trucks. Enter the rating factor in decimal format to the thousandth place and the corresponding tonnage in decimal format to the hundredth place into the available fields. Note that Inventory Rating is the first line and Operating Rating is the second line
- **Legal** column: This column corresponds to the Nebraska Legal trucks, including Special Hauling Vehicles and Emergency Vehicles if required. Enter the rating factor in decimal format to the thousandth place and the corresponding tonnage in decimal format to the hundredth place into the available fields.
- **Posting Value** column: Since weight limit postings are based on the legal trucks and emergency vehicles (if required) the only editable fields are those associated with NE Type 3, NE Type 3S2, NE Type 3-3, EV2, and EV3. Enter the recommend posting in tons as the Legal tonnage rating rounded down to the nearest whole number. Note that the NE Type 3 posting will be the lowest tonnage of the Single Unit Truck Types (NE Type 3, SU4, SU5, SU6, and SU7).
- **Member** column: Enter the name of the member that controls the rating for the associated truck.
- **Control Location** columns: Enter the span number, the distance in feet from the start of the span, and percentage along the span at which the controlling location occurs for each truck.
- **Limit State** column: Enter the limit state which controls the rating for each associated truck.
- **Weight Limit Posting Requirements**: Enter the tonnages from the Recommended Posting (tons) column into the sign diagram as appropriate. For more information about load posting see Sections 5.6 and 5.7.

5.11.2.5 Documentation Section

- **Rating information provided**: Select the appropriate documentation available for the bridge. More than one option may be selected.
- **BrR Computations Submitted**: Select the appropriate option from the dropdown menu.
- **Analysis Engine Version**: Enter the version of the software utilized to perform the load rating.

5.11.2.6 Additional Comments Section

The purpose of the Additional Comments section of the LRSS is to provide a complete summary of the condition of the bridge, and is meant to convey key information needed by Highway Superintendents and their maintenance staff as well as engineers who might be rerating the bridge in the future. The comments should include the following:

- Statement of instructions to the Bridge Owner if posting sign revision is needed (see following examples)
- Date of inspection report documenting the condition that generated the need for rerating
- Documentation of critical findings and/or maintenance issues
- Recommendation to improve the load rating
- Bracing conditions considered in the load rating of timber stringers. For example, if planks are nailed into the top of the stringer or are encased in a concrete deck
- The effect of gusset plates in the structure on the load rating, especially if they govern the load rating
- The names of AASHTOWare BrR files for the load rating

Examples of comments would include these types of statements:

- "This bridge is currently posted at XX Tons."
- "This bridge is currently posted at XX, XX and XX Tons for truck TSU (type single unit), Type N3S2, and Type N3-3, respectively."
- "The bridge load rating is shown above, and is greater than the legal limits for Nebraska legal trucks; load posting is not required."
- "The bridge load rating is shown above, and is lower than the legal limits for Nebraska legal trucks; load posting is required."
- "The bridge load rating is shown above, and is lower than the current posting of XX Tons. Load posting must be adjusted accordingly."
- "This bridge is currently not posted. The bridge load rating is shown above and the bridge needs to be load posted accordingly."
- "This bridge has no existing plans. Based on the inspected condition of the structural elements, this bridge is deemed to safely support loads in accordance with the NDOT Bridge Rating Table for Concrete Bridges with No Existing Plans."

5.11.3 Load Rating Computational Means – General Guidance

The following table is a summary of computational means generally used by NDOT for load rating of bridges and is provided as guidance for those performing load ratings. The Load Rating Engineer for any bridge is responsible for using good engineering judgment in the selection of the appropriate computational means.

General Guidance on Load Rating Computational Means	
Superstructure Element	
Concrete slab, simple and continuous	AASHTOWare BrR
Concrete girder, CIP, simple and continuous	AASHTOWare BrR
PS Concrete slab, continuous	Structural analysis software or other custom tools
PS Concrete NU or AASHTO girder, simple and continuous	AASHTOWare BrR
PS Concrete IT girder, simple and continuous	AASHTOWare BrR
PS Concrete double tee beam	AASHTOWare BrR
PS Concrete, hollow core slab	AASHTOWare BrR
Steel, rolled beam stringer, simple or continuous	AASHTOWare BrR
Steel, plate girder, simple or continuous	AASHTOWare BrR
Steel, truss	AASHTOWare BrR
Timber, stringer	AASHTOWare BrR
Steel culverts	NDOT provided spreadsheet
Concrete culverts	AASHTOWare BrR
Secondary superstructure element	
Concrete, deck	Structural analysis software or other custom tools
Timber, deck	Structural analysis software or other custom tools
Steel, floor beams transverse to traffic	AASHTOWare BrR
Concrete floor beams transverse to traffic	Structural analysis software or other custom tools
Substructure elements	Structural analysis software or other custom tools

5.11.4 Load Rating with Software

NDOT uses AASHTOWare BrR software for bridge ratings on state bridges. NDOT requires that other Bridge Owners and their Consultants use AASHTOWare BrR software to maintain the uniformity of the Nebraska Bridge Inventory database.

Load ratings completed with software must be completely and permanently documented. Permanent records should be the electronic AASHTOWare BrR model in .xml format.

5.11.5 Load Rating Methods

The following is a brief summary of load rating methods. See FHWA Memorandum *Bridge Load Ratings for the National Bridge Inventory*, October 30, 2006 for additional information on methods to be used for a given bridge.

5.11.5.1 Allowable Stress Rating (ASR)

Allowable Stress Rating method compares unfactored load effects and stresses to an allowable stress for a given material in accordance with the MBE. NDOT's policy is to use the ASR method only on timber and masonry elements.

5.11.5.2 Load Factor Rating (LFR)

Load Factor Rating method compares factored load effects and stresses to the strength of a member of a given material, which typically is less than a material's strength limit. NDOT's policy is to use LFR for steel and concrete elements.

5.11.5.3 Load and Resistance Factor Rating (LRFR)

Load and Resistance Factor Rating method compares factored load effects to the resistance of a member of a given material in accordance with the MBE LRFR. FHWA requires that bridges and total replacement bridges designed after October 1, 2010 be designed by LRFD Specifications using HL-93 design load. Load rating values are to be computed and reported to the NBI as a Rating Factor based on LRFR methods using HL-93 loading.

5.11.6 Load Rating Levels

Load rating levels are defined in the MBE and are briefly summarized in this section.

5.11.6.1 Inventory Level

The AASHTO MBE states that “Inventory rating level generally corresponds to the design level of stresses but reflects the existing bridge and material conditions with regard to deterioration and loss of section. “Load ratings based on the Inventory level allow comparisons with the capacity for new structures and, therefore, results in a live load which can safely utilize an existing structure for an indefinite period of time.”

“Inventory Level corresponds to the design level capacity with consideration of member condition and loss of section. Load effects are compared to the calculated Inventory Level capacity.”

5.11.6.2 Operating Level

The AASHTO MBE states that “Operating rating level generally describes the maximum permissible live load to which the structure may be subjected. Allowing unlimited numbers of vehicles to use the bridge at Operating level may shorten the life of the bridge.”

“Operating Level corresponds to the maximum permissible level of load capacity with consideration of a member condition and loss of section. Load effects are compared to the calculated Operating Level capacity.”

5.11.6.3 Posting Level

Posting Level corresponds to a load capacity selected by the governing state agency for load posting bridge structures. NDOT’s policy is that a bridge will need posting if the load effects exceed the maximum permissible level of load capacity, i.e. Operating Level. It should be noted by Consultants completing load ratings for bridges in Nebraska that other states’ posting policies can vary, and may be at a level between Inventory and Operating Level.

5.11.7 Analysis Considerations

See the Material-Specific Considerations Sections 5.11.8 (steel), 5.11.9 (concrete), 5.11.10 (timber) and 5.11.11 (other) for additional information.

5.11.7.1 Span lengths

The distance between the centerlines of bearing is to be used for the span length for analysis purposes.

5.11.7.2 Bridge Cross Section and Roadway Width

A bridge with a sidewalk/shoulder without an accepted or approved crash tested barrier on the traffic side will be analyzed as though the entire bridge width were available for traffic to occupy.

5.11.7.3 Load and Distribution Factors

Parameters such as load factors and distribution factors shall be determined by the LRE using the latest applicable AASHTO Manuals.

Distribution factor for corrugated metal decks with asphalt or gravel fill should use S/3.75 for stringers in multi-stringer bridges.

5.11.7.4 Dead Load

For supplementary dead load components on truss bridges, an increase as a percentage of the component dead load should be included. This percentage is to be based on the engineering judgment of the LRE, but no less than 5% of the dead load of the primary members.

5.11.7.5 Strength / Resistance

The evaluation of a deteriorated bridge member must use the “section remaining” to resist the load in determining the most critical primary structural element.

5.11.7.6 Deck Load Rating

Wheel loads to be used for deck load rating shall be the maximum wheel load for the rating vehicles. The load rating of a deck can govern the overall rating of a bridge. If it does, this needs to be noted in the LRSS. See more information in the sections of this Chapter on Material-Specific Considerations.

5.11.8 Material-Specific Considerations - Steel

5.11.8.1 Strength / Resistance

Operating and Inventory strength and resistance shall be determined by the engineer using the latest applicable AASHTO Manuals.

For steel structures with an unknown date of construction, yield stress should be based on best available information. In the absence of other data, it should be assumed that the structure was built prior to 1905 (see MBE LRFR Table 6-11).

5.11.8.2 Fracture Critical (FC) Structures

Steel fracture critical structures with fatigue prone connection details (pins, gusset plates, welds on FC members in tension, etc.), require connections be rated if the connection shows any sign of deterioration, or if the dead load supported by the structure has increased over that originally imposed on the bridge. The LRE should evaluate the fatigue of the detail with due consideration of the ADTT.

5.11.8.3 Steel Thru-girders

Compression flanges of thru girders shall be assumed to be braced if knee bracing is present and floor beams are attached to vertical transverse stiffeners that are attached to the compression flange.

5.11.8.4 Plate Girder Shear Capacity

Stiffeners should be included in the determination of the shear capacity. Bridge records and inspection reports should indicate stiffener size, weld size and spacing.

5.11.8.5 Members from Elements

Girders that have been fabricated from plates, angles and channels may be modeled as plate girders. Channels may be modeled as plate girders.

5.11.8.6 Steel Truss Members

If trusses have eye bars that are loose, cracked or gapped, they shall not be considered effective when calculating a load rating. Eye bars with forged seams should be noted on the LRSS Additional Comments, but the member may be considered effective when calculating a load rating.

5.11.8.7 Gusset Plates

Bridge owners are required to check the capacity of gusset plates as part of the load rating calculations conducted to reflect changes in condition or dead load, to make permit or posting decisions, or to account for structural modifications or other alterations that result in significant changes in stress levels.

5.11.8.8 Policy for Bracing by Deck – Expired, 2012

NDOT had established a policy for load rating bridges with longitudinal simple span steel beams supporting a concrete or timber deck with no or unknown lateral bracing. This policy expired January 1, 2012. NDOT continues to document and monitor those bridges that had invoked this policy in the load rating of the structure.

5.11.9 Material-Specific Considerations - Concrete

Load ratings for concrete structures typically can be accomplished with software for the various types of beam/girder and slab bridges on Nebraska Roads. For concrete bridges without plans, see the subsequent section.

NDOT started to use prestressed bridges in the late 1950's. Concrete girder types on Nebraska bridges would include prestressed concrete AASHTO girders, NU girders, IT girders and double tee girders. There are some monolithically cast concrete girders in use. Slab type bridges include continuous concrete slabs, pre-cast non-prestressed slabs, hollow core slabs, and continuous post-tensioned slabs.

Concrete decks shall be rated according to a punching shear analysis. The rating shall be for the remaining sound concrete. The deck may be assumed to be unreinforced, unless the amount and condition of deck steel can be field verified. The LRE can assume temperature and shrinkage reinforcement, as defined by AASHTO Design Codes, as a maximum amount of steel present based on their engineering judgment.

5.11.10 Material-Specific Considerations - Timber

Timber is a frequently used material in floor systems of steel truss type bridges as well as in traditional longitudinal stringer bridges and on substructures on low volume roads. Evaluation of the load capacity of these existing timber members requires knowledge of the species and grade of the timber as well as consideration of the effects of any deterioration.

When timber bridge plans are nonexistent, data collection, inspection and field measurements will be required. NDOT has established the following definitions, policies, guidelines and procedures in order to establish uniformity in the evaluation of this material,

5.11.10.1 Elements to be Load Rated

Timber decks and stringers must be evaluated for load capacity and will be load rated.

Critical connections of timber bridges shall be evaluated if the connections are shown to have deterioration or signs of distress.

Timber substructures shall be evaluated if the structural elements are shown to have deterioration or signs of distress.

5.11.10.2 Timber Unit Weight

The unit weight for timber should be taken as 50 lbs per cubic foot.

5.11.10.3 Impact

Impact allowances should follow AASHTO methods and specifications.

5.11.10.4 Design Stress Values

Design stress values shall be based on species and grade as specified in the MBE when known or can be readily established. In the absence of this information the following values, including all adjustment factors with the exception of the beam stability factor C_L, may be assumed according to the following:

Rough Sawn or finished lumber		
Allowable Stress	**Inventory**	**Operating**
Bending, F_b	1,050 psi	1,450 psi
Shear, F_v	65 psi	90 psi

Glulam Girders		
Allowable Stress	**Inventory**	**Operating**
Bending, F_b	1,600 psi	2,200 psi
Shear, F_v	120 psi	165 psi

No adjustment in the allowable stresses for timber is necessary for reasons of aging alone.

5.11.10.5 Timber Decks

Timber decks shall be rated according to an allowable bending moment capacity analysis and shear analysis based on the remaining sound timber and the assumed allowable stresses. The LRE and the inspection Team Leader should assess each deck for need for re-load rating. NDOT requires that the deck be load rated if the timber deck condition rating is 3 or less.

5.11.10.6 Lateral Bracing

The engineer performing the structural evaluation shall check the bracing conditions according to the AASHTO Standard Specifications for Highway Bridges, 17th Edition except when superseded by the policy below:

- If lateral bracing is not present at the points of bearing but at least two intermediate diaphragms are present, l_u shall be assumed to be equal to maximum of:
  - The distance between the point of bearing and the first adjacent intermediate diaphragm; or
  - The diaphragm spacing.
- If the Deck condition code, Item No. 58 is greater than 4, the stringers may be considered laterally braced by:
  - The embedment of the stringer into the concrete; or
  - The continuous nailing of timber planks into the stringer.

If the above two conditions don't exist and if lateral bracing is not present at the points of bearing and one or no intermediate diaphragms are present, the bridge shall be closed until corrective action is taken.

For purposes of lateral stability analysis E = E' (as defined by AASHTO) = 1,000,000 psi may be assumed for use in the computation of wood stiffness, beam stability factor, C_L, and the allowable compression in solid timber columns (both round and square) according to the AASHTO *Standard Specifications for Highway Bridges*.

- In no case shall the value of C_L be taken to be greater than 1.0.
- C_L shall be computed at inventory level using F_b^* = 1,050 psi. Bending capacity at operating level shall be calculated by multiplying the final adjusted inventory capacity by 1.33.

5.11.10.7 Variable Stringer Spacing

In spans with variable stringer spacing, the live load distribution factors shall be computed based on the maximum of the stringer spacing.

5.11.10.8 Variable Material Strengths

In spans with stringers of variable material strengths (i.e. timber and steel), live load distribution factors shall be proportioned according to the relative stiffness of the applicable material types.

5.11.10.9 Stringer Condition and Capacity Calculation

Modeling of the effective section capable of contributing to the resistance of applied loads within BrR will often be a matter of sound engineering judgment.

5.11.10.9.1 Broken Stringers

See Figure A, Broken Stringer that follows. In the event that the separation extends a distance greater than one fourth the depth of the stringer, the stringer shall be considered **broken**. All **broken stringers** shall be assumed to have no contribution to capacity. Live load distribution factors of adjacent interior stringers shall be computed based on the maximum average of the stringer spacing on either side.

5.11.10.9.2 Cracked Stringers

See Figure B, Cracked Stringer that follows. A crack shall be defined as a complete separation of the wood across the grain; however, the separation must not extend vertically more than one-fourth the depth of the stringer.

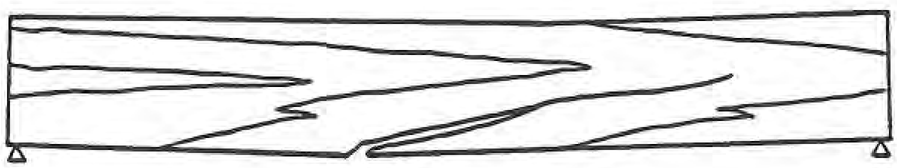
Shear and bending strength will be determined based on the section remaining (i.e. according to the effective section depth). Shear increase factors shall **not** be applied.

5.11.10.9.3 Split Stringers

See Figure C, Split Stringer that follows. A split shall be defined as a complete separation of the wood fibers parallel to the grain direction.

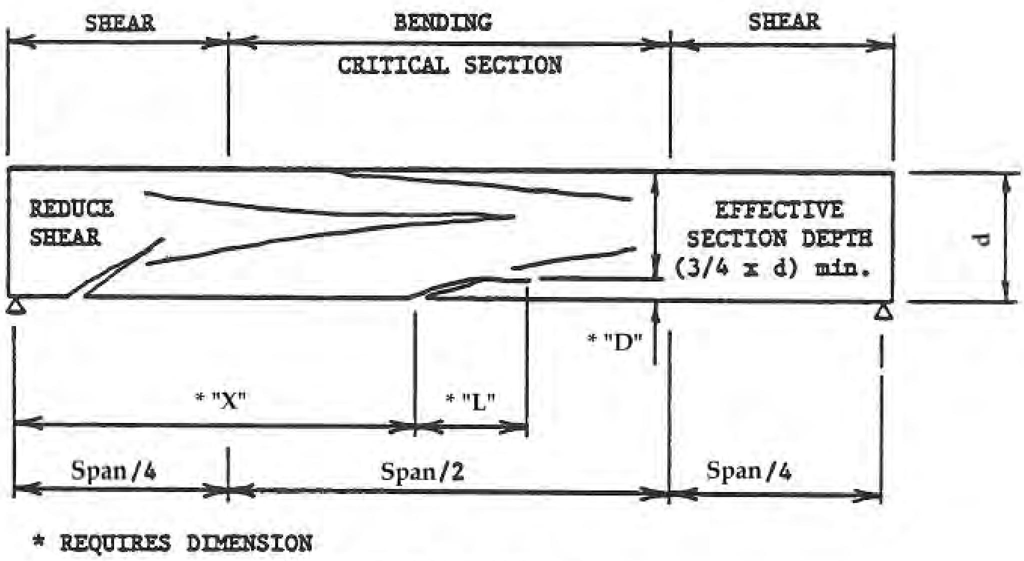
Splits extending **less than ¾ the length of the stringer shall not** be considered to affect member capacity and may be ignored. Splits extending **greater than ¾ the length of the stringer shall** be considered to affect member capacity and shall be analyzed using the section remaining. The section remaining used for rating shall be on the side of the split with the larger depth. Shear increase factors shall **not** be applied.

EVALUATING CONDITION OF TIMBER MEMBERS



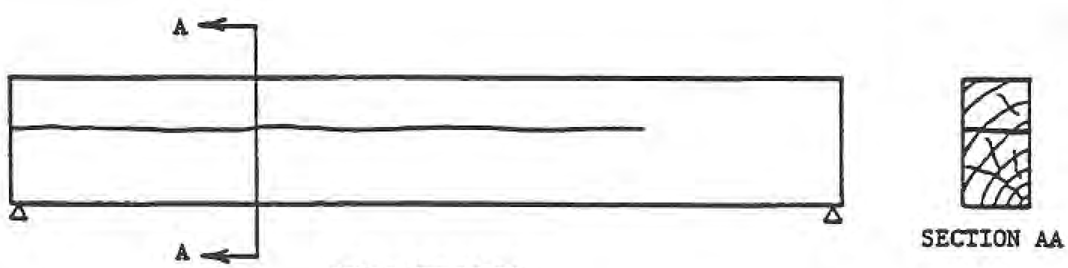
BROKEN STRINGER

Figure A



CRACKED STRINGER

Figure B



SPLIT STRINGER

Figure C

5.11.10.9.4 Checked Stringers

See Figure D, Checked Stringer that follows. A check shall be defined as a separation of the wood fibers parallel to the grain direction resulting from stresses set up in wood during seasoning, and usually extends across the annual growth rings.

Checks in a stringer may be on one or both sides. Checks need not be considered to affect member capacity and may be ignored.

5.11.10.9.5 Shaked Stringers

See Figure E, Shaked Stringer. A shake shall be defined as a separation of the wood fibers parallel to the grain which occur between the annual growth rings as a result of the growth in the tree.

Shakes shall **not** be considered to affect member capacity and may be ignored.

5.11.10.9.6 Decayed Stringers

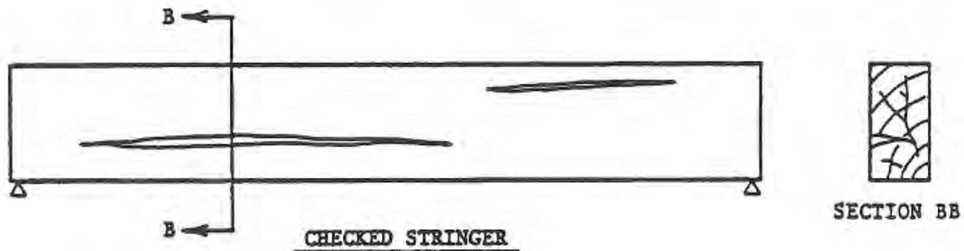
See Figure F, Decayed Stringer. Shear and bending strength will be rated based on the section remaining.

5.11.10.9.7 Knots in Stringers

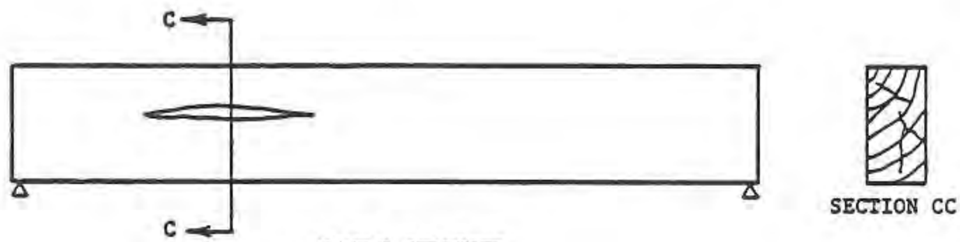
A knot shall be defined as a separation of the wood fibers due to an inner-grown limb and associated grain deviation.

Knots located in high tensile stress areas (the middle half of simple spans) affect member bending capacity and will be determined based on the section remaining (i.e. exclude the knot from the effective section depth).

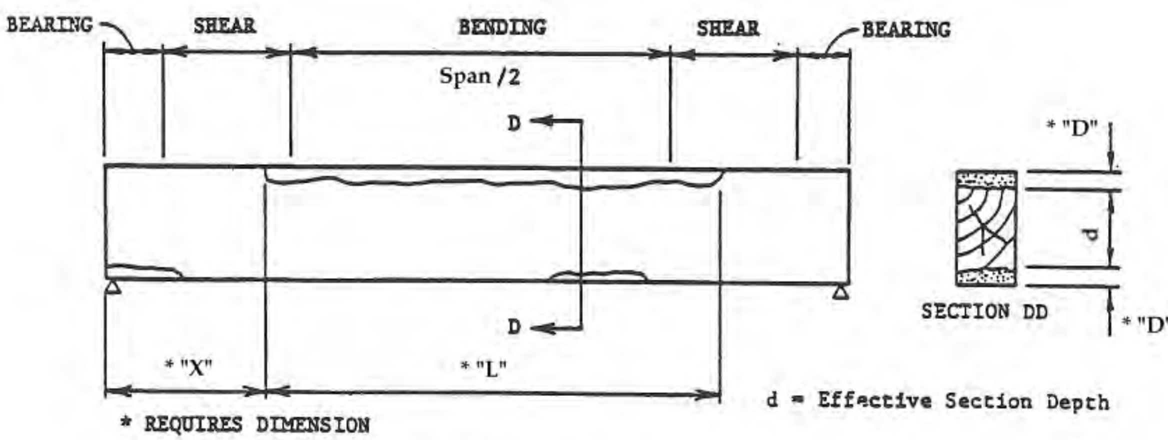
EVALUATING CONDITION OF TIMBER MEMBERS



CHECKED STRINGER
Figure D



SHAKED STRINGER
Figure E



DECAYED STRINGER
Figure F

5.11.11 Material Specific Considerations - Other

There are a few bridges in Nebraska with atypical materials, including masonry and aluminum culverts. LREs are to consult with the NDOT Bridge Inspection Program Manager for load rating these structures.

5.11.12 Load Ratings for Bridges without Plans

5.11.12.1 General

Load rating should be determined by calculations based on plans and current conditions found in inspection reports. Steel and timber bridges without plans must be field measured to provide the LRE with the dimensional data necessary to complete the load rating. Field measurement forms are included in the Appendix.

5.11.12.2 Load Rating Based on Load Testing

There are circumstances when load rating an individual structure by load test is needed. The Bridge Owner should make this decision on a case-by-case basis in consultation with their LRE. NDOT, however, believes that it is not advisable to perform load tests on concrete bridges with no plans.

5.11.12.3 Load Rating Based on Engineering Judgment

There may be cases where a load rating for a structure must be made with engineering judgment based on data available and the condition of the structure. The circumstances of the individual structure should be considered by the Bridge Owner in consultation with their LRE.

5.11.12.4 Concrete Decks on Steel Beams

Steel beam bridges with concrete decks that have no plans shall be rated as though there is no composite action between the steel girders and the deck.

5.11.12.5 Concrete Bridges

The load rating will be an evaluation based on the current inspection of the structural elements, the following table for concrete structures without plans, and the LRE's engineering judgment.

The Load Rating Summary Sheet Additional Comments section shall include a statement by the LRE. See Section 5.11.2 above.

NDOT Bridge Load Rating Table for Concrete Bridges without Plans
(Values shown in Tons. This table subject to revision at NDOT discretion.)

Struc - ture	Condition Rating	HS Operating	HS Inventory	Type 3	Type 3S2	Type 3-3	SU4	SU5	SU6	SU7
CIP Slab	Good/Fair (Code > 4)	36	26	32	47	55	34	39	44	49
	Poor (Code = 4)	28	20	25	37	43	27	31	34	38
	Serious, Critical (Code < 4)	Evaluate*	Evaluate*	< 25	< 37	< 43	<27	<31	<34	<38
CIP Box Culvert	Good/Fair (Code > 4)	36	26	32	47	55	34	39	44	49
	Poor (Code = 4)	28	20	25	37	43	27	31	34	38
	Serious, Critical (Code < 4)	Evaluate*	Evaluate*	< 25	< 37	< 43	<27	<31	<34	<38
	Good/Fair (Code > 4) +	99	99	32	47	55	34	39	44	49
CIP Frame	Good/Fair (Code > 4)	36	26	32	47	55	34	39	44	49
	Poor (Code = 4)	28	20	25	37	43	27	31	34	38
	Serious, Critical (Code < 4)	Evaluate*	Evaluate*	< 25	< 37	< 43	<27	<31	<34	<38
	Good/Fair (Code > 4) +	99	99	32	47	55	34	39	44	49

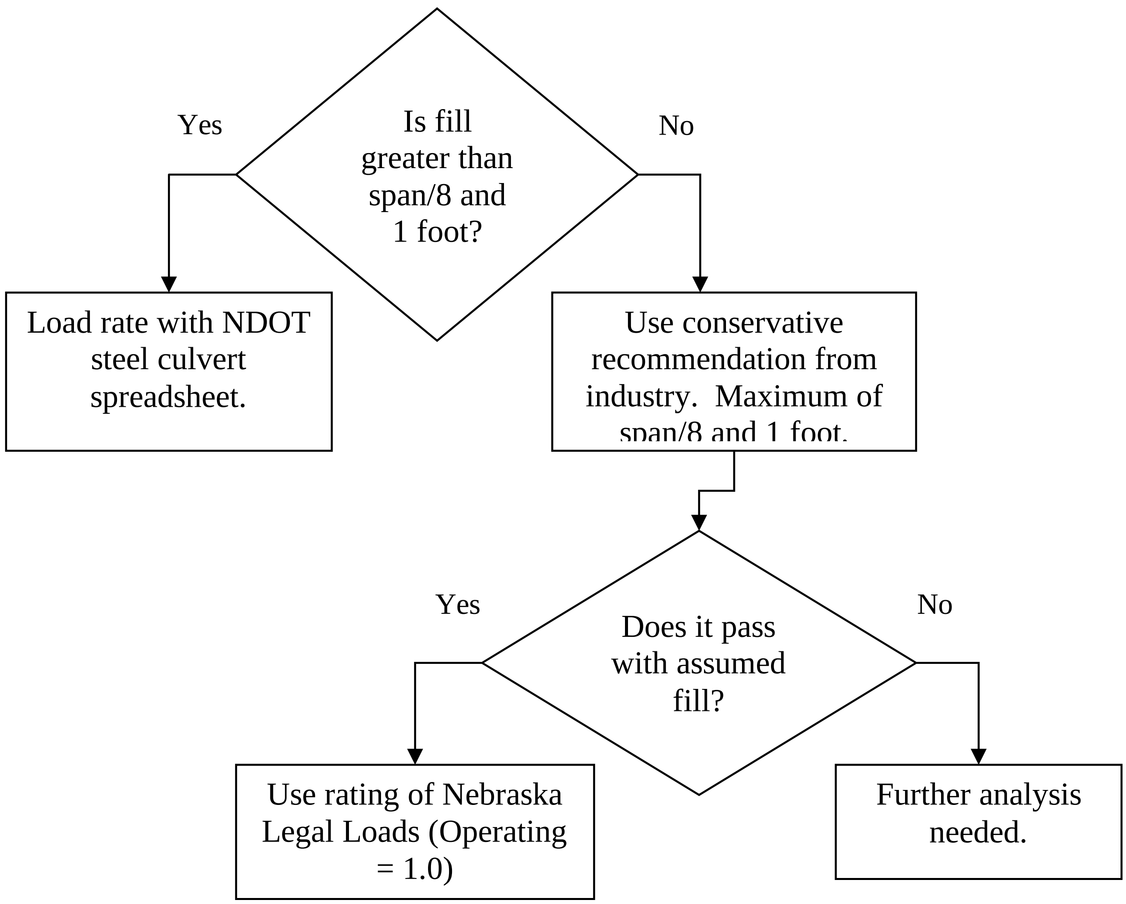
* These values must be determined by a professional engineer by evaluating the structure for condition and determining safe loads at which the bridge should be posted. Posting should be less than state legal loads for this condition rating.

\+ For culverts where it is determined live load that has no effect due to the 7' depth of overburden. For culverts in poor condition disregard the depth of overburden and use values in the Poor or Posted condition.

NDOT does not issue load permits on any bridge for which plans are not available.

5.11.13 Steel Culvert Bridges

NDOT recommends load rating steel culvert bridges based on the methodology in the National Corrugated Steel Pipe Association (NCSPA) Design Data Sheet No. 19, "Load rating and structural evaluation of in-service, corrugated steel structures", and information from Ohio Department of Transportation. NDOT has developed a spreadsheet for load rating these structure based on the NCSPA method and it is available for LRE use. The process is described in the following flowchart.



5.12 QUALITY CONTROL

The NBIS defines 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."

Quality Control is defined for NDOT's program as a system of routine technical activities to measure and control the quality of the bridge inventory data or report as it is being developed. The QC system is designed to include general methods such as accuracy checks on data acquisition and calculations, and the use of approved standardized procedures for measurement, calculation, recording information and reporting. QC activities include:

- Documents, data, or calculations signed by a PE, must have QC completed by an individual of equivalent or better qualifications than the originator (this is typically documented when the QC individual signs or initials the documents);
- See that the technical activity has followed procedures set by NDOT;
- Providing routine and consistent checks for data integrity, correctness and completeness;
- Identify and address errors and/or omissions;
- Documenting inventory data;
- Recording all QC activities.

Quality Control for this program is the responsibility of the Consultant or agency actually conducting the activity. Quality Control checks are conducted on every product of a program operation, and thus at a much higher frequency than quality assurance checks. When the QC on a program product is complete, it is finished and delivered to the Bridge Owner for their records.

Consultants providing professional services to Bridge Owners must submit a Quality Control plan to the Bridge Owner for review and approval. QC must be done on the deliverables prior to submittal to the Bridge Owner.

5.13 QUALITY ASSURANCE

Quality Assurance (QA) of all activities of the Bridge Inventory will be performed by NDOT or their selected agent. The QA program activities are described in Chapter 1 of this Manual.

5.14 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1
2	2013 March 04	Revision 2
3	2015 March 15	Revision 3
4	2016 March 16	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

5.15 FORMS

Forms used in completing load ratings that are mentioned in this Chapter are listed below. Participants and contributors to the Nebraska Bridge Inspection Program are advised to go to the NDOT Bridge Inspection Program website for the current list of applicable forms and the most recent versions of each form. http://dot.nebraska.gov/business-center/bridge/inspection/./

Name	DR Form
Load Rating Summary Sheet	DR465
Load Rating Summary Sheet Instructions, truck configurations	N/A
Field Measurement Forms	N/A

5.16 APPENDIX

Memos and other guidance that may have been issued after the issuance of the current revision of this Chapter can be found at the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/.

Bridge Owners and Load Rating Engineers are urged to check this site to ensure they have all the most current information and forms for load rating.

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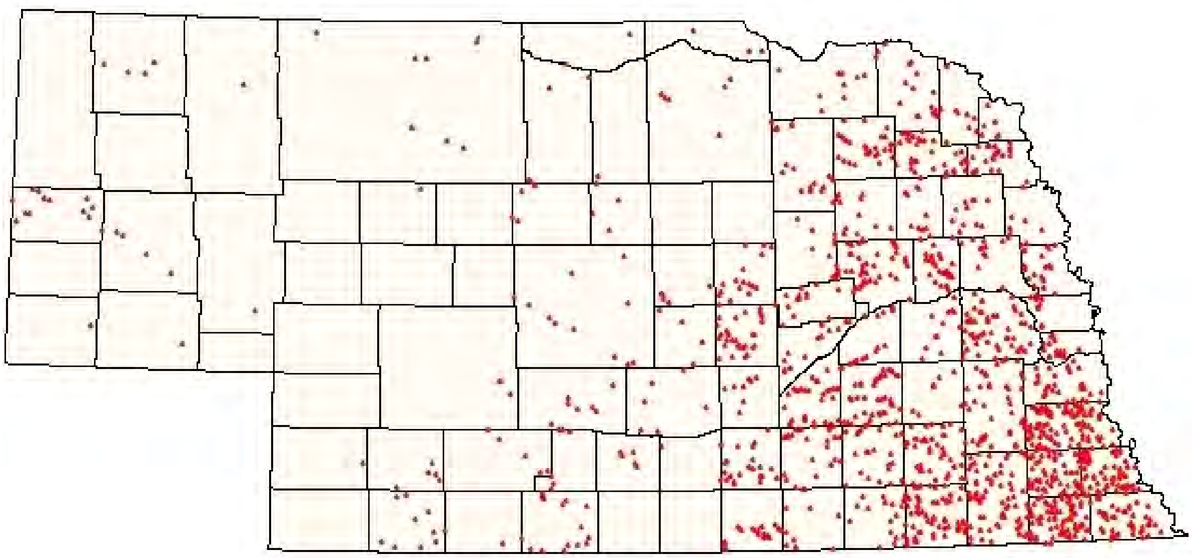
6.1 GENERAL

The purpose of this chapter of the NDOT Bridge Inspection Program Manual is to provide guidance to bridge inspectors on channel behavior and to provide information on how inspectors' observations contribute to the overall process of monitoring scour at bridges. Another key purpose is to set policy and provide guidance to Bridge Owners and their hydraulic engineers to meet the NBIS requirements regarding scour critical bridges:

- Identify scour critical bridges;
- Prepare a Plan of Action (POA) for scour critical bridges;
- Monitor known and potential deficiencies;
- Address scour-related critical findings;
- Monitor bridges that are scour critical in accordance with the Plan of Action.

The most common cause of bridge failure is the removal of material from around bridge foundations (i.e. scour) due to flooding. A 1973 national study indicated that of the 383 bridge failures that year, 25 percent involved pier damage and 72 percent involved abutment damage. Flood related damage is costly. A 1994 storm in Georgia left over 500 bridges damaged from scour. The cost to replace or repair these bridges exceeded $130 million.

The following map was developed in 2015 and shows the scour critical bridges as determined from hydraulic assessment. Scour is particularly prominent in southeast Nebraska where the area soils are susceptible to erosion. In the early 1900's many of the streams were straightened, thus steepening the stream grade and disrupting the natural gradient which typically results in a lowering of the stream bed. Scour in Nebraska generally begins to occur in sand bed streams at a stream-flow of 5 feet/second and stream beds with cohesive soils at a stream-flow of 7 feet/second. Scour can occur during any frequency of storm and as flood waters recede, the scour holes around piers may fill back in.



Scour Critical Bridges (February 2015)

The need to ensure the safety of the traveling public, minimize cost, and minimize the adverse effects resulting from bridge closures requires designing and maintaining bridge foundations to resist the effects of scour. Minimizing potential flood damage requires careful inspection of bridges for scour and scour-related behavior.

A scour assessment utilizes hydraulic, geotechnical, and structural data to determine the vulnerability of existing bridges to failure from flood events. The Interdisciplinary Scour Assessment Team (ISAT) is composed of hydraulic, geotechnical, and structural engineers as well as trained bridge inspectors and para-professional bridge personnel. This combination of individuals utilizes their special skills to prioritize and inspect bridges, assess channel behavior, and evaluate the structures for scour.

Bridges and roadways crossing floodplains are an encroachment on the natural floodplain and their design includes consideration of hydraulic constraints, cost, risks, regulatory requirements, channel behavior, environmental impacts, engineering requirement, and social concerns. General (contraction) scour and local (pier and abutment) scour can be estimated for a bridge allowing the substructure to be designed to withstand the calculated effects. Bridges built before 1980 were probably not designed in accordance with current methods for calculating scour nor have properly designed countermeasures and thus may be susceptible to scour causing damage or failure during flood events. Additionally, properly designed bridges may become unstable from erosion due to changes in channel behavior at the site (i.e. lateral migration and long-term degradation). Structures threatened by scour, lateral migration, and long-term degradation need to be identified, monitored, and NDOT bridge hydraulics notified (form BR385F).

A Plan of Action (POA) is a document prepared by the Bridge Owner (or their consultant) establishing specific instructions for management and monitoring of a scour critical structure (Item 113 code of 2, 3, or U) to protect the traveling public.

6.2 REFERENCES

The information in this Bridge Inspection Program Manual supplements requirements, procedures, and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP).

The references list of applicable documents is included in the manual appendix. The NBIS are also included in the manual.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in the NBIS and the *AASHTO Manual for Bridge Evaluation* as well as FHWA publications, technical advisories, and publications related to the NBIS.

6.3 ROLES AND RESPONSIBILITIES

6.3.1 Bridge Owners

Bridge Owners in Nebraska include the Nebraska Department of Transportation, cities, municipalities, and counties.

Bridge Owners are responsible for:

- Providing documentation that defines the NBI Item 113 code for all their bridges and retaining the information in the respective Bridge Record.
- Maintaining an accessible list of all their scour critical bridges.
- Ensuring that all scour critical bridges under their authority have a Plan of Action and must retain the Plan of Action in the respective Bridge Record;
- Monitoring scour critical bridges as specified in the POA.
- Ensuring that Quality Control (QC) of the scour documentation and POAs is completed for all bridges under their authority over water.
- Maintaining and updating POAs for their scour critical bridges.
- Maintaining a POA log which documents the POA monitoring activities and actions taken related to the POA.
- Maintaining design data and plans for implemented scour countermeasures and placing this information in the respective bridge records file.
- Documenting any visual inspections. This includes necessary measurements, sketches, and photographs of existing scour and the stream channel in the vicinity of bridge substructure elements and approach embankments. This information must be retained in the respective Bridge Record.
- Reporting changes in condition of the stream, scour mitigation, bridge substructure elements, or roadway embankments to the NDOT (including updated 300 series Items).

6.3.2 Nebraska Department of Transportation

NDOT is responsible for monitoring the Bridge Inspection Program as well as offering expertise in the assessment of scour conditions and scour ratings. Responsibilities include:

- Providing guidelines for hydraulic analysis.
- Providing guidelines for assessment of scour.
- Updating annually the statewide master list of scour critical bridges.
- Ensuring that all bridges have scour documentation completed and NBI Item 113 coded correctly.
- Ensuring that all scour critical bridges have POAs developed and implemented.
- Reviewing all bridge inspections with a change from N to Y for Item 358 (Is There a Scour Problem) and monitoring other scour-related inspection items to determine the need for a new hydraulic assessment.

6.3.3 Consultants Performing Services for Bridge Owners

Consultants performing inspections for Bridge Owners are responsible for:

- Being familiar with NDOT and FHWA requirements and policies on bridge hydraulics, scour assessment, and preparation of POAs.
- Maintaining staff qualifications required for the Nebraska Bridge Inspection Program.
- Completing quality control on services completed for bridge owners.
- Completing work for Bridge Owners in a timely manner to allow the bridge owners sufficient time for data review prior to submittal to NDOT.

6.4 QUALIFICATIONS

The NBIS and NDOT qualification requirements are described in Chapter 1 of this Manual.

NDOT requires that engineers performing hydraulic analysis and scour assessments for structures and preparing POAs for owners be experienced Hydraulic Engineers (HE) and registered Professional Engineers in Nebraska. It is recommended but not required that HEs completing hydraulic analysis and scour assessments be NDOT Certified Bridge Inspection Team Leaders.

NDOT recommends that individuals monitoring bridges during or after flood events are either an HE or NDOT Certified Bridge Inspection Team Leader.

6.4.1 Hydraulic Engineer

The Hydraulic Engineer (HE) requirements are described in Chapter 1 of this Manual.

The HE leads the Interdisciplinary Scour Assessment Team (ISAT), is responsible for the data that is submitted to NDOT for the National Bridge Inventory, and seals and signs the hydraulic analysis report or scour assessment with their NE Professional Engineers seal.

The HE is responsible for delivering a completed report and/or BR385 forms to the owner. The HE of record is responsible for ensuring that an engineer of equal or higher qualifications than the original analyst completes QC on the hydraulic analysis report and supporting files prior to submittal to the owner.

6.5 DEFINITIONS

These definitions apply to the NE Bridge Inspection Program.

6.5.1 Hydraulic Analysis Report and/or Hydraulic Data Sheet

Typically, both NDOT and Consultant HEs complete hydraulic analysis reports for new structures. These are completed in accordance with the most recent version of NDOT's Hydraulic Analysis Guidelines.

6.5.2 Scour Assessment Report and/or BR385 Forms

This is the bridge scour inspection and analysis as defined in the NDOT Hydraulic Analysis Guidelines for the evaluation of existing bridges for susceptibility to scour.

6.6 SUBMITTAL REQUIREMENTS

6.6.1 Hydraulic Analysis Report and/or Hydraulic Data Sheet

Hydraulic reports for new bridges must be submitted to the Owner at least 30 days prior to construction.

The Owner must submit a copy of the hydraulic submittal to NDOT within 30 days of receipt. See also Chapter 1 for NDOT policy.

6.6.2 Scour Plan of Action

The Bridge Owner prepares a Plan of Action, BR 385c, and submits a copy to NDOT within 30 days of the scour critical status notification. HE may assist the owner.

6.7 CHANNEL BEHAVIOR

6.7.1 Six Stages of Channel Development

An understanding of the six stages of channel development is necessary for successful evaluation of potential scour related problems at a specific site. Channels are dynamic and naturally adjust to changes in climate and changes imposed by man. Channel adjustments usually occur very slowly when reacting to natural environmental change. However, when the channel is subjected to man-made alterations, such as dredging or straightening, changes can occur rapidly.

The dominant parameters that influence channel adjustments are water discharge, channel slope, sediment transport, and the average size of channel bed material. A change in any of these four parameters causes the channel to readjust.

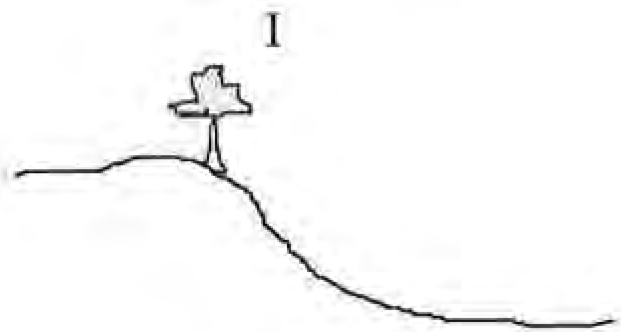
These six stages of development are used to understand how the channel adjusts when it is subjected to man-made alterations. They are described in the table below and shown with illustrations and photos on the following pages. A glossary of channel element and behavior terms can be found as an appendix to this chapter.

Stages of Channel Development

Stage	Name	Description
I	PREMODIFIED	The channel is in its natural state. A channel in this stage is relatively stable and properly designed bridges experience few scour problems.
II	CONSTRUCTED	This phase identifies channels recently modified by channel straightening. This phase usually has a short duration. After a major runoff event, major channel readjustments to the artificial channel are evident.
III	DEGRADATION	During this phase of channel evolution, degradation progresses in an upstream direction with a series of headcuts. Bank heights increase and bank slopes become steeper.
IV	THRESHOLD	At this time degradation is ending, headcuts are no longer visible, alternate bars start to form and channel widening by mass wasting is the dominant channel shaping process.
V	AGGRADATION	Stream meandering occurs and the flowline elevations aggrade.
VI	RESTABILIZATION	Channel equilibrium is reestablished, channel capacity is reduced and rates of channel readjustments are dramatically reduced.

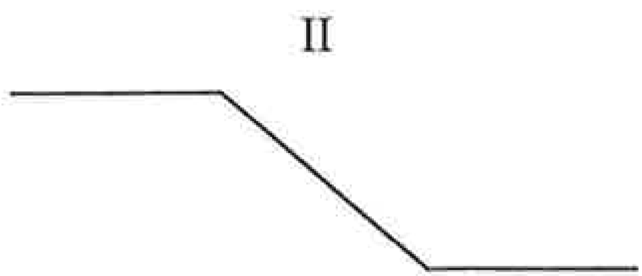
Stage 1, Premodified Characteristics

- Stable
- Vegetated banks to flow line
- Sediment transport
- Convex top bank shape
- Relatively shallow channel depths
- Meandering channel



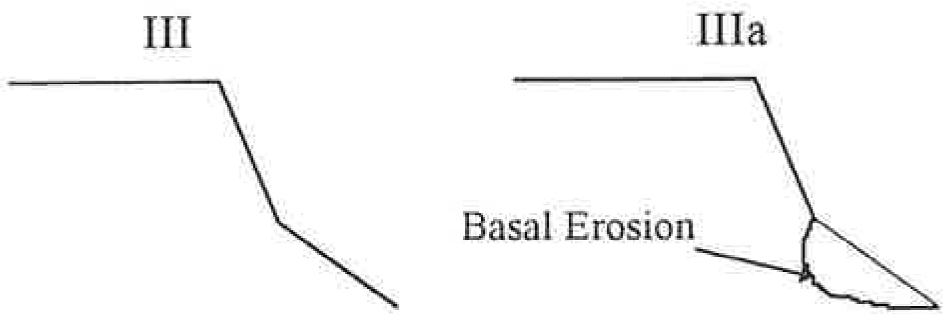
Stage II, Constructed (Modified) Characteristics

- Trapezoidal cross section
- Linear bank surfaces
- Removal of vegetation



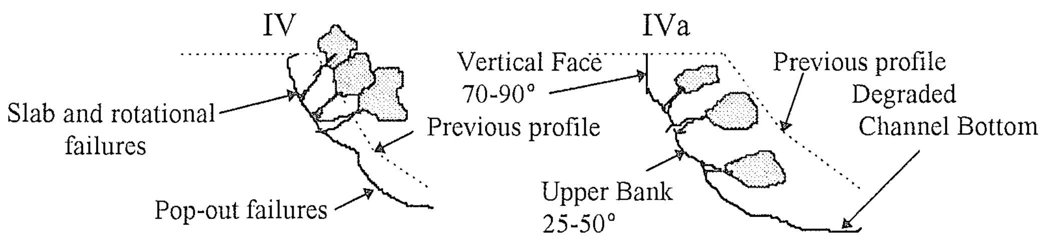
Stage III, Degradation Stage Characteristics

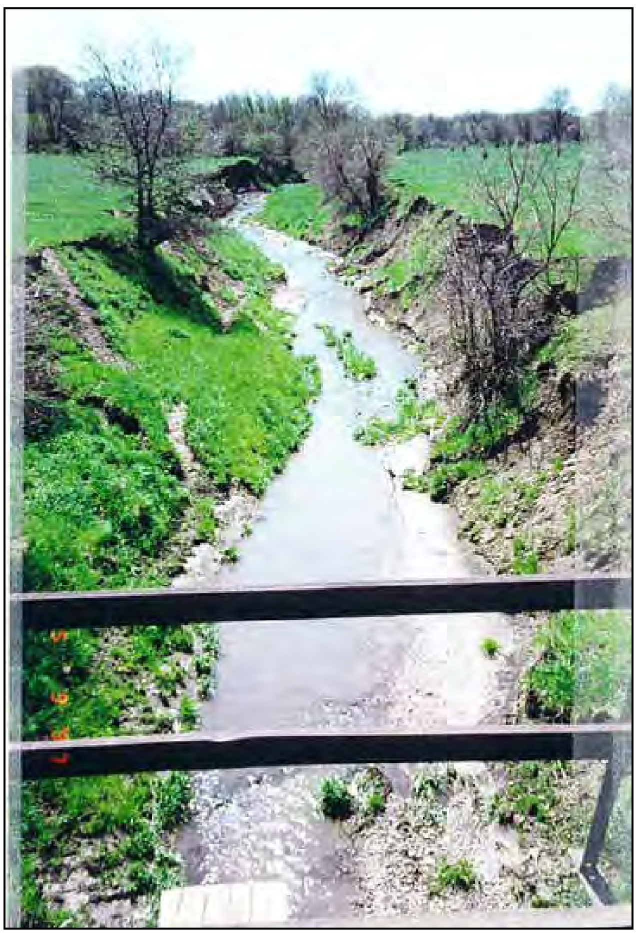
- Basal erosion on banks
- Pop out failures
- Heightened and steepened stream bank surfaces
- Head cuts
- Channel depth increasing
- Vegetation height relative to flow line and may lean to channel



Stage IV, Threshold Characteristics

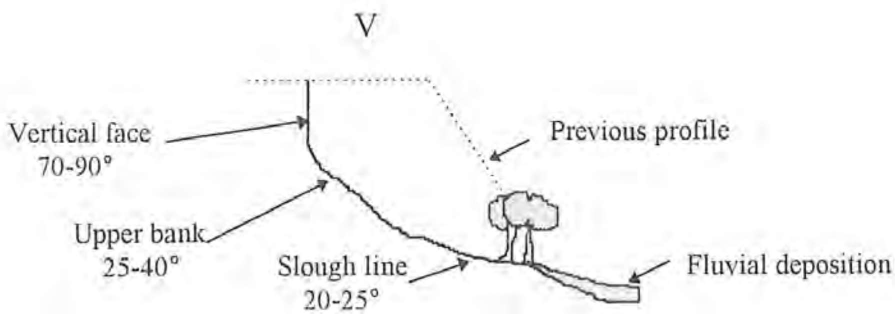
- Degradation continues
- Basal erosion on banks
- Slab, rotational, and pop-out failures
- Bank retreat
- Vertical face on upper bank surfaces
- Some reduction in bank angles
- Flow line very low relative to top bank
- Tilted and failed vegetation





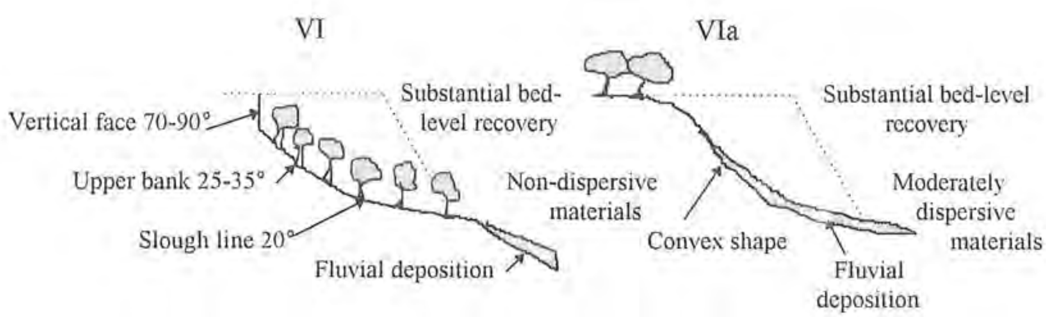
Stage V, Aggradation Stage, Characteristics

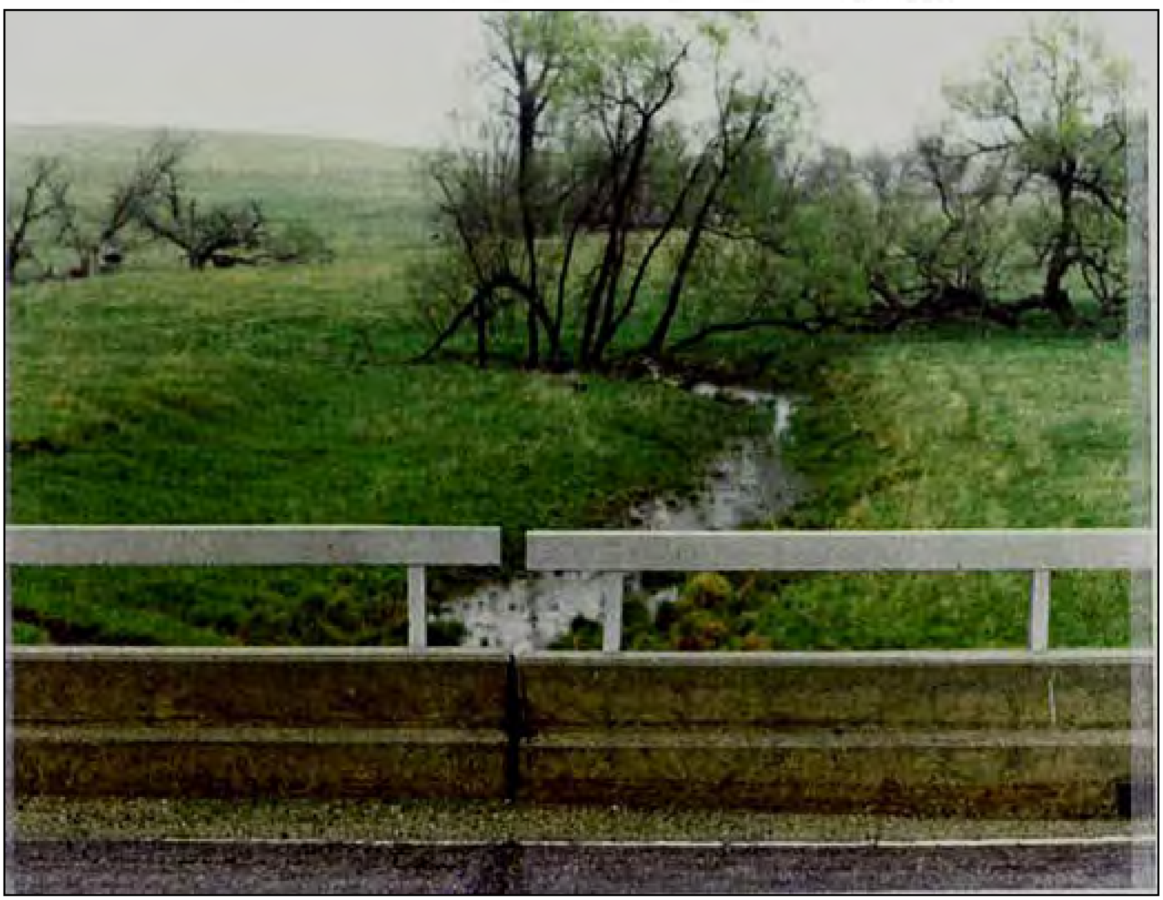
- Initial deposition of alternate bars
- Reworking of failed material on lower banks
- Low angled slides of previously failed material
- Bank retreat
- Vertical face upper bank and slough line
- Flattened bank angles
- Channel depth decreasing
- Development of new flood plain
- Tilted and fallen vegetation
- Re-establishing vegetation of banks.



Stage VI, Restabilization Characteristics

- Further development of meandering thalweg
- Further deposition of alternate bars
- Reworking of fallen material
- Low angle slides
- Stable alternate channel bars
- Convex short vertical face at top bank
- Flattened bank angles
- Relatively shallow channel depth
- Re-establishing vegetation extends up slough-line and upper bank
- Vegetation establishing on bars





Geomorphic Processes Along Modified Streams								
Stage	**Active Process**	**Channel Process**	**Channel Flowline Slope**	**Channel Banks**	**Channel Capacity**	**Estimated Duration**	**Floodplain Inundated**	**Land Loss**
I	Premodified	Natural	Meandering Natural Slope	2:1 or flatter	2-3 years	-------	> 2-3 years	------
II	Constructed (Modified)	Artificially Straightened	Straight Valley Slope	Artificial	3-5 year	± 5 year	> 3-5 years	Gain Due to Length Reduction
III	Degradation	Depth Increasing	Straight Valley Slope	Steeper than 2:1 to Vertical	Transitioning 25-100 year	± 25 year	> 5-100 years	± 1x Depth
IV	Threshold (Transition)	Widening	Straight Valley Slope	Slopes Flatten Towards 2:1	25-100 year	± 25 year	> 25-100 years	2-4 x Depth
V	Aggradation	Depth and Width Decreasing	Transition Towards Natural	Inside Bend <2:1 Outside Bend >2:1	Transitioning	± 100 year	Transition Period	Meandering
VI	Restabilization	Natural	Meandering Natural Slope	2:1 or flatter	2-3 year	------	> 2-3 years	------

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6.7.2 Bridge Scour - General Overview

Scour is the result of the erosive action of flowing water, excavating and transporting material from the bed and banks of streams. Different materials scour at different rates. Granular soils such as sand rapidly erode, cohesive or cemented soils (i.e. clays) are more resistant. The ultimate scour in cohesive soils can be as deep as scour in sand-bed streams; it is just a matter of time.

There are three main components of scour (see the following figure):

- long-term scour (aggradation-degradation)
- contraction scour
- local scour

Total scour depth is generally considered to be the sum of the depth of these three components. Bridge scour is time dependent and generally occurs on the rising stage of flow. A scour hole can refill as flow recedes.

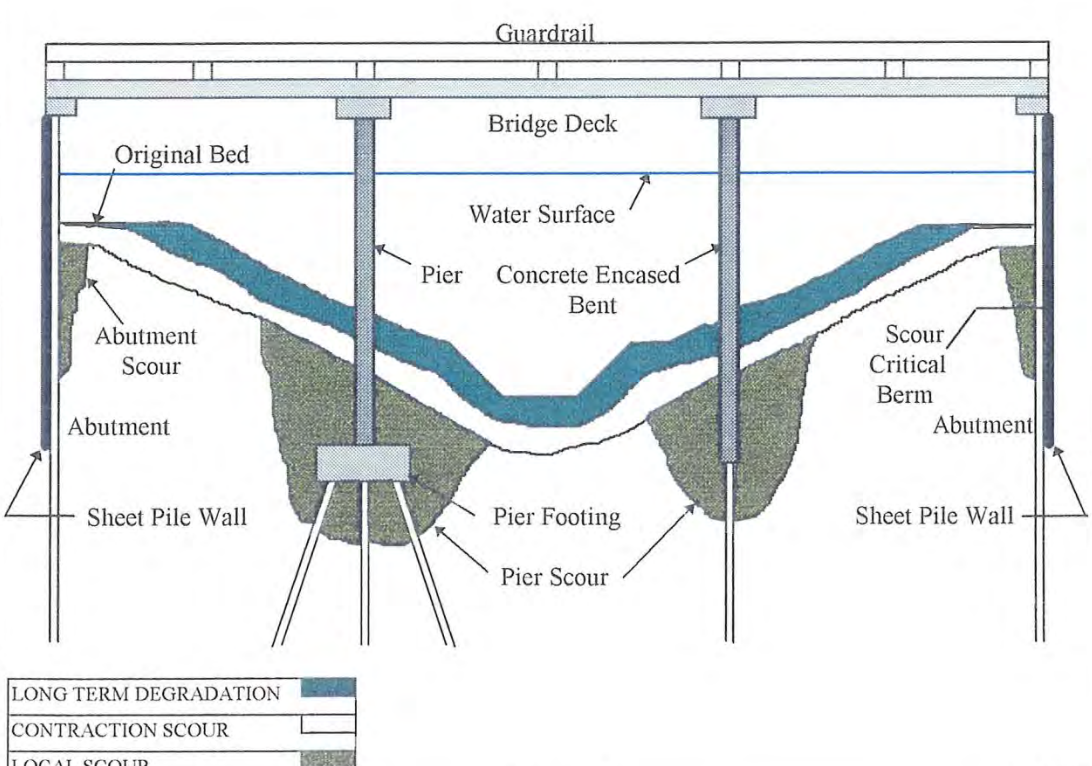


Figure 3.1 (NDOR)

6.7.3 Long-Term Scour (Aggradation and Degradation)

Aggradation and degradation are long-term streambed elevation changes due to natural or man-induced causes. Aggradation involves the deposition of material in the channel due to erosion in the watershed upstream of the site. Degradation involves the lowering of the streambed due to a deficit in sediment supply from upstream. Aggradation and degradation are not caused by the bridge but are geomorphic processes that occur as a watershed balances water flow and sediment transport within the basin.

The long-term trend of aggradation or degradation may change during the life of the structure. The changes could be the result of natural processes or human activities. Factors affecting long-term bed elevation changes include:

- Dams and reservoirs (up or downstream of bridge).
- Changes in watershed land use (urbanization, deforestation, etc.).
- Channelization or cutoffs of meander bends which result in increases in channel gradient and capacity (natural or man-made) as shown in the following aerials.
- Gravel mining from the streambed.
- Diversion of water into or out of the stream.
- Movement of a stream bed.

Consequences of degradation are bank failures and channel widening (the result of steeper and deeper banks).

The following photo shows a natural meander cutoff north of the east-west county road. The channel was also straightened through the bridge site. The west bank just north of the road is being attacked by the stream flow.

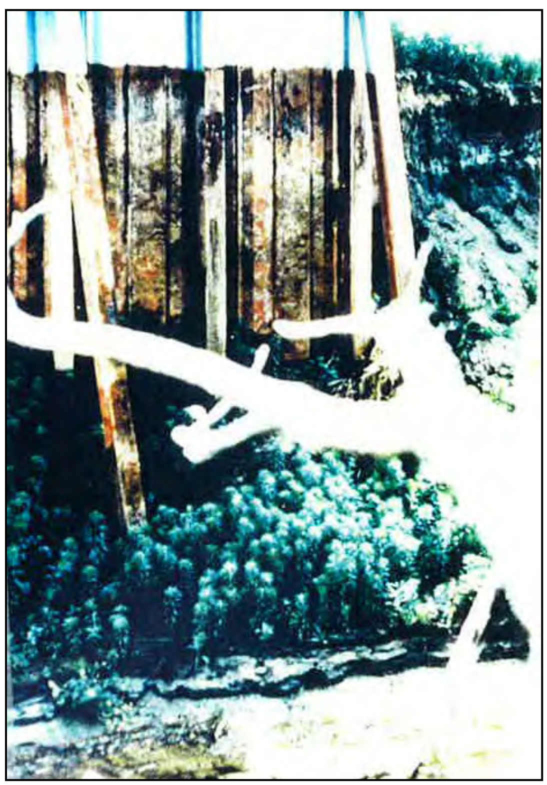
Natural meander cutoff and straightened channel

The following photo shows a straightened channel. The alignment of the natural channel is evident from the curvilinear bands of vegetation and timber and the apparent depressed areas.

Straightened channel

Additionally, degradation can undermine or expose substructures as shown in the following photos.

Portion of a bridge bent exposed due to degradation



Undermining at a bridge abutment

Aggradation results in a loss of channel capacity which in turn may increase the frequency of flooding. The following photo shows how aggradation can affect the waterway adequacy of a bridge.

Bridge opening partially silted shut from aggradation

6.7.4 Contraction Scour

Contraction scour is the removal of streambed material. It happens throughout the entire bridge opening due to increased flow velocities through the bridge. Increased velocities are a result of the flow area under the bridge being less than the flow area of the typical channel section or when flood water in the channel overbanks are forced through the bridge.

For the majority of main channel bridges, the scour hole may silt in after the flood waters recede. Softer, relatively fresh silt or freshly deposited sand across the bridge opening that differs from the upstream and downstream conditions is an indication contraction scour has occurred. Scour holes under overflow bridges typically remain visible after flood events.

Contraction scour potential can be assessed in the field by the following:

- Approach roadway overtopping.
- Overflow structures in the floodplain near the bridge.
- Bridge length compared to upstream channel width.

It is possible to have any combination of these present. The worst case would be a short bridge projecting into a deep channel with no roadway overtopping or overflow structures present. Likewise, a lower risk case would have a bridge spanning the entire main channel, overflow structures in the flood plain and the road sagged to allow overtopping to occur away from the bridges. Indications of road overflow include debris on the road, a washed out appearance of a gravel surface, or local experience with flooding.

Overflow structures provide relief for flow similar to road overtopping. They provide additional opening under the roadway to reduce the amount of water forced to pass through the main bridge opening resulting in a reduced risk of contraction scour in the main channel. The overflow structures also experience contraction scour and may be at risk depending on their size and the amount of flow.

Bridge abutments projecting into a channel can also cause a flow constriction. This constriction increases the flow velocities and the potential contraction scour. Abutments projecting into a channel are subject to local scour from the flow that is directed at the abutment. Contraction and local abutment scour can cause the approach to wash out. Bridge lengths spanning the channel top width or longer provide a greater waterway area under the bridge, which decreases the flow velocity and scour potential.

Bridge with inadequate length

It is important to note that an ice jam can block the flow in the main channel. This obstruction may cause the majority of water in the channel to flow overland increasing the volume and velocity of flow through nearby overflow structures. The potential contraction scour at these sites could be substantially increased. Some major rivers in Nebraska that are prone to ice jams include the Platte River, Elkhorn River and Loup Rivers.

The following photographs depict an ice jam occurring at a bridge.

Ice jam in main channel

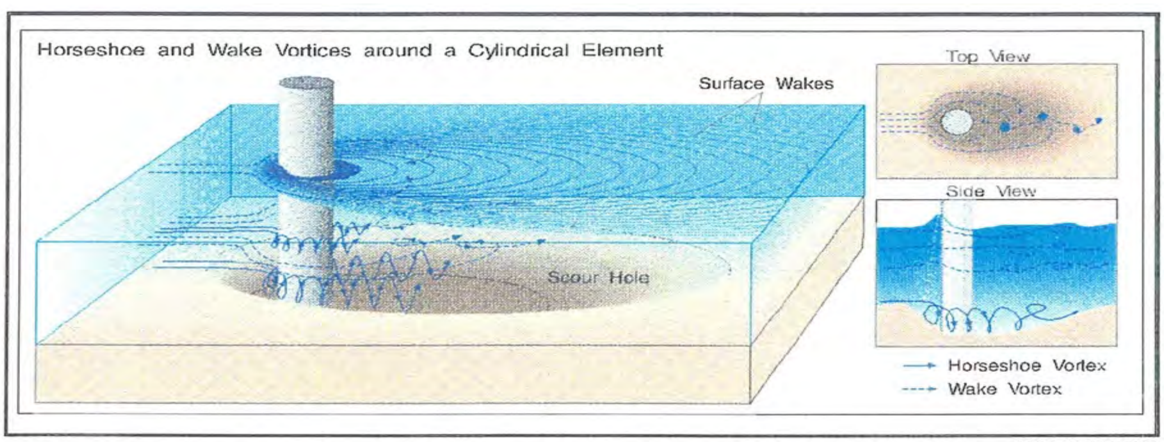
Overflow bridge flowing full due to ice condition

This is what happened next.

Overflow bridge failure due to high flows under bridge shown above

6.7.5 Pier and Abutment Scour

Scour that occurs at bridge piers and abutments is referred to as local scour. This scour is due to the localized acceleration of the flow around the pier or abutment wall. Water piles up at the upstream side of the pier, resulting in a downward flow down the upstream face of the pier. This downward component, together with localized acceleration of flow around the pier, results in the formation of the horseshoe vortex and the removal of streambed material around the base of the pier.



(USGS-MHTD)

The potential for local scour can be assessed by field observations of the following:

- Pier shape and size

Square faced piers can cause 10% more local scour than round nosed piers and 20% more local scour than a sharp nosed piers (for piers of similar width).

- Pier alignment and bridge skew (attack angle)

The more surface area that the water sees as it encounters a pier, the more scour will occur.

- Debris accumulation

Bridge piers block the flow of the stream making them ideal spots for debris to be trapped. The bridge opening decreases as more debris accumulates. The resulting flow constriction increases velocities through the bridge and can redirect the flow. The flow could be redirected towards an abutment or downward below the debris pile increasing potential pier scour.

- Stream meanders

Bridges are usually constructed perpendicular to the direction of flow in the stream. As stream meanders form and move, the angle of attack approaching a bridge changes. If the angle of attack increases significantly, increased scour can occur at the piers and/or abutments.

- Depth of flow

Flow depth is a key component in scour potential. Shallow flow depths generally result in less scour than deep flowing water.

- Velocity

Lower velocities create less local scour potential at bridges. Whereas higher velocities will increase scour potential.

The following photographs illustrate some of the concepts described above in recognizing scour potential in the field.

Misaligned bridge

Abutment failure due to improper skew

Debris trapped at pier

Stream meander attacking abutment

While both piers and abutments are generally designed with piling driven to a specific bearing capacity or spread footings keyed into rock, abutments are also designed to hold back fill from an approach roadway embankment and should resist scour down to a critical berm elevation. Once the critical berm is reached, any additional scour could cause abutment failure or the approach roadway to wash out. Indications of scour below critical berm include sheet pile buckling, bottom of bridge plank wall exposed or bottom of concrete wall exposed.

All these factors should be considered when evaluating a structure for local scour potential. Local experience and flood observations of bridge sites are also helpful in determining local scour risks.

It should be noted that erosion holes caused by deck drains, roadway runoff, cattle paths and ditch drainage into the stream do not qualify as local scour. The loss of berm due to the roadway runoff may increase the susceptibility of the structure to scour damage and thus create a scour critical situation.

6.8 IDENTIFICATION OF SCOUR CRITICAL BRIDGES BY HYDRAULIC ASSESSMENT

The NBIS defines a scour critical bridge as "a bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition." The FHWA Recording and Coding Guide further defines a scour critical bridge as a bridge with abutment or pier foundation rated as unstable due to:

- Observed scour at the bridge site (Item 113 of 2, 1, or 0).
- Scour potential as determined from a scour evaluation study, i.e. calculated scour (Item 113 of 3).

The HE will assign a code for Item 113 following the ISAT inspection, hydraulic analysis and scour assessment. The FHWA Recording and Coding Guide codes from the errata are repeated in the following table. A five-step evaluation/calculation process is used by the ISAT to assess bridges for scour. The general process is shown in the following flow chart.

Whenever a rating of 3 or below is determined for Item 113, the condition rating for Item 60 Substructure and other affected items (i.e., load ratings, superstructure rating) should be revised to be consistent with the severity of observed scour and resultant damage to the bridge.

Item 113 Code	Item 60 Code
3, bridge is scour critical	5 or less
2, bridge is scour critical, or 1, bridge is scour critical	4 or less

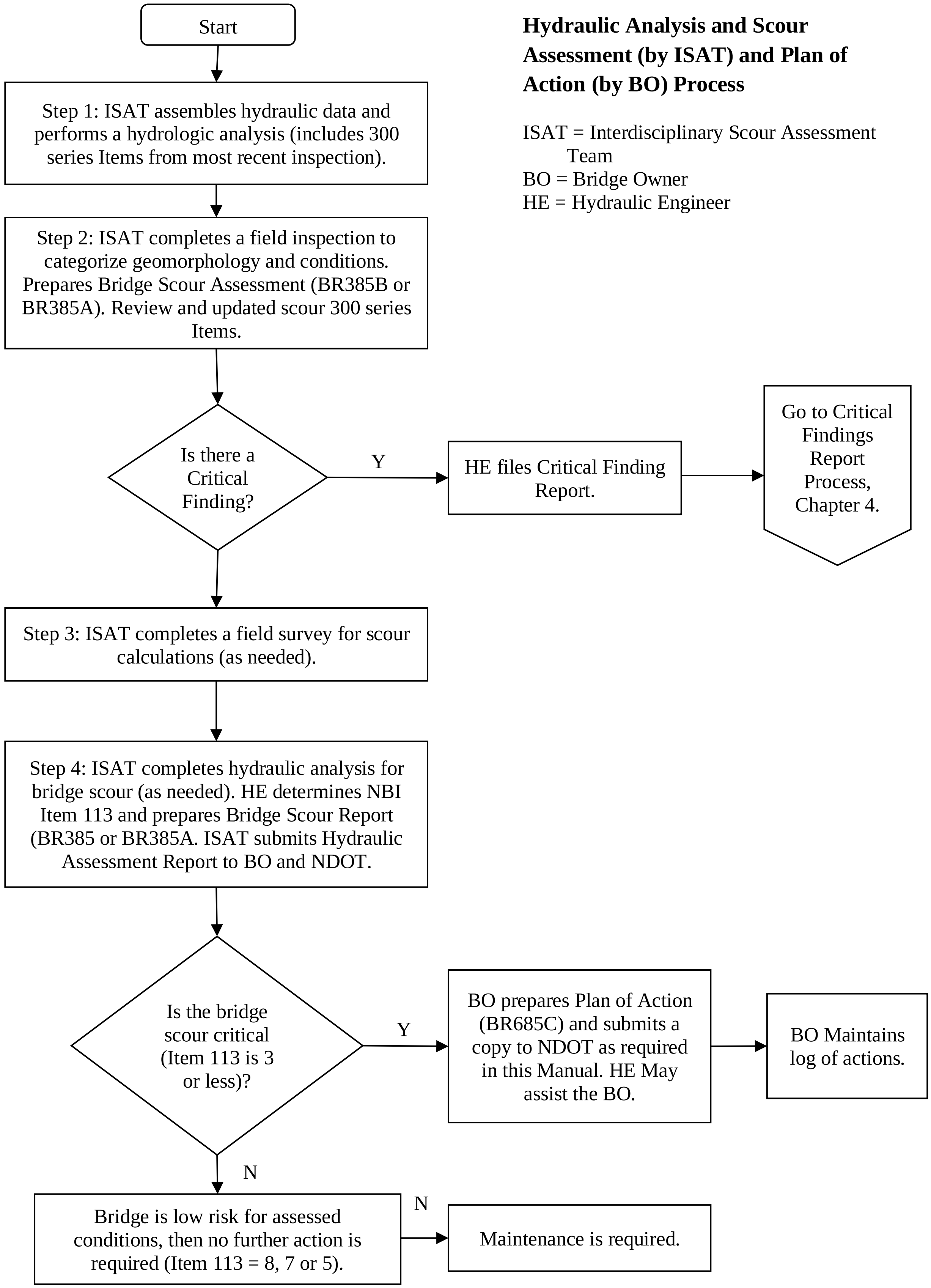
The Bridge Scour Report, DR Form 385, includes the scour-related 300 series inventory items. The values previously recorded by the bridge inspection team leader are verified by the HE who is responsible for reporting any revisions to the coding.

The bridge inspection team leader does not assign a code for Item 113 during a routine inspection of a scour critical bridge; however, they will assign codes for the scour-related 300 series data items which record conditions found during inspection. These items are flags of scour issues for the ISAT. See Section 6.1.

As previously mentioned, each bridge owner is responsible for maintaining a list of their scour critical bridges.

Hydraulic Analysis and Scour Assessment (by ISAT) and Plan of Action (by BO) Process

ISAT = Interdisciplinary Scour Assessment Team
BO = Bridge Owner
HE = Hydraulic Engineer



6.9 BRIDGE SCOUR PLAN OF ACTION

6.9.1 General

A bridge scour Plan of Action (POA) is a written document prepared by the Bridge Owner that establishes specific instructions for management and monitoring of the structure to protect the traveling public. A POA typically describes actions to be taken until the scour critical bridge can be replaced or permanent countermeasures installed. A HE may provide assistance to Bridge Owners when they are preparing their POAs.

A scour critical bridge will have a POA until:

- Adequate permanent countermeasures are installed.
- The bridge is replaced with a structure that can withstand potential scour depths.

6.9.2 Preparation

FHWA Memorandum HIBT-30 requires preparation of a POA for each scour critical bridge as well as bridges with unknown foundations types and depths. A POA is required for all bridges with Item 113 coded U, 3 or lower.

Guidance for POA preparation is contained in FHWA Hydraulic Engineering Circulars (HEC) 18, 20, & 23. A Bridge Scour Plan of Action form, BR Form 385c, has been developed by NDOT for bridge owners in Nebraska.

The ISAT reports scour critical findings to the bridge owners for use in the development of a POA. The bridge owner is given a copy of the scour study report and/or BR385 forms, and a blank POA form. The data in the report/forms provides hydraulic information and scour details that the owner may utilize for developing the POA.

The bridge owner should submit a copy of the completed POA to NDOT as required in this Manual. See Section 6.6 above.

6.9.3 POA Content

The POA may require increased inspections, periodic monitoring, installation of scour countermeasures, conditional closure, and/or bridge replacement. An acceptable POA includes:

- Monitoring
- Maintenance, if feasible
- Emergency Contacts in case closure becomes necessary
- Closure Plan and Detour Route
- Reopening Criteria.

Actions may include one or several of these:

- Monitoring during or after flood events
- Installation of countermeasure
- Closure, either temporary or permanent.

Actions for a POA should be selected based on the Owner’s assessment of the risk. A high risk site may require an inspector to be at the site prior to flood arrival and may be between/during/after flood events. A low risk of failure site may only need to be visited during the flood event and/or post flood. A visit to the site may be defined by rainfall parameters, flooding information, and/or road overtopping reports.

The POA should also include steps to be taken in the event a bridge closure is needed. A closure plan and detour route is required in the POA. The plan defines equipment needs, instructions on how to close the road, and the detour route. The agencies/people that may need to be immediately notified after a closure are identified including their contact information. Additionally, the general criteria and authorizing inspector for the reopening the bridge is specified.

6.9.4 POA Monitoring and Follow Up

It is important the POA is updated and maintained. Bridge Owners shall maintain a POA monitoring log to document that the items listed within the POA are being followed-up on. This is a document to record the actions taken and maintenance activities performed related to the POA. This includes monitoring scour issues during routine inspections as specified on the POA. Reports of any scour mitigation action shall include sketches and photos.

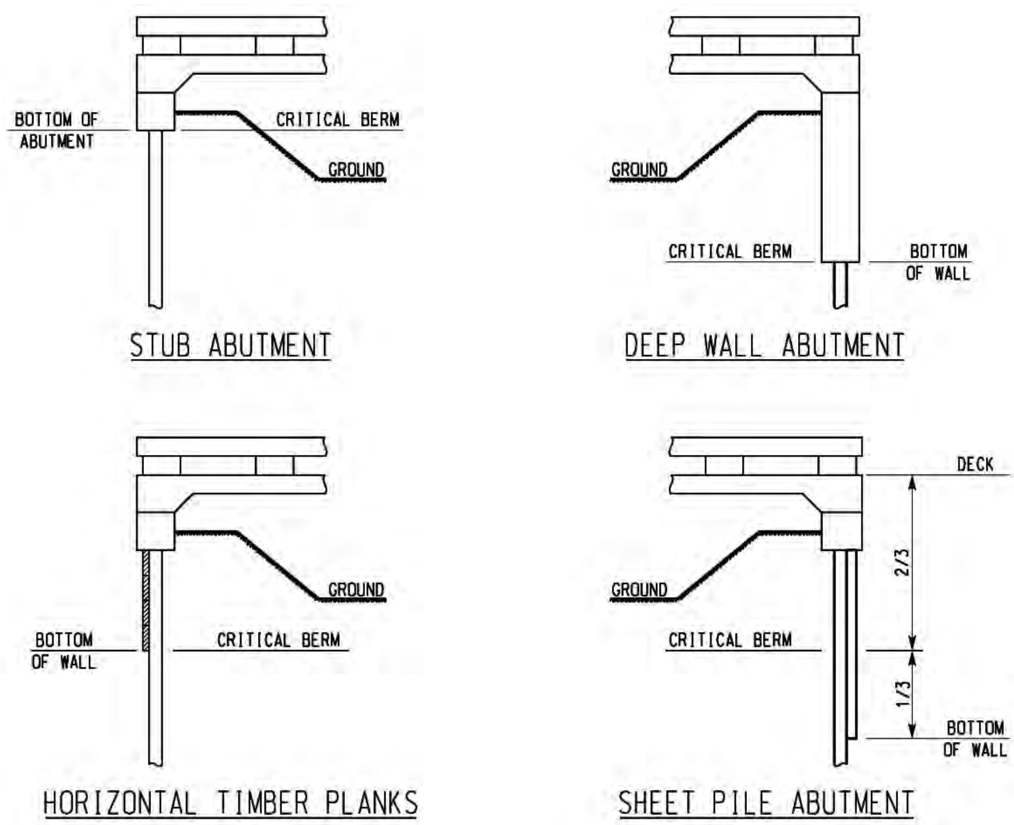
BR Form BR385e (POA Monitoring Log) and BR Form BR385f (Supplemental Hydraulic Findings and Maintenance for Scour Critical Bridges) are included in the Appendix. A best practice for implementing and maintaining POAs would be preparation of three-ring binder(s) that could be used in the field after inspections required by the POA. For each structure that requires a POA, the binder should include the POA and the POA monitoring log form on which the owner could record any POA activities (site visits, maintenance, repair, installation of permanent counter measures).

6.10 REQUIRED DOCUMENTATION FOR SCOUR CRITICAL BRIDGES

NBIS Item No. 113 (See Section 3.11 to Reference Examples)		**Required Documentation in Owner's Bridge File**
U	Bridge with "unknown" foundation that has not been evaluated for scour. Until risk can be determined, a plan of action will be developed and implemented to reduce the risk to users from a bridge failure during and immediately after a flood event.	• Place on list of bridges needing evaluation • Current Plan of Action • Monitoring Log
7	Countermeasures have been installed to mitigate an existing problem with scour and to reduce the risk of bridge failure during a flood event. Instructions contained in a plan of action have been implemented to reduce the risk to users from a bridge failure during or immediately after a flood event.	Documentation of countermeasure design and construction (plans, details, photos) and current condition during routine inspections
6	Scour calculation/evaluation has not been made.	Documentation that Owner is acquiring a Scour Assessment
5	Bridge foundations determined to be low risk for **assessed or calculated** scour condition. Scour is determined to be within the limits of footing or piles (Example B) by assessment (i.e., bridge foundations are on rock formations that have been determined to resist scour within the service life of the bridge), by calculations or by installation of properly designed countermeasures.	Hydraulic Analysis Report or Scour Assessment (BR 385B or BR 385A)
4	Bridge foundations determined to be stable for **assessed or calculated** scour conditions; field review indicates action is required to protect exposed foundations	• Hydraulic Analysis Report or Scour Assessment (BR 385B or BR 385A) • Should be checked after high water events for scour and damage to countermeasures
3	Bridge is scour critical; bridge foundations determined to be unstable for **assessed or calculated** scour conditions: - Scour within limits of footing or piles. (Example B) - Scour below spread-footing base or pile tips. (Example C)	• Hydraulic Analysis Report • Place on Master List (Bridge Owner's and NDOT's) of Scour Critical Bridges • Current Plan of Action • Monitoring Log
2 or less	Bridge is scour critical; field review indicates that extensive scour has occurred at bridge foundations, which are determined to be unstable by: - A comparison of calculated scour and **observed** scour during the bridge inspection, or - An engineering evaluation of the **observed** scour condition reported by the bridge inspector in Item 60**.**	• Documentation of observed scour • Hydraulic Analysis Report or Scour Assessment (BR 385B or BR 385A) • Place on Master List (Bridge Owner's and NDOT's) of Scour Critical Bridges • Current Plan of Action • Monitoring Log

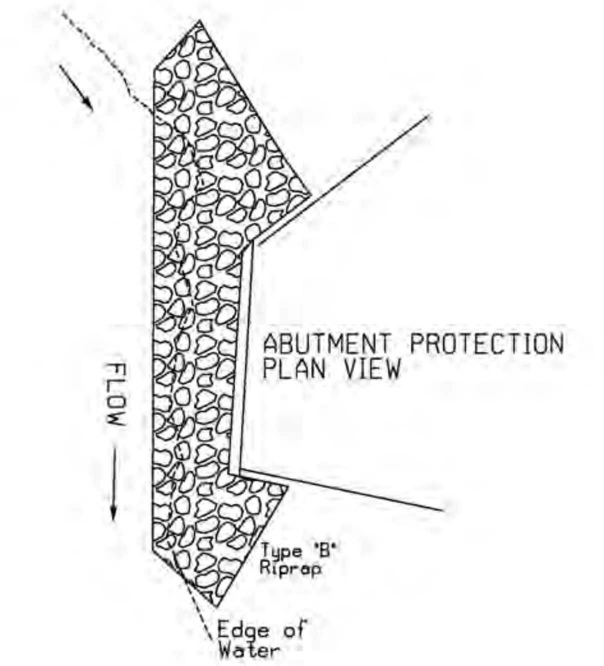
6.11 COUNTERMEASURES AND THE CRITICAL BERM ELEVATION

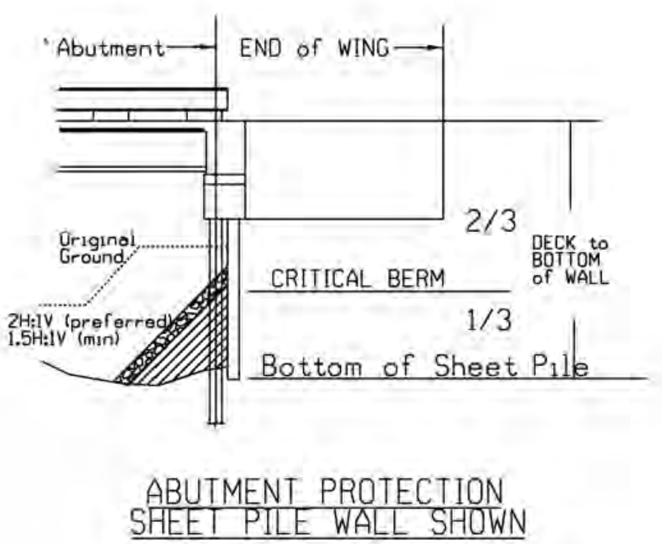
The critical berm elevation is typically the elevation at which scour depth could cause a failure of the abutment or approach. Scour depth can be calculated by hydraulic analysis to determine the critical berm elevation.



Critical Berm for sheet pile is 2/3 the distance from bridge deck to bottom of sheet pile.

One third of the distance from bottom of sheet pile to bridge deck is required for stability.





When scour has occurred near an abutment, typically the berm or other protection must be repaired. The critical berm elevation defines the depth requirements for a repair or countermeasure.

A slope perpendicular to the flow and extending up the wing should be 2H:1V preferred, with a minimum of 1.5H:1V.

Riprap should be Type "B" or broken concrete complying with NDOT Standard Construction Specifications. Broken concrete must be reduced to the size to meet the specifications. Large slabs of concrete should not be used as they may direct flow into the area to be protected or toward the opposite abutment or a pier.

The upstream and downstream limits of the repair are based on site conditions. The minimum limits are normally between the upstream and downstream toes of the roadway fill. Riprap must be transitioned to the natural stream bank to avoid abrupt velocity and flow direction changes. The riprap must tie into the upstream embankment, along the wings, through the bridge opening, and tie to the downstream embankment.

6.12 QUALITY CONTROL

The NBIS defines 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."

Quality Control is defined for NDOT's program as a system of routine technical activities, to measure and control the quality of the bridge inventory data or report as it is being developed. The QC system is designed to include general methods such as accuracy checks on data acquisition and calculations, and the use of approved standardized procedures for measurement, calculation, recording information and reporting. QC activities include:

- Documents, data, or calculations signed by a PE, must have QC completed by an individual of equivalent or better qualifications than the originator (this is typically documented when the QC individual signs or initials the documents).
- See that the technical activity has followed procedures set by NDOT.
- Providing routine and consistent checks for data integrity, correctness and completeness.
- Identifying and address errors and/or omissions
- Documenting inventory data.
- Recording all QC activities.

Quality Control for this program is the responsibility of the consultant or agency actually conducting the activity. Quality Control checks are conducted on every product of a program operation, and thus at a much higher frequency than quality assurance checks. When the QC on a program product is complete, it is finished and deliverable to the Bridge Owner for their records.

Consultants providing professional services to Bridge Owners must submit a Quality Control plan to the Bridge Owner for review and approval. QC must be done on the deliverables prior to submittal to the Bridge Owner.

6.13 QUALITY ASSURANCE

Quality Assurance (QA) of all hydraulic assessments and POAs will be performed by NDOT or their selected agent. The QA program activities are described in Chapter 1 of this Manual.

6.14 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1
2	2013 March 04	Revision 2
3	2015 March 15	Revision 3
4	2016 March 11	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

6.15 FORMS

Forms used in completing hydraulic assessments that are mentioned in this Chapter are listed below. Participants and contributors to the Nebraska Bridge Inspection Program are advised to go to the NDOT Bridge Inspection Program website for the current list of applicable forms and the most recent versions of each form. http://dot.nebraska.gov/business-center/bridge/inspection/.

Name	BR Form
Bridge Scour Report	385
Culvert Scour Report/Assessment	385a
Bridge Scour Assessment	385b
Bridge Scour Plan of Action	385c
Bridge Scour Worksheet	385d
POA Monitoring Log	385e
Supplemental Hydraulic Findings and Maintenance for Scour Critical Bridges	385f

6.16 APPENDIX

Memos and other guidance that may have been issued after the issuance of the current revision of this Chapter can be found at the NDOT Bridge Inspection Program website. Bridge Owners and Inspectors are urged to check this site to ensure they have all the most current information and forms. http://dot.nebraska.gov/business-center/bridge/inspection/.

Name	Revision Date
Channel Terms Glossary	2010 Jan 25

APPENDIX GUIDE

The Appendix to the Nebraska Department of Transportation Bridge Inspection Program (BIP) Manual provides the information listed below. The Manual sets for policies and procedures to be used for safety inspection and evaluation of bridges in the states that are subject to the National Bridge Inspection Standards.

BRIDGE INSPECTION PROGRAM FORMS

The Manual Appendix also incorporates by reference all forms that are used as part of the Bridge Inspection Program. The Forms Section of each Manual chapter lists forms that apply to work of that chapter. Forms are revised periodically and the most current are posted to the Bridge Division website. All participants are advised to get the most current forms from the Bridge Division website at

http://dot.nebraska.gov/business-center/bridge/inspection/

REFERENCE DOCUMENTS FOR THE MANUAL

This Appendix to the Manual contains documents that are referenced in the Chapters of the Manual, such as lists of County and City codes and the current National Bridge Inspection Standards. Typically these documents do not change.

Item Description (listed alphabetically)	BIP Manual Chapter
Abbreviations	All
Channel Behavior Glossary	6
Example of Permanent Bridge Closure	5
Fracture Critical Inspection Submission Procedures and Naming Convention	4
Legal Sizes and Weights for Nebraska Vehicles	5
Load Rating Report Checklist	5
National Bridge Inspection Standards CFR Vol. 69, Part 650, Subpart C	1
Nebraska Local Public Agencies List	3
Quality Control Examples	All
Referenced Publications	All
Standard Bridge Photo Locations / Descriptions	4
Sufficiency Calculation (English Units)	3

SUPPLEMENTAL MANUAL GUIDANCE

The Manual Appendix also incorporates by reference all supplemental guidance to the BIP Manual that NDOT may provide between the issues of Manual revisions. These will be posted to the Bridge Division website and participants will be notified.

http://dot.nebraska.gov/business-center/bridge/inspection/

BRIDGE INSPECTION PROGRAM MEMOS AND LETTERS

The Manual Appendix also incorporates by reference all NDOT memos, newsletters, letters, policies and other documents that may be issued by NDOT that supplement the BIP Manual, and may be incorporated into future revisions of the Manual. They are not included with this Manual document because they are revised or added periodically; these will be posted to the Bridge Division website. All participants are advised to get the most current forms from the Bridge Division website at

http://dot.nebraska.gov/business-center/bridge/inspection/

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5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

ABBREVIATIONS

AASTHO	American Association of State Highway and Transportation Officials
ADD	Agency Defined Defect
ADE	Agency Defined Element
BDMS	Bridge Document Management System
BIP	Bridge Inspection Program
BIPDM	Bridge Inspection Program Data Manager
BIPPM	Bridge Inspection Program Program Manager
BME	AASHTO Bridge Management Element
BO	Bridge Owner
BrM	AASHTOWare's Bridge Management software
BrR	AASHTOWare's Bridge Rating software
CF	Critical Finding
CP	Complex
DR	Department Roads (DR form prefix)
EI	Element Inspection
FC	Fracture Critical
FHWA	Federal Highway Administration
HE	Hydraulic Engineer
IBR	Individual Bridge Record
ISAT	Interdisciplinary Scour Assessment Team
LPA	Local Public Agency
LRE	Load Rating Engineer
LRSS	Load Rating Summary Sheet
MBE	AASHTO Manual for Bridge Evaluation
MUTCD	Manual for Uniform Traffic Control Devices

NBI	National Bridge Inventory
NBIS	National Bridge Inspection Standards
NBE	AASHTO National Bridge Element
NCHRP	National Cooperative Highway Research Program
NCSPA	National Corrugated Steel Pipe Association
NDOT	Nebraska Department of Transportation
NHS	National Highway System
PE	Professional Engineer
POA	Plan of Action
QA	Quality Assurance
QC	Quality Control
R	Routine
SC	Scour Critical
SHV	Special Hauling Vehicle
SI&A	Structure Inventory and Appraisal sheet
TL	Team Leader
UW	Underwater Water

CHANNEL BEHAVIOR GLOSSARY

Aggradation	General and progressive buildup of the longitudinal profile of a channel bed due to sediment deposition.
Alluvium	Unconsolidated material deposited in floodplain by a stream.
Alluvial stream	A stream which has formed its channel in cohesive or non-cohesive materials that has been and can be transported by the stream.
Alternating bars	Elongated deposits found alternately near the right and left banks of a channel.
Average velocity	Velocity at a given cross section determined by dividing discharge by cross sectional area.
Backwater	The increase in water surface elevation relative to the elevation occurring under natural channel and floodplain conditions, induced by a bridge or other structure that obstructs or constricts a channel. Backwater also can occur downstream of a constriction where flow expands, as in wide, wooded floodplains.
Bank	The side slopes of a channel between which the flow is normally confined.
Bank full discharge	Discharge that, on the average, fills a channel to the point of overflowing.
Bank protecting	Engineering works for the purpose of protecting stream banks from erosion.
Bank Revetment	Erosion-resistant materials placed directly on a streambank to protect the bank from erosion.
Bar	An elongated deposit of alluvium within a channel, not permanently vegetated.
Bed load	Sediment that is transported in a stream by rolling, sliding or skipping along the bed or very close to it; considered to be within the bed layer. Also, called contact load or contact sediment discharge.
Bed material	Material found in and on the bed of a stream (may be transported as bed load or in suspension).

Bedrock	The solid rock exposed at the surface of the earth or overlain by soils and unconsolidated material.
Braided stream	A stream whose flow is divided at normal stage by small mid-channel bars or small islands; the individual width of bars and islands is less than about three times water width; braided stream has the aspect of a single large channel within which are subordinate channels.
Bridge opening	The cross-sectional area beneath a bridge that is available for conveyance of water.
Bridge waterway	The area of a bridge opening available for flow, as measured below a specified stage and normal to the principal direction of flow.
Channel	The bed and banks that confine the surface flow of a stream.
Channelization	Straightening or deepening of a natural channel by artificial cutoffs, grading, flow-control measures or diversion of flow into a man-made channel.
Clear-water scour	Scour at a pier or abutment (or contraction scour) when there is no movement of the bed material upstream of the bridge crossing at the flow causing bridge scour.
Confluence	The junction of two or more streams.
Constriction	A natural or artificial control section, such as a bridge crossing, channel reach or dam, with limited flow capacity in which the upstream water surface elevation is related to discharge.
Contraction	The effect of channel or bridge constriction on flow streamlines.
Countermeasure	A measure intended to prevent, delay or reduce the severity of hydraulic problems.
Contraction scour	Scour in a channel or on a floodplain that is not localized at a pier, abutment, or other obstruction to flow. In a channel, contraction scour results from the contraction of streamlines and usually affects all or most of the channel width.
Critical berm	Elevation on abutment wall below which if material is eroded or scoured away, the increased soil pressure results in potential wall collapse. Sheet piling is designed to support the fill down to the critical berm. For concrete wall abutments critical berm is the bottom of concrete.

Cross section	A section normal to the trend of a channel or flow.
Debris	Floating or submerged material, such as logs or trash, transported by a stream.
Degradation (bed)	A general and progressive lowering of the channel bed due to scour.
Depth of scour	The vertical distance a streambed is lowered by scour below a reference elevation.
Dike	An impermeable linear structure for the control or containment of overbank flow. A dike trending parallel with a stream bank differs from a levee in that it extends for a much shorter distance along the bank, and it may be surrounded by water during floods.
Dike (groin, spur, jetty)	A structure extending from a bank into a channel that is designed to: (a) reduce the stream velocity as the current passes through the dike, thus encouraging sediment along the bank (permeable dike); or (b) deflect erosive current away from the stream bank (impermeable dike).
Dominant discharge	(a) The discharge which is of sufficient magnitude and frequency to have a dominating effect in determining the characteristics and size of the stream course, channel and bed. (b) That discharge which determines the principal dimensions and characteristics of a natural channel. The dominant formative discharge depends on the maximum and mean discharge, duration of flow, and flood frequency. For hydraulic geometry relationships, it is taken to be the bank full discharge which has a return period of approximately 1.5 years in many natural channels.
Drift	Alternative term for “debris”.
Eddy current	A vortex-type motion of a fluid flowing contrary to the main current, such as the circular water movement that occurs when the main flow becomes separated from the bank.
Erosion	Displacement of soil particles on the land surface or in a stream due to water or wind action.
Equilibrium scour	Scour depth in sand-bed stream with dune bed about which 1 live bed pier scour level fluctuates due to variability in bed material transport in the approach flow.

Fine sediment load (wash load)	The part of the total sediment load that is composed of particle sizes finer than those represented in the bed. Normally, the fine-sediment load is finer than 0.062 mm for sand-bed channel. Silts, clays and sand could be considered wash load in course gravel and cobble bed channels.
Flanking	Erosion resulting from stream flow between the bank and the forward end of a countermeasure for stream stabilization.
Floodplain	A nearly flat, alluvial lowland bordering a stream that is subject to inundation by floods.
Flow-control structure	A structure either within or outside a channel that acts as a counter-measure by controlling the direction, depth, or velocity of flowing water.
Gabion	A basket or compartmented rectangular container made of steel wire mesh. When filled with cobbles or other rock of suitable size, the gabion becomes a flexible and permeable block with which flow-control structures can be built.
Geomorphology	That branch of both physiography and geology that / morphology deals with the form of the earth, the general configuration of its surface, and the changes that take place due to erosion of the primary elements and in the buildup of erosional debris.
Grade-control structure (sill, check dam)	Structure placed bank to bank across a stream channel usually with its central axis perpendicular to flow) for the purpose of controlling bed slope and preventing scour or headcutting.
Guide bank	Preferred term for spur dike.
Hardpoint	A streambank protection structure whereby “soft” or erodible materials are removed from a bank and replaced by stone or compacted clay. Some hard points also occur naturally along streambanks as passing currents remove erodible materials leaving nonerodible materials exposed.
Headcutting	Channel degradation associated with abrupt changes in the bed elevation (headcut) that generally migrates in an upstream direction.
Incised reach	A stretch of stream with an incised channel that only rarely overflows its banks.

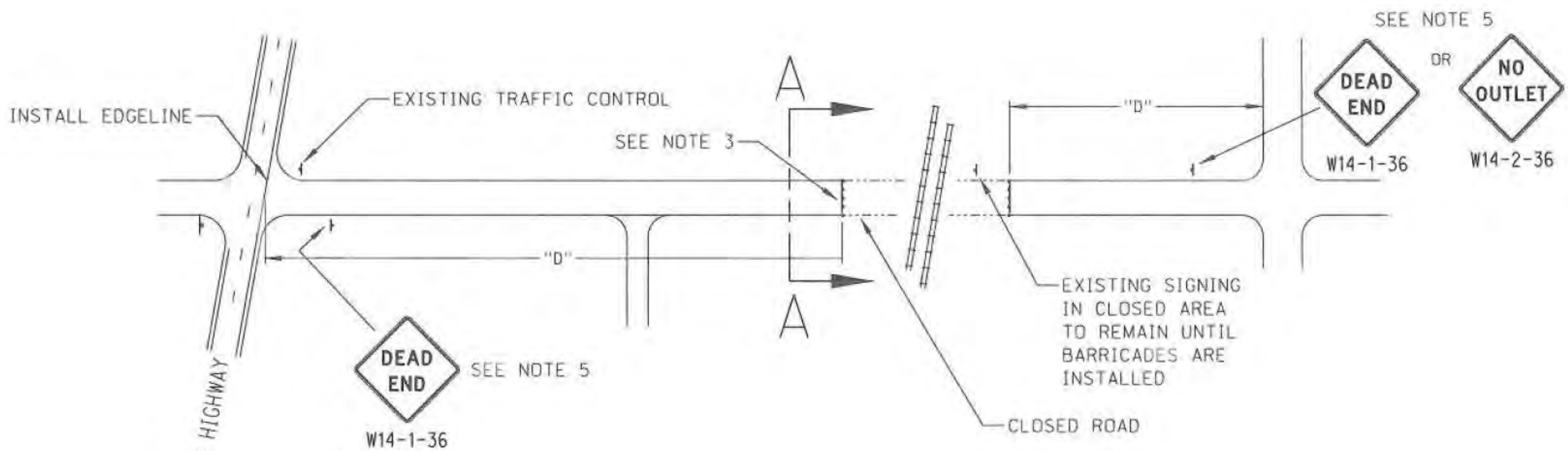
Jetty	(a) An obstruction built of piles, rock or other material extending from a bank into a stream, so placed as to induce scouring or bank building, or to protect against erosion. (b) A similar obstruction to influence stream, lake or tidal currents, or to protect a harbor.
Lateral erosion	Erosion in which the removal of material is extended in a lateral direction, as contrasted with degradation and scour in a vertical direction.
Launching	Release of undercut material (stone riprap, rubble, slag, etc.) downslope or into a scoured area.
Levee	An embankment, generally landward of top bank that confines flow during high water periods, thus preventing overflow into lowlands.
Live-bed scour	Scour at a pier or abutment (or contraction scour) when the bed material in the channel upstream of the bridge is moving at the flow causing bridge scour.
Local scour	Scour in a channel or on a floodplain that is localized at a pier, abutment, or other obstruction to flow.
Meander or full meander	A meander in a river consists of two consecutive loops, one flowing clockwise and the other anti-clockwise.
Meander belt	The distance between lines drawn tangent to the extreme limits of successive fully developed meanders.
Meandering	A stream which follows a sinuous path due to natural physical causes not imposed by external restraint, and is characterized by curved flow and alternating shoals and bank erosion.
Median diameter	The particle diameter of the 50 percentile point on a size distribution curve such that half of the particles (by weight for samples of sand, silt, or clay and by number for samples of gravel) are larger and half are smaller.
Migration	Change in position of a channel by lateral erosion of one bank and simultaneous accretion of the opposite bank.
Natural levee	A low ridge formed along streambanks during floods by deposition that slopes gently away from the channel banks.
Normal stage	The water stage prevailing during the greater part of the year.

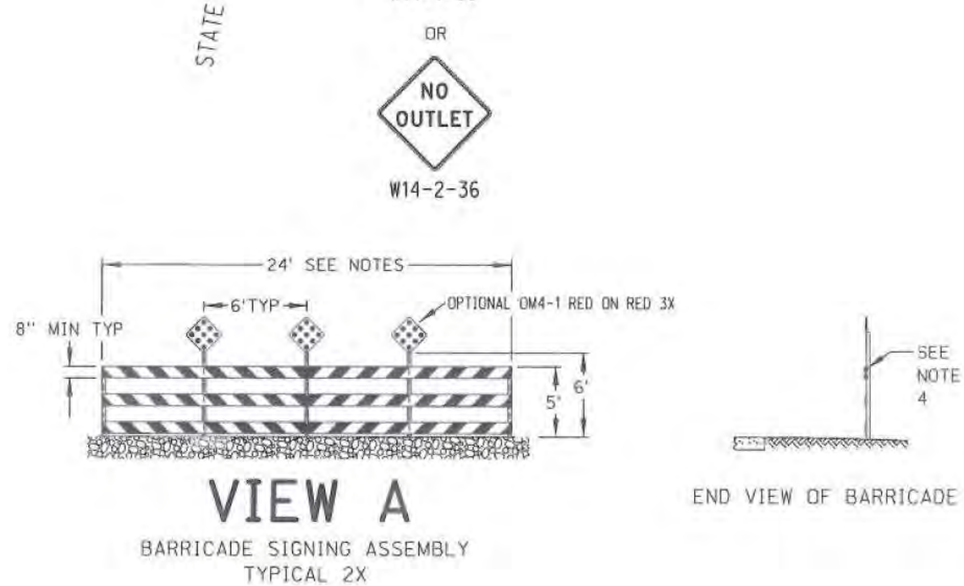
Overbank flow	Water movement over top bank either due to stream stage or to inland surface water runoff.
Perennial stream	A stream or reach of a stream that flows continuously for all or most of the year.
Reach	A segment of stream length that is arbitrarily bounded for purposes of study.
Retard (retarder structure)	A permeable or impermeable linear structure in a channel, parallel with the bank and usually at the toe of the bank, intended to reduce flow velocity, induce deposition, or deflect flow from the bank.
Revetment	Rigid or flexible armor placed to inhibit scour and lateral erosion (see bank revetment).
Riparian	Pertaining to anything connected with or adjacent to the banks of a stream.
Riprap	In the restricted sense, layer or facing of broken rock or concrete dumped or placed to protect a structure or embankment from erosion; also the broken rock or concrete suitable for such use. Riprap has also been applied to almost all kinds of armor, including wire-enclosed riprap, grouted riprap, sacked concrete, and concrete slabs.
River training works	Any structure configuration constructed in a stream or placed on, adjacent to, or in the vicinity of a streambank that is intended to deflect currents, induce sediment deposition, induce scour, or in some other way alter the flow and sediment regimes of the stream.
Rubble	Rough, irregular fragments of materials of random size used to retard erosion. The fragments may consist of broken concrete slabs or masonry.
Sack revetment	Sacks (e.g., burlap, paper, or nylon) filled with mortar, concrete, sand, stone or other available materials used as protection against erosion.
Scour	Erosion or removal of streambed or bank material from bridge foundations due to flowing water, usually considered as long-term bed degradation, contraction, and local scour.
Scoured depth	Total depth of the water from water surface to a scoured bed level (compare with "depth of scour").

Sediment	Fragmental material transported, suspended or deposited fluvial by water.
Sediment discharge	The quantity of sediment that is carried past any cross section of a stream in a unit of time. Discharge may be limited to certain sizes of sediment or to a specific part of the cross section.
Sediment load	Amount of sediment being moved by a stream.
Seepage	The slow movement of water through small cracks and ports of the bank material.
Sinuosity	The ratio between the thalweg length and the valley length of a sinuous stream.
Slope (channel or stream)	Fall per unit length along the channel of the bed water surface or energy gradeline. Also, sideslope of a channel bank.
Sloughing	Sliding of overlying material; same ultimate effect as caving, but usually occurs when a bank or an underlying stratum is saturated.
Spur dike/guide bank	A dike extending upstream from the approach embankment at either or both sides of the bridge opening. Guide banks may also extend downstream from the bridge.
Stable channel	A condition that exists when a stream has a bed slope and cross section which allows its channel to transport the water and sediment delivered from the upstream watershed without aggradation, degradation or bank erosion.
Stage	Water-surface elevation of a stream with respect to a reference elevation.
Stone riprap	Natural cobbles, boulders or rock dumped or placed as protection against erosion.
Stream	A body of water that may range in size from a large river to a small rill flowing in a channel. By extension, the term is sometimes applied to a natural channel or drainage course formed by flowing water whether it is occupied by water or not.
Streambank erosion	Removal of soil particles or a mass of particles from a bank surface due primarily to water action. Other factors such as weathering, ice and debris abrasion, chemical reactions, and land use changes may also directly or indirectly lead to bank erosion.

Streambank failure	Sudden collapse of a bank due to an unstable condition such as due to removal of material at the toe of the bank by scour.
Streambank protection	Any technique used to prevent erosion or failure of a streambank.
Suspended sediment	The quantity of suspended sediment passing through a discharge stream cross section above the bed layer in a unit of time.
Thalweg	The line extending down a channel that follows the main current of the flow.
Tieback	Structure placed between revetment and bank to prevent flanking.
Toe of bank	That portion of a stream cross section where the lower bank terminates and the channel bottom or the opposite lower bank begins.
Toe protection	Loose stones laid or dumped at the toe of an embankment, groin, etc., or masonry or concrete wall built at the junction of the bank and the bed in channels or at extremities of hydraulic structures to counteract erosion.
Turbulence	Motion of fluids in which local velocities and pressures fluctuate irregularly in a random manner as opposed to laminar flow where all particles of the fluid move in distinct and separate lines.
Velocity	The rate of motion in a fluid on a stream or of the objects or particles transported therein, usually expressed in m/s or f/s.
Vortex	Turbulent eddy in the flow generally caused by an obstruction such as a pier or abutment (e.g. horseshoe vortex).
Waterway opening width	Width or area of bridge opening at a specific elevation, (area) measured normal to principle direction of flow.

EXAMPLE OF PERMANENT BRIDGE CLOSURE





NOTES

1. Barricade Specs:
   * NCHRP 350 or Mash compliant
   * 6" Stripe width
   * Alternating red and white retroreflective stripes slope downward at 45° angle toward center. See details below.
2. Warning sign colors: Yellow and Black
3. Place barricade signing assy perpendicular to approach road.
4. Install two yellow retroreflectors at each end of top barricade slat.
5. Install DEAD END sign when distance "D" to barricade exceeds 250 feet.

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FRACTURE CRITICAL INSPECTION DELIVERABLES

A. Fracture Critical Inspections SHALL include the following files:

1. Inspection Reports (BR293). This form include the following parts:

BR 293 Cover - Fracture Critical Inspection Report - ***Cover Page and table of content***
BR 293a - Fracture Critical Inspection Report - ***Introduction***
BR 293g - Fracture Critical Inspection Report - ***Summary & Conclusions***
BR 293b - Fracture Critical Inspection Report - ***Bridge Orientation/Layout***
BR 293c - Fracture Critical Inspection Report - ***Identification of All Fracture Critical Members/Details***
BR 293d - Fracture Critical Procedural Report
BR 293e - Fracture Critical Inspection Report - ***NBIS Condition Rating***
BR 293f - Fracture Critical Inspection Report - ***Reference Photos/Sketches***
BR 293h - Fracture Critical Inspection Report - ***Follow-up Procedure and Appendix table of content***
Attachments (See paragraph 4 below)

Note: All BR293 series forms have been combined into a single report and shall be submitted in electronic (.pdf and .docx) formats.

2. Inspection Photos

   Note: All photos shall be submitted in electronic (.jpg) format thru BrM

3. BrM on line submittal

4. Fracture Critical Inspection report attachment MAY include any of the following files:
   a. Channel cross-section field measurements and plot of current and past cross sections superimposed on one plot.
   b. DR27 – Structure Maintenance Checklist if needed in .pdf format
   c. DR320 – Critical Finding Report in .pdf and .docx formats
   d. DR321 – Structure Repair Report in .pdf format
   e. BR385F – Supplemental Hydraulic Finding & Maintenance
   f. Intelligent PDF Form
   g. Latest Load Rating Summary Sheet (LRSS)
   h. Plans or Measurements

   Note: Items f, g and h shall be submitted in electronic (.pdf) format. All other formats, including Word (.doc) format, will NOT be accepted.

NAMING CONVENTIONS

A. Create folders for each structure

1. Example
    a. **C000100305**

B. All files below shall be named as:

STRUCTURE NUMBER_FORM NAME OR SUBMISSION CATEGORY _4 DIGIT YEAR 3 DIGIT MONTH

1. **Year and Month shall be for the date the file was created**

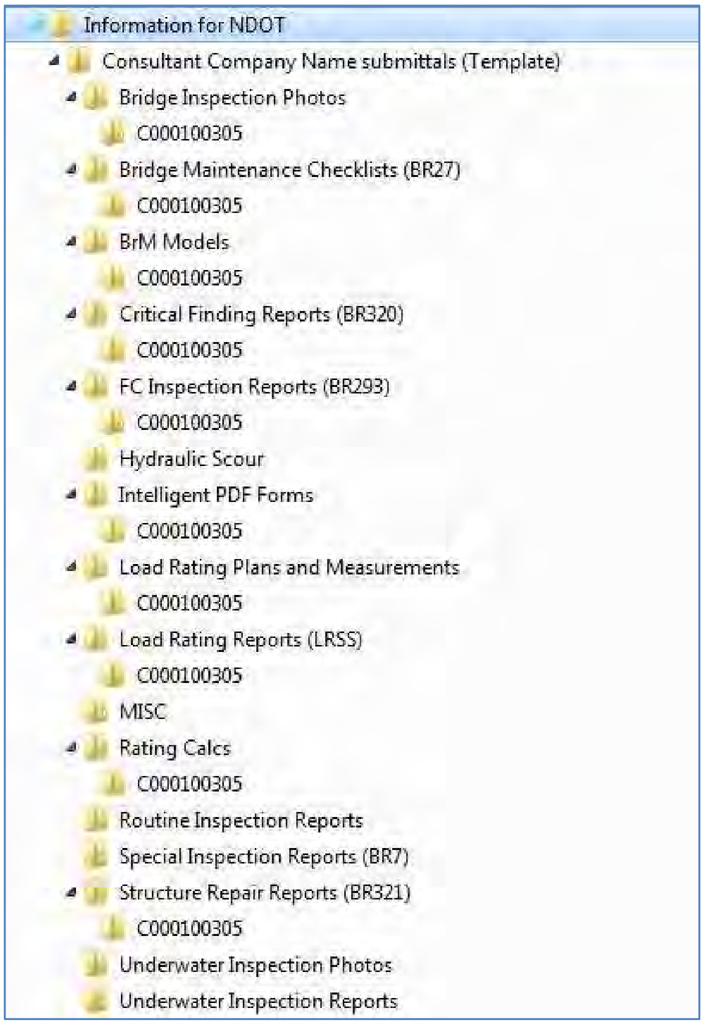
2. **Examples**
    a. Fracture Critical Inspection Report: **C000100305_DR293_2011FEB.pdf**
    b. Structure Maintenance Checklist: **C00010030_DR27_2011FEB.pdf**
    c. Critical Finding Reports: **C00010030_DR320_2011FEB.pdf**
    d. Structure Repair Reports: **C00010030_DR321_2011FEB.pdf**
    e. Rating Calculations (other than BrR output): **C00010030_Calcs_2011FEB.pdf**
    f. Intelligent PDF Form: **C00010030.pdf**
    g. Load Rating Report (LRSS): **C00010030_LRSS_2011FEB.pdf**
    h. Measurements: **C00010030_Field Measurements_2011FEB.pdf**

3. **Exceptions include:**
    a. BrR Model: **C00010030_2011FEB.xml**
    b. Plans: **C00010030_01.pdf**
    C00010030_02.pdf
    c. Inspection Photos: **C000100305_Y11_01.jpg**
    C000100305_Y11_02.jpg
    d. Rating Calculations - BrR output: **C000100305_FLXRPT_2011FEB.LIS**
    ~~e. Pontis File: **COUNTY NAME_FC_2011FEB**~~
    ~~**BURT_FC_2011FEB.pdi**~~

FRACTURE CRITICAL INSPECTION SUBMISSION PROCEDURES

All Fracture Critical Inspection reports, which cannot be submitted through BrM, shall be submitted using the NDOT FTP site. E-mail attachments and CDs will NOT be accepted.

1. Folders shall be created for each structure under each of the predefined submission categories that are applicable to each inspection



Individual files shall be placed within these folders

2. A single CD or flash drive containing all submission data shall be submitted directly to the Bridge Owner

BRM SUBMISSION

A. BrM entries shall be completed within 30 days of inspection

LEGAL SIZES & WEIGHTS FOR VEHICLES IN NEBRASKA

Standard From RM-421b, Sep 93
Updated Oct 1999

LEGAL SIZES AND WEIGHTS FOR VEHICLES IN NEBRASKA

1	Maximum overall width	8 feet 6 inches* (see below)
2	Maximum overall height	14 feet 6 inches*
3	Maximum overall length, single vehicle	40 feet*
4	Maximum overall length, combination of vehicles	65 feet
5	Maximum overall length, semi-trailer (excluding truck-tractor)	53 feet
6	Maximum overall length, semi-trailer and trailer (including connecting devices, excluding truck-tractor)	65 feet
7	Maximum single wheel load	10,000 lbs.
8	Maximum single axle load	20,000 lbs.
9	Maximum tandem axle load	34,000 lbs.

EXCEPTIONS

Width* - Eight feet six inch width shall not apply to farm equipment in temporary movement during daylight hours in normal course of farm operation.

Height - The owners, lessees and operators, jointly and severally, of vehicle exceeding twelve feet six inches in height shall assume the risk of loss to the vehicle and load and shall be liable for any damage that results to overhead obstructions from operation of a vehicle exceeding twelve feet six inches in height.

Length* - The length provisions shall not apply to the temporary moving of farm equipment during daylight hours in the normal course of farm operation, nor to the movement of public utility or other construction and maintenance material and equipment at any time. The length of refrigeration units mounted on the front of trailers which overhang the cab of the truck shall not be counted in determining length. Combination of vehicles, all trailing units of which must be equipped on each wheel with brakes that can be operated from the driving position of the towing vehicle.

****Weight** - In all cases, gross weights are subject to wheel and axle load restriction. It shall be unlawful to operate the public highways of this state any motor truck, truck-tractor, or trailer that weighs in excess of the gross weight for which the registration fee on such vehicle has been paid plus one thousand pounds. An axle load shall be defined as the total load transmitted to the road by all wheels whose centers may be included between two parallel transverse vertical planes forty inches apart, extending across the full width of the vehicle. The distance between axles shall be measured to the nearest foot. When a fraction is exactly one-half foot, the next larger whole number shall be used.

No group of two or more consecutive axles shall carry a load in pounds in excess of the value given in the following table corresponding to the distance in feet between the extreme axles of the group, measured longitudinally to the nearest foot, except two consecutive sets of tandem axles may carry a gross load of thirty-four thousand pounds each when the overall distance between the first and last axles of such consecutive sets of tandem axles is thirty-six, thirty-seven, or thirty-eight feet, and except that any group of three axles shall be restricted to a maximum load of thirty-four thousand pounds unless the distance between the extremes of the first and third axles is at least ninety-six inches in fact.

Dummy axles *shall be disregarded in determining the lawful weight of a vehicle or vehicle combination for operation on the highway. Dummy axle shall mean an axle attached to a vehicle or vehicle combination in a manner so that it does not articulate or substantially equalize the load and does not carry at least the lesser of eight thousand pounds or eight percent of the gross weight of the vehicle or vehicle combination.*

If any truck shall cross a bridge with total gross load in excess of the posted capacity of said bridge, and as a result of such crossing, any damage results to the bridge, the owner of such truck shall be responsible for all such damage.

Excess Size or Weight - The Department of Roads with respect to highways under its jurisdiction and County authorities with respect to highways under their jurisdiction may in their discretion upon application and good cause being shown therefore, issue a special permit in writing authorizing the applicant to operate or move a vehicle, a combination of vehicles or an object of a size or weight of vehicle or load exceeding the maximum specified by law, provided, no permit shall be issued for a vehicle carrying a load which cannot be dismantled or reduced in size or weight without great difficulty. The Department or County authority issuing a permit may require a permit fee not to exceed ten dollars.

MAXIMUM LOAD IN POUNDS CARRIED ON ANY GROUP OF TWO OR MORE CONSECUTIVE AXLES						
Distance in feet between the extremes of any group of two or more consecutive axles	Two Axles	Three Axles	Four Axles	Five Axles	Six Axles	Seven Axles
4	34,000					
5	34,000					
6	34,000					
7	34,000					
8	34,000	42,000				
9	39,000	42,500				
10	40,000	43,500				
11		44,000				
12		45,000	50,000			
13		45,500	50,500			
14		46,500	51,500			
15		47,000	52,000			
16		48,000	52,500	58,000		
17		48,500	53,500	58,500		
18		49,500	54,000	59,000		
19		50,000	54,500	60,000		
20		51,000	55,500	60,500		
21		51,500	56,000	61,000		
22		52,500	56,500	61,500		
23		53,000	57,500	62,500		
24		54,000	58,000	63,000		
25		54,500	58,500	63,500	69,000	
26		55,500	59,500	64,000	69,500	
27		56,000	60,000	65,000	70,000	
28		57,000	60,500	65,500	71,000	
29		57,500	61,500	66,000	71,500	
30		58,500	62,000	66,500	72,000	
31		59,000	62,500	67,500	72,500	
32		60,000	63,500	68,000	73,000	
33			64,000	68,500	74,000	
34			64,500	69,000	74,500	
35			65,500	70,000	75,000	
36			66,000	70,500	75,500	
37			66,500	71,000	76,000	81,500
38			67,500	72,000	77,000	82,000
39			68,000	72,500	77,500	82,500
40			68,500	73,000	78,000	83,500
41			69,500	73,500	78,500	84,000
42			70,000	74,000	79,000	84,500
43			70,500	75,000	80,000	85,000
44			71,500	75,500	80,500	85,500
45			72,000	76,000	81,000	86,000
46			72,500	76,500	81,500	87,000
47			73,500	77,500	82,000	87,500
48			74,000	78,000	83,000	88,000
49			74,500	78,500	83,500	88,500
50			75,500	79,000	84,000	89,000
51			76,000	80,000	84,500	89,500
52			76,500	80,500	85,000	90,500
53			77,500	81,000	86,000	91,000
54			78,000	81,500	86,500	91,500
55			78,500	82,500	87,000	92,000
56			79,500	83,000	87,500	92,500
57			80,000	83,500	88,000	93,000
58				84,000	89,000	94,000
59				85,000	89,500	94,500
60				85,500	90,000	95,000

MOD3-SO

LOAD RATING REPORT CHECKLIST

The Load Rating Engineer prepares the Load Rating Report and transmits the Report and other files to the Owner and to NDOT. See submittal deadlines in BIP Manual Chapter 5.

Load Rating Report

The Load Rating Report includes the items listed below and details are provided for each item in the following sections.

______ Load Rating Summary Sheet (LRSS) and Load Rating Review Sheets; current version available from http://dot.nebraska.gov/business-center/bridge/forms/. It is recommended that the LRSS be the first page in the Report (see below).

______ Structure geometry and condition information from the inspection report (see below).

______ Calculations supporting the load rating (see below).

______ Software analysis input and output in permanent format such as hard copy (PDF, TXT) or other secured electronic files (see below).

As part of the Load Rating package, the following must be completed.

______ The person completing QC shall initials and date all pages of the Report.

______ The Load Rating Engineer (LRE) is responsible for sealing and signing the Report in accordance with the NE Engineers and Architects regulation Act §81-3437 (3c and 3d).

______ The completed report shall be delivered to the Bridge Owner

______ An electronic copy of the Report shall be submitted to NDOT. A copy must be furnished to NDOT either by the Owner or, at the direction of the Owner, by the LRE.

______ Deliver to NDOT the software input file that can be executed in the software package.

The following sections provide details about each element of the Load Rating Report

Load Rating Summary Sheet (LRSS)

______ Use the current version – available from http://dot.nebraska.gov/business-center/bridge/forms/.

______ Analyst shall be the engineer performing the load rating. The Analyst can be the same as the Engineer of Record for the load rating.

______ Enter the Analyst as first initial, last name. For example, F. Last.

______ Notations of rating by hand calculations as appropriate

______ Include the software version used in the rating analysis in the comments section of the LRSS.

______ The Additional Comments section of the LRSS should include comments regarding the controlling member, posting required, inspection results, bridge geometry, structure modifications/repairs, rating considerations for the deck, rating considerations for the substructure, dead load and distribution factor calculation assumptions, section losses, member defects, bracing assumptions and allowable stresses (see Chapter 5 for examples).

______ Identify the controlling member in the table in the Ratings and Loads section.

______ Verify that the LRSS has been completely filled out

______ Completed LRSS shall be included in the Report (recommended as the first page).

Structure Geometry and Condition Information

______ Verify that bridge plans and/or current field measurements are available on the NDOT Bridge Management FTP site. If not, upload a PDF of the bridge plans and/or current field measurement to the NDOT Bridge Management FTP site.

______ Include basic bridge geometry such as sketches.

______ Include inspection information that documents the conditions affecting the load rating.

______ Include section losses and/or member defects.

______ Structure geometry and condition documentation shall be included in the Report.

Calculations and Documentation Supporting the Load Rating

The following are typically hand calculations or spreadsheets if not calculated by the program used to complete the rating.

______ Calculation for dead loads (DL).

______ Calculation for distribution factors (DF), including assumptions.

______ Analysis assumptions.

______ Analyst's initials and date of preparation shall be on each sheet.

______ QC reviewer's initials and date of review shall be on each sheet.

______ Calculations and documentation shall be included in the Report.

Software Analysis Model (BrR or other software)

______ Filename includes bridge number and the year of the load rating.

______ Analyst's initials and date of analysis shall be in the comments.

______ QC reviewer's initials and date of review shall be in the comments.

______ Description of the members analyzed shall be in the comments.

______ Allowable bending and shear stresses shall be in the comments.

______ Section losses and/or member defects shall be in the comments.

______ DF shall be in the comments.

______ If the timber deck is rated, include the NBI condition code and the issue that required the rating in comments.

______ Software version shall be in the comments.

______ Input file (PDF, TXT) shall be included in the Report.

______ Output file (PDF, TXT) shall be included in the Report.

______ Rating Summary Report file (PDF, TXT) identifying the controlling rating factor shall be included in the Report.

______ Executable model (input file) shall be uploaded to the NDOT Bridge Document Management folder on the FTP site.

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74436 Federal Register / Vol. 69, No. 239 / Tuesday, December 14, 2004 / Rules and Regulations

PART 650—BRIDGES, STRUCTURES, AND HYDRAULICS

■ 1. The authority citation for part 650 continues to read as follows:

Authority: 23 U.S.C. 109 (a) and (h), 144, 151, 315, and 319; 33 U.S.C. 401, 491 *et seq.*, 511 *et seq.*; 23 CFR 1.32; 49 CFR 1.48(b), E.O. 11988 (3 CFR, 1977 Comp. p. 117); Department of Transportation Order 5650.2 dated April 23, 1979 (44 FR 24678); sec. 161 of Public Law 97–424, 96 Stat. 2097, 3135; sec. 4(b) of Public Law 97–134, 95 Stat. 1699; and sec. 1057 of Public Law 102–240, 105 Stat. 2002; and sec. 1311 of Pub. L. 105–178, as added by Pub. L. 105–206, 112 Stat. 842 (1998).

■ 2. Revise subpart C to read as follows:

Subpart C—National Bridge Inspection Standards

Subpart C—National Bridge Inspection Standards

§ 650.301 Purpose.

This subpart sets the national standards for the proper safety inspection and evaluation of all highway bridges in accordance with 23 U.S.C. 151.

§ 650.303 Applicability.

The National Bridge Inspection Standards (NBIS) in this subpart apply to all structures defined as highway bridges located on all public roads.

§ 650.305 Definitions.

Terms used in this subpart are defined as follows:

American Association of State Highway and Transportation Officials (AASHTO) Manual. "Manual for Condition Evaluation of Bridges," second edition, published by the American Association of State Highway and Transportation Officials (incorporated by reference, see § 650.317).

Bridge. 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.

Bridge inspection experience. Active participation in bridge inspections in accordance with the NBIS, in either a field inspection, supervisory, or management role. A combination of bridge design, bridge maintenance, bridge construction and bridge inspection experience, with the predominant amount in bridge inspection, is acceptable.

Bridge inspection refresher training. The National Highway Institute "Bridge Inspection Refresher Training Course"[1] or other State, local, or federally developed instruction aimed to improve quality of inspections, introduce new techniques, and maintain the consistency of the inspection program.

Bridge Inspector's Reference Manual (BIRM). A comprehensive FHWA manual on programs, procedures and techniques for inspecting and evaluating a variety of in-service highway bridges. This manual may be purchased from the U.S. Government Printing Office, Washington, DC 20402 and from National Technical Information Service, Springfield, Virginia 22161, and is available at the following URL: *http://www.fhwa.dot.gov/bridge/bripub.htm.*

Complex bridge. Movable, suspension, cable stayed, and other bridges with unusual characteristics.

Comprehensive bridge inspection training. Training that covers all aspects of bridge inspection and enables inspectors to relate conditions observed on a bridge to established criteria (see the Bridge Inspector's Reference Manual for the recommended material to be covered in a comprehensive training course).

Critical finding. A structural or safety related deficiency that requires immediate follow-up inspection or action.

Damage inspection. This is an unscheduled inspection to assess structural damage resulting from environmental factors or human actions.

[1] The National Highway Institute training may be found at the following URL: *http://www.nhi.fhwa.dot.gov/.*

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Fracture critical member (FCM). A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.

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

Hands-on. Inspection within arms length of the component. Inspection uses visual techniques that may be supplemented by nondestructive testing.

Highway. The term "highway" is defined in 23 U.S.C. 101(a)(11).

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

Initial inspection. 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.

Legal load. The maximum legal load for each vehicle configuration permitted by law for the State in which the bridge is located.

Load rating. The determination of the live load carrying capacity of a bridge using bridge plans and supplemented by information gathered from a field inspection.

National Institute for Certification in Engineering Technologies (NICET). The NICET provides nationally applicable voluntary certification programs covering several broad engineering technology fields and a number of specialized subfields. For information on the NICET program certification contact: National Institute for Certification in Engineering Technologies, 1420 King Street, Alexandria, VA 22314–2794.

Operating rating. The maximum permissible live load to which the structure may be subjected for the load configuration used in the rating.

Professional engineer (PE). An individual, who has fulfilled education and experience requirements and passed rigorous exams that, under State licensure laws, permits them to offer engineering services directly to the public. Engineering licensure laws vary from State to State, but, in general, to become a PE an individual must be a graduate of an engineering program accredited by the Accreditation Board for Engineering and Technology, pass the Fundamentals of Engineering exam, gain four years of experience working under a PE, and pass the Principles of Practice of Engineering exam.

Program Manager. 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.

Public road. The term "public road" is defined in 23 U.S.C. 101(a)(27).

Quality assurance (QA). 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.

Quality control (QC). Procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level.

Routine inspection. 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 permit load. A live load, which has a gross weight, axle weight or distance between axles not conforming with State statutes for legally configured vehicles, authorized for unlimited trips over an extended period of time to move alongside other heavy vehicles on a regular basis.

Scour. Erosion of streambed or bank material due to flowing water; often considered as being localized around piers and abutments of bridges.

Scour critical bridge. A bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition.

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

State transportation department. The term "State transportation department" is defined in 23 U.S.C. 101(a)(34).

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

Underwater diver bridge inspection training. Training that covers all aspects of underwater bridge inspection and enables inspectors to relate the conditions of underwater bridge elements to established criteria (see the Bridge Inspector's Reference Manual section on underwater inspection for the recommended material to be covered in an underwater diver bridge inspection training course).

Underwater inspection. 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.

§ 650.307 Bridge inspection organization.

(a) Each State transportation department must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the State's boundaries, except for bridges that are owned by Federal agencies.

(b) Federal agencies must inspect, or cause to be inspected, all highway bridges located on public roads that are fully or partially located within the respective agency responsibility or jurisdiction.

(c) Each State transportation department or Federal agency must include a bridge inspection organization that is responsible for the following:

(1) Statewide or Federal agencywide bridge inspection policies and procedures, quality assurance and quality control, and preparation and maintenance of a bridge inventory.

(2) Bridge inspections, reports, load ratings and other requirements of these standards.

(d) Functions identified in paragraphs (c)(1) and (2) of this section may be delegated, but such delegation does not relieve the State transportation department or Federal agency of any of its responsibilities under this subpart.

(e) The State transportation department or Federal agency bridge inspection organization must have a program manager with the qualifications defined in § 650.309(a), who has been delegated responsibility for paragraphs (c)(1) and (2) of this section.

§ 650.309 Qualifications of personnel.

(a) A program manager must, at a minimum:

(1) Be a registered professional engineer, or have ten years bridge inspection experience; and

(2) Successfully complete a Federal Highway Administration (FHWA) approved comprehensive bridge inspection training course.

(b) There are five ways to qualify as a team leader. A team leader must, at a minimum:

(1) Have the qualifications specified in paragraph (a) of this section; or

(2) Have five years bridge inspection experience and have successfully completed an FHWA approved comprehensive bridge inspection training course; or

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(3) Be certified as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Certification in Engineering Technologies (NICET) and have successfully completed an FHWA approved comprehensive bridge inspection training course, or

(4) Have all of the following:

(i) A bachelor's degree in engineering from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology;

(ii) Successfully passed the National Council of Examiners for Engineering and Surveying Fundamentals of Engineering examination;

(iii) Two years of bridge inspection experience; and

(iv) Successfully completed an FHWA approved comprehensive bridge inspection training course, or

(5) Have all of the following:

(i) An associate's degree in engineering or engineering technology from a college or university accredited by or determined as substantially equivalent by the Accreditation Board for Engineering and Technology;

(ii) Four years of bridge inspection experience; and

(iii) Successfully completed an FHWA approved comprehensive bridge inspection training course.

(c) The individual charged with the overall responsibility for load rating bridges must be a registered professional engineer.

(d) An underwater bridge inspection diver must complete an FHWA approved comprehensive bridge inspection training course or other FHWA approved underwater diver bridge inspection training course.

§ 650.311 Inspection frequency.

(a) *Routine inspections.* (1) Inspect each bridge at regular intervals not to exceed twenty-four months.

(2) Certain bridges require inspection at less than twenty-four-month intervals. Establish criteria to determine the level and frequency to which these bridges are inspected considering such factors as age, traffic characteristics, and known deficiencies.

(3) Certain bridges may be inspected at greater than twenty-four month intervals, not to exceed forty-eight-months, with written FHWA approval. This may be appropriate when past inspection findings and analysis justifies the increased inspection interval.

(b) *Underwater inspections.* (1) Inspect underwater structural elements at regular intervals not to exceed sixty months.

(2) Certain underwater structural elements require inspection at less than sixty-month intervals. Establish criteria to determine the level and frequency to which these members are inspected considering such factors as construction material, environment, age, scour characteristics, condition rating from past inspections and known deficiencies.

(3) Certain underwater structural elements may be inspected at greater than sixty-month intervals, not to exceed seventy-two months, with written FHWA approval. This may be appropriate when past inspection findings and analysis justifies the increased inspection interval.

(c) *Fracture critical member (FCM) inspections.* (1) Inspect FCMs at intervals not to exceed twenty-four months.

(2) Certain FCMs require inspection at less than twenty-four-month intervals. Establish criteria to determine the level and frequency to which these members are inspected considering such factors as age, traffic characteristics, and known deficiencies.

(d) Damage, in-depth, and special inspections. Establish criteria to determine the level and frequency of these inspections.

§ 650.313 Inspection procedures.

(a) Inspect each bridge in accordance with the inspection procedures in the AASHTO Manual (incorporated by reference, *see* § 650.317).

(b) Provide at least one team leader, who meets the minimum qualifications stated in § 650.309, at the bridge at all times during each initial, routine, in-depth, fracture critical member and underwater inspection.

(c) Rate each bridge as to its safe load-carrying capacity in accordance with the AASHTO Manual (incorporated by reference, *see* § 650.317). Post or restrict the bridge in accordance with the AASHTO Manual or in accordance with State law, when the maximum unrestricted legal loads or State routine permit loads exceed that allowed under the operating rating or equivalent rating factor.

(d) Prepare bridge files as described in the AASHTO Manual (incorporated by reference, *see* § 650.317). Maintain reports on the results of bridge inspections together with notations of any action taken to address the findings of such inspections. Maintain relevant maintenance and inspection data to allow assessment of current bridge condition. Record the findings and results of bridge inspections on standard State or Federal agency forms.

(e) Identify bridges with FCMs, bridges requiring underwater inspection, and bridges that are scour critical.

(1) Bridges with fracture critical members. In the inspection records, identify the location of FCMs and describe the FCM inspection frequency and procedures. Inspect FCMs according to these procedures.

(2) Bridges requiring underwater inspections. Identify the location of underwater elements and include a description of the underwater elements, the inspection frequency and the procedures in the inspection records for each bridge requiring underwater inspection. Inspect those elements requiring underwater inspections according to these procedures.

(3) Bridges that are scour critical. Prepare a plan of action to monitor known and potential deficiencies and to address critical findings. Monitor bridges that are scour critical in accordance with the plan.

(f) *Complex bridges.* Identify specialized inspection procedures, and additional inspector training and experience required to inspect complex bridges. Inspect complex bridges according to those procedures.

(g) *Quality control and quality assurance.* Assure systematic quality control (QC) and quality assurance (QA) procedures are used to maintain a high degree of accuracy and consistency in the inspection program. 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.

(h) *Follow-up on critical findings.* Establish a statewide or Federal agency wide procedure to assure that critical findings are addressed in a timely manner. Periodically notify the FHWA of the actions taken to resolve or monitor critical findings.

§ 650.315 Inventory.

(a) Each State or Federal agency must prepare and maintain an inventory of all bridges subject to the NBIS. Certain Structure Inventory and Appraisal (SI&A) data must be collected and retained by the State or Federal agency for collection by the FHWA as requested. A tabulation of this data is contained in the SI&A sheet distributed by the FHWA as part of the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges," (December 1995) together with subsequent interim changes or the most recent version. Report the data using FHWA established procedures as outlined in the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges."

(b) For routine, in-depth, fracture critical member, underwater, damage and special inspections enter the SI&A data into the State or Federal agency inventory within 90 days of the date of inspection for State or Federal agency bridges and within 180 days of the date of inspection for all other bridges.

(c) For existing bridge modifications that alter previously recorded data and for new bridges, enter the SI&A data into the State or Federal agency inventory within 90 days after the completion of the work for State or Federal agency bridges and within 180 days after the completion of the work for all other bridges.

(d) For changes in load restriction or closure status, enter the SI&A data into the State or Federal agency inventory within 90 days after the change in status of the structure for State or Federal agency bridges and within 180 days after the change in status of the structure for all other bridges.

§ 650.317 Reference manuals.

(a) The materials listed in this subpart are incorporated by reference in the corresponding sections noted. These incorporations by reference were approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. These materials are incorporated as they exist on the date of the approval, and notice of any change in these documents will be published in the **Federal Register**. The materials are available for purchase at the address listed below, and are available for inspection at the National Archives and Records Administration (NARA). These materials may also be reviewed at the Department of Transportation Library, 400 Seventh Street, SW., Washington, DC, in Room 2200. For information on the availability of these materials at NARA call (202) 741–6030, or go to the following URL: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*. In the event there is a conflict between the standards in this subpart and any of these materials, the standards in this subpart will apply.

(b) The following materials are available for purchase from the American Association of State Highway and Transportation Officials, Suite 249, 444 N. Capitol Street, NW., Washington, DC 20001. The materials may also be ordered via the AASHTO bookstore located at the following URL: *http://www.aashto.org/aashto/home.nsf/FrontPage*.

(1) The Manual for Condition Evaluation of Bridges, 1994, second edition, as amended by the 1995, 1996, 1998, and 2000 interim revisions, AASHTO, incorporation by reference approved for §§ 650.305 and 650.313.

(2) 2001 Interim Revision to the Manual for Condition Evaluation of Bridges, AASHTO, incorporation by reference approved for §§ 650.305 and 650.313.

(3) 2003 Interim Revision to the Manual for Condition Evaluation of Bridges, AASHTO, incorporation by reference approved for §§ 650.305 and 650.313.

[FR Doc. 04–27355 Filed 12–13–04; 8:45 am]

BILLING CODE 4910–22–P

Nebraska County, Municipality and City Numbers

* Municipality in multiple counties

(These codes are **not** the NBI FPIS codes for NBI Items 3 or 4.)

County	County No.	District No.
Adams	01	4
Antelope	02	3
Arthur	03	6
Banner	04	5
Blaine	05	6
Boone	06	3
Box Butte	07	5
Boyd	08	8
Brown	09	8
Buffalo	10	4
Burt	11	3
Butler	12	1
Cass	13	1
Cedar	14	3
Chase	15	7
Cherry	16	8
Cheyenne	17	5
Clay	18	4
Colfax	19	3
Cuming	20	3
Custer	21	6
Dakota	22	3
Dawes	23	5
Dawson	24	6
Deuel	25	5
Dixon	26	3
Dodge	27	2
Douglas	28	2
Dundy	29	7
Fillmore	30	4
Franklin	31	7

County	County No.	District No.
Frontier	32	7
Furnas	33	7
Gage	34	1
Garden	35	5
Garfield	36	8
Gosper	37	7
Grant	38	6
Greeley	39	4
Hall	40	4
Hamilton	41	4
Harlan	42	7
Hayes	43	7
Hitchcock	44	7
Holt	45	8
Hooker	46	6
Howard	47	4
Jefferson	48	1
Johnson	49	1
Kearney	50	7
Keith	51	6
Keya Paha	52	8
Kimball	53	5
Knox	54	3
Lancaster	55	1
Lincoln	56	6
Logan	57	6
Loup	58	8
Madison	59	3
McPherson	60	6
Merrick	61	4
Morrill	62	5

County	County No.	District No.
Nance	63	4
Nemaha	64	1
Nuckolls	65	4
Otoe	66	1
Pawnee	67	1
Perkins	68	7
Phelps	69	7
Pierce	70	3
Platte	71	3
Polk	72	4
Red Willow	73	7
Richardson	74	1
Rock	75	8
Saline	76	1
Sarpy	77	2
Saunders	78	1
Scotts Bluff	79	5
Seward	80	1
Sheridan	81	5
Sherman	82	4
Sioux	83	5
Stanton	84	3
Thayer	85	4
Thomas	86	6
Thurston	87	3
Valley	88	4
Washington	89	2
Wayne	90	3
Webster	91	4
Wheeler	92	8
York	93	4
Border State County	96	n/a

Nebraska County, Municipality and City Numbers
* Municipality in multiple counties
(These codes are **not** the NBI FPIS codes for NBI Items 3 or 4.)

Municipality or City	City No.	County
Abie	0005	Butler
Adams	0010	Gage
Ainsworth	0015	Brown
Alma	0045	Harlan
Albion	0020	Boone
Alda	0025	Hall
Alexandria	0030	Thayer
Allen	0035	Dixon
Alliance	0040	Box Butte
Alvo	0050	Cass
Amherst	0055	Buffalo
Anoka	0065	Boyd
Anselmo	0070	Custer
Ansley	0075	Custer
Arapahoe	0080	Furnas
Arcadia	0085	Valley
Arlington	0090	Washington
Arnold	0095	Custer
Arthur	0100	Arthur
Ashland	0105	Saunders
Ashton	0110	Sherman
Atkinson	0115	Holt
Atlanta	0120	Phelps
Auburn	0125	Nemaha
Aurora	0130	Hamilton
Avoca	0135	Cass
Axtell	0140	Kearney
Ayr	0145	Adams
Bancroft	0150	Cuming
Barada	0155	Richardson
Barneston	0160	Gage
Bartlett	0165	Wheeler
Bartley	0170	Red Willow
Bassett	0175	Rock
Battle Creek	0180	Madison
Bayard	0185	Morrill
Bazile Mills	0190	Knox
Beatrice	0195	Gage
Beaver City	0200	Furnas
Beaver Crossing	0205	Seward
Bee	0210	Seward
Beemer	0215	Cuming
Belden	0220	Cedar
Belgrade	0225	Nance

Municipality or City	City No.	County
Bellevue	0230	Sarpy
Bellwood	0235	Butler
Belvidere	0240	Thayer
Benedict	0245	York
Benkelman	0250	Dundy
Bennet	0255	Lancaster
Bennington	0260	Douglas
Bertrand	0265	Phelps
Berwyn	0270	Custer
Big Springs	0275	Deuel
Bladen	0280	Webster
Blair	0285	Washington
Bloomfield	0290	Knox
Bloomington	0295	Franklin
Blue Hill	0300	Webster
Blue Springs	0305	Gage
Boelus	1250	Howard
Boys Town	0310	Douglas
Bradshaw	0315	York
Brady	0320	Lincoln
Brainard	0325	Butler
Brewster	0330	Blaine
Bridgeport	0335	Morrill
Bristow	0340	Boyd
Broadwater	0345	Morrill
Brock	0350	Nemaha
Broken Bow	0355	Custer
Brownville	0360	Nemaha
Brule	0365	Keith
Bruning	0370	Thayer
Bruno	0375	Butler
Brunswick	0380	Antelope
Burchard	0385	Pawnee
Burr	0390	Otoe
Burton	0395	Keya Paha
Burwell	0400	Garfield
Bushnell	0405	Kimball
Butte	0410	Boyd
Byron	0415	Thayer
Cairo	0420	Hall
Callaway	0425	Custer
Cambridge	0430	Furnas
Campbell	0435	Franklin
Carleton	0440	Thayer

Nebraska County, Municipality and City Numbers
* Municipality in multiple counties
(These codes are **not** the NBI FPIS codes for NBI Items 3 or 4.)

Municipality or City	City No.	County
Carroll	0445	Wayne
Cedar Bluffs	0450	Saunders
Cedar Creek	0453	Cass
Cedar Rapids	0455	Boone
Center	0460	Knox
Central City	0465	Merrick
Ceresco	0470	Saunders
Chadron	0475	Dawes
Chambers	0480	Holt
Chapman	0485	Merrick
Chappel	0490	Deuel
Chester	0495	Thayer
Clarks	0500	Merrick
Clarkson	0505	Colfax
Clatonia	0510	Gage
Clay Center	0515	Clay
Clearwater	0520	Antelope
Clinton	0525	Sheridan
Cody	0530	Cherry
Coleridge	0535	Cedar
Colon	0540	Saunders
Columbus	0545	Platte
Comstock	0550	Custer
Concord	0555	Dixon
Cook	0560	Johnson
Cordova	0565	Seward
Cornlea	0570	Platte
Cortland	0575	Gage
Cotesfield	0580	Howard
Cowles	0585	Webster
Cozad	0590	Dawson
Crab Orchard	0595	Johnson
Craig	0600	Burt
Crawford	0605	Dawes
Creighton	0610	Knox
Creston	0615	Platte
Crete	0620	Saline
Crofton	0625	Knox
Crookston	0630	Cherry
Culbertson	0635	Hitchcock
Curtis	0640	Frontier
Cushing	0645	Howard
Dakota City	0650	Dakota
Dalton	0655	Cheyenne

Municipality or City	City No.	County
Danbury	0660	Red Willow
Dannebrog	0665	Howard
Davenport	0675	Thayer
Davey	0680	Lancaster
David City	0685	Butler
Dawson	0690	Richardson
Daykin	0695	Jefferson
Decatur	0700	Burt
Denton	0705	Lancaster
Deshler	0710	Thayer
Deweese	0715	Clay
DeWitt	0720	Saline
Dickens	0725	Lincoln
Diller	0730	Jefferson
Dix	0735	Kimball
Dixon	0740	Dixon
Dodge	0745	Dodge
Doniphan	0750	Hall
Dorchester	0755	Saline
Douglas	0760	Otoe
DuBois	0765	Pawnee
Dunbar	0770	Otoe
Duncan	0775	Platte
Dunning	0780	Blaine
Dwight	0785	Butler
Eagle	0790	Cass
Edgar	0800	Clay
Edison	0805	Furnas
Elba	0810	Howard
Elgin	0815	Antelope
Elk Creek	0820	Johnson
Elkhorn	0825	Douglas
Elm Creek	0830	Buffalo
Elmwood	0835	Cass
Elsie	0840	Perkins
Elwood	0845	Gosper
Elyria	0850	Valley
Emerson	0855*	Dakota
Emerson	0855*	Dixon
Emerson	0855*	Thurston
Emmet	0860	Holt
Endicott	0865	Jefferson
Ericson	0870	Wheeler
Eustis	0875	Frontier

Nebraska County, Municipality and City Numbers
* Municipality in multiple counties
(These codes are **not** the NBI FPIS codes for NBI Items 3 or 4.)

Municipality or City	City No.	County
Ewing	0880	Holt
Exeter	0885	Fillmore
Fairbury	0890	Jefferson
Fairfield	0895	Clay
Fairmont	0900	Fillmore
Falls City	0905	Richardson
Farnam	0915	Dawson
Farwell	0910	Howard
Filley	0920	Gage
Firth	0925	Lancaster
Fordyce	0930	Cedar
Fort Calhoun	0935	Washington
Foster	0940	Pierce
Franklin	0945	Franklin
Fremont	0950	Dodge
Friend	0955	Saline
Fullerton	0960	Nance
Funk	0965	Phelps
Gandy	0970	Logan
Garland	0975	Seward
Garrison	0980	Butler
Geneva	0985	Fillmore
Genoa	0990	Nance
Gering	0995	Scotts Bluff
Gibbon	1000	Buffalo
Gilead	1005	Thayer
Giltner	1010	Hamilton
Glenvil	1015	Clay
Goehner	1020	Seward
Gordon	1025	Sheridan
Gothenburg	1030	Dawson
Grafton	1035	Fillmore
Grainton	1040	Perkins
Grand Island	1045	Hall
Grant	1050	Perkins
Greeley Center	1055	Greeley
Greenwood	1060	Cass
Gresham	1065	York
Gretna	1070	Sarpy
Gross	1075	Boyd
Guide Rock	1080	Webster
Gurley	1085	Cheyenne
Hadar	1090	Pierce
Haigler	1095	Dundy

Municipality or City	City No.	County
Hallam	1100	Lancaster
Halsey	1105*	Blaine
Halsey	1105*	Thomas
Hamlet	1110	Hayes
Hampton	1115	Hamilton
Harbine	1120	Jefferson
Hardy	1125	Nuckolls
Harrison	1130	Sioux
Hartington	1135	Cedar
Harvard	1140	Clay
Hastings	1145	Adams
Hay Springs	1155	Sheridan
Hayes Center	1150	Hayes
Hazard	1160	Sherman
Heartwell	1165	Kearney
Hebron	1170	Thayer
Hemingford	1175	Box Butte
Henderson	1180	York
Hendley	1185	Furnas
Herman	1195	Washington
Hershey	1200	Lincoln
Hickman	1205	Lancaster
Hildreth	1210	Franklin
Holbrook	1215	Furnas
Holdrege	1220	Phelps
Holstein	1225	Adams
Homer	1230	Dakota
Hooper	1235	Dodge
Hordville	1240	Hamilton
Hoskins	1245	Wayne
Howells	1255	Colfax
Hubbard	1260	Dakota
Hubbell	1265	Thayer
Humboldt	1270	Richardson
Humphrey	1275	Platte
Huntley	1280	Harlan
Hyannis	1290	Grant
Imperial	1295	Chase
Indianola	1300	Red Willow
Inglewood	1305	Dodge
Inman	1310	Holt
Ithaca	1315	Saunders
Jackson	1320	Dakota
Jansen	1325	Jefferson

Nebraska County, Municipality and City Numbers
* Municipality in multiple counties
(These codes are **not** the NBI FPIS codes for NBI Items 3 or 4.)

Municipality or City	City No.	County
Johnson	1330	Nemaha
Johnstown	1335	Brown
Julian	1340	Nemaha
Juniata	1345	Adams
Kearney	1350	Buffalo
Kenesaw	1355	Adams
Kennard	1368	Washington
Kilgore	1365	Cherry
Kimball	1370	Kimball
Lamar	1375	Chase
Laurel	1380	Cedar
LaVista	1383	Sarpy
Lawrence	1385	Nuckolls
Lebanon	1390	Red Willow
Leigh	1395	Colfax
Leshara	1400	Saunders
Lewellen	1405	Garden
Lewiston	1410	Pawnee
Lexington	1415	Dawson
Liberty	1420	Gage
Lincoln	1425	Lancaster
Lindsay	1430	Platte
Linwood	1435	Butler
Litchfield	1440	Sherman
Lodgepole	1445	Cheyenne
Long Pine	1450	Brown
Loomis	1455	Phelps
Lorton	1460	Otoe
Louisville	1465	Cass
Loup City	1470	Sherman
Lushton	1475	York
Lyman	1480	Scotts Bluff
Lynch	1485	Boyd
Lyons	1490	Burt
Madison	1515	Madison
Madrid	1520	Perkins
Magnet	1525	Cedar
Malcolm	1530	Lancaster
Malmo	1535	Saunders
Manley	1540	Cass
Marquette	1545	Hamilton
Marsland	1550	Dawes
Martinsburg	1555	Dixon
Maskell	1560	Dixon

Municipality or City	City No.	County
Mason City	1565	Custer
Maxwell	1570	Lincoln
Maywood	1575	Frontier
McCook	1495	Red Willow
McCool Jct.	1500	York
McGrew	1505	Scotts Bluff
McLean	1510	Pierce
Mead	1580	Saunders
Meadow Grove	1585	Madison
Melbeta	1590	Scotts Bluff
Memphis	1595	Saunders
Merriman	1605	Cherry
Milford	1610	Seward
Millard	1615	Douglas
Miller	1620	Buffalo
Milligan	1625	Fillmore
Minatare	1630	Scotts Bluff
Minden	1635	Kearney
Mitchell	1640	Scotts Bluff
Monowi	1645	Boyd
Monroe	1650	Platte
Moorefield	1655	Frontier
Morrill	1660	Scotts Bluff
Morse Bluff	1665	Saunders
Mullen	1670	Hooker
Murdock	1675	Cass
Murray	1680	Cass
Naper	1685	Boyd
Naponee	1690	Franklin
Nebraska City	1695	Otoe
Nehawka	1700	Cass
Neligh	1705	Antelope
Nelson	1710	Nuckolls
Nemaha	1715	Nemaha
Nenzel	1720	Cherry
Newcastle	1725	Dixon
Newman Grove	1730*	Madison
Newman Grove	1730*	Platte
Newport	1735	Rock
Nickerson	1740	Dodge
Niobrara	1745	Knox
Nora	1750	Nuckolls
Norfolk	1755	Madison
Norman	1760	Kearney

Nebraska County, Municipality and City Numbers
* Municipality in multiple counties
(These codes are **not** the NBI FPIS codes for NBI Items 3 or 4.)

Municipality or City	City No.	County
North Bend	1765	Dodge
North Loup	1770	Valley
North Platte	1775	Lincoln
Oak	1780	Nuckolls
Oakdale	1785	Antelope
Oakland	1790	Burt
Obert	1795	Cedar
Octavia	1805	Butler
Odell	1810	Gage
Ogallala	1815	Keith
Ohiowa	1820	Fillmore
Omaha	1825	Douglas
O'Neill	1830	Holt
Ong	1835	Clay
Orchard	1840	Antelope
Ord	1845	Valley
Orleans	1855	Harlan
Osceola	1860	Polk
Oshkosh	1865	Garden
Osmond	1870	Pierce
Otoe	1875	Otoe
Overton	1880	Dawson
Oxford	1885*	Furnas
Oxford	1885*	Harlan
Page	1890	Holt
Palisade	1895*	Hayes
Palisade	1895*	Hitchcock
Palmer	1900	Merrick
Palmyra	1905	Otoe
Panama	1910	Lancaster
Papillion	1915	Sarpy
Pawnee City	1920	Pawnee
Paxton	1925	Keith
Pender	1935	Thurston
Peru	1940	Nemaha
Petersburg	1945	Boone
Phillips	1950	Hamilton
Pickrell	1955	Gage
Pierce	1960	Pierce
Pilger	1965	Stanton
Plainview	1970	Pierce
Platte Center	1975	Platte
Plattsmouth	1980	Cass
Pleasant Dale	1985	Seward

Municipality or City	City No.	County
Pleasanton	1990	Buffalo
Plymouth	1995	Jefferson
Polk	2000	Polk
Ponca	2005	Dixon
Potter	2015	Cheyenne
Prague	2020	Saunders
Preston	2025	Richardson
Primrose	2030	Boone
Prosser	2035	Adams
Ragan	2040	Harlan
Ralston	2045	Douglas
Randolph	2050	Cedar
Ravenna	2055	Buffalo
Raymond	2060	Lancaster
Red Cloud	2065	Webster
Republican City	2070	Harlan
Reynolds	2075	Jefferson
Richland	2080	Colfax
Rising City	2085	Butler
Riverdale	2090	Buffalo
Riverton	2095	Franklin
Roca	2100	Lancaster
Rockville	2105	Sherman
Boelus	1250	Howard
Rogers	2110	Colfax
Rosalie	2115	Thurston
Roseland	2120	Adams
Royal	2125	Antelope
Rulo	2130	Richardson
Rushville	2135	Sheridan
Ruskin	2140	Nuckolls
Salem	2160	Richardson
Santee	2161	Knox
Sargent	2165	Custer
Saronville	2170	Clay
Schuyler	2175	Colfax
Scotia	2180	Greeley
Scottsbluff	2185	Scotts Bluff
Scribner	2190	Dodge
Seneca	2195	Thomas
Seward	2200	Seward
Shelby	2205	Polk
Shelton	2210	Buffalo
Sholes	2220	Wayne

Nebraska County, Municipality and City Numbers
* Municipality in multiple counties
(These codes are **not** the NBI FPIS codes for NBI Items 3 or 4.)

Municipality or City	City No.	County
Shubert	2225	Richardson
Sidney	2230	Cheyenne
Silver Creek	2235	Merrick
Smithfield	2240	Gosper
Snyder	2245	Dodge
South Bend	2250	Cass
South Sioux City	2255	Dakota
Spalding	2260	Greeley
Spencer	2265	Boyd
Sprague	2270	Lancaster
Springfield	2275	Sarpy
Springview	2280	Keya Paha
St. Edward	2145	Boone
St. Helena	2150	Cedar
St. Paul	2155	Howard
Stamford	2285	Harlan
Stanton	2290	Stanton
Staplehurst	2295	Seward
Stapleton	2300	Logan
Steele City	2305	Jefferson
Steinauer	2310	Pawnee
Stella	2315	Richardson
Sterling	2320	Johnson
Stockham	2325	Hamilton
Stockville	2330	Frontier
Strang	2335	Fillmore
Stratton	2340	Hitchcock
Stromsburg	2345	Polk
Stuart	2350	Holt
Sumner	2355	Dawson
Superior	2360	Nuckolls
Surprise	2365	Butler
Sutherland	2370	Lincoln
Sutton	2375	Clay
Swanton	2380	Saline
Syracuse	2385	Otoe
Table Rock	2390	Pawnee
Talmage	2395	Otoe
Tamora	2400	Seward
Taylor	2410	Loup
Tecumseh	2415	Johnson
Tekamah	2420	Burt
Terrytown	2425	Scotts Bluff
Thayer	2430	York

Municipality or City	City No.	County
Thedford	2435	Thomas
Thurston	2440	Thurston
Tilden	2445*	Antelope
Tilden	2445*	Madison
Tobias	2450	Saline
Trenton	2455	Hitchcock
Trumball	2460	Clay
Uehling	2465	Dodge
Ulysses	2470	Butler
Unadilla	2475	Otoe
Union	2480	Cass
Upland	2485	Franklin
Utica	2490	Seward
Valentine	2495	Cherry
Valley	2500	Douglas
Valparaiso	2505	Saunders
Venango	2510	Perkins
Verdel	2515	Knox
Verdigre	2520	Knox
Verdon	2525	Richardson
Virginia	2530	Gage
Waco	2535	York
Wahoo	2540	Saunders
Wakefield	2545*	Dixon
Wakefield	2545*	Wayne
Wallace	2550	Lincoln
Walthill	2555	Thurston
Washington	2560	Washington
Waterbury	2565	Dixon
Waterloo	2570	Douglas
Wauneta	2575	Chase
Wausa	2580	Knox
Waverly	2585	Lancaster
Wayne	2590	Wayne
Weeping Water	2595	Cass
Wellfleet	2600	Lincoln
West Point	2620	Cuming
Western	2605	Saline
Weston	2615	Saunders
Whitney	2625	Dawes
Wilber	2630	Saline
Wilcox	2635	Kearney
Wilsonville	2640	Furnas
Winnebago	2645	Thurston

Nebraska County, Municipality and City Numbers
* Municipality in multiple counties
(These codes are **not** the NBI FPIS codes for NBI Items 3 or 4.)

Municipality or City	City No.	County
Winnetoon	2650	Knox
Winside	2655	Wayne
Winslow	2660	Dodge
Wisner	2665	Cuming
Wolbach	2670	Greeley
Wood Lake	2675	Cherry
Wood River	2680	Hall
Wymore	2685	Gage
Wynot	2690	Cedar
York	2695	York
Yutan	2700	Saunders

QC.1 GENERAL

Quality Control (QC) is simply a check on every document, inspection dataset, or activity completed for the Bridge Inspection Program (BIP). When QC is completed on the work, ideally there are no errors, omissions or inaccuracies. QC may be done by the organization or another party engaged by the organization to complete QC.

The person who completes QC is called the "QC Officer" in accordance with quality management practice. The QC Officer must have a working knowledge of the BIP and associated manuals and publications. QC review is nearly always completed by an individual with equal or better qualifications than the document/dataset originator.

Quality Assurance (QA) is done by an independent party on a small random sample to assure that QC is attaining the required level of quality. See the BIP Manual Chapter 1, Section 10 for additional information.

QC.2 OWNER RECORDS, BIP MANUAL CHAPTER 2

QC items

- Individual Bridge Records
- Master lists of Critical Findings
- Master list of Scour Critical Bridges

QC Officer

- Any member of the Bridge Owner's staff who is familiar with the BIP Program

QC example activities

- Creating and maintaining a record for each structure under a Bridge Owner's control
- Systematic and regular updates of the information in the records
- Filing new load ratings in the bridge record within one week of receipt from Load Rating Engineer
- Filing a Scour Assessment within one week of receipt from the Hydraulic Engineer
- Filing inspection documents (revised SI&A, BrM print out, fracture critical reports, special reports) within one month of the completion of the inspection data input or receipt of report
- File information on maintenance or repair work done within one month of completion
- Maintaining a log of critical findings activity and updating when new reports are filed or closed
- Maintain a log of activities related to monitoring for Plans of Action

QC.3 INSPECTION CODING & REPORTS, MANUAL CHAPTERS 3 & 4

QC items

- Data such as condition codes
- Inspection reports such as fracture critical reports
- Critical Finding reports

QC Officer

- An in-house Team Leader (TL) or a TL from a neighboring agency
- The TL’s supervisor
- An in-house engineer (PE or EI) or engineering technician
- A consulting engineer
- County highway superintendent
- Local Public Agency Responsible Charge (RC)
- An Assistant Team Leader (ALT) for BrM input completed by others

QC example activities

- TL name on every page of the document. The QC reviewer name the on first page of the document and initials all pages that are reviewed. Many NDOT forms for inspection include a field for this purpose.
- An additional TL can be present when the inspection is being completed. The additional TL’s name and initials should be included on the inspection document.
- Data input from manual field notes is often input by administrative staff. The TL must review the BrM file when the input has been completed.
- A TL may determine BrM values in the field, record manually, and then revisit their coding on a later date prior to input into BrM.
- A TL may determine BrM values within BrM in the field, then have another TL or ATL review a BrM printout of the values against the inspection notes and photos.
- Critical finding reports are reviewed with the TL who originated the report.

QC.4 LOAD RATING, BIP MANUAL CHAPTER 5

QC items

- Load rating reports
- Load rating calculations, both manual and electronic
- Load Rating Summary Sheets (LRSS) and Load Rating Review Sheets (LRRS)

QC Officer

- A Nebraska PE with experience that equals or exceeds the originator of the work. An engineering intern can be the originator, but QC must be completed and sealed by the PE.

QC example activities

- Check manual calculations then initial each sheet of the document
- Check software input then initial the first sheet of the document
- Check software output then initial the first sheet of the document
- Check the document then initial the first sheet of any multi-page documentation. For example field measurements documenting the cause for rerating, photos, etc.
- Seal of PE on the LRSS

QC.5 SCOUR, BIP MANUAL CHAPTER 6

QC items

- Scour assessment reports
- Hydraulic calculations, both manual and electronic
- DR385 Bridge Scour Report, DR385B Bridge Scour Assessment, DR385C Bridge Scour Plan of Action, DR385D Bridge Scour Worksheet, DR385E POA Monitoring log, DR385F Change in Scour Conditions

QC Officer

- A Nebraska PE with experience that equals or exceeds the originator of the work. An engineering intern can be the originator, but QC must be completed and sealed by the PE.

QC example activities

- Check manual calculations then initial each sheet of the document
- Check software input then initial the first sheet of the document
- Check software output then initial the first sheet of the document
- Check the document then initial the first sheet of any multi-page documentation. For example channel cross sections, USGS maps, photos, etc.
- Seal of PE the Scour Assessment Report

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REFERENCED PUBLICATIONS

The information in this Bridge Inspection Program Manual supplements the requirements, procedures and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP).

The reference list of applicable documents is included in the Manual Appendix. The National Bridge Inspection Standards are also included in the Appendix.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in National Bridge Inspection Standards, the AASHTO *Manual for Bridge Evaluation*, and FHWA publications and technical advisories related to the NBIS. The references set forth procedures to be used by Bridge Owners in managing their Bridge File and Bridge Records.

The NBIS takes precedence over any material contained in the reference manuals, i.e. the AASHTO Manual. Where there may be implied or conflicting language between the documents, the nationwide direction provided by the NBIS will always govern.

The information in this Bridge Inspection Program Manual supplements the information in these references.

Primary Operation (Coding and Records may also be included)	Publisher or Author	Publication	Publication Date
Coding	FHWA	Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges, Report No. FHWA-PD-96-001	December 1995 with Errata, March 2004
Inspection	FHWA	Bridge Inspector's Reference Manual (BIRM), FHWA Publication No. FHWA-NHI-12-053	December 2001
Inspection	NCHRP	Synthesis 354: Inspection and Management of Bridges with Fracture-Critical Details	
Inspection, Load Rating	AASHTO	Manual for Bridge Evaluation (MBE), Second Edition with 2016 Edition Interim	
Load Rating	FHWA	Revisions to the Recording and Coding Guide for the Structure, Inventory, and Appraisal of the Nation's Bridges (Coding Guide) Items 63 and 65, Method Used to Determine Operating and Inventory Rating	November 15, 2011
Load Rating	FHWA	Revisions to the Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's bridges (Coding Guide) – Item 31, Design Load, and Items 63 and 65, Method Used to Determine Operating and Inventory Ratings	February 2, 2011
Load Rating	FHWA	Revisions to Items 63-66 to Support Load Reporting by Rating Factor	March 22, 2004
Load Rating	AASHTO	Standard Specifications for Highway Bridges, 17th Edition	September 1, 2002
Load Rating	AASHTO	LRFD Bridge Design Specifications, Seventh Edition with 2015 and 2016 Interims	2014
Load Rating	FHWA	Bridge Load Ratings for the National Bridge Inventory	October 30, 2006

Primary Operation (Coding and Records may also be included)	Publisher or Author	Publication	Publication Date
Load Rating	Nebraska Department of Transportation Bridge Division	Bridge Office Policies and Procedures (BOPP), Current version	See NDOT Bridge Division website.
Load Rating	Joseph A. Yura, and Brett A. Phillips	"Bracing Requirements for Elastic Steel Beams", University of Texas at Austin, Center for Transportation Research, Report No. FHWA/TX-92+1239-1	
Load Rating	Swarnalatha Vegesna, and Joseph A. Yura	"An Ultimate Load Test to Study Bracing Effects of Bridge Decks", University of Texas at Austin, Center for Transportation Research, Report No. FHWA/TX-92+1239-2	
Load Rating	Stuart T. Webb and Joseph A. Yura	"Evaluation of Bridge Decks as Lateral Bracing for Supporting Steel Stringers", University of Texas at Austin, Center for Transportation Research, Report No. FHWA/TX-92+1239-3	
Load Rating	Joseph A. Yura, Brett A. Phillips, Swarna Raju and Stuart T. Webb	"Bracing of Steel Beams in Bridges", University of Texas at Austin, Center for Transportation Research, Report No. FHWA/TX-92+1239-4F	
Load Rating	National Corrugated Steel Pipe Association (NCSPA), Washington, D C	"Load rating and structural evaluation of in-service, corrugated steel structures" Design Data Sheet No. 19	1995
Load Rating	David C. Cowherd, Vlad G. Perlea, Bowser Morner Associates, Dayton, Ohio	"An Evaluation of Flexible Metal Pipes"	1989
Load Rating	FHWA	Technical Advisory 5140.29, Load-carrying Capacity Considerations of Gusset Plates in Non-load-path-redundant Steel Truss Bridges	January 15, 2008

Primary Operation (Coding and Records may also be included)	Publisher or Author	Publication	Publication Date
Scour	FHWA	Technical Advisory T5140 23, Evaluating Scour at Bridges	October 28, 1991
Scour	FHWA	Evaluating Scour at Bridges, Fifth Edition, Hydraulic Engineering Circular, No. 18 (HEC 18)	April 2012
Scour	FHWA	Stream Stability at Highway Structures, Fourth Edition, Hydraulic Engineering Circular, No. 20 (HEC 20)	April 2012
Scour	FHWA	Bridge Scour and Stream Instability Countermeasures, Experience, Selection and Design Guidance, Third Edition, Volume 1, Hydraulic Engineering Circular, No. 23 (HEC 23)	2009
Scour	FHWA	Bridge Scour and Stream Instability Countermeasures, Experience, Selection and Design Guidance, Third Edition, Volume 2, Hydraulic Engineering Circular, No. 23 (HEC 23)	2009
Scour	FHWA	Revision of Coding Guide, Item 113 – Scour Critical Bridges	April 27, 2001
Scour	FHWA	Compliance with the National Bridge Inspection Standards – Plan of Action for Scour Critical Bridges	March 29, 2005
Scour	FHWA	National Bridge Inspection Standards – Scour Evaluations and Plans of Action for Scour Critical Bridges	January 4, 2008
Scour	FHWA	Technical Guidance for Bridges over Waterways with Unknown Foundations	January 9, 2008
Scour	FHWA	Scourability of Rock Formations	July 19, 1991
Scour	FHWA	Frequently Asked Questions – Bridges Over Waterways with Unknown Foundations	June 3, 2009

Primary Operation (Coding and Records may also be included)	Publisher or Author	Publication	Publication Date
Scour	FHWA	Additional Guidance for Assessment of Bridges Over Waterways with Unknown Foundations	October 29, 2009
Scour	NDOT	Hydraulic Analysis Guidelines, Current version	See NDOT Bridge Division website.

Note to Manual Users:

The AASHTO MBE superseded the AASHTO Manual for Condition Evaluation of Bridge and interims with the AASHTO Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges. Revisions based on approved agenda items from annual AASHTO Highways Subcommittee on Bridges and Structures meetings in 2007 and 2008 are also incorporated into the MBE. The MBE was adopted by the AASHTO Highways Subcommittee on Bridges and Structures in 2005. With the 2008 publication of the MBE, the Subcommittee conferred archive status on the Manual for Condition Evaluation of Bridges, the Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges and all Interim Revisions of both prior bridge evaluation titles.

In December 2009, FHWA updated the NBIS regulation to define the AASHTO Manual in 23 CFR § 650.317 as the MBE, effective January 25, 2010. The AASHTO Manual is included in the NBIS through incorporation by reference (IBR). IBR is a technique used by federal agencies to include and make enforceable materials published elsewhere without republishing those materials in full text in the agencies' regulations. The FHWA uses IBR extensively to incorporate documents such as AASHTO design standards into 23 CFR part 625 and to incorporate FHWA's *Manual on Uniform Traffic Control Devices* into 23 CFR part 655.

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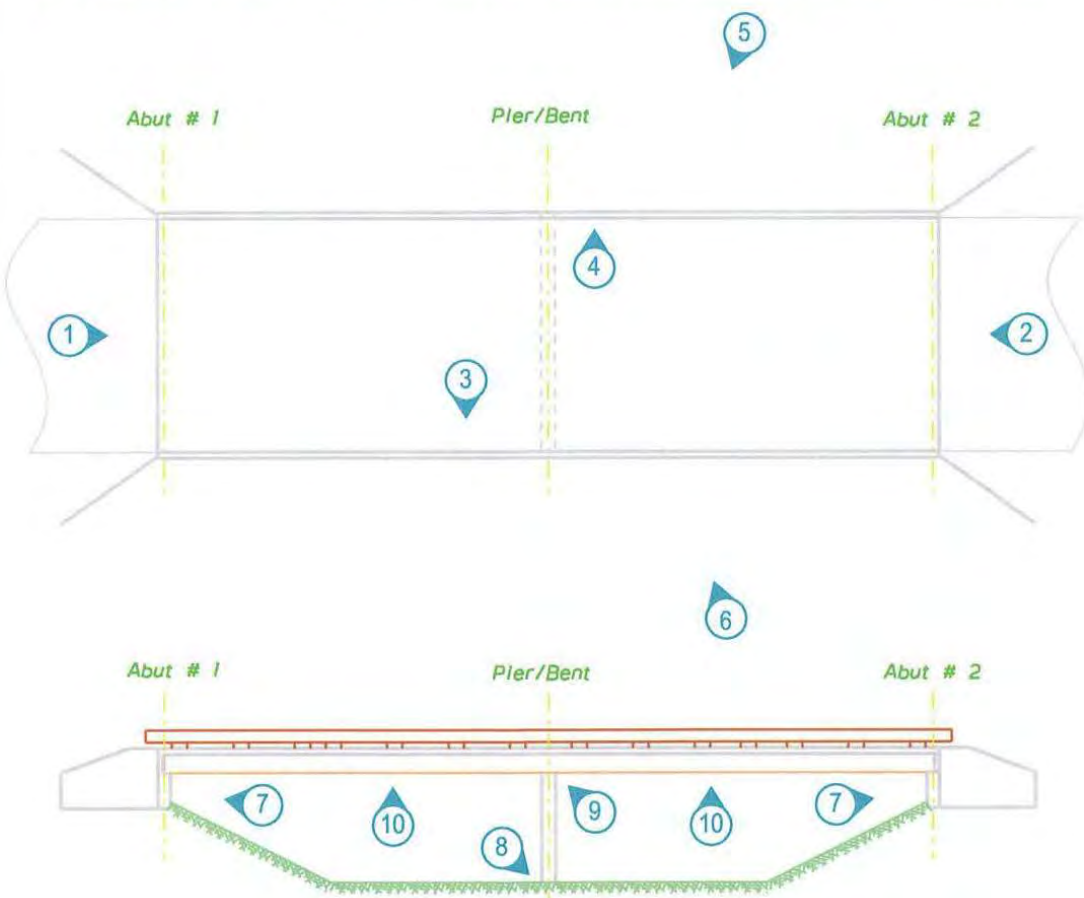
STANDARD BRIDGE PHOTO LOCATIONS & DESCRIPTIONS

Standard Bridge Photo Locations / Descriptions



Abutments and piers/bents should be numbered in the direction of increasing station.

1 2 Looking up and down station along the bridge deck, showing deck and roadway beyond. Photo should clearly show the entire deck from each direction. If not too far back, include posting limit sign, if posted.

3 4 Looking up stream and down stream from bridge.

5 6 Looking at the bridge from both sides. Photos should be taken from far enough away to see the entire bridge and at an angle as perpindicular to the bridge as possible.

7 Looking at the abutments. Photos should show the entire abutment.

8 Looking at the piers/bents. Photos should be taken of each pier/bent and should show the entire pier/bent.

9 Looking at the pier/bent cap(s). Photos should show the entire cap and the girders.

10 Looking at the underside of the bridge in each span. If possible, the photos should be taken to show the entire width of the bridge and all of the girders in a single photo for each span.

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SUFFICIENCY RATING CALCULATION

Sufficiency Rating Formula and Example

The sufficiency rating formula described herein is a method of evaluating highway bridge data by calculating four separate factors to obtain a numeric value which is indicative of bridge sufficiency to remain in service. The result of this method is a percentage in which 100 percent would represent an entirely sufficient bridge and zero percent would represent an entirely insufficient or deficient bridge.

An asterisk prefix is used to identify a sufficiency rating that was calculated even though some essential data was missing or coded incorrectly. The Edit/Update Program will substitute a value for the unusable data (which will not lower the rating) and calculate the sufficiency rating. The asterisk is dropped when the unusable data is corrected. It is normal that all culverts with Bridge Roadway Width, Curb-to-Curb – Item 51 coded '0000' will have an asterisk prefixed sufficiency.

Figure 1. Summary of Sufficiency Rating Factors

4. SPECIAL REDUCTIONS

S_4 = 13% Max.

19 Detour Length
36 Traffic Safety Features
43 Structure Type, Main

SUFFICIENCY RATING = $S_1 + S_2 + S_3 – S_4$

Sufficiency Rating shall not be less than 0% nor greater than 100%

Sufficiency Rating Formula

1. Structural Adequacy and Safety (55% maximum)

   a. Only the lowest code of Item 59, 60, or 62 applies.

   If #59 (Superstructure Rating) or

#60 (Substructure Rating) is	≤ 2	then	A = 55%
	= 3		B = 40%
	= 4		C = 25%
	= 5		D = 10%

   If #59 and #60 = N and

#62 (Culvert Rating) is	≤ 2	then	E = 55%
	= 3		F = 40%
	= 4		G = 25%
	= 5		H = 10%

   b. Reduction for Load Capacity:

   Calculate using the following formulas where IR is the Inventory Rating in tons or use Figure 2:

   $I = (36 - IR)^{1.5} \times 0.2778$

   If $(36 - IR) \leq 0$, then B = 0

   "B" shall not be less than 0% nor greater than 55%.

$S_1 = 55 - (A + B + C + D + E + F + G + H + I)$

S_1 shall not be less than 0% nor greater than 55%.

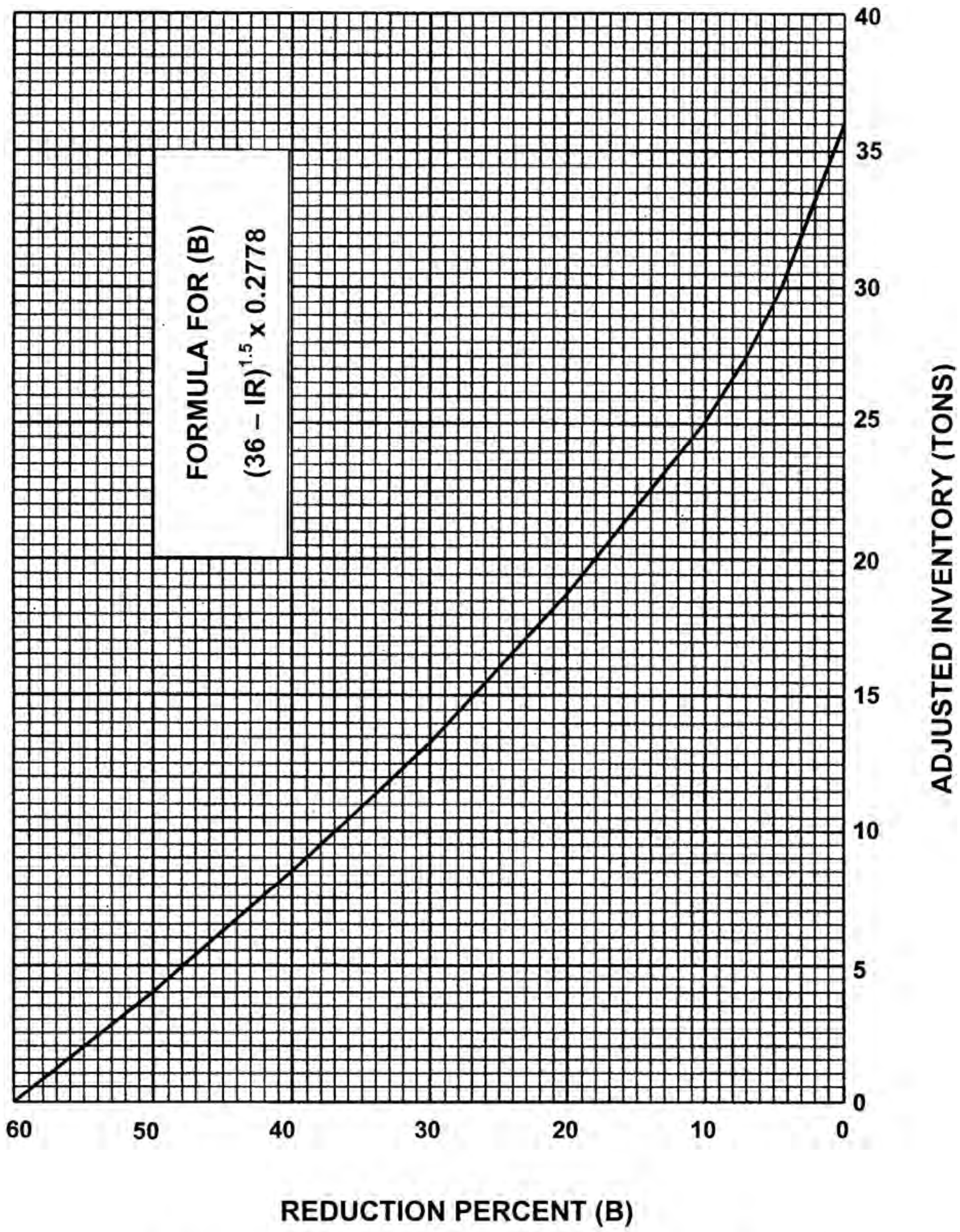

Figure 2. Reduction for Adjusted Inventory Tons

2. Serviceability and Functional Obsolescence (30% maximum)

a. Rating Reductions (13% maximum)

If #58 (Deck Condition) is	≤ 3	then	A = 5%
	= 4		A = 3%
	= 5		A = 1%
If #67 (Structural Evaluation) is	≤ 3	then	B = 4%
	= 4		B = 2%
	= 5		B = 1%
If #68 (Deck Geometry) is	≤ 3	then	C = 4%
	= 4		C = 2%
	= 5		C = 1%
If #69 (Underclearances) is	≤ 3	then	D = 4%
	= 4		D = 2%
	= 5		D = 1%
If #71 (Waterway Adequacy) is	≤ 3	then	E = 4%
	= 4		E = 2%
	= 5		E = 1%
If #72 (Approach Road Alignment) is	≤ 3	then	F = 4%
	= 4		F = 2%
	= 5		F = 1%

J = (A + B + C + D + E + F)

J shall not be less than 0% nor greater than 13%.

b. Width of Roadway Insufficiency (15% maximum)

Use the sections that apply:

(1) applies to all bridges;
(2) applies to 1-lane bridges only;
(3) applies to 2 or more lane bridges;
(4) applies to all <u>except</u> 1-lane bridges.

Also determine X and Y:

X (ADT/Lane) = #29 (ADT) ÷ first 2 digits of #28 (Lanes)

Y (Width/Lane) = #51 (Bridge Rdwy. Width) ÷ first 2 digits of #28

(1) Use when the last 2 digits of #43 (Structure Type) are not equal to 19 (Culvert):

If (#51 + 2 Ft.) < #32 (Approach Roadway Width) G = 5%

(2) For 1-lane bridges only, use Figure 3 or the following:

If the first 2 digits of #28 (Lanes) are equal to 01 and

$Y < 14$	then	$H = 15\%$
$Y \geq 14 < 18$		$H = 15 \left(\frac{18-Y}{4}\right) \%$
$Y \geq 18$		$H = 0\%$

(3) For 2 or more lane bridges. If these limits apply, do not continue on to (4) as no lane width reductions are allowed.

If the first 2 digits of #28 = 02 and $Y \geq 16$, $H = 0\%$
If the first 2 digits of #28 = 03 and $Y \geq 15$, $H = 0\%$
If the first 2 digits of #28 = 04 and $Y \geq 14$, $H = 0\%$
If the first 2 digits of #28 $\geq$ 05 and $Y \geq 12$, $H = 0\%$

(4) For all <u>except</u> 1-lane bridges, use Figure 3 or the following:

If $Y < 9$ and $X > 50$	then	$H = 15\%$
$Y < 9$ and $X \leq 50$		$H = 7.5\%$
$Y \geq 9$ and $X \leq 50$		$H = 0\%$

If $X > 50$ but ≤ 125 and

$Y < 10$	then	$H = 15\%$
$Y \geq 10 < 13$		$H = 15 \left(\frac{13-Y}{3}\right) \%$
$Y \geq 13$		$H = 0\%$

If $X > 125$ but ≤ 375 and

$Y < 11$	then	$H = 15\%$
$Y \geq 11 < 14$		$H = 15 \left(\frac{14-Y}{3}\right) \%$
$Y \geq 14$		$H = 0\%$

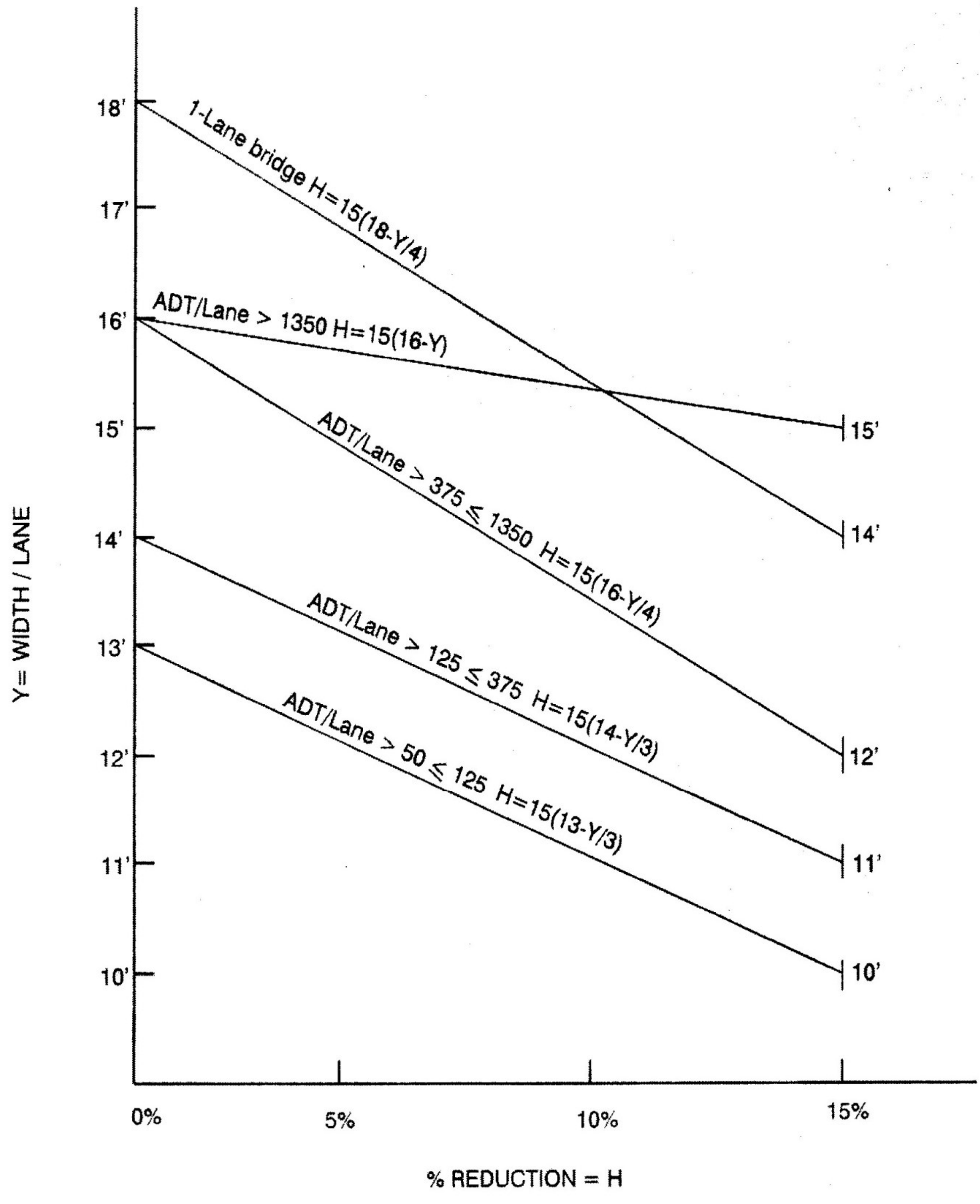

Figure 3. Width of Roadway Sufficiency

If $X > 375$ but ≤ 1350 and

$Y < 12$	then	$H = 15\%$
$Y \geq 12 < 16$		$H = 15 \left(\frac{16-Y}{4}\right)\%$
$Y \geq 16$		$H = 0\%$

If $X > 1350$ and

$Y < 15$	then	$H = 15\%$
$Y \geq 15 < 16$		$H = 15\,(16–Y)\,\%$
$Y \geq 16$		$H = 0\%$

G + H shall not be less than 0% nor greater than 15%.

c. Vertical Clearance Insufficiency – (2% maximum)

If #100 (STRAHNET Highway Designation) > 0 and

#53 (VC over Deck) ≥ 1600	then	I = 0%
#53 < 1600		I = 2%

If #100 = 0 and

#53 ≥ 1400	then	I = 0%
#53 < 1400		I = 2%

$S_2 = 30 – [J + (G + H) + I]$

S_2 shall not be less than 0% nor greater than 30%.

3. Essentiality for Public Use (15% maximum)

a. Determine:

$$K = \frac{S_1 + S_2}{85}$$

b. Calculate

$$A = \frac{\#29\text{ (ADT) x }\#19\text{ (Detour Length) x }15}{200{,}000\text{ x }K}$$

"A" shall not be less than 0% nor greater than 15%.

c. STRAHNET Highway Designation:

If #100 is > 0	then	B = 2%
If #100 = 0	then	B = 0%

$S_3 = 15 – (A + B)$

S_3 shall not be less than 0% nor greater than 15%.

4. Special Reductions (Use only when $S_1 + S_2 + S_3 \geq 50$)

a. Detour Length Reduction, use Figure 4 or the following:

$A = (\#19)^4 \text{ x } (5.205 \text{ x } 10^{-8})$

"A" shall not be less than 0% nor greater than 5%.

b. If the 2nd and 3rd digits of #43 (Structure Type, Main) are equal to 10, 12, 13, 14, 15, 16, or 17; then B = 5%

c.

If 2 digits of #36 (Traffic Safety Features)	= 0	C = 1%
If 3 digits of #36	= 0	C = 2%
If 4 digits of #36	= 0	C = 3%

$S_4 = A + B + C$

S_4 shall not be less than 0% nor greater than 13%.

Sufficiency Rating = $S_1 + S_2 + S_3 – S_4$

The Rating shall not be less than 0% nor greater than 100%.

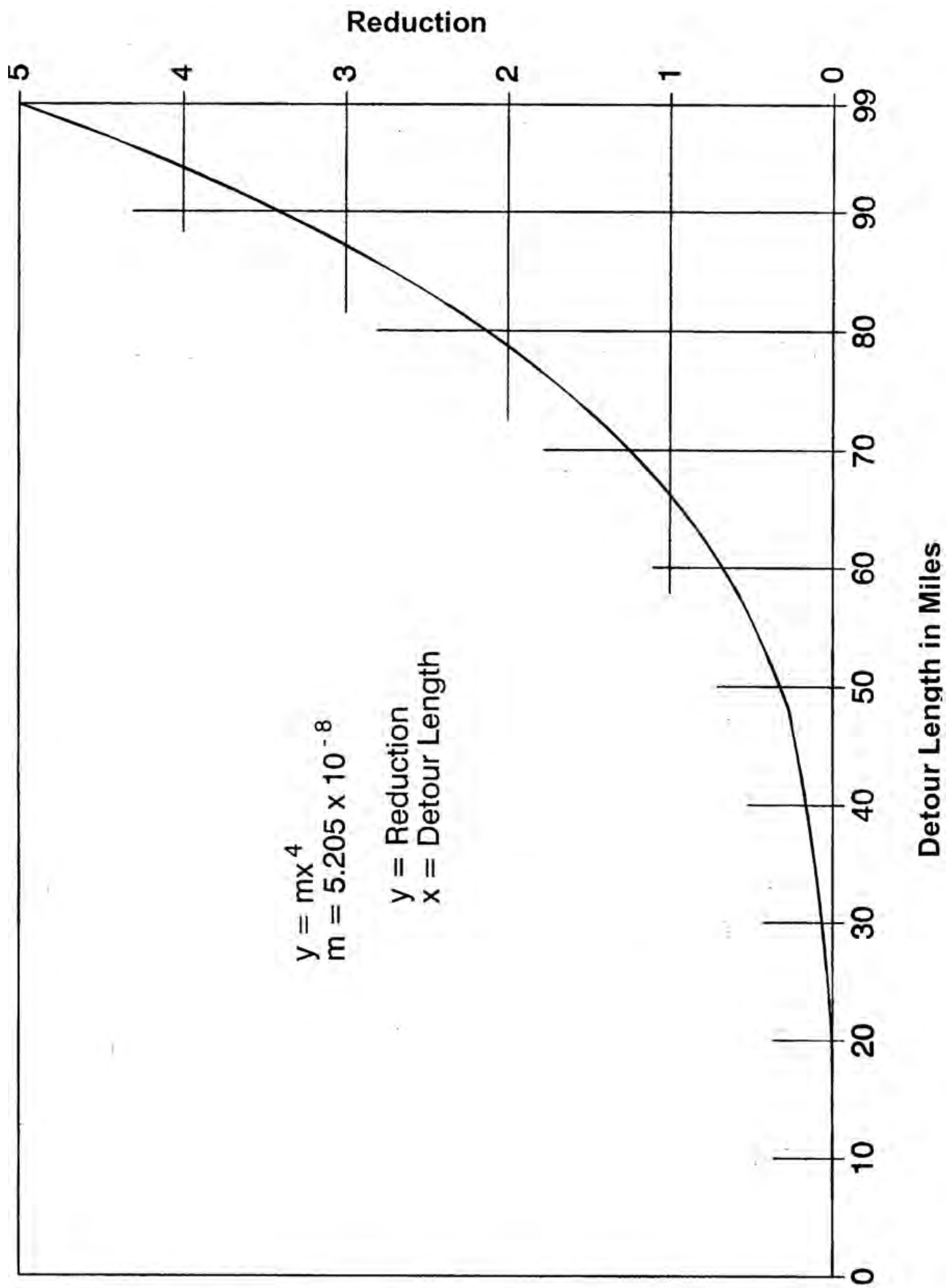

Figure 4. Special Reduction for Detour Length

Example
Calculation of Sufficiency Rating

1. Structural Adequacy and Safety

A, B, C, E, F, G, H = Not Applicable
D = 10%
$I = [36 - (1.00 \times 22)]^{1.5} \times 0.2778 = 14.6$
$S_1 = 55 - (10 + 14.6) = 30.4$

2. Serviceability and Functional Obsolescence

A = 3%, B = 1%, C = 4%, D = NA, E = NA, F = NA
J = (3 + 1 + 4) = 8%
$X = \frac{18500}{2} = 9250 \qquad Y = \frac{26.0}{2} = 13.0$

(1) If (26.0 + 2) < 40 then G = 5
(2) Not Applicable
(3) Not Applicable
(4) If X = 9250 and Y = 13.0 then H = 15

G + H = 5 + 15 = 20 (however, maximum allowable = 15)
I = 0
$S_2 = 30 - [8 + (15) + 0] = 7.0$

3. Essentiality for Public Use

$K = \frac{30.4 + 7.0}{85} = 0.44$

$A = \frac{18500 \times 8}{200{,}000 \times 0.44} \times 15 = 25.2$ (however, maximum allowable = 15)

B = 0
$S_3 = 15 - (15 + 0) = 0$

4. Special Reductions

$S_1 + S_2 + S_3 = (30.4 + 7.0 + 0.0) = 37.4 < 50$
$S_4 = NA$

SUFFICIENCY RATING = 30.4 + 7.0 + 0.0 = 37.4

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