BRIDGE INSPECTION PROGRAM MANUAL

Nebraska Department of Roads
Bridge Division

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INTRODUCTION TABLE OF CONTENTS

Intro-1 PURPOSE

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

The NBIS and NDOR 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 NDOR and Nebraska Public Agencies.

The objective and intent of the Manual is to assure consistent application of the NBIS and NDOR 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 NDOR 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 NDOR Bridge Inspection Program website. Program participants are urged to always check the website to ensure they are using the most current information.

The Manual is issued as PDF files in these forms listed. NDOR will not issue hard-copy Manuals.

- One PDF file including the Introduction and all Chapters
- Chapters 1 through 6 each as a PDF file
  - Letter size
  - Compact size (two pages printed on letter-size, flip-book style) for those who want to print a more compact Manual or Chapter for use.

Appendix Reference documents are issued as PDF files for each individual form, reference document, supplemental document or Bridge Inspection Program Memo.

It is anticipated that the Manual will be updated annually, prior to the start of any inspection cycle, typically in January. Interim guidance will be issued, if needed, throughout a given inspection cycle as an Appendix item; this guidance would be incorporated into the Manual with the next revision.

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. 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
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1500 Hwy 2
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Intro-5 REVISION HISTORY

NDOR 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 NDOR 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 NDOR Bridge Division website in March 2009.
- 2009 July 1, Interim Manual: The Interim Manual was posted on the NDOR 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 NDOR'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 NDOR 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 NDOR website; Other revisions from NDOR 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, revisions to or expansion of NDOR 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 NDOR.

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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 found 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.htm.

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 (NBIS) 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 has been summarized in the NDOR Bridge Inspection Program Operation Matrix in this Chapter.

The Nebraska Department of Roads is responsible for implementation or causing implementation of the NBIS regulation and all requirements of a Bridge Inspection Program (BIP). This chapter provides the plan and outline of how the Nebraska Department of Roads meets these requirements.

1.2 NBIS HISTORY AND FHWA OVERSIGHT

1.2.1 History

On December 15, 1967, the Silver Bridge over the Ohio River 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 suspended. 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.
1967 The Silver Bridge over Ohio River
1968 FHWA Memo initiating review and inventory of all existing structures
1971 NBIS published – regular, compressive 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
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 (USDOT) has continually identified the National Bridge Inspection Program as a high-risk area. More recently, the USDOT 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 to 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 as a result developed a risk-based, data-driven process to establish uniform oversight. The NBIS Metrics were released and are being evaluated beginning in 2011. A summary of the metrics can be found in this Manual’s Appendix. These metrics have also been identified in the NDOR Bridge Inspection Program Operation Matrix in this Chapter.

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 summary purposes. 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 NDOR *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(27)).”

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 NDOR 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 NDOR 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 NDOR Local Projects Division in accordance with the LPA Manual. The hydraulic design reports for all other Bridge projects shall be submitted to the NDOR Bridge Division prior to construction.”

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 NDOR Local Projects Division in accordance with the LPA Manual. The plans for all other Bridge projects shall be submitted to the NDOR 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 NDOR 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 NDOR Local Projects Division in accordance with the LPA Manual. The load-rating documents for all other bridges shall be submitted to the NDOR 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 Maintenance or Improvement of Bridges

NDOR is developing guidance for this topic to clarify this for the purposes of the Nebraska Bridge Inspection Program. This guidance will likely be distributed prior to the next Manual revision.

Bridge Owners often consult NDOR on whether work on structures constitutes rehabilitation, maintenance or reconstruction. Some common situations have been compiled in a document in the Appendix.

1.4 RESPONSIBILITIES

1.4.1 Nebraska Department of Roads

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. NDOR, 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 mater list periodically or as requested by FHWA;
- Other requirements.

1.4.2 Bridge Owners

NDOR has delegated these specific tasks as the responsibility of Bridge Owners, and this is supported by agreements between NDOR and local Bridge Owners:
- Bridge inspection of bridges under their authority
- Maintaining bridge files and records at their headquarters
- Cooperating with the NDOR in its implementation of the NBIS.

1.4.3 Engineering Consultants

Engineering consultants are often used by NDOR or other Nebraska Bridge Owners. 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 NDOR;
- Completing bridge load ratings under the direct supervision of and the signing of the same by a Nebraska professional engineer;
- Completing bridge scour assessment under the direct supervision of and the signing of the same by a Nebraska professional engineer.

1.5 DEFINITIONS

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

ABBREVIATIONS		
BIPDM	=	Bridge Inspection Program Data Manager
BIPPM	=	Bridge Inspection Program Program Manager
BO	=	Bridge Owner
CF	=	Critical Finding
CP	=	Complex
DR	=	Department Roads (DR form prefix)
FC	=	Fracture Critical
HE	=	Hydraulic Engineer
LARS	=	Load Rating and Analysis System
LRE	=	Load Rating Engineer
LPA	=	Local Public Agency
NDOR	=	Nebraska Department of Roads
PE	=	Professional Engineer
POA	=	Plan of Action
QA	=	Quality Assurance

QC	=	Quality Control
R	=	Routine
SC	=	Scour Critical

1.7 BRIDGE INSPECTION PROGRAM (BIP) ORGANIZATION

1.7.1 General

The Nebraska Bridge Inspection Program Organization includes NDOR staff that performs management and oversight functions for the execution of the NBIS requirements stated previously.

- BIP Manager
- BIP Data Manager
- BIP Load Rating Engineer.

Each Bridge Owner is responsible for following the policies and procedures of the BIP for bridges under their jurisdictions. The four primary categories of Bridge Owners include:

- Nebraska Department of Roads
- Nebraska Counties
- Nebraska Municipalities
- Private Owners operating public bridges

For the bridges under their jurisdictions, Bridge Owners are responsible for inventory inspections, inspection reports, load ratings, load postings, bridge maintenance and reporting of the results of all these operations to the Program Manager. Bridge Owners are also responsible for implementing scour Plans of Action (POA) and addressing critical findings on their bridges. Bridge Owners may delegate these responsibilities to other parties, including engineering consultants, but Owners are ultimately responsible for ensuring that all NBIS requirements are met.

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.

NDOR issues each Team Leader who meets the NBIS qualifications and NDOR requirements a Bridge Inspection Team Leader Certification. Certification may be obtained as either of the following:

- NBIS Routine Inspection Team Leader; or
- NBIS Routine Inspection and Fracture Critical 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 NDOR-approved comprehensive bridge inspection training course. The 3½-day FHWA NHI Course No. 130078, *Fracture Critical Inspection Techniques for Steel Bridge* must successfully completed to be certified by NDOR as a Fracture Critical Inspection Team Leader. NDOR 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

An applicant for certification must submit to the NDOR Program Manager the following:
1) Completed application, Nebraska Bridge Inspector Information Form DR Form 97; and
2) 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 above).

Certification Application – Accepted Proof of Achievement	
Accomplishment	Document
PE registration	Photocopy of the registration certificate
NICET certification	Photocopy of certification
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.

1.7.2.2.2 Certification Revocation

A Team Leader may also 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 NDOR; 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, prior to the expiration of Team Leader certification, achieves:
- Successful completion of the three-day FHWA National Highway Institute (NHI) Course No. 130053A, *Bridge Inspection Refresher Training*; or

- Successful completion of a minimum of twenty-four (24) hours of other bridge inspection refresher training approved by the NDOR 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 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 inventory inspections. NDOR will be developing these in the future.

1.7.2.4 Load Rating Engineer

The NBIS and NDOR 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 comprehensive bridge inspection training course, **or**
- Complete other FHWA-approved underwater diver bridge inspection training course.

NDOR further requires that Underwater Bridge Inspectors be NDOR certified Team Leaders.

1.7.2.6 Hydraulic Engineer

NDOR 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

NDOR requires that an individual completing Quality Control must have experience that is equal to or higher 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 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 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.

It is important that all parties involved in the NDOR Bridge Inspection Program and Quality Assurance program recognize the difference between Quality Control (QC) and Quality Assurance (QA). Generally, QC is a check on every document or product that is prepared by an organization, while QA is done by an independent party, done randomly, to assure that quality checks are being done for the program. 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 section provides more detailed descriptions.

Items of the Bridge Inspection Program that are subject to QC and QA include:
- bridge inspection reporting in Pontis
- inspection reports, such as fracture critical and underwater
- load ratings and associated calculations, both manual and those from software
- scour assessments
- plans of action, and
- follow up on critical findings and needed maintenance.

QC is compared to QA in the following table and described in more detail in the following sections.

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."
NDOR 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 identifies/corrects errors/omissions	QA identifies quality lapses
QC revises internal processes	QA proposes improvements
QC is done on every program product	QA is done on a random sample
QC, when complete, the program product is ready for delivery	QA, when complete, measure of QC & improves program

1.8.1 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 NDOR's program as a system of routine technical activities, to measure and control the quality of the inventory data 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:

- 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.

Quality Control procedures for specific activities are defined in the chapters for each activity of this Manual.

1.8.2 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 NDOR'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 given the current state of the structures and support the effectiveness of the QC program. Reviews should be performed on finalized inventory data following the implementation and performance of QC 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, considering the size of the 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.

1.8.2.1 NDOR QA Responsibilities

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

1.8.2.2 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 employees 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 with each organization that contributes to the BIP. **These reports are NOT to become part of a Bridge Record**. NDOR 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.

1.9 NDOR QUALITY ASSURANCE PROCESSES

Quality Assurance procedures for specific activities are defined in this Section. Forms used in the QA Evaluation for this NBI cycle are included in the Appendix of this Manual.

1.9.1 General

1.9.1.1 Sampling Procedures

Standard ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes provide guidance for selecting sample sizes. The standard states that the application 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 headings but for this procedure, all items will be addressed as an operation.

1.9.1.2 Definitions

The NDOR QA Review Program will use these definitions and are in general conformity to ANSI/ASQC Z1.4.

1.9.1.2.1 Lot

Lot will be a collection of units of product from which a sample is to be drawn and evaluated to determine conformance with the acceptability criteria.

The typical lot from which a sample will be taken for operations of this program will be the group of bridges for which data has been updated for a given period ending with the bridge inventory data submittal by NDOR to FHWA. This will generally coincide with the calendar year prior to the submittal.

1.9.1.2.2 Sample

A sample consists of one or more units of product drawn from a lot.

1.9.1.2.3 Operation

Sampling plans are intended to be applied to a given operation that affects the consistency and quality of the data of the Nebraska Bridge Inspection Program.

The NDOR Bridge Program Operations are outlined in the following NDOR Bridge Inspection Program Operation Matrix.

The program participants (variables) generate reports and NBI data, which are tabulated in the following Program Reports and Data Generated Matrix.

NDOR Bridge Inspection Program Operation Matrix

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

NBIS References (see end of matrix)	FHWA Metric	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), (c1), (c2), (e)	1	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	Maintenance of 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) § 650.315 (a)	12, 16 – 19	Inspection – R Inspection – FC Inspection – UW Inspection – SC Inspection – CP	TL and Inspectors	Pontis file 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

NDOR Bridge Inspection Program Operation Matrix

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

NBIS References (see end of matrix)	**FHWA Metric**	**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 (c) § 650.315 (a)	13	Load Rating	LRE	NBIS Load ratings from - LARS ratings - Non-LARS rating - NDOR 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	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 (d)	15	Maintenance of BO's files	BO	Quality records, accessible	BO Review	Process: independent check of file contents. Random sample drawn from list of BO in the NE bridge inventory.	Complete records for BO staff
§ 650.315 (a)	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	NBIS Static items NBIS Dynamic items
§ 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
§ 650.313 (d)	15	Address non-critical findings – State	Inspector, BO	Bridge Repair Report, Bridge Maintenance Checklist (state)	BO Review	Process: Review random sample of reports.	Resolution of findings, repairs
§ 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.	Resolution of findings, repairs

NDOR Bridge Inspection Program Operation Matrix

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

NBIS References (see end of matrix)	FHWA Metric	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	Scour Assessments and preparation of POA	HE	Scour Assessment Report	HE's organization supervisor review of report	Process: independent review of scour assessment reports Random sample of reports completed in the NBIS data submittal	Confirm established POA
§ 650.313 (e3)	18	Monitoring of SC bridges	BO	POA follow-up report	BIPPM	Process: independent check of BO's POA log concurrent with BO records review.	Operation verification

§ 650.307 Bridge inspection organization
§ 650.309 Qualifications of personnel
§ 650.311 Inspection frequency
§ 650.313 Inspection procedures
§ 650.315 Inventory

Program Participant Reports and Data Generated[1]				
Participant	**Qual's 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 Suggested POA for BO Inventory Data

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

1.9.1.2.4 Operation Variable

The operation variable typically is the party who is completing the operation, where the variations in observation and execution would be generated.

1.9.1.2.5 Level

"Inspection Level" is the standard industry term for the relationship between a lot and a sample. 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 avoid confusion with the Bridge Inspection Program operation of bridge inventory inspection.

The quantity of the total population, or lot, of an operation to receive a quality assurance check will be based on ANSI/ASQC Z1.4 Table 1. The general evaluation level will be used with "Normal" evaluation level, Column II, being the default level if insufficient performance data is available to justify a different level. Column I will be used for "Reduced" levels in areas that have a good quality trend and Column III will be used for "Tightened" levels when problems have been identified. The Program Manager has the authority to adjust which inspection level will be used and in addition, some "special" levels are identified under specific activities.

Sample Size for a Given Lot (based on ANSI/ASQ Standard Z1.4-2003)					
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

1.9.2 BIP Operations for QA

This procedure will provide the guidelines for selecting sample sizes for conducting quality assurance checks of the bridge inspection program. Guidance will also be provided for selecting the specific item to be checked within a given population. The quality assurance review program will address the operations listing in the NDOR Bridge Inspection Program Operations Matrix, generally listed here:

- Bridge inspection and reports
- Load ratings, calculations and reports
- Load posting
- Scour assessment and reports, and scour Plans of Action on scour critical bridges
- Inventory data review
- Owner's bridge files
- Personnel qualifications
- Follow-up on findings

1.9.3 QA Review Schedule and Reporting

Generally, the data set that is submitted to FHWA by April of a given year is for the data collected in the prior calendar 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, and the target date for the submittal of this report to FHWA is the end of the following October.

1.9.4 QA Review of Qualifications

1.9.4.1 Sample

The sample of program participants to be reviewed will include all who have contributed or prepared data for the current NBIS data cycle. The Program Manager will determine the appropriate evaluation level. The qualifications of the following contributors to the NBIS and scour assessments will be reviewed:

- Inspection Team Leaders
- Underwater Bridge Inspection Divers
- Load Rating Engineers
- Hydraulic Engineers

1.9.4.2 Methods of QA Review

- NDOR maintains a list of qualified Team Leaders that shall be reviewed. Qualified Team Leaders apply for approval by NDOR, and submit documentation of their training to NDOR. QA Review will include an annual review of the Program Manager's master list of qualified Team Leaders.

- Underwater inspections must be completed by an approved NDOR Team Leader who should be included in the NDOR list of qualified inspectors
- Load Rating Engineers and Hydraulic Engineers must be Nebraska registered Professional Engineers. Their PE numbers are recorded with the program documents that they have prepared; these will be checked against the Nebraska Board of Engineers and Architects data.

1.9.5 QA Review of Bridge Inspection and Frequencies

1.9.5.1 Lot

The lot for bridge inspection will be the structures for which inspections are completed and data is submitted for a given NBIS data submittal cycle. This lot will typically include structures inspected within a given cycle.

1.9.5.2 Sampling

The quantity of bridges to receive a quality assurance check will be based on the ANSI/ASQC Z1.4 Table 1, *Sampling Procedures and Tables for Inspection by Attributes*. The general evaluation levels will be used. The Program Manager will determine the evaluation level, (I reduced, II normal or III tightened) based on the findings on bridge inspections reviewed in the QA activities for the prior cycle. Initial sampling will be based on Level II, Normal but may be adjusted by the Program Manager as QA data becomes available.

This sampling method should be flexible and open for judgment decisions. The Program Manager may consider whether a structure was part of a quality assurance review from the preceding year(s). Consideration may also be given to whether a BO has inspections completed by the same staff or consultant each year.

1.9.5.3 Sample Augmentation Based on the Variable

The variable for the inspection operation is the Inspection Team Leader who is the originator of the data included on inspection reports and condition ratings. The random sample selected for QA will include 2% of the structures (with a minimum of 2) of each active Team Leader in a given cycle. If additional subjects are needed to meet these requirements, they will be selected at random from those structures for the particular Team Leader not part of the original sample.

1.9.5.4 Sample Augmentation Based on Attributes

The random sample may be augmented for certain attributes of structures in the lot as determined by the Program Manager.

Fracture Critical Structures: The random sample selected for QA will include a minimum of 2% of all fracture critical bridges, with a minimum of 2 from each fracture critical bridge type (truss, two-girder, etc.). If additional samples are needed, to meet these requirements, they will be selected at random from those structures with this attribute not part of the original sample.

1.9.5.5 Method of QA Review

The method of quality assurance review will be by independent inspection. The QA review team will inspect a structure after the subject bridge inspection team has concluded their activities and prior to the quality assurance review of the bridge inspection report. This independent inspection may be limited to checking only a few select items (i.e. Fracture critical member) or may be a complete inspection. The quality assurance inspection report will then be compared to the bridge inspection report and any differences noted. Differences in NBI condition ratings of more than one will be noted. Larger variations on all inventory items will be recorded and evaluated for program improvements. The intervals between the last inspection and the subject inspection will be checked.

QA review of inspection while observing an inspection team as they conducted their inspections was completed in the inaugural cycle of the BIP QA Program. This method was not as effective to assess inspection thoroughness, processes and results as the independent inspection of the random sample. Other methods to evaluate compliance with inspection plan, safety procedures, appropriate inspection equipment will be evaluated in future cycles.

1.9.6 QA Review of Underwater Bridge Inspections

1.9.6.1 Lot

NDOR has taken the responsibility for underwater inspections needed for bridges reported in the Nebraska Bridge inventory data. NDOR anticipates that they will have one consultant do all the underwater inspections. There are approximately 90 bridges that require underwater inspection; however, not all are inspected in a given cycle. The lot will be the structures for which underwater inspections are completed and the data is submitted for given NBIS submittal cycle.

1.9.6.2 Sampling

The quantity of bridges to receive a quality assurance check will be based on the ANSI/ASQC Z1.4 Table 1, *Sampling Procedures and Tables for Inspection by Attributes*. The general evaluation levels will be used. The Program Manager will determine the evaluation level, (I reduced, II normal or III tightened). Initial sampling will be based on Level II, Normal but may be adjusted by the Program Manager as QA is being completed.

1.9.6.3 Sample Augmentation Based on the Variable

The variable for the underwater bridge inspection operation is the Team Leader, the originator of the data that is entered into the Inventory data. The random sample selected for QA will include a minimum of two of each active Team Leader in a given cycle.

1.9.7 QA Review of Load Ratings

1.9.7.1 Lot

The lot for bridge load rating will be the structures for which load ratings are completed and data is submitted for a given NBIS data submittal cycle. This lot will typically include structures that are load rated within a given calendar year.

1.9.7.2 Sampling

The quantity of bridges to receive a quality assurance check will be based on the ANSI/ASQC Z1.4 Table 1, *Sampling Procedures and Tables for Inspection by Attributes*. The general evaluation levels will be used. The Program Manager will determine the evaluation level, (I reduced, II normal or III tightened). Initial sampling will be based on Level II, Normal but may be adjusted by the Program Manager as QA is being completed.

1.9.7.3 Sample Augmentation Based on the Variable

The variable for the load rating operation is the Load Rating Engineer, the originator of the data that is entered into the Inventory data. The random sample selected for QA will include 2% of the structures (with a minimum of 2) of each active Load Rating Engineer in a given cycle. If additional samples are needed, to meeting these requirements, they will be selected at random from those structures with this variable not part of the original sample.

1.9.7.4 Sample Augmentation Based on Attributes

The random sample may be augmented for certain attributes of structures in the lot as determined by the Program Manager.

Fracture Critical Structures: The random sample selected for QA will include a minimum of 2% of all fracture critical bridges, with a minimum of two from each fracture critical bridge type (truss, two-girder, etc.). If additional samples are needed, to meet these requirements, they will be selected at random from those structures with this attribute not part of the original sample.

1.9.7.5 Methods of QA Review

The following methods will be utilized:

- Review of the Load Rating Summary Sheet (LRSS) for each subject.

- Load Analysis and Rating System (LARS) software reports: Review report for qualification of personnel, completeness, input values and that the results are consistent with the bridge inspection report; each report to be PE stamped.
- Non-LARS reports – In addition to the above:
- 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.
- Review level varies. A standard review will include a review of the inspection report, the input and output documentation for the calculations and a verification that output is reported correctly on the LRSS. An extensive review, which includes an independent load rating or complete check of the load rating calculations and analysis, is completed for the following:
- First QA review of a LRE; or
- First QA review of a specific bridge type; or
- Non-LARS rating method has been employed.

1.9.8 QA Review of Load Postings

For the inaugural cycle of the QA Program, the postings on the bridges that were part of the Bridge Inspection sample were reviewed. Data from this activity indicated the need for additional methods or sampling to evaluated compliance.

Bridge Owners are notified by the Load Rating Engineer if a structure's load rating indicates load posting is required or if the bridge should be closed due to ratings. NDOR requires that signs are installed and notification to the Program Manager is made within 60 days of the date of the LRSS that documents the load restricted required.

1.9.8.1 Sampling

Each Bridge Owner is responsible for load posting and closure of the bridges under their jurisdiction. The operation variable is the Bridge Owner.

1.9.8.2 Sample

The quantity of Bridge Owners whose files will receive a quality assurance check will be based on the ANSI/ASQC Z1.4 Table 1. The sample for this operation will be the same random sample as that determined for Owner's Records. The general evaluation levels will be used. The Program Manager will determine the appropriate evaluation level.

1.9.8.3 Methods of QA Review

The QA review will prepare a list of each subject Bridge Owner's posted/closed bridges. The QA Inspection team will check each bridge site to verify signs have been posted or that closure barricades are in place.

1.9.9 QA Review of Bridge Owner Files

1.9.9.1 Sampling

Each Bridge Owner is responsible for maintaining a complete set of bridge inspection and load ratings files, as well as other records required by AASHTO and NDOR. The operation variable is the Bridge Owner. A quality assurance review at the office of the bridge owner will be conducted to verify that files are being maintained.

1.9.9.2 Sample

The quantity of Bridge Owners whose files will receive a quality assurance check will be based on the ANSI/ASQC Z1.4 Table 1. The general evaluation levels will be used. The Program Manager will determine the appropriate evaluation level.

The specific structure files to be checked will be selected randomly from the particular Bridge Owner's bridge inventory. 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 quality assurance reviewer determines that files are being maintained differently for different types of structures, then a sample of each filing system should be checked.

1.9.9.3 Methods of QA Review

The following methods will be utilized:

- Bridge Owner personnel will be interviewed to determine how the filing system works.
- A copy of the bridge owner's filing procedure will be obtained.
- Files will be reviewed utilizing a standard review check sheet in accordance with the policy and procedures of Chapter 2 of this Manual and the bridge owner's procedure.

1.9.10 QA Review of Inventory Data

1.9.10.1 Sampling

This activity will not be done using a defined sampling plan. NDOR 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.

1.9.10.2 Selection of Sample based on attributes

The specific data to be checked will not be determined by attributes. The sample will be the data contained in reports selected for quality assurance review of reports.

1.9.10.3 Methods of QA Review

The following method will be utilized:

- The NDOR Data Manager runs the NBIS Edit Check prior to any submittal to FHWA and resolves errors found.
- Upon completion of the quality assurance 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.
- As the samples are pulled from the QA lots, data inconsistencies or apparent miscoding will be reviewed.

1.9.11 QA Review of Follow Up on Critical Findings

All Bridge Owners are required to file Critical Finding Reports and report to the Program Manager when corrective action has been taken to address the finding, or if an Owner has chosen to close the bridge.

1.9.11.1 Sampling

Each Bridge Owner is responsible for developing a plan to address the Critical Finding and reporting the corrective action or permanent closure to the Program Manager. The operation variable is the Bridge Owner.

1.9.11.2 Sample

The quantity of Bridge Owners whose files will receive a quality assurance check will be based on the ANSI/ASQC Z1.4 Table 1. The sample for this operation will be the same random sample as that determined for Owner's Records. The general evaluation levels will be used. The Program Manager will determine the appropriate evaluation level.

1.9.11.3 Methods of QA Review

The QA evaluation will include a review the Master list of Critical Findings kept by the BIP Program Manager.

The QA review will prepare a list of each subject Bridge Owner's bridges with Critical Findings for the last two years. The QA team will check the Owners' records for the Critical Finding Reports and the structures maintenance history for documentation of the corrective actions.

1.9.12 QA Review of Repair or Maintenance Activities

NDOR has a procedure to report and address damage to bridges that need to be address, but that don't require closure of a bridge. This process results in either repairs being made by NDOR Maintenance personnel or construction contractors.

The non-state Bridge Owners have not been required to use this form of reporting, but have their own systems of handling repairs to bridges which are documented in a structure's Bridge Record.

1.9.12.1 Sampling

Each Bridge Owner is responsible for maintenance and repair of the bridges under their jurisdiction.

1.9.12.2 Sample

The quantity of Bridge Owners whose files will receive a quality assurance check will be based on the ANSI/ASQC Z1.4 Table 1. The sample for this operation will be the same random sample as that determined for Owner's Records. The general evaluation levels will be used. The Program Manager will determine the appropriate evaluation level.

1.9.12.3 Methods of QA Review

The QA Review on NDOR bridge will include a check of the bridge record for Bridge Damage Reports that have been filed and/or that have had the work scheduled or completed.

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.

1.9.13 QA Review of Scour Assessments

1.9.13.1 Sampling

The quantity of bridges to receive a quality assurance check for scour-related items will be based on the ANSI/ASQC Z1.4 Table 1. The general evaluation level will be used. The Program Manager will determine the appropriate evaluation level.

1.9.13.2 Augmentation of Sample by Variable

The variable for the scour assessment and coding is the Hydraulic Engineer (HE), the originator of the data that is entered into the Inventory data. The random sample selected for QA will include 2% of the assessments and coding (with a minimum of 2) from each Hydraulic Engineer. If additional samples are needed, to meet these requirements, they will be selected at random from those structures with this variable not part of the original sample.

1.9.13.3 Augmentation of Sample by Attribute

The random sample may be augmented for certain attributes of structures in the lot as determined by the Program Manager.

Scour Susceptible and Scour Critical Structures: The random sample selected for QA will include a minimum of 2% of all of these bridges. If additional samples are needed, to meet these requirements, they will be selected at random from those structures with this attribute not part of the original sample.

1.9.13.4 Methods of QA Review

The QA evaluation methods for scour assessments are described in NDOR's Hydraulic Assessment Guidelines. The QA evaluation for coding not requiring an assessment will be by review of the inspection reports.

1.9.14 QA Review of Follow Up on Scour Critical Monitoring

Bridge Owners are to maintain a log of maintenance activities and action required by a structure's Plan of Action. The POA may require increased inspection, periodic monitoring, installation of countermeasures, conditional closure and/or bridge replacement.

1.9.14.1 Sampling

Each Bridge Owner is responsible for monitoring scour critical bridges. The operation variable is the Bridge Owner. A QA review of scour monitoring logs at the office of the bridge owner will be conducted to verify that plans of action are being followed.

1.9.14.2 Sample

The quantity of Bridge Owners whose files will receive a quality assurance check will be based on the ANSI/ASQC Z1.4 Table 1. The general evaluation levels will be used. The Program Manager will determine the appropriate evaluation level.

1.9.14.3 Methods of QA Review

The QA review will check the bridge record of all structures under the jurisdiction of the Bridge Owner that have a scour plans of action. Bridge Owners are to keep a log of action completed for each action in the POA, which will vary for each structure.

1.10 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1

1.11 FORMS

These forms are Included in the Appendix of this Report.

Name	DR Form	Revision Date
Nebraska Bridge Inspector Information Form	DR 97	Feb 09
QA Review by Independent Inspection	na	
QA Review of Load Rating	na	
QA Review of Bridge Owner Records	na	
QA Review of Bridge Owner Records Summary	na	
QA Review of Hydraulic Assessments	na	

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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, which are a significant investment of public funds in capital assets.

The National Bridge Inspection Standards (NBIS) require that records be kept on bridges. 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 NDOR 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 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, NDOR and FHWA, and shall be kept in a logical order to allow efficient retrieval, typically by National Bridge Inventory ID.

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

NDOR encourages Owners to send them electronic files of their bridge information, and NDOR places a copy on the Bridge Division ftp site. Owners may consider this location as a back-up to the files they must keep on their own servers and computers. NDOR is not responsible for ensuring that Owners' information on this ftp site is up to date and current.

Two forms are used for the NE Bridge Inspection Program to indicate the format and location of Owners' documents:
1. The Bridge File Index (BFI). The BFI provides information regarding storage location and format for the various documents. This form incorporates (by reference) into Individual Bridge Records those documents maintained in group files, when the location of the group file is shown on the Index.
2. The Individual Bridge Record Checklist (IBRC). The IBRC is used to verify that documents of an Individual Bridge Record are included in the individual file. Typically, these are hardcopy documents that are related to that individual bridge (e.g. correspondence related to its load rating, bridge plans/measurement).

Examples of location and format for several components are shown in the following table. Each Owner should decide what location and format they will use for each component; however, the

Bridge File Index must allow any party who has need to review or use an Owners Bridge Records to find any of the components for any individual bridge record.

Location, Format	Examples / Comments
Group, Hardcopy (GH)	• Correspondence, General, Bridge Div. Memos • Maintenance records kept in ledgers or notebooks • Hydraulic Assessments kept in a common notebook(s)
Group, Electronic (GE)	• Photos (site and inspection) typically are taken with digital cameras and stored on an Owners network or office computers within the same folder, with individual folders for each bridge. Location examples: Drive Name:\...\Bridge Photos\Str ID\Site Drive Name:\...\Bridge Photos\Str ID\Inspection • Fracture Critical Inspection reports are typically done by consultants and provided to Owners electronically. Location examples: Drive Name:\...\Fracture Critical Insp\Str ID\Site • Load rating calculations Load rating calculations, especially those completed by consultants are typically delivered to Owners electronically. These can be kept in a folder on a computer network in a folder for each structure. (Location e.g. Drive Name:\...\Load Rating\Str ID)
Individual, Hardcopy (IH)	• Individual Bridge Record Checklist • Correspondence, related to an individual bridge • Load Rating Summary Sheet signed by the Load Rating Engineer • SIA Sheet for each inspection • Pontis reports printed after an NBI inspection • Maintenance Checklists after completion of the work
Individual, Electronic (IE)	• Bridge Inspection Procedures for a Complex Bridge • Some Owners prefer to keep their electronic files stored under the Structure ID versus document type. Location examples: Drive Name:\Bridge File\Str ID\Bridge Photos\Site Drive Name:\Bridge File\Str ID\Bridge Photos\Inspection Drive Name:\Bridge File\Str ID\Load Rating\Year Drive Name:\Bridge File\Str ID\Fracture Critical Inspection\Year Drive Name:\Bridge File\Str ID\Hydraulic Assessment\Year

2.2 REFERENCES

The references set forth procedures to be used by Bridge Owners in managing their Bridge File and Bridge Records. Persons involved with maintaining records for bridges listed in the Nebraska bridge inventory must be knowledgeable of the requirements in NBIS and in the AASHTO MBE. The information in this Bridge Inspection Program Manual supplements the information in these references.

- AASHTO. *Manual for Bridge Evaluation*. First Edition, 2008. (MBE)
- FHWA. *Bridge Load Ratings for the National Bridge Inventory.* Memorandum HIBT-30. October 30, 2006

The MBE supersedes 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, the 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.

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.

2.3 RESPONSIBILITIES

2.3.1 Nebraska Department of Roads

NDOR is responsible for:

- Providing procedures and guidance regarding Bridge Owners' Bridge File.
- Providing Pontis software to all Nebraska Bridge Owners for use in maintaining inventory information.
- Maintaining the inventory database for National Bridge Inventory and Nebraska Inventory Items.
- Maintaining the underwater inspection procedures and reports for each bridge requiring underwater inspection in Nebraska, and providing the Owner with a copy of the inspection report.

NDOR holds some information Bridge Owners Records 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 records for all of the bridges under the jurisdiction of the Bridge Owner.
- Providing bridge management staff access to the bridge file and all bridge records, whether they are electronic or hard copy, for their use.
- Keeping bridge records at their site or office.

- Keeping back-up of their electronic documents, either at their site or on the NDOR 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.
- Ensuring that **new** bridges receive an initial inventory inspection and load rating. This initial inspection data must be in the Nebraska bridge inventory within **90 days** of opening to traffic. Submittal of plans and load ratings to NDOR for new bridges should be submitted to NDOR prior to opening to traffic.
- Ensuring that **modified** bridges (e.g. rehabilitation or widening) are reinspected and a revised load rating is done. The revised inspection data must be in the Nebraska bridge inventory within 90 days of opening to traffic. Submittal of plans and revised load ratings to NDOR for modified bridges should be submitted to NDOR prior to opening to traffic.
- Having their bridges load rated when required by this Manual.
- Follow up on and resolution for Critical Findings and reporting closure to NDOR.

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, hydraulic assessment, etc.) directly to Bridge Owners. This information is not to be transmitted directly to NDOR, except at the request of NDOR.
- 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 they cannot be in permanent possession of an Owners Bridge File and 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 Bridge Record for each bridge and other group 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.

2.4.1.3 Base Data

Base data for a bridge-specific data 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 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 derived from the base and inspection data. Examples of derived data would be condition ratings, recommendation for maintenance or repair, and the calculated load rating for a structure.

2.4.2 NE Bridge Inspection Program Implementation and Definitions

2.4.2.1 Bridge File

The Bridge File includes all component documents, whether hardcopy or electronic format, and whether they are kept in a group or individually. Owners must provide information regarding to location of the component documents to their staff, LPA officials, NDOR and FHWA. NDOR has provided a form, the Bridge File Index (BFI) for this purpose. The BFI provides the location and the format of component documents for their bridges. This form incorporates documents maintained in group files (electronic and hardcopy) into Individual Bridge Records, by reference to the documents and their location.

2.4.2.2 Individual Bridge Record

The Individual Bridge Record (IBR) is a hardcopy file kept at the Owners' facilities that will contain all hard-copy components of the Bridge Record. The individual Bridge Record must be readily retrieved by Local Public Agency (LPA) officials, NDOR has provided a form, the Individual Bridge Record Checklist (IBRC), to help organize the Record and to show the information kept in the Individual Record.

2.4.2.3 BISON

Bridge Inspection System of Nebraska. This 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.

2.4.2.4 BRIN

Bridge Inspection Nebraska. This 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.

2.4.2.5 Site Photos

Site photos are those that provide a pictorial record of the site, and guidance on this can be found in the Chapter 4, Bridge Inspection.

2.4.2.6 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.

2.5 COMPONENTS OF BRIDGE FILE AND RECORDS

The following table lists the components of bridge records from the MBE, in the order shown in the MBE. Detail and guidance for each component follows the table.

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 IBRC.
Pile Driving Records	These records are sometimes necessary for load rating. If these are in the construction project file, indicate the location on the IBRC.
Correspondence	NDOR correspondence to the Bridge Owner regarding the bridge
Photographs	• Site photos • Inspection photos
Maintenance and Repair History	• Critical Finding Reports • Maintenance and Repair 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 bridges, bridges with fatigue-prone details and complex bridges must be kept in the Owner's bridge record • List of FC members
SI&A	All SI&A reports prepared for the bridge
Inventories and	All inspection documents and reports

Inspections	
Load Rating and Posting	All Load rating calculations and all signed LRSSs
Permit Load History	Any records of loads that exceeded the bridge load limits
Scour Assessment and POA	• Hydraulic assessment for scour • Plan of Action • POA Log

2.5.1 Plans and Measurements

The records for each bridge must contain the bridge's construction plans with as-built information, or detailed measurements sheets, as for timber and steel stringer structures for which plans are not available. This is a mandatory component of the Bridge Record.

Shop drawings should also be included in the Bridge Records. This is a mandatory component of the bridge record.

2.5.2 Specifications

Bridges in Nebraska typically are built with the governing NDOR 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 unique features that are built under special provisions; these are a mandatory item to be included in the bridge record. These typically are in the construction file, thus the location referenced on the IBRC.

2.5.3 Correspondence

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

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

Some correspondence from NDOR might pertain to several individual bridges; a copy of the correspondence should be included in each Bridge Record.

2.5.4 Photographs

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

Prior to the 2008 inspections, two site photos were required and these were stored in the BISON system.

2.5.5 Materials and Tests

Any materials data from the construction of the bridge should be included in the file, such as pile driving logs, concrete tests, mill certifications and the like. Pile driving records in particular are important in the rating of bridges. These typically are in the construction file, thus the location is referenced on the IBRC.

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

2.5.6 Maintenance and Repair History

Each 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.

Critical Findings Reports are a mandatory component of a bridge record, if this situation is applicable.

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. Some Owners have sign inventories that provide a record of load posting at a particular structure.

2.5.9 Permit Loads

NDOR 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 NDOR 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 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. See also the Scour Plan of Action and POA Log.

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 NDOR 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 inspection performed on the bridge. These could include routine (NBI), special, underwater and other inspection types described in Chapter 4, Bridge Inspection.

2.5.13 Inspection Requirements

Each bridge requiring non-routine inspection techniques (fracture critical, complex and underwater) should include 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.

NDOR has been utilizing engineering consultants to complete all underwater inspections needed in Nebraska. The LPA Bridge Owners are required to have a copy of the underwater inspection procedures in the records. These UW inspection procedures are kept at the Bridge Division Office.

2.5.14 Structure Inventory and Appraisal Sheets

The Bridge Record should contain a copy of each SI&A resulting from every inspection completed for the structure. Inspections between routine inspections that modify the NBI data items should also be included.

2.5.15 Inventories and Inspections

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

- Routine Inspections
- Fracture Critical inspection reports
- Special Inspections
  - Post-repair inspections completed after repairs made to address Critical Findings
  - Other inspections related to monitoring the general or a specific condition.

NDOR has been utilizing engineering consultant to complete underwater inspections in Nebraska. The LPA Bridge Owners must have a copy of the inspection report in the records.

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

2.5.16 Rating Records

The Bridge Record must include the complete 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, and all load rating calculations included for each load rating completed on the bridge. Originally 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. NDOR had 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). Existing bridges may see their scour status change over time. New bridges should not be designed so that they are scour critical.

The record should include the complete report of the assessment, including all analysis. 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 in the Bridge Record that documents activities related to the POA, such as installation of countermeasures or monitoring.

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

NDOR recommends that Owners prepare POA logs in a format that will allow ready portability to the field for scour monitoring and reporting. It is the Owners decision how to maintaining a POA, however, the Log must include the state, observations made and the status of the bridge.

Examples of POA logs used by NE Owners include:

- Three ring binder(s) that includes copies of Owners POAs and the NDOR form POA Logs for each structure.
- One county map per 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 observation are kept in a group, hardcopy file at the Owner’s office.
- The POA form reduced on a photocopier, and provided to maintenance personnel who document the date of monitoring and observation. The hardcopy is then filed in the hardcopy Bridge Record at the Owner’s office.

2.6 QUALITY CONTROL

Quality Control (QC) is 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.

An individual of equal or greater qualifications than the originator of the product shall complete Quality Control review on the work product. QC manager/engineer shall:

- See that an individual of equivalent or better qualifications than the originator completes the QC on a given document, data or calculations.
- See that the technical activity has followed procedures set by NDOR;
- Provide routine and consistent checks for data integrity, correctness and completeness;
- Identify and address errors and/or omission;
- Record the QC activities.

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.

QC for Owner’s records will be facilitated by the Individual Bridge Records Checklist list that can be found in the Appendix.

2.7 QUALITY ASSURANCE

NDOR 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

2.9 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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm for the current list of applicable forms and the most recent versions of each form.

Name	DR Form	Revision Date
Bridge File Index		
Individual Bridge Record Checklist	na	
Plan of Action (POA) Log	na	
QA Evaluation of Owners Records	na	

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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm. Participants are urged to check this site to ensure they have all the most current information and forms.

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3.1 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*. Where 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 NDOR commentary or supplemental guidance on these Items where necessary.

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

The 300 series Items are Nebraska custom fields used by NDOR and are not submitted to the FHWA. These items do not print on the SI&A report. These were developed by the NDOR 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.

3.2 REFERENCES

The information in this Bridge Inspection Program Manual supplements the information in these references.

- AASHTO. *Manual for Bridge Evaluation*. First Edition, 2008. (MBE)
- FHWA. *Bridge Load Ratings for the National Bridge Inventory.* Memorandum HIBT-30. October 30, 2006
- FHWA. *Technical Advisory T5140.23, Evaluating Scour at Bridges*. October 28, 1991.
- FHWA. *Bridge Inspector's Reference Manual*. NH103-001, Vols. 1 and 2. October 2002; Revised 2006. (BIRM)
- 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.
- FHWA. *Bridge Load Ratings for the National Bridge Inventory.* Memorandum HIBT-30. October 30, 2006
- FHWA. *Evaluating Scour at Bridges*. Hydraulic Engineering Circular, No. 18 (HEC 18), 4th Edition. Publication No. FHWA-NHI-01-001. May 2001 with Errata, September 6, 2001.
- FHWA. *Bridge Scour and Stream Instability Countermeasures, Experience, Selection and Design Guidance Second Edition*. Hydraulic Engineering Circular, No. 23 (HEC 23). Publication No. FHWA-NHI-01-003. 2001, with Errata September 6, 2001.
- FHWA. *Revision of Coding Guide, Item 113 – Scour Critical Bridges*. Memorandum HIBT-30. April 27, 2001.
- FHWA. *Compliance with the National Bridge Inspection Standards – Plan of Action for Scour Critical Bridges*. Memorandum HIBT-20. March 29, 2005.
- FHWA. *Scourability of Rock Formations*. Memorandum HNG-31. July 19, 1991.
- NCHRP. *Synthesis 354: Inspection and Management of Bridges with Fracture-Critical Details*. 2005.

The MBE supersedes 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.

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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.

3.3 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.*
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.*

Term	Definition
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.*
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.*

Term	Definition
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.*

3.4 NATIONAL BRIDGE INVENTORY DATA ITEMS

3.4.1 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
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 Pontis when changed
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 Vert Clearance	Geometric Data	4/N		S	I				
11	Kilometerpoint	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		
19	Bypass/Detour Length	Age and Service	3/N	S3, S4	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				

NBI ITEMS SHOWN IN NUMERICAL ORDER

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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
26	Functional Class Of Inventory Rte.	Classification	2/N	S2	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	S2	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	S2	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	S4	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		
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		

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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
46	Number Of Approach Spans	Structure Type and Material	4/N		S[2]	I, E		V		
47	Inventory Rte Total Horz Clearance	Geometric Data	3/N		S[1]	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		
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 Vert Clear Over Bridge Roadway	Geometric Data	4/N	S2	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	S2	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	S2	D	I		E		
58	Deck	Condition	1/AN	S2	D			E		
59	Superstructure	Condition	1/AN	S1	D			E		
60	Substructure	Condition	1/AN	S1	D			E		
61	Channel/Channel Protection	Condition	1/AN		D			E		
62	Culverts	Condition	1/AN	S1	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	S1	D	E				P
67	Structural Evaluation	Appraisal	1/AN	S2	D[3]					
68	Deck Geometry	Appraisal	1/AN	S2	D[3]					
69	Underclear, Vertical & Horizontal	Appraisal	1/AN	S2	D[3]					
70	Bridge Posting	Load Rating and Posting	1/N		D	E				P
71	Waterway Adequacy	Appraisal	1/AN	S2	D	E			P	

NBI ITEMS SHOWN 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 Pontis when changed P = provides data										
Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**	**Sufficiency**	**Static/ Dynamic**	**PM Staff**	**Owner**	**TL**	**HE**	**LRE**
72	Approach Roadway Alignment	Appraisal	1/AN	S2	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	Other Special Inspection	Inspections	3/AN		D^4			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	Other 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				
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	S2, S3	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		

NBI ITEMS SHOWN IN NUMERICAL ORDER

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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 Pontis when changed
P = provides data

Item No.	Item Name	SI&A Category	Code Length /Type	Sufficiency	Static/ Dynamic	PM Staff	Owner	TL	HE	LRE
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			
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] NDOR is responsible for these items for Underwater Inspection.

3.4.2 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 Vert Clearance	Geometric Data	4/N
11	Kilometerpoint	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
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

NBI ITEMS IN ORDER SHOWN IN THE NBI			
Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**
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 Horz 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 Vert 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
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

NBI ITEMS IN ORDER SHOWN IN THE NBI			
Item No.	**Item Name**	**SI&A Category**	**Code Length /Type**
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
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

3.4.3 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
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 Horz Clearance	3/N
10	Inventory Rte, Min Vert Clearance	4/N
11	Kilometerpoint	7/N

NBI ITEMS IN ALPHABETICAL ORDER		
Item No.	**Item Name**	**Code Length/Type**
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 Vert 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
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

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

3.5 NEBRASKA BRIDGE INVENTORY DATA ITEMS

3.5.1 Nebraska Items – 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.

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 Pontis 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[1]		
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		
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		

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 Pontis when changed
P = provides data

Item No.	Description	Category	Code Length /Type	Static/ Dynamic	PM Staff	TL	HE	LRE
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[2]	
347	Noticeable Contraction of Stream	Scour Related Routine Inspection	1/A	D		E	V[2]	
348	Local Scour at Piers/Abutments	Scour Related Routine Inspection	1/A	D		E	V[2]	
349	Banks Eroding/Unstable	Scour Related Routine Inspection	1/A	D		E	V[2]	
350	Stream Shifted from Bridge Center	Scour Related Routine Inspection	1/A	D		E	V[2]	
351	Floodwater Reaches Low Superstructure	Scour Related Routine Inspection	1/A	D		E	V[2]	
351A	Low Road Elevation Above Low Superstructure	Scour Related Routine Inspection	1/A	D		E	V[2]	
352	Floodwater Over Bridge Deck or Roadway	Scour Related Routine Inspection	1/A	D		E	V[2]	
353	Potential Debris Upstream	Scour Related Routine Inspection	1/A	D		E	V[2]	
354	Bents/Piers in Channel	Scour Related Routine Inspection	1/A	D		E	V[2]	
355	Bridge Alignment with Flow	Scour Related Routine Inspection	1/AN	D		E	V[2]	
356	Debris Blocking Channel at Bridge	Scour Related Routine Inspection	1/A	D		E	V[2]	
357	Drop from Upstream Deck to Flowline	Scour Related Routine Inspection	2/N	D		E	V[2]	
357A	Drop from Upstream Deck to Ground at Abut 1	Scour Related Routine Inspection	2/N	D		E	V[2]	
357B	Drop from Upstream Deck to Ground at Abut 2	Scour Related Routine Inspection	2/N	D		E	V[2]	
358	Is There a Scour Problem	Scour Related Routine Inspection	1/A	D		E	V[2]	
358A	Significant Flood in Last Two Years	Scour Related Routine Inspection	1/A	D		E	V[2]	
358B	Scour Increased in Last two Years	Scour Related Routine Inspection	1/A	D		E	V[2]	
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		

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 Pontis when changed P = provides data								
Item No.	**Description**	**Category**	**Code Length /Type**	**Static/ Dynamic**	**PM Staff**	**TL**	**HE**	**LRE**
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	1/N	D		E		
378	Date Maintenance Flagged	Maintenance	1/N	D		E		
379	Recommendations	Maintenance	1/N	D		E		
380	Percent of Stress Reduction	Load Rating	1/N	S				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

[1] TL codes posting as found on inspection.
[2] 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.

3.6 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. This Manual Appendix includes English unit calculation.

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]				
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.

3.7 NBI BRIDGE STATUS: STRUCTURALLY DEFICIENT OR FUNCTIONALLY OBSOLETE

A bridge's sufficiency rating and a general classification of the bridge's status, either structurally deficient or functionally obsolete, are used in preparing the selection list of bridges under the Highway Bridge Program (HBP). NDOR's Bridge Inventory database includes Status data item.

Structures must be NBI highway bridges and have not been constructed or had major reconstruction within the past ten years to be considered for the HBP list. NBI highway bridges are coded as shown. HBP list includes structurally deficient or functionally obsolete bridges.

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:

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 – Wterway 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

3.8 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 NDOR 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.

This is a two digit numerical code taken from an alphabetical code system to identify each county within the state. Numbers will be prefixed with zeroes where applicable. See listing in this Manual's 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.

This code shall be in accordance with the U.S. Census of Population and Housing - 1970. See listing in this Manual's 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 digits

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 Road uses this general format for structure ID numbers. One of the major problems with structure numbers has been the shifting of numbers left or right in the 15 spaces provided. Therefore, it is required that all 15 digits be filled and that there be no embedded blank spaces.

Item	Description	Length
8A	NE Bridge Owner	1 character
8B	Owner Number	4 digits
8C	Unique Identifier	5 to 6 /AN 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
C	NDOR Code for the county (this is not the same as FHWA codes for the same county). See list in Manual Appendix.
M	NDOR Code for the municipality (this is not the same as FHWA codes for the same municipality) See list in Manual Appendix.
U	NDOR 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	(note the underscore in the ID)
County Example:	C 0085 00805P	
Municipal Example:	M 2415 M2205	
Urban Municipal 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)

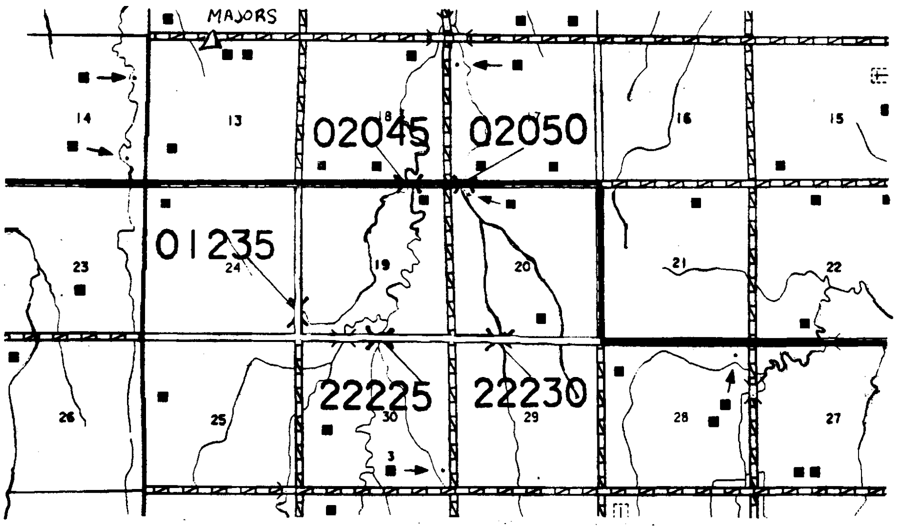
Indicate the actual length to the nearest mile of the detour length. The detour length should represent the total additional travel for a vehicle which would result from closing of the bridge. The factor to consider when determining if a bypass is available at the site is the potential for moving vehicles, 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.

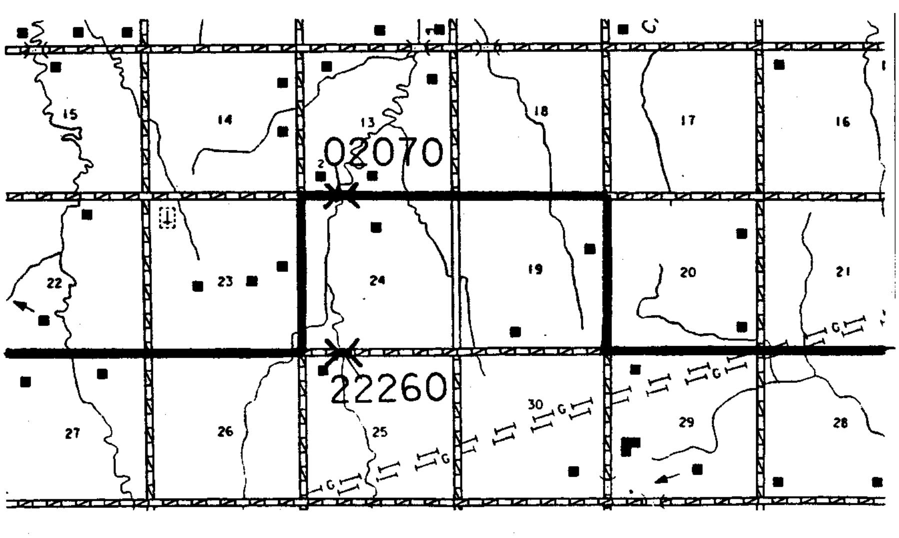
The detour route will be established following allowable criteria determined by the governing authority. (Some authorities will not allow a designated detour over a road or bridge of lesser "quality.")

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, by passable at ground level	*00*
Structure on dead end road	*99*



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.

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	• NDOR 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*
	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, NDOR 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.

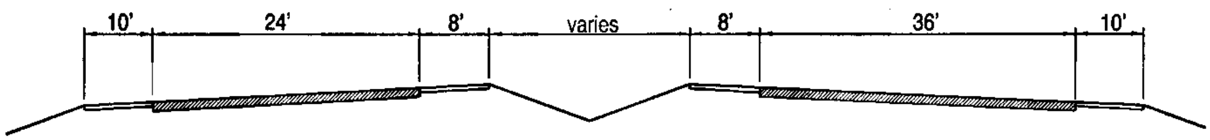
*For structures with medians of any type and double-decked structures, this item should be coded as the sum of the usable roadway widths for the approach roadways (i.e., all median widths which do not qualify as shoulders should **not** be included in this dimension).*

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:

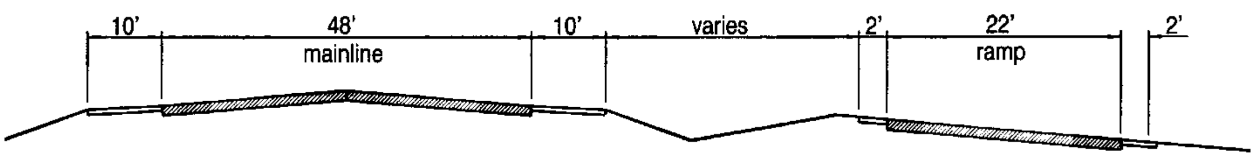
Left Shoulder	Left Roadway	Median Shoulders	Right Roadway	Right Shoulder	Code
4.0	--	--	16	6.0	026
6.0	--	--	36	12.0	054
12.0	48.0	30.0	48.0	12.0	150
10.0	24.0	16.0	36.0	10.0	096

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).



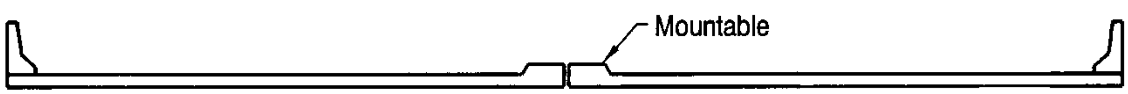
Item 33 – Bridge Median

1 digit

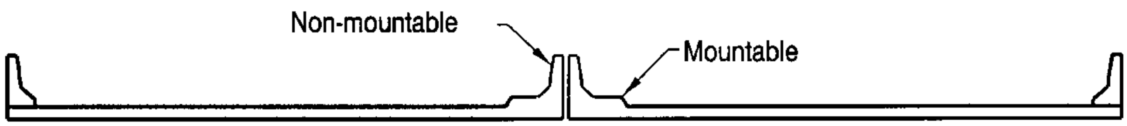
Indicate with a one digit code if the median is non-existent, open or closed. The median is closed when the area between the two roadways at the structure is bridged over and is capable of supporting traffic. All bridges that carry either one-way traffic or two-way traffic separated only by a centerline 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.

<u>Transition</u>

- 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.

<u>Height</u>

- 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' - 1 ½" or less.

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	
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 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.

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.

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.)*

For code B, this would include any bridge posted **over** the posting values shown on 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 completed any action needed to address a Critical Finding and has completed the Critical Finding Form.

Item 42 – Type of Service

1 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*

NDOR 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 NDOR 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

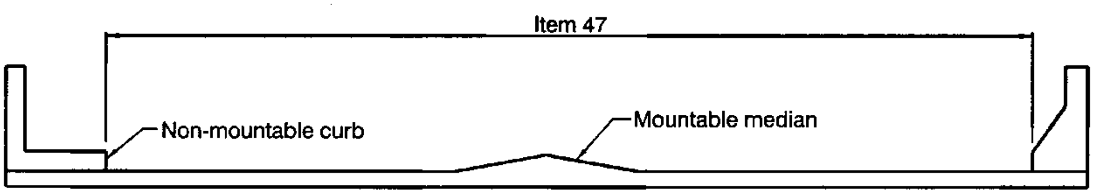
3 digits (XX.X feet)

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 foot (with an assumed decimal point). When the restriction is 100 feet or greater, code 999.

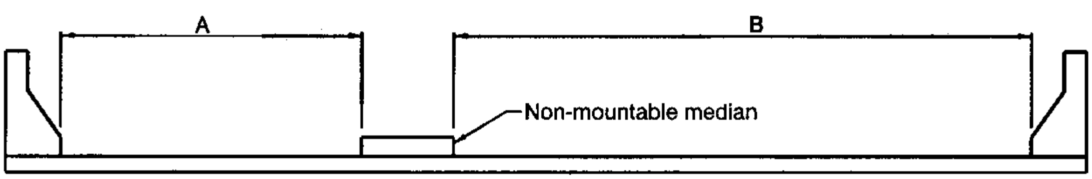
The purpose of this item is to give the largest available clearance for the movement of wide loads. Flush and mountable medians are not considered to be restrictions. This clearance has been identified in two ways; use the most applicable:

- *Clear distance between restrictions of the inventory route either "on" or "under" the structure.*
- *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

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)

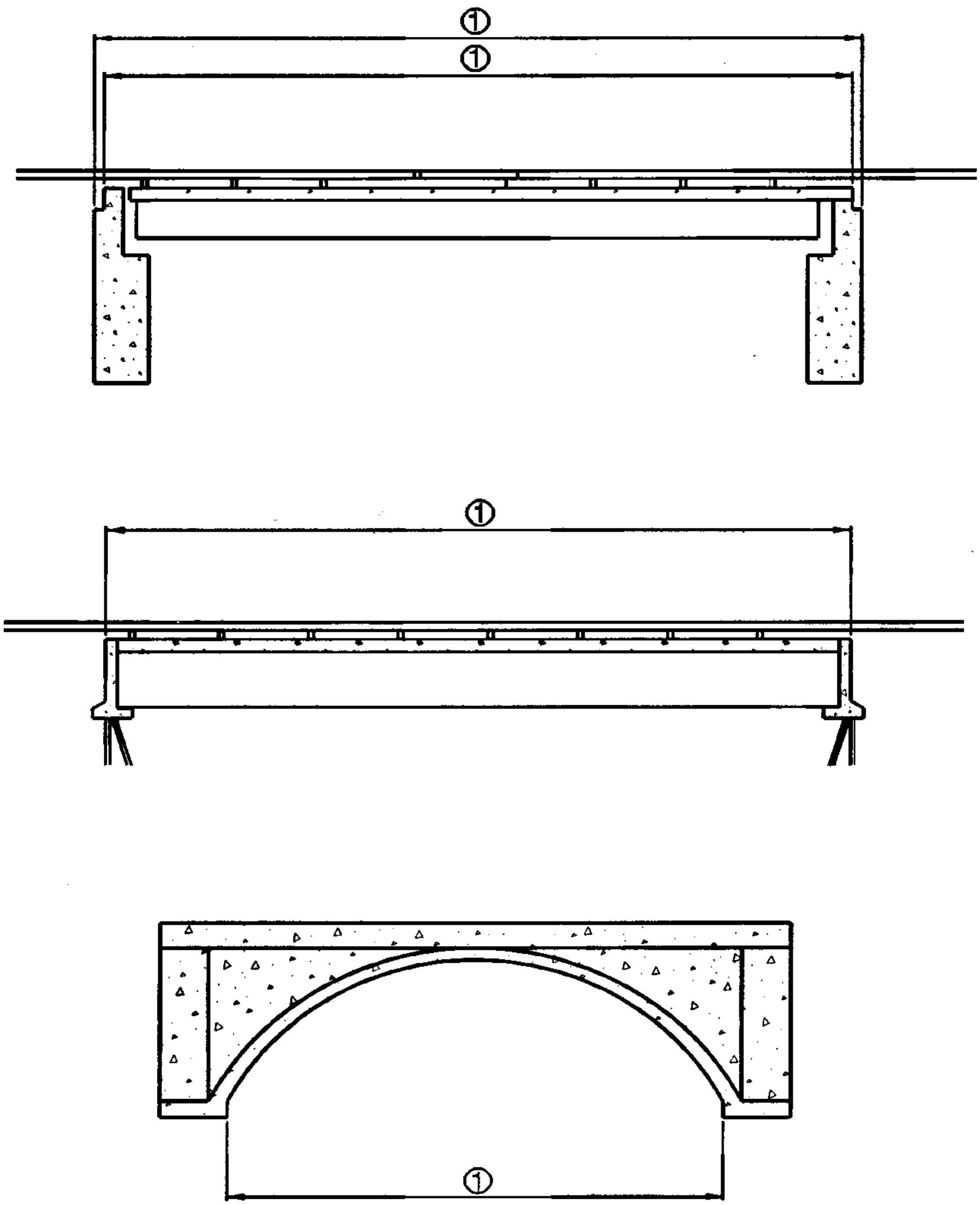
Record and code a six digit number (XXXXXX feet) to represent the length of the structure to the nearest foot. This shall be the length of roadway which is supported on the bridge structure.

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

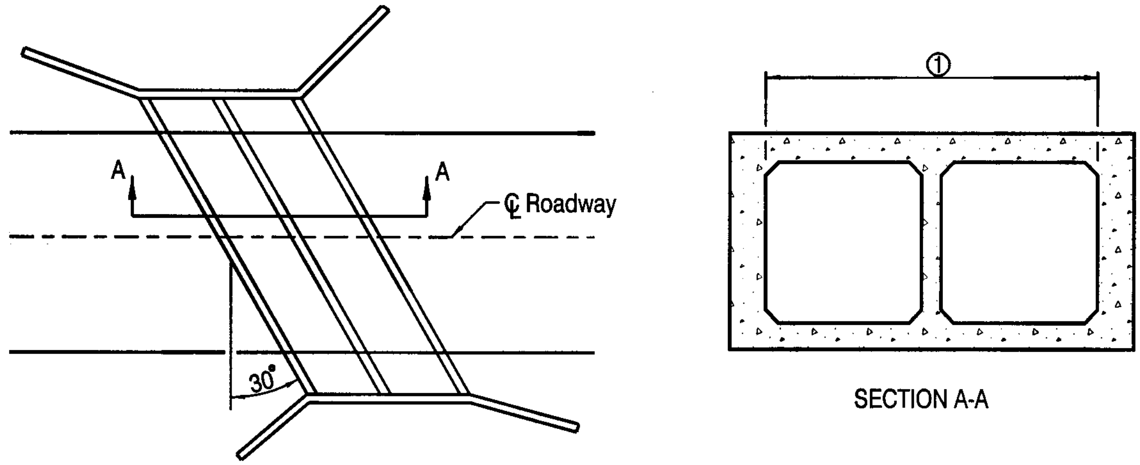
Culvert lengths should be measured along the center line of roadway regardless of their depth below grade. Measurement should be made between inside faces of exterior walls.

Examples:

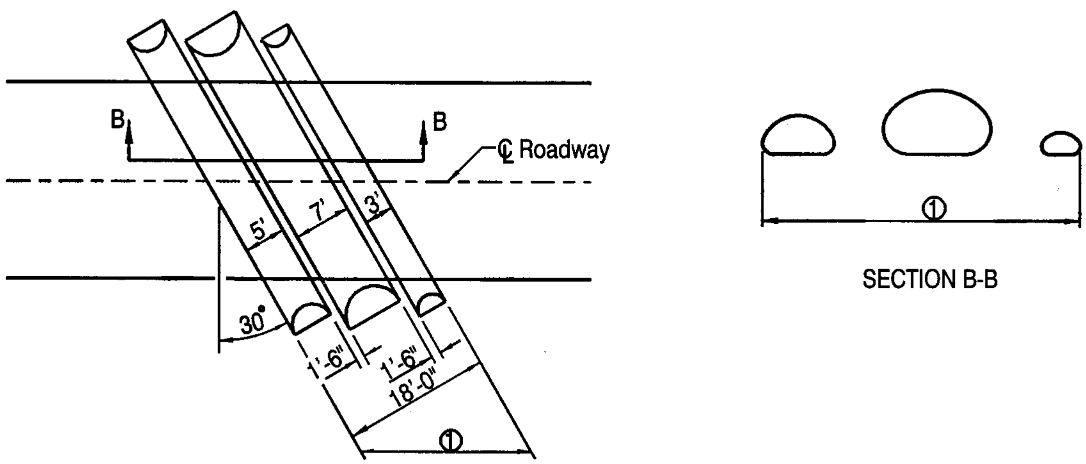
Structure Length	***Code***
50 feet	*000050*
5,421 feet	*005421*
333 feet	*000333*
101,235 feet	*101235*



① Item 49 - Structure Length



① **Item 49 – Structure Length**



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

Item 50 – Curb or Sidewalk Widths

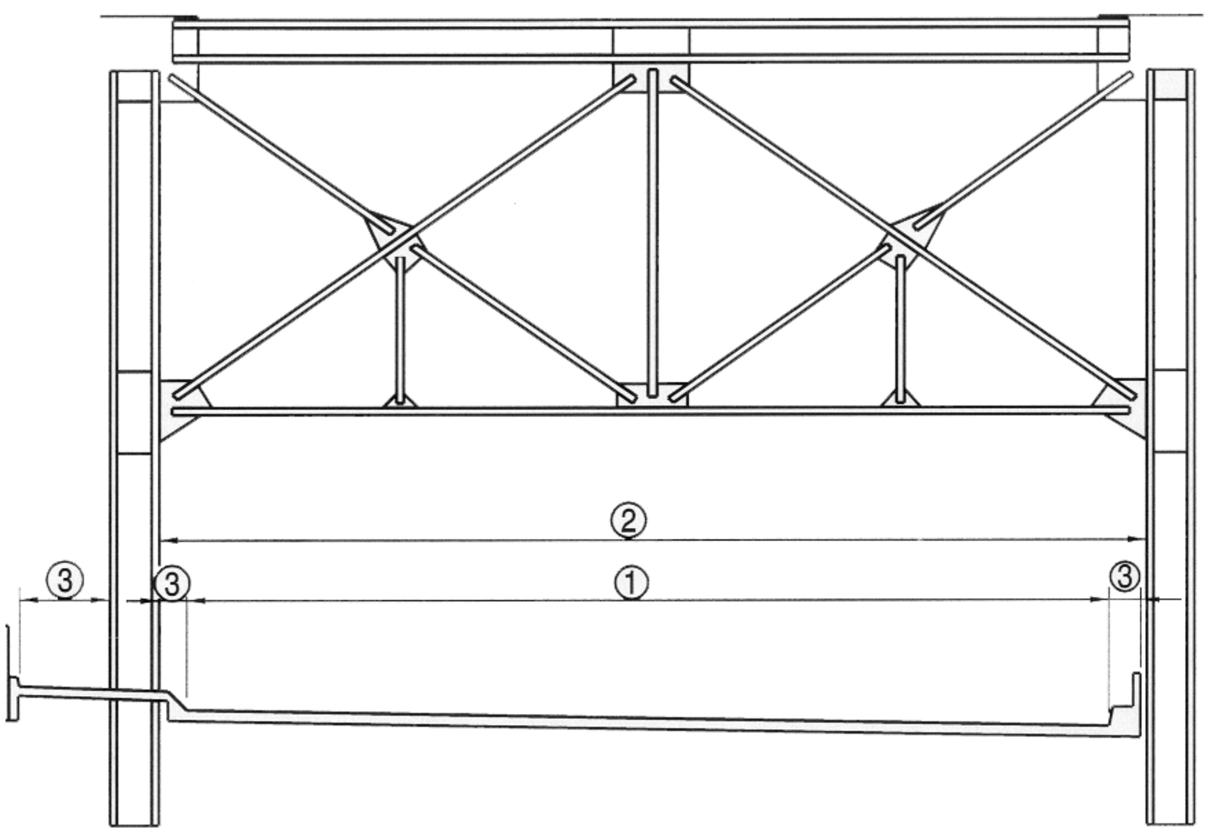
6 digits

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***
3 digits	*Left curb or sidewalk width*	
3 digits	*Right curb or sidewalk width*	

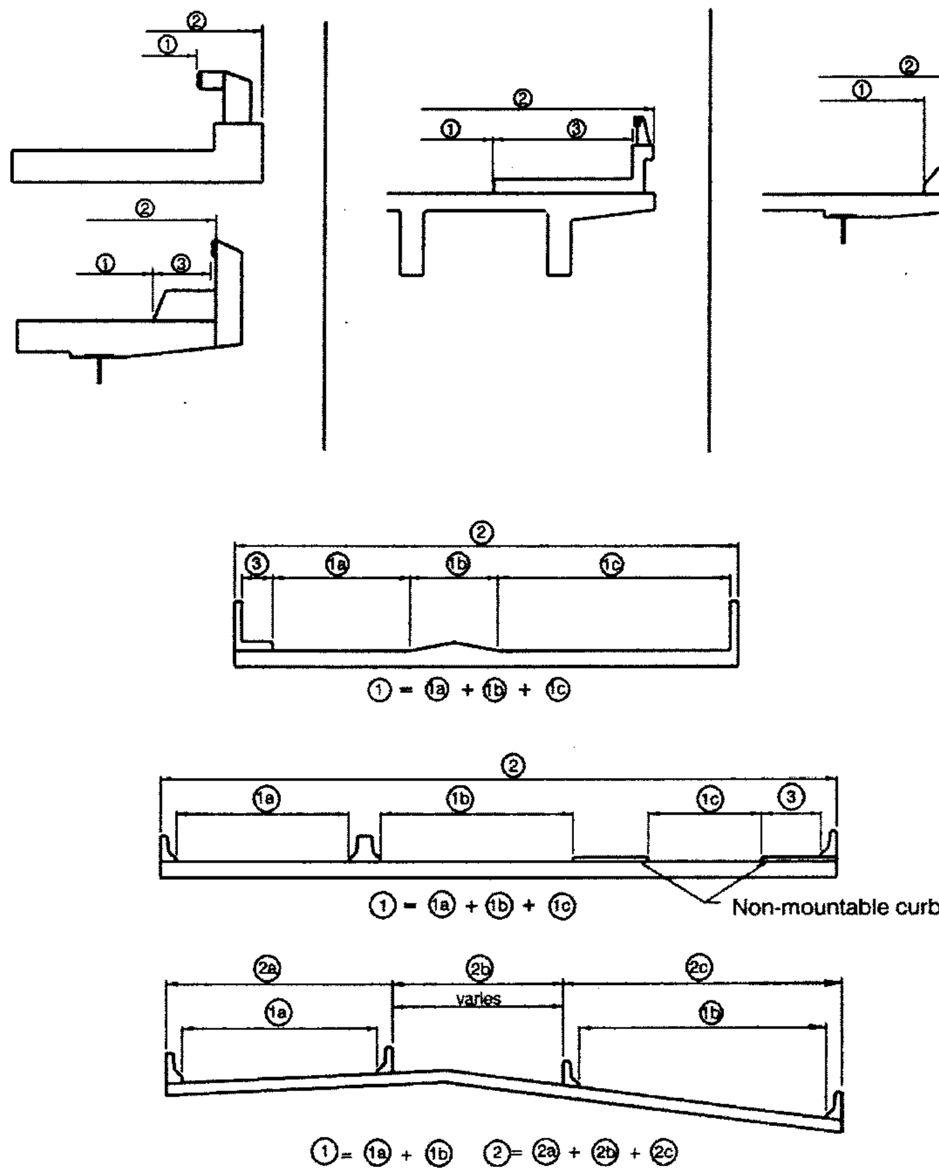
Examples:

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

Item 50 - Curb or Sidewalk Widths



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

② Item 52 - Deck Width, Out-to-Out

③ Item 53 - Curb or Sidewalk Width

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.

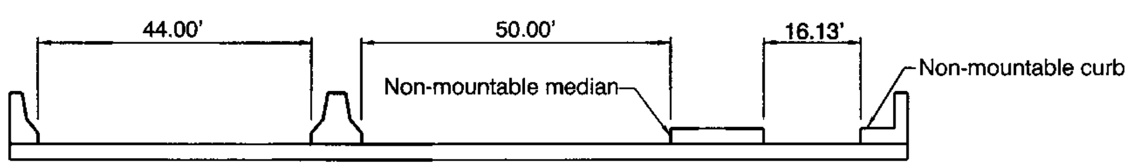
Where the roadway is on fill carried across a structure and the headwalls or parapets do not affect the flow of traffic, code 0000. This is considered proper inasmuch as a filled section simply maintains the roadway cross-section.

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 inch. When no superstructure restriction exists above the bridge roadway, code 9999. When a restriction is 100 feet or greater, code 9912. A four digit number should be coded to represent feet and inches.

Examples:

Minimum Vertical Clearance	*Code*
17'-3"	*1703*
75'-11"	*7511*
No restriction	*9999*
115'-6"	*9912*

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 remeasurement of the clearances and correction of the signs and records to reflect the change.

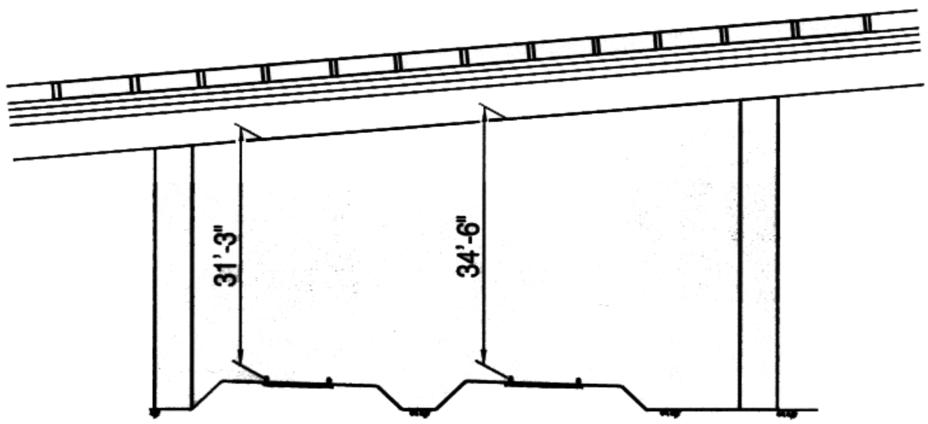
Using one of the codes below, code in the first position, the reference feature from which the clearance measurement is taken:

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

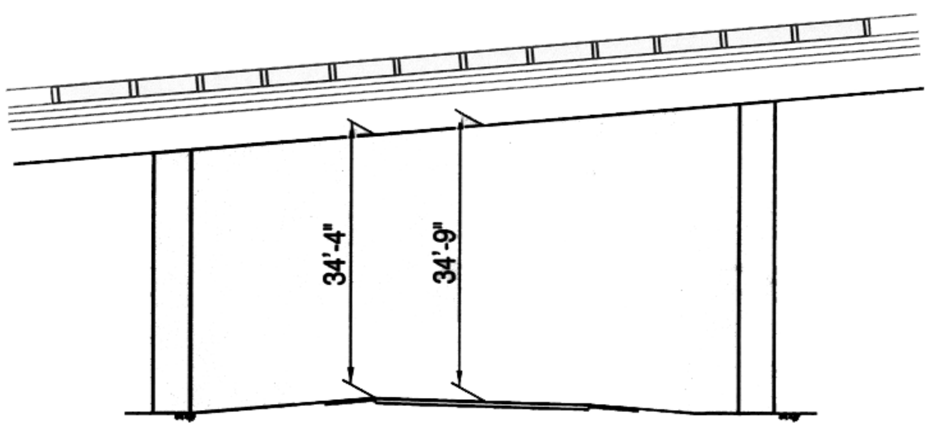
In the next four positions, code a four digit number to represent the minimum vertical clearance from that feature to the structure. If the feature is not a highway or railroad, code the minimum vertical clearance 0000.

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.*

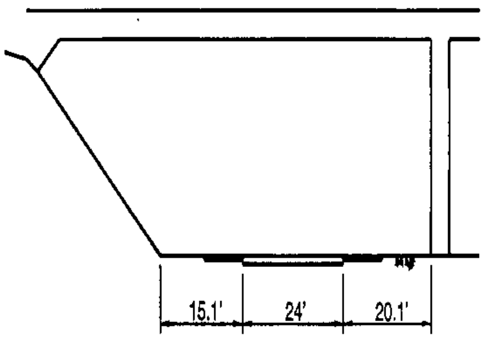
If two related features are below the bridge, measure both and record the lesser of the two. An explanation should be written as to what was recorded. If the feature beneath the structure is not a railroad or highway, code 000 to indicate not applicable.

*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.*

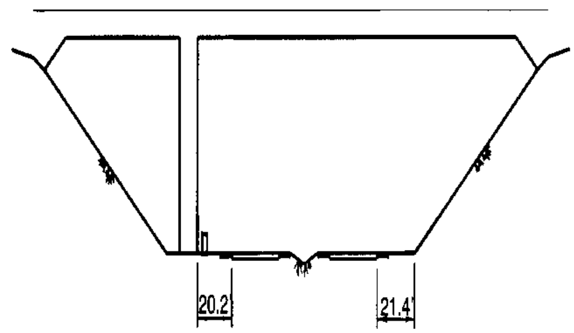
Examples:

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

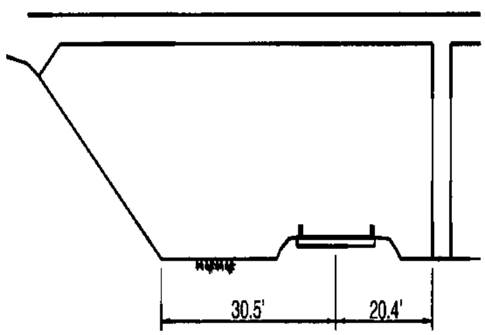
Examples: Item 55 – Minimum Lateral Underclearance on Right (cont'd)



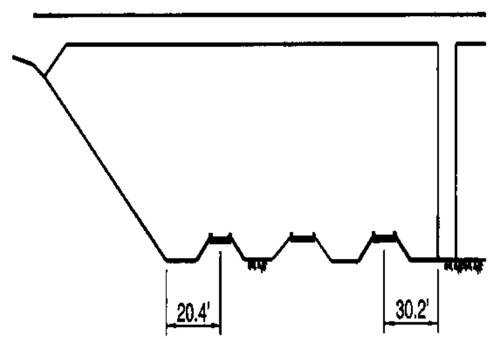
-- Lt. 15.1' Rt. for 2-way Traffic
15.1' Lt. 20.1' Rt. for 1-way Traffic



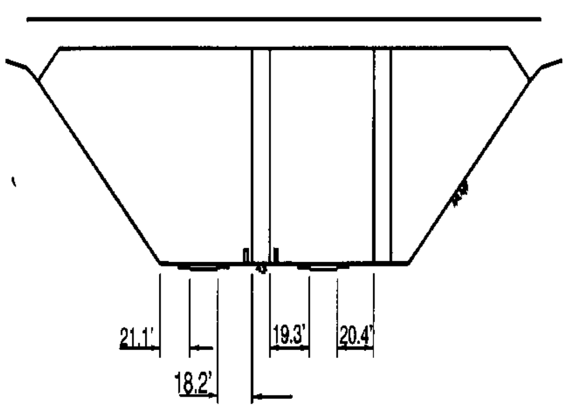
OPEN Lt. 20.2' Rt.



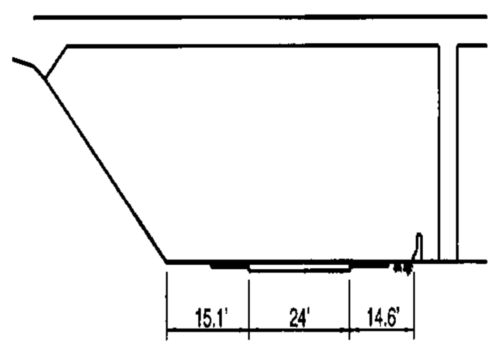
--Lt. 20.4' Rt.



-- 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)

3.9 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.*

<u>NBI Items 58, 59, 60, 61 or 62 and NE Item 320 coded 2 or Less:</u>

NDOR'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; and
Item No. 61, Channel and Channel Protection; and
Item No. 62, Culvert; and
Item No. 320 Piling.

When a condition rating is deemed to be 2 is a Critical Finding, and NDOR **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 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 asphalt or gravel overlay where the concrete deck is not visible	5 maximum
Bridges with concrete overlay where original the concrete deck is not visible	Rate as if it is a single-course integral deck
Concrete box culvert where top slab is near the travelled surface and it bears live load;	Code as for a concrete deck
Concrete box culverts where top slab is under deep fill and is not subject to direct live load	N

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.

<u>Concrete Decks</u>:

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 the Chapter on 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.

Concrete Deck		
Item 58 Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on a culvert, under deep fill
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 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. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
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.

<u>Steel Deck:</u>

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.

Steel Deck		
Item 58 Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on a culvert, under deep fill
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 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. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
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.

<u>Timber Decks:</u>

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.

Timber Plank Deck		
Item 58 Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on a culvert, under deep fill
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. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
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.

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

Item 58 - Timber Plank Deck		
Code	**Condition**	**Description**
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.

Item 58 - Timber Plank Deck		
Code	**Condition**	**Description**
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.

Item 58 - Timber Plank Deck		
Code	**Condition**	**Description**
4	POOR CONDITION (see guide photos)	• 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.

At expansion hanger devices measure across the expansion gap. 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 overheight 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 overheight 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, on a culvert, with deep fill
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 cracking
7	GOOD CONDITION	• Open cracks without disintegration • Light scaling • Visible wear in wheel lines • Ponding water • Cracks with or without efflorescence, top and/or bottom
6	SATISFACTORY CONDITION	• Area of deck spalled, 2% or less • Medium scaling • 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 • Rust stains on surface
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 • Rust stains on surface
2	CRITICAL CONDITION	• Need for repair or rehabilitation is urgent. Facility must be closed until the indicated repair is complete. • Rust stains on surface
1	IMMINENT FAILURE CONDITION	Facility is closed. Study should determine the feasibility for repair.
0	FAILED CONDITION	Facility is closed and is beyond repair.

ITEM 59 – CONCRETE GIRDER BRIDGES		
Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on a culvert, with deep fill
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 structural elements, concrete girders, trusses, etc. • Deterioration of deck girder ends, slab ends, precast ends, etc.
4	POOR CONDITION	• Critical collision damage sustained to structural elements. 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.

ITEM 59 – STEEL		
Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on 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. • Bent steel or slight misalignment, not requiring repairs.
7	GOOD CONDITION	• Heavy 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. • Deterioration of deck girder ends, slab ends, precast ends, 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. • Substantial disintegration of deck girder, slab, precast units, etc. • 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 may have to 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.

ITEM 59 – TIMBER		
Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on 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 • 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.

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 NDOR'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.

<u>Piers and Abutments</u>

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.

<u>Bents</u>

Bents are substructures where the bearing pile 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 areas.
- 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 will 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 pile 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 Pontis comment field.

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

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

<u>Underwater Inspection</u>

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

ITEM 60 – CONCRETE		
Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on 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 or on steel).
8	VERY GOOD CONDITION	Near new condition.
7	GOOD CONDITION	• Small (less than 1/16-inch) 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	• Open cracks 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.) • Moderate scouring, no action needed.
5	FAIR CONDITION	• Leaching through abutment backwall. Concrete beginning to spall. Abutments leaning in because of settlement or earth load. • Spalls around bearing devices, concrete deteriorating, bearing affected. • Pile collective area loss on a substructure, 10% to 19% • Extensive scouring and undermining of footings. Bearings might be affected.
4	POOR CONDITION	• Major spalling around bearing devices • Concrete deteriorating bearing affected • Need for repairs is urgent • Pile collective area loss on a substructure, 20% to 29% • Extensive scouring and undermining of footings affecting stability. Rehabilitation urgently needed.
3	SERIOUS CONDITION	• Wings separated from abutment. • Dirt spilling through back wall. • Girder seats breaking up. • Shoring recommended. • Pile collective area loss on a substructure, 30% to 49% • Two adjacent pile (next to each other in one bent or one abutment) have section loss • End pile under pile cap has section loss • Footings undermined. • Rehabilitation is urgent.

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. • Traffic restrictions should be considered. • Pile collective area loss on a substructure, 50% or more • Footings undermined. • 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.

ITEM 60 – STEEL		
Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on 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 or on steel).
8	VERY GOOD CONDITION	Near new condition.
7	GOOD CONDITION	• Minor rusting of steel pile
6	SATISFACTORY CONDITION	• Rusting of steel pile • Pile collective section area loss on a substructure, less than 10%
5	FAIR CONDITION	• Pier columns show section loss • Pile collective section area loss on a substructure, 10% to 19%
4	POOR CONDITION	• Need for repairs is urgent • Pile collective section area loss on a substructure, 20% to 29% • Extensive scouring and undermining of footings affecting stability. Rehabilitation urgently needed.
3	SERIOUS CONDITION	• Wings separated from abutment. • Dirt spilling through back wall. • Girder seats breaking up. • Shoring recommended. • Pile collective section area loss on a substructure, 30% to 49% • Two adjacent pile have section area loss • End pile under pile cap has section area loss • Footings undermined. • Rehabilitation is urgent.
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. • Traffic restrictions should be considered. • Pile collective section area loss on a substructure, 50% or more • Footings undermined. • 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.

ITEM 60 – TIMBER		
Code	**Condition**	**Description**
N	NOT APPLICABLE	for example, on 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 or on steel)
8	VERY GOOD CONDITION	Near new condition
7	GOOD CONDITION	• Insignificant decay, cracking, spitting or crushing of timber
6	SATISFACTORY CONDITION	• Timber 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 a substructure, less than 10%
5	FAIR CONDITION	• Substantial decay, cracking, spitting or crushing of timber members requiring some replacement. • Pile collective section area loss on a substructure, 10% to 19%
4	POOR CONDITION	• Need for repairs is urgent • Pile collective section area loss on a substructure, 20% to 29% • Extensive scouring and undermining of footings affecting stability. Rehabilitation urgently needed.
3	SERIOUS CONDITION	• Wings separated from abutment. • Dirt spilling through back wall • Girder seats breaking up • Shoring recommended • Pile collective section area loss on a substructure, 30% to 49% • Two adjacent pile have section area loss • End pile under pile cap has section area loss • Footings undermined • Rehabilitation is urgent
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 • Traffic restrictions should be considered. • Pile collective section area loss on a substructure, 50% or more • Footings undermined • 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.

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 inspection 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:

ITEM 61 – CHANNEL AND CHANNEL PROTECTION	
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.*
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.*
5	*Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.*
4	*Bank and embankment protection is severely undermined. River control devices have severe damage. Large deposits of debris are in the waterway.*
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.*

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. Corrective action required to maintain traffic. Metal culverts have extreme distortion and deflection throughout with extensive perforations and deflection throughout with extensive perforations due to corrosion.*
1	*Bridge closed. Corrective action may put back in light service.*
0	*Bridge closed. Replacement necessary.*

Item 63 – Method Used to Determine Operating Rating

1 digit

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

NDOR beginning in 2012 will report to FHWA load ratings by rating factor only. 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
- 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.

The FHWA June 28, 2000 Policy Memorandum required that all new bridge be designed by the LRFD Specifications after October 1, 2007. Load ratings for bridges designed by LRFD, are governed by the FHWA October 30, 2006 Memorandum and summarized in the following table. FHWA supports LRFR moving forward, but continues to accept 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

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*

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 Pontis by the Program Manager Staff.

NDOR beginning in 2012 will report to FHWA load ratings by rating factor only. 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.*	

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 Pontis by the Program Manager Staff.

NDOR beginning in 2012 will report to FHWA load ratings by rating factor only. 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.

3.10 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	*>236* (HS20)***	*>236 (HS20)*	*>236 (HS20)*
8	*236 (HS20)*	*236 (HS20)*	*236 (HS20)*
7	*231 (HS17)*	*231 (HS17)*	*231 (HS17)*
6	*223 (HS13)*	*225 (HS14)*	*227 (HS15)*
5	*218 (HS10)*	*220 (HS11)*	*222 (HS12)*
4	*212 (HS7)*	*214 (HS8)*	*218 (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								
TABLE 2A							*TABLE 2B*	
Deck Geometry Rating Code	*Bridge Roadway Width 2 Lanes; 2 Way Traffic*						*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				
Under-clearance Rating Code	*Functional Class*			*Railroad*
	Interstate and Other Freeway	*Other Principal and Minor Arterials*	*Major and Minor Collectors and Locals*	
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 Pontis 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:

- Type 3 straight truck- gross weight 25 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 NDOR Load Rating policy.

If any load ratings for any of the three rating trucks are **less than** the gross weight of the rating trucks, the bridge must be posted for the rating of that particular truck type. **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 any load ratings for any of the three rating trucks are **higher than** the gross weight of the rating trucks, 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 trucks 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.

3.11 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.

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	371

Type of Work Description	***Item 75 Code***
feet, which is the maximum that can be done without adding another line of stringers or girders to the superstructure.	
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:

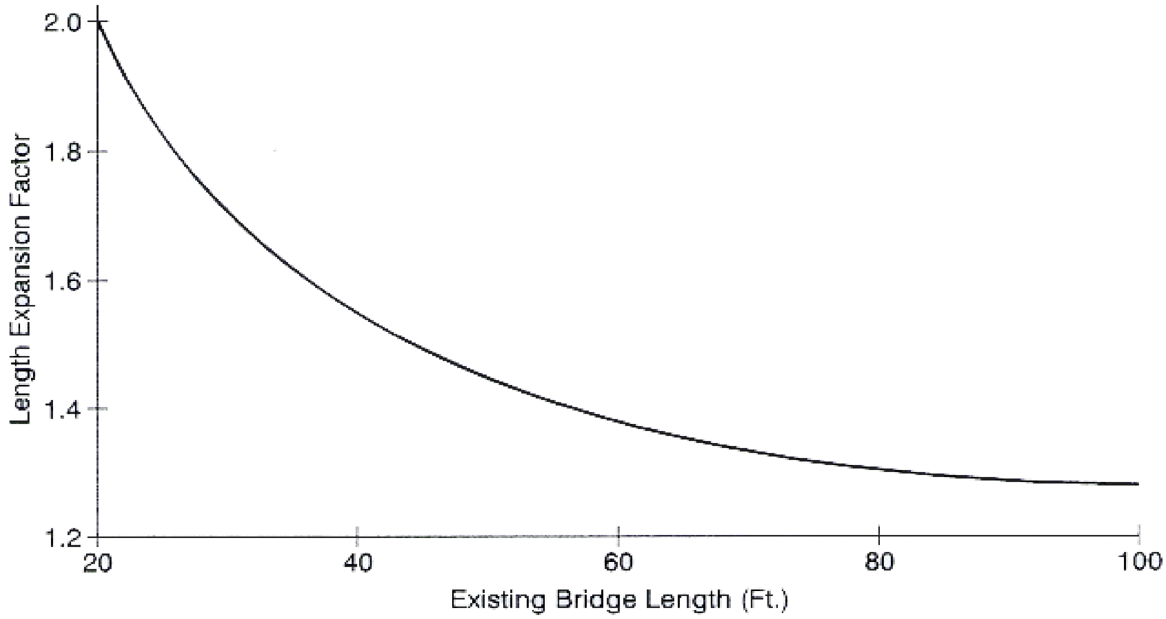
Length of Structure Improvement	***Code***
250 feet	*000250*
1,200 feet	*001200*
12,345 feet	*012345*

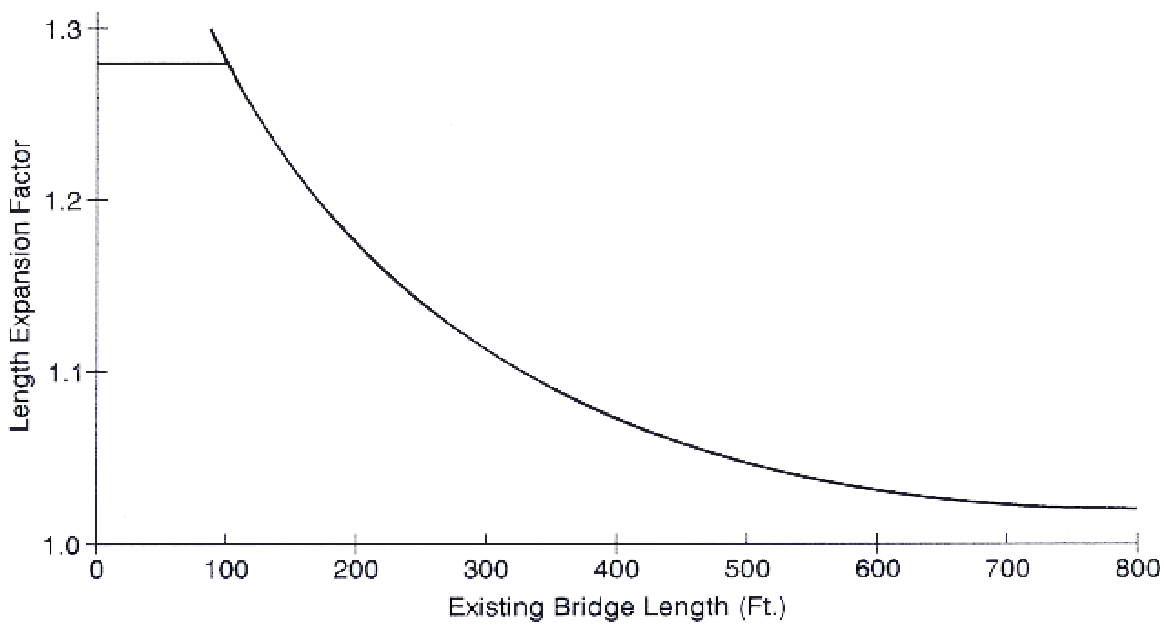
For substructure or channel work only, code the length of superstructure over, or supported by, the substructure or channel.

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

6 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*

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.*

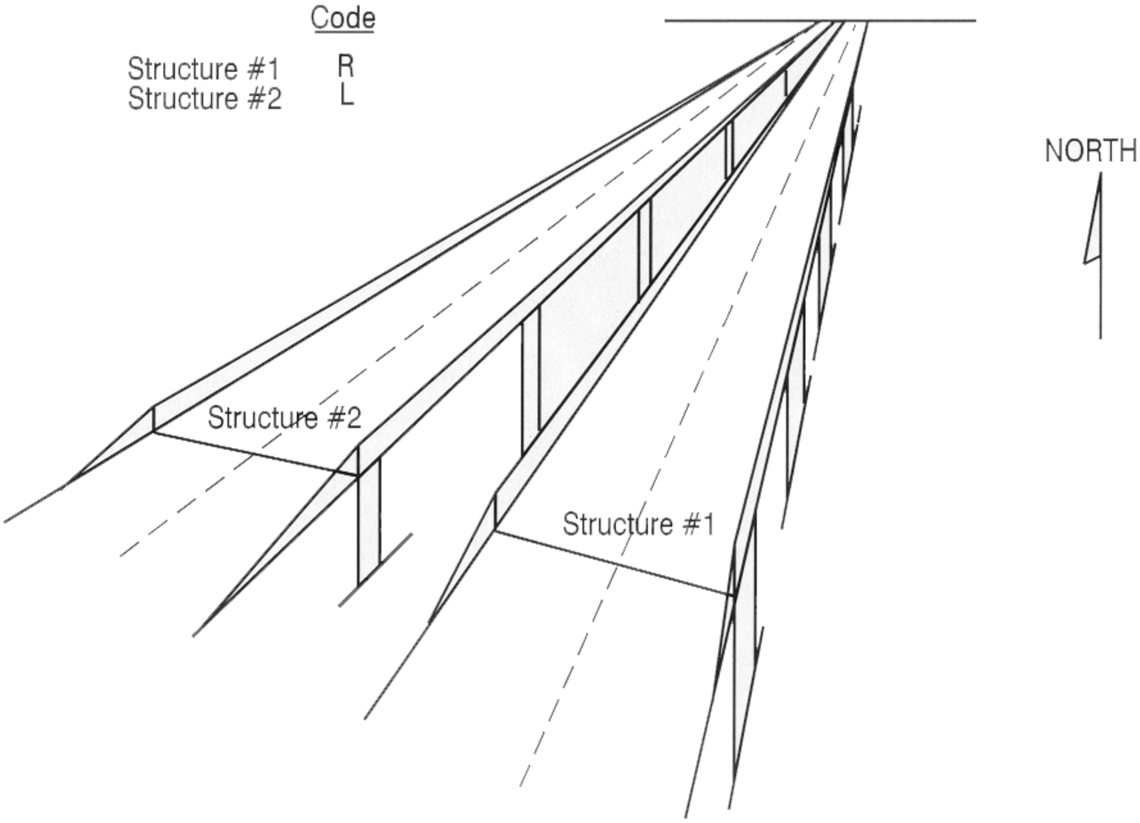
Item 101 – Parallel Structure Designation

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.)*

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*

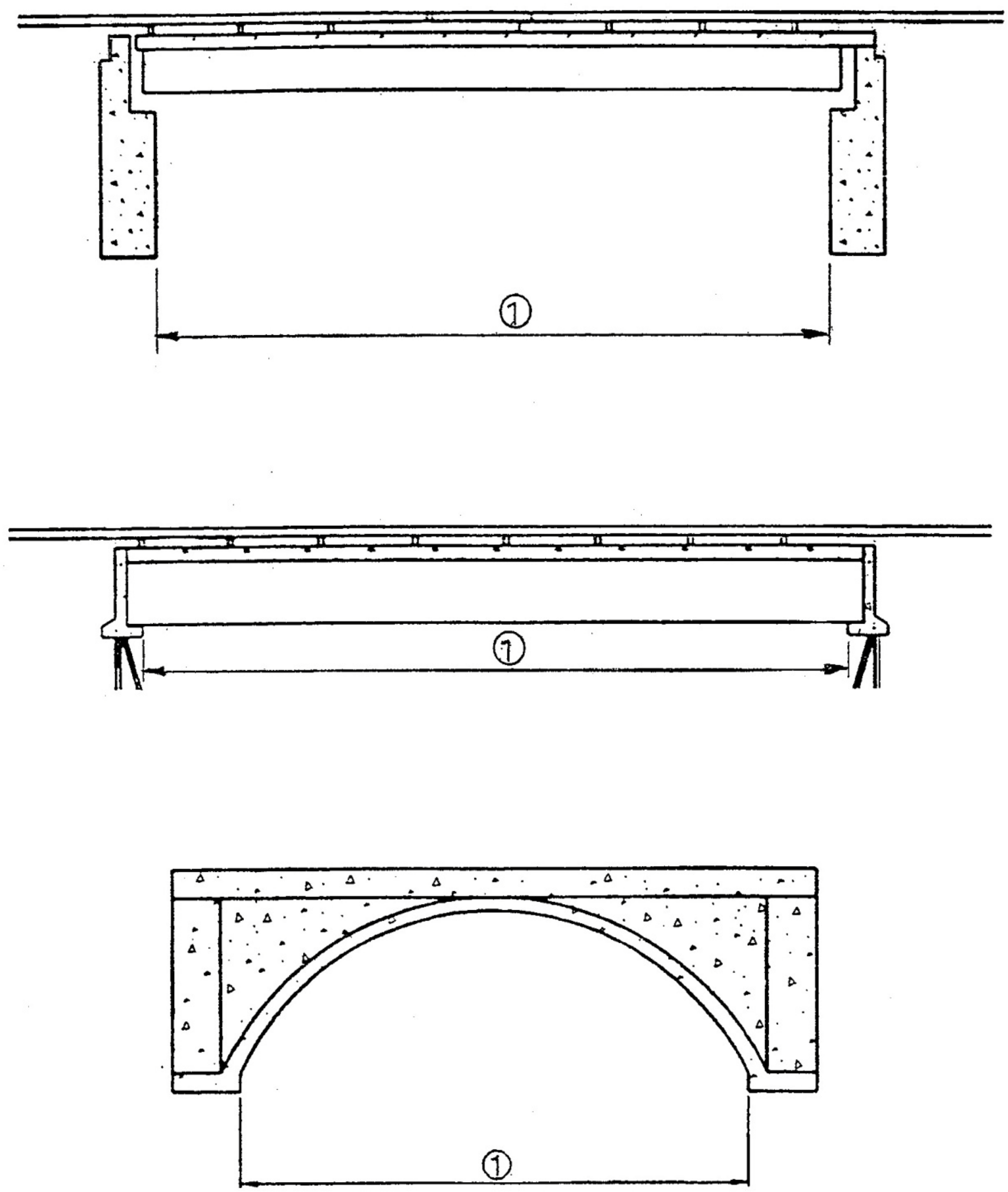
Item 112 – NBIS Bridge Length

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 by AASHTO and is 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 half of the smaller contiguous opening.

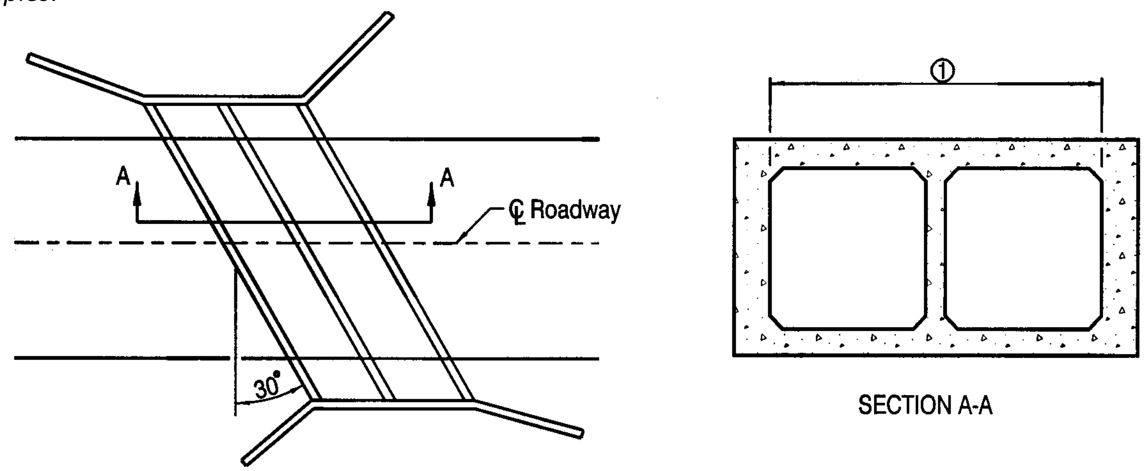
Code	***Description***
Y	*Yes*
N	*No*
R	Removed



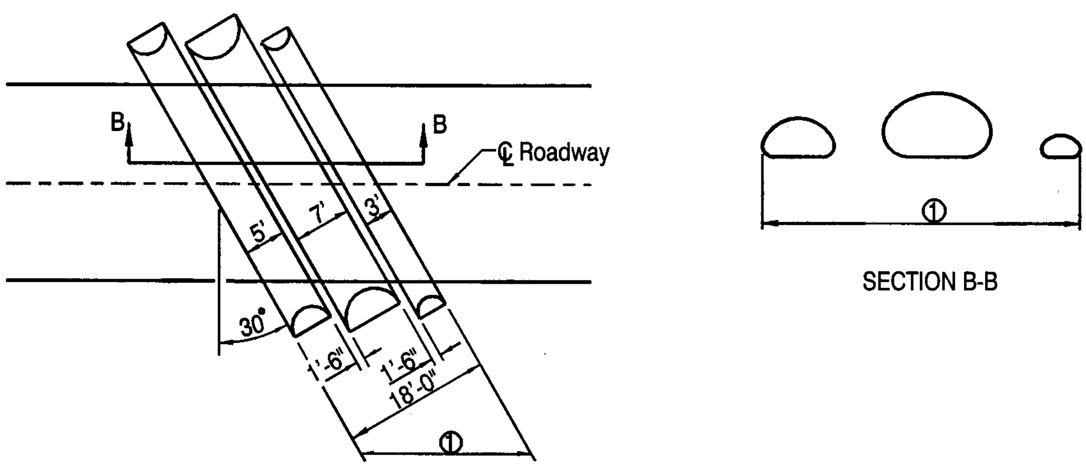
1 Item 112 – Bridge Length

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.

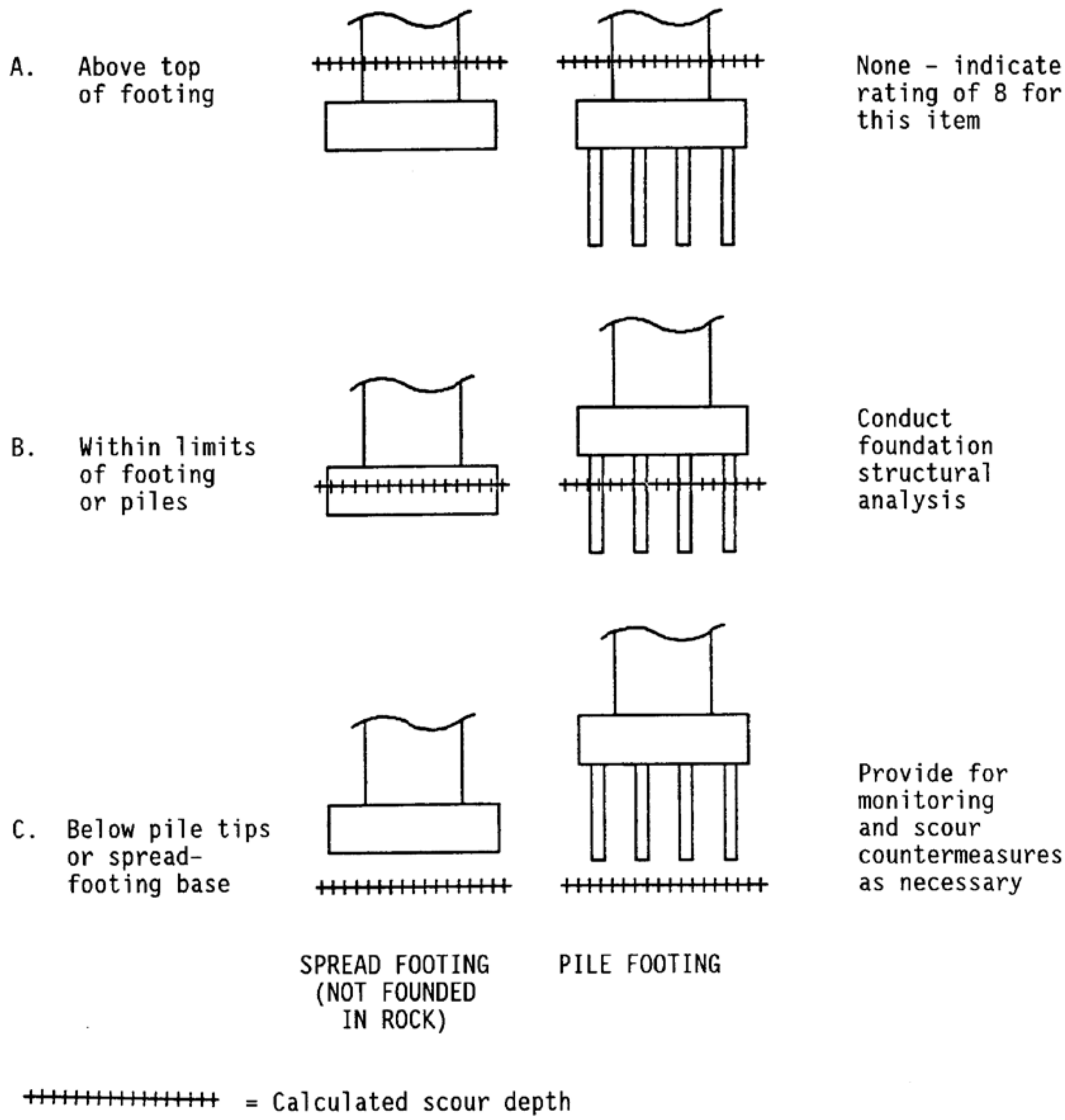
A plan of action should be developed for each scour critical bridge (see FHWA Technical Advisory T 5140.23, HEC 18 and HEC 23).

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 a routine inspection of a scour critical bridge does **not** assign a code for Item 113; however, they will assign 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 2 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.*
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*

3.12 NEBRASKA 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/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

30 digits

This item is determined by the Inspection Team Leader during routine inspection and entered into Pontis. 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 their proper place.

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 for this item as weight limits.

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.

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.

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

3.13 NEBRASKA DATA ITEMS – BRIDGE DECK AND APPROACHES

Item 301 – Percent of Defective Deck

2 digits

Code = 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 deck 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 deck 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

3.14 NEBRASKA 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. Inspectors should review the BIRM for complete descriptions of bearing types.

Code this item using the FHWA Condition Ratings codes and record the overall condition. 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.

3.15 NEBRASKA DATA ITEMS – SUBSTRUCTURE

Item 316 – Condition of Abutments

1 digit

Code this item using the FHWA Condition Ratings codes with NDOR 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 NDOR 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 NDOR 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 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.

3.16 NEBRASKA DATA ITEMS – CULVERT ITEMS

Inspectors should also review guidance in Chapter 6 Scour. If there are further questions, consultant the Owner's Hydraulic Engineer.

Item 323 – Culvert Barrel

1 digit

Code this item using the FHWA Condition Ratings codes and Item 62 coding descriptions for hydraulic obervations.

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 hydraulic observations.

Item 325 – Debris at Inlet

1 digit

Code this item using the FHWA Condition Ratings codes and Item 61 coding descriptions for hydraulic observations.

Item 326 – Embankment Erosion

1 digit

Code this item using the FHWA Condition Ratings codes and Item 61 coding descriptions for hydraulic observations.

Item 327 – Alignment with Structure

1 digit

Code this item using the FHWA Condition Ratings codes and Item 355. Inspectors should also review guidance in Chapter 6 Scour.

Item 328 – Flowline Drop at Culvert Inlet

2 digits

Record the depth of drop in feet, right justified.

Item 329 – Flowline Drop at Culvert Outlet

2 digits

Record the depth of drop in feet, right justified.

Item 330 – Silt in Barrel

2 digits

Record the average depth of silt in feet, right justified.

Item 335 – Inspectors Opinion on Culvert Adequacy

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.

Item 359 – Size of Culvert and Other Data

6/AN characters

This is a six-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.
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.

3.17 NEBRASKA DATA ITEMS – MISCELLANEOUS ITEMS

Item 342 – Total Number of Pins

2 digits

Record the total number of pins with movement in both expansion and fixed devices.

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.

3.18 NEBRASKA DATA ITEMS – SCOUR RELATED

The following list is a summary of items related to bridge scour. These are not to be used for culvert bridges. See the detailed description for each item.

Item No.	Description	Code
344	Abutment Walls Undermined	Y, N
344A	Approach Settles/Washes Out	Y, N
345	Bridge 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
355	Bridge 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 wing walls.
Code = N if there are no clues present.

Code	Description
Y	The bottom of the abutment wall is exposed.

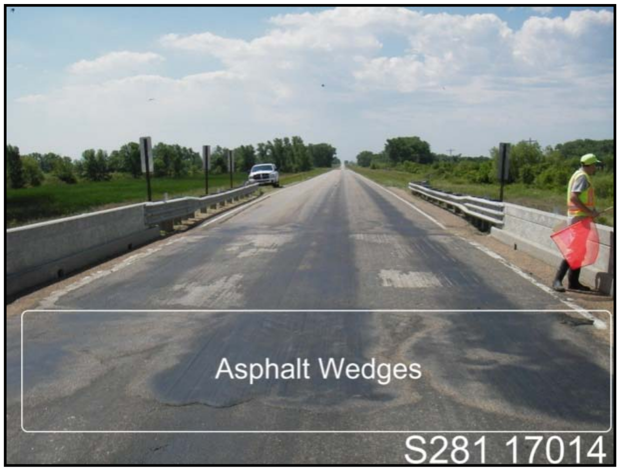
Code	Description
N	The bottom of the abutment is **not** exposed.

Item 344A – Approach Settles/Washes out

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.

Code	Description
Y	The approach is settled or asphalt wedge indicates past settlement and/or there is evidence the abutment wall has washed out from a past flood.



Item 345 – Bridge 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.

Code	Description
Y	The bridge is over a canal.

Code	Description
N	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. Stream degradation is common on streams where the channel has been straightened.
Code = Y if stream bed degradation is noticeable.
Code = N if there are no clues present.

Code	Description
Y	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.


S065 00477


S275 08860

Code	Description
N	The channel has not degraded. Typically natural channels only have the capacity for a 2 year flood.


S092 36868

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

Code	Description
Y	The bridge is shorter than the top of channel. **Note:** No berms at abutments.
	

Code	Description
NO	The 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.

Code	Description	Code	Description
A	Berm scour is evident at an abutment.	B	Scour holes are evident at the bents/piers.

Code	Description	Code	Description
C	Scour is evident at an abutment and bent/pier.	N	No evidence of Scour. **Note:** Channel degradation is not considered Local/Contraction Scour.

Item 349 – Banks Eroding/Unstable

1 character

Code = Y if the banks are eroding or unstable.
Code = N if banks are stable and vegetated.

Code	Description
Y	The channel's bank is eroding and unstable.

Code	Description
N	The channel's bank is stable and vegetated.

Item 350 – Stream Shifted from Bridge 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.

Code	Description
Y	There is a significant shift of the channel from the bridge center.

Code	Description
N	The channel is aligned with the center of the bridge.

Item 351 – Floodwater Reaches Low Superstructure

1 character

Code = Y if there is evidence of floodwater reaching superstructure.
Code = N if no evidence flood water reaching superstructure.

Code	Description
Y	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.

Code	Description
N	No evidence floodwater reaches low superstructure.

Item 351A – Low Road Elevation Above Low Superstructure

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.

Code	Description
Y	Low Road (within floodplain) is at a higher elevation than the low superstructure. Indicating floodwater can reach the superstructure should road overflow occur.
	

Code	Description
N	Low Road sag elevation is below the low superstructure elevation.
	

Item 352 – Floodwater Over Bridge Deck or Roadway

Code = Y evidence of flood water over road.
Code = N no evidence of flood water over road.

Code	Description
Y	Floodwater can go over the roadway at any location.

Code	Description
N	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 debris in the upstream channel.
Code = N no evidence of significant debris upstream

Code	Description
Y	Upstream view indicates significant debris in and along channel bank can wash down during a flood and restricting flow through the bridge opening.

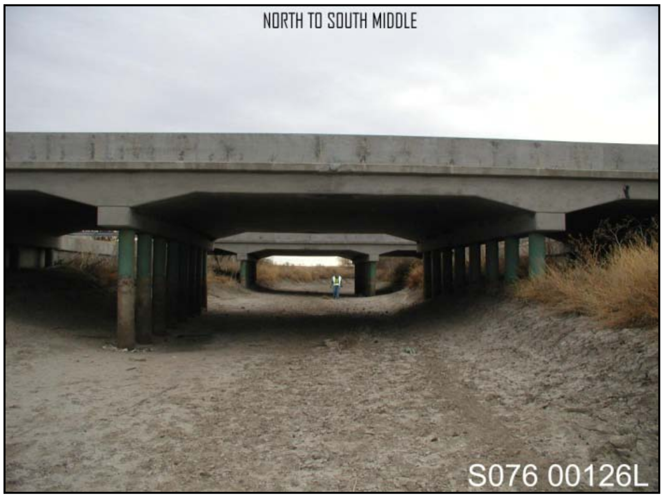
Code	Description
N	Upstream view indicates minimal amounts of debris along channel bank and restricting flow through the bridge opening is unlikely.

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.

Code	Description
Y	Bents/piers are located within the channel banks.



Code	Description
N	Bents/piers are not located within the channel banks

Item 355 – Bridge Alignment with Flow

1/AN character

Observe and record the direction of the approaching stream flow relative to the substructure of the bridge. Flow parallel to the substructure and 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 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	

Code	Description
4	Direction of approaching stream flow relative to the piers of the bridge is approximately 30°.

Item 356 – Debris Blocking Channel at Bridge

1/AN character

Code = Y if a significant amount of debris is lodged against structure.
Code = N if no significant debris lodged against structure.

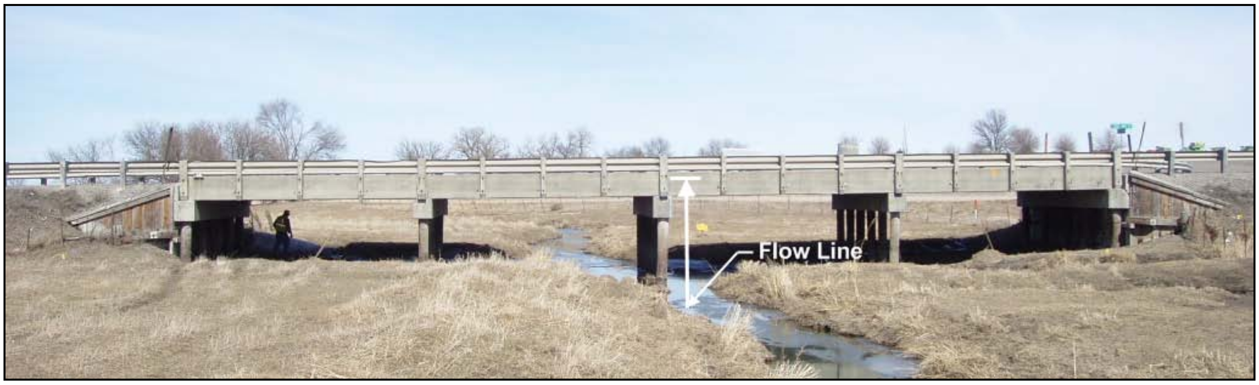
Code	Description
Y	Significant amount of debris is lodge under bridge.

Code	Description
N	No Significant debris is lodged under bridge.

Item 357 – Drop from Upstream Deck to Flowline

2 digits

Record the distance (in feet) from the upstream top of deck to the flow line (ground line).



Item 357A – Drop from Upstream Deck to Ground at Abutment No. 1

2 digits

Record the distance (in feet) from the upstream top of deck to the ground line Abutment No. 1.

Item 357B – Drop from Upstream Deck to Ground at Abutment No. 2

2 digits

Record the distance (in feet) from the upstream top of deck to ground line Abutment No. 2.

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?

Code	Description
Y	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.
 	

Code	Description
N	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.
No Picture Shown.	

Item 358A – Significant Flood in the Last Two Years

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

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

Code	Description
Y	When there is evidence bridge water way area has scoured, from a flood, within the last two years. Compare with photos from previous inspection.

Before	After
	

Code	Description
N	The water way area has not changed within the last two years. Compare with photos from previous inspection.
No Picture Shown	

Item 358C – Scour Plan of Action Effective Date

Record the effective date of the most current Scour Plan of Action. The format is mm/dd/yyyy.

3.19 NEBRASKA 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

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.

3.20 NEBRASKA DATA ITEMS – MAINTENANCE

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.

3.21 NEBRASKA DATA ITEMS – LOAD RATING

Item 380 – Percent of Stress Reduction

2 digits

This item is shown in this section only to inform Manual users that this item is no longer used in the Nebraska Bridge Inventory. This item is not used. 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 Pontis 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	NDOR Timber Program	Working Stress
11	NDOR 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	NDOR internal use only	Assigned Rating
37	na	NDOR Policy
38	na	Engineering Judgment
99		

Item 384 – HS Inventory Rating

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 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 Truck

6 digits

This is determined by the Load Rating Engineer and provided on the Load Rating Summary Sheet, then entered in Pontis 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. These are the load posting values calculated by the LRE and shall be used to for proper posting in the field. 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	Calculated tonnage for Type 3 truck
386B	Type 3S2	37 Tons	2 digits	Calculated tonnage for Type 3S2 truck
386C	Type 3-3	43 Tons	2 digits	Calculated tonnage for Type 3-3 truck

Item LOD_RAT_D – Load Rating Date

6 AN characters

This date is gathered by BIP Program Staff from the Load Rating Summary Sheet.

Item LOD_RAT_N – Load Rating Engineer ID

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. This data is gathered by BIP Program Staff from the Load Rating Summary sheet.

3.22 NEBRASKA 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 consist of the person’s initials from their first and last names followed by the last four digits of their Social Security Number.

3.23 QUALITY CONTROL

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the bridge inventory data 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. An individual of equal or higher qualifications than the originator of the product shall complete Quality Control review on the work product. QC manager/engineer shall:

- See that the QC on a given document, data or calculations is completed by an individual of equivalent or better qualifications than the originator.
- See that the technical activity has followed procedures set by NDOR;
- Provide routine and consistent checks for data integrity, correctness and completeness;
- Identify and address errors and/or omission;
- Record the QC activities.

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.

NDOR completes QC on data that has been entered into the PONTIS database on a continual basis.

3.24 QUALITY ASSURANCE

Quality Assurance (QA) of all load rating data in the Bridge Inventory will be performed by NDOR or their selected agent. The QA program activities are described in Chapter 1 of this Manual.

3.25 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1

3.26 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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm for the current list of applicable forms and the most recent versions of each form.

Name	DR Form	Revision Date
Structural Inventory and Appraisal	na	na

3.27 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 NDOR Bridge Inspection Program website athttp://www.nebraskatransportation.org/design/bridge/bipm.htm. Participants are urged to check this site to ensure they have all the most current information and forms.

4.1 GENERAL

The purpose of this chapter of the NDOR 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 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 the information in these references.

- AASHTO. *Manual for Bridge Evaluation*. First Edition, 2008. (MBE)
- FHWA. *Bridge Load Ratings for the National Bridge Inventory.* Memorandum HIBT-30. October 30, 2006
- FHWA. *Technical Advisory T5140.23, Evaluating Scour at Bridges*. October 28, 1991.
- FHWA. *Bridge Inspector's Reference Manual*. NH103-001, Vols. 1 and 2. October 2002; Revised 2006 (BIRM).
- 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.
- FHWA. *Evaluating Scour at Bridges*. Hydraulic Engineering Circular, No. 18 (HEC 18), 4th Edition. Publication No. FHWA-NHI-01-001. May 2001 with Errata, September 6, 2001.
- FHWA. *Bridge Scour and Stream Instability Countermeasures, Experience, Selection and Design Guidance Second Edition*. Hydraulic Engineering Circular, No. 23 (HEC 23). Publication No. FHWA-NHI-01-003. 2001, with Errata September 6, 2001.
- FHWA. *Revision of Coding Guide, Item 113 – Scour Critical Bridges*. Memorandum HIBT-30. April 27, 2001.
- FHWA. *Compliance with the National Bridge Inspection Standards – Plan of Action for Scour Critical Bridges*. Memorandum HIBT-20. March 29, 2005.
- FHWA. *Scourability of Rock Formations*. Memorandum HNG-31. July 19, 1991.
- NCHRP. *Synthesis 354: Inspection and Management of Bridges with Fracture-Critical Details*. 2005.

The MBE supersedes 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 the 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.

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.

4.3 ROLES AND RESPONSIBILITIES

4.3.1 Bridge Owners

Bridge Owners in Nebraska include the Nebraska Department of Roads, 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 within 90 days of the inspection.
- 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 signed in accordance with this Manual and that the signs are maintained.
- Ensuring that **new** bridges received an initial inventory inspection and load rating before opening to traffic. This data is in the Nebraska bridge inventory within **90 days** of the inspection.
- Ensuring that **modified** bridges (e.g. rehabilitation or widening) are reinspected before opening to traffic. This data is in the Nebraska bridge inventory within **90 days** of the inspection.
- Maintaining complete bridge records in their local office (bridge record details are covered in the Bridge Inspection Program Records Chapter).
- Ensuring critical findings are addressed by corrective action or permanent closure of the bridge.
- Completing, or causing to be completed, Quality Control (QC) of the inspections and load ratings done for bridges under their authority.
- Being familiar with biological resources that may be encountered during inspection and following protocols for their protection.

4.3.2 Nebraska Department of Roads

NDOR is responsible for:

- Providing Pontis software to Bridge Owners and their consultants.
- Assigning inventory structure numbers.
- Maintaining the Nebraska Bridge Inventory database.

- Quality Assurance review of bridge data submitted for all bridges that are included in the Bridge Inventory.
- 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 provided for the National Bridge Inventory by the Bridge Owners for compliance with Federal regulations.
- Providing protocols for the protection of biological resources that may be encountered during bridge inspection.

4.3.3 Consultants Performing Inspections for Bridge Owners

Consultants performing inspections for Bridge Owners are responsible for:

- Being familiar with NDOR and FHWA requirements and policies on bridge inspection.
- Maintaining staff qualifications required for the Nebraska Bridge Inspection Program.
- 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 NDOR.
- Being familiar with biological resources that may be encountered during inspection and following protocols for their protection.

4.4 QUALIFICATIONS

The NBIS qualification requirements and NDOR 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. NDOR qualifications are more stringent than those for NBIS for some items.

NDOR 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 Owners, NDOR and, if applicable, their Consultant employers.

4.5 NBIS DEFINITIONS AND NDOR COMMENTARY

The NBIS definition of types of inspections and NDOR 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. NDOR specific expectations for inspection procedures are described herein. Note that some of the terms describe the “level” or depth of inspection, but are not strictly a type of inspection that is recorded in Pontis.

Inspections that are recorded in Pontis are regularly scheduled inspections, or inspections that are event-driven, such as the reconstruction or rehabilitation of an existing bridge that alters that bridge’s NBI data.

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 Pontis as a Special inspection.

NDOR requires that new bridges, replacement bridges or existing bridges that have been significantly altered by widening/lengthening, or rehabilitated after a Critical Finding receive an initial inspection. The structure data is new or a significant revision of data in 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 are reported in Pontis as an NBI inspection.

Routine inspections may include both inspection of features of the structure and inspection of the site for a scour issues. Routine inspections must be completed by a Team Leader. Routine inspection includes sounding of concrete decks, such as with a chain-drag.

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 NDOR Bridge Inspection Program requirements.

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 Pontis.

A Fracture Critical inspection typically is done along with the Routine Inspection.

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 Pontis.

The underwater inspection is required for structures that are 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 the defects and causes of deterioration.

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 Pontis.

NDOR's policy beginning in 2012 is 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.

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.

Special Inspections may be scheduled or event-driven.

NDOR has determined certain conditions or cases require a Special Inspection between Routine Inspections, and these are shown in the following table. For these special inspections the structure condition codes must be reviewed.

Scheduled Special Inspections are to be done between the routine inspections at an interval equal to half the routine inspection interval.

NDOR recommends that Owners keep a master list of their bridges that are subject to Special Inspection.

NDOR-Required Scheduled Special Inspections 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.

Examples of Scheduled Special Inspections	
Case	Inspection By
An inspection of a foundation settlement	Team Leader
An inspection of a member whose condition is of concern	Team Leader
An inspection of a load-posted bridge subject to heavy traffic	Team Leader
An inspection of a fracture critical element with a known issue	FC certified Team Leader
An inspection required by the “Bracing by Deck” policy (this policy expires at the end of 2011.)	Team Leader

Examples of Event-driven Special Inspections	
Case	Inspection By
Inspection of a recently completed bridge	Team Leader
Inspection of an altered/retrofit bridge	Team Leader
Structures retrofitted or repaired to address a particular FC issue that required a half-interval (e.g.12-month) and to be returned to the routine inspection interval (e.g. 24-month)	FC qualified Team Leader
An inspection done after repair of a bridge.	Team Leader
An inspection done after retrofit of a steel stringer bridge with acceptable bracing	Team Leader
Damage inspection after vehicle impact that revises inventory data (condition ratings, etc.)	Team Leader
Damage inspection after a flood event that revises inventory data (condition ratings, etc.)	Team Leader

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 are not an inspection type in Pontis. Damage inspections are event-driven. Depending on the severity of the damage and steps taken to address damage, a Team Leader may need to enter data into Pontis as a Special Inspection.

An initial assessment of damage to a bridge may be done by a person who is not a Team Leader. Impact to any structural elements or change in the conditions near the bridge due to scour, must be inspected by a Team Leader. The Damage Inspection should be documented (including findings, date, course of action) and placed in the individual Bridge Record.

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 Pontis.

In-depth inspection is done along with Routine, Fracture Critical, Underwater or Special Inspections.

4.5.8 Hands-on Inspection

“Inspection within arms 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 Pontis.

Hands-on inspection is done along with Routine, Fracture Critical, Underwater or Special Inspections.

4.6 INSPECTION FREQUENCY OR TIMING

4.6.1 Routine Inspection Intervals

NBIS requires that bridges be routinely inspected at intervals no greater than 24 months, however, allows inspection intervals of up to 48 months with FHWA approval.

NDOR requires that all routine inspection intervals be done at intervals not exceeding 24 months. These inspections are the biennial routine inspections, and shown in Pontis as NBI inspection.

Note that NDOR’s policy beginning in 2012 is that the initial inspection of a bridge is a Special inspection for new bridges, bridges that have changed in configuration (e.g. widening, lengthening, supplemental bents) or when there is a change in ownership of the bridge. This should be entered into Pontis as a Special inspection and **not** an NBI inspection.

4.6.2 Fracture Critical (FC) Member Inspection

Fracture Critical inspections will be done along with Routine Inspections. These inspection dates are recorded in Pontis as Fracture Critical inspections on the same day as the Routine Inspection.

Note that NDOR’s policy beginning in 2012 is that Fracture Critical bridges with elements requiring inspection between the routine inspection interval shall be a Special Inspection This should be entered into Pontis as a Special inspection and **not** an NBI inspection, nor a Fracture Critical Inspection.

4.6.3 Underwater Inspection

The NBIS requires that underwater inspection intervals not exceed 60 months. In Nebraska, NDOR conducts all underwater inspections required, regardless of the Bridge Owner. The Bridge Owner must have the report in the bridge record.

The underwater inspection is required for water crossing with substructure units submerged in a minimum of 4 feet of water at all times.

4.6.3.1 Bridges over Controlled-Flow Channels

Bridges over controlled-flow channels, such as power or irrigation canals, shall have an underwater inspection interval not to exceed 60 months. These types of waterways typically have controlled and nearly constant stream velocities.

4.6.3.2 Bridges over Natural Waterways

The inspection of foundation elements and determination of its on-going resistance to scour is the objective of an underwater inspection. 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.

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 within Nebraska over waterways 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 will guide the determination of the underwater inspection interval. NDOR will determine the maximum interval between inspections, but will not exceed the intervals shown in the following table.

Underwater Inspection Intervals			
NBI Item 113*	**Description**	**Maximum Interval**	**Comment**
U	Unknown foundation	To be determined by HE assessment	
4	Stable for calculated scour	60 months	
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.			

4.6.4 Special Inspections Intervals

Special Inspections are either scheduled or event-driven. See Special Inspections section above.

4.6.5 In-depth Inspection Intervals

In-depth inspection is done along with Routine, Fracture Critical, Underwater or Special Inspections.

4.7 INSPECTION SUBMITTAL DEADLINES

4.7.1 General

NDOR continually updates the state inventory as data is received from Bridge Owners. NDOR submits the state inventory to FHWA annually, no later than April 1. This submittal generally includes all data updates to the inventory data for activities of the prior calendar year.

Submittal deadlines need to allow time for QC/QA process so that data updates will meet the submittal requirements shown in this section. NDOR and FHWA monitor the compliance with the submittal requirements for the Program.

The NBIS requires that SI&A data to be entered into the state and national inventory database within 90 days of the date of inspection for state agency bridges and within 180 days of the date of inspection for all other bridges. NDOR, however, recommends that for both state and non-state bridges, participants generating data submit it to NDOR as soon as QC has been completed, but within **90 days** of an inspection, the completion of a new bridge or bridge modification or the change in the status of the bridge. This procedure keeps the data in the inventory current and it also 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.

4.7.2 Inspections

For routine, in-depth, fracture critical member, underwater, damage and special inspections enter the SI&A data into the State agency inventory within 90 days of the date of inspection for all bridges in the inventory.

4.7.3 New Bridges or Existing Bridge Modifications

NDOR requires for new bridges and for existing bridge modifications which alter previously recorded data, that the data be entered into the SI&A data into the Nebraska bridge inventory database within 90 days of the inspection.

If any bridge has been significantly altered by widening, lengthening or by some other major reconstruction, or the structure has been replaced, the new structure inventory record must be reinspected within 90 days of the opening to traffic.

4.7.4 Revised Load Ratings

If any changes to a bridge, due to condition changes or structure alteration, warrant a revised load rating, field measurements and supporting documentation must be included in the inspection report. If plans are available for this structure alteration, the plans should be included with the inspection report.

4.7.5 Bridge Removal or Replacement with Short Span Bridge

If a bridge has been removed or replaced by a short-span (span less than or equal to 20 feet) structure, pipe culvert, dam, etc., the Bridge Division must be notified in writing to delete the structure from the Inventory.

4.7.6 Change in Bridge Status – Load Restriction or Closure

For changes in load restriction or closure status, enter the SI&A data into the state agency inventory within 90 days after the change in status of the structure. Owners must put new load restrictions or closures in place as specified in Chapter on Load Rating.

4.8 GENERAL INSPECTION PROCEDURES

4.8.1 NBIS Inspection Process

The following flowchart provides a general process for inspections of structures.

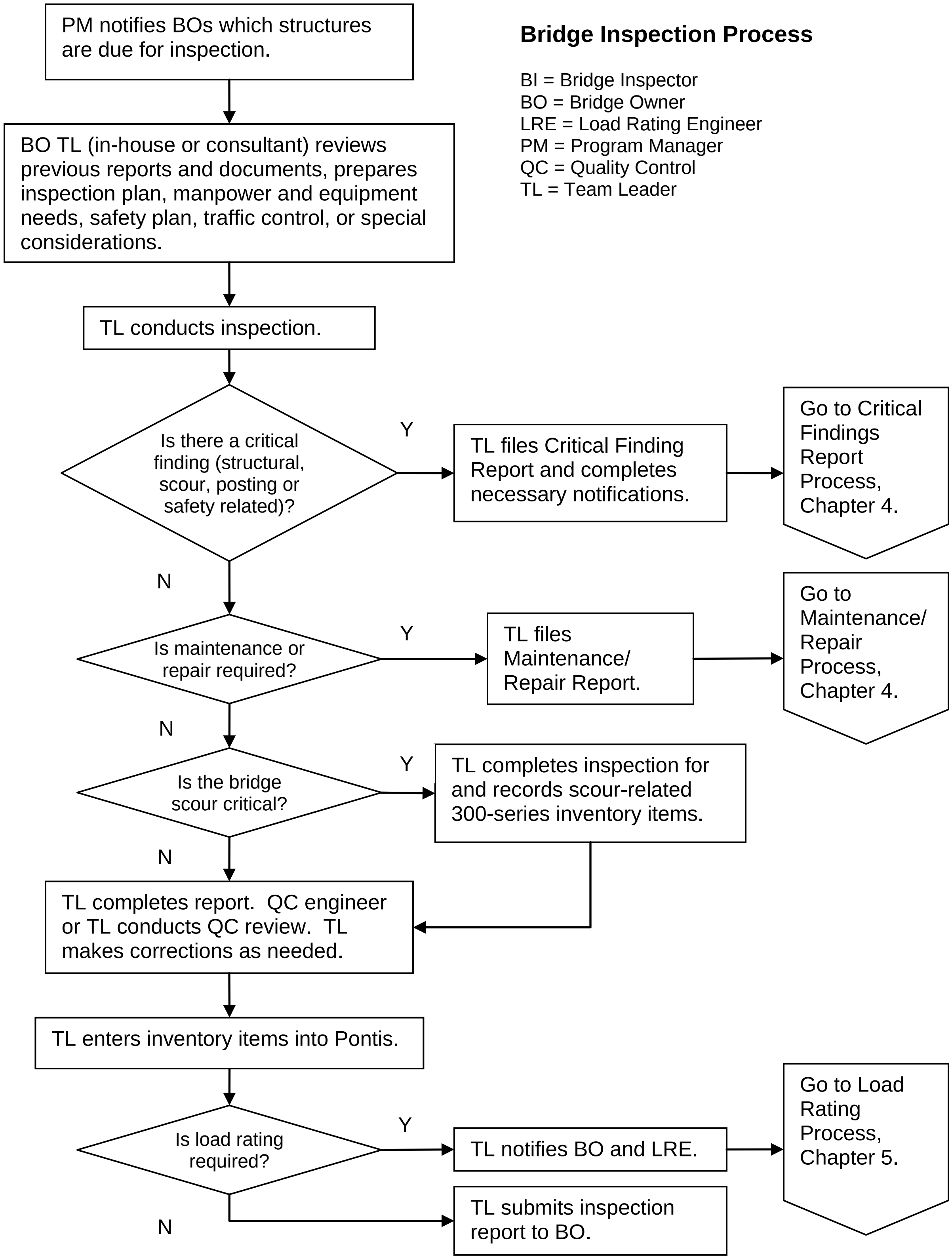
Inspectors are advised to carefully review the Tables of Inventory Items in Chapter 3 Inventory Coding for the specific items that Inspectors enter into the inventory (static items) or should verify while they are in the field (dynamic items).

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 a 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.

Bridge Inspection Process

BI = Bridge Inspector
BO = Bridge Owner
LRE = Load Rating Engineer
PM = Program Manager
QC = Quality Control
TL = Team Leader



4.8.2 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 include, 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.

4.8.3 Safety

Inspectors should review the FHWA BIRM, particularly Section 3.2 “Safe Practices” for thorough coverage of recommended requirements.

Inspectors should review the MBE for safeguarding the safety of 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.

4.8.4 Inspection and Tools

Inspectors should review the FHWA BIRM particularly 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

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.

4.8.5 Reporting

4.8.5.1 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 the "Critical Findings Reporting" section of this Chapter.

Sketches and photographs should be included in an effort to minimize long wordy descriptions. Inspection reports should include the following:

- All noteworthy findings stemming from the inspection. Examples include:
  - any bridge component with a condition rating of 4 (poor) or less would need to have a photo and notes clearly describing the location, severity and extent of the defect or deterioration
  - any item of maintenance
  - any evidence of a change in scour condition
- Fracture critical members, fatigue-prone details and special features inspections must be included in the comment file.
- All features that will require special inspection and/or close monitoring need detailed documentation. A description of the problem, or anticipated problem, with sketches and photos must be included in the inspection report.
- A minimum of 12 digital photographs of the site in general. See the guide for taking site photos in the Appendix.
- Enough digital photographs to accurately record inspection findings.
- Reporting of repairs to the structure that alters any previously recorded data.

An advisory regarding photos: NDOR 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 up to the discretion of the Inspector.

NDOR recommends labeling with a filename that includes the structure ID followed by a sequence number or other unique identifier for that photo.

4.8.5.2 Pontis Input

The inspection data collected is input by the Inspector into Pontis. Routine inspections are shown in Pontis as NBI inspections. 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. See Chapter 3 Bridge Inventory Coding for the list of these items.

Comments input into reports and Pontis 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, especially when Condition Codes drop to 5 and below. Inspectors must document the type and location of defects. This is important for bridge management personnel and for load rating.

Documentation of maintenance completed and repairs made is also important.

Export completed inspection reports to NDOR frequently. This will insure that inspections are received by the NDOR within the required NBI time frame.

NDOR does not recommend attaching photos to the Pontis record. It can be done, however, there is only one way to correctly do this. If done incorrectly, it causes problems with the file when exported and uploaded at NDOR.

New inspections delete previous inspection notes and then add current inspections notes.

4.8.6 QA Findings from Past Inspection Cycles

These items have been found to have significant variability or issues in coding; Inspectors are advised to carefully code in accordance with Chapter 3 Bridge Inventory Coding.

Inventory Items Needing Careful Attention		
Item No.	**Description**	**Comments**
36	Traffic Safety Features	Standards change thus Inspectors should check this each cycle.
41	Structure Open, Posted, or Closed to Traffic	Clarification added.
90	Inspection date	Input a NEW report into Pontis for a new inspection and **DO NOT** edit the data that was the prior inspection.
311	Bridge bearing devices	Clarification added.
316, 317, 320	Substructure items	Clarification added.
321	Piling type	Clarification added.
326, 327	Stream related	Inspectors should also consult Chapter 6 Scour.
377	Maintenance comments	Clear but specific comments needed.
378	Maintenance date	If comments are provided, date must be provided.

Bridge Inspectors were not checking posting or closure status against the LRSS. Inspectors must always have the current LRSS with them in the field. Posting for load restrictions found in the field must be checked against the LRSS. Missing signs or field postings over that shown on the LRSS is a critical finding and must be reported. Furthermore, if a bridge that is supposed to be closed, but is found open, a critical finding must be reported.

4.9 INSPECTION PERTAINING TO THE BRIDGE MATERIAL

4.9.1 Steel

Corrosion and section loss can adversely affect the load capacity of a bridge. 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 list given below is general in nature and not comprehensive. The Inspection staff, while in the field, should contact the LRE if there are any questions and to ensure key measurements are obtained in the field.

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

4.9.2 Timber

Timber structures can, over time, exhibit deterioration and section loss. 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 list given below is for simple spans and is general in nature and not comprehensive. The Inspection staff, while in the field, should contact the LRE if there are any questions and to ensure key measurements are obtained in the field.

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).

4.9.3 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 Inspection. A Bridge Owner will determine the need for tests as part of an inventory, special or in-depth inspection.

Concrete Bridge Deck Evaluation and Condition Coding (Condition Indicators as % of Deck Area)			
Classification	Condition Code	Spalls	Delaminations
Light Deterioration	9	None	None
	8	None	None
	7	None	< 5% of all Deck Concrete
Moderate Deterioration	6	< 2% Spalls or sum of all deteriorated Deck Concrete < 10%	
	5	< 5% Spalls or sum of all deteriorated Deck Concrete 10% to 29%	
Extensive Deterioration	4	> 5% Spalls or sum of all deteriorated Deck Concrete 30% to 60%	
	3	> 5% Spalls or sum of all deteriorated Deck Concrete > 60%	
	2	Deck Structural capacity grossly inadequate.	
Structurally Inadequate Deck	1	Holes in Deck, or danger of other sections of deck failing.	
	0	Deck has failed completely. Bridge can be repaired by deck replacement only.	

4.9.4 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.

4.10 SCOUR RELATED BRIDGE INSPECTION

4.10.1 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.

4.10.2 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 that are noted by a bridge inspector on a routine inspection may trigger a revision to the POA.

4.10.3 Inspection and Reporting for Scour Critical Bridges

Inspectors performing routine inspections for a scour critical bridge must include inspection of the structure and site. Routine inspections may find issues that may trigger a revision to that structures POA.

A routine inspection of a scour critical bridge will include the following:

- Review of past inspection reports and the POA, if the structure has this.
- 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 depth, width and length of scour holes and undermining with sketches.
- Documentation of hydraulic observations with photos, preferably from the same location as those from the current POA:
  - 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 and berms
  - piers or bents
  - natural banks
  - scour countermeasures (rip rap, channel slope protection, wing dikes, etc.)
  - scour related problems
  - recent high water marks

4.11 FRACTURE CRITICAL INSPECTION

4.11.1 Fracture Critical Member Definition

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."

4.11.2 Fracture Critical Steel Member Identification

A list of common fracture critical structure types and members is shown below for the inspector's information. 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 eyebar components
  - Eyebar chain
  - Cable
  - Cable stayed
- Two-truss systems
  - Eyebar members
  - Counters
- Tied arches
- Steel pier caps and cross girders with 2 or less supports
- Pin and hanger connections on two- or three- girder systems
  - Hanger plates
  - Pin
    - Girder pin and hanger
    - Fixed pin and girder
    - Truss pin and hanger

4.11.3 Frequency

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. See the Section on Inspection Frequency of this Chapter. NDOR 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.

4.11.4 Fracture Critical Inspection Plan

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 a plan prepared by an engineer that identifies each fracture critical member as well as each fatigue detail and fracture-prone detail. If a plan is not in the bridge file, an engineer must prepare a plan for that structure. This plan provides a list of fracture critical members and fatigue and fracture-prone details on the structure, and describes the inspection methods to be used and equipment and procedures for accessing them.

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 plan 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:
  - o Bang of the hammer
  - o Magnetic-particle testing (MT)
  - o Dye-penetrant testing (PT)
  - o Ultrasonic testing (UT)
  - o Eddy current
- Tools necessary for inspection, including any special equipment such as non-destructive testing devices.

4.11.5 Inspection Reporting

4.11.5.1 General

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 a narrative as well as the NDOR FC inspection forms.

4.11.5.2 Report Narrative

The Fracture Critical Report shall have a narrative including these components:

- Purpose
  - o Provide clear, concise backup of the field documentation
  - o Provide insight about observed defects and potential problem areas
- Methodology
  - o Introduction
    - Inventory data relevant to fatigue
    - Reference information
    - Site conditions
    - Inspection crew information
  - o Identify Fracture Critical Member (FCM)
    - Include FCM inspection plans
      - o Inventory of the FCMs
      - o Identify fatigue prone details
      - o Quality control tool
    - Systematic procedure for efficient inspection
  - o 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
  - 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.

4.12 UNDERWATER INSPECTION

4.12.1 General

Underwater bridge element inspection is necessary for public safety and protection of the public investment in bridges by detecting existing or potential maintenance and safety problems.

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.

It 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, similar to those for fracture critical structures.

NDOR hires a consultant to complete all the underwater bridge inspections for all Owners in Nebraska. NDOR 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 underwater inspection reports are reviewed by the Program Manager. The Program Manager will review the condition ratings and compare them to the routine inventory inspection. The Program Manager will track the UW condition ratings and may update the condition ratings reported in the inventory if the underwater inspection report indicates this is necessary. The Program Manager will send a copy of the underwater inspection report to the Bridge Owner for their bridge record.

4.12.2 Dive Team and Member Qualifications

OSHA 29 CFR Part 1910, Subpart T, *Commercial Diving Operations*, shall govern the inspections that require diving. The team conducting the inspection should preferably include a Professional Engineer. All underwater inspection shall be done by divers who are NDOR-Certified Team Leaders. The underwater inspector, at a minimum, will be a certified diver, have a basic knowledge of medical emergency procedures such as CPR and First Aid, be in good physical condition and be familiar with the theory and operation of the diving equipment and tools that will be used to complete the bridge inspection.

The dive team shall be appropriate in size for the structure, but shall consist of a minimum of three team members. Each member should be able to function in any of the positions and to rotate duties. These positions will include:

- Main diver who is responsible for the actual tactile and visual inspection of the structure and reporting the information. The main diver must be a certified team leader.
- 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.

4.12.3 Frequency

Regular interval for underwater inspection is 60 months.

4.12.4 Inspection - Minimum Expectations

4.12.4.1 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.

4.12.4.2 Concrete

Note the length, width, location and orientation of cracks. Note spalling and deterioration of the concrete members.

4.12.4.3 Steel

Check for corrosion on all structural members, noting any loss in section and 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.

4.12.4.4 Timber

Timber members that are subject to cycles of wetting and drying are highly susceptible to deterioration. All timber pile shall be checked to detect 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.

4.12.5 Inspection Preparation and Planning

4.12.5.1 General

The inspection dive team leader must complete the following:

- Verify the qualifications of all members of the dive team;
- Review the previous inspection report, dive log and the SI&A sheet;
- Hold the Predive Meeting with the Dive Team.

4.12.5.2 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 NDOR 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.

4.12.6 Inspection Reporting

4.12.6.1 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 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.

4.12.6.2 Underwater Inspection Report

An Underwater Bridge Inspection Report and the Work Dive Log will be completed immediately following the inspection and submitted to the Bridge Owner and the Program Manager.

4.12.6.3 Divers' Personal Dive Log

Divers will complete their personal Dive Log following the completion of the above documentation.

4.13 COMPLEX BRIDGE INSPECTION

4.13.1 Definition

The NBIS defines a Complex Bridge as “a movable, suspension, cable stayed and other bridges with unusual characteristics.”

NDOR defines a Complex Bridge as “a bridge possessing unique or unusual design features not often found in Nebraska.” NDOR will review all bridges in the state and identify Complex Bridges. Two examples of complex bridges include the tied arch bridge at Ravenna and the segmental box bridge at Nebraska City.

Complex bridges will be designated as such by the State Bridge Engineer or the Assistant Bridges 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.

4.13.2 Inspection Procedures

The unique or unusual structural design feature(s) of a bridge shall be identified during the bridge design.

4.14 SPECIAL INSPECTIONS

4.14.1 Definition

A special inspection is an inspection of a suspected or known defect or condition (structural or scour-related) that could potentially become critical. A special inspection is done on a specified date or interval of time, to closely monitor the defect for adverse changes in its condition, and may or may not coincide with a routine bridge inspection.

4.14.2 Procedures

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.

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.

4.15 DAMAGE INSPECTION

4.15.1 Definition

Damage Inspection is an 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 damage load bearing elements of the bridge, or vehicular impact to a bridge that damages traffic safety related elements of a bridge.

4.15.2 Procedures

The Bridge Owner must determine if the damage requires an emergency load restriction, lane closure, bridge closure or if a bridge has failed. A qualified Inspection Team Leader must complete a Damage Inspection. 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 Inspection Team Leader and 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, make 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 as 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	
• 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 (NDOR) Maintenance work order (non-state)

NDOR 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 in this Chapter.

Non-state Bridge Owners have maintenance work order systems that they use to report, document and effect 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.

4.16 CRITICAL FINDING REPORTING

4.16.1 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.

4.16.2 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”.

Critical findings are most often discovered by a routine inspection. 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 to the structure by traffic or stream.

Conditions that constitute a critical finding include, but are not limited to the following:

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
A scour analysis results in a Scour Critical, Item 113 of 1	Scour Assessment
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

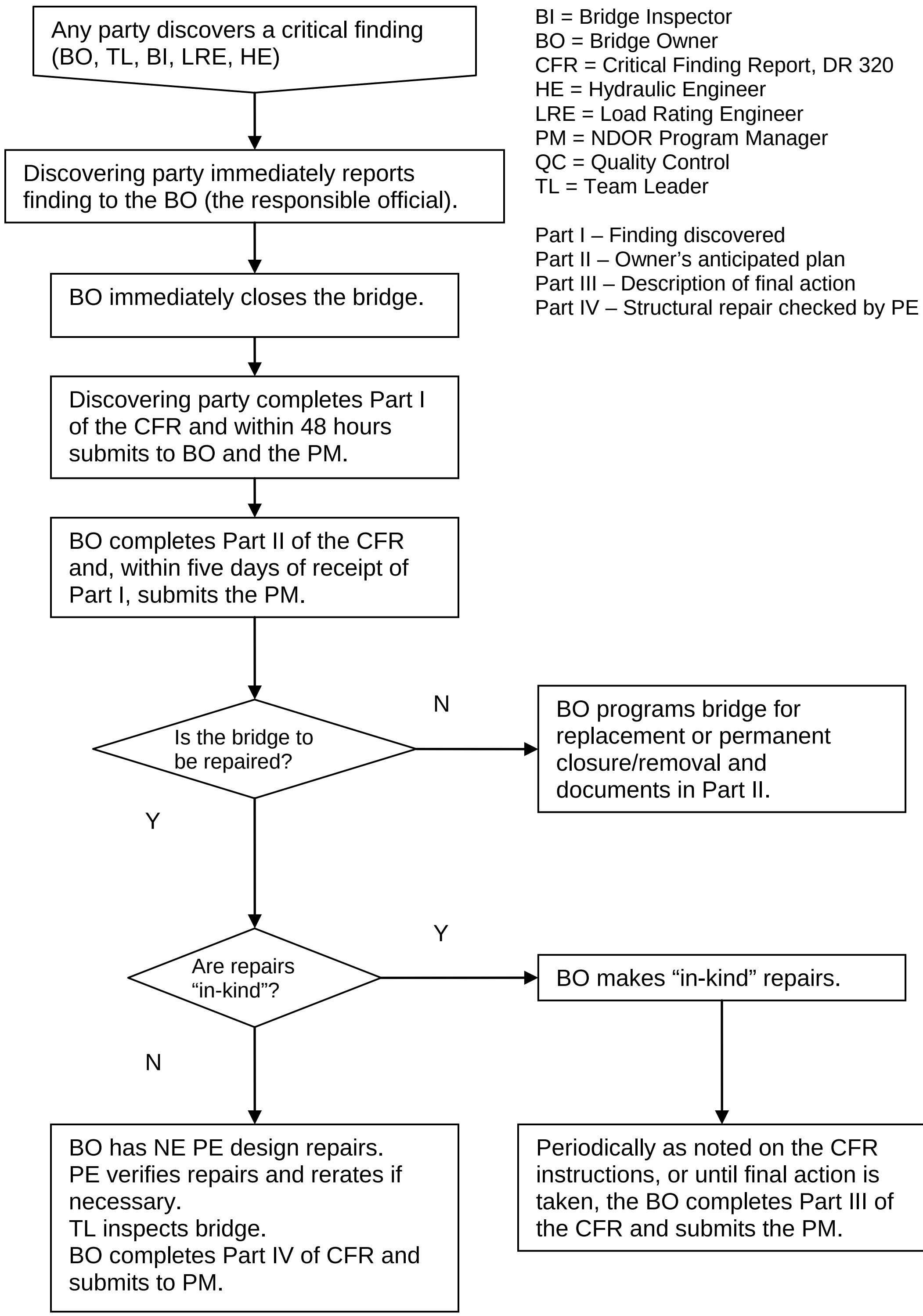
In cases where it is possible that the bridge might be used safely at lower posted load limit, a load rating **must** be completed. The inspector should close the bridge in this case. Load posting without a revised load rating for the critical finding is not an option. The results of the load rating determine whether the bridge may be opened again.

A Critical Findings Report, DR 320, must be initiated by the inspector, or other party that may have discovered the critical finding, such as a Load Rating Engineer, Hydraulic Engineer or a Bridge Owner. Once a critical finding is identified, it must be reported to the Owner. The Owner must report the critical finding to the NDOR Program Manager and identify the action anticipated for the bridge. The Owner is responsible for completion of the action and notification of completion to the Program Manager. All discovery, immediate actions taken, and the actual work performed and follow-up must be recorded. The process is shown in the following flowchart.

Critical Finding Reporting

BI = Bridge Inspector
BO = Bridge Owner
CFR = Critical Finding Report, DR 320
HE = Hydraulic Engineer
LRE = Load Rating Engineer
PM = NDOR Program Manager
QC = Quality Control
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



4.16.3 Responsibilities for Critical Findings Reporting and Follow-Up

4.16.3.1 Inspection Team Leaders

Inspection Team Leaders may find critical findings during routine or other inspections. Team Leaders should complete the appropriate sections of the CFR and take the required measures given on the CFR. These actions include required notifications to the Bridge Owner, NDOR Program Manager and others. The CFR must be completed and submitted to Owner within 48 hours of the discovery of the finding.

4.16.3.2 Bridge Owners

Bridge Owners have the ultimate responsibility for management of their structures for the public safety. The Bridge Owner may have a consultant complete the Critical Findings Report; however, it is the responsibility of the Bridge Owner to report to the Program Manager on the status periodically as noted on the CFR instruction until the action needed is completed. Bridge Owners must report periodically to NDOR 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).

4.16.3.3 Nebraska Department of Roads

NDOR'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. NDOR also will send letters to Bridge Owners to verify status of the action needed if the Owner has not notified the Program Manager that corrective action has been taken.

4.16.3.4 Consultants Performing Services for Bridge Owners

It is the responsibility of the Consultants to be familiar with NDOR and FHWA policies, and to follow procedures related to notifications and preparation of the report as described herein.

4.16.4 Procedures

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 NDOR web site. This form and instruction are revised periodically.

DR Form 320 includes individual parts for unique action from the Inspector 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 an inspector 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.

4.17 REPAIR AND MAINTENANCE REPORTING

4.17.1 Purpose

Non-critical findings include items of repair or maintenance. Some Nebraska Local Bridge Owners have processes and systems in place to accomplish maintenance and repair. Those who do not have such a system in place are encouraged to use the NDOR forms for their own structures to meet this requirement; and this is described in this section. The Structure Repair Report and the Structure Maintenance Checklist may be downloaded from the NDOR web site.

NDOR Structure Repair Report, DR 321, is used to document repair to a bridge that **does not** require closure and is **NOT** a critical finding. Any damage to a structure that requires closure of a bridge is a critical finding and a Critical Findings Report must be completed, however, a Repair Report is not required. See the prior section of this Chapter.

The purpose of the Repair Report is to alert the Bridge Owner so it would be repaired in a proper and timely manner and that the damage and repairs are well documented for future reference. A Structure Repair Report is prepared by the inspector, or other party that may have discovered the damage or condition needing repair. Examples of damage that require reporting include vehicular impact to traffic safety devices, serious concrete deck spalling or shoulder erosion, and damage to substructure from debris.

NDOR Structure Maintenance Checklist, DR 27 is used to report maintenance type work. Examples of maintenance include wash the bridge, sweep the deck, clean dirt off bearings, or clean debris from deck expansion devices.

4.17.2 Structure Repair Report Procedures

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 Appendix of this Manual for situations that require the attention of a NE PE.)
- The Owner records on the Report form the date and details of the corrective action taken and files it in the bridge record.

4.17.3 Structure Maintenance Checklist Procedures

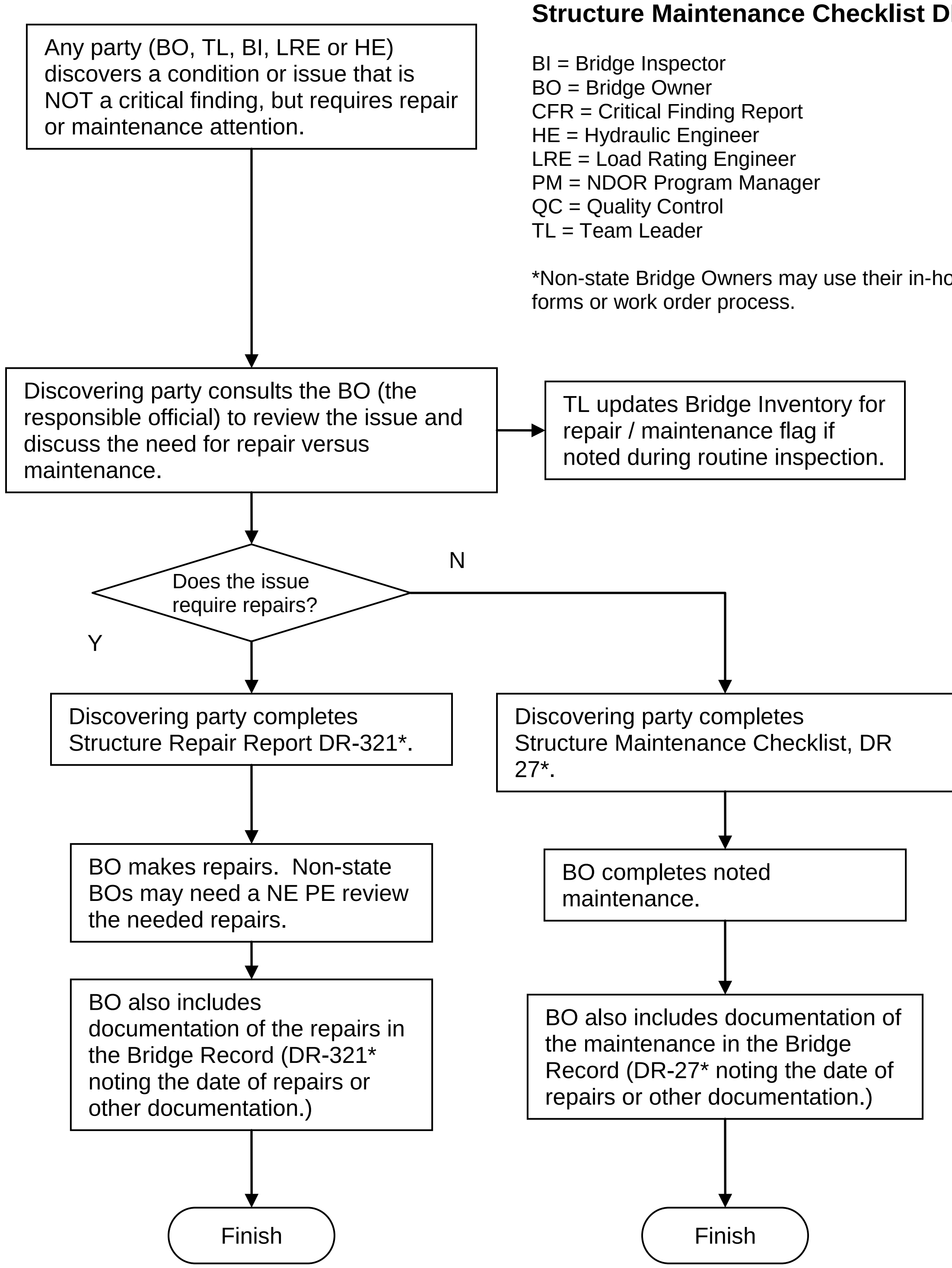
The Structure Maintenance Checklist includes a listing of typical maintenance work done on bridges.

- The Checklist is prepared by the Owner’s staff or a bridge inspector who notes the need for maintenance.
- The Owner records on the Checklist the date and details of the corrective action taken and files it in the bridge record.

Structure Repair Report DR 321 or Structure Maintenance Checklist DR27

BI = Bridge Inspector
BO = Bridge Owner
CFR = Critical Finding Report
HE = Hydraulic Engineer
LRE = Load Rating Engineer
PM = NDOR Program Manager
QC = Quality Control
TL = Team Leader

*Non-state Bridge Owners may use their in-house forms or work order process.



4.18 BIOLOGICAL RESOURCES NEAR BRIDGE SITES

Program participants that visit bridge sites in Nebraska should be aware that there are biological resources that may be encountered at these sites and that need to be conserved.

General information is provided in this Manual regarding resources endangered and threatened as of the date of the issuance of this Manual. Program participants should review detailed and current information at web sites of the U.S Fish and Wildlife Services (USFWS), http://www.fws.gov, and the Nebraska Game and Parks Commission (NGPC), http://www.ngpc.state.ne.us.

4.18.1 Migratory Bird Treaty Act

Migratory birds are protected by the Migratory Bird Treaty Act. This law was first enacted in 1918 to protect birds that migrate across borders of countries. Currently 836 bird types are covered by this law. It is a misdemeanor offense to disturb active migratory bird nests.
See additional information at http://www.fws.gov/pacific/migratorybirds/mbta.htm.

Birds, eggs and young are protected. Birds and active nests should not be harmed, harassed, disturbed, capture, killed or maimed.

4.18.2 Bald and Golden Eagles Protection Act

On August 9, 2007, bald eagles were removed from the federal list of threatened and endangered species and, therefore, they are not protected under the Endangered Species Act. However, bald eagles remain protected under the Bald and Golden Eagle Protection Act (Eagle Act). The Eagle Act prohibits anyone from “taking" bald eagles. Among other actions, "take" includes disturbance of bald eagles. "Disturb" is the form of take that is most likely to occur and is the most ambiguous. Therefore, the U.S. Fish and Wildlife Service prepared National Bald Eagle Management Guidelines.
See http://www.fws.gov/midwest/eagle/guidelines/index.html.

Do not disturb any eagles or nests (active or inactive) if they are encountered during inspection.

4.18.3 Threatened and Endangered Birds

A list of threatened and endangered species can be found at
http://ecos.fws.gov/tess_public/pub/stateListingIndividual.jsp?state=NE&status=listed.

4.18.3.1 Whooping Cranes

Whooping cranes were placed on the Federal list of endangered species in 1967. They migrate through Nebraska during two periods: spring migration from March 10 through May 10 and fall migration from September 16 through November 16. Its habitat in Nebraska is found along the Platte Valley, with its wide slow moving river and associated sandbars and islands. It forages in nearby wet meadows, croplands and marshland. Its appearance is similar to

the Sandhill Crane, Snow Geese and especially the American White Pelican.
http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B003

4.18.3.2 Interior Least Tern

Interior Least Tern was placed on the Federal list of endangered species in 1985. Their nesting season in Nebraska is from April 15 through August 15. Its appearance is similar to the Common Tern and Forster Tern.
http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B07N
http://www.fws.gov/midwest/Endangered/section7/tern.html

4.18.3.3 Piping Plover

Piping Plover was placed on the Federal list of endangered species in 1986. Their nesting season in Nebraska is from April 15 through August 15.
http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B079.
http://www.fws.gov/midwest/Endangered/pipingplover/pipingpl.html

4.18.4 Protocols for Bird Surveys at Bridge Sites

The NDOR Environmental Section has established protocols for bird surveys at bridge sites to be inspected. These are available from the NDOR Environmental Section office at 402-479-4766. Team Leaders, Hydraulic Assessment team members, and others who may be performing any inspections for the Bridge Inspection Program, including underwater, special and damage inspections, shall follow these protocols for conservation of these biological resources.

These survey protocols give the following:

- Counties Lists where the bird surveys must be done;
- Date ranges that surveys should be done;
- Times and frequencies for surveys; and
- Method of survey.

4.19 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 Roads 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.

4.20 QUALITY CONTROL

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the bridge inventory data 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. An individual of equal or better qualifications than the originator of the product shall complete Quality Control review on the work product. QC manager/engineer shall:

- See that the QC on a given document, data or calculations is completed by an individual of equivalent or better qualifications than the originator (this is typically documented when the QC individual signs or initials the document.)
- See that the technical activity has followed procedures set by NDOR;
- Provide routine and consistent checks for data integrity, correctness and completeness;
- Identify and address errors and/or omission;
- Record the QC activities.

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.

4.21 QUALITY ASSURANCE

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

4.22 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1

4.23 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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm for the current list of applicable forms and the most recent versions of each form.

Name	DR Form	Revision Date
Special Inspection Bridge Report	7	Apr 08
Structure Maintenance Checklist	27	Sep 09
Complex Bridge – Unusual Feature Inspection List	29	Apr 08
Fracture Critical Inspection Report, Bridge Orientation/Layout	293	Nov 09
Fracture Critical Inspection Report, Introduction	293a	Nov 09
Fracture Critical Inspection Report, Identification of All Fracture Critical Member/Details	293b	Nov 09
Fracture Critical Procedural Report	293c	Nov 09
Fracture Critical Inspection Report, General Structure Condition	293d	Nov 09
Fracture Critical Inspection Report, Summary and Conclusions	293e	Nov 09
Fracture Critical Inspection Report, Follow-up Procedure	293g	Nov 09
Bridge Inspection Field Sketch Template	319	Jun 09
Critical Finding Report	320	Jun 09
Critical Finding Report, Instructions	320i	Jun 09
Structure Repair Report	321	Jun 09
Underwater Inspection Report	TBD	TBD

4.24 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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm. Bridge Owners and Inspectors are urged to check this site to ensure they have all the most current information and forms.

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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 superstructure, including the deck, and substructure elements and their connections. Bridge conditions change over time as will the load rating. The load rating will be determined by a professional engineer and determined by calculations, engineering judgment 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 have been 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 rated 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.

5.2 REFERENCES

These references set forth procedures to be used in the load rating of bridges. 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*. First Edition, 2008 (MBE)
- AASHTO. *Standard Specifications for Highway Bridges, 17th Edition.*
- AASHTO. LRFD Bridge Design Specifications, 4th Edition with 2008 Edition Interim.
- 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.
- FHWA. *Revisions to Items 63-66 to Support Load Reporting by Rating Factor.* Memorandum HIBT-30. March 22, 2004
- FHWA. *Bridge Load Ratings for the National Bridge Inventory.* Memorandum HIBT-30. October 30, 2006
- 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.* Memorandum HIBT-30. February 2, 2011
- FHWA. *Technical Advisory T5140.23, Evaluating Scour at Bridges*. October 28, 1991.
- FHWA. *Bridge Inspector's Reference Manual*. NH103-001, Vols. 1 and 2. October 2002; Revised 2006.
- FHWA. *Evaluating Scour at Bridges*. Hydraulic Engineering Circular, No. 18 (HEC 18), 4th Edition. Publication No. FHWA-NHI-01-001. May 2001 with Errata, September 6, 2001.

- FHWA. *Bridge Scour and Stream Instability Countermeasures, Experience, Selection and Design Guidance Second Edition*. Hydraulic Engineering Circular, No. 23 (HEC 23). Publication No. FHWA-NHI-01-003. 2001, with Errata September 6, 2001.
- FHWA. *Revision of Coding Guide, Item 113 – Scour Critical Bridges*. Memorandum HIBT-30. April 27, 2001.
- FHWA. *Compliance with the National Bridge Inspection Standards – Plan of Action for Scour Critical Bridges*. Memorandum HIBT-20. March 29, 2005.
- FHWA. *Scourability of Rock Formations*. Memorandum HNG-31. July 19, 1991.
- NCHRP. *Synthesis 354: Inspection and Management of Bridges with Fracture-Critical Details*. 2005.
- Nebraska Department of Roads Bridge Division. *Bridge Office Policies and Procedures.* (BOPP)
- Joseph A. Yura, and Brett A. Phillips. "Bracing Requirements for Elastic Steel Beams". University of Texas at Austin, Center for Transportation Research, (CTR) 1992. (CTR 1239-1).
- 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, (CTR) 1992. (CTR 1239-2).
- 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, (CTR) 1992. (CTR 1239-3).
- 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, (CTR) 1992. (CTR 1239-4F).
- 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.
- David C. Cowherd, Vlad G. Perlea. “An Evaluation of Flexible Metal Pipes.” Bowser Morner Associates, Dayton, Ohio.

The MBE supersedes 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 the 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.

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.

5.3 ROLES AND RESPONSIBILITIES

5.3.1 Bridge Owners

Bridge Owners in Nebraska include the Nebraska Department of Roads, 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 the original Load Rating Summary Sheet to NDOR and ensure a copy of the same is accessible to determine load capacities and postings.
- Having the bridge properly posted, if posting is required. Posting signs must be installed as soon as practical, but no later than **60 days** of receipt of the LRSS.
- Providing documentation of revised load posting to NDOR no later than **60 days** after the load posting signs are installed.
- Ensuring new bridges are placed into the Bridge Inventory and that the data and load rating are submitted to NDOR prior to the bridge being opened to public traffic.
- Maintaining complete bridge records in their local office (bridge record details are covered in the Bridge Record Chapter).
- Completing, or causing to be completed, Quality Control (QC) of the load ratings done for bridges under their authority.
- Closing their bridges and maintaining the bridge closure barricades if the bridge is closed for critical findings or due to the current load rating of less than 3 Tons, operating level.

Bridge Owners and their consultants are responsible for determining when a bridge must be re-rated. Load ratings must be submitted to the Owner and NDOR within **60 days** of the date of bridge inspection. It is preferred that load ratings are submitted as soon as they have been completed after the bridge inspection.

5.3.2 Nebraska Department of Roads

NDOR 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.

NDOR has set policy for bridge posting.

NDOR is the repository of bridge data including bridge plans, pictures and other records. This repository does not constitute the Bridge Owner's official bridge file.

NDOR is responsible for completing Quality Assurance (QA) on the data provided for the National Bridge Inventory by the Bridge Owners for compliance with Federal regulations.

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 NDOR 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 higher 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 Rating for Bridge Owners

Consultants are responsible for being familiar with NDOR Bridge Inspection Program policies and procedures. Consultants performing load ratings for Bridge Owners are responsible for Quality Control (QC) on their work for accuracy and completeness.

5.4 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 covering Owner's records.

NDOR 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 and inspection photos. NDOR can only accept plans in electronic format for inclusion in the archive.

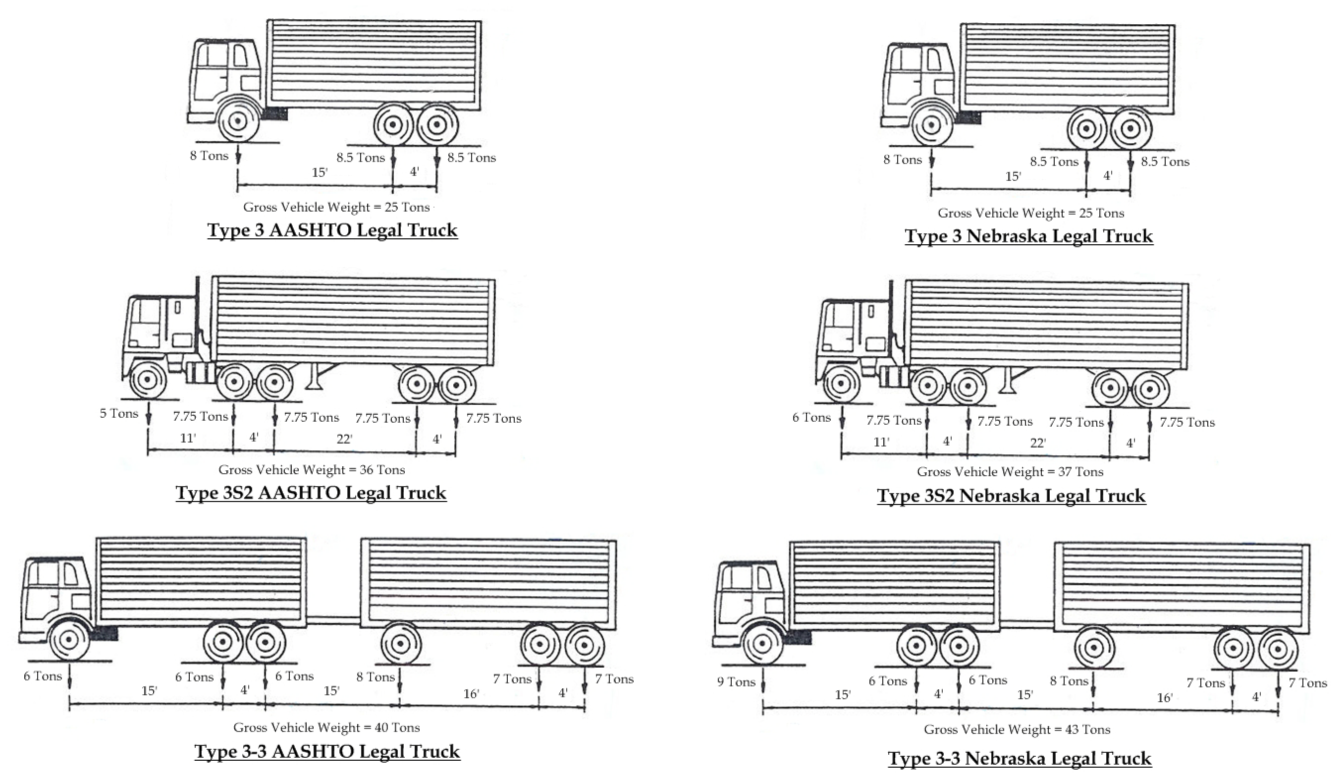
As of the issuance of this Manual, only NDOR personnel are able to retrieve information from the BDMS. Bridge Owners and their consultants should contact the Bridge Division regarding availability of data for their bridges in the BDMS.

5.5 NEBRASKA LEGAL TRUCKS AND AASHTO TRUCKS

Load ratings are normally completed for three types of trucks as well as for design loading as required by AASHTO. Sometimes, other types of vehicles are used to load rate a bridge; for example, if a special permit load to transport a heavy load is used, and has a unique axle spacing.

AASHTO requires that load ratings be completed with the AASHTO standard rating vehicles as well as for AASHTO design live loads. Design live loads typically are larger than actual vehicles in use on the road. See the AASHTO Manual for design live load information.

Load rating vehicles are representative of trucks typically using roads in the United States. Each state determines by statue the maximum legal axle weight and spacing for vehicles in their particular state. The following figure shows the AASHTO rating vehicles on the left. The Nebraska load rating vehicles are shown on the right and show the Nebraska legal truck axle weights determined by Nebraska statute.



AASHTO LEGAL TRUCKS **NEBRASKA LEGAL TRUCKS**

These photos generally depict the configuration of each Legal truck.

NE Type 3

NE Type 3S2

NE Type 3-3

5.6 BRIDGE LOAD POSTING

5.6.1 General

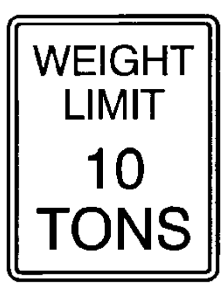
The Bridge Owner must have a current load rating in the bridge files at the Owner's office. The load rating shall be prepared by a Load Rating Engineer and documented on the Load Rating Summary Sheet which shall be accessible to determine load capacities and postings.

As a general rule, bridges capable of carrying Nebraska legal truck loads do not require posting. A bridge shall be load posted as determined by the LRE where the Load Rating Summary Sheet show Operating Level load rating values less than Nebraska legal weights for the Type 3 (25 Tons), Type N3S2 (37 Tons), and Type N3-3 (43 Tons). All bridges requiring posting shall be posted at the Operating Level or below. All bridges rated less than 3 Tons shall be closed and barricaded to all traffic.

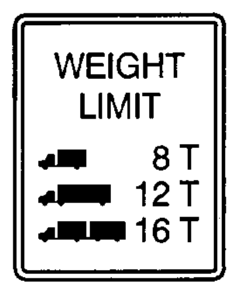
Bridge Owners or their consultant LRE are responsible for reviewing inspection reports and assessing the structures regarding the need to revise the load rating. The LRE notifies the Bridge Owners if a structure's load rating indicates load posting is required or if the bridge should be closed due to the load rating.

NDOR requires that signs be installed as soon as practical, but no later than **60 days** of the date of receipt of the LRSS. Furthermore, it is required that the Owner provide written notification to the NDOR Program Manager that the posting has been completed within **60 days** of the installation of the signs.

5.6.2 Bridge Posted Weight Limit Signing



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.

NDOR highly recommends that Bridge Owners use the R12-5 sign showing three truck-posting for **all** structures that require load posting. The R12-1 single limit sign, which would show the lowest tonnage truck, unnecessarily limits the use of the structure.

Weight limit signs should be installed in accordance with the Manual of Uniform Traffic Control Devices. NDOR also recommends that advance notice signs be installed at the intersections closest to the load posted bridge.

5.6.3 Data from the Load Rating Summary Sheet

The following figure is a part of the Load Rating Summary Sheet.

Nebraska Department of Roads - Bridge Division

Load Rating Summary Sheet

Analyst

State Bridge Number | Analysis Date

County Bridge Number | Year Built

Structure Type | Year Reconstructed

Highway System | Design Load

NBI Rating Factor Summary (HS or HL93):
Inventory Capacity | Operating Capacity

Legal Truck Summary:
Type 3 (Tons) | Type 3S2 (Tons) | Type 3-3 (Tons)

Recommended Posting Summary:
Type 3 (Tons/NA) | Type 3S2 (Tons/NA) | Type 3-3 (Tons/NA)
Posting is required for capacities less than 25T, 37T, and 43T respectively. Gross Posting should be avoided.

Permit Load Summary:
Type 3 (Tons) | Type 3S2 (Tons) | Type 3-3 (Tons)
For permitting purposes only, capacity based on a single lane distribution factor with no impact. *Condition code(s) too low.
No other vehicles are to be allowed on the bridge, crawl speeds less than 5 mph, and no gear shifting or braking, are to be strictly observed

If values shown in the box "Recommended Posting Summary" are less than the Gross vehicle weight for the Nebraska trucks (Type 3 = 25 Tons, Type N3S2 = 37 Tons, and Type N3-3 = 43 Tons) then the bridge must be load posted.

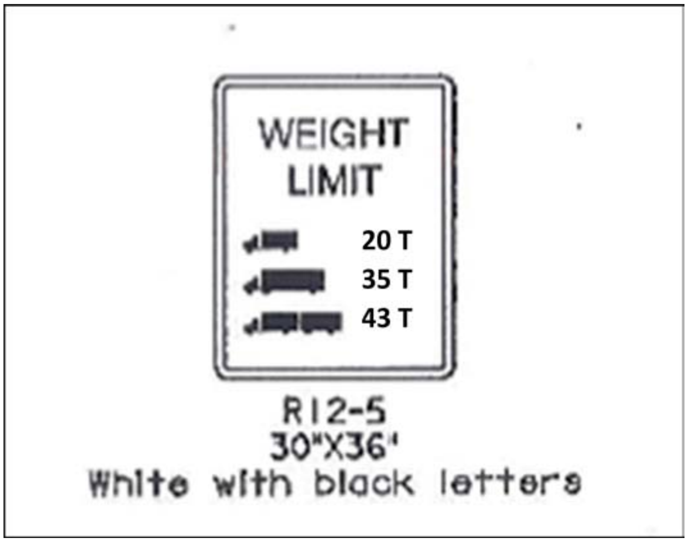
The Owner shall not load post a bridge higher than values shown in the box "Recommended Posting Summary" which was determined by the LRE.

If the values shown in the box "Recommended Posting Summary" are more than the Gross vehicle weight for the Nebraska trucks, no load posting is required.

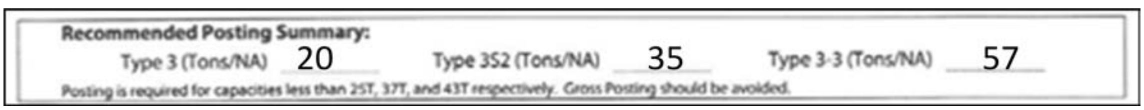
A value of "NA" indicates that the posting is not required for that specific truck; thus, if "NA" is shown for a truck, then for that truck, the gross vehicle weight for the Nebraska Legal weight should be on the sign.

Example: Calculated load rating exceeds NE Legal limit for some, but not all trucks


Recommended Posting Summary:
Type 3 (Tons/NA) 20 Type 3S2 (Tons/NA) 35 Type 3-3 (Tons/NA) 57
Posting is required for capacities less than 25T, 37T, and 43T respectively. Gross Posting should be avoided.



Example: Local Road, Owner desires to single post


Recommended Posting Summary:
Type 3 (Tons/NA) 20 Type 3S2 (Tons/NA) 35 Type 3-3 (Tons/NA) 57
Posting is required for capacities less than 25T, 37T, and 43T respectively. Gross Posting should be avoided.

5.7 SITUATIONS REQUIRING LOAD RATING

5.7.1 New Bridges

All new bridges shall be load rated prior to opening to public traffic.

5.7.2 Retrofit Bridges

Existing bridges that have been physically altered, for example, by a widening or a deck replacement that changes the original deck width or thickness, must be rerated.

5.7.3 Rehabilitated Bridges

Existing bridges that have been repaired to address a critical finding or a repair finding, or modified must be assessed by a Load Rating Engineer to determine need for rerating.

5.7.4 Change in Bridge Physical Condition

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 for possible rerating.

5.7.5 Change in Condition for Deck, Superstructure, Substructure or Culvert

The following drops in condition rating (Item 58 Deck, Item 59 Superstructure, or Item 60 Substructure, Item 62 Culverts) may trigger a new load rating.

- Condition rating drops from 5, Fair Condition to 4, Poor Condition;
- Condition rating drops from 4, Poor Condition to 3, Serious Condition.

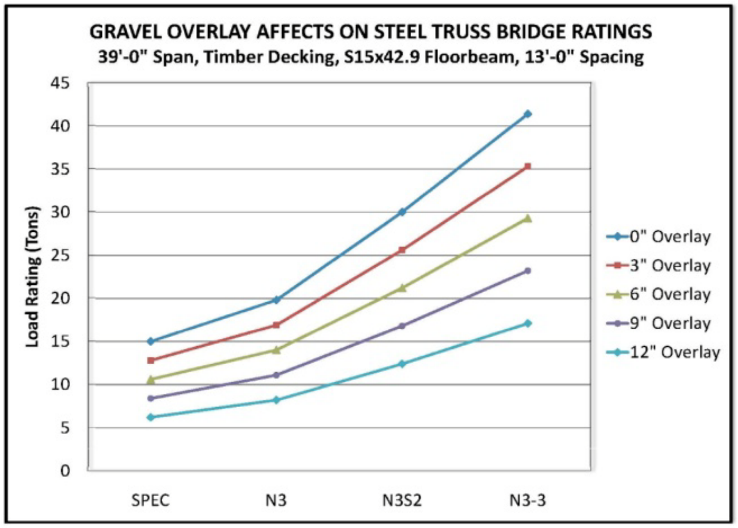
These structures must be reviewed and assess by a LRE for possible rerating.

Note that when a bridge inspection results in the condition rating (Item 58 Deck, Item 59 Superstructure Item 60 Substructure, or Item 62 Culvert) of 2 or less, the structure must be closed to traffic.

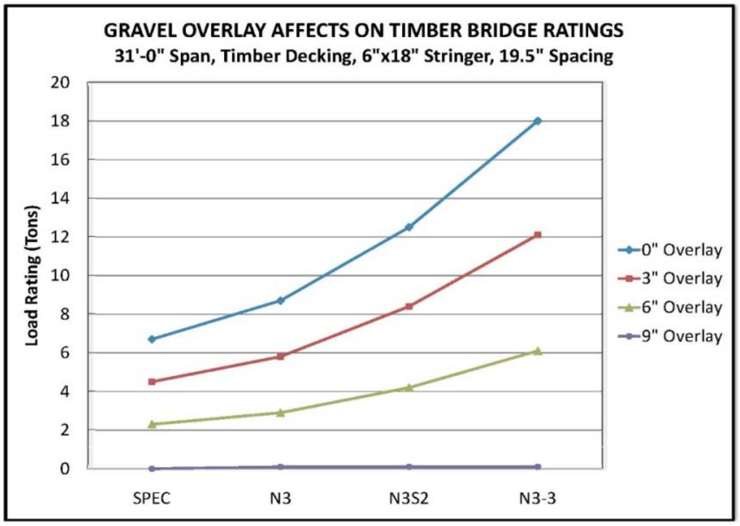
5.7.6 Change in Overburden Dead Load

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 graphics, for illustrative purposes only, show the dramatic reduction in available capacity with increasing thickness of gravel overburden for various structure types typical in rural Nebraska. The Special Vehicle shown in the graphs that follow 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

5.8 INVENTORY ITEMS RELATED TO DESIGN LOAD, RATING AND POSTING

The LRE determines the values shown in the following table as well as Permit loads for the three legal trucks in Nebraska. All values are reported on the LRSS.

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 Pontis when changed
P = prepared by

Item No.	Item Name	Static/ Dynamic	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 (NDOR requires Rating factor)
65	Method Used To Determine Inventory Rating	D	E		P	
66	Inventory Rating	D	E		P	Calculated (NDOR requires Rating factor)
70	Bridge Posting	D	E		P	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		E			No longer used in the NE Inventory
385	HS Operating Rating		E			No longer used in the NE Inventory
386A	Calculated Load Rating for NE Legal truck, Type 3	D	E		P	Calculated for current bridge condition
386B	Calculated Load Rating for NE Legal truck, Type 3S2	D	E		P	Calculated for current bridge condition
386C	Calculated Load Rating for NE Legal truck, Type 3-3	D	E		P	Calculated for current bridge condition

5.9 LOAD RATING CALCULATION OR DETERMINATION

5.9.1 FHWA Requirements

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 had been revised in 2004 to allow reporting of rating factors for all rating methods (Load and Resistance Factor, Load Factor and Allowable Stress). Beginning in 2012, NDOR will be reporting rating factors to FHWA ratings.

FHWA further made revisions to Coding for several items; see FHWA Memorandum *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.*

5.9.2 Load Rating Vehicles

Illustrations of the Nebraska Legal Trucks and the AASHTO truck are shown previously in this Chapter. These illustrations show the axle spacing and axle loads.

Vehicle Type	Type	NE ID for load rating	AASHTO Weight	Nebraska Legal Weight	Wheel Load (half axle)
H20	Design		20 Tons	na	16,000 lbs
HS20	Design		36 Tons	na	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*
HL-93	Design		36 Tons***	na	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 and Operating load ratings must be calculated for the Nebraska Legal trucks for Type 3, Type N3S2 and Type N3-3 trucks for multiple lanes (where applicable) and impact. Wheel loads for analysis shall be equal to half of the axle load for a given truck.

Permit Load ratings are based on Operating Level and are calculated for NE legal trucks in a single lane with no impact. An additional analysis should be done with this load. If completed with LARS for non-state bridges, the LRE should submit the LARS files to

NDOR. Permit Load Summary load ratings are shown on the LRSS, and are not reported in the Nebraska Inventory.

5.10 LOAD RATING DOCUMENTATION AND SUMMARY

It is important that the documentation of the load rating for each bridge is a complete record of the load rating and 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.

All load rating documentation will be initialed by the LRE, dated, and include the NE PE number; this includes the electronic file(s) used to perform the analysis.

5.10.1 Load Rating Record Contents

Load rating records at a minimum shall include the following:

- Load Rating Summary Sheet, the original signed by the Load Rating Engineer retained in the Bridge Owner's bridge record;
- The inspection report showing the inspection date and the condition that generated the need for rerating;
- Calculations and documentation of values used in the load rating such as live load distribution factors and dead load values;
- Documentation of section reduction for members, if taken;
- Bridge load rating software input and output documentation in permanent format such as hard copy or pdf.

5.10.2 Load Rating Summary Sheet

All Nebraska bridges in the Bridge Inventory that are reported to FHWA will have a Load Rating Summary Sheet. The LRSS includes a summary of the load rating results for AASHTO load, Nebraska legal trucks (posting and permitting) 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. An example LRSS is in the Appendix. Instructions for completing the Summary Sheet are provided with the form; additional guidance is given in this section.

The Load Rating Engineer must affix their stamp and sign the original Summary Sheet, and submit the originally signed document to the Bridge Owner. A copy must be furnished to NDOR either by the Owner or, at the direction of the Owner, the LRE.

5.10.2.1 Analyst

The Analyst field on this Summary Sheet shall be the Load Rating Engineer's Nebraska license number; these are typically four or five digit numbers. Do not include the "E" that precedes the PE license number as shown on the license or in Nebraska Board for Technical Registration listings.

5.10.2.2 Additional Comments Section

The purpose of the Additional Comments section of the Summary Sheet 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:

- Notation if the load rating was completed with the bracing by concrete or timber deck;
- 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 concrete deck;
- The effect of gusset plates in the structure on the load rating, especially if they govern the load rating;
- The version of LARS used to perform the load rating;
- The names of the LARS files for the load rating, including file names for structures with steel and timber LARS files;
- The controlling element of the load rating and associated key points;
- Recommendation to improve the load rating;
- Documentation of critical findings and/or maintenance issues;
- Date of inspection report documenting the condition that generated the need for rerating.

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 Ton for truck Types 3, N3S2 and N3-3, respectively.”
- “The calculated bridge load rating is shown above, and is greater than the legal limits for Nebraska Legal trucks; load posting is not required.”
- “The calculated bridge load rating is shown above, and is lower than the legal limits for Nebraska Legal trucks; load posting is required.”
- “The calculated bridge load rating 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 calculated load rating is shown above and the bridge needs to be load posted accordingly.”;
- “Based on a thorough review of the inspection report dated mm/dd/yy, the beam’s unbraced length is reduced by one-half in accordance with the Bracing by Deck Policy. A 12-month special inspection interval is required until such time as corrective action is taken for the bracing or verification of existing bracing is provided by the Owner. Future inspections shall include specific comments as to the observed lateral stability of all beams, and that all requirements for implementation of this policy are still applicable.”

5.10.3 Load Rating Means – General Guidance

The following table is a compilation of rating methodology generally used by NDOR for load rating of bridges and is provided as guidance for those performing load ratings. The Load Rating Engineer of record for any bridge is responsible for using good engineering judgment in the selection of the appropriate load rating methodology.

General Guidance on Load Rating Means	
Superstructure Element	
Concrete slab, simple and continuous	Rating software (LARS, Virtis, etc.)
Concrete girder, CIP, simple and continuous	Rating software (LARS, Virtis, etc.)
PS Concrete slab, continuous	Structural analysis software or other custom tools
PS Concrete NU or AASHTO girder, simple and continuous	Rating software (LARS, Virtis, etc.)
PS Concrete IT girder, simple and continuous	Rating software (LARS, Virtis, etc.)
PS Concrete double tee beam	Rating software (LARS, Virtis, etc.)
PS Concrete, hollow core slab	Rating software (LARS, Virtis, etc.)
Steel, rolled beam stringer, simple or continuous	Rating software (LARS, Virtis, etc.)
Steel, plate girder, simple or continuous	Rating software (LARS, Virtis, etc.)
Steel, truss	Rating software (LARS, Virtis, etc.)
Timber, stringer	Rating software (LARS, Virtis, etc.)
Steel culverts	NDOR provided spreadsheet
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	Structural analysis software or other custom tools
Concrete floor beams transverse to traffic	Structural analysis software or other custom tools
Substructure elements	Structural analysis software or other custom tools

5.10.4 Software

Load ratings completed with software must be completely and permanently documented. Permanent records should be hard-copy and/or electronic documents. The date of the rating should be included in the input files and output files of software-generated ratings.

NDOR uses Bentley LARS software for bridge ratings on state bridges because it is compatible with Bentley Superload software used for permitting over-sized vehicles.

NDOR prefers that other Bridge Owners and their Consultants use LARS bridge rating software to maintain the uniformity of the Nebraska Bridge Inventory database and to assist counties and municipalities with the load permitting process.

LARS documentation for specifics customization sheeting used by NDOR is provided in the Appendix of this Manual. Bridges that have multiple spans of differing materials (steel and timber) are very common. Bridges that have multiple simple spans of the same material should be included in the same LARS file. For bridges with steel and timber spans, two LARS files will be included in the records. It is recommended that the LARS file for steel be named with the structure number followed by the letter “S”. Likewise, the file for the timber span(s) should be named with the structure number followed by the letter “T”.

5.10.5 Load Rating Methods

The following is a brief summary of load rating methods.

5.10.5.1 Allowable Stress Rating (ASR)

Allowable stress method compares unfactored load effects and stresses to an allowable stress for a given material in accordance with the MBE. The policy of NDOR is to use the AS method only on timber and masonry elements.

5.10.5.2 Load Factor Rating (LFR)

Load Factor 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. The policy of NDOR is to use LF for steel and concrete elements.

5.10.5.3 Load and Resistance Factor Rating (LRFR)

Load and Resistance Factor method compares factored load effects to the resistance of a member of a given material in accordance with the MBE LRFR. FHWA will require that bridges and total replacement bridges designed by LRFD Specifications using HL-93, after October 1, 2010. Load Rating values are to be computed and reported to the NBI as a RF based on LRFR methods using HL-93 loading.

5.10.6 Load Rating Levels

Load rating levels are defined in the MBE and are briefly summarized in this section.

5.10.6.1 Inventory Level

The AASHTO MBE states that “inventory rating level generally corresponds to the customary 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.

5.10.6.2 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.

5.10.6.3 Posting Level

Posting Level corresponds to a load capacity selected by the governing agency for load posting bridge structures. NDOR'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.

5.10.7 Analysis Considerations

See the Material-Specific Considerations Section in this Chapter for additional information.

5.10.7.1 Span lengths

The distance between the centerlines of bearing is to be used for the span length for analysis purposes.

5.10.7.2 Bridge Cross Section and Roadway Width

A bridge with a sidewalk/shoulder without a barrier on the traffic side will be analyzed for moment capacity as though the entire bridge width were available for traffic to occupy.

5.10.7.3 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.

5.10.7.4 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.

5.10.7.5 Strength / Resistance

The evaluation of a deteriorated bridge member must use “section remaining” values in determining the most critical primary structural element.

5.10.7.6 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 Summary Sheet. See more information in the Sections of this Chapter on Material-Specific Considerations.

5.10.8 Material-Specific Considerations - Steel

5.10.8.1 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).

5.10.8.2 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.

5.10.8.3 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.

5.10.8.4 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.

5.10.8.5 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.

5.10.8.6 Shear Resistance in Steel Floor Beams, LARS

LARS software will not rate floor beams for shear at this time; however, Bentley is developing this feature. Manual calculations must be done and included in the load rating records.

5.10.8.7 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 Summary Sheet Comments, but the member may be considered effective when calculating a load rating.

Truss members may be modeled in LARS by inputting the section properties calculated manually.

5.10.8.8 Policy for Bracing by Deck

NDOR has 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, and this policy is described in this section. This policy shall expire January 1, 2012. NDOR will document and monitor those bridges that have invoked this policy in the load rating of the structure.

In the case where lateral bracing is not present, corrective action by the Bridge Owner should be completed by installing lateral bracing. The Bridge Owner can subsequently report the current bracing status and the bridge shall be rerated based on the installed lateral bracing configuration and spacing. If the Bridge Owner does not install lateral bracing for the beams by this policy’s expiration date, the structure shall be rerated without bracing. The resulting load rating will very likely be substantially reduced, or may even cause the bridge to be closed.

In the case where lateral bracing exists, the Bridge Owner shall field verify the configuration and spacing of lateral bracing, and the bridge shall be rerated.

This policy is, based on research done by the University of Texas at Austin conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration entitled "Bracing Effects of Bridge Decks", as endorsed by the University of Nebraska at Lincoln (UNL) and the National Bridge Research Organization (NaBRO). The research found that the decks typically had sufficient stiffness to force the supporting stringers to yield before buckling. Also, according to section 6.1.4 (6.1.5 in Oct 2003 Edition) of the AASHTO Manual for Condition Evaluation of Bridges (second edition), there may be instances in which the behavior of a member under traffic is not consistent with that predicted by the controlling design specification. In this situation, deviations from the controlling specifications based on the known behavior of the members under traffic may be used and should be fully documented.

NDOR's policy is that in the calculation of a load rating, the unbraced length of simple span steel girders may be reduced by one-half for steel beams meeting the following requirements. Steel spans not meeting these requirements shall be rated with the actual unbraced length.

- The bridge is a simple span steel girder design.
- The span length ≤ 40 ft.
- Deck is bearing directly on the top flange at midspan.
- At least 4 lines of girders of equal section are present.
- The actual cross section remaining is used in the computation of load capacity.
- Deck condition code (Item No 58) shall be greater than or equal to 5 (Fair).
- Superstructure condition code (Item No 59) shall be greater than or equal to 5 (Fair).

When this policy is applied to the load rating of any structure the following restrictions also apply:

- The moment capacity applied to the final load rating shall be limited to that of the factored yield moment for determining operating and inventory levels (i.e. use of plastic section capacity is prohibited).
- The routine inspection interval must be limited to no more than 12 months.
- Routine inspections shall include specific comments as to the observed lateral stability of the girders and verification that all requirements as to the implementation of this policy are still met (see policy above).
- Appropriate reference to this policy shall be made on the Load Rating Summary Sheet in the Additional Comments section. An example note is:

  > "Based on a thorough review of the mm/dd/yyyy inspection report, the beam's unbraced length is reduced by one-half in accordance with the Bracing by Concrete or Timber Deck Policy in the calculation of this load rating. A 12-month routine inspection interval is required until the Owner installs lateral

bracing. Future inspections shall include specific comments as to the observed lateral stability of all girders and that all requirements for implementation of this policy are still applicable."

5.10.9 Material-Specific Considerations - Concrete

Load ratings for concrete structures typically can be accomplished with software for the various types of beam/girder and slab type bridges on Nebraska Roads. For concrete bridges without plans, see the subsequent section.

NDOR started to use prestressed bridges in the 1960s. Concrete girder types on Nebraska bridges would include prestressed concrete AASHTO girders, NU girders, IT girders and double tee. There are some monolithically cast concrete girders in use. Slab type bridges include continuous concrete slabs, pre-cast, nonprestressed 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. Temperature and shrinkage reinforcement may be assumed as a maximum amount of steel present based on the LRE’s judgment.

5.10.10 Material-Specific Considerations - Timber

Timber is a frequently used material in the construction of floor systems of steel truss type bridges as well as in traditional longitudinal girder applications in off-system structures. 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 measurement will be required. In order to establish uniformity in the evaluation of this material, NDOR has established the following definitions, policies, guidelines and procedures.

5.10.10.1 Elements to be load rated

Timber decks and stringers must be evaluated for load capacity and will be load rated if the condition rating is less than 4.

Critical connections of timber bridges shall be evaluated only if the connections are shown to have deterioration or signs of distress.

Timber substructures shall be evaluated only if the structural elements are shown to have deterioration or signs of distress.

5.10.10.2 Timber Unit Weight

The unit weight for timber should be taken as 50 lbs per cubic foot.

5.10.10.3 Impact

Impact allowances should follow AASHTO methods and specifications.

5.10.10.4 Design Stress Values

Design stress values shall be based on species and grade as given in AASHTO (1996) when known or can be readily established. In lieu 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

5.10.10.5 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. If the timber deck condition rating is 4, the need to rate should be assessed (e.g. in the opinion of the LRE; would it govern the load rating). If the timber deck condition rating is 3, the deck must be load rated.

5.10.10.6 Lateral Bracing

Lateral bracing is not included in the evaluation of timber members as performed by LARS. The engineer performing the structural evaluation shall check the bracing conditions according to the AASHTO Guide Specifications 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:

- o The distance between the point of bearing and the first adjacent intermediate diaphragm; or
- o The diaphragm spacing.

- If the Deck condition code, Item No. 58 is > 4, the top flange of stringers may be considered laterally braced by:
  - o For concrete decks, embedment of the stringer into the concrete;
  - o For timber decks, continuous nailing of the planking into the stringer.
  - o If the above two conditions are not met 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 $F_b^* = 1050$ psi. Bending capacity at operating level shall be calculated by multiplying the final adjusted inventory capacity by 1.33.

5.10.10.7 Variable Stringer Spacing

In spans with variable stringer spacing, the live load distribution factors shall be computed based on the maximum average of the stringer spacing.

5.10.10.8 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.

5.10.10.9 Stringer Condition and Capacity Calculation

5.10.10.9.1 Cracked Stringers

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. See Figures A and B.

Shear and bending strength will be rated based on the section remaining (i.e. according to the effective section depth). Shear increase factors shall **not** be applied.

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.

5.10.10.9.2 Split Stringers

A split shall be defined as a complete separation of the wood fibers parallel to the grain direction. See Figure C.

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 shall be understood to have an effective depth equal to the larger of the depths on either side of the split. Shear increase factors shall **not** be applied.

5.10.10.9.3 Checked Stringers

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. See Figure D.

Checks in a stringer may be on either or both sides. Checks shall not be considered to affect member capacity and may be ignored.

5.10.10.9.4 Shaked Stringers

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. See Figure E.

Shakes shall **not** be considered to affect member capacity and may be ignored.

5.10.10.9.5 Knotted 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) shall be considered to affect member bending capacity according to a section remaining analysis.

5.10.10.9.6 Decay

Shear and bending strength will be rated based on the section remaining.

5.10.10.9.7 Aging

No adjustment in the allowable stresses for timber is necessary for reasons of aging alone.

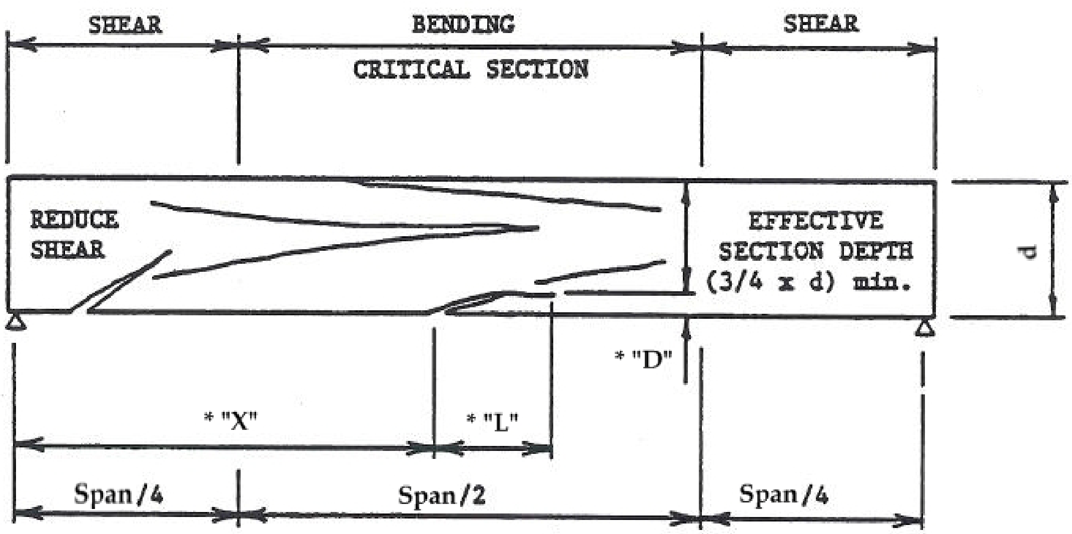
5.10.10.10 Defect modeling

Defect modeling (i.e. section remaining) is not a capability currently provided for in LARS. Modeling of the effective section capable of contributing to the resistance of applied loads within the load rating software will often be a matter of sound engineering judgment.

EVALUATING CONDITION OF TIMBER MEMBERS

BROKEN STRINGER

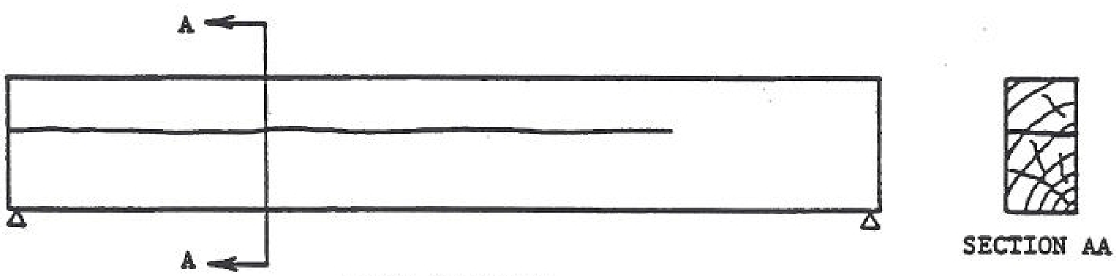
Figure A



* REQUIRES DIMENSION

CRACKED STRINGER

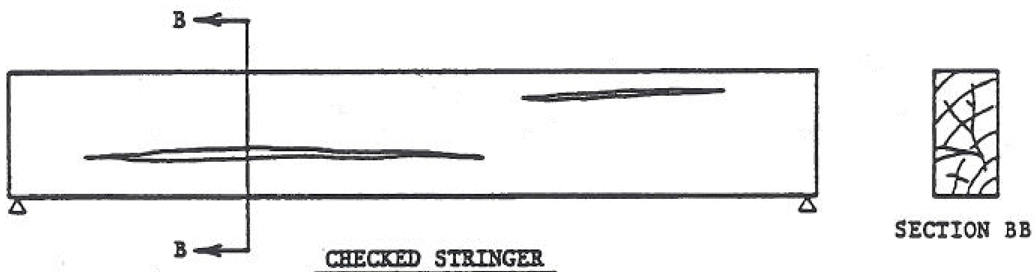
Figure B



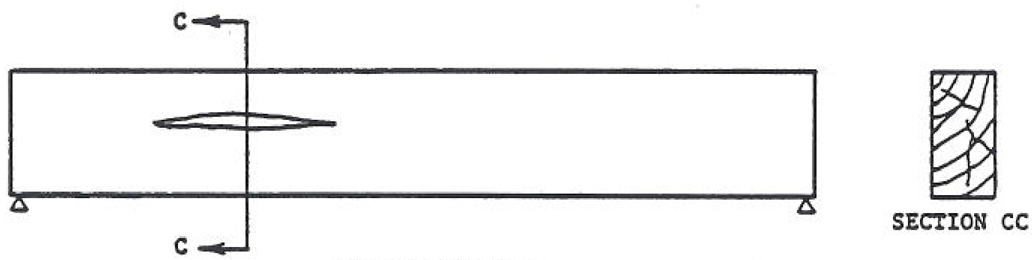
SPLIT STRINGER

Figure C

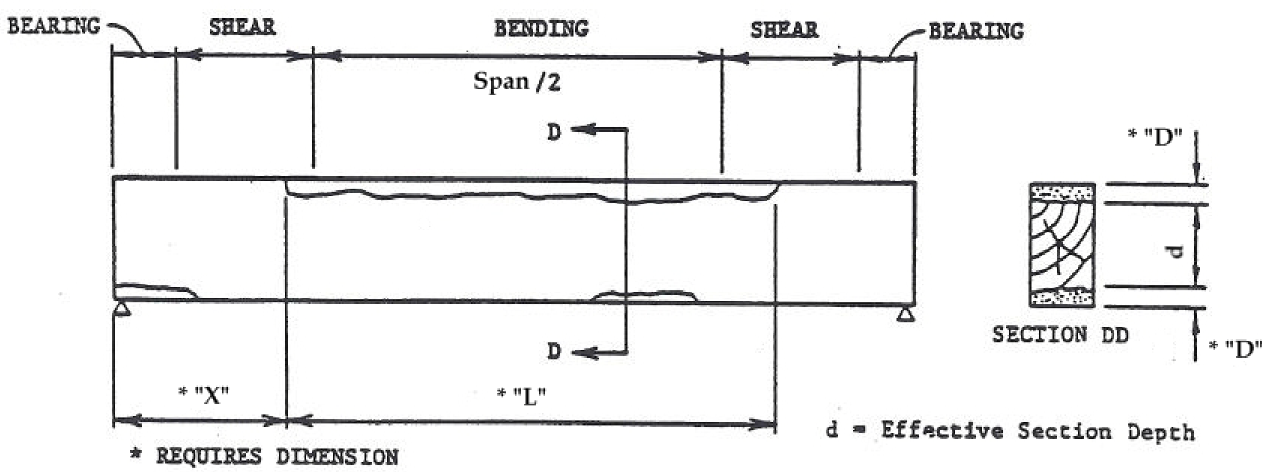
EVALUATING CONDITION OF TIMBER MEMBERS



CHECKED STRINGER
Figure D



SHAKED STRINGER
Figure E



DECAYED STRINGER
Figure F

5.10.10.11 Other

There are a few bridges in Nebraska with atypical materials, including masonry and aluminum culverts. LREs are to consult with the NDOR Bridge Inspection Program Manager for load rating these structures.

5.10.11 Load Rating for Bridges without Plans

5.10.11.1 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.

5.10.11.2 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 a LRE. NDOR, however, believes that it is not advisable to perform load tests on concrete bridges with no plans.

5.10.11.3 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's in consultation with a LRE.

5.10.11.4 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.

5.10.11.5 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 Comment section shall include a statement by the LRE. An example is:

> "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 NDOR Bridge Rating Table for Concrete Bridges with No Existing Plans."

NDOR Bridge Load Rating Table for Concrete Bridges without Plans
(Values shown in Tons. This table subject to revision at NDOR discretion.)

Struc-ture	Condition Rating	HS Operating	HS Inventory	Type 3	Type 3S2	Type 3-3
CIP Slab	Good/Fair (Code > 4)	36	26	32	47	55
	Poor (Code = 4)	28	20	25	37	43
	Serious, Critical (Code < 4)	Evaluate*	Evaluate*	< 25	< 37	< 43
CIP Box Culvert	Good/Fair (Code > 4)	36	26	32	47	55
	Poor (Code = 4)	28	20	25	37	43
	Serious, Critical (Code < 4)	Evaluate*	Evaluate*	< 25	< 37	< 43
	Good/Fair (Code > 4) +	99	99	32	47	55
CIP Frame	Good/Fair (Code > 4)	36	26	32	47	55
	Poor (Code = 4)	28	20	25	37	43
	Serious, Critical (Code < 4)	Evaluate*	Evaluate*	< 25	< 37	< 43
	Good/Fair (Code > 4) +	99	99	32	47	55

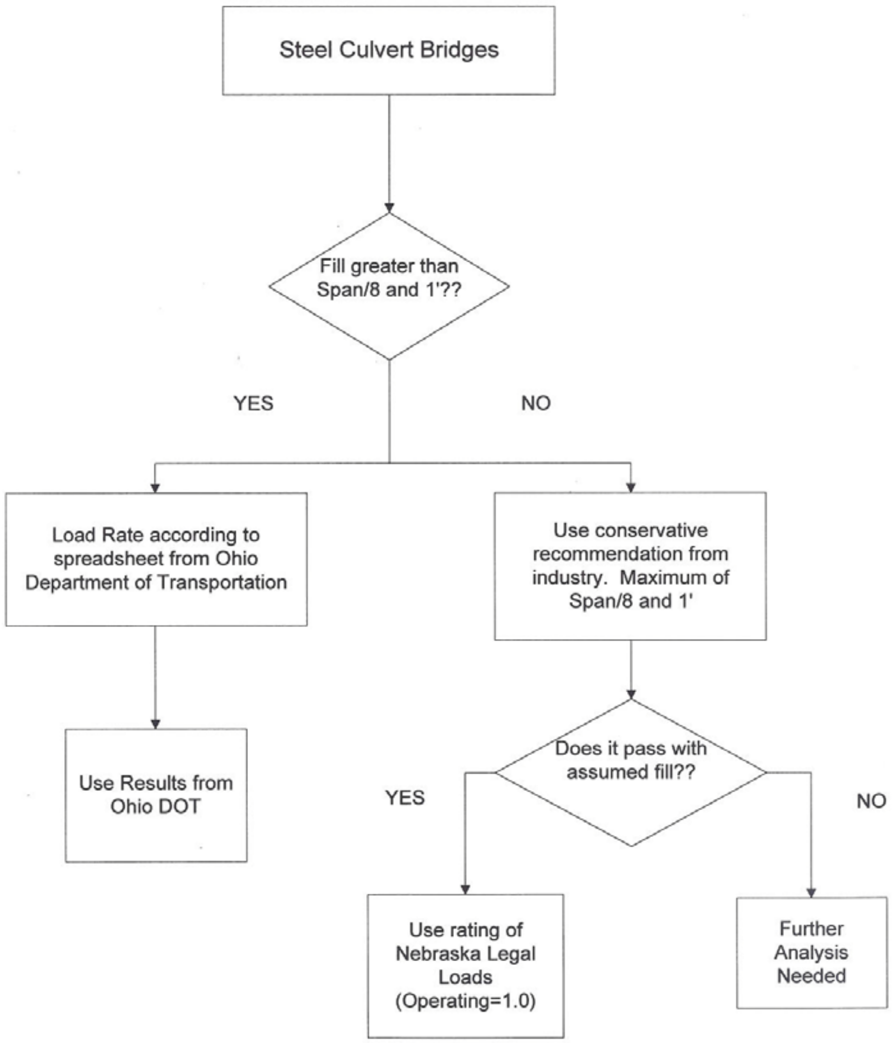
* These values must be determined by a professional engineer by evaluating the structure for condition and determining safe loads at which the bridge should be posted. Posting should be less than state legal loads for this condition rating.

\+ 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.

NDOR does not permit any bridge for which plans are not available.

5.10.12 Steel Culvert Bridges

NDOR recommends load rating steel culvert bridges based on the methodology in the NCSPA Design Data Sheet No. 19, "Load rating and structural evaluation of in-service, corrugated steel structures." Ohio Department of Transportation has developed a spreadsheet for load rating these structure based on the NCSPA method. This spreadsheet is available from NDOR. The process is described in the following flowchart.



5.11 QUALITY CONTROL

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the bridge inventory data 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. An individual of equal or better qualifications than the originator of the product shall complete Quality Control review on the work product. QC manager/engineer shall:

- See that the QC on a given document, data or calculations is completed by an individual of equivalent or better qualifications than the originator.
- See that the technical activity has followed procedures set by NDOR;
- Provide routine and consistent checks for data integrity, correctness and completeness;
- Identify and address errors and/or omission;
- Record the QC activities.

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.

5.12 QUALITY ASSURANCE

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

5.13 CHAPTER REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1

5.14 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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm for the current list of applicable forms and the most recent versions of each form.

Name	DR Form	Revision Date
Load Rating Summary Sheet	DR465	June 09
Load Rating Summary Sheet Instructions, truck configurations	na	na
Field Measurement Forms	na	na

5.15 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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm. 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.

Name	Revision Date
NDOR LARS Configuration Settings	na

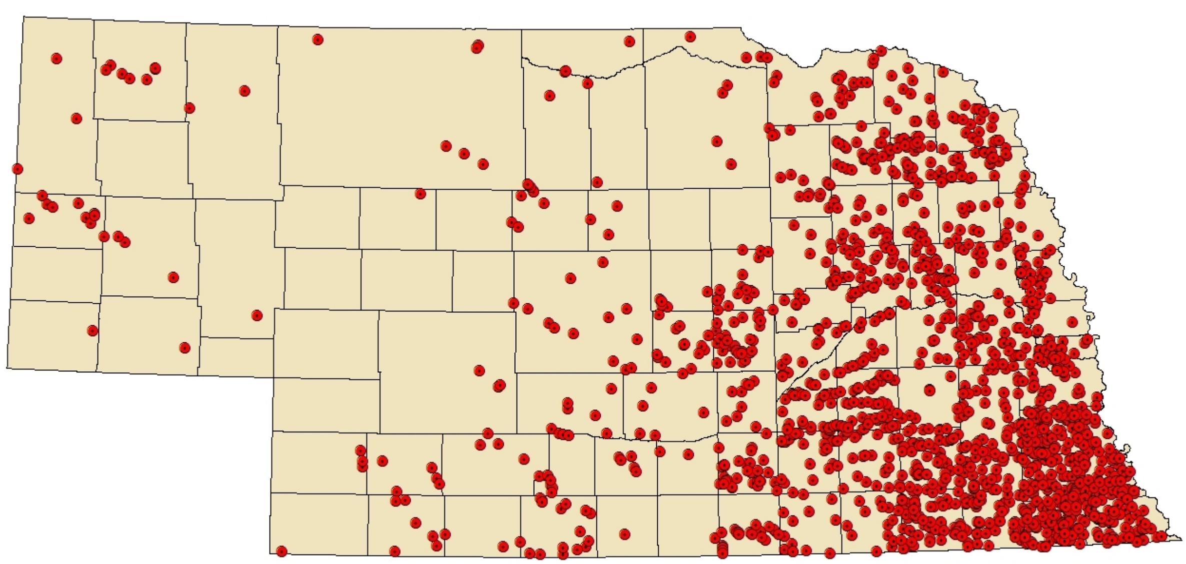
6.1 GENERAL

The purpose of this chapter of the NDOR 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 failures are floods. The removal of material from around bridge foundations (i.e. scour) is the most common cause of flood damage to bridges. 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 2010 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 and in the early 1900 many of the streams were straightened, thus steepening the stream grade and disrupting the natural gradient. Scour in stream beds in Nebraska generally takes place in sand beds at stream velocity of 5 feet/second and can scour at every storm, then as water recedes, the scour holes fill back in. Stream beds with cohesive, clay soils typical start to scour when stream velocity reaches 7 feet/second.



The need to ensure public safety, minimize cost and minimize the adverse effects resulting from bridge closures requires designing and maintaining bridge foundations to resist the effects of scour. The need to minimize future flood damage requires careful inspection of bridges for scour and scour-related behavior.

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. Bridge contraction scour, local pier/bent scour and abutment scour can be estimated and the structure and countermeasures can be designed to withstand the calculated effects. Existing bridges may not have been designed with current methods for calculating scour nor properly designed countermeasures and thus may be susceptible to damage or collapse during flood events and the resulting scour. Properly designed bridges may experience scour due to changes in channel behavior at the site. These structures must be identified and monitored in accordance with a defined POA.

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 trained bridge inspectors, para-professional bridge personnel, and hydraulic, geotechnical and structural engineers, who combine their special skills to prioritize and inspect bridges, assess channel behavior and evaluate the structures for scour.

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.

6.2 REFERENCES

The information in this Bridge Inspection Program Manual supplements the information in these references.

- AASHTO. *Manual for Bridge Evaluation*. First Edition, 2008. (MBE)
- FHWA. *Technical Advisory T5140.23, Evaluating Scour at Bridges*. October 28, 1991.
- FHWA. *Bridge Inspector's Reference Manual*. NH103-001, Vols. 1 and 2. October 2002; Revised 2006.
- 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.
- FHWA. *Evaluating Scour at Bridges*. Hydraulic Engineering Circular, No. 18 (HEC 18), 4th Edition. Publication No. FHWA-NHI-01-001. May 2001 with Errata, September 6, 2001.
- FHWA. *Stream Stability at Highway Structures.* Hydraulic Engineering Circular, No. 20 (HEC 20), 3rd Edition. Publication No. FHWA-NHI-01-002. March 2001. Errata September 6, 2007.
- FHWA. *Bridge Scour and Stream Instability Countermeasures, Experience, Selection and Design Guidance Second Edition*. Hydraulic Engineering Circular, No. 23 (HEC 23). Publication No. FHWA-NHI-01-003. 2001, with Errata September 6, 2001.
- FHWA. *Revision of Coding Guide, Item 113 – Scour Critical Bridges*. Memorandum HIBT-30. April 27, 2001.
- FHWA. *Compliance with the National Bridge Inspection Standards – Plan of Action for Scour Critical Bridges*. Memorandum HIBT-20. March 29, 2005.

- FHWA. *National Bridge Inspection Standards – Scour Evaluations and Plans of Action for Scour Critical Bridges*. Memorandum HIBT-20. January 4, 2008.
- FHWA. Technical Guidance for Bridges over Waterways with Unknown Foundations. Memorandum HIBT-20. January 9, 2008.
- FHWA. *Scourability of Rock Formations*. Memorandum HNG-31. July 19, 1991.
- FHWA. *Frequently Asked Questions – Bridges Over Waterways with Unknown Foundations*. Memorandum HIBT-20. June 3, 2009.
- FHWA. *Additional Guidance for Assessment of Bridges Over Waterways with Unknown Foundations.* Memorandum HIBT-20. October 29, 2009.
- NDOR. *Hydraulic Assessment Guidelines.* 2009, or current version.

The MBE supersedes 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 the 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.

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.

6.3 ROLES AND RESPONSIBILITIES

6.3.1 Bridge Owners

Bridge Owners in Nebraska include the Nebraska Department of Roads, cities, municipalities and counties.

Bridge Owners are responsible for:

- Ensuring the bridges under their authority are evaluated for potential scour;
- Ensuring that scour critical bridges under their authority have a Plan of Action;
- Monitoring scour critical bridges and updating the POA, including maintenance of scour countermeasures.
- Completing, or causing to be completed, Quality Control (QC) of the scour assessments and POAs for bridges under their authority.
- Maintaining current scour assessments/evaluations and POA for their scour critical bridges.
- Ensuring scour documentation is kept in the Bridge Owner's bridge file.
- Maintaining a master list of all scour critical bridges.
- Maintaining design data and plans for scour countermeasures.
- Providing a scour evaluation that defines the scour NBI Item 113 code for new bridge construction and retaining in individual bridge record.
- Documenting visual inspections, including necessary measurements and photographs of scour mitigation, stream channel in the vicinity of the bridge, bridge substructure elements and approach embankments must be retained in the individual bridge files.
- Reporting changes to stream, scour mitigation, bridge substructure elements or roadway embankments to the NDOR, including updated Item 300 series.
- Maintain a log documenting the POA monitoring activities and actions taken.

6.3.2 Nebraska Department of Roads

NDOR 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 evaluation completed and NBI Item 113 coded correctly;
- Ensuring that all scour critical bridges have POAs developed and implemented.
- Reviewing all bridge inspections for Item 358, and 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 NDOR 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 NDOR.

6.3.4 Hydraulic Engineer

The Hydraulic Engineer (HE) leads the Interdisciplinary Scour Assessment Team and signs the Scour Assessment Report.

6.4 QUALIFICATIONS

The NBIS qualification requirements and NDOR qualification requirements are described in Chapter 1 of this Manual.

NDOR requires that engineers performing hydraulic assessment of structures and approving POAs be experienced hydraulic engineers and registered professional engineers in Nebraska. It is recommended but not required that HEs completing hydraulic assessments be NDOR Certified bridge inspection Team Leaders.

NDOR recommends that individuals monitoring bridges during or after flood events are either a Hydraulic Engineer or an NDOR Certified Bridge inspection Team Leader.

6.5 CHANNEL BEHAVIOR

6.5.1 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. 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.

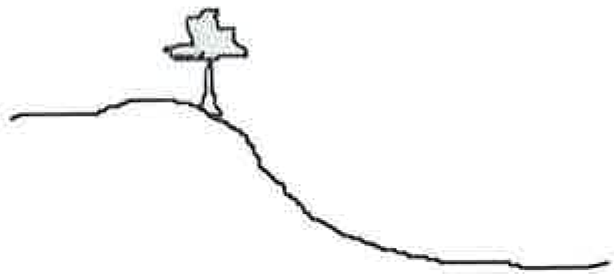
These six stages of development are used to understand how the channel adjusts when it is subjected to man-made alterations. They are described in the table below and shown with illustrations and photos on the following pages. A glossary of channel element and behavior terms can be found as an Appendix 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, degrading progresses in an upstream direction with a progression of headcuts. Bank heights increase and bank slopes become steeper.
IV	THRESHOLD	At this time Degradation is ending, headcuts are not 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

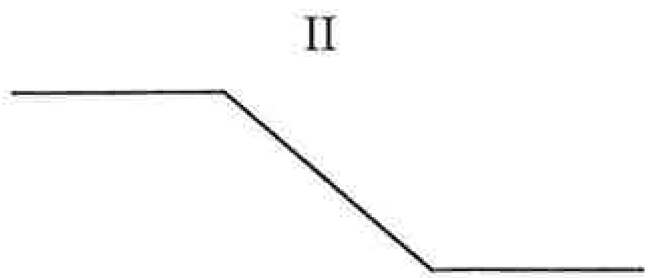
- Stable
- vegetated banks to flow line
- Sediment transport
- Convex top bank shape
- Relatively shallow channel depths
- Meandering channel

I



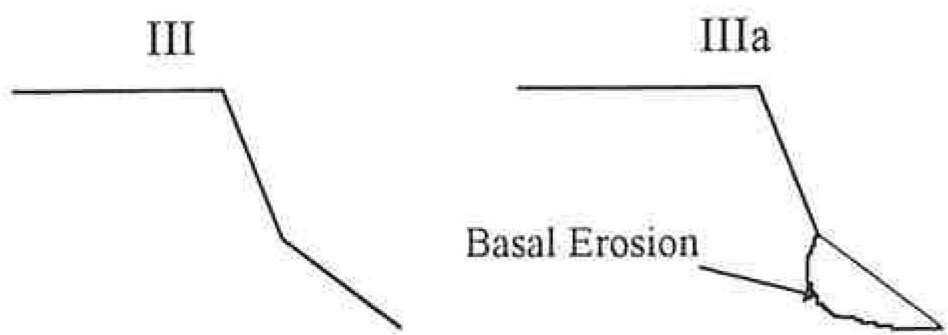
Stage II, Constructed (Modified) Characteristics

- Trapezoidal cross section
- Linear bank surfaces
- Removal of vegetation



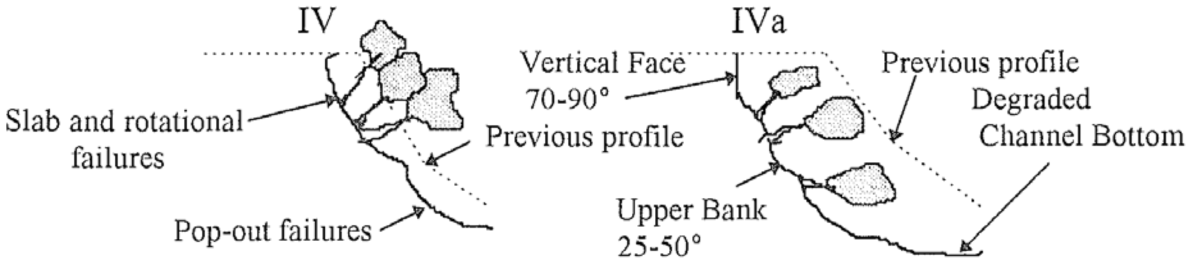
Stage III, Degradation Stage Characteristics

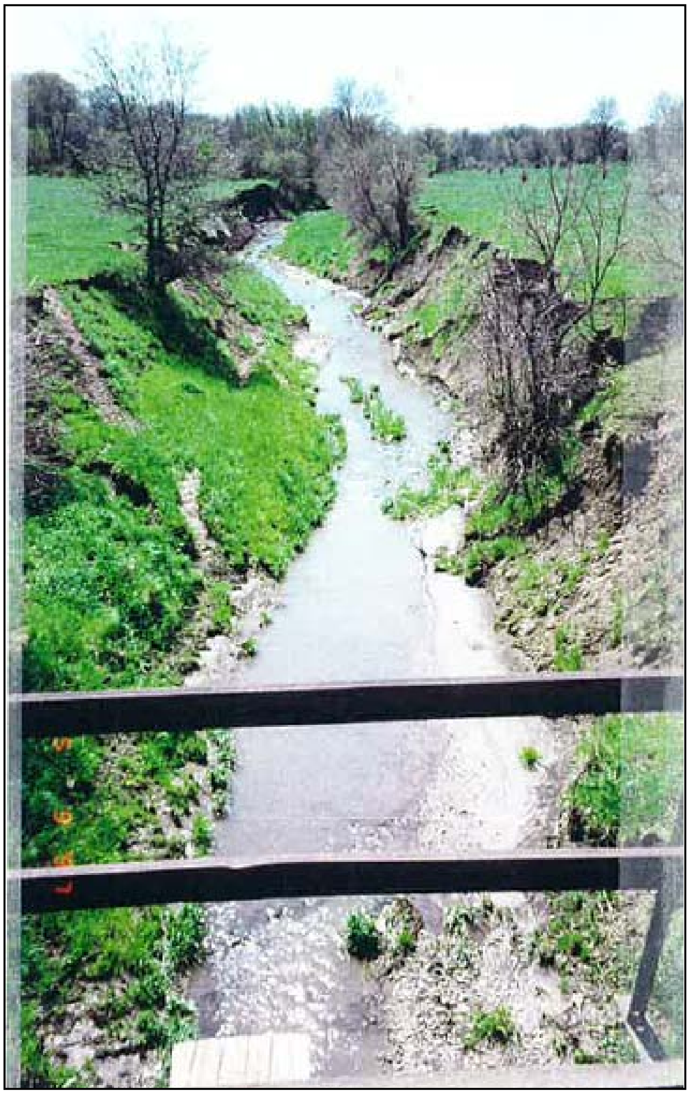
- Basal erosion on banks
- Pop-out failures
- Heightened and steepened stream bank surfaces
- Head cuts
- Channel depth increasing
- Vegetation height relative to flow line and may lean to channel



Stage IV, Threshold Characteristics

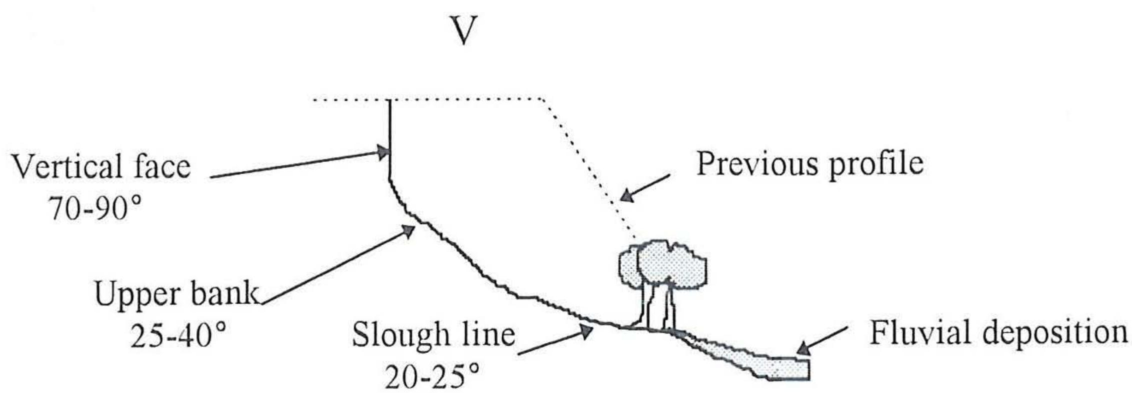
- Degradation continues
- Basal erosion on banks
- Slab, rotational and pop-out failures
- Bank retreat
- Vertical face on upper bank surfaces
- Some reduction in bank angles
- Flow line very low relative to top bank
- Tilted and failed vegetation





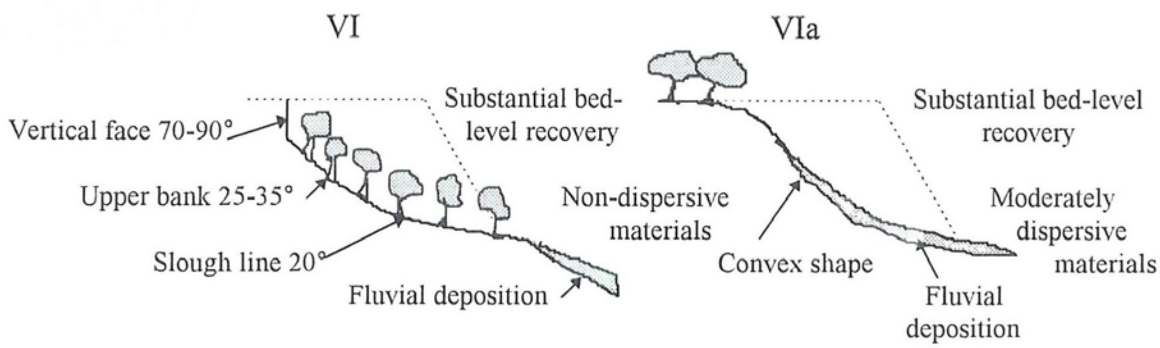
Stage V, Aggradation Stage, Characteristics

- 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	------

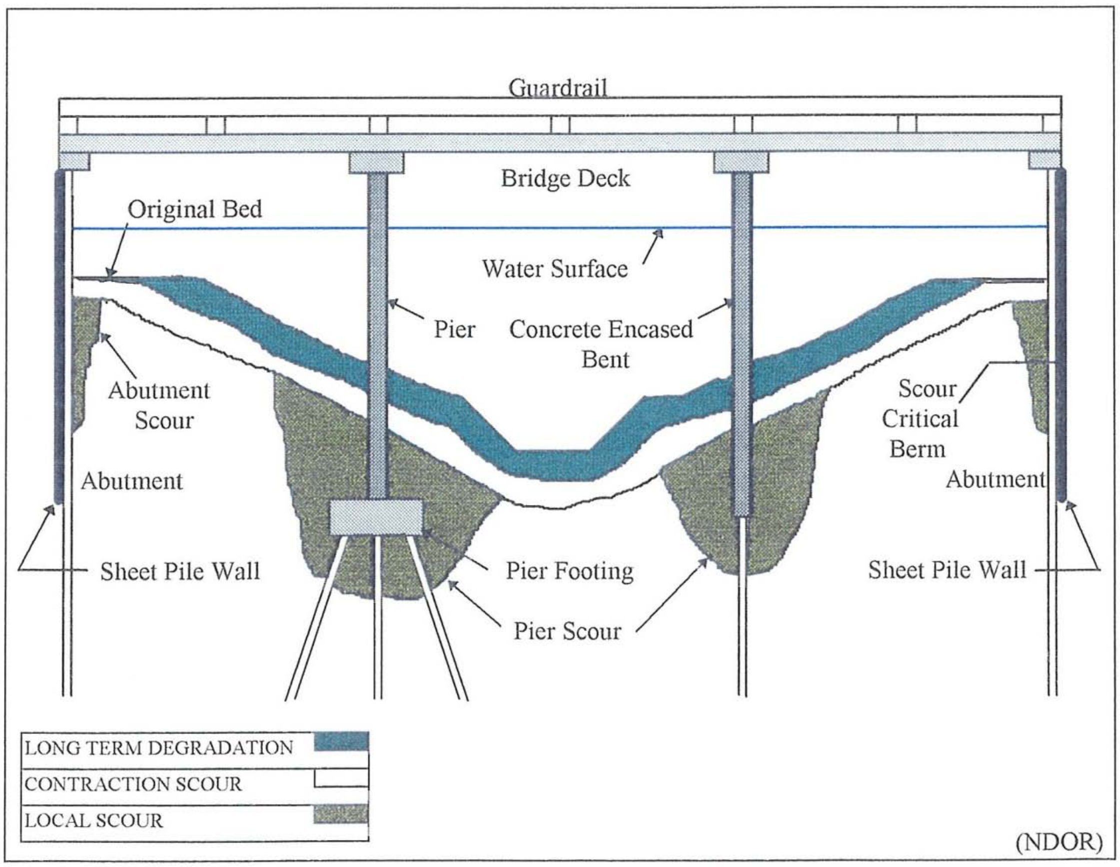
6.5.2 Bridge Scour - General

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.



Aggradation and degradation is the long term change in stream bed elevation. Aggradation adds material to the bed elevation, degradation removes it. It is estimated by comparing stream cross-section profiles over time.

Contraction scour is the removal of bed material across most of all of the width of the channel. It is caused by:

- natural stream constrictions
- contraction of flow by bridge or approaches
- islands, bars, berms, ice, debris, or vegetation
- change in downstream control

Local scour is the removal of bed material from a small part of the channel. It occurs at an obstruction such as a pier, abutment, embankment, etc. It is caused by the acceleration of flow and vortex development resulting from the impact of the flow with these obstructions.

Rivers are in a constant state of change. A shift in the meander of the stream near a bridge may erode the approach or change the total scour because of the change in the attack angle.

6.5.3 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 at a site eroded from the watershed upstream of the site. Degradation involves the lowering or scouring 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 in a watershed and 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; and
- 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.

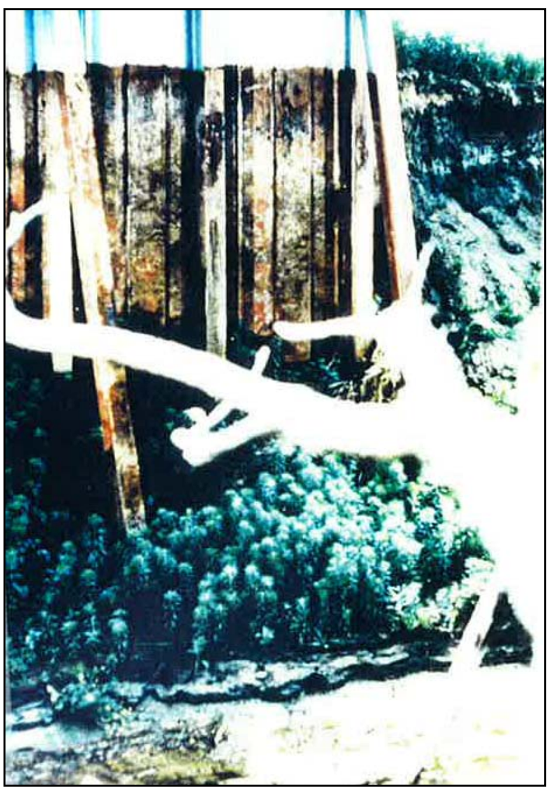
Natural meander cutoff and straightened channel

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

Degradation can undermine substructures as shown in the following photos showing bent and abutment.

Undermining at a bridge bent



Undermining at a bridge abutment

Aggradation is the result of sediment depositing along the lower downstream reaches that has eroded from upstream degrading reaches. It results in a loss of channel capacity which in turn increases the frequency of flooding and the magnitudes of peak flows (see the following photo).

Bridge opening partially silted shut from aggradation

6.5.4 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 or when overbank (floodwaters) are forced through the bridge.

For the majority of main channel bridges, the scour hole will silt in after the flood waters recede unless soil conditions prevent re-silting. 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 will remain visible after flood events (see the following photo).

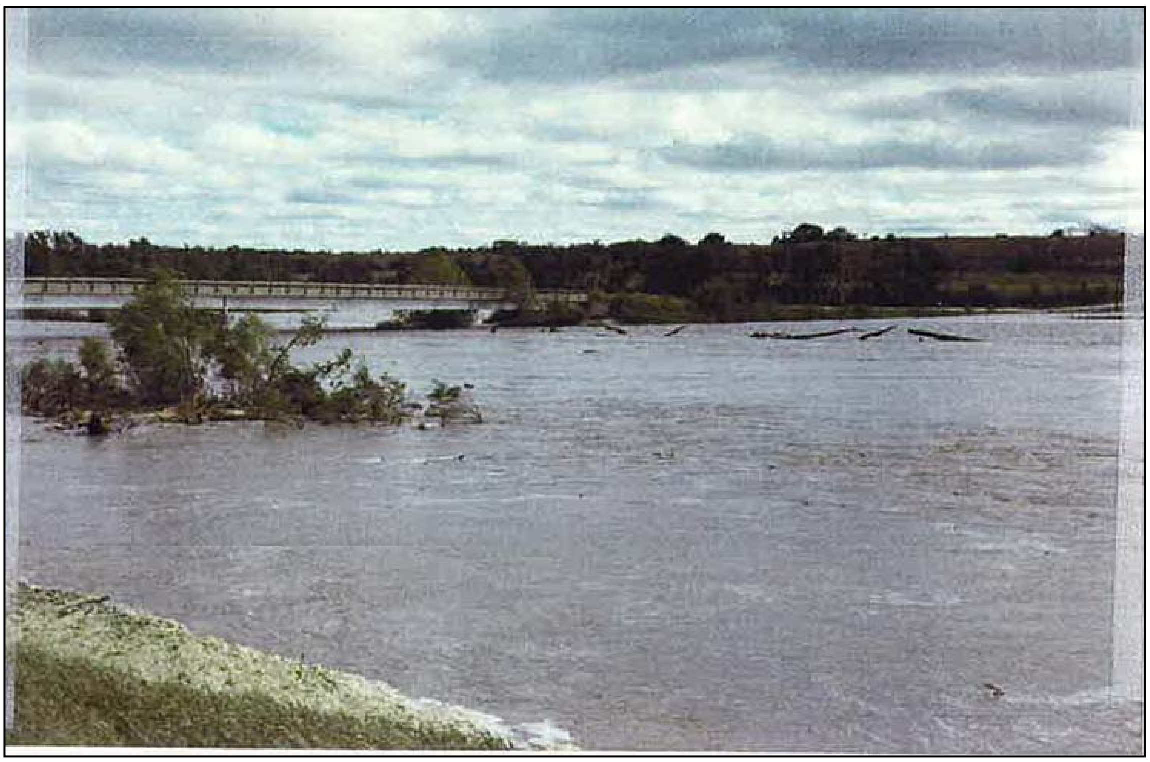
Overflow structure with scour hole

Contraction scour potential can be assessed in the field by the following:

- Road overflow
- Overflow structures in the flood plain
- Bridge length

It is possible to have any combination of these present. The worse case would be a short bridge projecting into a deep channel with no overflow 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 overflow.

Road overflow – A sag in the roadway allowing overflow in the flood plain reduces flow through the bridge (see the following photo). The relief provided by this sag decreases velocities and potential contraction scour through the bridge. Indications of road overflow include debris on the road, a washed out appearance of a gravel surface or local experience with flooding.



Main bridge and roadway sag (County road over Blue River)

Overflow structures in the flood plain – Overflow structures provide relief for flow similar to road overflow (see photo below). They provide additional opening under the roadway to relieve pressure on the main structure during high flows. The reduction of velocity results 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.

Road overflow section with overflow structure

Bridge Length – Bridge abutments projecting into a channel cause a flow constriction (see following photo). This constriction increases the flow velocities and the potential contraction scour. Abutments projecting in to 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 (see following photo). 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.

Ice jam in main channel

The potential contraction scour at these sites could be substantially increased (see the following photos). Some major rivers in Nebraska that are prone to ice jams include the Platte River, the Elkhorn Rivers and the Loup Rivers.

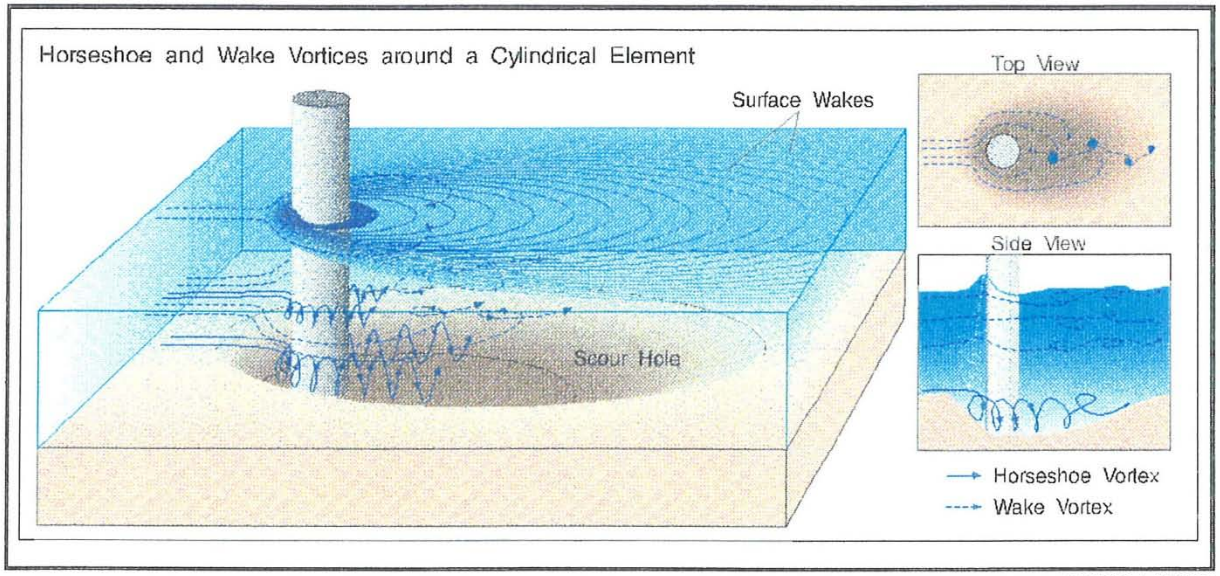
Road overflow section between overflow structures

Overflow bridge flowing full due to ice condition

Overflow bridge failure due to high flows under bridge shown above

6.5.5 Local Scour

Local scour occurs in the immediate vicinity of a pier or abutment 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 (see the following figure).



(USGS-MHTD)

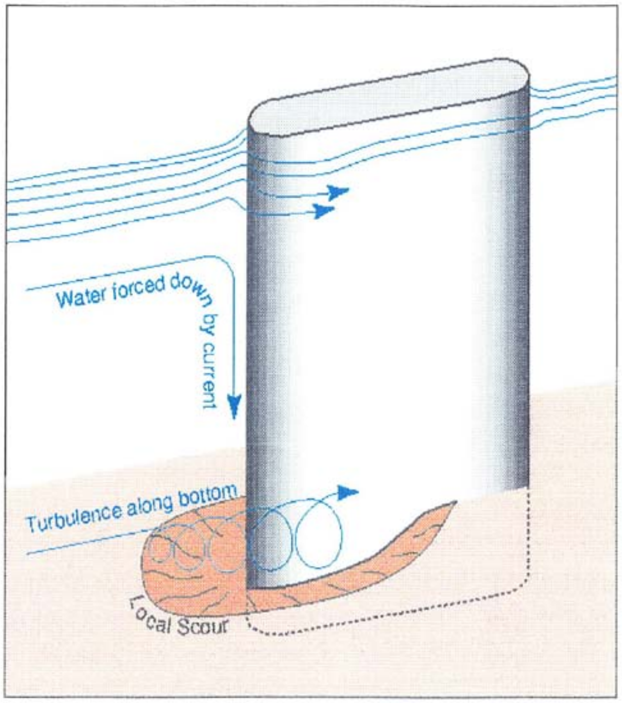
As with contraction scour, local scour holes usually silt in for main channel bridges unless soil conditions prevent silting. Local scour holes are likely to remain for overflow bridges where there is little or no incoming sediment. Softer, relatively fresh silt or freshly deposited sand near piers or abutments is an indicator that local scour has occurred.

The potential for local scour can be assessed by field observations of the following:

- Pier shape and size
- Pier alignment and bridge skew (attack angle)
- Debris
- Stream meanders
- Depth of flow
- Velocity

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 pier, for piers of similar width. Wider piers increased the downward component of flow and the localized acceleration of flow increasing the local scour potential.

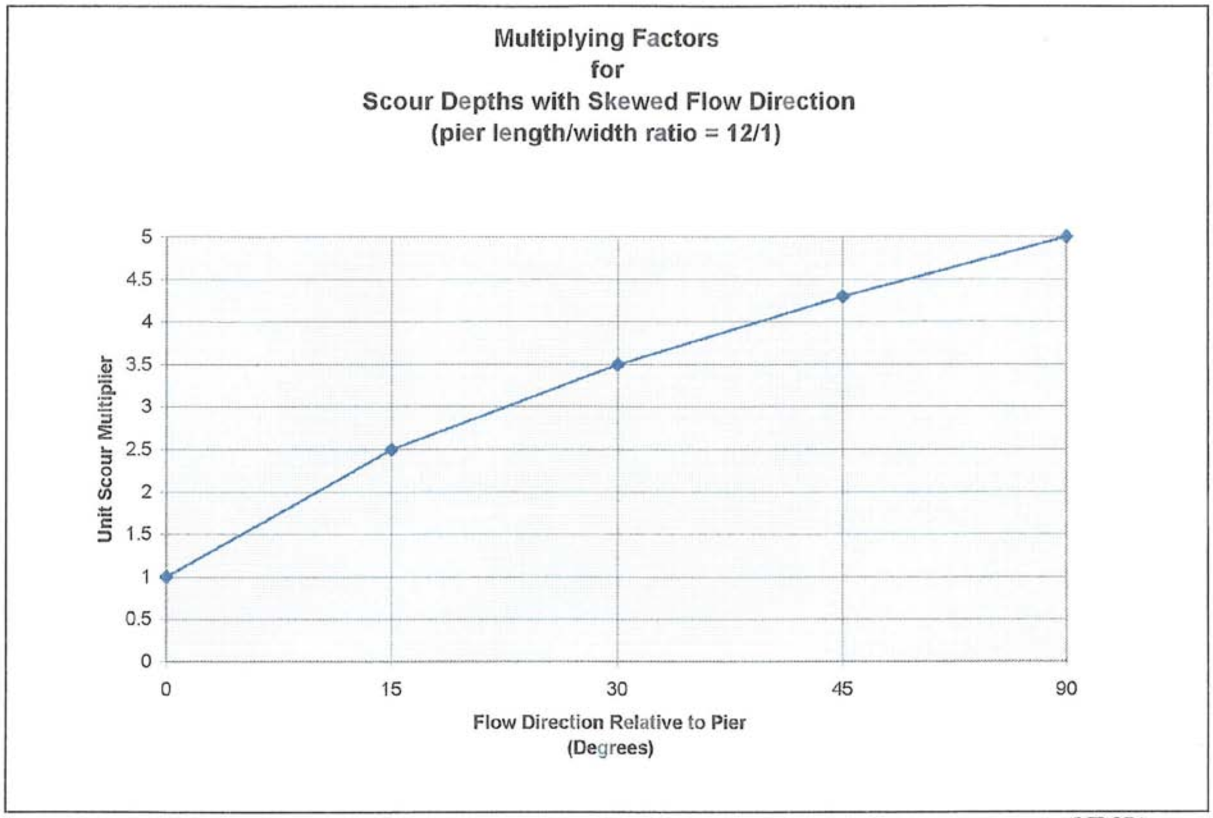
Pier Alignment and Bridge Skew (Attack Angle) – As the stream flows around a pier, water is deflected downward and scour can occur around the pier (see following figure).



(USGS-INDOT)

Flow Paths Around Pier

A misaligned pier obstructs flow by effectively making the pier wider. The scour potential is magnified by the construction of flow and the increased intensities of the vortices created as water strikes the pier. Pier misalignment with flow of only 15° can double the magnitude of local scour (see figure and photos below).



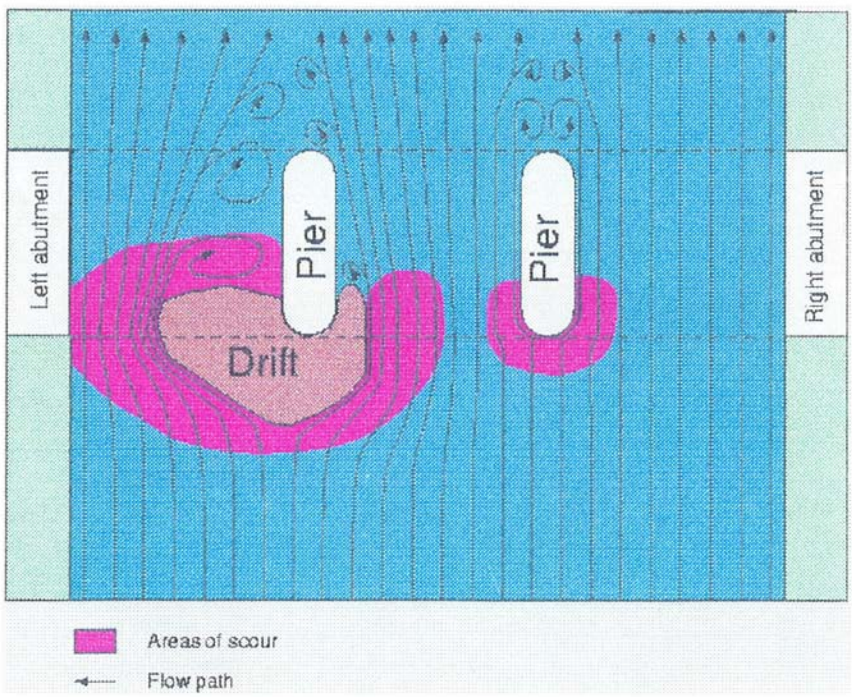
(NDOR)

Affect of Flow Direction on Scour

Misaligned bridge

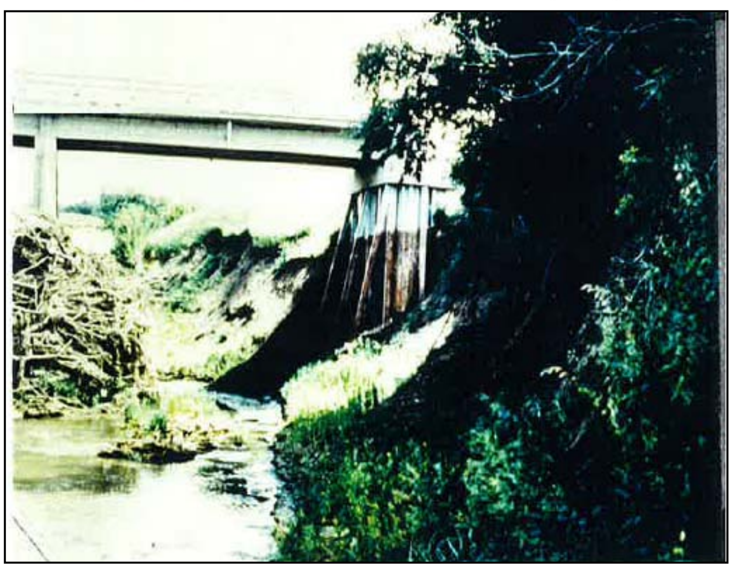
Abutment failure due to improper skew

Debris – 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 (see the following).



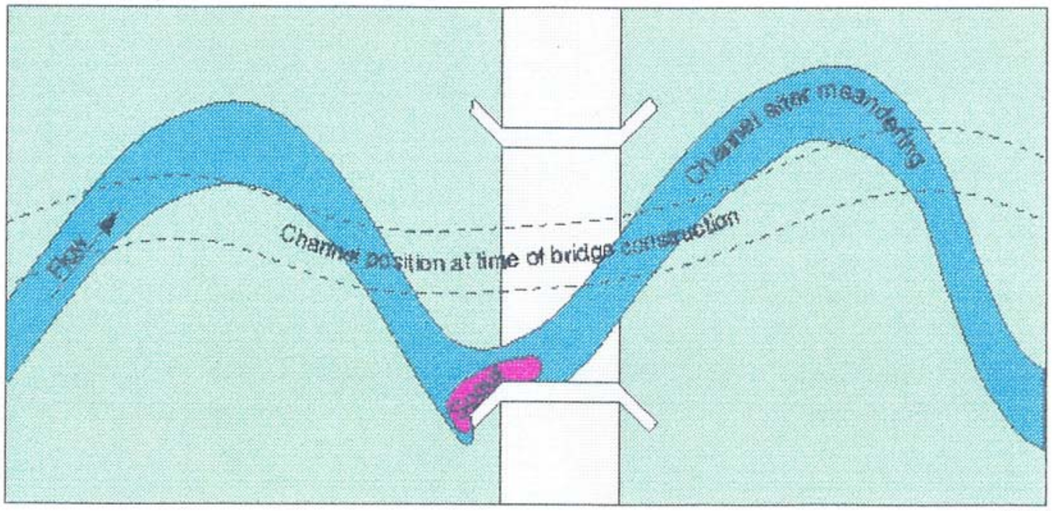
(USGS-INDOT)

Flow Paths Around Piers with Debris (Drift)



Debris trapped at pier

Stream Meanders – Bridges are usually constructed perpendicular to the flow in the stream. As stream meanders form and move, the angle of flow approaching a bridge changes. If the angle of attack increases significantly increased scour can occur at the piers or abutments (see the following).



(USGS-INDOT)

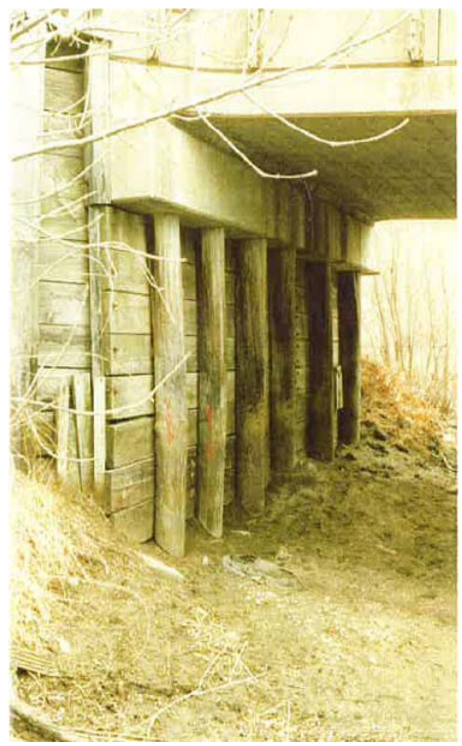
Meandering Channel Showing Resulting Scour

Stream meander attacking abutment

Depth of Flow – Shallow streams do not have the local scour capability of deeper streams.

Velocity – Lower velocities and less local scour potential will occur at bridges where the stream slope is small, the abutments do not block the channel, overflow structures are present or road overflow occurs. Higher velocities and increased scour potential occur where the stream slope is steeper, the abutments project into the channel, or all flow is forced through the bridge opening (no overflow structures or road overflow occurring).

Local scour at abutments occurs similarly to local scour at piers. Water piles up at the abutment face and is forced downward. This along with the increased flow velocity near the abutment generates currents that remove material at the base of the abutment. Abutments are designed to resist scour down to 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 included sheet pile buckling, bottom of bridge plank wall exposed or bottom of concrete wall exposed (see the following photo.)



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 also 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, but as local erosion only.

6.6 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); or
- Scour potential as determined from a scour evaluation study, i.e. calculated scour (Item 113 of 3).

The ISAT will assign a code for Item 113 following the team's inspection, scour calculation and 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 factor of 2 or below is determined for Item 113, 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.

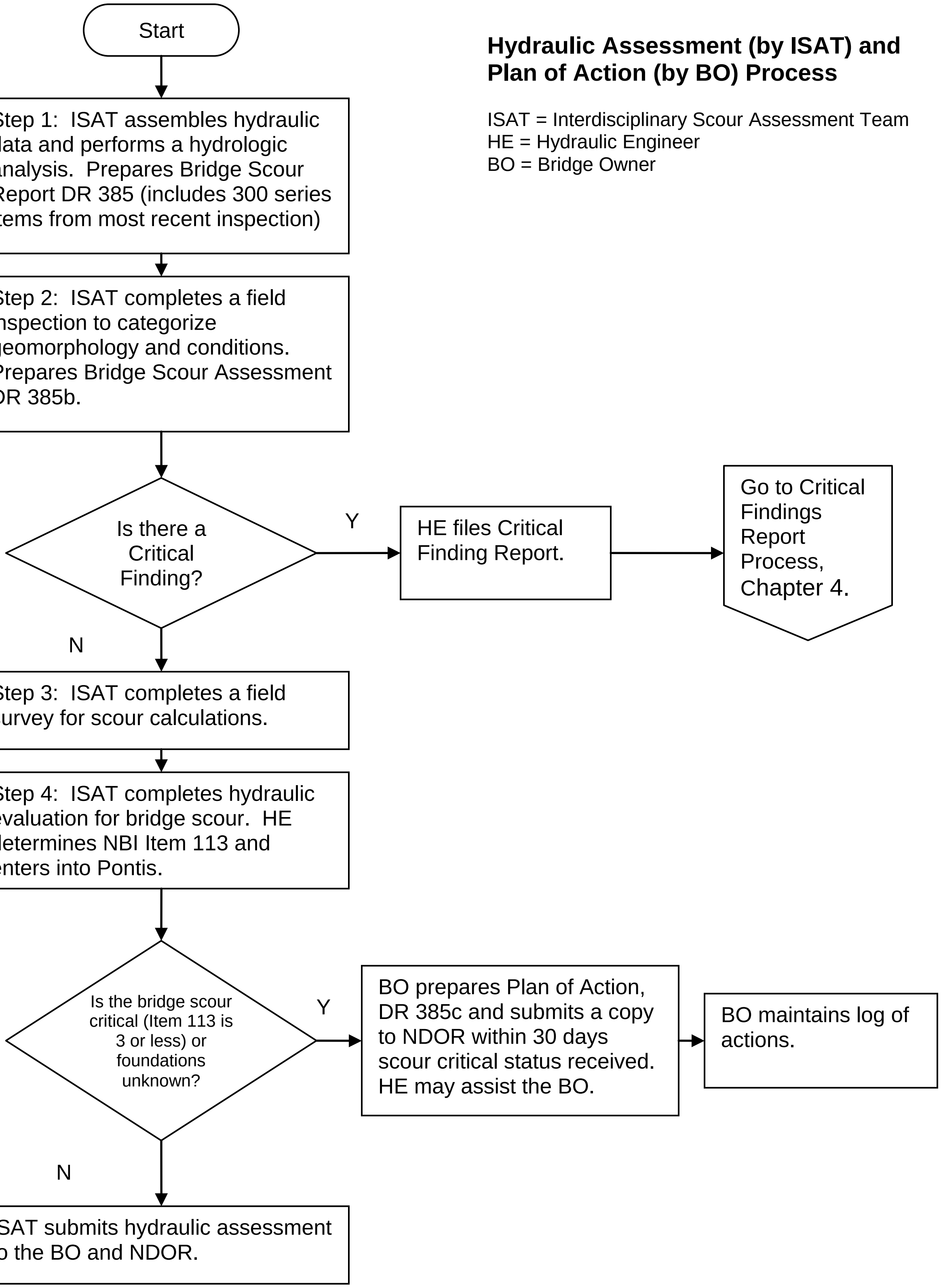
The Bridge Scour Report, DR Form 385 includes the scour-related 300 series inventory items. The values previously recorded by the bridge inspector are verified by the Hydraulic Engineer who is responsible for reporting any revisions to the coding.

The inspector for a routine inspection of a scour critical bridge does not assign a code for Item 113; however, they will assign codes for the scour-related 300 series data items which record conditions found by the inspector. These items are flags of scour issues for the ISAT. See Section in this Chapter Routine Inspection for Scour.

Each Bridge Owner is responsible for maintaining a list of their scour critical bridges.

Hydraulic Assessment (by ISAT) and Plan of Action (by BO) Process

ISAT = Interdisciplinary Scour Assessment Team
HE = Hydraulic Engineer
BO = Bridge Owner



6.7 BRIDGE SCOUR PLAN OF ACTION

6.7.1 General

A bridge scour Plan of Action (POA) is a written document prepared by the Bridge Owner setting out specific instructions for management of the structure for the public safety. A POA typically describes actions to be taken until the scour critical bridge can be replaced or permanent countermeasures installed.

Actions to monitor the bridge may include some or several of these actions:
- Monitoring during or after flood events
- Installation of countermeasure
- Closure, either temporary or permanent.

In the event bridge closure is needed, the POA should also include steps to be taken including who to notify and the detour route to be used.

A scour critical bridge will have a POA until:
- Adequate permanent countermeasures are installed or
- The bridge is replaced with structure that can adequately accommodate the stream flow
- The bridge is permanently closed.

6.7.2 Preparation

FHWA Memorandum HIBT-30 requires preparation of a POA for each scour critical bridge. A POA is required for all bridges with Item 113 coded 3 or less or Item 113 coded U.

Guidance for POA preparation is contained in FHWA Hydraulic Engineering Circular (HEC) 18, 20 & 23. A form, Bridge Scour Plan of Action, DR Form 385c, has been developed by NDOR for Bridge Owner's in Nebraska.

The Interdisciplinary Scour Assessment Team (ISAT) reports scour critical findings to the Bridge Owners for development of a POA. The Bridge Owner is given a copy of the scour study report and a POA form. The data in the report provides hydraulic and scour details the Owner may utilize for developing the POA.

The Bridge Owner should submit a copy of the POA to NDOR within **30 days** of the date when the Bridge Owner was notified that a bridge is scour critical.

6.7.3 POA and Follow up

The POA may require increased inspections, periodic monitoring, installation of scour countermeasures, conditional closure and/or bridge replacement. An acceptable POA includes a schedule for implementation of the actions prescribed.

Bridge Inspectors review the site during routine inspections and record their observations. Special inspections may also be required by the POA. These special hydraulic inspections may be between/during/after flood events and are identified in the POA. A high risk site may require an inspector to be at the site prior to flood arrival. Prestorm rainfall parameters are identified to define when to initiate an onsite visit. A low risk of failure site may be visited during the flood event and/or post flood. A visit to the site may be defined by rainfall parameters, flooding information and road overflow reports.

A closure plan and detour route is required in the POA. The plan defines equipment needs, instructions on how to close the road and defines a detour route. The agencies/people that may be immediately notified after a closure are identified. The general criteria and authorizing inspector for the reopening the bridge is specified.

Bridge Owner shall also maintain a POA Monitoring Log. This is a document that records the actions taken and maintenance activities performed related to the POA. Reports of any scour mitigation action shall include drawings and photos.

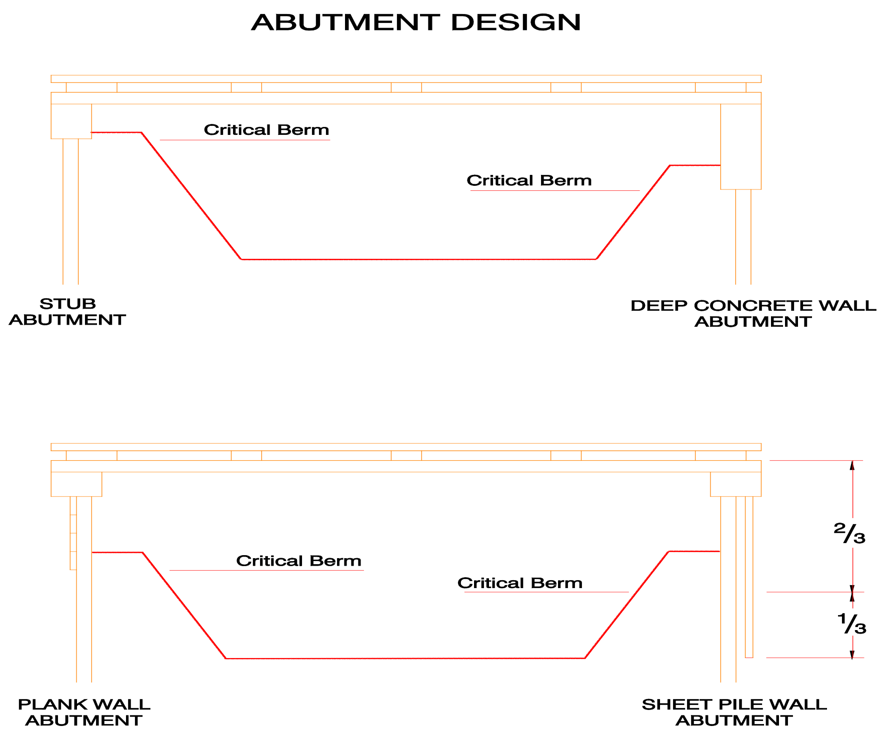
DR Form DR385e, POA Monitoring Log, and DR Form DR385f Supplemental Hydraulic Findings and Maintenance for Scour Critical Bridges are included in the Appendix. A best practice for implementing POAs would be preparation of three-ring binder(s) that could be used in the field after possible inspections required by the POA. The binder could include for each structure that required a POA: the POA; and the POA log form on which the Owner could record any POA activities (site visits, maintenance, repair, installation of permanent counter measures).

6.8 REQUIRED DOCUMENTATION FOR SCOUR CRITICAL BRIDGES

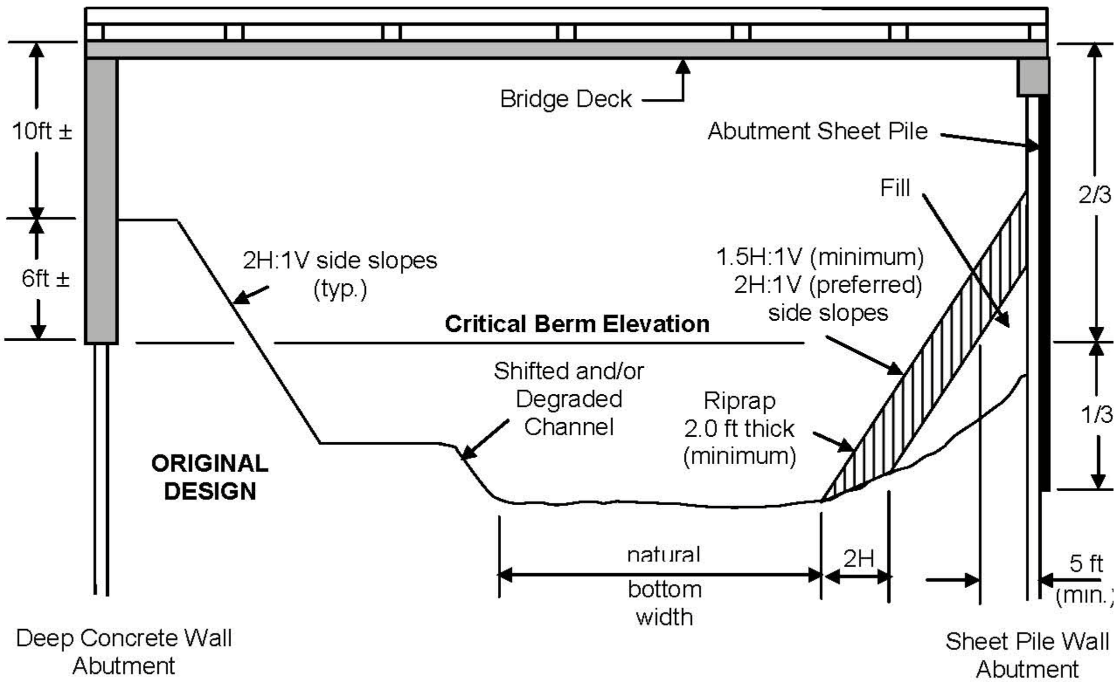
NBIS Item No. 113		Required Documentation in Owner's Bridge Record
U	Bridge with "unknown" foundation that has not been evaluated for scour. Until risk can be determined, a plan of action should be developed and implemented to reduce the risk to users from a bridge failure during and immediately after a flood event.	• Place on list of bridges needing evaluation • Plan of Action is monitoring during flood events
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.	Place on list of bridges needing evaluation
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.**	Scour Evaluation or Assessment
4	Bridge foundations determined to be stable for **assessed or** calculated scour conditions; field review indicates action is required to protect exposed foundations	• Scour Evaluation or Assessment, including calculated scour depth resulting in instability • 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)	• Scour Evaluation or Assessment, including calculated scour depth resulting in instability • Place on Master List (Bridge Owner's and NDOR's) of Scour Critical Bridges • Current Plan of Action
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 depths • Scour Evaluation or Assessment, including calculated scour depth resulting in instability • Place on Master List (Bridge Owner's and NDOR's) of Scour Critical Bridges • Current Plan of Action

6.9 COUNTERMEASURES AND THE CRICIAL BERM ELEVATION

Scour can be calculated during a hydraulic design to determine the critical berm elevation. The critical berm elevation is typically the elevation at which scour would cause a failure of the abutment or approach.



When scour has occurred near an abutment, typically the berm or other protection must be repaired.



The Critical Berm elevation defines the 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 NDOR 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 limits of the repair are based on site conditions; minimum limits are normally between the toe 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.

6.10 NBIS ROUTINE INSPECTION FOR BRIDGE SCOUR

NBIS routine inspections include inspection of the structure and the site. Inspection preparation shall include a review of the hydraulic assessment, current POA and countermeasure records. The Bridge Inspector makes scour-related observations to monitor and document hydraulic changes for bridges over waterways.

Changes to the condition of the bridge that are noted by a bridge inspector on a routine inspection may trigger a hydraulic assessment or a revision to the POA. The inspector records observations using the scour-related 300 series bridge inventory coding items which cover evidence of scour and flood event evidence as well as factors that can potentially contribute to scour during flood events. See Chapter 4 for the complete list of the scour-related 300 series and guidance on coding these items.

If any of the following is coded as "YES" by the inspector, the structure may 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 358 - Inspector's Opinion – Is there a Scour Problem.

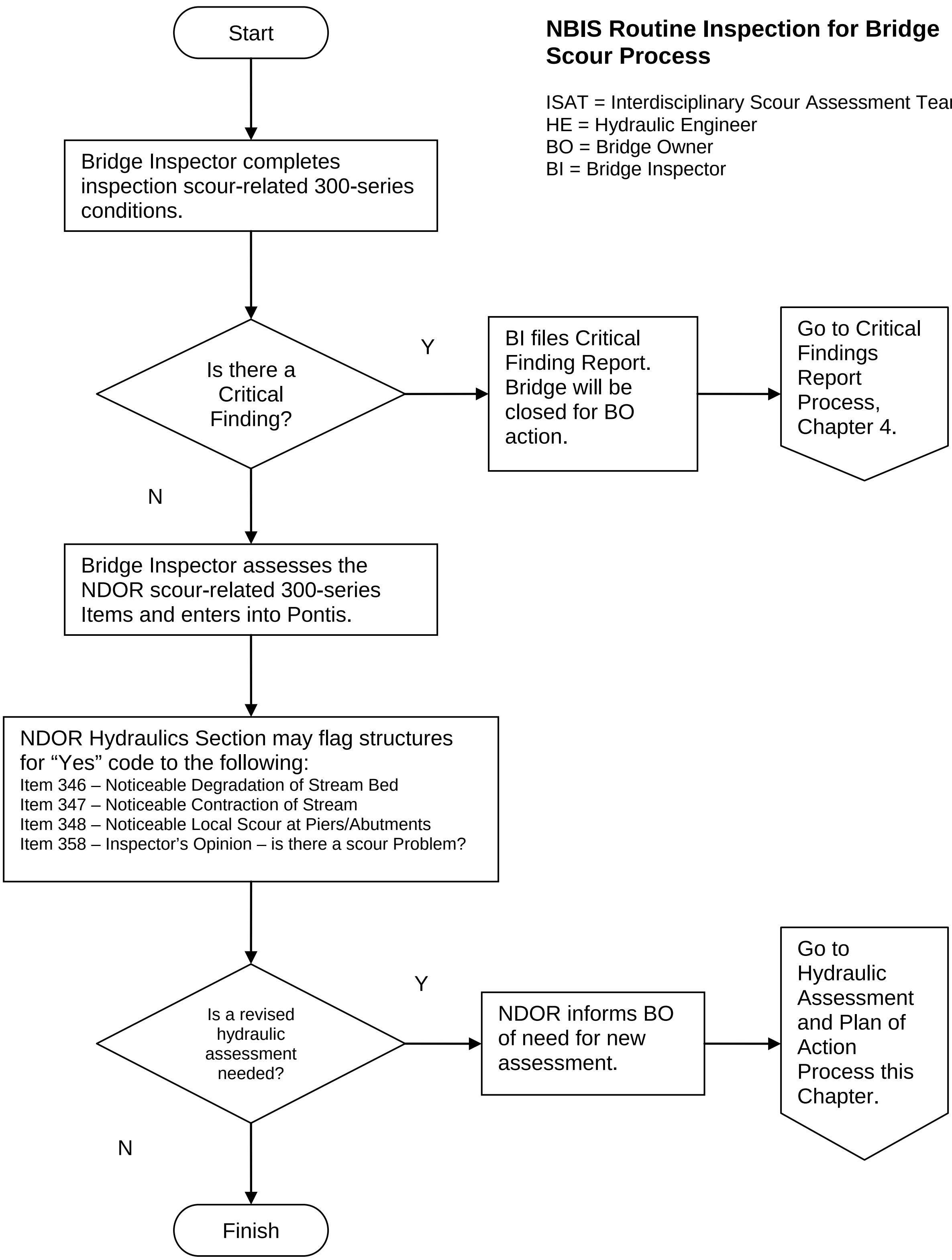
The inspection will include reporting and documentation of the following:

- Identification of soil voids and undermining of abutment and/or approaches. Sounding and probing may be required.
- Probing for evidence of scour immediately upstream of the piers or bents.
- Documentation of hydraulic observations with photos, preferably from the same location as those from the current POA:
  - bridge deck relative to low road grade
  - upstream and downstream channel view
  - bridge side profile showing waterway area
  - wings
  - abutment back walls and berms
  - piers or bents
  - natural banks
  - scour countermeasures (rip rap, channel slope protection, wing dikes, etc.)
  - scour related problems (debris upstream)
  - recent high water marks

The Bridge Inspector should file a Critical Findings Report if the condition of the bridge warrants a substructure condition rating, Item 60, of 1 or less. See Chapter 4 Bridge Inspection. A flow chart of scour related inspection follows.

NBIS Routine Inspection for Bridge Scour Process

ISAT = Interdisciplinary Scour Assessment Team
HE = Hydraulic Engineer
BO = Bridge Owner
BI = Bridge Inspector



6.11 QUALITY CONTROL

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the bridge inventory data 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. An individual of equal or better qualifications than the originator of the product shall complete Quality Control review on the work product. QC manager/engineer shall:

- See that the QC on a given document, data or calculations is completed by an individual of equivalent or better qualifications than the originator.
- See that the technical activity has followed procedures set by NDOR;
- Provide routine and consistent checks for data integrity, correctness and completeness;
- Identify and address errors and/or omission;
- Record the QC activities.

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.

6.12 QUALITY ASSURANCE

Quality Assurance (QA) of all hydraulic assessments and POAs will be performed by NDOR or their selected agent. The QA program activities are described in Chapter 1 of this Manual.

6.13 REVISION HISTORY

Rev	Date	Description
0	2010 January 25	Initial Issue of Chapter
1	2011 November 01	Revision 1

6.14 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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm for the current list of applicable forms and the most recent versions of each form.

Name	DR Form	Revision Date
Bridge Scour Report	385	April 09
Bridge Scour Assessment	385b	April 09
Bridge Scour Plan of Action	385c	April 09
Bridge Scour Worksheet	385d	April 09
POA Monitoring Log	385e	Dec 10
Supplemental Hydraulic Findings and Maintenance for Scour Critical Bridges	385f	Dec 10

6.15 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 NDOR Bridge Inspection Program website at http://www.nebraskatransportation.org/design/bridge/bipm.htm. Bridge Owners and Inspectors are urged to check this site to ensure they have all the most current information and forms.

Name	Revision Date
Channel Terms Glossary	2010 Jan 25