STATE OF MINNESOTA

Bridge and Structure Inspection Program Manual

DEPARTMENT OF TRANSPORTATION

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INTRODUCTION

The purpose of this Bridge and Structure Inspection Program Manual (BSIPM) is to compile the policies and procedures of the Minnesota Department of Transportation (MnDOT) in a comprehensive reference to promote consistent and uniform methods of inspection and documentation of bridge conditions throughout the state. This manual facilitates:

- Public safety on bridges
- Compliance with Federal and State Regulations
- Accurate and consistent information to manage bridges as a critical infrastructure asset

BSIPM User Note:
Text in this format indicates that another Chapter of the manual may contain additional information regarding the topic.

Inspector Note:
Text in this format symbolizes an important note that is applicable to a bridge inspector to alert of an item to verify in the field.

The BSIPM is divided into multiple Chapters containing all applicable bridge inspection program information in one location. The Chapters are divided into separate manuals including Policies and Procedures, Bridge Inspection Field Manual, Structure Information Management System (SIMS), Recording and Coding Guide, Quality Control (QC) and Quality Assurance (QA), MnDOT Inspection Vehicle Policy Manual, and Inspection of High Mast Light Poles.

MNDOT BRIDGE OFFICE – BRIDGE INSPECTION CONTACTS

Up-to-date contacts are posted to the MnDOT Bridge Office website.

DEPARTMENT OF TRANSPORTATION

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ABBREVIATIONS

The following is a list of abbreviations used in all Chapters of the BSIPM.

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
BIMU	Bridge Inventory Management Unit
BIE	Bridge Inspection Engineer
BMS	Bridge Management System
BR	Bridge Rater
BRE	Bridge Rating Engineer
BSIPM	Bridge and Structure Inspection Program Manual
CFR	Code of Federal Regulations
Conc	Concrete
CoRE	Commonly Recognized Structural Elements
DN	Do Nothing
FC	Fracture Critical
FCM	Fracture Critical Member
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standards
GPR	Ground Penetrating Radar
GPS	Global Positioning System
HCADT	Heavy Commercial Average Daily Truck Traffic
HEC	Hydraulic Engineering Circulars
HPMS	High Performance Monitoring System
ISTEA	Inter-Modal Surface Transportation Efficiency Act
IRT	Infrared Thermography
LEL	Lower Explosive Limit
LRFD	Load Resistance Factor Design
LRS	Linear Referencing System
MBE	AASHTO Manual for Bridge Evaluation
MNDOT	Minnesota Department of Transportation
MT	Magnetic Particle Testing
MUTCD	Manual of Uniform Traffic Control Devices
NBI	National Bridge Inventory
NBIS	National Bridge Inspection Standards
NCHRP	National Cooperative Highway Research Program
NDE	Non-destructive Evaluation

NDT	Non-destructive Testing
NHI	National Highway Institute
NHS	National Highway System
NRHP	National Register of Historic Places
OFCVO	Office of Freight and Commercial Vehicle Operations
PA	Program Administrator
PCA	Plan of Corrective Action
POA	Plan of Action
PPE	Personal Protection Equipment
PT	Liquid Penetrant Testing
PTFE	Polytetrafluoroethlyene
SBE	State Bridge Engineer
SI&A	Structure Inventory and Appraisal
SIMS	Structure Information Management System
STRAHNET	Strategic Highway Network
TH	Trunk Highway
TL	Team Leader
TTC	Temporary Traffic Control
UBIV	Under Bridge Inspection Vehicle
UT	Ultrasonic Testing
UTG	Ultrasonic Thickness Gage
UTM	Universal Transverse Mercator
UW	Underwater

REVISION HISTORY

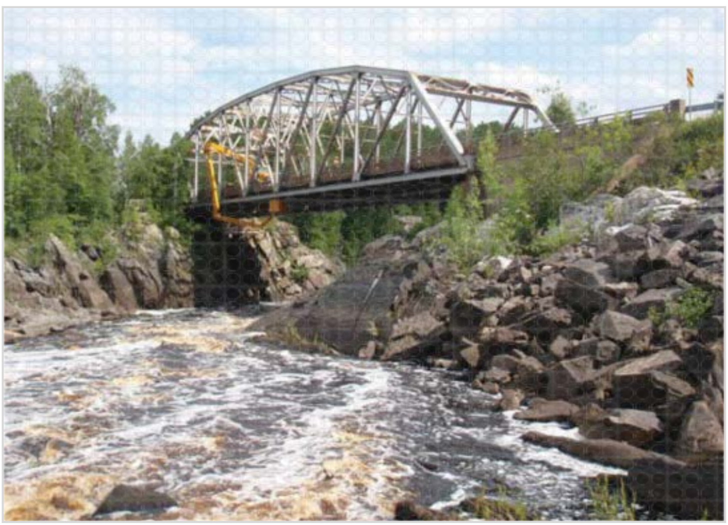
The MnDOT Bridge Office completed its first iteration of the BSIPM in April 2016. Individual Chapters in the BSIPM will be updated as needed as procedures are updated and new information becomes available. The BSIPM is available on the Bridge Office website at: http://www.dot.state.mn.us/bridge/inspection.html

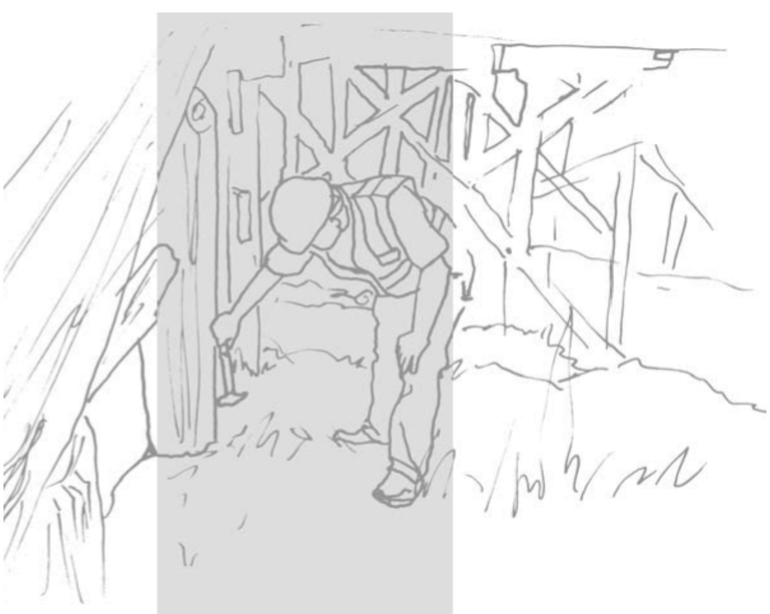
Revisions to Chapters with a brief update can be found below.

- 2016 April, Bridge and Structure Inspection Program Manual: Revisions included updating, creating, and combining Policies and Procedures, Bridge Inspection Field Manual, Structure Information Management System (SIMS), Recording and Coding Guide, Quality Control (QC) Quality Assurance (QA), MnDOT Inspection Vehicle Policy Manual, and Inspection of High Mast Light Poles Chapters.
- 2016 April, Bridge and Structure Inspection Program Manual: Revisions included updating, creating, and combining Policies and Procedures, Bridge Inspection Field Manual, Structure Information Management System (SIMS), Recording and Coding Guide, Quality Control (QC) Quality Assurance (QA), MnDOT Inspection Vehicle Policy Manual, Inspection of High Mast Light Poles Chapters, and Appendices.
- 2017 May, Bridge and Structure Inspection Program Manual: Revisions included updating Chapters A, B, D, E, and F. Deleting several non-required appendices and renumbering the Appendix section.
- 2018 May, Bridge and Structure Inspection Program Manual: Revisions included updating Chapters A, B, D and E. Chapter D added SIMS field ID and names, and BrM tables and field names to inventory items.
- 2019 May, Bridge and Structure Inspection Program Manual: Revisions included updating Chapters A, B, D and E.

STATE OF MINNESOTA

Bridge and Structure Inspection Program Manual





Chapter A

POLICIES AND PROCEDURES

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A.1 OVERVIEW

The Policies and Procedures Chapter of the Bridge and Structure Inspection Program Manual (BSIPM) is intended to provide detailed guidance of the purpose, requirements, and procedures of MnDOT's Bridge inspection program.

BSIPM User Note:

Text in this format indicates that another Chapter of the manual may contain additional information regarding the topic.

This chapter is intended for use by all persons involved in bridge inspection activities and will provide guidance on the following aspects.

- Responsibilities of various parties for bridge safety inspections
- Technical standards and specifications for bridge inspections
- Administrative requirements to meet State and Federal regulations regarding recording and reporting inspection information

Inspector Note:

Text in this format symbolizes an important note that is applicable to a bridge inspector to alert of an item to verify in the field.

Provisions are not included for bridges used solely for railroads, rail-transit, pedestrian, or public utilities that don't cross a public road.

This chapter is not intended to be a training manual on bridge inspection and only provides the minimum requirements necessary for compliance with Federal and State regulations. The Owner or Engineer may have to implement additional requirements that exceed those outlined in this manual based on engineering judgment or when presented with unusual circumstances.

A.2 ABBREVIATIONS

The abbreviations and acronyms for Chapter A – Policies and Procedures are located in the Introduction section of the BSIPM.

A.3 ADMINISTRATIVE

The administrative section is intended to provide guidance of the bridge inspection program for the state of Minnesota, including applicable standards and specifications, responsibilities of agencies involved, and the type of structures included in the program.

A.3.1 PROGRAM SUMMARY

The Minnesota Department of Transportation (MnDOT) Bridge Inspection Program is federally mandated and has been in effect since 1971. The policies of the program are based upon the National Bridge Inspection Standards (NBIS). Bridge inspection reports and records are housed by MnDOT in an electronic database. These records are also forwarded to the Federal Highway Administration (FHWA) on an annual basis.

MnDOT has a decentralized Bridge Inspection Program that delegates bridge inspections, reports, load rating, and other requirements to the District Offices and also to the public authorities that own bridges. The MnDOT Bridge Office is responsible for the overall supervision of the statewide bridge inspection and inventory program, statewide bridge load posting program, statewide training of Bridge Inspection Team Leaders, fracture critical and complex inspections. This includes ensuring compliance with Federal directives regarding bridge inspection and maintenance, making sure that all bridges are inspected at proper intervals, and that bridge files are kept current and accurate.

A.3.2 DEFINITIONS

- Bridge – See Section A.3.4.1 for the NBIS definition and Section A.3.4.2 for Minnesota's definition.
- Bridge Inspection – Includes any routine, special, hands-on fracture critical, complex or underwater (UW) inspection performed on a bridge.
- Bridge Inspection Team Leader (TL) – Personnel certified by MnDOT to conduct inspections of in-service bridges and culverts on the state, county and local highway system throughout the state of Minnesota. A MnDOT certified Bridge Inspection Team Leader must be present at the bridge site at all times during a bridge inspection.
- Bridge Owner – The entity listed on the MnDOT Bridge Inventory as the Owner of the bridge.
- Program Manager (PM) – At the highest level, the individual appointed by MnDOT with statewide responsibility for bridge inspection, reporting, inventory, and policy as designated by the Commissioner of Transportation in accordance with Minnesota Statute 165.03 Subd.2. Currently this title is held by the Bridge Construction and Maintenance Engineer. For the NBIS definitions see Section A.3.5.1.
- Program Administrator (PA) – A certified Professional Engineer appointed by an agency or jurisdiction to oversee the bridge inspection program and have quality control responsibilities as delegated by the PM. Typically, the PA is the City or County Engineer, a consultant, or the District Bridge Engineer. In accordance with Minnesota Statute 165.03 Subd. 2, the County Highway Engineer is designated as Program Administrator for all bridges located wholly or partially within or over the right-of-way of any county or town road, or any street within a municipality that does not have a city engineer regularly employed.
- MnDOT Bridge Inspection Engineer (BIE) – Refers to the State Bridge Inspection Engineer who is the primary statewide contact under the direction of the Program Manager for the bridge inspection program in regards to policy, manuals, certifications, training, non-destructive testing methods, fracture critical and complex bridge inspections, and Critical Finding reporting.
- Public Road – See Section A.3.4.1.
- Structure Information Management System (SIMS) – MnDOT's bridge management system (BMS) where inspectors enter inspection data and Bridge Owners can review data. SIMS contains all bridge data including inventory, inspection findings, reports, pictures, sketches, and more.
- Structural Evaluation Engineer – A certified Professional Engineer, or others under supervision of, that conducts a structural assessment of a bridge based on inspection findings of fracture critical complex inspections and other inspection types as requested. A standard template of the Structural Assessment Report is provided in SIMS.

A.3.3 MANUAL REVIEW AND REVISION

The most current version of the BSIPM will be located on the MnDOT website located at http://www.dot.state.mn.us/bridge/pdf/insp/bridge-and-structure-inspection-program-manual.pdf. It is the user's responsibility to ensure they are using the most current version.

The BSIPM will be updated yearly. Tech Memos will not be issued for each update however, an e mail notification will be sent to all current Program Administrators and Team Leaders when a revised BSIPM has been published.

Each page in the manual has a date in the header that indicates the month and year of the latest update for the BSIPM. Significant changes to a section or paragraph of a chapter will be designated by a vertical line in the right hand margin of the revised page. The flowchart below illustrates the process.

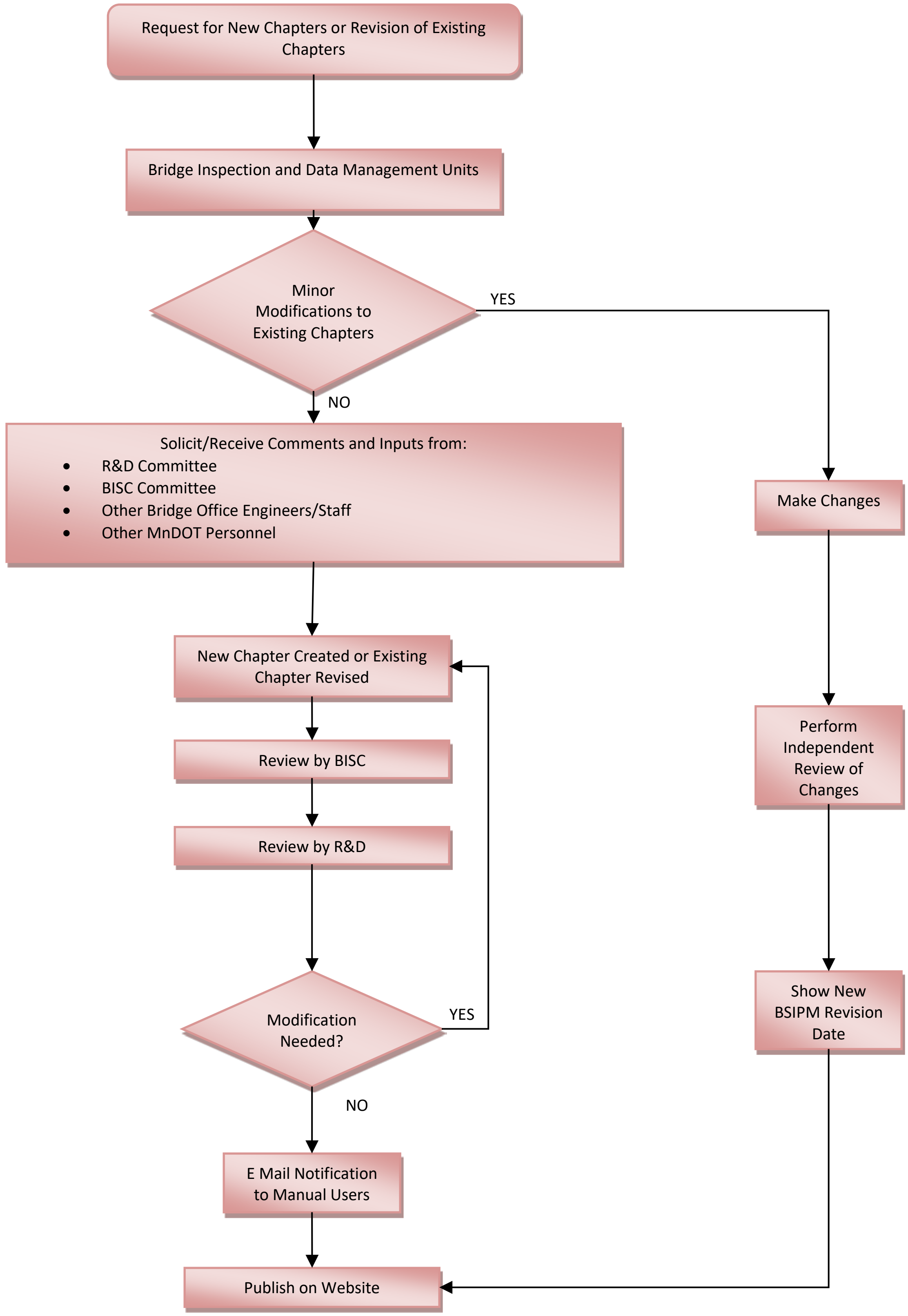


Figure A.3.3.1
Flowchart for Revising Bridge Standards

A.3.4 APPLICABLE SPECIFICATIONS AND STANDARDS

Other inspection manuals, design manuals, or specifications that can be used as further guidance for inspecting bridges or structures are listed in the following section.

A.3.4.1 Federal Highway Administration Requirements

The National Bridge Inspection Standards (NBIS) were developed after the 1968 Federal Highway Act became effective and were first published as a notice in the Federal Register, Volume 36, No. 81, Page 7851 on April 27, 1971. The NBIS have been amended several times by the FHWA to include new provisions for fracture critical inspections, scour evaluations, and underwater inspections.

The NBIS are, therefore, mandated by Federal Law and are intended to ensure the proper inspection of the nation's bridges more than 20 feet in length on public roads. The NBIS are included in subpart C of Part 650 of the Code of Federal Regulations (CFR), Title 23 – Highways.

The FHWA administers the NBIS under the guidelines outlined in their “Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges” (Federal Coding Guide). The NBIS applies to all structures defined as highway bridges located on all public roads. The following definitions have been taken from the Federal regulations.

As defined by NBIS 23 § 650, subpart C:

> *Bridge*. A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than twenty (20) feet between under copings 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.

As defined by 23 U.S.C. 101(a) (27:

> *Public road*. The term “public road” means any road or street under the jurisdiction of and maintained by a public authority and open to public travel.

The FHWA gives policy guidance and established criteria. In addition, the FHWA utilizes a set of metrics to review the results of each states program for compliance with the Standards through its annual compliance reviews of State and Local Agencies.

A.3.4.2 State Requirements

Minnesota has additional requirements governing the inspection of bridges within the State, which are found in Statute 165.01, Strength of Bridge Inspection. The following definition is taken for this Statute.

As defined by MN Statute 165.01, Subdivision. 3:

> *Bridge.* “Bridge” is defined as a structure including supports erected over a depression or an obstruction such as water, highway, or railway, having a track or passageway for carrying traffic or other moving loads, and having an opening measured horizontally along the center of the roadway of 10 feet or more between under copings of abutments, between spring line of arches, or between extreme ends of openings for multiple boxes. Bridge also includes multiple pipes where the clear distance between openings is less than half of the smaller contiguous opening. This definition of a bridge includes only those railroad and pedestrian bridges over a public highway or street.

A.3.4.3 Inspection Specifications

The following specifications, unless otherwise modified in this Chapter, shall govern the safety inspection of bridges.

- Minnesota Statute 165.03 – Strength of Bridge Inspection: https://www.revisor.mn.gov/statutes/?id=165.03
- Code of Federal Regulation (CFR) Title 23, Part 650, Subpart C – National Bridge Inspection Standards: http://www.ecfr.gov/cgi-bin/text-idx?SID=eadb0f3dc61e36c8db52dede38c5be31&node=23:1.0.1.7.28.3&rgn=div6
- MnDOT Load Resistance Factor Design (LRFD) Bridge Design Manual
- The Manual for Bridge Evaluation, Second Edition, 2011 with 2013 Interim Revisions, published by the American Association of State Highway and Transportation Officials (AASHTO)
- AASHTO Manual for Bridge Element Inspection, Second Edition, 2013
- AASHTO LRFD Bridge Design Specifications, Customary U.S. Units, 6th Edition, with 2013 Interim Revisions
- AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002
- FHWA Bridge Inspector's Reference Manual, 2002 (Revised February 2012)
- FHWA Manual of Uniform Traffic Control Devices (MUTCD)

Manuals can be purchased at: https://bookstore.transportation.org/.

A.3.4.4 Other Inspection Manuals and References

Other inspection manuals that can be used as guidance for inspections are as follows.

- Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (Repot No. FHWA-PD-96-001): https://www.fhwa.dot.gov/bridge/mtguide.pdf
- Culvert Inspection Manual (Report No. FHWA-IP-86-2): http://isddc.dot.gov/OLPFiles/FHWA/006625.pdf
- Inspection of Fracture Critical Bridge Members (Report No. FHWA-IP-86-26): http://isddc.dot.gov/OLPFiles/FHWA/009349.pdf
- FHWA Highway and Rail Transit Tunnel Inspection Manual, 2005: http://www.fhwa.dot.gov/bridge/tunnel/inspectman00.cfm
- USFS Timber Bridge Manual: http://www.woodcenter.org/docs/em7700_8--entire-publication.pdf

A.3.5 RESPONSIBILITIES FOR BRIDGE SAFETY INSPECTIONS

MnDOT has federal and State statutory responsibilities for the safety and inspections of all bridges on public roads, as defined in Section A.3.4.2, within the State of Minnesota. Some of the more critical of these responsibilities include assurance of NBIS compliance, proper bridge restrictions for vehicle size and weight and the reporting of NBI bridge data to the FHWA. In addition to public road bridges, the safety of non-highway bridges and structures over public roads is a Department responsibility.

A.3.5.1 State Program Manager

The FHWA directs that each State transportation department must have a Program Manager who has been delegated responsibility for statewide bridge inspection policies and procedures, quality control and quality assurance, and preparation and maintenance of a bridge inventory. The State Program Manager is also responsible for the proper conduct of all bridge inspections, inspection reports, load ratings and other requirements relating to these standards.

As defined by NBIS § 23 CFR 650, subpart C:

> *Program Manager.* The individual in charge of the program that has been assigned or delegated the duties and responsibilities for bridge inspection, reporting, and inventory. The Program Manager provides overall leadership and is available to inspection team leaders to provide guidance.

In Minnesota, the Program Manager duties have been delegated to the State Bridge Construction and Maintenance Engineer. Specific responsibilities for the State Program Manager are located in Section A.4.2.1.

A.3.5.2 Program Administrators

In Minnesota, every MnDOT District, County, City (or other agency with inspection jurisdiction for a bridge), must appoint a "Bridge Inspection Program Administrator" to oversee the bridge inspection and inventory. Program Administrators must meet minimum qualification requirements, which are outlined Section A.4.1.2.

The MnDOT District Bridge Engineer (or District Bridge Inspection Engineer) will typically serve as the Bridge Inspection Program Administrator for State owned bridges. For Local Agency bridges, the County or City Engineer will typically serve as the Bridge Inspection Program Administrator. Cities, which do not employ an engineer, may elect to designate a private consultant engineer as the Program Administrator. Specific responsibilities for Program Administrators can be found in Section A.4.2.2.

A.3.6 HIGHWAY BRIDGES

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

A.3.6.1 Owner Responsibilities

The Bridge Owner has an overall obligation to ensure that its structure does not present an unacceptable safety risk to the public. The acceptable level of safety is defined by MnDOT standards as presented or referenced within the BSIPM. The Owner must perform maintenance and repair activities or take other actions (i.e., closing or removal) to ensure public safety. In order to demonstrate that a structure is safe, inspections by the Bridge Owner prescribed by law and State regulations and in some cases best practices.

In this context, the term "Bridge Owner" applies to that party with overall maintenance responsibility for the bridge or structure. Thus, Bridge Owners may include MnDOT, counties, municipalities, or other State, local and federal agencies with assigned maintenance responsibilities.

For highway bridges, the Bridge Owner responsibilities include:

- Management of the bridge safety inspection program for bridges within their jurisdiction
- Inspection of the bridge in accordance with the NBIS and MnDOT standards, this includes completing bridge inspections within the required inspection interval
- Reporting of bridge inventory and condition information to MnDOT in accordance with NBIS and MnDOT standards
- Installation and maintenance of proper bridge restriction signing for vehicle weight and size, including barricades for closed bridges
- Maintenance of the bridge file including inventory and inspection records
- Ensuring their bridge inspection staff is properly trained, certified, and equipped

A.3.6.2 MnDOT Responsibilities

MnDOT responsibilities include:

- Maintain a central inventory of highway bridges within Minnesota and border bridges where Minnesota is listed as having inspection or maintenance responsibility, including:
    - All NBIS highway bridges including those owned by Locals Agencies
    - All other highway bridges meeting the State definition of a bridge (10'-20' length) including those owned by Local Agencies
    - All bridges that go over public roadways
- Ensure compliance with NBIS for all highway bridges as noted above that meet the NBIS definition of a bridge
- Determine the safe load carrying capacity of all highway bridges meeting the NBIS and/or State definition of a bridge
- Ensure Owners post bridges in accordance with the posted load assigned by MnDOT
- Maintain a Bridge Management System for all bridges as noted above that meet the NBIS and/or State definition of a bridge
- Reporting of all required NBIS bridge inventory and appraisal information to FHWA on an annual basis
- Quality Control/Quality Assurance of the bridge inspection program
- Provide FHWA an updated Critical Findings list annually or as requested by FHWA

A.3.7 DEPARTMENT OF NATURAL RESOURCES BRIDGES

Minnesota Statute 165.03, Subdivision 7 requires that the Commissioner of Transportation and the Commissioner of Natural Resources negotiate a memorandum of understanding that governs the inspection of bridges owned, operated, or maintained by the Department of Natural Resources. This memorandum of understanding must provide for:

- The inspection and inventory of all bridges meeting the NBIS and/or State definition of a bridges
- The frequency of inspection of bridges described above meeting the NBIS and/or State definition of a bridge
- Who may perform inspections required under the memorandum of understanding

The current (1999) memorandum of understanding states:

"The DNR agrees to develop an inventory and inspection program for its bridges on or over roads in accordance with Federal law or regulations and to submit inspection results to MnDOT each year on the forms developed and used by MnDOT for this purpose. Current Federal regulations require a 2 year inspection interval for bridges <u>20 feet in length and larger</u>. The DNR can, as provided for under the code of Federal Regulations, section 23 Highways, Part 650.301, Application of Standards, request an extended bridge inspection interval for those bridges that are in good condition and have very low usage. All bridge inspections shall be by or under the supervision of a professional engineer or certified Team Leader.

MnDOT agrees to provide technical assistance to the DNR in developing its bridge inventory and inspection program. This will include load rating bridges where necessary bridge data is obtained and provided by the DNR. Requests for technical assistance shall be in writing, shall describe the extent of assistance requested, and shall describe any agreement on cost reimbursement."

A.3.8 RAILROAD BRIDGES OVER PUBLIC ROADS

Minnesota Statute 165.03, Subdivision 2 requires that railroad bridges over public roadways be inspected by the agency with roadway authority. General guidelines for "highway" agency inspectors conducting these railroad bridge inspections are located in Section A.4.1.

The Federal Railroad Administration was created by the Department of Transportation Act of 1966. Its purpose is to enforce rail safety regulations, administer railroad assistance programs, conduct research and development in support of improved railroad safety and national rail transportation policy, provide for the rehabilitation of Northeast Corridor rail passenger service and consolidate government support of rail transportation activities. The railroad track owner is responsible for ensuring that the bridge is capable of safely carrying all railroad traffic operated on that track, and for specifying the maximum loads that may be operated over the bridge.

A.3.9 OTHER NON-HIGHWAY BRIDGES OVER PUBLIC ROADS

Where a non-highway facility (a bike/pedestrian pathway, skyway, etc.) exists over a public road, the bridge/structure needs to be inventoried and inspected to ensure public safety. The NBIS does not require a structural safety inspection as it does for highway bridges. However, Minnesota Statute 165.03, Subdivision 2 requires that bridges over public roadways be inspected by the agency with roadway authority. Bridge Owners of public roadways with these types of structures within their jurisdiction need to be aware of the general safety of these facilities. The scope of these non-highway bridge inspections may be tailored to fit the individual bridge type.

A.3.10 NON-COMPLIANCE WITH NBIS

When the Local Agencies responsible for bridge inspection cannot or will not inspect their bridges in a timely manner in accordance with NBIS and MnDOT standards, State Statute 165.03 requires MnDOT to perform the necessary inspections. If the Bridge Owner has not taken appropriate actions in a timely manner to have a bridge inspected to meet NBIS requirements, the State Program Manager will notify the Bridge Owner in writing of MnDOT's intent to have the bridge inspected and that the Commissioner of Transportation will assess the Bridge Owner for the cost of the inspection.

A.4 INSPECTOR TRAINING AND QUALIFICATION REQUIREMENTS

MnDOT recognizes that the quality of an agency's inspection program is dependent on the performance of the individual in charge of the agency's inspection program, and the individuals leading the inspection teams performing the field inspections. These individuals must be adequately qualified to perform their duties.

A.4.1 INSPECTION PROGRAM PERSONNEL QUALIFICATIONS

Certification in Bridge Safety Inspection (the inspection of in-service bridges and culverts) is coordinated by the MnDOT Bridge Office, and is separate from other MnDOT technical certifications. The requirements listed below have been developed by the MnDOT Bridge Office to comply with Section 650.309 of the NBIS, as outlined in the Federal Code of Regulations.

A.4.1.1 Program Manager

The Program Manager for the State of Minnesota is the Bridge Construction and Maintenance Engineer, who is appointed by the State Bridge Engineer to administer the Bridge Inspection Program statewide.

The NBIS requires that the Program Manager must:

- be a registered professional engineer (PE); or have a minimum of ten years of bridge inspection experience, and
- have successfully completed an FHWA approved comprehensive bridge inspection training course

A.4.1.2 Program Administrator Qualifications

Agencies, such as MnDOT Districts, Counties, Cities or other public or private entities designated with inspection jurisdiction for one of more bridges must designate a "Program Administrator" to oversee the inspection and inventory program. The Program Administrator must be a registered PE in the State of Minnesota.

A.4.1.3 Bridge Inspection Team Leader Qualifications

A Bridge Inspection Team Leader can conduct inspections of in-service bridges and culverts on the state, county, and local highway system throughout the state of Minnesota.

The NBIS outlines five methods to qualify as a Bridge Inspection Team Leader, all of them require the successful completion of a FHWA approved comprehensive bridge inspection training course (see Section A.4.5.1 for approved courses). MnDOT recognizes all five certification options, but requires an additional field proficiency test for all Bridge Inspection Team Leaders.

> **Inspector Note:**
> A MnDOT certified Bridge Inspection Team Leader must be present at the bridge site at all times during a bridge inspection.

1. Be a registered professional engineer in the state of Minnesota, successfully complete an FHWA approved comprehensive bridge inspection training course, and pass a field proficiency test (administered by the MnDOT Bridge Office).
2. Have five years of bridge inspection experience, successfully complete an FHWA approved comprehensive bridge inspection training course, and pass a field proficiency test (administered by the MnDOT Bridge Office).
3. Be certified by NICET as a Level III or IV Bridge Safety Inspector, successfully complete an FHWA approved comprehensive bridge inspection training course, and pass a field proficiency test (administered by the MnDOT Bridge Office).
4. Have a bachelor's degree in engineering from an accredited college or university, successfully pass the Fundamentals of Engineering (FE or EIT) Examination, have two years of bridge inspection experience, successfully complete an FHWA approved comprehensive bridge inspection training course, and pass a field proficiency test (administered by the MnDOT Bridge Office).
5. Have an associate's degree in engineering or engineering technology from an accredited college or university, have four years of bridge inspection experience, successfully complete an FHWA approved comprehensive bridge inspection training course, and pass a field proficiency test (administered by the MnDOT Bridge Office).

A.4.1.4 Assistant Team Leader

While the FHWA and MnDOT have no minimum requirements for who can assist in a bridge inspection, MnDOT encourages completion of the National Highway Institute (NHI) Course #130101 “Introduction to Safety Inspection of In-Service Bridges” prior to assisting in bridge inspections. This is an online tutorial and assessment that should take approximately 14 hours to complete. Any NHI training course can be taken in conjunction with gaining bridge inspection experience. Training courses do not have to be taken prior to starting the 5 year experience stipulation stated in Section A.4.5.1 of this manual. MnDOT does not issue certification cards for Assistant Team Leaders. *This course is mandatory for anyone intending to become certified as a MnDOT Bridge Inspection Team Leader*.

A.4.1.5 Fracture Critical Bridge Inspector Qualifications

Fracture critical inspections shall be conducted by or under the direct supervision of individuals which have been certified as a MnDOT Bridge Safety Team Leader in accordance with Section A.4.1.3 above. They must also meet one of the following additional requirements:

1. Have taken the NHI Course: Fracture Critical Inspection Techniques for Steel Bridges, or
2. Have or obtain experience and/or classes related to fracture critical inspection that may be substituted in lieu of the NHI Course, but at the discretion of the Program Manager.

Only qualified American Society for Non-Destructive Testing Level II or III technicians shall conduct NDT services, by ultrasonic methods. See Section A.10.1.5 for additional information and requirements for inspectors performing NDT.

A.4.1.6 Complex Bridge Inspector Qualifications

Complex bridge inspections shall be conducted by or under the direct supervision of individuals which have been certified as a MnDOT Bridge Safety Team Leader in accordance with Section A.4.1.3 above. They must also meet one of the following additional requirements:

1. Have taken the NHI Course: Fracture Critical Inspection Techniques for Steel Bridges, as this class focuses on specific inspection techniques than can also apply to complex bridge features, or
2. Have or obtain experience and/or classes related to fracture critical or complex inspections that may be substituted in lieu of the NHI Course, but at the discretion of the Program Manager.

Only qualified American Society for Non-Destructive Testing Level II or III technicians shall conduct NDT services, by ultrasonic methods. See Section A.10.1.5 for additional information and requirements for inspectors performing NDT.

A.4.1.7 Underwater Bridge Inspector Qualifications

Underwater inspections shall be conducted by or under the direct supervision of individuals which have been certified as a MnDOT Bridge Safety Inspection Team Leader in accordance with Section A.4.1.3 above. They must also meet the following additional requirements:

1. Have at least two years’ experience in Underwater bridge inspections, and
2. Conduct diving operations in accordance with requirements of the most current revision of 29 CFR Part 1910, Subpart T – Commercial Diving Operations, published by the Occupational Safety and Health Administration (OSHA), and
3. Successfully completed FHWA NHI Course No. 130091A, Underwater Bridge Inspection

A.4.2 INSPECTION PROGRAM PERSONNEL RESPONSIBILITIES

This section identifies the responsibilities of the Program Manager, Program Administrator, and the Bridge Inspection Team Leader.

A.4.2.1 Program Manager Responsibilities

For Minnesota, the PM duties have been delegated to the States Bridge Construction and Maintenance Engineer. The PM is responsible for statewide bridge inspection policies and procedures, quality control and quality assurance, inspection reporting, preparation and maintenance of a bridge inventory, load ratings, and other requirements relating to these standards. The PM provides overall leadership and is available to inspection Team Leaders to provide guidance. The Program Manager responsibilities include:

- Review Inspection Plans *
- Review Specialty Equipment
  - Condition of current equipment
  - Acquisition of new equipment
  - Calibration and certification requirements
- Review Inspection Access Equipment
  - Condition of current equipment
  - Acquisition of new equipment
  - Calibration and certification requirements
- Review Inspection Reports
- Review of follow-up items to inspection findings *
- Determine Program Administrator/Inspector Qualification Requirements
  - Enforce De-certification and Denials if Requirements not met
- Establish Program Administrator/Inspector Training and Certification
  - Annual refresher training seminars
- Critical Findings review and follow-up *
- Statewide Inventory Data Reviews
  - Accuracy of inspection reports
  - Late inspections
  - Critical Findings
  - New ratings or postings requirements
  - NBI Condition State 2 review

(Items that may be delegated to a Program Administrator)*

A.4.2.2 Program Administrator Responsibilities

The Program Administrator should be familiar with the Minnesota Bridge Inspection Report format and the NBI and structural element condition ratings (as outlined in Chapter B – Bridge Inspection Field Manual of the BSIPM), and of the resources available on the Bridge Office website at http://www.dot.state.mn.us/bridge/index.html, including bridge inspection and inventory reports, inspections due and inspection frequency reports, bridge scour reports, bridge load posting and rating reports and bridge roster reports. The Program Administrator responsibilities include:

- Review and sign all routine bridge inspection reports
- Review in-depth inspection reports (fracture critical, complex or underwater reports)
- Respond to recommendations made in reports
- Identify and follow up on repair or rehabilitation identified from the inspection
- Report Critical Findings to the MnDOT Bridge Inspection Engineer and follow-up to resolution
- Review Condition Ratings for accuracy and changes from previous year

- Determine reduced inspection frequency (i.e. 24 months to 12 months) and/or need for in-depth inspection based on inspection findings
- Report changes in load ratings and inventory data to the MnDOT Bridge Office
- Maintain Inspector Qualifications
- Report and/or schedule necessary maintenance
- Maintain bridge files
- Report Bridge inspection data to MnDOT Bridge Office within 90 days for Trunk Highway bridges and within 180 days for non-TH bridges
- Act through the State Commissioner of Transportation in regards to bridges owned by cities or towns/townships to enforce bridge safety and maintenance

A.4.2.3 Team Leader Responsibilities

A MnDOT certified Bridge Inspection Team Leader must be present at the bridge site at all times during a bridge inspection. Their duties include:

- Assure that inspection equipment and required inspection tools are available during inspections
- Observe proper safety and traffic control procedures
- Accurately record and report field conditions in accordance with Chapter B – Bridge Inspection Field Manual of the BSIPM
- Use photos and sketches to document and quantify element conditions are deficiencies
- Properly report conditions
- Update plans and inventory data based on observations during inspections
- Document deterioration of concrete, timber or steel elements for load rating updates
- Document and report Critical Findings found during bridge inspections as outlined in Section A.6.2

A.4.3 CERTIFICATION AND APPOINTMENT PROCESS

The requirements listed below have been developed by the MnDOT Bridge Office to comply with the NBIS, as outlined in the Federal Code of Regulations Part 650.309 and Minnesota Statute 165.

A.4.3.1 Program Administrator

Designation as a Bridge Inspection Program Administrator does not also qualify that individual as a Bridge Safety Inspection Team Leader. If a Program Administrator also wants to perform bridge inspections, they must be certified by MnDOT as a Team Leader.

> **Inspector Note:**
> The certification levels defined below refer to the inspection of in-service bridges and culverts. This should not be confused with bridge construction inspection certification.

A.4.3.1.1 Appointment

Any agency with inspection jurisdiction for one or more bridges on the MnDOT structure inventory must designate a Program Administrator to oversee the bridge inspection and inventory program. To designate a Program Administrator, an appointment form must be filled out by an appropriate supervising individual employed by the agency (in many cases this will be the same individual designated as the Program Administrator) and submitted to the Bridge Office. The MnDOT Bridge Safety Inspection Appointment Form for Program Administrators can be found at the MnDOT Bridge Inspection website: http://www.dot.state.mn.us/bridge/inspection.html

The District Bridge Engineer will typically be designated as the Program Administrator for MnDOT Districts; the County Engineer will typically be designated as the Program Administrator for counties; the City Engineer will typically be designated as the Program Administrator for municipalities. Smaller cities, which employ a consultant to perform bridge inspections, may choose to designate a consulting engineer as the Program Administrator.

A.4.3.1.2 Renewal of Appointment

Program Administrators are automatically renewed every four years unless the Program Administrator does not meet the required training, the Program Administrator is replaced, or the Program Administrator is denied reappointment by the Program Manager. To maintain appointment the following two minimum requirements must be met:

- Be registered as a PE in the state of Minnesota
- Attend a minimum of two MnDOT refresher seminars or other bridge inspection related training during the four year appointment period

A.4.3.1.3 Denial Process

The Program Manager can deny/revoke appointment to a Program Administrator for a variety of reasons, not limited to the following:

- Failure to attend refresher seminars or bridge inspection related training at required intervals
- Failure to maintain registration as a Professional Engineer, as applicable
- Continued lack of proper follow-up for Critical Findings, critical scour, or other items that could adversely affect the performance of the bridge or the safety of the public
- Failure to correct findings from NBIS Quality Assurance Agency Compliance Reviews, including failure to respond to repeated compliance review inquiries
- Lack of follow-up for correcting load posting deficiencies
- Failure to submit inspection data into inventory in a timely manner
- Failure to follow or comply with any MnDOT, State, or Federal Policy, rules or law
- Failure to inspect bridges within the required frequency
- Dishonest or unethical behavior that adversely affects the inspection program

A.4.3.1.4 Re-appointment

A Program Administrator denied appointment may re-qualify, if they indicate in a written report, or plan of action, how they will correct their deficiencies. Upon approval by the MnDOT Program Manager, the Program Administrator shall be re-appointed, but monitored for one year under the NBIS compliance review process.

A.4.3.2 Team Leader Certification

In addition to the training and experience requirements outlined in the NBIS, MnDOT requires a separate field proficiency test to become certified as a Bridge Inspection Team Leader. The purpose of this test is to ensure compliance with the NBIS standards, to improve the quality of bridge inspections, and to increase the statewide consistency of bridge condition ratings. To schedule a field proficiency test, an application form must be submitted to MnDOT Bridge Office. This form is located at:
http://www.dot.state.mn.us/bridge/pdf/insp/fieldtestapplicationform.pdf

The test consists of a routine inspection of an in-service bridge (based upon Chapter B –Bridge Inspection Field Manual, and Inspection Report Format of the BSIPM). The inspector is given two hours to examine a bridge, take notes, and determine the NBI and structural element condition ratings.

Grading of the field proficiency test is determined by comparing the candidate's inspection report to a reference inspection report. Emphasis is placed on the overall completeness and accuracy of the report, and on the proper documentation of any critical structural or safety conditions. Scoring is based on a percentage scale of 0-100, with a minimum passing score of 75% required. Applicants who fail the field proficiency test may apply again after six months. The score is weighted using the following criteria:

- 30% – NBI condition ratings
- 40% – Structural element condition ratings
- 30% – Inspection Notes

A certification card will be sent to MnDOT certified Team Leaders with a four year expiration date.

A.4.3.2.1 Renewal of Certification

Certification must be renewed every four years (renewal forms are mailed out prior to expiration date). To maintain certification, a Team Leader must meet the following requirements:

- Attend a minimum of two MnDOT refresher seminars or other bridge inspection related training during the four year certification period
- Actively engage in bridge inspections during at least two of the four year certification period (must be verified by Program Administrator or the MnDOT Bridge Inspection Engineer)

A.4.3.2.2 De-Certification

The Program Manager can decertify a Team Leader for a variety of reasons, not limited to the following:

- Failure to attend refresher seminars or bridge inspection related training at required intervals
- Failure to maintain registration as a Professional Engineer as applicable
- Continued lack of proper follow-up for Critical Findings, critical scour, or other items that could adversely affect the performance of the bridge or the safety of the public
- Failure to correct findings from NBIS Quality Assurance Agency Compliance Reviews, including failure to respond to repeated compliance review inquiries
- Recurring miscoded critical items, such as structural elements
- Lack of follow-up for correcting load posting deficiencies
- Failure to submit inspection data into inventory in a timely manner
- Failure to follow or comply with any MnDOT, State, or Federal Policy, rules or law
- Failure to inspect bridges within the required frequency
- Dishonest or unethical behavior that adversely affects the inspection program

A.4.3.2.3 Re-Certification

If a Team Leader is decertified for reasons other than failure to fulfill training requirements within the four year certification period, the decertified Team Leader must recertify by completing NHI Course #130101 (Introduction to Safety Inspection of In-Service Bridges) or by completing and passing NHI Course #130101A (Prerequisite Assessment for Safety Inspection of In-Service Bridges). In addition, the decertified Team Leader must complete the MnDOT Field Proficiency test and achieve a score of 75% or better.

If a Team Leader is decertified only due to failure to fulfill training requirements within the four year certification period, he/she may be recertified by retaking and passing the MnDOT Field Proficiency test. If the decertified Team Leader doesn’t pass the MnDOT Field Proficiency test, he/she must complete and pass the two week NHI training course “Safety Inspection of In-Service Bridges”.

A.4.4 CERTIFICATION AND APPOINTMENT TRACKING

MnDOT maintains a database identifying Team Leaders, Program Administrators, and anyone having taken the NHI bridge safety courses, and/or a MnDOT bridge inspection seminar. Certification information tracked by the MnDOT Bridge Office is as follows:

- Name
- Address
- Certification number (if applicable)
- Agency information
- Certification expiration date
- Test scores
- NHI Bridge Safety Inspection Training Class attendance and scores
- MnDOT field proficiency test date and scores
- Inspection refresher seminar attendance

A.4.5 BRIDGE SAFETY INSPECTION TRAINING COURSES

FHWA and the State of Minnesota both require mandatory inspection training courses prior to becoming a certified Bridge Inspection Team Leader. This section identifies the different classes available to satisfy this qualification.

A.4.5.1 NHI Training Courses

MnDOT typically offers the 10-day NHI Training Course #130055 “Safety Inspection of In-Service Bridges” in February or March at the MnDOT Arden Hills Training Center. This course was developed by the National Highway Institute (NHI), and provides detailed instruction on the inspection, evaluation, and condition rating of in-service bridges. This course is based upon the FHWA “Bridge Inspectors Reference Manual” (BIRM) and the AASHTO “Manual for Bridge Element Inspection”.

Note: Under Federal law (the National Bridge Inspection Standards), this course is mandatory for anyone intending to become certified as a Bridge Inspection Team Leader.

- MnDOT employees should register through their Employee Development Specialist (EDS)/Training Representative (a course announcement is usually distributed in December of the preceding year)
- Non-MnDOT employees must register directly through the NHI web site listed below; http://www.nhi.fhwa.dot.gov

Please keep in mind that there is high demand for this course, and it usually fills up shortly after registration opens (typically in December of the preceding year).

In 2012, the FHWA and NHI added prerequisite requirements for the 10-day NHI Training Course #130055 “Safety Inspection of In-Service Bridges”. Two free online prerequisite course options are available through the NHI web site. To register for the prerequisite classes follow the instructions below.

Go to the FHWA website http://www.nhi.fhwa.dot.gov and click on “Register for a Course”, then click on “Find Training Courses”, and then enter the course number and click “Search”. You will need to register on the NHI site and get a password.

Note: These prerequisite courses are only considered valid for two years. You must bring a copy of your completion certificate to the first day of the 10-day course.

1. NHI Course #130101A (Prerequisite Assessment for Safety Inspection of In-Service Bridges): This is an online assessment consisting of three quizzes of 15 questions each. You need to pass each quiz with a score of 70% or higher. This assessment should take approximately one hour. Note: you should only take this one hour assessment quiz if you feel confident in your knowledge of the topics listed in the “outcomes for NHI Course #13101” (see course description on the NHI web site) – if not, you should instead take NHI Course 130101. If you do not pass this course, you will need to take the NHI Course #130101.
2. NHI Course #130101 (Introduction to Safety Inspection of In-Service Bridges): This is an online tutorial and assessment that should take approximately 14 hours to complete. It includes essentially the same quiz format as NHI Course 130101A (three quizzes of 15 questions each), but you have the option of taking the quizzes as you go, or taking them all at the end. You need to pass each quiz with a score of 70% or higher.

While the 5-day NHI Course #130054 “Engineering Concepts for Bridge Inspectors” is also considered to be a valid prerequisite option, this course will no longer be offered by MnDOT. Like the other prerequisite options, this course is only considered to be valid for two years.

Other NHI Classes periodically offered by MnDOT are the following:

1. NHI Course #130078 (Fracture Critical Inspection Techniques for Steel Bridges): This is a 3½ -day course for inspectors to identify fracture critical bridges, fracture critical bridge members, and fatigue prone details. Tasks include: categorize contributing factors in the initiation and propagation of fatigue cracks; perform an intensive, in-depth, and thorough fracture critical member inspection; identify various crack types and access their impact on the performance of the member; evaluate, select, and facilitate the use of available NDT methods; and recommend a necessary course of action based on inspection findings.
2. NHI Course # 130053 (Bridge Inspection Refresher Training): This is a 3½ -day course for practicing bridge inspectors to refresh skills in fundamental visual inspection techniques; review the background knowledge necessary to understand how bridges function; communicate issues of national significance relative to the nations' bridge infrastructures; re-establish proper condition and appraisal rating practices; and review the professional obligations of bridge inspectors.
3. NHI Course # 135046 (Stream Stability and Scour at Highway Bridges): This 3 -day course provides participants with comprehensive training in the prevention of hydraulic-related bridge failures. Course participants will receive training in conducting a stream stability classification and qualitative analysis of stream response and make estimates of scour at a bridge opening.

   Material for the course comes primarily from two Hydraulic Engineering Circulars (HEC), "Evaluating Scour at Bridges" (HEC-18), 5th Edition (2012), and "Stream Stability at Highway Structures" (HEC-20), 4th Edition (2012). The effects of stream instability, scour, erosion, and stream aggradation and degradation are covered. Quantitative techniques are provided for estimating long-term degradation and for calculating the magnitude of contraction scour in a bridge opening. Procedures for estimating local scour at bridge piers and abutments for simple and complex substructures are also provided. A comprehensive workshop integrates qualitative analysis and analytical techniques to determine the need for a Scour Plan of Action for correcting stream instability and scour problems.

Registration for NHI courses is through the NHI web site as explained above.

A.4.5.2 Bridge Safety Inspection Refresher Training Seminars

The NBIS requires periodic bridge inspection refresher training for Bridge Inspection Team Leaders and Program Administrators. The intent of this training is to improve the quality of bridge inspections, introduce new inspection equipment and techniques, and maintain the consistency and reliability throughout the state-wide network of bridge safety inspection programs.

MnDOT conducts annual one-day bridge safety inspection refresher seminars. These classes are typically held in February and March in various locations throughout the state. For seminar locations, dates and registration information visit the MnDOT Bridge Office training portion of the website at http://www.dot.state.mn.us/bridge/training.html .

To maintain MnDOT certification as a Bridge Inspection Team Leader, attendance is required at a minimum of two bridge inspection seminars during each four year re-certification period.

Engineers who are currently designated as Bridge Inspection Program Administrator are required to attend at least two of these refresher seminars every four years.

Seminar topics will vary each year, but will generally cover bridge inspection condition ratings, structure inventory coding, bridge load capacity ratings, bridge hydraulics, and a variety of topics related to bridge inspection.

A.5 BRIDGE SAFETY INSPECTION TYPES

This section describes the procedures for determining the required inspection type and frequency for individual bridges and culverts. It also establishes the process for request and approval of any changes to inspection frequencies.

There are eight types of bridge inspections: Initial, Routine, In-Depth, Damage, Special, Fracture Critical, Complex and Underwater Inspections. The scope and frequency of the various types of bridge safety inspections are described here to provide an understanding of the purpose and use of each inspection type. These inspections are performed at intervals that are influenced by the individual bridges structural condition, structure type and details, site conditions, load capacity evaluation, and scour critical evaluation.

Complex bridge structures such as movable, suspension, cable-stayed, and other bridges with unusual characteristics must have published inspection procedures and inspection team qualification requirements for the structure(s). These procedures should cover the inspection frequency, scheduling and requirements for the In-Depth inspections, traffic control, special equipment, methods of access, and specific components on the structure where hands-on inspection is required for each inspection. The requirements for any special inspection techniques such as non-destructive testing should also be identified including the locations where applicable.

Bridges that are temporarily closed for rehabilitation work must be inspected on their regular inspection frequency. A temporarily closed bridge is defined as a bridge that is closed 12 months or less. If an element cannot be accessed due to construction activity, the Team Leader is required to inspect the elements that can be accessed and document in the notes what could not be inspected. After the bridge is reopened to traffic or upon the time construction activity will no longer effect the bridge elements that could not be inspected, the Team Leader is required to inspect and document in the appropriate SIMS report the elements that were not inspected. Revision of the bridge inventory maybe required after rehabilitation work is completed.

Bridges that are closed for longer than 12 months due to rehabilitation **may** have NBI 41 (Inspection Status) on the inventory changed to “K Closed”. When NBI 41 is changed to K Closed, the inspection due (routine, fracture critical, etc.) is not required for that bridge. After the bridge is reopened to traffic or upon the time construction activity will no longer effect the bridge inspection, the inspection due must be completed within 3 months. Verification and revision to the SI&A data must be completed at this inspection and NBI 41 must be changed to “A Open” on the inventory.

A.5.1 INITIAL INSPECTIONS

As defined by NBIS 23 CFR § 650.305:

> *Initial inspection*. The first inspection of a bridge, as it becomes a part of the bridge file, is to provide all Structure Inventory and Appraisal (SI&A) data and other relevant data and to determine baseline structural conditions.

A.5.1.1 Scope of Initial Inspections

All new structures must receive an initial inspection. The initial inspection serves to provide verification of inventory information that has been entered into SIMS by the Bridge Inventory Management Unit and to document its structural and functional conditions by:

- Verification that required SI&A data in SIMS is accurate per Federal regulations along with all other data required by MnDOT standards and/or the Bridge Owner
- Determining baseline structural conditions
- Determine if the bridge will require a channel cross-section and/or be added to the underwater inspection list
- Identifying and listing any existing problems
- Identifying maintenance needs, including preventative maintenance activities

Coinciding with the initial inspection is the creation of the bridge file for the structure. Documents including, but not limited to, plans, SI&A sheets, photographs, bridge load ratings and signing recommendations, scour analysis, foundation information, hydrologic and hydraulic data are to be inserted into the bridge file. Selected construction records (e.g., pile driving records, field changes) may also be of great use in the future and should be included. Maintenance records for existing bridges should also be included.

The level of effort required to perform an initial inspection will vary according to the structure’s type, size, complexity, and location. An initial inspection needs to verify that all inspection elements have been accounted for and document the baseline conditions. Traffic control and special access equipment may be required.

A.5.1.2 Frequency of Initial Inspections

As stated in section 4.2.4.1 of the Manual for Bridge Evaluation, Initial Inspections are not recurrent and thus do not have an established inspection frequency. However, upon completion of new bridge construction and once all travel lanes are open to traffic, the bridge is assigned a routine inspection frequency of 3 months for State and Federally owned bridges and 6 months for all other bridges. Once the initial inspection is entered into SIMS and approved by the PA, the bridge will be assigned a routine inspection frequency of 24 months. It is contingent on the bridge owner to notify the Bridge Inventory Management Unit when all travel lanes have been opened to traffic.

A.5.2 ROUTINE INSPECTIONS

As defined by NBIS 23 CFR § 650.305:

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.

A.5.2.1 Scope of Routine Inspections

Routine inspections are also known as “regular” and “NBIS” inspections. Although these inspections are used to determine bridge maintenance or repair needs, the primary focus of the routine inspection is public safety. This inspection includes sufficient observations and measurements to determine the physical condition of a structure in order to accomplish the following functions:

- Determine the physical and functional condition of the structure and its components
- Identify changes from the previously recorded conditions
- Correct any inaccuracies in bridge inventory data noted during the inspection
- Determine the need for the load-carrying capacity to be re-evaluated based on either the condition of the structural members or increased dead loading
- Identify and document potential problems that may affect bridge safety
- Determine maintenance needs that may be required

The level of detail and effort required to perform a routine inspection will vary according to the structure’s type, size, design complexity, existing conditions, and location. Generally, every element in a bridge does not require a hands-on inspection during each routine inspection to provide an acceptable level of safety. Knowledge of the structure and good engineering judgment are necessary when considering those portions that do not require a hands-on inspection during each routine inspection.

Bridge elements requiring a detailed hands-on inspection during each routine inspection include, but are not limited to:

- Load carrying members in Poor condition
- Fracture Critical Members/Details in Poor condition
- Fracture Critical Member/Details where out-of-plane bending or fatigue problems exist
- Redundancy retrofit systems (e.g., Catcher-beams) for fracture critical details (pin hangers, etc.)
- Critical sections of controlling members on load posted bridges
- End regions of steel girders or beams in Poor condition under a deck joint
- Timber substructure elements in Poor condition
- Other areas determined by the Program Administrator or Team Leader to be potentially critical

The application of these guidelines noted above does not relieve the Team Leader from the responsibility to perform other hands-on inspection tasks and/or tests needed to ascertain the condition of the bridge and assure its safety. If the Team Leader feels additional access equipment, special tools or specific testing equipment is required, this should be discussed with the Program Administrator.

Routine inspections are generally conducted from the deck, ground and/or water levels, ladders and from permanent work platforms or walkways, if present. Inspection of underwater members of the substructure is generally limited to observations during periods of low flow and/or probing/sounding for evidence of local scour and by wading.

Special attention should be given to the wearing surface type and fill depth during each routine inspection. If there appears to be a recent overlay on the structure that has occurred since the previous inspection, it is possible the inventory data hasn’t been updated. Additional dead loads resulting from increased fill depths or bridge rails have a direct impact on the load carrying capacity of the structure. Refer to Section A.8.2 for additional information and general guidelines for when a bridge load re-rating may be warranted.

A general review of inventory items should be a part of each routine inspection, with any needed corrections noted and forwarded to the Program Administrator with the other inspection findings. The goal is to have the bridge inventory data as accurate as possible and this can only be accomplished by a periodic review of this data. This general review of inventory information during the routine Inspection does not necessarily require the inspector to take physical measurements, but should include an effort to identify obvious errors in existing structure inventory information.

BSIPM User Note:

Refer to Chapter D – Recording and Coding Guide of the BSIPM which details specific requirements for all Inventory Items.

For information regarding routine inspection frequency, see Section D.7.3.3.

A.5.2.2 Frequency of Routine Inspections

After completion of the Initial Inspection, all newly constructed bridges or culverts are assigned a routine inspection frequency of 24 months. For culverts, following the initial inspection, the Bridge Owner can request a longer interval for routine inspections as long as the conditions stated in Section D.7.3.3 are met. Refer to Section E.4.3 for inspection frequency requirements.

Those structures not meeting the biennial inspection conditions shall be inspected on a 12 month frequency or less depending on the condition of the structure.

A.5.3 IN-DEPTH INSPECTIONS

As defined by NBIS 23 CFR § 650.305:

> *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.

A.5.3.1 Scope of In-Depth Inspections

In-depth inspections serve to collect and document the existing condition of all elements in greater detail than a typical routine inspection. These inspections can also provide the necessary documentation of deficiencies for use in determining the need for immediate repairs or future rehabilitation of the structure. Many times, this data is more difficult to collect than data collected during a routine inspection.

The level of effort required to perform an in-depth inspection will vary according to the structure’s type, size, design complexity, existing conditions, and location. Traffic control and special equipment, such as an UBIV, bucket truck, man lift or specialized rigging may be required to adequately perform an in-depth inspection. Inspectors with special skills such as divers, riggers and certified non-destructive testing technicians may also be required. Other non-destructive and/or material tests can be part of an in-depth inspection to determine the extent of a Finding or evaluate the existing strength of a bridge element. A structural analysis for load carrying capacity may be required with an in-depth inspection to fully evaluate the findings of this more detailed inspection.

A.5.3.2 Frequency of In-Depth Inspections

The frequency of an in-depth inspection will be established by the Bridge Owner. An in-depth inspection that includes all elements and satisfies all requirements of a routine inspection can be scheduled to take the place of a routine inspection for a given inspection cycle. In-depth inspections may also be scheduled as a follow-up to a previous inspection. For large or complex bridge structures, in-depth inspections should be routinely scheduled to ensure that maintenance work is identified early, programmed to secure funding, and completed in a timely manner.

A.5.4 FRACTURAL CRITICAL INSPECTIONS

As defined by NBIS 23 CFR § 650.305:

> *Fracture critical member (FCM)*. A steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.
>
> *Fracture critical member inspection*. A hands-on inspection of a fracture critical member or member components that may include visual and other nondestructive evaluation.
>
> *Hands-on*. Inspection within arm's length of the component. Inspector uses visual techniques that may be supplemented by nondestructive testing.

A.5.4.1 Scope of Fracture Critical Inspections

Inspection under these guidelines will apply to all bridges that have members determined to be fracture critical (FC), except those bridges that carry only railroad and or pedestrian traffic. The Bridge Office will evaluate all bridges that are not load path redundant to determine if and where FCMs are present. FC inspections shall be conducted using an UBIV, bucket trucks, man lifts, rigging, boats, ladders or any means necessary to visually inspect all FC members hands-on. Inspections will be conducted following appropriate MnDOT safety guidelines for both the employee and the general public.

Field inspections should be conducted in a systematic and organized manner that will be efficient and minimize the possibility of any bridge item being overlooked. Critical Findings shall be reported as detailed in Section A.6.2. Findings that may affect the load carrying capacity of the bridge shall be reported to the MnDOT Load Ratings Engineer in accordance with the same timeframe as Critical Findings.

The Bridge Office completes all fracture critical inspections and maintains files on the bridges. The Bridge Office will maintain a list of the following items for those bridges which contain FCM's to ensure the safety of such bridges:

- Location and description of such FCMs for each bridge
- In-depth or special feature inspection frequency
- Inspection procedure(s)
- Date of the last inspection
- Description of inspection findings
- Description of any follow-up action resulting from the most recent inspection

> BSIPM User Note:
> For additional information regarding fracture critical inspection frequency, see Section D.7.3.9.

Fracture critical inspections, on both the Trunk Highway and Local System, are conducted by the Bridge Office. Scheduling priority for inspections will be given to large and complex bridges. Traffic control and certain access equipment (man-lift, etc.) are the Bridge Owner's responsibility in accordance with Chapter F – MnDOT Inspection Vehicle Policy Manual of the BSIPM regardless of participation by the Bridge Office.

The Bridge Office will provide a wide range of services to the Districts, Local Agencies, and consultants in support of Fracture Critical Inspections, including:

- Identification of FCM's and critical details
- Training
- On-site inspections
- Non-destructive testing

Refer to Section A.4.1.5 for specific FC inspector qualifications.

Inspector Note:

Only qualified American Society for Non-Destructive Testing (ASNT) Level II or III technicians shall conduct and/or verify non-destructive testing services done by others in regards to ultrasonic and magnetic particle testing methods.

A.5.4.2 Frequency of Fracture Critical Inspections

Non-redundant structural members that are determined to be fracture critical shall receive a hands-on FC inspection at an interval not to exceed 24 months. Upon request from the Program Administrator, a reduced inspection frequency of 12 (not to exceed 15) months (or less) will be instated when the superstructure has an NBI rating of a 3 or less and the bridge is open to traffic.

A fracture critical inspection that includes all elements and satisfies all requirements of a routine inspection can be scheduled to take the place of a routine inspection for a given inspection cycle. Fracture critical inspections may also be scheduled as a follow-up to a previous inspection. For large or complex bridge structures, fracture critical inspections should be routinely scheduled to ensure that maintenance work is identified early, programmed to secure funding, and completed in a timely manner.

A.5.5 COMPLEX INSPECTIONS

As defined by NBIS 23 CFR § 650.305:

> *Complex bridge*. Movable, suspension, cable-stayed and other bridges with unusual characteristics.
>
> *Hands on*. Inspection within arm's length of the component. Inspection uses visual techniques that may be supplemented by nondestructive testing.

A.5.5.1 Scope of Complex Inspections

Inspection under these guidelines will apply to all bridges that have members or structures determined to be complex, except those bridges that carry only railroad and or pedestrian traffic. Complex inspections shall be conducted using an UBIV, bucket trucks, man lifts, rigging, boats, ladders or any means necessary to visually inspect all complex members hands-on. Inspections will be conducted following appropriate MnDOT safety guidelines for both the employee and the general public.

Field inspections should be conducted in a systematic and organized manner that will be efficient and minimize the possibility of any bridge item being overlooked. Critical Findings shall be reported as detailed in Section A.6.2. Findings that may affect the load carrying capacity of the bridge shall be reported to the MnDOT Load Ratings Engineer in accordance with the same time as Critical Findings.

The Bridge Office completes all complex bridge inspections and maintains files on the bridges. The Bridge Office will maintain a list of the following items for those bridges which are complex to ensure the safety of such bridges:

- Location and description of such complex details for each bridge

- In-depth or special feature inspection frequency
- Inspection procedure(s)
- Date of the last inspection
- Description of inspection findings
- Description of any follow-up action resulting from the most recent inspection

Complex bridge inspections, on both the Trunk Highway and Local System, are conducted by the Bridge Office. Scheduling priority for inspections will be given to complex bridges. Traffic control and certain access equipment (man-lift, etc.) are the Bridge Owner's responsibility in accordance with Chapter F – MnDOT Inspection Vehicle Policy Manual of the BSIPM regardless of participation by the Bridge Office.

The Bridge Office will provide a wide range of services to the Districts, Local Agencies, and consultants in support of Complex Bridge Inspections, including:

- Identification of complex bridge details
- Training
- On-site inspections
- Non-destructive testing

BSIPM User Note:

For additional information regarding complex bridge frequency, see Section D.7.3.10.

Refer to Section A.4.1.6 for specific complex bridge inspector qualifications.

A.5.5.2 Frequency of Complex Inspections

Each complex bridge shall have its own complex inspection procedure, reporting method and frequency, as determined by the MnDOT Bridge Office. Complex bridges shall receive a hands-on inspection of complex components.

A complex inspection that includes all elements and satisfies all requirements of a routine inspection can be scheduled to take the place of a routine inspection for a given inspection cycle. Complex inspections may also be scheduled as a follow-up to a previous inspection. For large or complex bridge structures, complex inspections should be scheduled to ensure that maintenance work is identified early, programmed to secure funding, and completed in a timely manner.

A.5.6 DAMAGE INSPECTIONS

As defined by NBIS 23 CFR § 650.305:

> *Damage Inspection*. This is an unscheduled inspection to assess structural damage resulting from environmental factors or human actions.

A.5.6.1 Scope of Damage Inspections

Damage inspections are performed to investigate damage in order to evaluate the potential effect on the load-carrying capacity of the structure. A damage inspection may also be used to determine the immediate need to place an emergency restriction on a bridge due to a traffic impact or extreme weather event, or to determine repairs that are necessary to put the bridge back into service.

The scope of the damage inspection has to match the level of detail necessary to accurately and adequately determine the safe load-carrying capacity of the structure. Inspectors must evaluate any fractured members, determine extent of section loss, take measurements for misalignment of members, and check for any loss of foundation support. In the case of an assessment due to a severe weather event or bridge impact, the inspector may need to make an on-site determination of the need to close or severely restrict the traffic on the structure. Refer to Section A.8.2 for additional information on conducting inspections for the purpose of completing a bridge load re-rating structures with damaged members.

A.5.6.2 Frequency of Damage Inspections

Damage inspections are performed on an as-needed basis as determined by the Bridge Owner and/or Program Administrator. For trunk highway structures, the Minnesota Bridge and Structures Incident Response Plan must be followed as stated in Section A.6.6.1.

A.5.7 SPECIAL INSPECTIONS

As defined by NBIS 23 CFR § 650.305:

> *Special Inspection*. An inspection scheduled at the discretion of the Bridge Owner, used to monitor a particular known or suspected finding.

A.5.7.1 Scope of Special Inspections

Special inspections are performed in addition to the other NBIS inspections and typically focus on specific elements of the structure. They may be prompted by structural deterioration, conditions affecting the stability of the structure, or for other reasons at the discretion of the State Program Manager. Some examples of Special Inspections would be:

- Extensive deterioration to main load carrying members
- Recorded or potential scour
- Movement of a substructure unit
- Settlement
- Damage or Impact
- A pinned assembly requiring non-destructive testing on a set routine inspection frequency
- Structural details with a history of poor performance such as pin and hanger details

Special inspections that require ultrasonic testing (UT) of pins are conducted by the MnDOT Bridge Office. These inspections may be completed in conjunction with both District and Local Agency inspectors. Traffic control and certain access equipment such as man-lifts or UBIVs are the Bridge Owner's responsibility in accordance with Chapter F – MnDOT Inspection Vehicle Policy Manual of the BSIPM.

The Bridge Office will maintain a list of those bridges which contain unique or special features requiring additional attention to ensure the safety of such bridges (e.g. pin and hanger details and steel pier caps).

Inspections will be conducted following appropriate MnDOT safety guidelines for both the employee and the general public. Special inspections will be conducted using the same guidelines as FC inspections.

A.5.7.2 Frequency of Special Inspections

Pin and hanger details and pinned assemblies shall receive a special inspection at an interval not to exceed 60 months. Other special inspections may be established at the discretion of the State Bridge Inspection Program Manager. Reduction in inspection frequency (e.g. 24 months to 12 months) may be determined by the Structural Evaluation Engineer based on inspection findings if deemed necessary.

Special Inspections are regularly scheduled until repairs are made, corrective actions are taken to reduce or negate any potential risks to the safety of the structure, or the poor performing structural details are removed from the structure.

A.5.8 UNDERWATER INSPECTIONS

As defined by NBIS 23 CFR § 650.305:

> *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.

A.5.8.1 Scope of Underwater Inspections

NBIS require inspection of all bridges as needed to determine the condition of the underwater portion of the substructures with certainty. Minnesota defines a bridge as needing an underwater inspection when, "the water depth is such that the underwater portions of a substructure cannot routinely be inspected using waders during periods of low water depth". It can also apply to structures that cannot be examined by feel for condition, integrity and safe load capacity due to excessive water flow velocity and/or turbidity.

Underwater inspections shall be both a visual and a tactile inspection of the entire underwater portion of the substructure. Inspections shall include checking all concrete for erosion, wear, and abrasion, scaling, spalling, exposure, and deterioration, and for any exposed reinforcing steel and all cracking. All exposed structural steel and piling shall be checked for misalignment and loss of sections. All timber shall be sounded and checked for presence of bores, decay, and weathering. The channel bottom shall also be inspected for presence, size, condition of riprap, and for any evidence of scour. Underwater inspections should be conducted in a systematic and organized manner that will be efficient and minimize the possibility of any underwater bridge item being overlooked.

The Bridge Office will, for all Trunk Highway bridges, monitor and administer the underwater inspections and maintain files on each of these bridges. Underwater Inspections will normally be performed by diving contracts administered by the Bridge Office for all bridges requiring UW inspections. The Bridge Office will maintain a list of the following for those bridges which require Underwater Inspections:

- Location of the bridge and member to be inspected
- Type of foundation
- Bottom of foundation elevation or pile tip elevation
- Depth soundings at bridge as well as upstream and downstream of bridge
- Type and frequency of required inspections
- Inspection procedure(s)
- Date of last inspection
- Special equipment requirements
- Description of inspection findings
- Description of any follow-up action(s) resulting from most recent inspection

Underwater inspections must be conducted under the direct supervision of either a MnDOT certified Team Leader or someone with NBIS Team Leader qualifications. Refer to Section A.4.1.6 for information regarding Underwater Bridge Inspector Qualifications.

A.5.8.2 Frequency of Underwater Inspections

The frequency of underwater inspections will be based upon the criticality and condition of the bridge. Diving inspections are performed by consulting engineers on state-wide contracts. To ensure compliance with FHWA Metric #17, beginning in 2016 and continuing into the future, all Trunk Highway, County, City, and Township bridges will receive underwater inspections on a 48 month cycle. The inspections will be combined under a single contract. UW inspections by a certified engineer-diver may also be required for a scour critical bridge immediately after floods.

Reduced inspection frequency (i.e. 48 months to 12 months) may be suggested by the lead consultant engineer based on inspection findings and then determined by the State Bridge Hydraulics Engineer. The Program Administrator must approve any suggested change in inspection frequency. Upon request from the Program Administrator, a reduced inspection frequency of 24 months (or less) will be instated when the substructure or channel NBI rating is 3 or less and the bridge is open to traffic.

A.5.9 INSPECTIONS OF RAILROAD BRIDGES

The owner of the railroad track supported by a bridge is fully responsible for the safety of trains that operate over that bridge, regardless of any agreement or division of ownership or maintenance expense to the contrary.

It is highly suggested that the railroad track owner should:

- Maintain an accurate bridge inventory (location, configuration, type of construction, number of spans, span lengths, and all other information necessary to provide for bridge management)
- Ensure that every bridge that carries railroad traffic is inspected at least once per year; bridge inspection reports should be reviewed by an engineer who is competent in the field of railroad bridge engineering
- Ensure that bridges are not loaded beyond their capacities. A professional engineer competent in the field of railroad bridge Engineering (or under supervision) should determine the bridge load capacity, and a record of the safe capacity of every bridge which carries its track should be maintained

Like all bridges on the MnDOT inventory, railroad bridges with condition ratings of “5” or higher for NBI Items 59 and 60 may be inspected on a 24-month interval. Non-redundant railroad bridges which carry an active railroad must be inspected on a 12-month frequency, regardless of condition. Non-redundant railroad bridges are not considered “fracture critical” or “complex” and do not require in-depth inspections as they do not carry highway traffic.

A.5.9.1 Scope of Railroad Bridge Inspections

A Routine Inspection of a railroad bridge should not differ significantly from the inspection of a highway bridge, except for the issue of railroad property access. As the intent of the roadway agency is to safeguard those traveling beneath a railroad bridge, the inspection will typically be performed exclusively from below. A Routine Inspection of a typical railroad bridge will consist of a visual inspection of all the spans from the ground level.

In addition to routine inspection notes as previously discussed, notes should also include the following:

- Emergency and non-emergency railroad contact information
- Railroad mile point or US/DOT ID number
- Bridge Owner and “custodian” – agency with bridge maintenance responsibility

The roadway agency inspector is not required to walk across the deck of a railroad bridge. The deck can be visually inspected from below. Railroad decks are often too narrow to provide a safe place to stand when a train is passing over, and many railroad bridges do not have railings. If possible, the inspector should note if the railroad tracks are active, abandoned or removed.

On some multi-span railroad bridges, only the spans(s) crossing the public roadway will be inspected by the roadway agency, and the inspection notes should clearly state what portion of the bridge was inspected.

The roadway agency should pay particular attention to the safety of the roadway passing below a railroad bridge. The inspector should verify that any required clearance signing is present, correct and in readable condition. Vertical and horizontal clearance measurements should be verified and current measurements kept on file. The inspector should always note if the roadway below the bridge has been recently resurfaced, and the MnDOT Bridge Office should be notified of any changes.

A.5.9.2 Railroad Flagger Requirements

If access to railroad property is required to perform a bridge inspection, the railroad owner must be notified and right of entry to the property obtained. A railroad flagger is required whenever access equipment is used on a highway bridge over an active railroad. Requirements established by the operating railroad owner for flaggers during the inspection will be determined prior to the inspection and strictly adhered to by the roadway agency inspectors.

A.5.10 VERIFICATION OF CLOSED BRIDGES

When bridges are closed to vehicle traffic, and are not removed, it is the responsibility of the PA to verify the bridge is still closed to assure public safety from either pedestrian access on the structure or from vehicle and/or pedestrian access below the structure. If the structure meets the NBIS definition of a bridge and remains in the State's Inventory, it must continue to be closed.

Closed bridges are often found open to traffic due to the public removing temporary barricades or signage. If the public continues to remove temporary barricades, the Bridge Owner should install permanent barricades that the public cannot readily move. It is very important that these bridges remain closed as a matter of public safety.

A.5.10.1 Frequency of Closed Bridge Verification

Verification that the bridge is still closed to traffic should be completed on an annual basis.

Verification that the bridge is still closed to traffic is the responsibility of the Bridge Owner. The frequency of this verification is established and monitored by the Bridge Owner.

A.6 INSPECTION REPORTING PROCEDURES

The following sections provide guidance for procedures to be followed for documenting and reporting inspections and specific procedures and requirements.

A.6.1 GENERAL REPORTING TIMELINES

For all routine bridge inspections, the inspection date must be entered into SIMS within 3 months or less of the inspection due date. The general reporting and approval requirements for the inspection report are stated below.

State Owned Bridges including Department of Natural Resource Bridges:
For general reporting QC procedures of state owned highway bridges, see Section E.4.4.1.
The inspection report must be reviewed and approved by the appropriate Program Administrator within 90 days of the inspection for Trunk Highway bridges per NBIS.

Non-State Owned Bridges:
For general reporting QC procedures of non-state owned highway bridges, see Section E.4.4.2.
The inspection report must be reviewed and approved by the appropriate Program Administrator within 180 days of the inspection for Local Agency bridges per NBIS.

Railroad Bridges:
MnDOT and other Local Agencies normally do not forward bridge inspection reports to the Railroad Owner unless one of the following criteria has been met:

- If the Condition rating for NBI Item 58 (Deck), Item 59 (Superstructure) or Item 60 (Substructure) is rated a “4” or less
- A Critical Finding as defined by Section A.6.2 of the manual is found during the inspection
- A Serious Safety Hazard Finding as defined by Section A.6.3 of this manual is found during the inspection
- If a special inspection is necessary to monitor a particular known or suspected finding
- If a damage inspection is necessary due to damage that has caused the load carrying capacity of the structure may be affected

The general reporting timelines outlined for non-state owned bridges should be followed for all railroad structures.

A.6.2 CRITICAL FINDINGS

A Critical Finding is any structural condition that, if not promptly corrected, could result in collapse (or partial failure) of a bridge or culvert. This is not limited to findings observed during a scheduled inspection, and can include traffic impact damage or flood damage. It may be necessary to restrict traffic until further evaluation can be made or until the situation is corrected. A Critical Finding should be thoroughly documented, and the Program Administrator (and Bridge Owner) must be notified immediately. Critical Findings must also be reported to the MnDOT Bridge Office (a report must be entered and submitted in SIMS). Refer to the reporting procedures outlined below.

To ensure public safety, it is essential that Critical Findings not only be brought to the attention of those responsible but that these findings are reviewed to confirm that all necessary corrective actions have been completed.

A.6.2.1 Critical Finding Process

Upon discovery of a possible Critical Finding, the Team Leader is responsible for the following:

- Public Safety: If the observed condition is severe enough to warrant immediate closure of the bridge (or immediate restriction of traffic above or below the bridge), the Team Leader shall immediately take any actions necessary to ensure public safety.
- Immediate Notification of the Program Administrator: Upon discovery of a Critical Finding, the Team Leader shall immediately notify the Program Administrator.

If a Critical Finding is confirmed, a Critical Finding Report must be created by the Team Leader in SIMS:

- The report will summarize the specifics of the event. Sketches, photos, and measurements should be included to fully describe the situation. The purpose of the report is to document the event and the resolution.
- If the bridge is still in a critical state at the time of the report, the “Critical Finding/Safety Hazard” (Element #800) should be rated as “Condition State 4”. If the critical state of the bridge has been resolved, the “Critical Finding/Safety Hazard” (Element #800) should be rated as “Condition State 2”. In either case, the element should be narrated appropriately to give future inspectors proper insight to monitor the resolution with additional consideration.
- **Like all SIMS reports: the Critical Finding Report must be approved within SIMS at 90 days from initial observation (date of inspection) for state-owned structures, 180 days for other-owned structures, or February 15th (date of annual Minnesota data submission to FHWA), whichever comes first.**

MnDOT will monitor SIMS for candidate structures requiring Critical Finding action and documentation. FHWA notification will occur from the MnDOT Bridge Office with an email whenever a bridge is put into a critical state, defined by any of the following criteria:

- NBI 58 (Deck Condition) is rated 2 or less.
- NBI 59 (Superstructure Condition) is rated 2 or less.
- NBI 60 (Substructure Condition) is rated 2 or less.
- NBI 61 (Channel Condition) is rated 2 or less.
- NBI 62 (Culvert Condition) is rated 2 or less.
- ADE 800 (Critical Status) is rated in condition state 4.
- A SIMS Critical Finding Report is created by an agency for any bridge.

FHWA will be notified again by email once bridge is removed from critical status.

A.6.3 SERIOUS SAFETY HAZARD

A Serious Safety Hazard is defined as an element level condition that may be hazardous to public safety, but IS NOT expected to lead to collapse or partial collapse of the bridge.

A serious safety hazard refers to a non-structural condition that poses a significant safety hazard and must be addressed immediately. Examples include severely damaged railings or guardrails, loose concrete above traffic or a pedestrian walkway and missing load posting signs. Serious safety hazards should be immediately reported to the Inspection Program Administrator and Bridge Owner, but do not need to be reported to the MnDOT Bridge Office (a separate report in SIMS is not required). Once a serious safety hazard is observed, the inspector should rate the "Critical Finding/Safety Hazard" (Element #800) as a "Condition State 3" either in the inspection report or an Update Report (if not found during a scheduled inspection) and briefly describe the safety hazard (if necessary, supplemental notes, sketches, photos, and measurements should be included to fully describe the situation) and submit the inspection report to the Program Administrator.

A.6.4 FRACTURE CRITICAL INSPECTION REPORTING

This report is a standard narrative report that provides NBI and element coding and identifies the inspection procedures, fracture critical members (FCMs), fatigue prone details, and inspection findings of the bridge. The standard Fracture Critical Inspection Report template is available in SIMS.

A.6.4.1 Fracture Critical Report

The Fracture Critical Inspection Report undergoes a review process as follows:

- Critical Findings, New Load Rating Recommendation, Safety Hazards, and/or Structural Analysis Recommendation – if any of these items are determined during a fracture critical bridge inspection, the TL must notify the BIE and the Bridge Evaluation Unit immediately. The Bridge Evaluation Unit will call an assessment meeting to develop a plan of action. Once a plan of action is determined, the Bridge Evaluation Engineer will submit a response via e-mail to the BIE and CC the assessment meeting participants. The BIE will then submit to the inspection team, who will then in turn document the plan of action in the bridge file, notify the Program Administrator as applicable, and/or create a Critical Finding Report in SIMS if necessary.
- If no Critical Finding is determined during a fracture critical inspection, the designated inspection report writer will create the Fracture Critical Inspection Report in SIMS in conjunction with the inspection team members for review.
- Once reviewed by the inspection team members and revised, the inspector will submit the Fracture Critical Inspection Report to the BIE for review via SIMS and record that day as the Date Sent for Inspection Review in the Bridge Office Inspection Tracking spreadsheet for that year. The BIE will review the report for inspection-related items, grammar, format, and completeness. The review will be returned to the report writer for revision through the SIMS application by way of personal edits within the application or in the comments section upon submittal.
- Once revisions are made, the inspector will submit the Fracture Critical Inspection Report to the BIE who then submits to the Bridge Evaluation Unit via SIMS. The BIE records that day as the Date Sent for Structural Review in the Bridge Office Inspection Tracking spreadsheet for that year. The Bridge Evaluation Unit will review the report for any items that may need attention prior to distribution of the report. The Bridge Evaluation Unit shall complete the Structural Assessment Report form tab in SIMS and promptly submit back to the BIE.

If the Bridge Evaluation Unit identifies any Critical Findings, New Load Rating Recommendation, Safety Hazards, and/or Structural Analysis Recommendation that were not previously identified by the TL, the Evaluation Unit will follow the process outlined above. The report writer will revise and redistribute the Fracture Critical Inspection Report as necessary under the direction of the BIE.

- The BIE will approve the report in SIMS and send a PDF of the report via e-mail to the applicable Minnesota Program Administrator and CC the report writer. This will be completed within 90 days for Trunk Highway bridges and within 180 days for Local Agency bridges per the NBIS. Bridge Office support staff will then upload the report into EDMS. In the case of a border bridge, the Fracture Critical Report must also be sent to the respective agency contact.
- The BIE will then record that day as the Date Sent to Owner in the Bridge Office Inspection Tracking spreadsheet for that year.
- When required, upon completion and approval of the Fracture Critical Inspection Report, the report writer will complete an Update Report in SIMS. A PDF of the revised field notes and any additional inspection photographs will be attached to the Update Report.

The inspection date of the Update Report will correspond to the date the Update Report was created and will not affect the fracture critical inspection date.

A.6.4.2 Structural Assessment Report

The Bridge Evaluation Unit conducts a structural assessment of the bridge based on the Fracture Critical Report. Purposes of the report include:

- Verify Critical Findings have been addressed
- Determine if repair or rehabilitation is recommended or needed
- Determine if the structure is functioning as designed
- Determine if load rating should be re-evaluated
- Identify items to schedule for repair

A standard template of the Structural Assessment Report is provided in SIMS. The Structural Assessment Report is submitted with the Fracture Critical Report to the Bridge Owner. Structural Assessment by the Bridge Evaluation Unit may be utilized for other Inspections Types (i.e. Damage, Special, etc.) at the discretion of the Bridge Owner.

A.6.5 COMPLEX INSPECTION REPORTING

Per the NBIS, a complex structure is defined as movable, suspension, cable stayed, and other bridges with unusual characteristics. Only bridges carrying vehicular traffic are designated as "Complex." Railroad and pedestrian bridges are currently excluded. Each complex bridge shall have its own complex inspection procedure, reporting method, and frequency, as determined by the MnDOT Bridge Office.

There are three complex bridges or bridges with complex components in the state of Minnesota, as of January 2016. These three bridges include: the Hennepin Avenue Bridge (BR27636 Hennepin County), the Duluth Aerial Lift Bridge (BRL6116 City of Duluth), and Saint Croix Crossing (BR82045 MnDOT).

A.6.5.1 Complex Bridge Inspection Report

This report is a standard narrative report that provides NBI and element coding and identifies the inspection procedures, complex details, fatigue prone details if applicable, and inspection findings of the bridge. The standard Complex Bridge Inspection Report template is available in SIMS.

The Complex Bridge Inspection Report undergoes a review process as follows:

- Critical Findings, New Load Rating Recommendation, Safety Hazards, and/or Structural Analysis Recommendation – if any of these items are determined during a complex bridge inspection, the TL must notify the BIE and the Bridge Evaluation Unit immediately. The Bridge Evaluation Unit will call an assessment meeting to develop a plan of action. Once a plan of action is determined, the Bridge Evaluation Engineer will submit a response via e-mail to the BIE and CC the assessment meeting participants. The BIE will then submit to the inspection team, who will then in turn document the plan of action in the bridge file, notify the Program Administrator as applicable, and/or create a Critical Finding Report in SIMS if necessary.

- If no Critical Finding is determined during a complex bridge inspection, the designated inspection report writer will create the Complex Bridge Inspection Report in SIMS in conjunction with the inspection team members for review.
- Once reviewed by the inspection team members and revised, the inspector will submit the Complex Bridge Inspection Report to the BIE for review via SIMS and record that day as the Date Sent for Review in the Bridge Office Inspection Tracking spreadsheet for that year. The BIE will review the report for inspection-related items, grammar, format, and completeness. The review will be returned to the report writer for revision through the SIMS application by way of personal edits within the application or in the comments section upon submittal.
- Once revisions are made, the inspector will submit the Complex Bridge Inspection Report to the BIE who then submits to the Bridge Evaluation Unit via SIMS. The BIE records that day as the Date Sent for Structural Review in the Bridge Office Inspection Tracking spreadsheet for that year. The Bridge Evaluation Unit will review the report for any items that may need attention prior to distribution of the report. The Bridge Evaluation Unit shall complete the Structural Assessment Report form tab in SIMS and promptly submit back to the BIE.

If the Unit identifies any Critical Findings, New Load Rating Recommendation, Safety Hazards, and/or Structural Analysis Recommendation that were not previously identified by the TL, the Evaluation Unit will follow the process outlined above. The report writer will revise and redistribute the Complex Bridge Inspection Report as necessary under the direction of the BIE.

- The BIE will approve the report in SIMS and send a PDF of the report via e-mail to the applicable Minnesota Program Administrator and CC the report writer. This will be completed within 90 days for Trunk Highway bridges and within 180 days for Local Agency bridges per the NBIS. Bridge Office support staff will then upload the report into EDMS. In the case of a border bridge, the Complex Bridge Report must also be sent to the respective agency contact.
- The BIE will then record that day as the Date Sent to Owner in the Bridge Office Inspection Tracking spreadsheet for that year.

A.6.6 DAMAGE INSPECTION REPORTING

A bridge or structural asset incident is anything that affects or could affect the structural integrity of the asset and may include impact damage, critical deterioration, scour, or a public safety hazard such as falling deck concrete or damaged rails. These types of incidents initiate a damage inspection, which for bridges will require a Damage Report in SIMS, and communication and reporting as described in the Minnesota Bridge and Incident Response Plan (see Appendix J).

A.6.6.1 Incident Response Plan

Incident management is defined in the Federal Highway Administration's (FHWA) Incident Management Handbook as "the systematic, planned, and coordinated use of human, institutional, mechanical, and technical resources to reduce the duration and impact of incidents, and improve the safety of motorists, crash victims, and incident responders".

Response to an incident includes dispatching the appropriate personnel and equipment, and activating the appropriate communication links and motorist information media as soon as there is reasonable certainty that an incident is present. As a result, the Minnesota Bridge and

Structures Incident Response Plan was created to establish and implement a required state-wide policy, so that the appropriate certified personnel and equipment are dispatched to the bridge when an incident occurs, and to ensure the incident is properly documented.

The Minnesota Bridge and Structures Incident Response Plan (Appendices Q and R) must be followed in the event of structural damage to a trunk highway bridge. Local agencies are encouraged to follow similar protocol.

A.6.7 UNDERWATER INSPECTION REPORTING

Underwater inspection reports shall include the following items:

- Location of the bridge and members to be inspected
- Type of foundation
- Bottom of foundation elevation or pile tip elevation
- Depth soundings at bridge as well as upstream and downstream of bridge
- Type and frequency of required inspections
- Inspection procedures
- Date of last inspection
- Special inspection requirements
- Description of inspection findings
- Description of any follow-up actions resulting from those findings

The consultant performing the inspection shall develop a Quality Management Plan that specifies how the consultant will perform quality assurance and quality control activities throughout the duration of the project to ensure delivery of a quality product in a timely manner that conforms to established contract requirements. The Quality Management Plan shall be submitted to the State's Program Manager for approval.

Detailed narrative reports including condition assessment, sketches, and photographs must be entered into SIMS upon completion of the inspection and then reviewed and approved by the appropriate PA within 90 days of the inspection for TH bridges and within 180 days of the inspection for local agency bridges. The reports shall include the following items: location of the bridge and members to be inspected, type of foundation, bottom of foundation elevation or pile tip elevation, depth soundings at bridge as well as upstream and downstream of bridge, type and frequency of required inspections, inspection procedures, date of last inspection, special inspection requirements, description of inspection findings, and description of any follow-up actions result from those findings.

A.6.8 SPECIAL INSPECTION REPORTING

Reports include condition assessment, sketches, and photographs and must be entered into the special inspection report in SIMS upon completion of the inspection and then reviewed and approved by the appropriate Program Administrator within 90 days of the inspection for Trunk Highway and within 180 days of the inspection for local agency bridges.

A.6.9 MAINTENANCE RECOMMENDATION REPORTING

Maintenance recommendation reporting is crucial in order to highlight issues with the bridge superstructure, substructure, and/or channel. With prompt reporting, these issues can hopefully be reduced with proper maintenance. See the Bridge Maintenance Manual for procedures on reporting maintenance recommendations.

A.6.10 INSPECTION UPDATE REPORTS

Update reports may be completed in SIMS for a bridge when there is a change to any core NBI/element inspection data or maintenance task outside of a regular inspection frequency interval. The Update Report will apply changes only to those items without affecting the established routine, fracture critical, complex, special, etc. inspection date.

An Update Report allows inspectors to change data without affecting the next inspection due date.

An example of using an Update Report would be obscured elements during a winter inspection.

A.7 INSPECTION RECORDS AND BRIDGE FILES

The AASHTO Manual for Bridge Evaluation Section 2.2 recommends that Bridge Owners should maintain a complete, accurate, and current record of each bridge under their jurisdiction. At a minimum, a bridge file should include a chronological record of Inventory and Appraisal sheets, inspections performed, including Special, Underwater, Complex and Fracture Critical Reports, bridge load rating and posting records, photographs, design plans, and bridge related correspondence. A bridge file can either be electronic, hard-copy, or a combination of both.

A.7.1 PURPOSE OF INSPECTION RECORDS AND BRIDGE FILES

This section establishes policies and procedures on how State and Local Agencies are to maintain their bridge records to effectively manage physical assets within their right-of-way and to meet FHWA requirements. This section is largely based on requirements established by Chapter 2 of the AASHTO Manual for Bridge Evaluation (MBE) and therefore mandated by FHWA. Bridge Owners should maintain a complete, accurate, and current record of each bridge under their jurisdiction. Complete information, in good usable form, is vital to the effective management of bridges. These records are needed to:

- Establish an inventory of infrastructure assets
- Document the condition and functionality of structures, including the need and justification for bridge restrictions for public safety
- Identify improvement and maintenance needs for planning and programming
- Document maintenance repairs performed
- Document bridge rehabilitation performed
- Provide the basis for a replacement bridge record if structure is replaced
- Meet documentation requirements for work performed using Federal and State funding
- Provide available information in a timely manner for safety inspections

A.7.2 MAINTAINING BRIDGE FILES/RECORDS

The bridge inspection file is an integral part of an effective bridge inspection and management system.

The information in the bridge inspection file is kept current through bridge inspections scheduled at regular intervals. As bridge inspection files are updated, the existing information is archived and retained to establish a history for each bridge.
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.

Some or all of the information pertaining to a bridge may be stored in electronic format as part of SIMS. When both electronic and paper formats are used for saving data, they should be cross-referenced to ensure that all relevant data are available to the inspector.

A.7.3 COMPONENTS OF BRIDGE RECORDS

Some of the components of good bridge records are described below. It is recognized that, in many cases (particularly for older bridges), only a portion of this information may be available. The components of data entered in a bridge record should be dated and include the signature of the individual responsible for the data presented if applicable.

- Plans – Current structural plans, including initial construction and subsequent widening, rehabilitation and repair plans associated with the structure. Each bridge record should include one set of final drawings showing the “as-built” condition of the bridge. Plans associated with maintenance work, including guardrail, paving, and joint replacement should also be retained.
- Specifications –Special provisions, including initial construction and subsequent widening, rehabilitation and repair specifications associated with the structure. Standard specifications may be considered included by reference when stated on the plan sheets.
- Photographs – Maintain current and past photos of the structure elevation view, deck, both approach roadway views, and current defects or other significant features. The approach roadway and elevation photos need to be sufficient to easily identify the bridge, and should be updated whenever the bridge is rehabilitated, widened, or otherwise visibly altered. If the bridge is load posted, photos of the approach roadway needs to include the load posting signs.

  A digital camera is basic bridge inspection equipment. Photographs should be taken (and entered in SIMS) during each routine bridge inspection. Photos can provide an excellent illustration of changes in the condition of a bridge (or culvert) over time.

  Note: Photographs should not be used as a replacement for inspection notes, but rather as a way to complement the inspection notes.

  Section 2.2.1 of the AASHTO Manual for Bridge Evaluation requires that these three general photographs must be included in the file for each bridge. Taking these three photographs during each routine inspection will ensure that each bridge file will have up-to-date photographs to meet this requirement.
    - Top view of the roadway across the bridge (or culvert)
    - A side elevation view of the bridge (or culvert)
    - An underside view of the main span (or a typical span)

Refer to Chapter B “Bridge Inspection Field Manual” Section B.4.1.1 for examples of the photographs stated above.

The MnDOT Bridge Office requires photos for the following situations.

- Critical findings must always be documented with photographs.
- If a primary structural element is rated as condition state 4, at least one photograph of the element is required during each routine inspection.

Other recommended photographs to take during a routine bridge inspection (or have in the bridge file) include the following.

- Significant damage or deterioration (primary elements rated as condition state 3)
- Serious safety hazards
- General and/or close-up views of primary structural elements (even if there is little or no deterioration) to provide a baseline of the general structural condition
- Structural repairs or modifications
- Load posting signing (if present)
- Height restriction signing (if present)
- Significant or unusual bridge features
- Upstream and downstream views of the channel or waterway below the bridge
- Deck expansion joint gaps
- Bearing orientation
- Safety features (railings and guardrail)
- Utilities or other ancillary items that have been added to the bridge

- Posting – Current load and clearance posting values, date of posting, and description of posting signage used. This description needs to identify the posting requirements to meet state and local laws. In cases when advance warning signs are needed, these signs shall be included in this documentation. Maintaining current information includes:
  - Ensuring the most current load rating calculations are consistent with the load posting values
  - Documentation for posting restrictions created by executive decision (usually as a result of bridge damage) is included
  - The most current vertical and/or horizontal clearance measurements are consistent with the vertical clearance posting values on and under the bridge
- Traffic Data – All traffic data required for the bridge record is maintained in the SI&A sheet or equivalent.
- Inspection History – A cumulative record of all routine, fracture critical, complex, underwater, and special feature inspections; all damage inspections required as a result of accidents, structure deterioration or natural disasters; all other special follow-up inspections to assess damage after a natural disaster; and any other in-depth inspection or testing report. This bridge record component also includes a cumulative record of all in-depth studies or evaluations, including but not limited to fatigue evaluations, material test reports, or scour evaluations.
- Inspection Requirements – A current set of documents that define requirements and procedures for all routine, fracture critical, complex, underwater, in-depth and special feature inspections. These documents are intended to facilitate inspection planning by defining the appropriate equipment and access needs. Special requirements to ensure the safety of the inspection personnel, the public, or both should be noted, including a traffic control plan if applicable. The following areas of preparation, where applicable, are to be documented for each bridge.
  - <u>Required Tools and Equipment</u> – Identify any specialized tool or piece of equipment necessary that is not ordinarily carried by the Team Leader. Example tools might be extendable ladders, special non-destructive testing equipment, power tools, lights, special safety equipment, special underwater tools or diving gear.
  - <u>Special Services</u> – Record any special services that are required. Example services might be traffic control, structure cleaning operations, inspection access

such as structure rigging, an Under Bridge Inspection Vehicle (Snooper), or special working platforms such as a barge.
  - Scheduling – Document specific scheduling needs for non-routine inspections. This includes manpower needs for larger structures that require an extended duration inspection effort with multiple inspectors, bridges subject to seasonal flooding conditions, fracture critical and complex bridges where special services are required, and underwater bridge inspections.
  - Site Condition Considerations – Identify unique site conditions that require more than routine preparation. Unique site conditions include railroad property right-of-way restrictions, navigable waterway restrictions, high voltage transmission lines, confined space, unusually heavy vegetation, mud, pollution, insect or animal droppings, unusually high water level or unique traffic safety procedures.
- SI&A (Structure Inventory and Appraisal) Sheets – A cumulative record that displays all the data for the bridge. Additional information on this can be found in Chapter D – Recording and Coding Guide of the BSIPM.
- Load Rating Records – A current and complete record of load rating calculations, including a summary of the controlling rating factor and controlling element. In addition, this summary should provide all the information needed to code relevant fields in the SI&A sheet. The summary sheet shall be signed and stamped by the Professional Engineer of record for the load rating document.
- Correspondence – Cumulative correspondence directly related to the bridge, with emphasis on bridge condition, damage, repairs, rehabilitation, and replacement. The intent is to retain pertinent information for the long term management of the in-service bridge that is not retained in other locations.
- Maintenance and Repair History – A chronological record documenting the maintenance and repairs that have occurred since the initial construction of the bridge. At a minimum, this includes completed maintenance records for all repair recommendations documented in inspection reports.
- Coating History – Cumulative paint, sealant and other protective membrane material specifications and testing documents.
- Accident Records – This component refers to vehicular accidents resulting in damage to the bridge.
- Permit Loads – A cumulative record of all permit loads requiring review by the Load Rating Engineer, or other designated individual who meets the qualifications of a Load Rating Engineer.
- Flood Data – A chronological history of major flooding events, including high-water marks at the bridge site and scour activity for bridges over water.
- Waterway Information – Channel cross-sections, soundings and stream profiles.
- Scour Plan of Action (POA) – Scour records are required for all bridges over water.
- Agreements – A current record of all maintenance, inspection, or other relevant agreements with other agencies or consultants pertinent to bridge management.
- Permits – A current record of all permits issued by other agencies.
- Materials and Tests – Material certification and testing documents associated with construction records.

A.7.4 INSPECTION ORGANIZATION UNIT FILE

The Districts and Local Agency Bridge Owners are to maintain a general file of their organization for bridge safety inspection in addition to individual files for each specific bridge. This general organization file should contain:

- List of all bridge and culvert structures
- List of load posted structures
- List of Fracture Critical Member bridges

- List of complex bridges/details
- List of structures with special features and/or conditions that necessitate special feature inspections at intervals less than that specified for the routine inspection
- List of bridges that require underwater inspection
- List of bridges to be inspected during/after high water events
- Contact list for key staff during bridge emergencies

Inspection organization
- Organization Chart
- Staffing with inspection certification credentials indicated
- Internal inspection Quality Control Plan
- List of inspection equipment
- Availability of bridge design and inspection reference material
- Results of previous QA and FHWA reviews

A.7.5 ARCHIVING BRIDGE RECORDS FOR REPLACED STRUCTURES

When a bridge is demolished or permanently removed from service, the Program Administrator for the removed bridge shall provide documented acknowledgement of the removal. It is suggested that the Bridge Owner maintain bridge records for the removed bridge permanently.

A.7.6 ADDITIONAL BRIDGE RECORDS FOR NON-HIGHWAY BRIDGES

The bridge files for all non-highway bridges that cross a public roadway must contain all of the applicable requirements outlined in Section A.7.3 above. Additionally, the following items must be maintained:
- Department of Natural Resources Bridges: The memorandum of understanding that governs the inspection of bridges owned, operated, or maintained by the Department of Natural Resources should be maintained. Review Section A.3.7 for the requirements that must be included in this memorandum.
- Other Non-Highway Bridges over Public Roads: Any agreements that pertain to the inspection of these structures need to be maintained in the bridge file.

A.8 LOAD RATING

The bridge owners are responsible for the load rating of their bridges. The Bridge Load Rating Unit of the MnDOT Bridge Office rates bridges on the trunk highway (TH) system. Counties, cities etc. are responsible for rating their own bridges. Bridge load ratings must be performed by qualified engineers.

The MnDOT Bridge Load Rating and Evaluation Manual (http://www.dot.state.mn.us/bridge/index.html) provides guidance for the load rating of most bridges in Minnesota including bridges on both the State and Local system. Other pertinent references include Section 6 of the AASHTO Manual for Bridge Evaluation (MBE).

All bridges in Minnesota open to the public, carrying cars and trucks, with spans of 10 feet or greater require a load rating. This includes all county, local, and private bridges. Railroad bridges are rated by the operating railroad. Bridges that carry pedestrians or recreational traffic are rated only in special cases. Culverts with spans of 10 feet or more are also rated.

A.8.1 LOAD RATINGS BASIC REQUIREMENTS

A load rating calculates the safe live load carrying capacity of a bridge and to provide a basis for posting and permit decisions. It factors in the original capacity of the bridge and any changes in configuration and reductions due to deterioration or damage. The load rating calculation results determine whether the bridge needs to be load posted in order to restrict the type and weight of vehicles that can cross the bridge.

All bridges or culverts on the MnDOT structure inventory carrying vehicular traffic require a current load rating. Newly constructed bridges must have a load rating completed and submitted before the bridge can be opened to traffic. Throughout the life of the bridge, the load rating needs to be recalculated anytime the physical condition of the structure changes (based upon information from inspections) or when new loading conditions exist. See Section A.8.2 below for common reasons a bridge needs to be reload rated.

A load rating report along with the calculations must be retained in the Bridge Owner's files and a copy must be submitted to the MnDOT Bridge Office.

A.8.2 GENERAL RE-RATING GUIDELINES

For existing structures, a prior load rating should already be on file. These load ratings must reflect the condition of the bridge including any changes in loading that have occurred over time. If conditions have not changed since the last time the load rating was updated, there is typically no need to re-rate the bridge. However, ensuring that changes in condition are properly documented and those results communicated to the load rating engineers is essential.

Structures must be re-rated, using LRFR methodology, when it is determined that a meaningful change has occurred in the condition of the structure. Review, and if necessary, update load ratings when there is an increase to the allowable legal load using the structure. Some examples of situations that would necessitate a new load rating include:

- A change in the dead load on the bridge (such as a thicker layer of gravel or overlay)
- Damage that alters the structural capacity of the bridge (such as being struck by an oversize load)
- Deterioration that alters the structural capacity of the bridge (such as corrosion or rot)
- Settlement, movement, or scour of a pier or abutment
- Repairs or reconstruction
- A change in the AASHTO rating specification
- An upgrading of the rating software
- A change in the laws regulating truck weights

A.8.2.1 Changes in NBI Condition Ratings

As the NBI condition ratings for deck (NBI Item 58), superstructure (NBI Item 59), substructure (NBI Item 60) and culvert (NBI Item 62) describe the overall physical condition of the structure, they can be a useful tool for determining if a new load rating is required. The following general rules should be followed when reviewing the NBI ratings during each inspection cycle:

- If an NBI condition rating falls to 4 ("poor" condition), the bridge inspection report and existing load rating should be reviewed to determine if a new load rating is required
- If an NBI condition rating falls to 3 ("serious" condition), a new load rating should be performed

A.8.2.2 Changes in Structural Element Condition Ratings

As the structural elements describe the condition of specific bridge components, they can be useful in determining if a new load rating is required, and for identifying which specific structural member requires analysis. While any structural element rated at the worst condition state should be reviewed by the Program Administrator, the following general rules should be followed when reviewing the structural element condition ratings during each inspection cycle:

- If any portion of a primary structural element is rated as a condition state 4, the existing load rating and inspection notes (along with any photographs, sketches, or measurements) should be reviewed to determine if a new rating is required. See Chapter B – Bridge Inspection Field Manual of the BSIPM for rating descriptions for the Structural Element Condition Ratings.
- Section loss due to corrosion is a common problem on steel bridges in Minnesota; the Section Loss (Element #881) should be reviewed. If the Section Loss element is rated as condition state “4”, the existing load rating and inspection notes (along with any photographs, sketches, or measurements) should be reviewed to determine if a new rating is required.

A.8.3 ROLE OF THE TEAM LEADER

The information gathered during a bridge inspection (condition ratings, inventory information, and inspection notes) is essential in determining if there is a need for a new load rating. The Team Leader must understand the basic principles of bridge load ratings, should be familiar with the MnDOT load rating forms, and should have access to the most recent load rating report for the structure being inspected.

Prior to performing an inspection, the bridge inspection report and structure inventory report should be reviewed to determine the following:

- When was the last load rating performed?
- Is load posting signage required?

During a bridge inspection, the inspector should determine (and report) the following:

- Has any damage or deterioration occurred since the last load rating which is significant enough to reduce the load carrying capacity of the bridge?
- Has any dead load been added to the bridge since the last load rating?
- Is the load posting signage (if required) in-place, correct, and readable?

The inspector should also note the presence of any salvaged steel components, temporary structural supports, or any other information that might affect the load carrying capacity of the structure.

> **Inspector Note:**
> If the inspector suspects that a new load capacity rating is required or that a review of the load rating may be warranted – the Program Administrator should be notified immediately.

A.8.3.1 Documenting the Condition of Primary Structural Elements

Only those structural elements that are in the direct load path (from the vehicle down to the supporting earth) affect the bridge load rating. This includes primary structural elements of the deck, superstructure, and substructure.

- Deck deterioration may have an effect on the load carrying capacity of a bridge. This may be a concern on timber decks, slab spans, composite structures, or bridges with an integral deck and superstructure (such as cast-in-place concrete or prestressed T-beam bridges).
- A superstructure component (girder, beam, arch, truss, floorbeam, stringer, etc.) will typically be the controlling element in a load rating. Any significant damage or

deterioration of a primary superstructure element will likely reduce the load-carrying capacity of the bridge.

- The substructure (piers and abutments) should be examined for deterioration, as well as damage from ice flows or flood debris. Substructure components should be examined for any evidence of instability (settlement, tipping, misalignment, or undermining) or section loss that could affect the load-carrying capacity of the bridge.

Inspector Note:
The bridge inspection report should document deterioration or damage on a primary structural element (direct load path element) with sufficient detail so that the load-carrying capacity of the member can be determined in a load rating analysis.

A.8.3.2 Identifying and Reporting Additional Dead Loads

The inspector should note any significant dead loads which have been added to the bridge since it was constructed. Any significant change in the dead load on a bridge should be promptly reported to the Program Administrator.

- Verify the deck wearing surface type, depth, and year of installation – this is a particular concern on bridges with bituminous or gravel wearing surfaces. **Any discrepancies with the information displayed on the structure inventory report should be noted, and brought to the attention of the Program Administrator.**
- Have the original bridge railings been replaced, filled in, or otherwise modified?
- Have sign structures, light poles, or other ancillary structures or decorative features been installed on the bridge?
- Have utilities (water mains, gas mains, etc.) been installed on the bridge?
- On culvert structures, the inspector should note any unusual deterioration or distortion below the driving lanes (which may indicate the need to restrict heavy loads), and verify the embankment fill depth displayed on the structure inventory report.

A.8.3.3 Verification of Load Posting Signage

During each inspection, the inspector must verify that load posting signage (if required) is in-place, correct, and readable.

If posting is required, the actual posting will be displayed on the header of the Minnesota Bridge Inspection Report and at the bottom right corner of the Minnesota Structure Inventory Report. All signs must display the correct weight limits. The condition of load posting signage is rated using Element #890 (see Section B.3.12.1). If the load posting signs are missing or posted greater than the inspection report, the PA should be promptly notified.

If it is apparent that load postings are not being adhered to, the Program Administrator should be notified.

A.8.3.4 Verification of Member Sizes and Steel Type

The size of structural members (and the type of steel of which they are comprised) will have a significant effect on the load-carrying capacity of the structure. While verification of the member sizes and steel type is not typically within the scope of a routine bridge inspection, information observed and reported during an inspection can be essential to performing accurate load ratings.

Field Measurements: On bridges without plans, load ratings are based upon field measurements. The load rating will only be as accurate as the field measurements. If possible, it is a good idea to note the size, number, and spacing of structural members on the inspection report. This may help identify errors in the load rating calculations. Prior to performing a new load rating, the size and spacing of the structural members should be confirmed. Any discrepancies with plan dimensions, or the dimensions indicated on the load rating calculations, should be promptly reported to the Program Administrator.

Salvaged Steel Members: The presence of salvaged structural members should be noted on the bridge inspection report. If the age of salvaged structural elements can be determined, it should be noted on the bridge inspection report. If the inspector suspects that the structural steel on the bridge is older that what was assumed in the load rating calculations, it should be promptly reported to the Program Administrator.

A.8.4 ROLE OF BRIDGE INSPECTION PROGRAM ADMINISTRATOR

In Minnesota, every MnDOT District, County, City (or other agency with inspection jurisdiction for a bridge), must appoint a “Bridge Inspection Program Administrator”. The role and duties of the Program Administrator as they relate to load ratings are outlined below.

A.8.4.1 MnDOT District Program Administrators

Responsibilities of a MnDOT District Bridge Inspection Program Administrator include, but are not limited to, the following:

- Review the inspection reports and structure inventory reports during each inspection cycle to determine if changes in condition or dead loads indicate that a new load rating should be performed. The most recent load rating reports for Trunk Highway bridges are now available on Electronic Document Management System.
- If a new load rating is required for a Trunk Highway vehicular bridge, the MnDOT District Bridge Inspection Program Administrator should immediately contact the MnDOT Bridge Office Load Rating Engineer. See the Introduction of the BSIPM for contact information.
- If a load rating determines that a bridge must be posted (or that an existing posting be revised), the posting signs must be installed within 30 days of the District being notified by the MnDOT Bridge Office Load Rating Engineer. Significant changes in the posted limit may warrant installation of temporary posting signs until permanent posting signs can be installed. The MnDOT District Bridge Inspection Program Administrator must notify the MnDOT BIMU when posting signs are in place.
- Contacting the railroad, if inspections determine that damage or deterioration to a railroad bridge is sufficient to reduce the load carrying capacity of the structure (registered mail is preferred).

A.8.4.2 County/Local Program Administrators

The County or City Engineer will typically serve as the Bridge Inspection Program Administrator. Cities which do not employ an engineer may elect to designate a private consultant engineer as the Program Administrator. Responsibilities of a Bridge Inspection Program Administrator include, but are not limited to, the following:

- Verify that load capacity ratings have been performed on all vehicular bridges on the agency roster.
- Review the inspection reports and structure inventory reports during each inspection cycle to determine if changes in condition or dead loads indicate that a new load rating should be performed.
- The online report “Load Posting and Rating Review” should be reviewed annually. This report lists bridges that require load postings, bridges without a load rating date, and bridges that may require a new load capacity rating. Any errors or discrepancies should be reported to the MnDOT Bridge Inventory Management.

- See that any required load ratings are promptly performed, and that the appropriate load rating form is submitted to the MnDOT Bridge Management Unit to update the structure inventory. Many agencies will hire a consulting engineer to perform bridge load ratings, most culvert load ratings can be performed by the agency using Form 90.
- Verify that load posting signage (if required) is in-place, correct, and readable. Township or municipalities should be promptly notified if load restriction signage is incorrect, missing or damaged. A follow-up inspection should be performed to verify that the load posting signage has been corrected, repaired or replaced. If a new rating requires that a bridge must be posted (or that an existing posting be revised), posting signs should be installed as soon as reasonably possible, but no more than 30 days after the load rating date. Significant changes in the posted limit may warrant installation of temporary posting signs until permanent posting signs can be installed.
- County and City Program Administrators should be aware of Minnesota Statute 165.03, Subdivisions 3 and 4, which require the following:

  A report of the inspections shall be filed annually, on or before February 15 of each year, with the county auditor or town clerk, or the governing body of the municipality. The report shall contain recommendations for the correction of, or legal posting of load limits on any bridge or structure that is found to be under strength or unsafe.
- Contacting the railroad, if inspections determine that damage or deterioration to a railroad bridge is sufficient to reduce the load carrying capacity of the structure (registered mail is preferred).

A.8.5 LOAD RATING RESPONSIBILITY

This section identifies who is responsible for insuring that load ratings are completed as well as the procedures and qualifications to complete the load ratings.

A.8.5.1 Procedures and Qualifications

Federal Law, as outlined in the NBIS, requires that bridges be load rated in accordance with procedures specified in the AASHTO Manual for Bridge Evaluation. The NBIS require that the individual charged with overall responsibility for the load rating of bridges must be a registered professional engineer.

Bridge load rating calculations should be based upon all relevant information in the bridge file. This includes the original plans, reconstruction or repair plans, any structural modifications which have increased the dead load on the bridge, traffic data, and the existing structural condition based upon the most recent inspection. MnDOT recommends that bridge load rating calculations be checked by another engineer.

The skills necessary to perform a load rating varies considerably depending upon the type of the structure. Complex or non-redundant (fracture critical) bridges may require specialized engineering knowledge.

A.8.5.2 Responsibility for Performing Load Ratings

Trunk Highway Bridges: Load ratings for Minnesota Trunk Highway bridges are performed by the MnDOT Bridge Office Load Rating Unit. Load ratings for Truck Highway culvert structures are the shared responsibility of the MnDOT Bridge Office and the District. For newly constructed Trunk Highway culverts, the MnDOT BIMU will fill out Form 90 and enter the corresponding operating and inventory load ratings in the MnDOT database. The District is responsible for monitoring culvert conditions and consulting with the MnDOT Bridge Office Load Rating Unit if changes in condition indicate that a new rating may be needed.

County and Local Bridges: Load ratings for County/local bridges and culverts are the responsibility of the agency with inspection jurisdiction over the bridge. Counties and Cities will typically hire consultants to perform some (or all) of their load ratings.

Railroad Bridges: The FRA guidelines to railroads for the inspection and management of railroad bridges are outlined in 49CFR 213, Appendix C. The railroad owner is responsible for ensuring that the bridge is capable of safely carrying all railroad traffic operated on that track, and for specifying the maximum loads that may be operated over the bridge. Load ratings for railroad bridges are performed according to AREMA Manual for Railway Engineering. Load ratings for railroad bridges are not generally filed by MnDOT. Load rating information for a railroad bridge is not entered in the MnDOT database, and is not reported to the FHWA.

A.8.5.3 Load Rating Responsibilities of the MnDOT Bridge Office

The MnDOT Bridge Office Load Rating Unit will perform load ratings on new Trunk Highway bridges when a Trunk Highway bridge is remodeled, or when a MnDOT District requests a new load rating due to structural damage of deterioration.

> *After being contacted by a MnDOT District that a bridge requires a new load rating, the MnDOT Load Rating Engineer will perform a preliminary evaluation – the time frame for calculating a new load rating will depend upon the level of importance determined from the preliminary evaluation. The final load rating (if necessary) should be completed within 45 days of the preliminary evaluation.*

While the MnDOT Bridge Office Load Rating Unit does not perform load ratings for County/local bridges, they are available for technical assistance.

MnDOT Bridge Office – Bridge Inventory Management Unit: The MnDOT BIMU files a copy of the load rating report for any bridge (Trunk Highway, County, City, Township, Etc.) which carries vehicular traffic.

The BIMU is responsible for updating load rating items in the structure inventory database and reporting load rating information to the FHWA.

The NBIS requires that load rating information for state Trunk Highway bridges be updated within 90 days of the load rating date, and that load rating information for County/local bridges be updated within 180 days of the load rating date.

For newly constructed Trunk Highway culverts, the MnDOT BIMU will fill out Form 90 and enter the corresponding operating and inventory load ratings in the MnDOT database.

A.8.6 LOAD RATING FORMS

Summarize the results of a bridge load rating analysis on a bridge load rating and load posting report form. MnDOT load rating forms can be found on the MnDOT Bridges and Structures website under the heading “Bridge Rating” (see link below):
http://www.dot.state.mn.us/bridge/datamanagement.html

These are the MnDOT load rating and posting report forms:
- Form RC-TH & RD-TH (Bridge Rating and Load Posting Report for Trunk Highways)
- Form RC-CL & RD-CL (Bridge Rating and Load Posting Report for County and Local Agencies)
- Form PIR-TH (Bridge Rating and Load Posting Report for Trunk Highways – Physical Inspection Rating)

- Form PIR-CL (Bridge Rating and Load Posting Report for County and Local Agencies – Physical Inspection Rating)
- Form 90 (Culvert Rating Form)
- Truss R (truss member rating form)
- Form PW (supplemental load posting worksheet)

Any questions related to performing load ratings, or filling out the MnDOT load rating and posting report forms, should be directed to the MnDOT Load Rating Engineer. Immediately after a load rating is performed, a copy of the appropriate MnDOT load rating and posting report form(s) should be submitted to the MnDOT Bridge Inventory Management Unit to update the structure inventory.

Form RC-CL (County and Local Bridges): Form RC-CL is the bridge rating and load posting report for County and local bridges – this form (along with all load rating calculations) must be retained in the files of the Bridge Owner. A copy of Form RC-CL should be submitted to the MnDOT BIMU to update the structure inventory report. This will be retained in the files of the MnDOT BIMU.

Form RC-TH (Minnesota Trunk Highway Bridges): Form RC-TH is the bridge rating and load posting report for Minnesota Trunk Highway bridges. This form and any load rating calculations are retained in the MnDOT Load Rating Engineer files. A copy of Form RC-TH shall be forwarded to the MnDOT BIMU to update the structure inventory report. This will be retained in the files of the MnDOT BIMU. Load rating reports for most Trunk Highway bridges are now available through the MnDOT EDMS to allow MnDOT Districts to view, download or print load rating reports.

Form 90 (Culvert Rating Form): Any culvert which carries vehicular traffic and is defined as “bridge” under Minnesota state law (total structure length of 10 feet or greater), must have a load rating. New culverts, or culverts in fair or better condition with no evidence of distress due to normal traffic loads, can be rated using Form 90. Form 90 includes a table from which the inventory and operating ratings can be selected based upon the culvert design and material type. The inventory ratings shown in the table are based upon the minimum original design load, regardless of original capacity.

Before using the table on Form 90, the most recent bridge inspection report must be reviewed to confirm that the NBI culvert rating (NBI Item 62) is condition 5 or greater. If the NBI culvert rating is 4 (“poor” condition) or lower, Form 90 cannot be used. Form PIR should then be used to determine a reduced level for these ratings.

Some other guidelines for using Form 90 include:

- If the Form 90 table guidelines are not followed in determining the inventory and operating ratings, an explanation should be provided.
- Box culverts with a clear span 20 ft. or greater cannot be rated using Form 90 – they must be rated as a “bridge” (use Form RC-CL or RC-TH instead).
- If a culvert is comprised of more than one culvert type or material, the segment with the lowest inventory and operating ratings will govern (this should be noted on Form 90).
- Cast-in-place concrete box culverts are typically classified as either type “W” (generally constructed prior to 1944) or type “C” (generally constructed after 1945). As the type “W” culverts have less steel reinforcement, they will have lower inventory and operating ratings.

The Culvert Rating Form 90 must be retained in the files of the Bridge Owner. A copy of Form 90 must be submitted to the MnDOT BIMU to update the structure inventory report. This will be retained in the files of the MnDOT BIMU.

Form PIR-CL or Form PIR-TH (Physical Inspection Rating Form): In situations where a load rating cannot readily be calculated, an evaluation by an engineer based upon the most recent inspection may be used to approximate the inventory and operating ratings. Form PIR (Physical Inspection Rating) may be used for one or more of the following reasons:

- No bridge plans are available
- For concrete bridges where the steel reinforcement is unknown
- If the superstructure has deterioration or damage which cannot be quantitatively measured, but has obviously reduced the load carrying capacity of the bridge
- If the substructure has deterioration, shifting, tipping or misalignment which obviously reduced the load carrying capacity of the bridge, but the extent of the reduction cannot be readily be calculated
- A culvert with an NBI culvert rating of 4 (“poor” condition) or lower
- A culvert posted with less than legal loads

The rating is determined by the engineer upon careful consideration of all available information, including bridge condition (corrosion, spalling, damage, deflection, settlement, cracking, etc.), age, type of construction, redundancy, average daily traffic (ADT), loading (past, present, and future), etc. Engineering judgment or a combination of calculations, experience, and engineering judgment is used.

The numbers in the rating should follow this approximately ratio: (1.6 x HS Inventory Rating) = (HS Operating Rating) = (the posting weight in Tons for the single truck) = (0.625 x the posting weight in Tons for a combination truck).

For type of analysis check “Other” and write in “PIR” and for method of rating check “No Rating Computations Performed.”

The Physical Inspection Rating Form PIR must be retained in the files of the Bridge Owner. A copy of Form PIR should be submitted to the MnDOT BIMU to update the structure inventory report. These will be retained in the files of the MnDOT BIMU.

Bridges rated using Form PIR should have all overweight permits prohibited, unless the bridge has a documented history of carrying heavier trucks with no evidence of distress beneath the traffic lanes.

A.8.7 QUALITY CONTROL/QUALITY ASSURANCE

Quality control checks shall be conducted on every load rating product, and thus at a much higher frequency than quality assurance checks. The quality control and quality assurance expectations are described in more detail in Chapter E – Quality Control (QC)/Quality Assurance (QA) of the BSIPM.

A.8.8 LOAD RATING REFERENCES AND LAWS

References for performing bridge load capacity ratings include the following:

- MnDOT Bridge Load Rating and Evaluation Manual (http://www.dot.state.mn.us/bridge/index.html)
- MnDOT LRFD Bridge Design Manual – Section 15 (2009)
- AASHTO Manual for Bridge Evaluation (2008)
- AASHTO Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges (2003)
- AASHTO Manual for Bridge Evaluation (2011)
- AASHTO Standard Specifications for Highway Bridges (2002)
- AASHTO LRFD Bridge Design Specifications (2007)

Laws Pertaining to Bridge Load Ratings
The NBIS are outlined in the Code of Federal Regulations Title 23: Highways, Part 650 – Bridges, Structures, and Hydraulics, Subpart C – National Bridge Inspection Standards. Sections of the NBIS which pertain to bridge load capacity ratings include the following:

- CFR 650.303 – Applicability
- CFR 650.305 – Definitions
- CFR 650.309 – Qualifications of Personnel
- CFR 650.315 – Inventory
- CFR 650.317 – References

Some key Minnesota State Statutes pertaining to bridge load capacity ratings include the following:

- Minnesota Statute 165.03, Subdivision 3 and 4 – Annual Reporting of Load Rating Changes
- Minnesota Statute 165.03, Subdivision 6 – Toll bridge load ratings reported every two years
- Minnesota Statute 165.03, Subdivision 6a – Bridge Load Rating and Posting
- Minnesota Statute 169.80 – Size, Weight, Load
- Minnesota Statute 169.801 – Implements of Husbandry
- Minnesota Statute 169.822 – Weight Limitations and Definitions
- Minnesota Statute 169.824 – Gross Weight Schedule
- Minnesota Statute 169.826 – Seasonal Increases
- Minnesota Statute 169.8261 – Timber Products
- Minnesota Statute 169.84 – Load Limit on Bridge
- Minnesota Statute 169.86 – Special Permits
- Minnesota Statute 169.871 – Excess Weight Penalty
- Minnesota Statute 169.88 – Damages and Liability

Minnesota State Rules and Statutes can be viewed on the following link:
https://www.revisor.leg.state.mn.us/pubs/

A.9 SCOUR ANALYSIS AND CHANNEL CROSS-SECTIONS

All new bridges must be designed to be stable for predicted scour depths. Bridge scour analysis procedures are provided in FHWA Publication HEC-18 "Evaluating Scour at Bridges".

> BSIPM User Note:
>
> See Section D.7.9.8 for information on the MnDOT Scour Evaluation process and how to determine the MnDOT Scour Code.

The Minnesota Bridge Scour Program for existing bridges has consisted of four parts which follow procedures described in FHWA publications HEC-18, "Evaluating Scour At Bridges", HEC-20, "Stream Stability At Highway Structures" and HEC-23 "Bridge Scour and Stream Instability Countermeasures". The parts include: primary screening, secondary screening, scour analysis, and developing and implementing a POA, which may include countermeasures and/or monitoring during floods.

A.9.1 SCOUR CRITICAL BRIDGES

Bridges deemed scour critical need to have a scour monitoring plan on file at the Bridge Office and in the agency's bridge files. Scour monitoring plans may also be required if a bridge has experienced severe scour or, if for other reasons, its structural stability is in question for higher discharges. For more information regarding scour monitoring plans, contact the State Bridge Hydraulics Engineer.

A.9.2 CHANNEL CROSS-SECTIONS

A channel cross-section is a series of channel bottom elevation measurements taken across the channel (perpendicular to the direction of flow) – these are typically taken along the edge of the bridge deck. Channel cross-sections are useful tools for identifying scour problems or long-term changes in the channel, such as aggradation, degradation, or channel migration. Section 2.4.1 of the AASHTO Manual for Bridge Evaluation recommends that bridge files contain information relating to the channel cross-sections:

- Channel cross-sections should be taken and a sketch developed to become part of the bridge record. The sketch should show the foundation of the structure and, where available, a description of material upon which footings are founded, the elevation of the pile tips, the footings of piers and abutment, or any combination thereof. This information is valuable for reference in anticipating possible scour problems through periodic observation and is especially useful to detect serious conditions during periods of heavy flow. The use of aerial photography, when used to monitor channel movement, should also become part of the bridge record.
- Channel cross-sections from current and past inspections should be plotted on a common plot to observe waterway instability such as scour, lateral migration, aggradation, or degradation. Vertical measurements should be made or referenced to a part of the structure such as the top of curb or top of railing that is readily accessible during high water.
- Soundings and multiple cross-sections may be necessary to provide adequate information on waterway instability and how the structure may be affected. Such requirements will vary with the stream velocity and general channel stability. The necessity of additional soundings must be determined by the Engineer. These soundings will normally be limited to an area within a radius of 100 feet from a pier.

A.9.2.1 MnDOT Criteria and Minimum Frequency for Performing Channel Cross-Sections

While a routine bridge inspection will include examining piers and abutments for scour (by probing those substructure units that are accessible by wading), channel cross-sections are not necessarily performed during routine inspections. MnDOT has developed the following criteria for determining which bridges require channel cross-sections, and establishing a minimum frequency for performing channel cross-sections. More frequent channel cross-sections (or supplemental soundings) may be needed if significant scour problems exist, or if specified in the Scour Plan of Action. Channel cross-sections are recommended during or immediately after high water events, or if a significant change in the streambed is observed.

A.9.2.1.1 Bridges Requiring Channel Cross-Section

Channel cross-sections are <u>only required</u> for bridges carrying vehicular traffic if they meet the following criteria:

1. Bridges classified as "Scour Critical" (MnDOT scour codes "D", "R" or "U").
2. Bridges with an NBI Channel Condition Rating (NBI Item 61) of "3".

If channel cross-sections are required according to the criteria above, they should be performed at a minimum frequency of 5 years.

Any bridge included with a state-wide underwater inspection contract will have a channel cross-section performed as part of the contract, regardless of the MnDOT Scour Code. The agency with inspection jurisdiction is responsible for performing all required channel cross-sections for those bridges not included in a state-wide underwater bridge inspection contract.

A.9.2.1.2 Bridges Recommended for Channel Cross-Sections

Channel cross-sections are <u>recommended</u> for bridges meeting the following criteria:

- Bridges over 20 ft. in length with a MnDOT scour code of "G" (unknown foundations)
- Bridges over 20 ft. in length with a MnDOT scour code of "J" (scour susceptible)
- Any bridge with an NBI Channel Condition Rating (NBI Item 61) of "4"
- Any bridge with a Scour rating (structure Element #885) of condition "3" or "4"
- If cross-section measurements are recommended in the Scour Plan of Action

If channel cross-sections are recommended (according to the criteria above), the agency with inspection jurisdiction should establish an appropriate frequency – this will vary depending upon such factors as the stream volume and velocity, structure type, and site conditions.

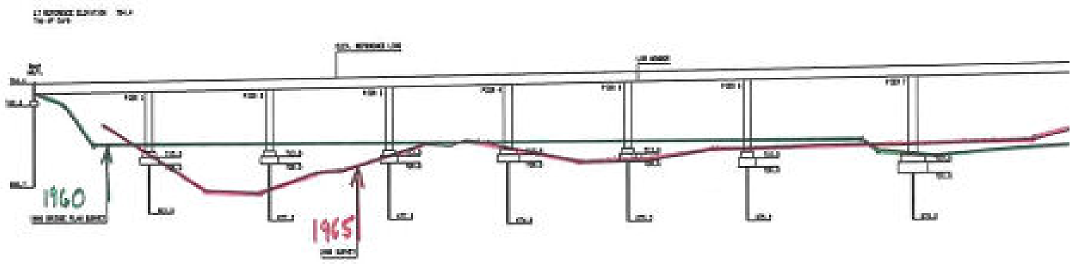
A.9.3 CHANNEL CROSS-SECTION PROCEDURES, EQUIPMENT, AND DOCUMENTATION

At a minimum, a channel cross-section shall be taken along the upstream and/or downstream face of the bridge. Channel bottom elevation measurements should be taken at a sufficient number of locations along the bridge to obtain a representative channel cross-section which can be compared to past and future cross-sections. At a minimum, this shall include channel bottom elevation measurements at each substructure unit and at the center of each span. On longer spans, establishing specific measurement locations along the bridge can speed up data collection and will make it easier to compare to past and future measurements.

Channel bottom elevation measurements may be obtained by using a sounding rod, weight, sonar, or survey equipment. The type of equipment used will often be dictated by the water depth and velocity (sonar readings may not be possible in turbulent water). A benchmark elevation should be clearly marked on the curb or railing (or another easily accessible location on the bridge), so that channel bottom elevations can be easily determined from depth readings. Elevation measurements are generally recorded to the nearest tenth of a foot.

Channel cross-section measurements shall be documented in the bridge file so that past data can be readily accessed and compared to present measurements. For large bridges, or bridges over large rivers, lakes, or streams – a cross-section diagram (a graphical display of the actual streambed elevation) is recommended. A reference cross-section diagram should be established showing the original (plan) channel cross-section – this should include the substructure foundation elevations. For smaller bridges, or bridges over smaller streams with a relatively stable history – channel cross-section measurements may be documented in a table. If only a few measurement locations are required, they can be included in the bridge inspection notes (general notes section).

Example:



This channel cross-section diagram shows how the main channel of the Minnesota River shifted dramatically during flooding in 1965, severely undermining the second pier from the left.

A.9.4 FOLLOW-UP ACTIONS FOR CHANNEL CROSS-SECTIONS

By performing channel cross-section measurements on regular intervals (and during floods), scour or channel problems can be identified and corrected before they threaten the structural integrity of the bridge or approach fill. Problems which might not be obvious during an inspection may be more apparent when comparing past and present cross-section measurements.

Any significant scour or channel problems discovered during an inspection, or determined through the comparison of channel cross-sections should be promptly reported to the Bridge Inspection Program Administrator. This includes streambed elevations below the substructure footings or seals (or below the critical scour depth specified in the Scour Plan of Action), undermined footings, exposed foundation piling, failure of scour countermeasures or slope protection, loss of abutment backfill, or notable shifting or lowering of the channel.

A.10 NON-DESTRUCTIVE TESTING

Non-destructive testing (NDT) is a wide group of analysis techniques used in science and industry to evaluate the properties of a material, component or system without causing damage. The most basic NDT method is visual examination. Visual examination procedures could range from simply looking at a structure component to see if surface imperfections are visible to using computer controlled camera systems to look at a structure component.

A.10.1 STEEL STRUCTURES

NDT is often used during the inspection of steel structures to determine the presence or extent of a defect when visual inspection either suggests the existence of a crack, or is not sufficient to verify the internal integrity of structural elements such as pins. The NDT methods most frequently used in the field by inspectors are:

- Ultrasonic Thickness Testing
- Liquid Penetrant Testing (PT)
- Magnetic Particle Testing (MT)
- Ultrasonic Testing (UT)

Personnel inspecting steel structures should be familiar with the use and limitations of the various methods of NDT. The information provided within this manual provides only basic guidance in the NDT methods typically used by Team Leaders. To ensure proper application of the testing procedures and interpretation of results, inspection personnel require additional training by certified instructors and extensive hands-on experience.

A.10.1.1 Ultrasonic Thickness Testing

An ultrasonic thickness gage (UTG) is an instrument that is used to measure steel plate thicknesses at discrete locations. Several different models of UTGs are available. Consult the manual for the specific UTG being used for proper operation. For rough or corroded surfaces an instrument with an A-scan presentation should be used to assure that accurate readings are obtained.

For inspection procedures go to http://www.dot.state.mn.us/bridge/inspection.html.

When determining the potential uses for a UTG, the following should be considered.

Advantages:

- Able to obtain plate thickness measurements in confined areas or where large plate widths prevent the use of typical calibers.
- Effective method of obtaining plate thickness measurements along seams of built-up members such as truss gusset plates.
- Able to determine individual plate thicknesses where corrosion and/or pack rust is developing between plates of built-up members.

Disadvantages:

- Surface must be cleaned down to bare metal to get accurate results.

A.10.1.2 Liquid Penetrant Testing

PT relies on the ability of a liquid to enter into a discontinuity. Therefore it can only find discontinuities which are open to the surface of the material. It can be applied to any material provided it is non-porous, and is not adversely affected by the Penetrant material. The basic procedure requires that the material be pre-cleaned to remove all surface contaminates and the application of a liquid (penetrating oil) to the surface being tested. The Penetrant will seek out and enter small surface openings. Penetrant is then removed from the test surface by wiping with a solvent dampened rag. After drying, a developer is applied. The penetrant remaining in the discontinuity bleeds out forming a highly visible, contrasting indication on the test surface.

A Dye Penetrate Testing kit typically contains:

- Visible dye penetrant that will be pulled into defects and held by capillary action.
- Cleaner/remover fluid for use in pre-cleaning the test area and removing excess penetrant from the surface being tested.
- Non-aqueous developer that will both extract the dye which penetrated into a discontinuity and also provide a contrasting background color for the dye.
- Wiping towels, brushes and directions for using the kit.

On steel bridge structures, PT is often used to verify the existence and extent of cracks open to the surface after a visual inspection reveals a potential crack location.

For inspection procedures go to http://www.dot.state.mn.us/bridge/inspection.html.

When determining if PT should be used to evaluate indications, the following should be considered.

Advantages:

- Can be used on such materials as aluminum, cast iron, forgings, castings, plastics and ceramics.
- Is simple to use and less costly than most other NDE methods.
- Very portable and well adapted for field use.
- Very effective tool for detecting surface cracks, and can be easily carried and used without a power supply or complex equipment.

Disadvantages:

- Removal of paint from existing structures can be problematic.
- Can only detect discontinuities that are open to the surface.
- Surfaces must be properly cleaned to remove all surface contaminants such as paint, rust, scale, welding flux, etc.
- Is affected by temperature, at low temperatures test sensitivity is reduced.
- Test typically takes longer to perform than other NDE methods.

A.10.1.3 Magnetic Particle Testing

MT, also often called “mag” particle testing, can be used to locate both surface and near surface discontinuities in ferrous steel elements using magnetization techniques and principles. It cannot be used on aluminum or non-ferritic (non-carbon stainless) steels. For bridge inspection, the most commonly used piece of equipment is the Electromagnetic Yoke.

To perform MT with a yoke, the following material and equipment is required:

- A source of electricity
- An electromagnetic yoke
- Ferromagnetic “powder”
- Dry, low pressure air usually a small hand held puffer

For inspection procedures go to http://www.dot.state.mn.us/bridge/inspection.html.

When determining if MT should be used to evaluate indications, the following should be considered.

Advantages:

- Can be performed without removing well adhered paint from the tested surface if 2 mils or less.
- Able to locate small and shallow surface cracks.
- Much faster than other NDE methods.
- No or little limitation due to size or shape of the part being inspected.
- Cracks filled with foreign material can be detected.
- No elaborate pre-cleaning is necessary.

Disadvantages:

- The magnetic field must be in a direction perpendicular to the principal plane of the discontinuity for best detection.
- Power source is required.

A.10.1.4 Ultrasonic Testing

UT is a nondestructive means of detecting and characterizing internal discontinuities using high frequency sound waves. It is also used to detect surface discontinuities, define bond characteristics and to measure thickness. The principle advantages of UT over other NDT methods are:

- Allows for detection of discontinuities deep within the part.
- High sensitivity permits the detection of very small discontinuities.
- Greater accuracy in determining the position of internal discontinuities.
- Only one surface needs to be accessible.
- Provides almost instantaneous indications of discontinuities.

UT is used by MnDOT bridge inspection personnel to ascertain the internal condition of structural elements that cannot be visually or otherwise inspected. Testing pins for the presence of internal cracks is the most common use of UT during bridge inspections. UT must be performed by personnel trained to use the equipment and interpret the test results.

For inspection procedures go to http://www.dot.state.mn.us/bridge/inspection.html.

A.10.1.5 NDT Certification

Training and certification of all methods of NDT is coordinated by the MnDOT Bridge Office, and is separate from other MnDOT technical certifications.

A.10.2 CONCRETE

Delamination in concrete can be a serious problem and often are “heard” before they are seen. The most common NDE method for concrete structures is by sounding. Sounding is used to determine the presence of delamination within a concrete element and is typically performed using a hammer on the surface of concrete substructure units and using a chain drag when evaluating the condition of a concrete deck. Delamination typically result from corrosion of the reinforcement bars or debonding in the case of a concrete overlay.

The test procedure involves delineating between sound and unsound concrete by the sound produced when stuck by a metal object such as a hammer or chain. With little experience an Inspector can began to delineate the different sounds produced. However, it does take a trained ear to differentiate defects that are located further below the surface and to clearly identify the true limits of defects. Many delaminations are visible on the surface due to the general deterioration of the concrete, but others show no visual signs and require another NDE method to locate.

A.10.2.1 Chain Drag Survey

A chain drag is basically another method of sounding concrete and is typically used to evaluate the condition of a concrete bridge deck. The chain drag allows inspectors to cover a large area of deck surface in a short time with a reasonable amount of accuracy. The chain drag survey is also a low cost alternative to other NDE methods discussed later in this chapter. Due to its low cost, many agencies use this method as an initial evaluation to determine the need for further investigation. Like hammer sounding methods, the chain drag test is subjective, and therefore requires an experienced inspector to perform the survey with a high degree of accuracy. Also, localized areas are harder to detect with a chain drag, and may require hammer sounding to provide accurate limits of the delamination. Due to the nature of the test, localized areas of delaminations are more difficult to detect.

The chain drag survey simply entails dragging a chain over the concrete surface and listening for the sound difference between sound and unsound areas of concrete. The device typically consists of a four or five sections of chain mounted to an 18” (+/-) long tube. The chain sections are 12” to 18” long and the tube is connected to a handle that can be fabricated to any length for operator comfort. The test is performed by dragging the chain sections across the surface of the concrete and marking areas that produce a dull sound. Care must be taken to accurately differentiate and mark the unsound areas. This usually involves going over a suspect area several times to clearly identify the locations of unsound concrete. A grid system should be constructed on the surface of the deck so that delaminated areas can be plotted easily. This test usually involves two people conducting the test: one to drag the chain and one to do the marking. A photograph of an inspector conducting a chain drag test can be seen in the figure above:

When determining if a Chain Drag should be used to evaluate the deck condition, the following should be considered.

Advantages:
- Test produces immediate results on near surface anomalies.
- Generally lower cost than other NDE methods used on concrete decks.
- Can usually be conducted as part of any Routine Inspection.

Disadvantages:
- Sensitive to an inspectors care and attention to detail when performing the test.
- Test is subjective and results may vary between inspectors.
- More time consuming that other NDE methods used on concrete decks.

A.10.2.2 Ground Penetrating Radar

Ground Penetrating Radar (GPR) is a nondestructive test method that uses high-frequency radio waves to penetrate and detect reflected signals to create an image of the subsurface. Integrated radar inspection systems combine ground penetrating radar technology with data acquisition and data processing hardware and software into an integrated and automatic GPR system that can be used at highway speeds. GPR is a real-time, non-destructive evaluation method that quickly and accurately locates delamination. It can also be used to determine the depth and location of post-tension cables, rebar, and electrical or fiber optic conduits embedded in concrete. GPR uses high frequency radio waves to inspect the interior of concrete structures and locate defects or other buried obstructions with a high degree of accuracy. A typical GPR equipped vehicle is shown in the figure below.

The advantage of combining NDT and field verification is that it provides a comprehensive evaluation of subsurface conditions throughout the entire project, not only at locations where coring is performed. The data acquired from GPR surveys can then be kept on file so any future evaluations can be compared to predict future maintenance or rehabilitation needs. The record produced by the GPR is a continuous, cross-sectional picture or profile of subsurface conditions. However, there are different reporting levels depending on the purpose/scope of the evaluation.

When determining if a GPR should be used to evaluate the deck condition, the following should be considered.

Advantages:

- The speed of data collection and the immediate availability of the results.
- Data can be collected at highway speeds without any traffic control required.
- The record produced by the GPR is a continuous, cross-sectional picture or profile of subsurface conditions.

Disadvantages:

- Higher costs than chain drag NDE method.

A.10.2.3 Infrared Thermography

Infrared Thermography (IRT) is a non-destructive evaluation technique that characterizes the properties of a material by monitoring its response to thermal loading. The term “thermal loading” is commonly used to describe the transfer of energy from a heat source to a solid object. IRT can be complete at traffic speeds with automated systems, or using hand held devices. The hand held devices can be used or other applications other than concrete decks depending on the field conditions encountered.

For automated systems evaluating concrete bridge decks, this test also involves a vehicle mounted IR imaging scanner where the vehicle is driven over the bridge deck. If the evaluation is performed during daylight hours, the delaminated areas will appear as “hot spots”. During the evening time as the bridge is cooling down, the delaminated areas will appear “cooler” relative to the sound bridge deck. The IR scanner is usually incorporated with an electronic distance-measuring device so the resulting thermographs can be overlaid onto scaled CAD drawings to locate suspect areas.

The test procedure is highly sensitive to temperature and other environmental conditions. For delamination to be detected there must be some minimum temperature difference between the delaminated area and sound areas. Therefore, the deck must receive direct sunlight for a period of time before the test can be performed. Because water could penetrate cracks in the deck surface and affect the results, the test procedure also requires the deck to be dry for a certain minimum amount of time. Windy conditions and/or shaded areas will affect the test results and must be considered when interpreting results.

Typical IRT Equipped Vehicle

When determining if an IRT should be used to evaluate the deck condition, the following should be considered.

Advantages:

- The speed of data collection and the immediate availability of the results.
- Data can be collected at highway speeds without any traffic control required.
- Hand held devices have widespread adaptability for evaluation of concrete components other than bridge decks.

Disadvantages:

- Sensitive to weather conditions.
- Higher costs than chain drag NDE method.

A.10.3 TIMBER

Visual inspection of timber members is the most basic NDE method utilized during timber bridge inspections. Timber has the unique characteristic of typically not showing distress due to internal decay until significant section loss has occurred.

It is important for inspectors to look closely at areas where typical decay exists such as the dirt line on timber piling and bearing areas between superstructure and substructure elements. These areas need to be evaluated at an “arms-length” to effectively locate suspect decay locations. For example, any amount of slight crushing of a timber cap should be documented and evaluated by another NDE method such as sounding.

Visual inspection of timber members should always include sounding, which is discussed below. These two NDE methods must be used together to effectively inspect timber members and for an inspector to gain experience in the evaluation of timber as a structural member.

A.10.3.1 Sounding

Sounding is the oldest and most widely used NDE method for assessing the condition of timber components of bridge structures other than visual methods. Sounding provides a quick inspection procedure to identify serious decay within members. With sounding, the timber member is struck by a hammer and the resulting sound tone is used to make inferences to the condition of a member. This test method is highly subjective and is sensitive to an inspector experience and ability to differentiate sound tones produced. Additionally, other defects within the member such as knots, splits, checks, etc. can affect the sound being produced and can lead to many false interpretations of decayed areas.

This NDE method is usually used in conjunction with boring to determine the extent of decay and to confirm or negate suspect areas. Boring is the most dependable and widely used method for detecting internal decay in timber. When a "hollow" sound is encountered, this area should be marked and examined further to determine if decay is present. This can be performed with either an increment borer to extract wood cores for examination, or drilled with a battery operated drill using a 3/8" wood core bit. When drilling, the bit should be marked at 1" increments to help the inspector determine the depth of where the decay is located within a member.

Many times decay is isolated within certain growth rings. As the inspector begins to drill, care should be taken to attempt to determine the depth and thickness of each decayed layer encountered as the drill extends into the member. Note: Hardwood plugs should be used to plug any drilled out holes.

Sounding and subsequent drilling of timber members is somewhat an art and not an exact science. Proper training and experience cannot be overemphasized. The following should be considered when inspecting timber members.

Advantages:
- Immediate results
- Inexpensive method of evaluating timber members

Disadvantages:
- Highly subjective with results varying between inspectors
- Sounding only indicates serous decay, where initial decay may not be able to be detected
- Typically needs to be combined with the semi-destructive evaluation technique of drilling to quantify the extent of internal decay

A.11 BRIDGE SAFETY INSPECTION EQUIPMENT

Quality inspections begin with the inspector having access to the correct tools. Without correct tools, an inspector cannot adequately inspect a structure to the adopted standards required by the NBIS. The information provided in this section is just a guide and should not be limited to the equipment shown; special circumstances may necessitate the use of non-standard tools. The Central Bridge Office and Districts have some specialized tools that can be signed out to other Local Agencies as needed.

The inspection team should always have Chapter B – Bridge Inspection Field Manual and Chapter D – Recording and Coding Guide available for reference during the inspection. These ready references are critical and should be consulted often.

A.11.1 INSPECTION TOOLS EQUIPMENT

Inspectors should review Section 3.4 “Inspection Equipment” of the FHWA BIRM before an inspection assignment for thorough coverage of recommended requirements.

A.11.1.1 Inspection Tools

Inspectors should have available for use the following tools at a minimum for Visual Inspections.

12” Steel Rule	Micrometer
100-foot tape	Feeler gauges
Thermometer	Optical crack gauge
Tape Measure (25’ to 35’)	Plumb bob
4-foot level	String line
2-foot level	Telescoping Range Pole
Calipers	6-foot folding rule (with sliding depth gauge)

A.11.1.2 Visual Aid Tools

Inspectors should have available for use the following tools at a minimum for Visual Aid.

Binoculars	Flashlight/Headlamp
10x magnifying glass	Mirror

A.11.1.3 Inspection Tools

Inspectors should have available for use the following tools at a minimum for routine inspections,

Hammer (masons or pick)	Pocketknife
Sounding chains	Ice pick
Steel wire brush	Incremental borer or 18V Cordless Drill with 3/8” bit
Flathead screwdriver	Probing rod
Scraper	Protractor
Whisk broom	Hip boots or waders
Spade	First Aid Kit

A.11.1.4 Documentation Materials

Inspectors should have available for use the following tools at a minimum for documenting inspections.

Inspection forms	Camera
Computation paper	Pencil/pen
Clip board	Permanent marker
Straight edge	Paint stick/marker
Laptop computer	Lumber crayon

A.11.2 INSPECTION ACCESS

Inspection access needs to be determined during the planning stage and may depend on the type and scope of the inspection. Gaining access to every part of the structure can be challenging and may take different types of equipment based on several factors. For routine bridge inspections, the access requirements stated in the “Requirements for Routine Bridge Inspection Access” must be adhered to. Refer to Appendix A for these requirements. Common inspection access equipment is listed below:

Ladder	Under Bridge Inspection Vehicle (UBIV)/Snooper
Boat	Bucket Truck
MOOG	Rigging
Manlift	Rope Access

MnDOT has several snoopers that are stationed at the Central Bridge Office as well as at several of the District maintenance facilities. Refer to Chapter F – MnDOT Inspection Vehicle Policy Manual of the BSIPM for use and scheduling of the Snoopers and MOOG.

A.11.3 CONFINED SPACE ENTRY

Due to unique construction of many bridges, "confined space" situations (i.e. inside box beam superstructures, towers for suspension bridges, enclosed abutments and piers, exhaust and fresh air plenums of tunnels and some culverts) are issues that need to be thoroughly planed and coordinated prior to the inspection.

Confined spaces may pose special hazards such as toxic, flammable, or asphyxiating atmospheres, inwardly converging walls, or engulfment. To minimize the hazards presented by confined space entries, State and Local Agencies should develop procedures to protect the health and safety of employees while entering, working in, and exiting confined spaces.

Confined space is defined as:
- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit; and
- Is not designed for continuous employee occupancy

In general, confined spaces are considered to be enclosures that restrict the natural movement of air; or enclosures with limited openings for entry and exit. A Safety Plan for work in a confined space must address the lack of oxygen and possible toxic or explosive gasses such as pollutants, carbon monoxide, methane, or petroleum fumes. Confined spaces can be deadly if an inspector does not follow the proper procedures. The interior of a box girder, a vaulted abutment, or a long culvert can all be confined spaces. Confined spaces are classified as permit-required or non-permit confined spaces.

A.11.3.1 Permit Required Confined Space

"Permit-required confined space" means a confined space that has one or more of the following characteristics:
- Contains or has a potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section
- Contains any other recognized serious safety or health hazard

In the United States, entry into permit-required confined spaces must comply with regulations developed by OSHA. These regulations include developing a written program, issuing entry permits, assigning attendant(s), designating entrants, and ensuring a means of rescue.

A.11.3.2 Non-Permit Required Confined Space

A non-permit confined space is a confined space that does not contain or, with respect to atmosphere hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

The classification of a confined space must be verified in the field by the inspection team prior to entering. Although the bridge file should contain information documenting past testing and the classification of the confined space, the space should be treated as permit-required until on-site data is collected to support the designation as a non-permit confined space.

A.11.3.3 Air Monitoring

A hazardous atmosphere is an atmosphere that may expose workers to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor or mist in excess of 10% of the Lower Explosive Limit (LEL).
- The LEL may be referred to as “LFL-Lower Flammable Limit” in some references.
- Airborne combustible dust at a concentration that meets or exceeds the LEL.
- This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less.
- Atmospheric oxygen concentration below 19.5% or above 23%. If below 19.5%, it is considered to be “oxygen-deficient”, and if above 23%, it is “oxygen-enriched.” Enriched atmospheres are very rarely encountered; Inspectors should always be concerned, however, with identifying and avoiding oxygen deficient atmospheres).
- Atmospheric concentration for any substance for which a dose or a published exposure guideline is available, and which could result in employee exposure in excess of its exposure value.
- Any other atmospheric condition that is Immediately Dangerous to Life or Health.

A.11.3.4 Pre-Entry Checklist

Prior to engaging in any activity involving confined spaces, the inspection Team Leader is to inspect and evaluate space conditions and to complete the form "Confined Space Safety Inspection Checklist:

CONFINED SPACE SAFETY INSPECTION CHECKLIST

Date of Inspection: : / /

Agency:		Bridge Number:		
Inspected by (Signature):		Location:		

CONFINED SPACES NOTE: OSHA Construction Safety and Health (29 CFR 1926) references in parentheses.		Yes	No	N/A
1	Does the space have a limited means of access (porthole, hatch, only one door, etc.)? If not, it is not a confined space.			
2	Is the space large enough, or has openings large enough, that a worker may place any portion of his/her body into it? If not, it is not a confined space.			
3	Is the space NOT designed or intended for continuous human occupancy (Is it missing an HVAC system, lighting, workstations, etc.)? If answer is "NO" (It IS intended for continuous human occupancy), then it is not a confined space.			
IF ITEMS # 1, 2 and 3 ARE ALL ANSWERED "YES", THEN IT IS A "CONFINED SPACE".				
4	Does the space contain a hazardous atmosphere, physical hazard (heat, electrocution) explosive atmosphere (>10% LEL), potential for engulfment (water/grain) or have inwardly converging walls? If "YES" has been answered to all items # 1, 2, 3, 4, and then it is a Permit Required Confined Space (PRCS). Complete questions # 5-20.			
5	Are employees going to enter the PRCS? If not, is the space sealed so that it is inaccessible to entry? (.146(c)(3)). If space will not be entered, just seal space, answer "NO" and stop here – items #6-20 will not apply.			
6	Is the Agencies Permit Space Program being followed? (.146(c)(4))			
7	Do the entrants/attendants understand their respective duties? (.146(h)).			
8	Have the entrants/attendants received formal Confined Space Training? (.146(g)).			
9	Has the space atmosphere been sampled for oxygen finding, explosive concentrations and the presence of toxic gasses, in that order? (.146(d)(5)).			
10	Is a sign posted near the entrance, stating "DANGER—PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" or equivalent language? (.146(C)(2)).			
11	Has a written Confined Space permit been completely filled out, been signed by the entry supervisor, and been posted at the space entrance? (.146(e)).			
12	Is a communication system implemented, such that the entrant is in constant communication (Visual, Voice, Signs, Hand Signals) with the attendant at all times?			
13	Is the entrant equipped with a lifeline/body harness, and if a vertical descent over 5 feet is required, is the entrant attached via retrieval line to a mechanical winch? (.146(k)(3)).			
14	Are there trained rescue workers standing by to assist in case of an emergency, or has an outside rescue organization been contracted to act? (.146(k)).			
15	Is natural lighting sufficient, and if not, is explosion-proof lighting being used due to the presence of combustible gasses/vapors? (.146(d)(4)).			
16	Are the entrant(s) using all needed Personal Protective Equipment (gloves, Tyvek, respirators, hard hats, steel-toed safety shoes)? (.146(d)(3)).			
17	If the space contains a harmful atmosphere, Is a blower w/hose on-site and being utilized at least 30 minutes prior to entry? (.146(c)(5)).			
If any of the questions #6-17 were answered "No", then a further review of the space/situation is required prior to entry. Contact				
REMARKS:				

A.11.4 TRAFFIC CONTROL

Inspection operations can create unexpected and unusual situations for motorists. Effective traffic control eliminates surprises and routes traffic safely around any hazards, inspection personnel, or equipment. Minnesota utilizes the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD) for the design and layout of Temporary Traffic Control (TTC) systems. They also have a Field Manual, Temporary Traffic Control Zone Layouts, which is Part 6 of the MN MUTCD and contains general Temporary Traffic Control standards. This manual contains typical layouts for temporary traffic control zones ranging from mobile operations to zones which may remain in-place overnight. When specific TTC plans for a specific operation are not available, any public or private agency whose work affects vehicular and pedestrian traffic should use this Field Manual to provide proper TTC.

Traffic control requirements should be reviewed prior to performing an inspection to assure safety of the inspection team and the traveling public. The Team Leader should review safety considerations and the traffic control requirements with the Maintenance Supervisor or Contractor providing TTC. Consultants working on state-owned bridges must submit any traffic control plans to the owner for approval at least two weeks prior to the start of the work. Inspectors working for Local Agencies should coordinate with the Bridge Owner for traffic control. A traffic control plan is a plan view drawing of the proposed work zone that shows where traffic control devices will be placed, what devices will be used, and how they will be oriented. All parties that will be operating in the work zone should review and be familiar with the approved traffic control plan.

A.11.5 PERSONAL PROTECTIVE EQUIPMENT

Bridge inspections typically present hazards requiring the use of personal protective equipment (PPE) to prevent bodily harm. The purpose of PPE is to shield or isolate individuals from the environmental, chemical, physical, and biological hazards present on-site. No single combination of protective clothing and equipment, however, is capable of protecting against all hazards. Proper training and access to personal protective equipment is required to safely perform bridge inspection work.

The following is a list of typical PPE used during normal bridge inspection work. This listing is not all inclusive and should only be used as a guide. Various other types of PPE may be required depending on the specific location and type of inspection.

- High-Visibility Safety Vest – The use of a serviceable ANSI/ISEA Class 2 (minimum) vest is required for all bridge inspection work. A Class 3 vest may be required when working at night or adjacent to freeway traffic.
- Respirators – ANSI N95 particulate respirators are to be worn when an inspector’s exposure to airborne contaminants cannot be eliminated or controlled. This includes working in areas where pigeon dung is prevalent.
- Head Protection –Head protection must be worn when there is potential to be struck from a falling object or when working from bridge access equipment such as a snooper, bucket truck or man lift. Protective headwear must meet ANSI Z89.1 requirements.
- Eye and Face Protection – Standards for appropriate eye or face protection are covered in 29 CFR 1910.133 and ANSI Z87.1. Face shield (full-face coverage, eight-inch minimum) or splash hood protects against chemical splashes, but does not protect adequately against projectiles. Safety glasses protect eyes against large particles and

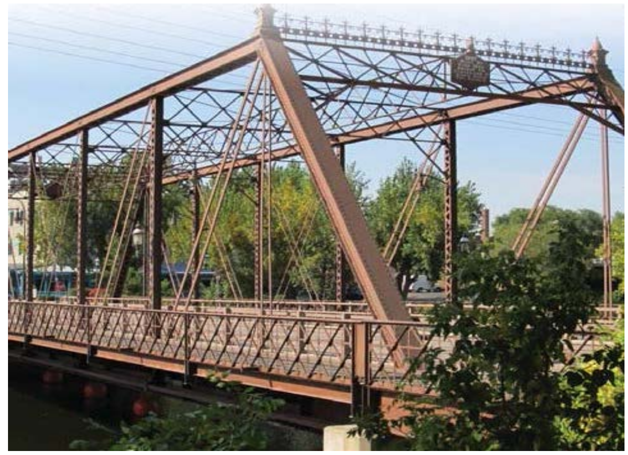
projectiles. Goggles, depending on their construction, can protect against vaporized chemicals, splashes, large particles and projectiles.

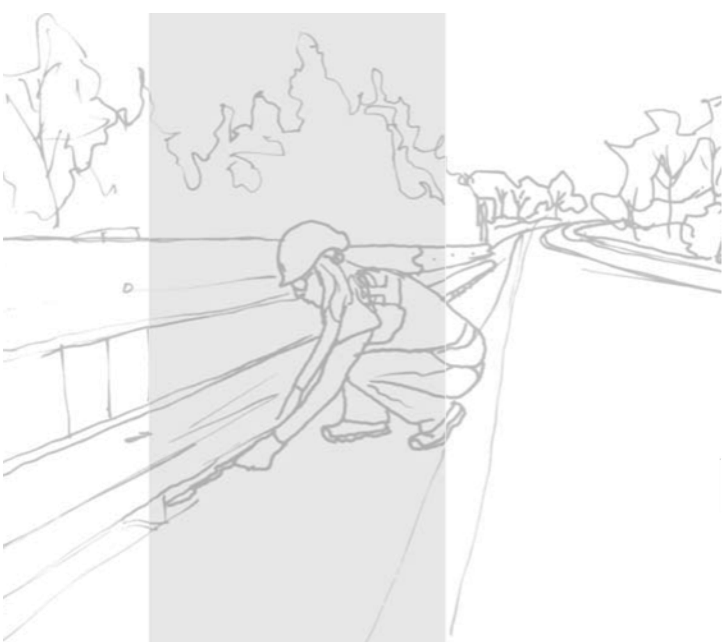
- Foot Protection –Steel-shank or steel-toe safety boots protect feet from compression, crushing, or puncture by falling, moving, or sharp objects. They should provide good traction and must meet 29 CFR 1910.136 and ANSI Z41. Non-conductive or spark-resistant safety boots protect the wearer against electrical hazards and prevent ignition of combustible gases or vapors.
- Hand Protection –Appropriate hand protection should be used when hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, pigeon dung, thermal burns, and harmful temperature extremes.
- Personal Fall Arrest System – A personal fall arrest system must be employed when working from a height of 6 feet or more. Components of a Personal Fall Arrest System (PFAS) include a body system (harness); connecting device (rope or web lanyard, shock absorbing lanyard, self-retracting lifeline); and a tie-off or anchorage point (eye bolt or beam, cross-arm strap connector), with a minimum tensile strength of 5,000 lbs. per worker. All components of a Personal Fall Arrest System must be routinely inspected for defects and must be replaced at the end of their serviceable life. The recommended serviceable life is considered 5-years from the purchase date.

STATE OF MINNESOTA

Bridge and Structure Inspection Program Manual

DEPARTMENT OF TRANSPORTATION





Chapter B

BRIDGE INSPECTION FIELD MANUAL

DEPARTMENT OF TRANSPORTATION

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B.1 OVERVIEW

This manual is intended to serve as a field guide for the inspection and condition rating of bridges and culverts on roadways in Minnesota. A bridge inspection includes examining the structure, evaluating the physical condition of the structure, and reporting the observations and evaluations on the bridge inspection report. MnDOT currently uses two separate bridge condition rating systems - the NBI condition ratings and the structural element condition ratings:

- The NBI condition ratings describe the general overall condition of a bridge, culvert, or tunnel. This 0-9 rating system was developed by the Federal Highway Administration (FHWA) in 1971, and is outlined in the "FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges". The NBI condition ratings are used to determine inspection frequency, deficient status, and are a key component of the Bridge Sufficiency Rating.

- Structural element condition ratings divide a bridge into separate components which are then rated individually based upon the severity and extent of deterioration. This 1-4 rating system was developed by the American Association of State Highway and Transportation Officials (AASHTO), and is outlined in the "AASHTO Manual for Bridge Element Inspection". Minnesota has been collecting element level bridge condition data since 1994. The FHWA began mandating (and collecting) element level data in October of 2014. Structural element condition ratings provide input data for a Bridge Management System (BMS) which can be used to identify present maintenance needs, and is intended to provide cost-effective options for long-range bridge maintenance and improvement programs (using computer projections of future deterioration).

Bridge inspection reports (along with the NBI & structural element condition ratings), are entered into SIMS (Structure Information Management System). Access to this system is typically restricted to MnDOT certified Bridge Inspection Team Leaders or Bridge Inspection Program Administrators appointed by those agencies with bridge inspection responsibility. A username and password are required. For more information, contact simshelp.dot@state.mn.us.

Bridge inspection reports and structure inventory reports for any bridge on the MnDOT inventory can be printed at the link below (no password required):
http://dotapp7.dot.state.mn.us/bridgereports/Logon.aspx

B.2 NBI CONDITION AND APPRAISAL RATINGS

The NBI bridge condition and appraisal ratings were introduced in 1971 with the National Bridge Inspection Standards (NBIS). These ratings are outlined in the FHWA Recording & Coding Guide. Minnesota has added some guidance in an effort to improve consistency.

B.2.1 NBI BRIDGE CONDITION RATINGS

The NBI condition ratings describe the general overall condition of a bridge or culvert. These must be reviewed during each inspection.

B.2.1.1 NBI Condition Ratings – General Guidelines

There are five NBI condition ratings. They are rated on a numerical scale of 1 to 9 (with 9 being a "new" condition).

- Deck Condition Rating (NBI Item 58)
- Superstructure Condition Rating (NBI Item 59)
- Substructure Condition Rating (NBI Item 60)
- Channel & Channel Protection Condition Rating (NBI Item 61)
- Culvert Condition Rating (NBI Item 62)

Bridges are typically rated in three components – deck, superstructure, and substructure. If a bridge spans over a waterway, the channel (NBI Item 61) must also be rated.

- For filled spandrel arch bridges (or rigid frame structures with fill), the NBI superstructure and substructure items should be rated, but the NBI deck rating may be entered as "N".
- For concrete slab span structures with concrete wearing surfaces, the NBI deck and superstructure ratings will typically be the same. The NBI deck and superstructure ratings may differ when the wearing surface material is different than the structural slab material (such as a timber slab with a bituminous overlay).

Culverts are rated as a single component (NBI Item 62). NBI Item 62 describes the general overall condition of the culvert. This rating should consider the condition of the culvert barrel, joints and seams, as well as any deflection, distortion, misalignment, settlement, scour, or voiding of backfill. Headwalls, wingwalls or aprons (up to the first construction joint) should be included in this rating. If water flows through a culvert, the channel (NBI Item 61) must also be rated.

The following general guidelines apply to the NBI Condition Ratings:

- New bridges and culverts are initially assigned NBI ratings of "9" (excellent condition).
- Repaired components should typically not be rated higher than "7" (good condition).
- An NBI rating of "5" (fair condition) or less generally implies that repairs are recommended. NBI ratings of "5" or less will also reduce the bridge sufficiency rating.
- An NBI rating of "4" (poor condition) or less may impact the inspection frequency.
- An NBI rating of "3" (serious condition) or less generally implies that immediate repairs, structural analysis, or a new load rating is necessary.
- An NBI rating of "2" (critical condition) indicates a critical finding. Specific reporting and follow-up procedures are required for critical findings. NBI ratings of "2" should be adjusted immediately after the critical finding is addressed.
- Temporary supports (shoring, bracing, or underpinning) should generally not improve the NBI rating. One exception would be if a critical condition was corrected with temporary shoring (the NBI rating should be raised from condition 2 after the temporary repairs have been performed).
- The load carrying capacity should not be considered when determining the NBI condition ratings.

B.2.1.2 Deck Condition Rating (NBI Item 58)

<table>
<tr><th colspan="2">Deck Condition Rating (NBI Item 58)</th></tr>
<tr><th>Code</th><th>This rating should reflect the overall general condition of the deck (or slab). This includes the underside of the deck and the wearing surface. The condition of railings, sidewalks, curbs, expansion joints, and deck drains are not considered in this rating.</th></tr>
<tr><td>N</td><td>Not Applicable: Use for culverts, roadway tunnels, or filled spandrel arch bridges.</td></tr>
<tr><td>9</td><td>Excellent Condition: Deck is in new condition (recently constructed).</td></tr>
<tr><td>8</td><td>Very Good Condition: Deck has very minor (and isolated) deterioration.
• Concrete: minor cracking, leaching, scale, or wear (no delamination or spalling)
• Timber: minor weathering and/or isolated (minor) splitting
• Steel: no corrosion (paint/protection system remains sound)</td></tr>
<tr><td>7</td><td>Good Condition: Deck has minor (or isolated) deterioration.
• Concrete: minor cracking, leaching, scale, or wear (isolated spalling/delamination)
• Timber: minor weathering or splitting (no decay or crushing) – planks are secure
• Steel: minor paint failure or corrosion (no section loss) – connections are secure</td></tr>
<tr><td>6</td><td>Satisfactory Condition: Deck has minor (or isolated) deterioration.
• Concrete: moderate cracking, leaching, scale, or wear (minor spalling and/or delamination)
• Timber: moderate weathering or splitting (isolated decay or crushing) – some planks may be slightly loose
• Steel: moderate paint failure and/or surface corrosion (minor section loss) – some connections may have worked loose</td></tr>
<tr><td>5</td><td>Fair Condition: Deck has moderate deterioration (repairs may be necessary).
• Concrete: extensive cracking, leaching, scale, or wear (moderate delamination or spalling)
• Timber: extensive weathering or splitting (moderate decay or crushing) – some planks may be loose, broken, or require replacement
• Steel: extensive paint failure and/or surface corrosion (moderate section loss) – several connectors may be loose or missing (primary components remain secure)</td></tr>
<tr><td>4</td><td>Poor Condition: Deck has advanced deterioration (replacement or overlay should be planned).
• Concrete: advanced cracking, leaching, scale, or wear (extensive delamination or spalling) – isolated full-depth failures may be imminent
• Timber: advanced weathering, splitting, or decay – numerous planks may be loose, broken, or require replacement
• Steel: advanced corrosion (significant section loss) – deck components may be loose or slightly out of alignment</td></tr>
<tr><td>3</td><td>Deck has severe deterioration. Immediate repairs may be necessary.
• Concrete: severe cracking, leaching, delamination, or spalling – full-depth failures may be present
• Timber: severe splitting, crushing or decay – majority of planks need replacement
• Steel: severe and section loss – deck components may be severely misaligned</td></tr>
<tr><td>2</td><td>Critical Condition: Deck has failed. Emergency repairs are required.</td></tr>
<tr><td>1</td><td>"Imminent" Failure Condition: Bridge is closed. Corrective action is required to open to restricted service.</td></tr>
<tr><td>0</td><td>Failed Condition: Bridge is closed. Deck replacement is necessary.</td></tr>
</table>

B.2.1.3 Superstructure Condition Rating (NBI Item 59)

Superstructure Condition Rating (NBI Item 59)	
Code	This rating should reflect the overall general condition of the superstructure – this includes all primary structural components located above (and including) the bearings.
N	**Not Applicable:** Use for culverts.
9	**Excellent Condition:** Superstructure is in new condition (recently constructed).
8	**Very Good Condition:** Superstructure has very minor (and isolated) deterioration.
7	**Good Condition:** Superstructure has minor (or isolated) deterioration. • Steel: minor corrosion, little or no section loss • Concrete: minor scale or non-structural cracking (isolated spalling/delamination) • Timber: minor weathering or splitting (no decay or crushing) • Masonry: minor weathering or cracking (joints have little or no deterioration)
6	**Satisfactory Condition:** Superstructure has minor to moderate deterioration. Members may be slightly bent or misaligned – connections may have minor distress. • Steel: moderate corrosion (section loss or cracks in non-critical areas) • Concrete: moderate scale or cracking (minor spalling/delamination) • Timber: moderate weathering or splitting (minor decay or crushing) • Masonry: moderate weathering or cracking (joints may have minor deterioration)
5	**Fair Condition:** Superstructure has moderate deterioration. Members may be bent, bowed, or misaligned. Bolts/rivets may be loose/missing, but connections remain intact. • Steel: extensive corrosion (initial section loss in critical stress areas); cracks have been arrested or are not likely to propagate into critical stress areas • Concrete: extensive scaling or cracking (structural cracks may be present), moderate spalling or delamination (reinforcement may have some section loss) • Timber: extensive weathering or splitting (moderate decay or crushing) • Masonry: extensive weathering or cracking (slight joint separation or offset)
4	**Poor Condition:** Superstructure has advanced deterioration. Members significantly bent or misaligned. Connection failure may be imminent. Bearings severely restricted. • Steel: significant section loss in critical stress areas; un-arrested cracks exist that may likely propagate into critical stress areas • Concrete: advanced scaling, cracking, or spalling (significant structural cracks may be present – exposed reinforcement may have significant section loss) • Timber: advanced splitting (extensive decay or significant crushing) • Masonry: advanced weathering or cracking (joint separation or offset)
3	**Serious Condition:** Superstructure has severe deterioration – immediate repairs or structural evaluation may be required. Members may be severely bent or misaligned - connections or bearings may have failed. • Steel: severe section loss or cracks in critical stress areas • Concrete: severe structural cracking or spalling • Timber: severe splitting, decay, or crushing • Masonry: severe cracking, offset or misalignment
2	**Critical Condition:** Superstructure has critical damage or deterioration. Primary structural elements may have failed (severed, detached or critically misaligned). Immediate repairs may be required to prevent collapse or closure.
1	**"Imminent" Failure Condition:** Bridge is closed. Superstructure is no longer stable (corrective action might return the structure to restricted service).
0	**Failed Condition:** Bridge is closed due to superstructure failure and is beyond corrective action (replacement required).

B.2.1.4 Substructure Condition Rating (NBI Item 60)

Substructure Condition Rating (NBI Item 60)	
Code	This rating should reflect the overall general condition of the substructure – this includes all structural components located below the bearings. Integral wingwalls or retaining walls (up to the first expansion or construction joint) may be considered in this rating.
N	**Not Applicable:** Use for culverts.
9	**Excellent Condition:** Substructure is in new condition (recently constructed).
8	**Very Good Condition:** Substructure has very minor (and isolated) deterioration.
7	**Good Condition:** Substructure has minor (or isolated) deterioration. • Concrete: minor cracking, leaching, or scale (isolated delaminations or spalls) • Steel: minor paint failure and/or surface corrosion (little or no section loss) • Timber: minor weathering or splitting (no decay or crushing) • Masonry: minor weathering or cracking (joints have little or no deterioration)
6	**Satisfactory Condition:** Substructure has minor to moderate deterioration. Scour or erosion is minor and isolated (there may be slight movement or misalignment). • Concrete: moderate scaling, cracking, or leaching (minor spalling/delamination) • Steel: moderate paint failure and/or surface corrosion (minor section loss) • Timber: moderate weathering or splitting (minor decay or crushing) • Masonry: moderate weathering or cracking (joints may have minor deterioration)
5	**Fair Condition:** Substructure has moderate deterioration. Repairs may be necessary. There may be moderate scour, erosion, or undermining. There may be minor settlement, movement, misalignment, or loss of bearing area. • Concrete: extensive scaling, cracking or leaching (isolated structural cracks may be present) – there may be moderate delamination or spalling • Steel: extensive paint failure and/or surface corrosion (moderate section loss) • Timber: extensive weathering or splitting (moderate decay or crushing) • Masonry: extensive weathering or cracking (slight joint separation or offset)
4	**Poor Condition:** Substructure has advanced deterioration. Repairs may be necessary to maintain stability. There may be extensive scour, erosion, or undermining. There may be significant settlement, movement, misalignment, or loss of bearing area. • Concrete: advanced scaling, cracking, or leaching (significant structural cracks may be present) – there may be extensive delamination or spalling • Steel: advanced corrosion (significant section loss) • Timber: advanced splitting (significant decay or crushing) • Masonry: advanced weathering or cracking (joints separation or offset)
3	**Serious Condition:** Substructure has severe deterioration. Immediate corrective action may be required. Scour, erosion, or undermining may have resulted in severe settlement, movement, misalignment, or loss of bearing area. • Concrete: severe spalling or structural cracking • Steel: severe section loss • Timber: severe decay or crushing • Masonry: severe cracking, offset or misalignment
2	**Critical Condition:** Substructure has critical damage or deterioration (near the point of collapse). It may be necessary to close the bridge until corrective action is completed. Scour may have removed substructure support.
1	**Imminent Failure Condition:** Bridge is closed. Substructure is no longer stable (corrective action might return the structure to restricted service).
0	**Failed Condition:** Bridge is closed due to substructure failure and is beyond corrective action (replacement required).

B.2.1.5 Channel and Channel Protection Condition Rating (NBI Item 61)

Channel and Channel Protection Condition Rating (NBI Item 61)	
Code	This rating should reflect the overall general condition of the waterway under the bridge (or running through the culvert), even if the channel is occasionally dry. This rating can be based upon findings from routine inspections, soundings, or underwater inspections. This rating includes the channel and banks below the bridge, as well as immediately upstream and downstream of the bridge (typically those areas visible from the bridge). Changes in the channel – such as aggradation, degradation, or lateral stream migration – that might adversely affect the bridge should be considered in this rating. The presence drift in the channel, debris lodged against the bridge, or sediment inside culvert barrels should also be considered in this rating. *Note: For bridges over a navigable waterway (NBI Item 38 coded as '1') the condition and adequacy of substructure protection devices (such as dolphins, fenders, and shear walls) must be rated using NBI Item 111.*
N	**Not Applicable:** Bridge is not over a waterway.
9	**Excellent Condition:** There are no noticeable or noteworthy deficiencies.
8	**Very Good Condition:** Channel banks are protected (or well vegetated) – there is little or no erosion. Control structures and protection devices (if present) have little or no deterioration. Drift or debris in the channel is incidental. Culvert has little or no sediment.
7	**Good Condition:** Channel has no notable aggradation, degradation, or lateral movement. There is no notable scour around the bridge substructure. The banks may have minor erosion – bank protection (if any) may have minor deterioration. Control structures and/or protection devices may have minor deterioration. There may be minor drift or debris in the channel. Culvert barrel may have minor sediment.
6	**Satisfactory Condition:** Channel may have minor aggradation, degradation, or lateral movement. The channel banks may have moderate erosion or slumping. Bank protection may have moderate deterioration. Control structures and/or protection devices may have moderate deterioration. Drift or debris in the channel may be slightly restricting the channel. Culvert barrel may have moderate sediment.
5	**Fair Condition:** Channel may have moderate aggradation, degradation, or lateral movement, but the bridge and approaches have not yet been adversely affected. The channel banks may have extensive erosion – the bank protection may have extensive deterioration. Control structures and/or protection devices may have extensive deterioration, but are functioning as intended. Debris in the channel (or sediment in the culvert barrel) is restricting the channel and should be removed.
4	**Poor Condition:** Aggradation, degradation, or lateral movement of the channel may be adversely affecting the structure or approaches. Channel banks may have severe erosion. The bank protection may have severe deterioration. Control structures and/or protection devices may be deteriorated to the extent that they are no longer functioning as intended. Large accumulations of debris or sediment are severely restricting the channel, and should be removed immediately.
3	**Serious Condition:** Aggradation, degradation, or lateral movement has altered the channel to the extent that the structure (or approach roadway) is threatened. Bank protection has failed. Control structures and/or protection devices have been destroyed. Channel is blocked by debris or sediment.
2	**Critical Condition:** Aggradation, degradation, or lateral movement has altered the channel to the extent that the bridge (or culvert) is near a state of collapse. It may be necessary to close the bridge (or culvert) until corrective action is completed.
1	**Bridge closed due to channel failure:** Corrective action may restore bridge to light service.
0	**Bridge closed due to channel failure:** Replacement necessary.

B.2.1.6 Culvert Condition Rating (NBI Item 62)

Culvert Condition Rating (NBI Item 62)	
Code	This rating should reflect the overall general condition of the culvert. If this item is rated, the NBI deck, superstructure, and substructure ratings must all be “N”.
N	**Not Applicable:** Structure is not a culvert.
9	**Excellent Condition:** Culvert is new condition (recently constructed).
8	**Very Good Condition:** Culvert has very minor (and isolated) deterioration.
7	**Good Condition:** Culvert has minor (or isolated) deterioration. Joints are sound and properly aligned (no backfill infiltration). Footings have no undermining. • Concrete/Masonry: minor weathering, cracking, or leaching (isolated spalling) • Steel: minor corrosion (little or no section loss) - barrel has no distortion • Timber: minor splitting (no decay, crushing, or sagging)
6	**Satisfactory Condition:** Culvert has minor to moderate deterioration. Joints may have minor separation or misalignment (slight backfill infiltration). • Concrete/Masonry: moderate weathering, cracking, or leaching (minor spalling) • Steel: moderate corrosion (minor section loss) – barrel may have minor distortion (seams may have minor distress, but no cracking) • Timber: moderate splitting (minor decay, crushing, or sagging)
5	**Fair Condition:** Culvert has moderate deterioration – repairs may be required, but the culvert is structurally sound and functioning as intended. Joints may have separation or misalignment (moderate backfill infiltration). Footings may be partially undermined (minor settlement). • Concrete/Masonry: extensive weathering, cracking, or leaching (moderate spalling) • Steel: extensive corrosion (any significant section loss is isolated) – barrel may have moderate distortion (seams may have missing bolts or isolated cracking) • Timber: extensive splitting (moderate decay, crushing, or sagging)
4	**Poor Condition:** Culvert has advanced deterioration – structural evaluation or repairs may be necessary (structural integrity or functional capacity of the culvert may be slightly reduced). Footings may have significant undermining or settlement. • Concrete/Masonry: advanced weathering, cracking, leaching, or scaling (significant spalling). Joints may have significant separation or misalignment. • Steel: advanced corrosion (significant section loss) – barrel may have significant distortion (seams may have extensive cracking or isolated failures) • Timber: advanced splitting (significant decay, crushing, or sagging)
3	**Serious Condition:** Culvert has serious deterioration – immediate repairs or corrective action may be required (structural integrity or functional capacity of the culvert has been significantly reduced). Joints may have severe deterioration, misalignment, offset, or separation. Loss of backfill may have resulted in significant settlement or undermining of the roadway or embankment. Severe undermining or settlement. • Concrete/Masonry: severe weathering, cracking, or spalling • Steel: severe section loss or severe barrel distortion (seams may have failed) • Timber: severe decay, crushing, or sagging
2	**Critical Condition:** Culvert has critically advanced deterioration (near collapse) – it may be necessary to close the roadway until corrective action is completed.
1	**"Imminent" Failure Condition:** Culvert is closed – corrective action may restore to light service.
0	**Failed Condition:** Culvert is closed – replacement is necessary.

B.2.2 NBI BRIDGE APPRAISAL RATINGS

The FHWA has five appraisal ratings that are used to evaluate a bridge in regards to the current standards for the particular highway system it is located on.

- Deck Geometry Appraisal Rating (NBI Item 68)
- Vertical and Horizontal Under Clearance Appraisal Rating (NBI Item 69)
- Bridge Posting Appraisal Rating (NBI Item 70)
- Waterway Adequacy Appraisal Rating (NBI Item 71)
- Approach Roadway Alignment Appraisal Rating (NBI Item 72)

NBI Items 68 (Deck Geometry), 69 (Under Clearance), and 70 (Bridge Posting) are automatically calculated based upon other structure inventory items. These ratings are displayed on the Minnesota Structure Inventory Report. They are not displayed on the Minnesota Bridge Inspection Report.

NBI Items 71 (Waterway Adequacy) and 72 (Approach Roadway Alignment) are displayed on the header of the Minnesota Bridge Inspection Report, and on the Minnesota Structure Inventory Report. The coding for these two items must be determined by the inspector, and entered in SIMS, according to the guidance below.

B.2.2.1 Approach Roadway Alignment Appraisal Rating (NBI Item 72)

NBI Item 72 is a general assessment that identifies bridges or culverts that do not function properly or adequately due to the approach roadway alignment. For new bridges or culverts, this item will initially be rated as “9” – an appropriate rating must be determined during the initial inspection. This item should also be reviewed if the bridge approaches have been reconstructed or reconfigured. This rating only applies to the roadway passing over the bridge (not the roadway passing below the bridge). For railroad or pedestrian bridges crossing over a roadway, this item should be coded as “N”.

This rating is based upon the speed reduction required (due to the vertical or horizontal approach alignment) by a typical vehicle using the roadway. If an advisory speed limit is posted, the reduction from the base speed limit should be used to determine this rating. Note: Speed reductions necessary due to structure width shall not be considered when evaluating this item.

Approach Roadway Alignment Appraisal Rating (NBI Item 72)	
Code	**Description**
N	Not Applicable (use for railroad or pedestrian bridges).
9	***New Structure – an appropriate rating code should be determined.***
8	No speed reduction required.
7	Minor sight distance problems with no speed reduction required.
6	Very minor speed reduction required (less than 5 MPH for a typical vehicle using the roadway).
5	Minor speed reduction required (5 MPH for a typical vehicle using the roadway).
4	Significant speed reduction required (6-10 MPH for a typical vehicle using the roadway).
3	Intolerable alignment requiring a substantial reduction in the operating speed (11-20 MPH for a typical vehicle using the roadway).
2	Severe vertical or horizontal alignment problems, such as a sharp vertical or horizontal curve immediately adjacent to the bridge (speed reduction greater than 20 MPH for a typical vehicle using the roadway).
1	***This rating code should not be used.***
0	Bridge Closed.

B.2.2.2 Waterway Adequacy Appraisal Rating (NBI Item 71)

This rating is a general assessment of the waterway opening with respect to the passage of flow through the bridge. This rating is based upon the frequency of “overtopping” of the bridge and approach (and the resultant traffic delays). The functional class of the roadway is also taken into consideration. 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). Note: When a new bridge or culvert is added to the MnDOT bridge database, this item will initially be coded as “9” – as this coding may not be appropriate, this item should always be reviewed for new bridges.

The descriptions given in the bottom table mean the following:

Chances of Overtopping			Traffic Delays	
Remote	Greater than 100 years		**Insignificant**	Minor inconvenience (impassable for a few hours)
Slight	11 to 100 years			
Occasional	3 to 10 years		**Significant**	Traffic delays of up to several days
Frequent	Less than 3 years			
“Freeboard” is defined as the distance from the bottom of the superstructure to the water surface (at the water level of the 50-year frequency design storm)				

Waterway Adequacy Appraisal Rating (NBI Item 71)			
Functional Classification			
Interstates, Freeways, or Expressways	**Other Principal and Minor Arterial and Major Collectors**	**Minor Collectors and Local Roads**	**Description**
N	**N**	**N**	Bridge not over a waterway.
9	**9**	**9**	Bridge deck and roadway approaches above floodwater elevations (high water). Chance of overtopping is remote.
8	**8**	**8**	Bridge deck above roadway approaches. Slight chance of overtopping roadway approaches. Greater than 3 ft. of freeboard.
6	**6**	**7**	Bridge deck above roadway approaches. Slight chance of overtopping bridge deck and roadway approaches. 2 to 3 ft. of freeboard.
4	**4**	**6**	Bridge deck above roadway approaches. Occasional overtopping of roadway approaches with insignificant traffic delays. 1 to 2 ft. of freeboard.
3	**4**	**5**	Bridge deck above roadway approaches. Occasional overtopping of roadway approaches with significant traffic delays. Less than 1 ft. of freeboard.
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.

B.3 STRUCTURAL ELEMENT CONDITION RATINGS

Structural element condition ratings provide a detailed condition evaluation of the bridge by dividing the bridge into separate elements, which are then rated individually based upon the severity and extent of any deterioration. This rating system was developed by the American Association of State Highway and Transportation Officials (AASHTO), and is outlined in the "AASHTO Manual for Bridge Element Inspection".

B.3.1 INTRODUCTION TO STRUCTURAL ELEMENT CONDITION RATINGS

Structural element condition ratings provide input data for a Bridge Management System (BMS), which allows computer projections of deterioration rates, providing cost-effective options for bridge maintenance, rehabilitation, or replacement. Bridge Management Systems are intended to be a source of information (and qualitative backing) for engineers and managers responsible for long-range bridge improvement programs. MnDOT adopted an element based bridge inspection format in 1994 to comply with the 1991 Inter-Modal Surface Transportation Efficiency Act (ISTEA), which mandated that all states develop and implement a Bridge Management System (BMS) by October of 1998. In 2014, the FHWA mandated that element level condition ratings (based upon the AASHTO Manual for Bridge Element Inspection) be submitted for all bridges on the National Highway System (NHS).

An "element" refers to structural members (beams, pier columns, decks, etc.), or any other components (railings, expansion joints, approach panels, etc.) commonly found on a bridge.

B.3.1.1 Structural Element Types

AASHTO defines three basic element types:

- **National Bridge Elements (NBEs)** represent the primary structural components of a bridge or culvert (bearings and railings are also included). The condition rating language for NBE's cannot be altered, as these are intended to remain consistent across the country.
- **Bridge Maintenance Elements (BME's)** include components of the bridge such as joints, wearing surfaces, and protective coating systems that might be managed by agencies using Bridge Management Systems. The condition rating language for BME's can be altered by states to best suit their bridge management practices.
- **Agency-Developed Elements (ADEs)** are custom elements defined by an agency. They may be sub-elements of NBE's or BME's, or may have no ties to the AASHTO elements. ADE's provide some flexibility for agencies to rate specific bridge components not addressed by the NBE's or BME's.

Structural elements are also classified into five groups, depending upon structural function:

- **Deck Elements** (decks, slabs, wearing surface, deck joints, railings, and approaches)
- **Superstructure Elements** (girders, beams, arches, trusses, and bearings)
- **Substructure Elements** (abutments, piles, columns, pier caps, pier walls, and footings)
- **Culvert Elements** (culvert barrels, culvert end treatments, and roadway above culvert)
- **Miscellaneous Elements** (bridge components that do not fall under the other groups)

Structural elements are also divided into six material groups:

- **Steel Elements**
- **Reinforced Concrete Elements**
- **Pre-stressed (and Post-Tensioned) Concrete Elements**
- **Timber Elements**
- **Masonry Elements**
- **Other Material Elements** (Aluminum, Plastic, Composite, Etc.)

B.3.1.2 Structural Element Quantities

Structural element quantities may be expressed in three ways:

- **Square Feet (SF):** elements such as decks, slabs, wearing surfaces, and coatings are expressed in square feet (SF) quantities. *Example, a deck with a length of 100 ft. and a width of 24 ft. would have an element quantity of 2,400 SF.*
- **Linear Feet (LF):** elements such as girders, beams, box girders, culvert barrels, deck joints, and railings are expressed in linear feet (LF) quantities*. Example, on a 100 ft. long bridge with five beam lines, the beam quantity would be 500 LF.*
- **Each (EA):** elements such as columns, pilings, and bearings are expressed as each (EA) quantities. *Example, on a bridge with three piers, and three columns at each pier, the column quantity would be 9 EA.*

B.3.1.3 Structural Element Ratings

Structural elements are all rated on a scale of 1-4. Condition state 1 is the best condition, with condition state 4 being the worst condition (this is the reverse of the NBI condition ratings).

If the severity of deterioration varies within a particular element, the element should be rated using more than one condition state. Example, on a bridge with 500 LF of beams, 250 LF could be rated as condition state 1, 150 LF could be rated as condition state 2, and 100 LF could be rated as condition state 3, and condition state 4 would be 0 LF.

Elements expressed as an “Each” (EA) quantity can also be rated using more than one condition state (but only if the total quantity is greater than one). Example, on a bridge with 9 columns, five could be rated as condition state 1, three could be rated as condition state 2, and one could be rated as condition state 3, and condition state 4 would be 0.

B.3.1.4 Structural Element Display (Bridge Inspection Report)

Only structural elements that have been entered for a bridge will be displayed on the Minnesota Bridge Inspection Report. The element condition ratings from the most recent inspection, as well as those from the previous inspection, are displayed on the inspection report in “SF”, “LF”, or “Each” quantities. Inspection notes pertaining to each element are displayed directly below the element. It is the Team Leaders responsibility to verify that the elements and quantities displayed on the inspection report are correct.

B.3.1.5 MnDOT Structural Element List

This list displays the 112 structural elements currently being used by MnDOT. This includes 82 of the 103 AASHTO elements, and 30 elements developed by MnDOT. AASHTO elements that do not apply to bridges in Minnesota are not included in this manual.

This element list is arranged in groups based upon the structural function and material type, in the same order that they are arranged in this manual. The AASHTO element numbering systems is used for National Bridge Elements (NBE’s) and Bridge Management Elements (BME’s). Agency-Developed Elements (ADE’s) created by MnDOT are numbered starting with 800.

MnDOT Structural Element List					
#	**Element Description**	**Type**	**Component**	**Units**	**Page**
	Critical Findings				
800	Critical Findings or Safety Hazards	ADE	Miscellaneous	Each	19
	Deck & Slab Elements				
12	Reinforced Concrete Deck	NBE	Deck	SF	21
16	Reinforced Concrete Top Flange	NBE	Deck	SF	21
38	Reinforced Concrete Slab	NBE	Deck	SF	21
13	Prestressed Concrete Deck	NBE	Deck	SF	24
15	Prestressed Concrete Top Flange	NBE	Deck	SF	24
805	Prestressed Concrete Slab	ADE	Deck	SF	24
31	Timber Deck	NBE	Deck	SF	26
54	Timber Slab	NBE	Deck	SF	26
28	Steel Grid Deck - Open	NBE	Deck	SF	29
29	Steel Grid Deck - Concrete Filled	NBE	Deck	SF	29
30	Other Steel Deck	NBE	Deck	SF	29
	Wearing Surface Elements				
510	Wearing Surface	BME	Deck	SF	32
810	Concrete Wearing Surface - Cracking & Sealing	ADE	Deck	LF	40
521	Concrete Protective Coating	BME	Deck	SF	40
	Deck Joint Elements				
300	Strip Seal Deck Joint	BME	Deck	LF	42
815	Plow Fingers	ADE	Deck	Each	44
301	Poured Seal Joint	BME	Deck	LF	45
302	Compression Deck Joint	BME	Deck	LF	47
303	Modular Deck Joint	BME	Deck	LF	49
304	Open Deck Joint	BME	Deck	LF	51
305	Assembly Deck Joint	BME	Deck	LF	53
816	Approach Relief Joint	ADE	Deck	LF	55
	Bridge Railing Elements				
330	Metal Bridge Railing	NBE	Deck	LF	58
331	Reinforced Concrete Bridge Railing	NBE	Deck	LF	60
332	Timber Bridge Railing	NBE	Deck	LF	62
333	Other Material Bridge Railing	NBE	Deck	LF	64
334	Masonry Bridge Railing	NBE	Deck	LF	66
	Bridge Approach Roadway Elements				
321	Concrete Approach Slab	BME	Deck	SF	68
822	Bituminous Approach Roadway	ADE	Deck	Each	70
823	Gravel Approach Roadway	ADE	Deck	Each	70
	Steel Superstructure Elements				
102	Steel Box Girder	NBE	Superstructure	LF	72
107	Steel Girder or Beam	NBE	Superstructure	LF	72
113	Steel Stringer	NBE	Superstructure	LF	72
120	Steel Truss	NBE	Superstructure	LF	72
141	Steel Arch	NBE	Superstructure	LF	72
152	Steel Floorbeam	NBE	Superstructure	LF	72
162	Steel Gusset Plate	NBE	Superstructure	Each	72
	Steel Substructure Elements				
202	Steel Column	NBE	Substructure	Each	75
207	Steel Column Tower (Trestle)	NBE	Substructure	LF	75
219	Steel Abutment	NBE	Substructure	LF	75
225	Steel or CIP Piling	NBE	Substructure	Each	75
231	Steel Pier/Bearing Cap	NBE	Substructure	LF	75
	Steel Protective Coating				
515	Steel Protective Coating	BME	Miscellaneous	SF	78

MnDOT Structural Element List					
#	Element Description	Type	Component	Units	Page
	Reinforced Concrete Superstructure Elements				
105	Reinforced Concrete Box Girder	NBE	Superstructure	LF	82
110	Reinforced Concrete Girder or Beam	NBE	Superstructure	LF	82
116	Reinforced Concrete Stringer	NBE	Superstructure	LF	82
144	Reinforced Concrete Arch	NBE	Superstructure	LF	82
155	Reinforced Concrete Floorbeam	NBE	Superstructure	LF	82
	Reinforced Concrete Substructure Elements				
205	Reinforced Concrete Column	NBE	Substructure	Each	85
210	Reinforced Concrete Pier Wall	NBE	Substructure	LF	85
215	Reinforced Concrete Abutment	NBE	Substructure	LF	85
220	Reinforced Concrete Footing	NBE	Substructure	LF	85
227	Reinforced Concrete Piling	NBE	Substructure	Each	85
234	Reinforced Concrete Pier/Bearing Cap	NBE	Substructure	LF	85
	Prestressed Concrete Superstructure Elements				
104	Prestressed Concrete Box Girder	NBE	Superstructure	LF	88
109	Prestressed Concrete Girder or Beam	NBE	Superstructure	LF	88
115	Prestressed Concrete Stringer	NBE	Superstructure	LF	88
154	Prestressed Concrete Floorbeam	NBE	Superstructure	LF	88
	Prestressed Concrete Substructure Elements				
204	Prestressed Concrete Column	NBE	Substructure	Each	91
226	Prestressed Concrete Piling	NBE	Substructure	Each	91
233	Prestressed Concrete Pier/Bearing Cap	NBE	Substructure	LF	91
	Timber Superstructure Elements				
111	Timber Girder or Beam	NBE	Superstructure	LF	93
117	Timber Stringer	NBE	Superstructure	LF	93
135	Timber Truss	NBE	Superstructure	LF	93
146	Timber Arch	NBE	Superstructure	LF	93
156	Timber Floorbeam	NBE	Superstructure	LF	93
	Timber Substructure Elements				
206	Timber Column	NBE	Substructure	Each	96
208	Timber Column Tower (Trestle)	NBE	Substructure	LF	96
216	Timber Abutment	NBE	Substructure	LF	96
228	Timber Piling	NBE	Substructure	Each	96
235	Timber Pier/Bearing Cap	NBE	Substructure	LF	96
	Masonry Superstructure & Substructure Elements				
145	Masonry Arch	NBE	Superstructure	LF	99
213	Masonry Pier Wall	NBE	Substructure	LF	99
217	Masonry Abutment	NBE	Substructure	LF	99
	Bearings & Special Feature Elements				
310	Elastomeric Expansion Bearing	NBE	Superstructure	Each	105
311	Expansion Bearing	NBE	Superstructure	Each	108
313	Fixed Bearing	NBE	Superstructure	Each	111
314	Pot Bearing	NBE	Superstructure	Each	113
315	Disk Bearing	NBE	Superstructure	Each	113
161	Pin & Hanger Assembly or Pinned Connection	NBE	Superstructure	Each	116
850	Steel Hinge Assembly	ADE	Superstructure	Each	119
851	Concrete Hinge Assembly	ADE	Superstructure	Each	119
147	Steel Main Cable	NBE	Superstructure	LF	125
148	Steel Secondary Cable	NBE	Superstructure	Each	125
855	Secondary Members (Superstructure)	ADE	Superstructure	Each	128
856	Secondary Members (Substructure)	ADE	Substructure	Each	128
861	Non-Integral Retaining Wall	ADE	Substructure	Each	132
862	Tiled Surface	ADE	Miscellaneous	SF	133
863	Decorative Facade	ADE	Superstructure	LF	134

MnDOT Structural Element List					
#	**Element Description**	**Type**	**Component**	**Units**	**Page**
	Culvert Elements				
240	Steel Culvert	NBE	Culvert	LF	138
241	Concrete Culvert	NBE	Culvert	LF	141
242	Timber Culvert	NBE	Culvert	LF	145
243	Other Material Culvert	NBE	Culvert	LF	147
244	Masonry Culvert	NBE	Culvert	LF	149
870	Culvert End Treatment	ADE	Culvert	Each	151
871	Roadway Over Culvert	ADE	Culvert	Each	153
	Defect Elements				
880	Impact Damage	ADE	Miscellaneous	Each	155
881	Steel Section Loss	ADE	Miscellaneous	Each	157
882	Steel Cracking	ADE	Miscellaneous	Each	159
883	Concrete Shear Cracking	ADE	Miscellaneous	Each	161
884	Substructure Settlement & Movement	ADE	Miscellaneous	Each	162
885	Scour	ADE	Miscellaneous	Each	164
	Other Elements				
890	Load Posting and Vertical Clearance Signing	ADE	Miscellaneous	Each	166
891	Other Bridge Signing	ADE	Miscellaneous	Each	167
892	Slopes & Slope Protection	ADE	Miscellaneous	Each	168
893	Guardrail	ADE	Miscellaneous	Each	169
894	Deck & Approach Drainage	ADE	Miscellaneous	Each	170
895	Sidewalk, Curb, & Median	ADE	Miscellaneous	Each	171
899	Miscellaneous Items	ADE	Miscellaneous	Each	171
900	Protected Species	ADE	Miscellaneous	Each	172

B.3.2 CRITICAL FINDINGS AND SAFETY HAZARDS

B.3.2.1 Critical Findings or Safety Hazards (Element #800)

#800: Critical Findings or Safety Hazards (Each)

This element indicates if a critical structural deficiency or a serious safety hazard is present. *Note: This element must be rated for all structures on the MnDOT bridge inventory (vehicular bridges, culverts, railroad bridges, and pedestrian bridges).*

A critical finding is any structural condition that, if not promptly corrected, could result in collapse (or partial failure) of a bridge or culvert. This is not limited to findings observed during a scheduled inspection, and can include traffic impact damage or flood damage. It may be necessary to restrict traffic until further evaluation can be made or until the situation is corrected. A critical finding should be thoroughly documented, and the Engineer (and Bridge Owner) must be notified immediately. Critical findings must also be reported to the MnDOT Bridge Office (a report must be entered and submitted in SIMS). Refer to the reporting procedures outlined in Section A.6.2 of the Minnesota Bridge and Structure Inspection Program Manual (BSIPM). *Note: A critical structural deficiency should correlate with an NBI condition rating of 2 (critical condition) for the deck, superstructure, substructure, channel, or culvert.*

A serious safety hazard refers to a non-structural condition that poses a significant safety hazard and must be addressed immediately. Examples include severely damaged railings or guardrails, or loose concrete above traffic or a pedestrian walkway. Serious safety hazards should be immediately reported to the Inspection Program Administrator and Bridge Owner, but do not need to be reported to the MnDOT Bridge Office (a separate report in SIMS is not required).

If a critical finding (or serious safety hazard) is present on a bridge or culvert, refer to the reporting procedures outlined in Section A.6.2 of the Minnesota Bridge and Structure Inspection Program Manual (BSIPM).

Defect or Item	Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Critical Finding	None	* Previously reported critical finding has been addressed.	NA	A critical finding is present.
Serious Safety Hazard	None	NA	A serious safety hazard is present.	NA

*After a critical finding has been addressed, the condition state rating should be changed from condition state 4 to condition state 2. The element notes should briefly describe the critical finding, note when it occurred, and explain how it was resolved.

B.3.3 DECK AND SLAB ELEMENTS

B.3.3.1 Rating Procedures for Decks and Slabs

A typical deck or slab will be rated using two structural elements. The underside is rated using one of the deck or slab elements, and the top is rated using Element #510 (Wearing Surface).

MnDOT uses 11 deck and slab elements. The square feet (SF) quantity should include the full width of the deck (out-to-out dimension) over the length of the bridge. If segments of a bridge deck are comprised of different material types, more than one deck (or slab) element should be used. If the roadway and sidewalk decks are comprised of different materials, they should be rated under separate deck (or slab) elements.

The SF quantities may be broken up into multiple conditions states. In most situations, the deck (or slab) element rating will be based upon the underside condition. In this manual, the condition rating descriptions for deck and slab elements are divided into four material groups:

- **Concrete Decks & Slabs** (Elements #12, #16 and #38)
- **Prestressed Concrete Decks & Slabs** (Elements #13, #15, and #805)
- **Timber Decks & Slabs** (Elements #31 and #54)
- **Steel Decks** (Elements #28, #29, and #30)

Most bridge decks in Minnesota are reinforced concrete. Virtually all concrete bridge decks constructed in Minnesota since 1980 have epoxy coated reinforcement; however, decks designed prior to 1986 often had epoxy coated reinforcement on the top mat only (uncoated reinforcement was used on the lower mat). These decks tend to have increased deterioration (rust staining and delamination) on the underside.

Element #510 (Wearing Surface) is used to rate the top surface on bridge decks or slabs – this element includes any wearing surface type or material. The wearing surface type, depth, and year of installation are displayed on the Minnesota Structure Inventory Report. The inspector should note any changes in the type or depth of the wearing surface. Any significant increase in dead load will require a new load rating. On decks with bituminous or gravel wearing surfaces, it is common for the wearing surface depth to increase over the years.

- On roadway bridges, the SF wearing surface quantity includes only the roadway surface area (curb to curb). Sidewalks, curbs, and raised medians are excluded.
- On pedestrian bridges, the SF wearing surface quantity includes the entire top deck surface area (curb-to-curb or rail-to-rail).
- For bridge decks that carry only rail traffic, Element #510 does not have to be rated. There is no need for a roadway agency to inspect the top of the deck on an active railroad. An appropriate deck element should be selected and rated (based upon the underside condition). The inspection report notes should indicate if the railroad is active and how many tracks are present.
- Element #510 does not need to be rated for bare timber decks (such as a timber plank deck without wearing planks), or bare steel decks (such as an open grid steel deck).

Element #810 (Concrete Wearing Surface – Cracking & Sealing) must be rated for all MnDOT bridges with a concrete wearing surface. This element is optional for other agencies. It tracks the total length of cracks in the deck wearing surface and indicates if they are sealed.

Element #521 (Concrete Protective Coating) is intended only for concrete bridge decks that have been “flood sealed” with a waterproof sealant.

B.3.3.2 Reinforced Concrete Decks & Slabs (Elements #12, #16 and #38)

<table>
<tr><th colspan="5">Reinforced Concrete Deck & Slab Elements</th></tr>
<tr><th colspan="3">#12: Reinforced Concrete Deck (SF)
#16: Reinforced Concrete Top Flange (SF)</th><th colspan="2">#38: Reinforced Concrete Slab (SF)</th></tr>
<tr><td colspan="5">These elements describe the underside condition of reinforced concrete decks or slabs. The deck overhangs and vertical fascia edges should also be considered in this rating. The top surface of the deck or slab is rated using Element #510 (Wearing Surface).
Element #16 (Reinforced Concrete Top Flange) refers to the upper horizontal “flange” of box girders, cast-in-place concrete T-girders, or precast concrete channel beams.
If shear cracking is present on reinforced concrete slabs, Element #883 (Shear Cracking) must be added and rated.</td></tr>
<tr><th rowspan="3">Item or Defect</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Structural Review, Repairs, or Underpinning</td><td>No deck repairs present.</td><td>Repaired area that is sound.</td><td>Repaired area that is unsound or distressed. Structural underpinning present.</td><td>Immediate repairs or structural review required.
Full-depth failures present or imminent.</td></tr>
<tr><td>Delamination, Spall, or Exposed Reinforcement</td><td>None</td><td>Delamination (not yet loose). Spall 1” or less deep <u>and</u> 6” or less in diameter.</td><td>Loose delamination. Spall more than 1” deep <u>or</u> more than 6” diameter. Exposed rebar with corrosion or section loss.</td><td>Loose delamination (safety hazard). Spalling greater than 3” deep.
Rebar has severe section loss.</td></tr>
<tr><td>Efflorescence (Leaching)</td><td>None</td><td>Light leaching (little or no build-up).</td><td>Heavy leaching (significant build-up or stalactites).</td><td>Severe leaching (deck failure imminent).</td></tr>
<tr><td>Water/Salt Saturation, or Rust Staining</td><td>None</td><td>Water saturation.
Minor rust stains (rebar chairs).</td><td>Significant water/salt saturation.
Rust stains indicating rebar corrosion.</td><td>Severe salt/water saturation (deck failure imminent).</td></tr>
<tr><td>Cracking</td><td>Minor cracks.</td><td>Moderate cracks or moderate density map cracking.</td><td>Wide cracks or heavy density map cracking.</td><td>Severe cracks or fractures (deck failure imminent).</td></tr>
<tr><td>Stay-in-Place Steel Forms</td><td>No corrosion</td><td>Surface corrosion.
Minor sagging.</td><td>Flaking rust or through corrosion. Significant bulging or sagging.</td><td>Steel forms loose (safety hazard).</td></tr>
<tr><td colspan="5">When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.012" can be considered “minor”, cracks from 0.012" to 0.05" wide can be considered “moderate”, and cracks wider than 0.05" can be considered “wide”.
Transverse or longitudinal cracks on the underside of concrete decks (or slabs) are typically documented as a linear feet (LF) quantity. When determining condition states for square feet (SF) deck elements, the LF crack quantity should be multiplied by the estimated width of the affected concrete adjacent to the crack (a minimum crack width of 0.1 ft. should be assumed). Example, on a concrete deck with 200 LF of light transverse leaching cracks, the 200 LF crack quantity is multiplied by 0.1 ft., and 20 SF of the deck element is rated condition state 2.
Map cracking on the underside of a concrete deck is typically documented as a SF quantity, which would correlate directly with SF deck element condition ratings.</td></tr>
</table>

Reinforced Concrete Deck & Slab Elements	
Condition Rating Examples (Reinforced Concrete Decks & Slabs)	
 **Condition State 2** **Transverse crack on the underside of a concrete deck with light leaching (efflorescence)**	 **Condition State 2** **Diagonal crack on the underside of a concrete deck with light leaching (efflorescence)**
 **Condition State 3** **Heavy density map cracking with leaching) on the underside of a concrete deck)**	 **Condition State 3** **Leaching, rust stains, and delamination on the underside of a deck (not over traffic)**

Reinforced Concrete Deck & Slab Elements

Condition Rating Examples (Reinforced Concrete Decks & Slabs)

Condition State 3
Spalling (deeper than 1") with exposed and corroded rebar on the underside of a concrete deck

Condition State 3
Steel stay-in-place forms on underside of concrete deck rusted through

Condition State 4
Delaminated and loose concrete on the underside of a concrete deck (over traffic - safety hazard)

Condition State 4
Severe spalling (more than 3” deep) on the underside of a concrete deck

B.3.3.3 Prestressed Concrete Decks and Slabs (Elements #13, #15, and #805)

Prestressed Concrete Deck & Slab Elements

#13: Prestressed Concrete Deck (SF) **#15: Prestressed Concrete Top Flange (SF)**	**#805: Prestressed Concrete Slab (SF)**

These elements describe the underside condition of prestressed (or post-tensioned) concrete decks or slabs. The deck overhangs and vertical fascia edges should also be considered in this rating. The top surface of the deck or slab is rated using Element #510 (Wearing Surface).

- Element #15 (Prestressed Concrete Top Flange) refers to the upper horizontal "flange" of prestressed box girders or prestressed Bulb, Double, or Quad Tees.
- If shear cracking is present on prestressed concrete slabs, Element #883 (Shear Cracking) must be added and rated.

Defects	**Condition States**			
	1 **Good**	**2** **Fair**	**3** **Poor**	**4** **Severe**
Structural Review, Repairs, or Underpinning	No deck repairs present.	Repaired area that is sound.	Repaired area that is unsound or showing distress. Structural underpinning in good condition.	Immediate repairs or structural review required. Full-depth failures present or imminent.
Delamination, Spall, or Exposed Reinforcement	None	Delamination (not yet loose). Spalling 1" or less deep **and** 6" or less in diameter.	Loose delamination. Spalling greater than 1" deep **or** greater than 6" diameter. Exposed or corroded rebar.	Loose delamination (safety hazard). Spalling deeper than 3" or rebar with severe section loss.
Exposed Prestressing Strands	None	None	Exposed with corrosion or section loss (not severed).	Exposed with severe section loss (or severed).
Cracking	Minor cracks.	Moderate cracks or moderate density map cracking.	Wide cracks or heavy density map cracking.	Severe cracks or fractures (deck failure imminent).
Efflorescence (Leaching)	None	Light leaching (little or no build-up).	Heavy leaching (significant build-up or stalactites).	Severe leaching (deck failure imminent).
Water/Salt Saturation, and Rust Staining	None	Water saturation. Minor rust stains.	Significant water/salt saturation. Rust stains indicate rebar corrosion.	Severe salt/water saturation (deck failure imminent).

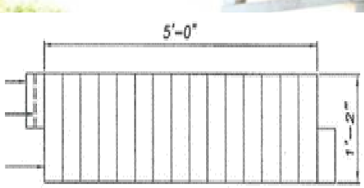
When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.004" can be considered "minor", cracks from 0.004" to 0.009" wide can be considered "moderate", and cracks wider than 0.009" can be considered "wide".

Transverse or longitudinal cracks on the underside of concrete decks (or slabs) are typically documented as a linear feet (LF) quantity. When determining condition states for square feet (SF) deck elements, the LF crack quantity should be multiplied by the estimated width of the affected concrete adjacent to the crack (a minimum crack width of 0.1 ft. should be assumed). Example, on a concrete deck with 200 LF of light transverse leaching cracks, the 200 LF crack quantity is multiplied by 0.1 ft., and 20 SF of the deck element is rated condition state 2.

Map cracking on the underside of a concrete deck is typically documented as a SF quantity, which would correlate directly with SF deck element condition ratings.

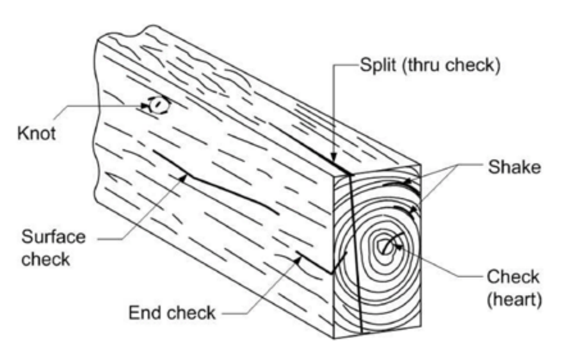
<table>
<tr><th colspan="2">Prestressed Concrete Deck & Slab Elements</th></tr>
<tr><th>#13: Prestressed Concrete Deck (SF)
#15: Prestressed Concrete Top Flange (SF</th><th>#805: Prestressed Concrete Slab (SF)</th></tr>
<tr><th colspan="2">Condition Rating Examples (Prestressed Concrete Decks & Slabs)</th></tr>
<tr><td>
Condition State 2
Light leaching along joint between prestressed voided slab panels</td><td>
Condition State 2
Minor spalling (no exposed steel) along the edge of a prestressed voided slab panel</td></tr>
<tr><td>
Condition State 3
Cracking with significant leaching on the underside of a prestressed voided slab panel</td><td>
Condition State 4
Loose delamination (over traffic) on the underside of prestressed voided slab panel</td></tr>
</table>

B.3.3.4 Timber Decks and Slabs (Elements #31 and #54)

Timber Deck & Slab Elements	
#31: Timber Deck (SF) **#54: Timber Slab (SF)**	
These elements describe the condition of timber decks (or slabs). This includes timber plank decks, glue-lam timber deck panels, and nail laminated timber decks or slabs. The rating will typically reflect the underside condition, but should also consider the top condition on bare timber decks or slabs. If a wearing surface (bituminous overlay, gravel, timber wearing planks, or other material) is present, Element #510 (Wearing Surface) must also be rated.	
	**Timber Plank Decks** Plank decks are comprised of transverse timber planks (wide dimension in the horizontal plane). The planks are typically clipped to the top flange of steel beams, and nailed (or bolted) to timber beams. Timber plank decks are found primarily on low-volume roads or pedestrian bridges. Timber plank decks are typically bare (no overlay), but longitudinal wearing planks are sometimes present along the wheel tracks.
	**Nail-Laminated Timber Decks** Nailed-laminated timber decks consist of transverse timbers (wide dimension in the vertical position) that are nailed to the adjacent timbers. These are often installed in pre-nailed sections, with overlap joints between adjacent sections. Nailed-laminated decks may have a bituminous overlay, longitudinal timber wearing planks, or a gravel wearing surface.
	**Glulam Timber Decks** Glulam decks are similar to nail-laminated decks, except the individual timbers are bonded together with waterproof structural adhesive. The panels are typically around 4 ft. wide, and are installed transversely across the deck. Glulam timber decks are often used on temporary bridges (with a bituminous overlay). When used in new construction, they may have timber wearing planks.
  **Timber Slab Panel Cross Section**	**Timber Slabs** Timber slabs are comprised of adjacent timber planks set vertically – the timbers run longitudinally, and serve as the primary superstructure element (as well as the deck). Most timber slabs are nail-laminated, newer timber slabs may be glulam or stress-laminated. Timber slabs are typically comprised of prefabricated panels – there will often be a transverse beam running below the slab at the center of each span – these help to tie the panels together and distribute load and deflection across the width of the slab. Transverse beams below timber slabs should be rated using Element #156 (Timber Floorbeam). Timber slabs often have a bituminous or gravel wearing surface.

Timber Deck & Slab Elements				
#31: Timber Deck (SF) #54: Timber Slab (SF)				
Defects	**Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** structural review has determined that the defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **or** existing repair is deteriorated.	Immediate repairs are required (failures present or imminent).
Section Loss	None	Less than 10% of the deck or slab thickness.	10% - 40% of the deck or slab thickness.	40% of the deck or slab thickness.
Decay	No evidence of decay.	Staining. No crushing or sagging.	Minor crushing or sagging.	Significant crushing or sagging.
Fire Damage	None	Soot or superficial charring.	Significant charring.	Severe charring.
Delamination (Glulam)	None	Minor	Significant	Severe
Weathering or Abrasion	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% - 40% of the member thickness.	Section loss more than 40% of the member thickness.
Connection or Misalignment	Components are properly aligned and securely connected.	Loose fasteners or slight misalignment of components.	Fasteners broken or missing. Components loose or misaligned.	Components severely misaligned or missing.
Shakes, Checks, or Splits	Less than 5% of the member thickness.	5% to 50% of the member thickness and not in a tension zone.	More than 50% of the thickness (or more than 5% of the member thickness in a tension zone).	Split through entire member (or more than 25% of the member thickness in a tension zone).

- **Shake:** A separation along the grain (between the growth rings). Usually forms within a standing tree or during felling.
- **Check:** A separation perpendicular to the grain (across the growth rings). Usually results from stress due to drying shrinkage.
- **Split (or Thru Check):** A check extending further through the timber member due to tearing apart of wood cells.



Timber Deck & Slab Elements	
#31: Timber Deck (SF) **#54: Timber Slab (SF)**	
Condition Rating Examples (Timber Decks & Slabs)	
 **Condition State 2** **Weathering on timber plank deck**	 **Condition State 2** **Staining on the underside of a timber slab**
 **Condition State 3** **Fire damage (significant charring) on a timber slab**	 **Condition State 4** **Hole in a timber plank deck**

B.3.3.5 Steel Decks (Elements #28, #29, and #30)

<table>
<tr><th colspan="5">Steel Grid Deck Elements</th></tr>
<tr><th colspan="5">#28:Steel Grid Deck – Open (SF)
#29: Steel Grid Deck – Concrete Filled (SF)</th></tr>
<tr><td colspan="5">These elements describe the condition of steel grid decks. Note: The rating should consider any deck support components that are not addressed by other structural elements.</td></tr>
<tr><td colspan="3"></td><td colspan="2">Open Grid Steel Decks (Element #28)
Open grid steel grid panels may be welded, riveted, or bolted.
Note: Element 510 (Wearing Surface) does not need to be rated for open grid decks.</td></tr>
<tr><td colspan="3"></td><td colspan="2">Concrete-Filled Steel Grid Decks (Element #29)
Use this element for steel grid decks that are fully or partially filled with concrete.
Note: Element 510 (Wearing Surface) would only apply to the filled section of the deck.</td></tr>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Structural Review or Repairs</td><td>No deck repairs present.</td><td>Repaired area that is sound.</td><td>Repaired area that is showing distress.

Repairs may be recommended (structural review is not required)
<u>or</u>
structural review has determined that the strength of the deck has not been impacted.</td><td>Immediate repairs or structural review are required.

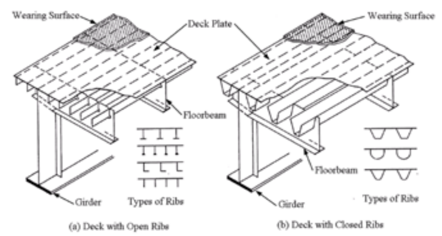
Full-depth failures may be present or imminent
<u>or</u>
structural review has determined that the defects impact the strength of the deck.</td></tr>
<tr><td>Corrosion (Steel)</td><td>None</td><td>Surface corrosion (freckled rust).</td><td>Section loss or pack rust is present.</td><td>Severe section loss (holes rusted through).</td></tr>
<tr><td>Cracking (Steel)</td><td>None</td><td>Crack has self-arrested or has been arrested or repaired.</td><td>Crack that has not been arrested, but is unlikely to propagate.</td><td>Crack through deck panel (or support beam) that warrants immediate repair.</td></tr>
<tr><td>Connection or Misalignment</td><td>Deck panels are properly aligned and securely connected.</td><td>Loose fasteners or slightly misaligned deck panels.</td><td>Broken or missing fasteners.
Deck panels loose or misaligned.</td><td>Steel grid deck panels severely misaligned or missing.</td></tr>
<tr><td>Impact Damage or Distortion (Steel)</td><td>Superficial damage (minor scrapes).</td><td>Deck components slightly bent, or bowed.</td><td>Deck components bent, bowed, loosened, or misaligned.</td><td>Severely bent, bowed, torn loose or missing.</td></tr>
</table>

Other Steel Decks

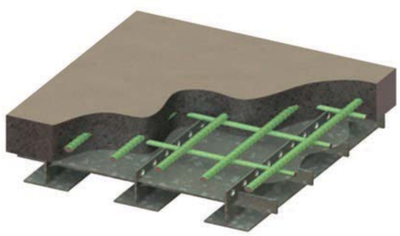
#30: Other Steel Deck (SF)

This element should be used to describe the underside condition of corrugated steel decks, orthotropic steel plate decks, exodermic decks, steel ballast plate decks, or any type of steel deck that cannot be adequately described using elements #28 or #29.
The top surface will typically be rated using Element #510 (Wearing Surface).
Note: The rating should take into consideration any deck support components that are not addressed by other structural elements.

Corrugated Steel Decks
Corrugated decks are comprised of corrugated steel forms (with concrete or bituminous fill). The steel forms provide the primary structural support for the completed deck.



Orthotropic Steel Plate Decks
An orthotropic deck consists of a steel plate that has been stiffened by closely spaced ribs. An orthotropic deck typically acts integrally with the superstructure.
None are known to currently exist in Minnesota.



Exodermic Decks
An Exodermic deck is a recently developed composite design that combines a steel grid deck with a reinforced concrete deck (advantages include light weight and rapid construction).

Steel Ballast Plate Decks
These decks are common on railroad bridges in Minnesota – they typically consist of a solid steel plate, covered with a waterproof membrane, rock ballast, and railroad ties and tracks.
Steel ballast plates are typically connected to the top flange of the supporting beams with small clips - these clips sometimes have a small chain to prevent them from falling onto traffic if they come loose.

For decks carrying a railroad tracks only, Element #510 (Wearing Surface) does not need to be rated. The inspector should note if the railroad tracks are active or if the tracks have been removed.
Railroad bridges converted to trail use may have a concrete, bituminous, or gravel wearing surface – Element #510 (Wearing Surface) should be rated.

Other Steel Decks				
#30: Other Steel Deck (SF)				
Defects	**Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review or Repairs	No deck repairs present.	Repaired area that is sound.	Repaired area that is showing distress. Repairs may be recommended (structural review is not required) **<u>or</u>** structural review has determined that the strength of the deck has not been impacted.	Immediate repairs or structural review are required. Full-depth failures may be present or imminent **<u>or</u>** structural review has determined that the defects impact the strength of the deck.
Corrosion (Steel)	None	Surface corrosion (freckled rust).	Section loss or pack rust is present.	Severe section loss (holes rusted through).
Cracking (Steel)	None	Crack has self-arrested or has been arrested or repaired.	Crack that has not been arrested, but is unlikely to propagate.	Crack through deck panel (or support beam) that warrants immediate repair.
Connection or Misalignment	Primary deck components are properly aligned and securely connected.	Some loose fasteners, but primary deck components are still secure.	Some fasteners broken or missing. Primary deck components may be loose or misaligned.	Primary deck components may be severely misaligned or missing.
Impact Damage or Distortion (Steel)	Superficial damage (minor scrapes).	Deck components slightly bent, bowed, or misaligned.	Deck components significantly bent, bowed, or misaligned.	Deck components severely damaged (bent, bowed, or missing).

Condition Rating Examples (Other Steel Decks)

Condition State 2
Paint failure and surface corrosion on the underside of a wrought iron ballast plate deck

Condition State 4
Hole rusted through a steel ballast plate deck (crack extending out of rust hole)

B.3.4 WEARING SURFACE ELEMENTS

#510: Deck Wearing Surface (SF)				
For bridges with a deck or slab element, this element is typically used to rate the condition of the top (wearing) surface. This table includes specific condition rating criteria for low slump concrete, plain concrete (bare decks), bituminous, epoxy chip seal, bituminous, timber plank, or gravel wearing surfaces. For other deck wearing surfaces, use the "General" condition guidelines. This element does not need to be rated for bare timber decks, open grid steel decks, or decks carrying only rail traffic.				
General Guidelines (All Wearing Surface Types)				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
General Condition	Little or no deterioration.	Minor to moderate deterioration (no repairs needed).	Significant deterioration (repairs recommended).	Severe deterioration (repairs required).

B.3.4.1 Deck Wearing Surface (Element #510)

#510: Deck Wearing Surface – Low Slump Overlay (SF)				
Low slump concrete overlays are the most common wearing surface on concrete bridge decks in Minnesota (approximately 66% of the concrete bridge deck area). Low slump overlays are intended to provide a high-density surface to protect the underlying deck from chlorides. This is typically a 2" layer of concrete with a high cement content, small course aggregate, and a ¾" slump (such as MnDOT mix #3U17A). Low slump concrete is mixed at the bridge site, and is bonded to the deck with a grout layer.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Delamination or Spalling	None	Spalls less than ½" deep. No delamination.	Spalls from ½" to 1½" deep. Delamination.	Spalls 1½" deep or greater. Loose overlay sections.
Scale, Wear, or Abrasion	Less than ¼" deep.	From ¼" up to ½" deep.	From ½" up to 1½" deep.	1½" deep or greater.
Patching or Repairs	None	Permanent patches (concrete or other high quality repair) that remain sound.	Bituminous or other temporary patches. Deteriorated repairs.	Repair patches that have failed.
Cracking	Unsealed cracks less than 0.012" wide.	Unsealed cracks from 0.012" wide up to 0.05" wide. Sealed cracks.	Unsealed cracks from 0.05" wide up to 1/8" wide.	Unsealed cracks1/8"or wider.
Map Cracking	Minor map cracking.	Moderate density map cracking.	Heavy density map cracking.	Severe map cracking.
• Transverse or longitudinal cracking in a low slump concrete overlay is typically documented as a linear feet (LF) quantity. When determining condition ratings for Element #510, cracks must be converted to a square feet (SF) quantity by multiplying by the estimated width of the affected concrete adjacent to the crack (a minimum crack width of 0.1 ft. should be assumed). Example, on a low slump concrete overlay with 1,000 LF of unsealed transverse cracks (with a typical crack width 1/16"), the 1,000 LF crack quantity is multiplied by 0.1 ft.), and 100 SF of Element #510 would be rated as condition state 3. • Map cracking on a low slump overlay is typically documented as a square feet (SF) quantity, so no conversion is required when determining the condition ratings.				

#510: Deck Wearing Surface – Low Slump Overlay (SF)

Condition Rating Examples (Low Slump Concrete Overlay)

Condition State 2
Sound concrete patches on a low slump overlay

Condition State 2
Scaling on low slump concrete overlay

Condition State 3
Delamination on a low slump concrete overlay

Condition State 3
Bituminous patch on a low slump concrete overlay

Condition State 3
Unsealed crack in a low slump overlay ($^1/_8$” wide)

Condition State 4
Failed patch on low slump concrete overlay

#510: Deck Wearing Surface – Plain Concrete (SF)				
This element should be used for concrete wearing surfaces that are not low slump concrete. This may include concrete decks without an overlay, monolithic decks that include a wearing surface layer (poured with the underlying deck), or plain concrete wearing surfaces added to the deck. Bridge decks (or slabs) are constructed without a low slump overlay when there are construction time constraints or on bridges with a low traffic volume. Concrete bridge decks (or slabs) constructed prior to the 1970's are often bare.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Delamination or Spalling	None	Spalling less than ½" deep. No delamination.	From ½" up to 2" deep (no exposed reinforcement). Delamination.	2" deep or greater **or** with exposed reinforcement
Scale, Wear, or Abrasion	Less than ¼" deep.	From ¼" up to ½" deep.	From ½" up to 2" deep (no exposed reinforcement).	2" deep or greater **or** with exposed reinforcement
Patching or Repairs	None	Concrete (or other high quality) patches that. remain sound	Temporary patches (such as bituminous) **or** Deteriorated repairs.	Repair patches that have failed.
Cracking	Unsealed cracks less than 0.012" wide.	Unsealed cracks from 0.012" wide up to 0.05" wide. Sealed cracks.	Unsealed cracks from 0.05" wide up to 1/8" wide.	Unsealed cracks 1/8" or wider.
Map Cracking or Rust Staining	Minor map cracking.	Light to moderate map cracking (no rust staining).	Heavy map cracking or rust staining (corrosion of reinforcement).	Severe concrete deterioration.

- Transverse or longitudinal cracking in a concrete wearing surface is typically documented as a linear feet (LF) quantity. When determining condition ratings for Element #510, cracks must be converted to a square feet (SF) quantity by multiplying by the estimated width of the affected concrete adjacent to the crack (a minimum crack width of 0.1 ft. should be assumed). Example, on a concrete wearing surface with 1,000 LF of unsealed transverse cracks (with a typical crack width 1/16"), the 1,000 LF crack quantity is multiplied by 0.1 ft.), and 100 SF of Element #510 would be rated as condition state 3.
- Map cracking on a concrete wearing surface is typically documented as a square feet (SF) quantity, so no conversion is required when determining the condition ratings.

#510: Deck Wearing Surface – Plain Concrete (SF)	
Condition Rating Examples (Plain Concrete Wearing Surface)	
 **Condition State 2** **Sound concrete patches on a bare concrete deck**	 **Condition State 3** **Bituminous patch on a bare concrete deck**
 **Condition State 3** **Crack in a concrete wearing surface (width between $^{1}/_{16}$” and $^{1}/_{4}$”)**	 **Condition State 3** **Map cracked area with rust staining on a bare concrete deck**
 **Condition State 3** **Deteriorated patch on a bare concrete deck**	 **Condition State 4** **Spalling 2” or deeper on a bare concrete deck**

#510: Deck Wearing Surface – Bituminous (SF)

Bituminous wearing surfaces are mainly found on older (pre-1970's) concrete bridge decks, laminated timber bridge decks, or timber slab span bridges.

Item or Defect	Structural Element Condition States			
	1 Good	**2 Fair**	**3 Poor**	**4 Severe**
Potholes	No potholes.		Less than 2" deep (underlying deck is not exposed).	2" or deeper (or underlying deck is exposed).
Wear or Rutting	Minor wearing, no rutting.	Moderate wearing or minor rutting.	Significant wearing or rutting.	Severe wearing or rutting.
Patching or Repairs	None	Patches that remain sound.	Deteriorated patches or repairs.	Repair patches that have failed.
Cracking	Minor cracks	Moderate unsealed cracks. Sealed cracks.	Significant unsealed cracks.	Severe unsealed cracks.

Condition Rating Examples (Bituminous Wearing Surface)

Condition State 2
Sealed crack on a bituminous overlay

Condition State 2
Sound patches on a bituminous overlay

Condition State 3
Significant cracking on a bituminous overlay

Condition State 4
Pothole (2" deep) in bituminous overlay

#510: Deck Wearing Surface – Epoxy Chip Seal Overlay (SF)

Minnesota starting using epoxy chip seal overlays on concrete decks around 2012. While they have only been used on a handful of bridge decks, many of those are large major river crossings. Epoxy chip seal overlays are comprised of a thin epoxy layer covered with small course aggregate. They have been used on new and existing concrete decks, they have been used on bare decks as well as decks that already had a low slump overlay.

Item or Defect	Structural Element Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
Delamination, Bubbling, or Adhesion Failure	No delamination or bubbling of the epoxy layer.		Delamination or bubbling of epoxy layer.	Epoxy layer loose or missing.
Scale, Wear, or Abrasion	None	Minor to moderate aggregate loss or polishing of surface (no significant friction loss).	Significant loss of aggregate or polishing of surface (noticeable loss of friction).	Severe wear – loss of friction could pose a hazard in adverse weather conditions.
Patching or Repairs	None	Permanent patches that remain sound.	Temporary patches **or** deteriorated repairs.	Repair patches that have failed.
Cracking	None	Minor to moderate. Sealed cracks.	Significant	Severe

Condition Rating Examples (Chip Seal Overlay)

Condition State 2
Repair patch on a chip seal overlay

Condition State 3
Significant cracking on a chip seal overlay

Condition State 4
Chip seal overlay peeling off (loose)

Condition State 4
Chip seal overlay missing

#510: Deck Wearing Surface – Timber Planks (SF)

The wearing surface element is not used for bare timber decks. This element is intended only for timber decks that have an additional layer of timber wearing planks (typically orientated parallel to traffic). Wearing planks may be present over the entire deck, or only along the wheel tracks.

Item or Defect	Structural Element Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
Connections	Timber wearing planks are properly aligned and solidly attached.		Timber planks are slightly loose or misaligned.	Timber planks are loose or missing.
Timber Deterioration	Minor weathering or splitting.	Moderate weathering or splitting. No significant decay.	Significant weathering or splitting. Decay without crushing or sagging.	Severe splitting. Significant decay (severe section loss, crushing, or sagging).

Condition Rating Examples (Timber Wearing Planks)

Condition State 1
Minor weathering on timber wearing planks

Condition State 2
Moderate weathering on a timber wearing plank

Condition State 3
Significant weathering/decay on timber wearing planks

Condition State 4
Section of timber wearing plank missing

#510: Deck Wearing Surface – Gravel (SF)

A gravel (or dirt) wearing surface may be present on concrete or timber bridge decks. As gravel roads are periodically graded, the gravel depth on the bridge deck may vary. The inspector should attempt to determine the depth of gravel present on a bridge deck, as it may be a significant dead load on the bridge.

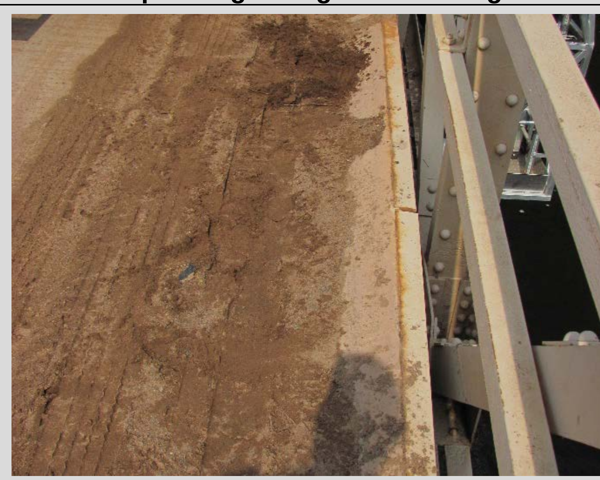
Item or Defect	Structural Element Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
General Deterioration	Gravel is evenly graded and flat.	Minor to moderate rutting or ponding.	Significant rutting or ponding.	Severe rutting.

Condition Rating Examples (Gravel Wearing Surface)

Condition State 1
Gravel evenly graded and smooth

Condition State 2
Moderate ponding on a gravel wearing surface

Condition State 3
Significant rutting on a gravel wearing surface



Condition State 3
Significant rutting on shoulder

B.3.4.2 Concrete Wearing Surface – Cracking and Sealing (Element #810)

#810: Concrete Wearing Surface – Cracking & Sealing (LF)

This element is intended to describe the quantity (and severity) of cracking on concrete wearing surfaces, approach slabs, sidewalks, or medians, and to identify if crack sealing is required. If the deck or approach slab has a bituminous or gravel wearing surface, there is no need to use this element. Cracking of the top surface will eventually result in chloride contamination of the underlying concrete deck or approach slab, and corrosion of the reinforcing steel – sealing these cracks can extend the service life of the deck.

Note: This element is required for MnDOT bridges with concrete deck wearing surfaces; it is optional for other agencies.

The inspector should first determine the total linear feet (LF) of sealed and unsealed cracks on the concrete wearing surface, concrete sidewalks, and concrete medians. This should include all transverse, longitudinal, diagonal, or random cracks that can be quantified in linear feet (LF). The cracks should then be rated using the following criteria.

Defect or Item	Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
Unsealed Cracks	Unsealed cracks less than 0.012” wide.	Unsealed cracks from 0.012” wide up to 0.05” wide.	Unsealed cracks from 0.05” wide up to 1/8” wide.	Unsealed cracks 1/8” or wider.
Sealed Cracks	NA	Crack is effectively sealed.	NA	NA

B.3.4.3 Concrete Protective Coating (Element #521)

#521: Concrete Protective Coating (SF)

This element is primarily intended for concrete bridge decks that have been flood sealed with High Molecular Weight Methacrylate (HMWM) sealants. It could also be used for decks coated with Silane or Siloxane water-proofers, or similar products. These coatings will generally be effective at sealing cracks for about 5-6 years. These coatings are difficult to see or inspect. The inspector should look for obvious unsealed cracks on the wearing surface or obvious leakage through cracks on the underside of the deck. **Note: This element does not apply to epoxy chip seal overlays – they should be rated using Element #510.**

Defect or Item	Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
Unsealed Cracks	Unsealed cracks less than 0.012” wide.	Unsealed cracks from 0.012” wide up to 0.05” wide.	Unsealed cracks from 0.05” wide up to 1/8” wide.	Unsealed cracks 1/8” or wider.

Transverse or longitudinal cracking in a concrete wearing surface is typically documented as a linear feet (LF) quantity. When determining condition ratings for Element #521, cracks must be converted to a square feet (SF) quantity by multiplying by the estimated width of the affected concrete adjacent to the crack (a minimum crack width of 0.1 ft. should be assumed). Example, on a flood sealed deck wearing surface with 100 LF of unsealed transverse cracks (with a typical crack width 1/16”), the 100 LF crack quantity is multiplied by 0.1 ft., and 10 SF of the Element #521 would be rated as condition state 3.

B.3.5 DECK JOINT ELEMENTS

Deck Joint Elements

MnDOT has eight structural elements to rate the condition of bridge deck joints:

- #300 – Strip Seal Deck Joint (LF)
- #815 – Plow Fingers (Each)
- #301 – Poured Deck Joint (LF)
- #302 – Compression Seal Deck Joint (LF)
- #303 – Modular Deck Joint (LF)
- #304 – Open Deck Joint (LF)
- #305 – Assembly Deck Joint (LF)
- #816 – Approach Relief Joint (LF)

Deck Joint Element Quantities

For most deck joints, the plan quantity (LF) will be entered as the element quantity. This will typically include the roadway portion of the joint, but may also include portions of the joint that extend through railings or under sidewalks and medians.

On bridge deck joints, steel cover plates are often present at the curbs, medians, sidewalks, and railings. These cover plates are a component of the deck joint, and should be rated as part of the deck joint element. If a sealed joint (such as a strip seal or modular joint) extends below a sidewalk or median, that section should be rated under the strip seal or modular joint element. If the seal does not extend below the sidewalk or median, that portion of the joint should be rated under a separate deck joint element (typically Element #305 – Assembly Joint).

Inspection of Deck Joints

Deck joints should be inspected for leakage, as well as for proper function. Deck joint leakage is a significant concern in Minnesota due to de-icing salt applied to roadways and sidewalks. Deck joint leakage that results in damage to the superstructure or substructure below the joint should result in a lowered condition rating, even if the joint is not designed or intended to be sealed.

Deck joints should be examined for skew, offset, or any evidence that the joint is restricted or is beyond the limits of expansion or contraction. Deck expansion joints that are closed tightly, offset vertically or horizontally, or have large gaps may indicate severe structural problems (such as substructure movement).

Deck Joint Measurements

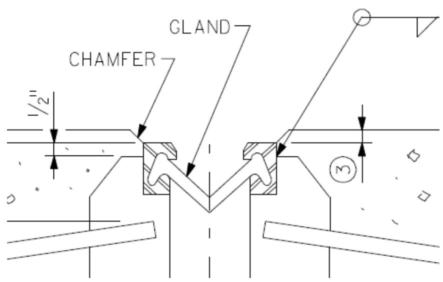
In order to confirm that deck expansion joints are properly functioning, periodic joint measurements are recommended. Joint measurements should be taken at the same location, in a consistent manner, and ideally under a wide range of temperatures.

A common place to take deck joint gap measurements is at the shoulder stripes. The gap between the inside vertical faces of the joint is typically measured. Measurements can also be taken at railing gaps or at sidewalk or curb cover plates. Recent scrape marks along the edges of cover plates are a good indication that the joint is expanding and contracting.

B.3.5.1 Strip Seal Deck Joint (Element #300)

#300: Strip Seal Deck Joint (LF)

This element applies to deck joints that utilize a single line “V” shaped neoprene gland, typically held in place by a steel extrusion.



Strip seal deck joints came into use in Minnesota around 1974, and are now the most common type of bridge deck expansion joint used in the state.

- Type 4 joints are designed to accommodate 4” of movement (they are typically installed with a 2” gap).
- Type 5 joints are designed to accommodate 5” of movement. They are often used on skewed joints.

The condition state language for Element #300 (Strip Seal Deck Joint) is configured with the intent that joints requiring replacement (or concrete/steel extrusion repairs) are rated as condition state 4, and that joints requiring gland repair or replacement are rated as condition state 3.

Item or Defect	Structural Element Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
General Joint Condition	Little or no deterioration.	Minor to moderate deterioration (no repairs needed).	Strip seal gland repair or replacement is required.	Joint reconstruction or concrete repair work is required.
Joint Function and Alignment	Joint is functioning as intended (movement is not restricted).		Slight restriction of joint movement.	Joint is restricted (not functioning as intended).
	Horizontal joint gap is within design limits.		Joint gap is at or near design limits.	Joint is closed to less than ½” or has opened beyond design limits.
	No vertical offset.	Vertical offset of ¼” or less.	Vertical offset of ½” or less.	Vertical offset greater than ½”.
Leakage	None	Minimal leakage (slight dripping).	Significant leakage.	NA
Strip Seal Gland	Securely anchored and properly positioned.	Strip seal gland is partially pulled out of the extrusion.	Strip seal gland is torn, punctured, or pulled out from the extrusion.	NA
Steel Extrusions, Anchorages, or Cover Plates	Minor surface corrosion or superficial scrapes.	Corrosion (or damage), that does not affect joint function.	NA	Damage or section loss that prevents proper joint function or presents a safety hazard.
Adjacent Deck or Header	Sound.	Deterioration that does not affect joint function.	NA	Significant deterioration that affects joint function.

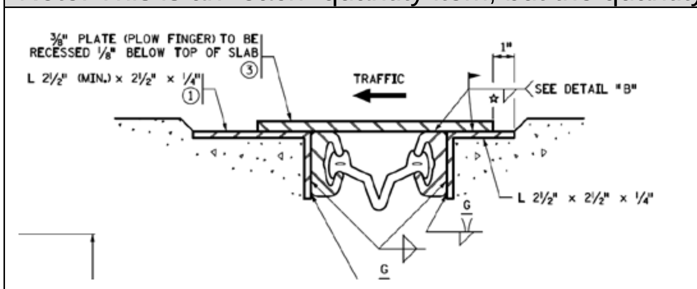
#300 : Strip Seal Deck Joint (LF)	
Condition Rating Examples (Strip Seal Deck Joints)	
 **Condition State 2** **Strip seal gland partially pulled out**	 **Condition State 3** **Hole in strip seal gland**
 **Condition State 4** **Strip seal deck joint closed to less than a ½” gap**	 **Condition State 4** **Joint open beyond design limits (5” gap) – the gland has pulled out of the steel extrusion**

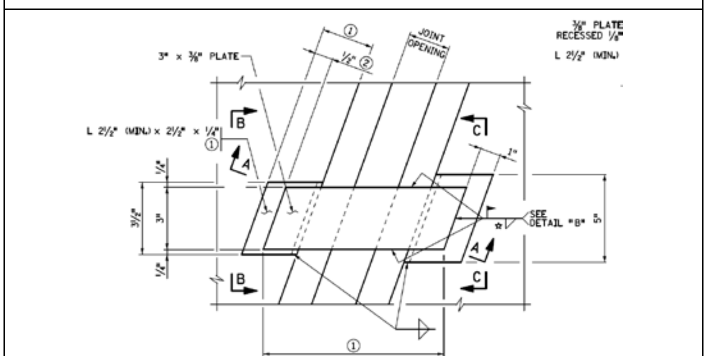
B.3.5.2 Plow Fingers (Element #815)

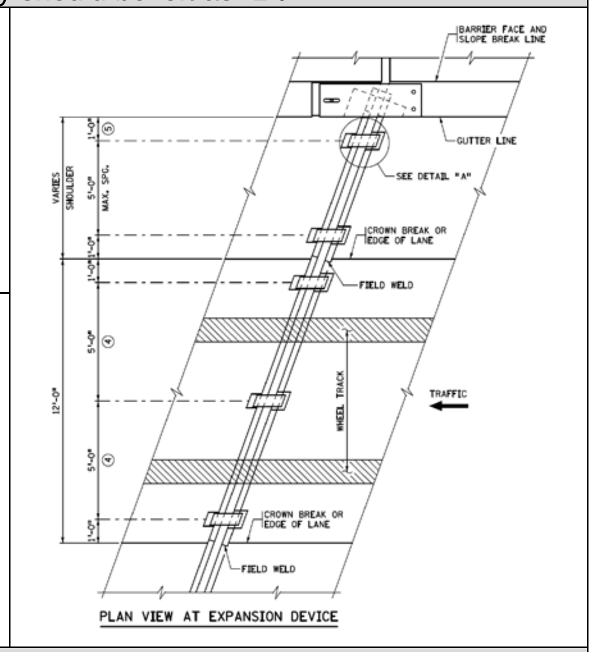
#815: Plow Fingers (1 Each)

Plow fingers are small steel plates welded to bridge deck expansion joints to prevent a snow plow blade from falling into the joint. They are typically installed on strip seal expansion joints that are skewed to an angle that approximates the angle of a snow plow (skews between 15° and 50°). The current design standard (MnDOT Standard Detail 5-397.628) is a 3/8" thick steel plate (3" wide – length varies) that is welded to one side of the joint and can slide freely on the other side. Plow fingers are spaced at 5 ft. intervals, with 3 plow fingers in each traffic lane (a typical MnDOT snowplow blade is 11 to 12 ft. wide).

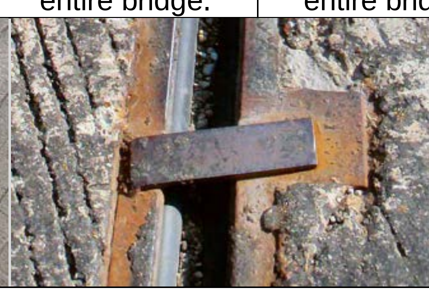
Note: This is an "each" quantity item, but the quantity should be left as "1".







Item or Defect	Structural Element Condition States			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Plow Fingers Missing (Individual Joint)	All plow fingers are present.	No adjacent plow fingers missing on any particular joint.	Two adjacent plow fingers missing on any particular joint.	3 or more adjacent plow fingers missing on a particular joint.
Plow Fingers Missing (Entire Bridge)		3 or less plow fingers missing on the entire bridge.	4 to 7 plow fingers missing on the entire bridge.	More than 7 plow fingers missing on the entire bridge.
Plow Fingers Missing (Entire Bridge)		Less than 10% of plow fingers missing on the entire bridge.	11% to 25% of plow fingers missing on the entire bridge.	More than 25% of plow fingers missing on the entire bridge.


B.3.5.3 Poured Seal Joint (Element #301)

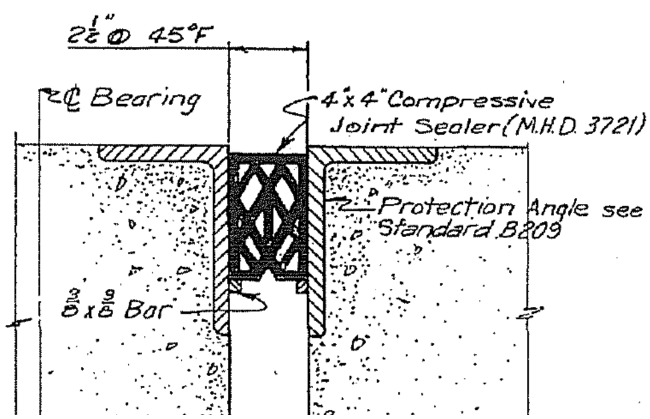
#301: Poured Seal Joint (LF)				
This element applies to joints filled with a poured or extruded sealant – this typically refers to transverse saw and seal joints (above piers or along end blocks), but can include any poured joint on the bridge deck or on a concrete bridge approach panel. The condition state language for Element #301 (Poured Seal Joint) is configured with the intent that joints requiring reconstruction (or concrete repairs) are rated as condition state 4, and that joints that need to be resealed are rated as condition state 3.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
General Joint Condition	Little or no deterioration	Minor to moderate deterioration (no repairs needed).	Joint resealing is required.	Joint reconstruction or concrete repair work is required.
Joint Alignment	No vertical offset.	Slight vertical offset (1/4” or less).	Vertical offset (1/2” or less).	Vertical offset greater than ½”.
Leakage	None	Minimal. Minor dripping through the joint.	Significant leakage is present on the underside of the joint.	NA
Joint Adhesion	Joint sealant is properly adhered.	Minor adhesion failure or seal deterioration.	Complete adhesion failure. Seal has severe deterioration or is missing.	NA
Adjacent Deck, End Block, or Concrete Approach Panel	Sound and intact.	Spalling or deterioration that does not affect joint function.	NA	Spalling or deterioration that prevents proper joint function or presents a safety hazard.

#301: Poured Seal Joint (LF)	
Condition Rating Examples (Poured Deck Joints)	
 **Condition State 3** **Section of poured seal missing**	 **Condition State 4** **Cracking and delamination adjacent to a transverse poured deck joint**
 **Condition State 4** **Extensive deck deterioration (bituminous patching) along transverse poured deck joints**	 **Condition State 4** **Severe spalling along a longitudinal poured joint**

B.3.5.4 Compression Seal Deck Joint (Element #302)

#302: Compression Seal Deck Joint (LF)

This element applies to deck joints consisting of a pre-formed elastic compression seal.
Note: This element should not be used for approach relief joints (use Element #816 instead).



Compression seal deck joints were phased out in favor of strip seal joints around 1975 (only a few remain on Minnesota bridges).

Compression seals may have a solid or hollow cross-section. The joint may or may not include steel protection angles along the deck edges.

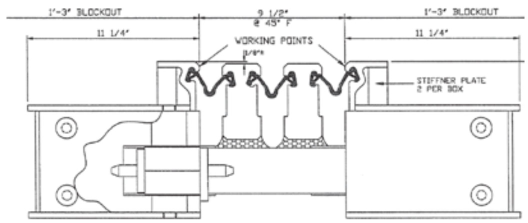
A cross-section plan diagram of typical compression seal deck joint (with steel protection angles) is shown at left.

The condition state language for Element #302 (Compression Seal Deck Joint) is configured with the intent that joints requiring replacement (or concrete/steel protection angle repairs) are rated as condition state 4, and that joints requiring seal repair or replacement are rated as condition state 3.

Item or Defect	Structural Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
General Joint Condition	Little or no deterioration	Minor to moderate deterioration (no repairs needed).	Compression seal gland repair or replacement is required.	Joint reconstruction or concrete repair work is required.
Joint Function and Alignment	Joint is functioning as intended (movement is not restricted).		Slight restriction of joint movement.	Joint is restricted (not functioning as intended).
	Horizontal joint gap is within design limits.		Joint gap width is at or near the design limits.	Joint is closed tightly or gap has opened beyond design limits.
	No vertical offset.	Vertical offset of ¼" or less.	Vertical offset of ½" or less.	Vertical offset greater than ½".
Leakage	None	Minimal leakage (slight dripping).	Significant leakage.	NA
Compression Seal Gland	Securely anchored.	Gland partially pulled out, pushed up, or dropped slightly.	Compression seal gland is torn, punctured, pulled out, or fallen out.	NA
Steel Protection Angles, Anchors, or Cover Plates	Minor surface corrosion or superficial scrapes.	Corrosion (or damage), that does not affect joint function,	NA	Damage or section loss that prevents proper joint function or presents a safety hazard.
Adjacent Deck or Header	Sound	Spalling that does not affect joint function.	NA	Significant spalling that affects joint function.

#302: Compression Seal Deck Joint (LF)	
Condition Rating Examples (Compression Seal Deck Joint)	
 **Condition State 2** **Plow damage on steel protection angle along compression joint**	 **Condition State 3** **Compression seal gland has dropped out of joint**
 **Condition State 4** **Steel protection angle on a compression seal joint fractured and separated**	 **Condition State 4** **Severe spalling (temporary patch) along a compression seal joint**

B.3.5.5 Modular Deck Joint (Element #303)

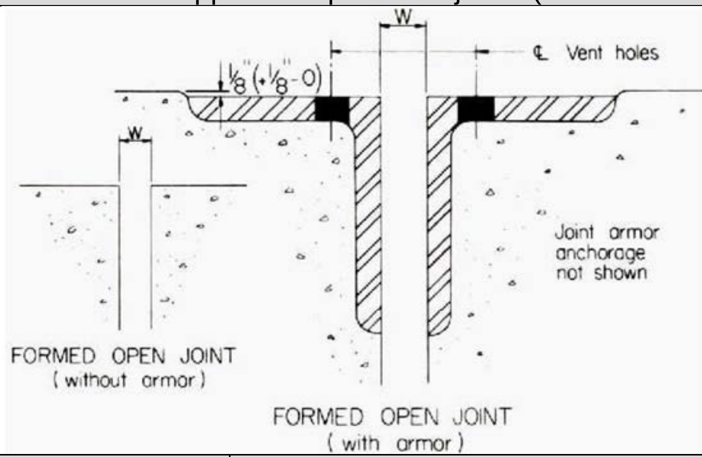
<table>
<tr><th colspan="5">#303: Modular Deck Joint (LF)</th></tr>
<tr><td colspan="5">This element only applies to modular deck joints comprised of two or more adjacent waterproof seals ("V" strip or compression seal).</td></tr>
<tr><td colspan="2">
</td><td colspan="3">Modular deck joints came into use in Minnesota in the 1980's, and are now the standard deck joint used if more than 4" of expansion must be accommodated. A cross-section diagram of a 3-gland modular deck joint is shown at left.</td></tr>
<tr><td colspan="2"></td><td colspan="3">The seals are anchored by steel extrusions cast into the deck, and are typically supported from below by small beams (with an independent expansion bearing system). Modular joints typically incorporate equalizer springs and guide systems to keep the seals equally spaced and properly aligned. The underside support beams and equalizer system on a 7-gland modular joint are shown at left.</td></tr>
<tr><td colspan="5">The condition state language for Element #303 (Modular Deck Joint) is configured with the intent that joints requiring replacement (or concrete/steel extrusion repairs) are rated as condition state 4, and that joints requiring seal repair/replacement are rated as condition state 3.</td></tr>
<tr><th rowspan="3">Item or Defect</th><th colspan="4">Structural Element Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td rowspan="3">Joint Function and Alignment</td><td colspan="2">Joint is functioning as intended (movement is not restricted).</td><td>Slight restriction of joint movement.</td><td>Joint is restricted (not functioning as intended).</td></tr>
<tr><td colspan="2">Overall joint gap is within design limits. Individual joint gaps are relatively equal.</td><td>Individual (or overall) joint gaps are at or near the design limits.</td><td>Individual (or overall) joint gaps are beyond design limits.</td></tr>
<tr><td>No vertical offset.</td><td>Vertical offset of ¼" or less.</td><td>Vertical offset of ½" or less.</td><td>Vertical offset greater than ½".</td></tr>
<tr><td>Leakage</td><td>None</td><td>Minimal</td><td>Significant</td><td>NA</td></tr>
<tr><td>Seals (Glands)</td><td>Secure and properly positioned.</td><td>Seal partially pulled out of extrusion.</td><td>Seal torn, punctured, or pulled out of extrusion.</td><td>NA</td></tr>
<tr><td>Support Beams and Equalizer System</td><td>Little or no deterioration</td><td>Minor to moderate deterioration (no repairs needed).</td><td>Equalizer/guide components loose, missing, or malfunctioning. Joint support loose or misaligned.</td><td>Joint support is dislodged, jammed, detached, or missing.</td></tr>
<tr><td>Steel Extrusions or Cover Plates</td><td>Minor surface corrosion or superficial scrapes.</td><td>Corrosion (or damage), that does not affect joint function.</td><td>NA</td><td>Damage or section loss that prevents proper joint function or presents a safety hazard.</td></tr>
<tr><td>Adjacent Deck or Header</td><td>Sound</td><td>Minor spalling (doesn't affect joint function).</td><td>NA</td><td>Significant spalling that affects joint function.</td></tr>
</table>

#303: Modular Deck Joint (LF)	
Condition Rating Examples (Modular Deck Joints)	
 **Condition State 1** **Minor surface corrosion on steel extrusions (debris is not affecting the joint function)**	 **Condition State 2** **Minor leakage (with surface corrosion) on underside of a modular joint**
 **Condition State 3** **Modular joint gaps are uneven (equalizer system is not functioning properly) - one gland is pulled out.**	 **Condition State 4** **Support missing from underside of modular joint - gland has fallen out and is hanging down**

B.3.5.6 Open Deck Joint (Element #304)

#304: Open Deck Joint (LF)

This element applies to open deck joints (with or without steel protection angles).



Due to the heavy use of chlorides on roadways during the winter months, open joints are rarely used on bridge decks in Minnesota.

Leakage through an open deck joint should be considered in the condition rating if it is contributing to deterioration of superstructure or substructure elements located below the joint.

Item or Defect	Structural Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Joint Function and Alignment	Joint is functioning as intended (movement is not restricted).		Slight restriction of joint movement.	Joint is completely restricted (no longer functioning as intended).
	Horizontal joint gap is within design limits.		Joint gap width is at or near the design limits.	Joint is closed tightly or gap has opened beyond design limits.
	No vertical offset.	Vertical offset of ¼" or less.	Vertical offset of ½" or less.	Vertical offset greater than ½".
Leakage	Leakage is effectively directed away from structure below.	Leakage through joint is causing minor damage to structure below.	Leakage through joint is causing significant damage to structure below.	NA
Steel Extrusions or Cover Plates	Minor surface corrosion.	Minor section loss or traffic damage.	Section loss or traffic damage that does not affect joint function.	Severe section loss or traffic damage that prevents proper joint function or presents a safety hazard.
Adjacent Deck or Header	Sound	Minor spalling.	Moderate spalling that does not affect joint function.	Significant spalling that affects joint function.

<table>
<tr><th colspan="2">#304: Open Deck Joint (LF)</th></tr>
<tr><th colspan="2">Condition Rating Examples (Open Deck Joints)</th></tr>
<tr><td>
Condition State 2
Minor spalling along an open deck joint</td><td>
Condition State 3
Leakage through and open deck joint resulting in severe corrosion of superstructure below</td></tr>
<tr><td>
Condition State 3
Moderate spalling along an open deck joint (does not impact function or present a safety hazard)</td><td>
Condition State 4
Open joint contacting at curb (no further expansion is permitted) – deck is offset laterally</td></tr>
</table>

B.3.5.7 Assembly Deck Joint (Element #305)

#305: Assembly Deck Joint (LF)

This element applies to finger plate deck joints, sliding plate deck joints, or any other joint that cannot be adequately defined by the other joint elements.
Note: This element includes joints with or without seals or drainage systems. Joint leakage should be considered in the condition rating, particularly if it is contributing to deterioration of superstructure or substructure elements located below the joint.

Item or Defect	Structural Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Joint Function and Alignment	Joint is functioning as intended (movement is not restricted).		Slight restriction of joint movement.	Joint is completely restricted (not functioning).
	Horizontal joint gap is within design limits.		Joint gap width is at or near the design limits.	Joint is closed tightly or gap has opened beyond design limits.
	No vertical offset.	Vertical offset of ¼" or less.	Vertical offset of ½" or less.	Vertical offset greater than ½".
Leakage (Sealed Joints)	None	Minimal	Significant leakage is present.	NA
Leakage (Joints without Seals)	Leakage is effectively directed away from structure below.	Leakage through joint is causing minor damage to the structure below.	Leakage through joint is causing significant damage to the structure below.	NA
Seal Torn, Punctured, or Pulled Out of Extrusion	None	Seal gland is partially pulled out.	Seal is torn, punctured, or pulled out completely.	NA
Steel Plate Corrosion or Damage	Minor surface corrosion.	Minor section loss or traffic damage.	Section loss or traffic damage that does not affect joint function.	Severe section loss or traffic damage (affects joint function).
Steel Plate Anchorage	Steel plates are properly anchored (no noise under traffic) – all anchor bolts are intact.		Plate may be slightly loose (noise under traffic) – anchor bolts loose or missing.	Plate is loose or missing.
Adjacent Deck or Header	Sound	Minor spalling.	Moderate spalling that does not affect joint function.	Significant spalling that affects joint function.

#305: Assembly Deck Joint (LF)

Condition Rating Examples (Assembly Deck Joints)

Condition State 2

Anchor bolt covers missing from a "Wabo®Flex" deck expansion joint

Condition State 3

Spalling and temporary patching along a sliding plate deck joint (does not impact joint function)

Condition State 3

Finger joint laterally misaligned (fingers contacting)

Condition State 4

Finger joint is opened beyond design limits (gap between the two finger plates)

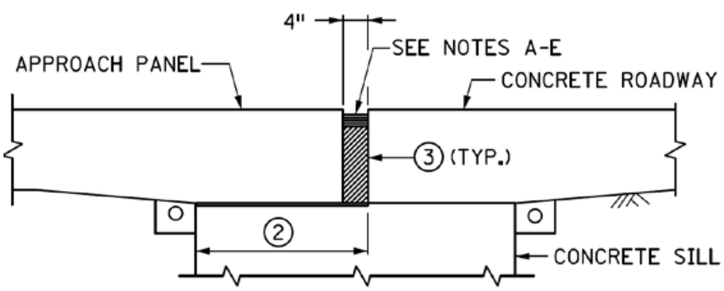
B.3.5.8 Approach Relief Joint (Element #816)

#816: Approach Relief Joint (LF)

This element applies to approach relief joints. A typical “E-8” approach relief joint is 4” wide (some are 2” wide), and consists of a preformed polystyrene filler (MnDOT Spec. #3702) with a hot poured seal (MnDOT Spec. #3725). Approach relief joints are typically located at the roadway end of the approach panel adjacent to the approach roadway.

Note: As bridges with “Integral” or “Semi-Integral” abutments typically do not have expansion joints on the bridge deck, the approach relief joint must accommodate expansion/contraction of the bridge deck as well as the approach roadway. If approach relief joints are present on such bridges, it is particularly important that they be functioning properly.

Periodic relief joint gap measurements at different temperatures are recommended – particularly on bridges with “Integral” or “Semi-Integral” abutments that have no deck expansion joints.



E8H JOINT DETAIL AT PAVEMENT

A cross-section of a typical “E8H” Approach Relief Joint (note 3) is shown at left.

Concrete approach slabs are typically supported by a concrete sill. A plastic sheet on top of the sill (note 2) breaks the bond, allowing the approach slab to expand and contract.

The condition state language for Element #816 (Approach Relief Joint) is configured with the intent that joints requiring reconstruction (or concrete repairs) are rated as condition state 4, and that joints that need to be resealed are rated as condition state 3.

<table>
<tr><th rowspan="3">Item or Defect</th><th colspan="4">Structural Element Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Joint Function and Alignment</td><td colspan="2">Joint is functioning as intended (movement is not restricted).</td><td>Slight restriction of joint movement.</td><td>Joint is completely restricted (no longer functioning).</td></tr>
<tr><td>Joint Gap (for a 4” Relief Joint)</td><td colspan="2">Joint gap is between 3” and 5”.</td><td>Closed to less than 3” or opened to more than 5”.</td><td>Closed to less than 2” or opened to more than 6”.</td></tr>
<tr><td>Joint Seal & Filler</td><td>Little or no deterioration</td><td>Minor to moderate deterioration of seal (foam filler still in place).</td><td>Poured seal has failed - foam filler may be missing.</td><td>NA</td></tr>
<tr><td>Adjacent Deck or Header</td><td>Sound</td><td>Minor spalling.</td><td>Moderate spalling that does not affect joint function.</td><td>Significant spalling that affects joint function.</td></tr>
</table>

#816: Approach Relief Joint (LF)

Condition Rating Examples (Approach Relief Joints)

Condition State 2
Minor spalling along an approach relief joint

Condition State 2
Partial failure of poured seal on an approach relief joint

Condition State 3
Poured seal and foam filler missing from an approach relief joint

Condition State 4
Severe spalling (temporary patch) along approach relief joint

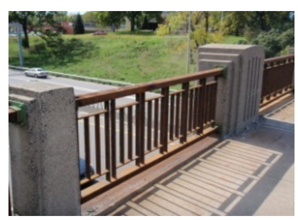
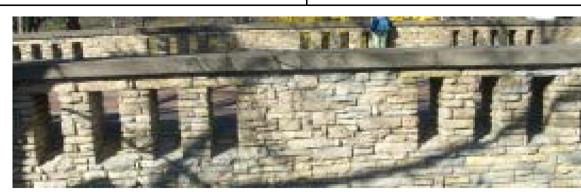
B.3.6 BRIDGE RAILING ELEMENTS

Bridge railing elements apply to railing mounted on bridge decks, approaches, or wingwalls. This includes vehicular barriers, ornamental railing, pedestrian fencing, and handrails. Railing elements can also be used for railings directly connected to culvert structures. Note: Guardrail that is not directly attached to the structure should be rated using Element #982 (Guardrail).

MnDOT uses five bridge railing elements:

- **#330: Metal Bridge Railing (LF)**
- **#331: Reinforced Concrete Bridge Railing (LF)**
- **#332: Timber Bridge Railing (LF)**
- **#333: Other Material Bridge Railing (LF)**
- **#334: Masonry Bridge Railing (LF)**

Railing element quantities are expressed in linear feet (LF). The quantity is measured along the length of the railing (for each railing line). Most bridges will have two railing lines (one on each side), but there may be additional rail lines if there is a median barrier or a protected bicycle or pedestrian lane. Solid median barriers are counted as one line – split median barriers are counted as two lines. The railing quantity may include approach railing (generally up to the first construction joint beyond the approach panel), but could include railing extending beyond that point if those railing sections are included in the plan quantity for the bridge.

Railing Element Selection Examples for Combination Railings		
Railings comprised of more than one material should be broken up into separate elements to best represent the materials present. Some examples for common railing types are shown below.		
For concrete parapets with metal railing mounted on top, the railing must be spilt into two elements. The lower parapet is rated using Element #331 (Concrete Railing) and the upper rail is rated using Element #330 (Steel Railing) – the element quantities would be the same.		
If the railing can be logically divided into separate material segments, those segments should be rated under separate elements. The steel segments are rated using Element #330 (Steel Railing) and the concrete posts are rated using Element #331 (Concrete Railing). Quantities should reflect the total length of the segments.		
For masonry railings with a concrete top cap, the railing is split into two elements. The lower parapet is rated using Element #334 (Masonry Railing) and the top cap is rated using Element #331 (Concrete Railing).		
For steel plate beam railing with timber posts & curbs, the railing should be split into two elements. The steel plate beam is rated using Element #330 (Steel Railing). The timber posts and curb are rated using Element #332 (Timber Railing).		
Steel railings (Element #330) are typically painted, galvanized, or both (galvanized then painted). If a protective coating is present, Element #515 (Steel Protective Coating) must also be rated as a sub-element. The SF quantity may be estimated by multiplying the railing length by the railing height.		

B.3.6.1 Metal Bridge Railing (Element #330)

#330: Metal Bridge Railing (LF)				
This element applies to railings comprised of steel, stainless steel, aluminum, or any other metal. This includes tubes, pipes, cables, beams, or other rolled, cast, or built-up shapes. This includes vehicular railings, pedestrian railings, and chain link fence. This element includes railings constructed entirely of metal, as well as the metal portions of combination railings. The other components of a combination railing should be rated separately using the appropriate railing element (concrete, timber, or masonry). Steel railings typically have a protective coating – they may be painted, galvanized, or both (galvanized then painted). Chain link fence is typically galvanized or vinyl-coated. Aluminum or stainless steel railings typically have no protective coating. If a protective coating is present, Element #515 (Steel Protective Coating) must also be rated as a sub-element. The SF quantity may be estimated by multiplying the railing length by the railing height.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** review of existing defects has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** review has determined that defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repairs are in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Corrosion	None	Surface corrosion.	Flaking rust (section loss) or pack rust with distortion.	Post, rail beam, or anchorage rusted through.
Cracking	None	Crack is arrested and/or reinforced.	Un-arrested crack that is unlikely to propagate through member.	Post, rail beam, or anchorage cracked through.
Connection or Anchorage	In-place and functioning.	Loose fasteners, but functioning as intended.	Missing fasteners or broken welds.	Connection has failed (or failure is eminent).
Distortion	None	Mitigated distortion or mitigation not required.	Distortion that requires mitigation that has not been addressed.	Severely bent or bowed.
Alignment	Proper alignment.	Slightly misaligned.	Significantly misaligned.	Severely misaligned.
Impact Damage	Superficial damage.	Railing slightly gouged, torn or bent.	Railing significantly gouged, torn or bent.	Railing severely bent, torn, or missing.

<table>
<tr><th colspan="2">#330: Metal Bridge Railing (LF)</th></tr>
<tr><th colspan="2">Condition Rating Examples (Metal Bridge Railing)</th></tr>
<tr><td>
Condition State 2
Surface corrosion on steel rail beams</td><td>
Condition State 3
Steel angle railing bent significantly</td></tr>
<tr><td>
Condition State 4
Horizontal steel rail pipe rusted through at connection to a concrete post</td><td>
Condition State 4
Aluminum rail post severely damaged</td></tr>
</table>

B.3.6.2 Reinforced Concrete Bridge Railing (Element #331)

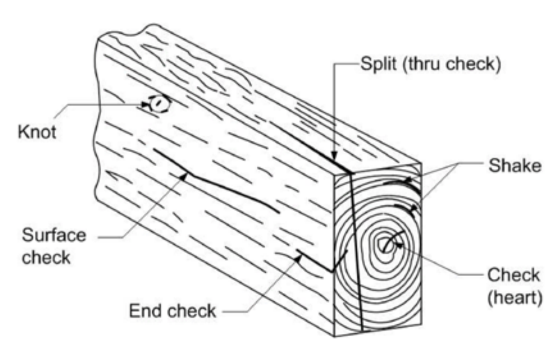
#331: Reinforced Concrete Bridge Railing (LF)				
This element applies to all types and shapes of reinforced concrete bridge railings or barriers. This includes railings constructed entirely of reinforced concrete, as well as the reinforced concrete base (or "parapet") portions of combination railings. The other components of a combination railing should be rated separately using the appropriate railing element (metal, timber, or masonry).				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review of has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** structural review has determined that the defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repairs are in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Delamination, Spall, or Patched Area	None	Delamination. Spall 1" or less deep **and** 6" or less in diameter.	Spall greater than 1" deep **or** greater than 6" diameter. Exposed rebar with section loss.	Spalling deeper than 4" or exposed rebar with severe section loss.
Scale, Abrasion, or Wear	Superficial	Course aggregate is exposed but remains secure.	Course aggregate is loose or popped out.	Severe voiding (concrete unsound).
Efflorescence or Rust Staining	None	Leaching without build-up or rust staining.	Leaching with heavy build-up or rust staining.	Severe leaching (concrete unsound).
Impact Damage	Superficial scrapes.	Minor to moderate impact damage.	Significant impact damage.	Severe impact damage.
Cracking	Minor cracks.	Moderate cracks or moderate map cracking. Sealed cracks.	Wide cracks or heavy pattern (map) cracking.	Severe structural cracking.
When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.012" can be considered "minor", cracks from 0.012" to 0.05" wide can be considered "moderate", and cracks wider than 0.05" can be considered "wide".				

#331: Reinforced Concrete Bridge Railing (LF)	
Condition Rating Examples (Concrete Bridge Railing)	
 **Condition State 2** Scale and pot-outs on a solid concrete parapet railing	 **Condition State 3** Cracking, delamination, and rust staining on a concrete post & beam railing
 **Condition State 3** Spalling along the top of a concrete J-rail	 **Condition State 4** Severe spalling on the concrete rail base of a combination railing

B.3.6.3 Timber Bridge Railing (Element #332)

#332: Timber Bridge Railing (LF)				
This element applies all types and shapes of timber railing. This includes railings constructed primarily of timber (the connections are typically steel), as well as the timber portions of combination railings. The other components of a combination railing should be rated separately using the appropriate railing element (metal, concrete, or masonry).				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** review of existing defects has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** review has determined that the defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repairs in sound condition.	Repairs recommended **or** existing repair is unsound.	Immediate repairs are required.
Section Loss from Decay, Abrasion, or Fire Damage	Minor deterioration (no section loss).	Less than 10% section loss. No crushing or sagging.	10% to 40% section loss. Some crushing or sagging.	More than 40% section loss. Severe crushing or sagging.
Connection (Steel)	Connection in-place and functioning.	Loose fasteners, but connection is functioning.	Missing fasteners; broken welds; or pack rust with distortion.	Connection has failed (or failure is eminent).
Misalignment	None	Slightly misaligned.	Significantly misaligned.	Severely misaligned.
Impact Damage	Superficial damage.	Minor to moderate impact damage.	Significant impact damage.	Members severely damaged, detached, or missing.
Shakes, Checks, or Splits	Penetrating less than 5% of the member thickness.	Penetrates 5% to 50% of the member thickness (not in a tension zone).	Penetrates more than 50% of the member thickness or more than 5% of member thickness in a tension zone.	Penetrates through entire member or more than 25% of member thickness in a tension zone.

- **Shake:** A separation along the grain (between the growth rings). Usually forms within a standing tree or during felling.
- **Check:** A separation perpendicular to the grain (across the growth rings). Usually results from stress due to drying shrinkage.
- **Split (or Thru Check):** A check extending further through the timber member due to tearing apart of wood cells.



#332: Timber Bridge Railing (LF)

Condition Rating Examples (Timber Bridge Railing)

Condition State 2
Checks in a timber rail post

Condition State 3
Significant decay on a timber rail beam

Condition State 4
Timber rail post missing (adjacent post is severely damaged)

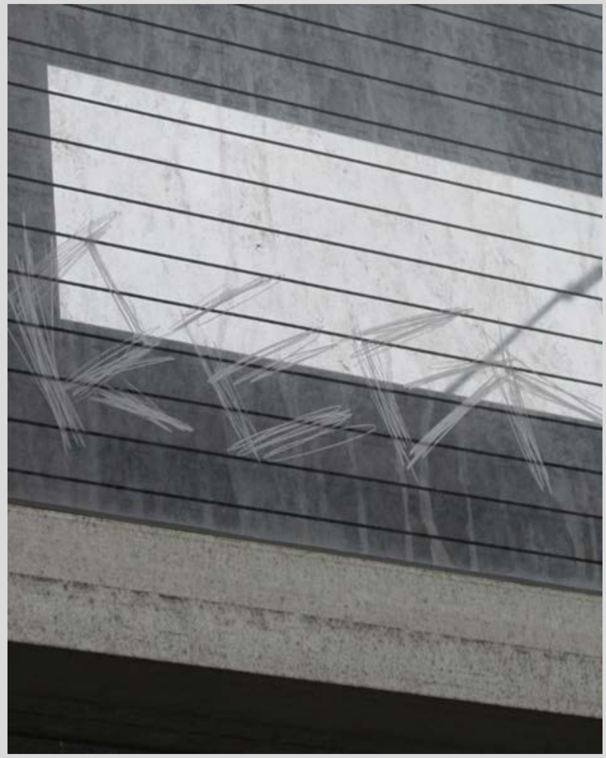
Condition State 4
Timber rail beam detached from posts

B.3.6.4 Other Material Bridge Railing (Element #333)

#333: Other Material Bridge Railing (LF)				
This element applies to bridge railings where the primary material is something other than metal, concrete, timber, or masonry. This includes railings comprised of glass, acrylic, or other transparent materials. This could include the enclosure on pedestrian skyways (if not adequately described by the other railing element). Note: The other components of a combination railing should be rated separately using the appropriate railing element (metal, concrete, masonry, or timber).				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review of has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** structural review has determined that the defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repairs are in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
General Deterioration	Superficial deterioration.	Minor to moderate deterioration.	Significant deterioration.	Severe deterioration.
Transparent Materials (Glass, Acrylic, Etc.)	May be dirty, but with no permanent loss of transparency	Abrasion, staining, or discoloration (some permanent loss of transparency)	Cracking or pitting. Severe loss of transparency.	Fractured, loose or missing sections.
Connections	Connection in-place and functioning.	Loose fasteners, but connection is functioning.	Missing fasteners; broken welds; or pack rust with distortion.	Connection has failed (or failure is eminent).
Sealant (Enclosed Skyways)	Functioning properly	Deterioration with no leakage	Leakage	Severe leakage
Misalignment	None	Slightly misaligned.	Significantly misaligned.	Severely misaligned.
Impact Damage	Superficial damage.	Minor to moderate impact damage.	Significant impact damage.	Members severely damaged, detached, or missing.

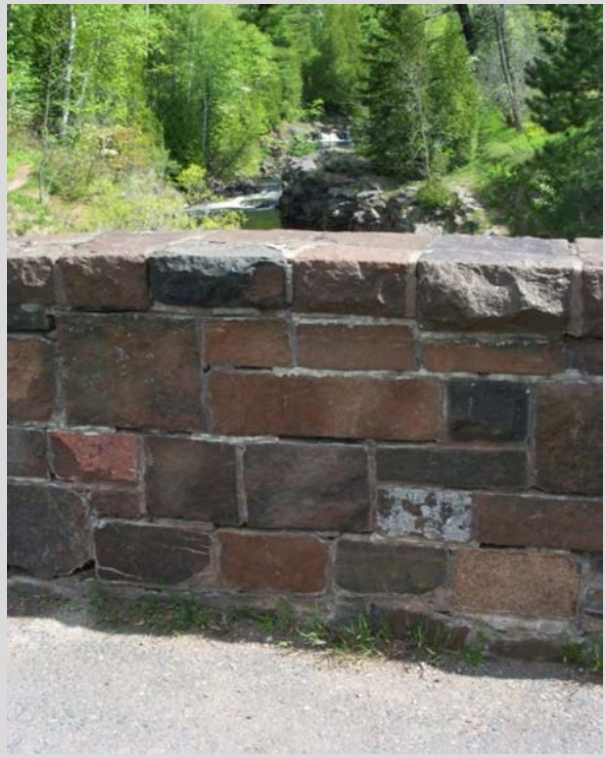
#333: Other Material Bridge Railing (LF)

Condition Rating Examples (Other Material Bridge Railing)

 **Condition State 1** **Transparent Noise Barrier is dirty (no permanent loss of transparency)**	 **Condition State 2** **Transparent Noise Barrier scratched by vandal.**
 **Condition State 2** **Loose seal (no leakage) on an enclosed pedestrain skyway**	 **Condition State 3** **Cracks in a transparent panel**

B.3.6.5 Masonry Bridge Railing (Element #334)

#334: Masonry Bridge Railing (LF)				
This element applies all shapes or types of masonry bridge railing (block, brick, or stone). This includes railings constructed entirely of masonry, as well as the masonry portions of combination railings. The other components of a combination railing should be rated separately using the appropriate railing element (metal, concrete, or timber).				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** review of defects has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** review has determined that the defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repairs are in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Mortar Breakdown (Masonry)	None	Cracks or voids in less than 10% of the joints.	Cracks or voids in 10% or more of the joints.	NA
Delamination or Spall (Masonry)	None	Delamination. Spalling less than 10% loss of block thickness.	Spalling with 10% to 25% loss of block thickness.	Spalling with more than 25% loss of block thickness.
Spilt or Fracture (Masonry)	None	Block split (no continuation into adjacent courses).	Fractured through adjacent courses or block split with significant offset.	Fracture or split reduces stability of structure.
Weathering or Abrasion (Masonry)	Minor weathering.	Less than 10% loss of block thickness.	10% to 25% loss of block thickness.	More than 25% loss of block thickness.
Masonry Displacement	None	Block or stone slightly misaligned.	Block or stone significantly misaligned.	Block or stone is severely misaligned (or detached).
Impact Damage	Superficial damage.	Minor to moderate impact damage.	Significant impact damage.	Block or stone severely damaged, displaced, or missing.

#334: Masonry Bridge Railing (LF)	
Condition Rating Examples (Masonry Bridge Railing)	
 **Condition State 2** **Minor mortar breakdown on a masonry bridge railing**	 **Condition State 3** **Extensive mortar breakdown on a masonry bridge railing**
 **Condition State 3** **Block split on a masonry parapet**	 **Condition State 4** **Severe impact damage on a masonry railing**

B.3.7 BRIDGE APPROACH ELEMENTS

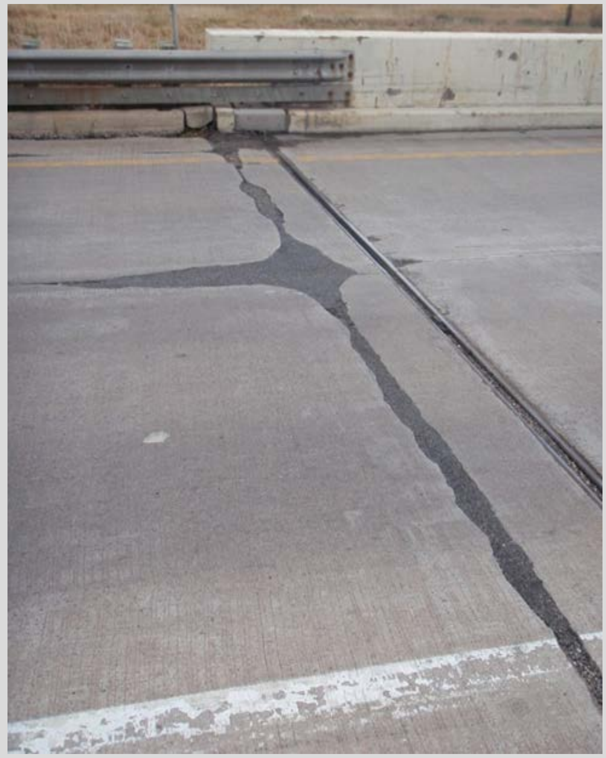
MnDOT has three bridge roadway approach elements. The approach should provide a smooth transition for vehicles travelling on and off of the bridge deck. In addition to material defects, bridge approaches should be inspected for settlement or undermining. Approach alignment and geometric issues should be addressed using the Approach Roadway Alignment Appraisal Rating (NBI Item 72).

- **#321: Concrete Approach Slab (SF)**
- **#822: Bituminous Approach Roadway (Each)**
- **#823: Gravel Approach Roadway (Each)**

Note: these elements are intended for vehicular bridges, and should not be used for culverts, pedestrian bridges, or railroad bridges. Approaches on pedestrian bridges should be rated using Element #895 (Sidewalk, Curb, or Median).

B.3.7.1 Concrete Approach Slab (Element #321)

#321: Concrete Approach Slab (SF)				
This element applies to reinforced concrete bridge approach slabs, regardless of wearing surface type. A bridge approach slab is a short (about 20 ft. long) reinforced concrete roadway paving segment adjacent to the bridge. The SF quantity typically includes the approach roadway width (cub-to-curb) from the abutment end block joint to the approach relief joint. If no relief joint is present, the quantity should include the area extending to the end of the approach slab, or to a construction joint that provides a logical termination point.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Wearing Surface	Little or no deterioration	Minor to moderate deterioration.	Significant deterioration (repairs recommended).	Severe deterioration (repairs required).
Delamination or Spalling	None	Spalling less than ½” deep. No delamination.	Delamination or spalling from ½” up to 2” deep (no exposed reinforcement).	2” deep or greater **or** with exposed reinforcement.
Scale, Wear, or Abrasion	Less than ¼” deep.	From ¼” up to ½” deep.	From ½” up to 2” deep (no exposed reinforcement).	2” deep or greater **or** with exposed reinforcement.
Patching or Repairs	None	Permanent patches that remain sound.	Temporary patches or deteriorated repairs.	Repair patches that have failed.
Settlement or Undermining	None	Slight undermining or settlement.	Significant undermining or settlement (traffic impact on bridge).	Severe undermining or severe settlement (possible traffic hazard).
Cracking	Minor cracks.	Moderate cracks or moderate map cracking. Sealed cracks.	Wide cracks or heavy map cracking.	Severe cracking or slab fracture.
When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.012"can be considered “minor”, cracks from 0.012" to 0.05" wide can be considered “moderate”, and cracks wider than 0.05" can be considered “wide”.				

#321: Concrete Approach Slab (SF)	
Condition Rating Examples (Concrete Approach Slab)	
 **Condition State 2** Concrete patch on a concrete approach panel (along the end block joint)	 **Condition State 3** Temporary bituminous patch on a concrete approach panel (along the end block joint and centerline)
 **Condition State 4** Severe spall along centerline of a concrete approach panel	 **Condition State 4** Concrete approach panel fractured at the corner

B.3.7.2 Bituminous and Gravel Approach Roadway (Elements #822 and #823)

Element #822: Bituminous Approach Roadway (Each) Element #823: Gravel Approach Roadway (Each)				
These elements apply to roadways that terminate at the bridge abutments (with no underlying concrete slab). These are "each" items – the quantity is typically "2 "(one for each end of the bridge). If the bridge has a divided median or ramp, the quantity can be increased to rate each approach roadway segment separately. The area considered in the rating typically includes the approach roadway extending out about 20 ft. from the end of the bridge deck.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
General Condition	Little or no deterioration.	Minor to moderate deterioration.	Extensive or significant deterioration – repairs may be required.	Severe deterioration – immediate repairs are required.
Bituminous Roadway	Smooth and even (no potholes).	Moderate cracking or slight rutting (potholes may be present).	Significant rutting or uneven surface. Extensive cracking or potholes.	Severe deterioration of the bituminous roadway (possible traffic hazard).
Gravel Roadway	Evenly graded.	Moderately rutted or eroded.	Extensive rutting or erosion.	Severe deterioration of the gravel roadway (possible traffic hazard).
Settlement or Undermining	No settlement or undermining – smooth transition on and off the bridge deck.	Slight settlement or undermining (traffic impact on the bridge has not been significantly increased).	Settlement has significantly increased traffic impact on the bridge. Significant undermining.	Settlement has severely increased traffic impact on the bridge. Severe undermining.

#822: Bituminous Approach Roadway (Each)
#823: Gravel Approach Roadway (Each)

Condition Rating Examples (Bituminous or Gravel Approach Roadways)

Condition State 2
Moderate deterioration on a bituminous approach roadway (cracking and patching)

Condition State 3
Extensive deterioration on a bituminous approach roadway (settlement, cracking, and patching)

Condition State 3
Significant settlement on a bituminous approach roadway (along the bridge deck)

Condition State 4
Severe washouts on a gravel approach roadway (traffic hazard)

B.3.8 SUPERSTRUCTURE AND SUBSTRUCTURE ELEMENTS

Steel Superstructure Elements

#102: Steel Box Girder (LF)
#107: Steel Girder or Beam (LF)
#113: Steel Stringer (LF)
#120: Steel Truss (LF)
#141: Steel Arch (LF)
#152: Steel Floorbeam (LF)
#162: Steel Gusset Plate (Each)

These elements apply to steel components of the bridge superstructure. This includes any steel type (weathering or non-weathering steel), and also includes wrought iron.

- Element #515 (Steel Protective Coating) must be rated as a separate sub-element for each of these steel elements.
- If impact damage is present, Element #880 (Impact Damage) must be added and rated.
- If section loss is present, Element #881 (Section Loss) must be added and rated.
- If cracking is present, Element #882 (Steel Cracking) must be added and rated.

Item or Defect	Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that the strength of the element has not been impacted.	Condition warrants structural review **or** structural review has determined that the strength of the element has been reduced.
Repairs	No repairs are present.	Existing repair in sound condition.	Repair recommended **or** existing repair is unsound.	Immediate repairs are required.
Corrosion	None	Surface corrosion (freckled rust).	Section loss, flaking rust, or pack rust is present.	Section loss exceeds 10% of the member cross section (or effective section).
Corrosion (Weathering Steel)	Initial layer of protective oxide coating.	Corrosion beyond the initial layer of protective oxide coating.		
Cracking	None	Crack has self-arrested or has been arrested.	Un-arrested crack that is unlikely to propagate into a critical stress area.	Crack that has (or might) propagated into a critical stress area.
Connection	Connection in-place and functioning as intended.	Loose fasteners, but the connection is functioning as intended.	Missing bolts or rivets; broken welds; or pack rust with distortion.	Connection has failed (or failure is eminent).
Distortion	None	Mitigated distortion (or mitigation is not required).	Distortion requires mitigation and has not been addressed.	Severely bent or bowed.
Misalignment	None	Slightly out of position or alignment.	Significantly out of proper position or alignment.	Severely out of proper position or alignment.

B.3.8.1 Steel Superstructure Elements

Steel Superstructure Elements	
Condition Rating Examples (Steel Superstructure Elements)	
 **Condition State 1** **Unpainted weathering steel (initial protective layer of surface corrosion)**	 **Condition State 2** **Paint failure and surface corrosion on the bottom flange of a steel beam**
 **Condition State 2** **Extensive paint failure and surface corrosion on a steel girder**	 **Condition State 2** **Truss diagonal member reinforced with a bolted channel plate**

Steel Superstructure Elements	
Condition Rating Examples (Steel Superstructure Elements)	
 **Condition State 3** **Flaking rust (and pitting) in girder web at splice**	 **Condition State 3** **Pitting in girder web at splice (painted over)**
 **Condition State 3** **Pack rust along truss connection**	 **Condition State 4** **Large hole rusted through the web of a steel floorbeam**

B.3.8.2 Steel Substructure Elements

Steel Substructure Elements				
#202: Steel Column (Each) #207: Steel Tower Trestle (LF) #219: Steel Abutment (LF)			**#225: Steel or CIP Piling (Each) #231: Steel Pier/Bearing Cap (LF)**	
These elements apply to steel components of the bridge substructure – this includes any steel type (weathering or non-weathering steel), and includes wrought iron. • If a steel substructure element is present on a bridge, Element #515 (Steel Protective Coating) must be rated specifically for that element. • If impact damage is present, Element #880 (Impact Damage) must be added and rated. • If section loss is present, Element #881 (Section Loss) must be added and rated. • If settlement is evident, Element #884 (Settlement) must be added and rated. • If scour is present, Element #885 (Scour) must be added and rated.				
Item or Defect	**Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that the strength of the element has not been impacted.	Condition warrants structural review **or** structural review has determined that the strength of the element has been reduced.
Repairs	No repairs are present.	Existing repairs are in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Corrosion	None	Surface corrosion (freckled rust).	Section loss or pack rust is present.	Section loss exceeds 10% of the cross-section.
Cracking	None	Crack has self-arrested or has been arrested with holes, plates, or similar.	Un-arrested crack that is unlikely to propagate into a critical stress area.	Un-arrested crack that may propagate into a critical stress area.
Connection	None	Loose fasteners, but functioning as intended.	Missing fasteners, broken welds, or pack rust.	Connection has failed (or failure is eminent).
Distortion	None	Distortion not requiring mitigation or mitigated distortion.	Distortion requiring mitigation that has not been addressed.	Severely bent or bowed.
Misalignment	None	Slightly out of position or alignment.	Significantly out of position or alignment.	Severely misaligned.
Settlement	None	Within tolerable limits or arrested (no structural distress).	Exceeds tolerable limits.	Stability of element has been reduced.
Scour	None	Within tolerable limits (or counter-measures installed).	Exceeds tolerable limits but is less than the critical scour limits.	Exceeds the critical scour limits.

Steel Substructure Elements	
Condition Rating Examples (Steel Substructure Elements)	
 **Condition State 2** **Paint failure and surface corrosion on a CIP Pile**	 **Condition State 2** **Paint failure and surface corrosion on a steel column**
 **Condition State 2** **Impact damage (bent flange) on a steel H-pile**	 **Condition State 3** **Flaking rust and pack rust on a steel channel pier cap**

Steel Substructure Elements	
Condition Rating Examples (Steel Substructure Element	
	
Condition State 3 **Flaking rust (section loss) on a CIP Pile**	**Condition State 3** **Flaking rust (section loss) on a steel H-Pile**
	
Condition State 4 **Severe corrosion and section loss on a steel h-pile**	**Condition State 4** **Fracture in steel shell of a CIP Piling**

B.3.8.3 Steel Protective Coating (Element #515)

<table>
<tr><th colspan="5">#515: Steel Protective Coating (SF)</th></tr>
<tr><td colspan="5">If an NBE steel element (deck, railing, superstructure, substructure, or culvert) is present on a bridge, Element #515 (Steel Protective Coating) must be rated as a sub-element for that particular steel element. Element #515 is entered in SIMS (and displayed on the inspection report) directly below each steel element.

The total surface area (in square feet) of each steel element must be determined. Portions of a steel element that are encased in concrete (such as the top surface of the top flange of a beam), should not be included in this quantity. For steel box members, this quantity will include the exterior and interior surfaces. This SF quantity may initially be entered as a rough estimate, but a more accurate quantity should eventually be calculated.</td></tr>
<tr><th rowspan="3">Item or Defect</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Painted Steel Surfaces</td><td>Little or no paint deterioration.</td><td>Minor paint deterioration. Chalking and fading of finish coat.</td><td>Moderate paint deterioration. Finish coat failure (cracking, bubbling, or peeling) – prime coat remains mostly intact.</td><td>Paint system failure. Prime coat cracked, bubbling or peeling (steel exposed).</td></tr>
<tr><td rowspan="2">Rusting Steel Percentage (1 SF Coated Segment</td><td>0.3% or less*</td><td>0.3% to 3%*</td><td>3% to 16%*</td><td>More than 16%*</td></tr>
<tr><td colspan="4">*Percentages are based upon The Society for Protective Coatings SSPC-VIS 2 (Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces)</td></tr>
<tr><td>Galvanized Steel Surfaces</td><td>Little or no deterioration of galvanized coating.</td><td>Minor coating deterioration. Light chalking or fading of galvanized surface.</td><td>Moderate coating deterioration (coating remains mostly intact). Heavy chalking.</td><td>Galvanized coating system failure.</td></tr>
<tr><td>Duplex Coated (Galvanized and Painted) Steel Surfaces</td><td>Little or no deterioration.</td><td>Minor coating deterioration. Chalking or fading of finish coat – any exposed steel is very isolated.</td><td>Moderate coating deterioration. Finish coat failure (cracking, bubbling, or peeling) – galvanized coating remains mostly intact.</td><td>Extensive duplex coating system failure.</td></tr>
<tr><td>Unpainted Weathering Steel Surfaces (Protective Oxide Coating)</td><td>Protective oxide coating is uniform and tightly adhered (yellow, orange, or brown color)</td><td>Protective oxide coating is uneven or has minor deterioration. Dark brown color – the surface may be dusty or granular.</td><td>Protective oxide coating has moderate failure (small flakes, less than ½” diameter). Black color.</td><td>Protective oxide coating has failed. Large areas of the surface layer are flaking off.</td></tr>
</table>

#515: Steel Protective Coating – Paint (SF)

Condition Rating Examples (Protective Coatings – Paint)

Condition State 2
Chalking paint on steel arch bracing members

Condition State 2
Minor paint failure (Isolated – less than 3%)

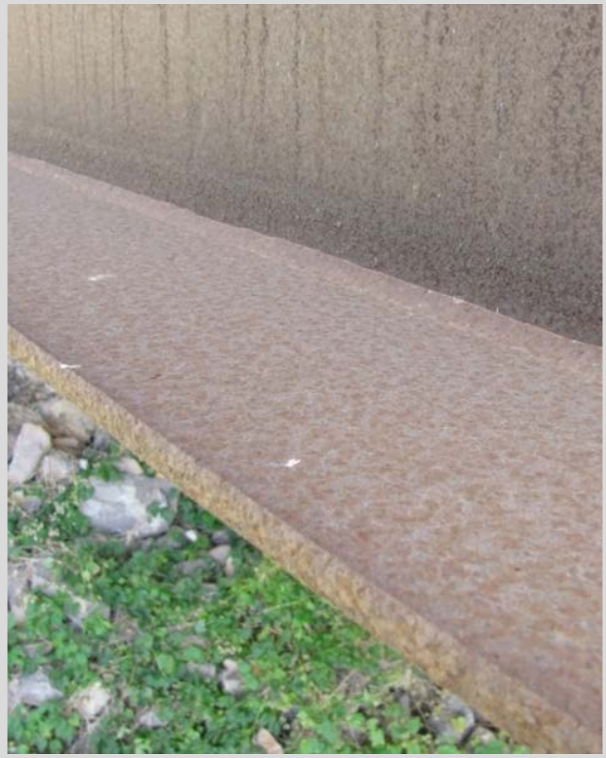
Condition State 3
Paint finish coat failure (primer coat remains intact)

Condition State 4
Paint system failure (exposed steel)

#515: Steel Protective Coating – Weathering Steel (SF)

Condition Rating Examples (Protective Coatings – Weathering Steel)

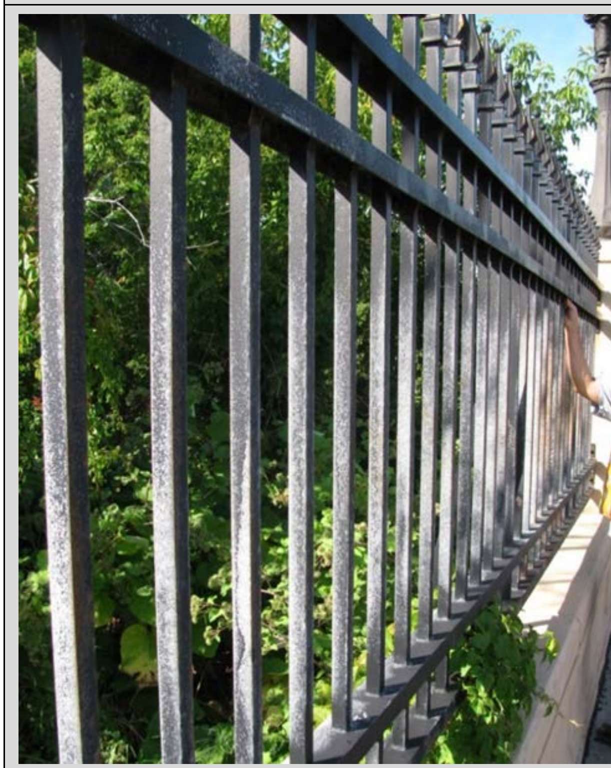
Condition State 1
Weathering steel patina is uniform and tightly adhered to the steel beam



Condition State 2
Weathering steel patina is slightly uneven – surface is granular and dusty

Condition State 3
Weathering steel patina has flaking (less than ½” diameter) along the bottom flange

Condition State 4
Weathering steel patina has failed – large areas of surface layer flaking off

#515: Steel Protective Coating – Galvanized or Duplex (SF)	
Condition Rating Examples (Protective Coatings – Glanvanized or Duplex)	
 **Condition State 2** **Galvanized coating on bridge rail is faded**	 **Condition State 3** **Finish paint coat (Duplex system) has been scraped off, the galvanized layer below remains intact**
 **Condition State 3** **Finish paint coat (Duplex system) has extensive failure, the galvanized layer below remains intact**	 **Condition State 4** **Complete failure of a Duplex system on a steel railing (isolated locations)**

B.3.8.4 Reinforced Concrete Superstructure Elements

<table>
<tr><th colspan="5">Reinforced Concrete Superstructure Elements</th></tr>
<tr><th colspan="3">#105: Reinforced Concrete Box Girder (LF)
#110: Reinforced Concrete Girder/Beam (LF)
#116: Reinforced Concrete Stringer (LF)</th><th colspan="2">#144: Reinforced Concrete Arch (LF)
#155: Reinforced Concrete Floorbeam (LF)</th></tr>
<tr><td colspan="5">These elements apply to structural members constructed of reinforced concrete (cast-in-place or pre-cast). These elements should not be used for prestressed or post-tensioned concrete.
• If impact damage is present, Element #880 (Impact Damage) must be added and rated.
• If shear cracking is present, Element #883 (Shear Cracking) must be added and rated.</td></tr>
<tr><th rowspan="3">Item or Defect</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Structural Review</td><td>Structural review is not required.</td><td>Structural review is not required.</td><td>Structural review is not required <u>or</u> structural review has determined that the strength of the element has not been impacted.</td><td>Condition warrants structural review <u>or</u> structural review has determined that the strength of the element has been reduced.</td></tr>
<tr><td>Repairs</td><td>No repairs are present.</td><td>Existing repair in sound condition.</td><td>Repairs are recommended <u>or</u> existing repair is unsound.</td><td>Immediate repairs are required.</td></tr>
<tr><td>Delamination, Spall, or Exposed Rebar</td><td>None</td><td>Delamination. Spall 1” or less deep <u>and</u> 6” or less in diameter.</td><td>Spall greater than 1” deep <u>or</u> greater than 6” diameter. Exposed rebar with corrosion or section loss.</td><td>Spalling deeper than 4” or exposed rebar with severe section loss.</td></tr>
<tr><td>Efflorescence Rust Staining</td><td>None</td><td>Leaching without build-up (stalactites). Minor rust stains (rebar chairs).</td><td>Leaching with heavy build-up (stalactites).Rust stains indicating rebar corrosion.</td><td>Severe leaching (concrete unsound).</td></tr>
<tr><td>Scale, Abrasion, or Wear</td><td>Superficial</td><td>Course aggregate is exposed but remains secure.</td><td>Course aggregate is loose or has popped out.</td><td>Severe voiding (concrete unsound).</td></tr>
<tr><td>Misalignment</td><td>None</td><td>Slightly out of position or alignment.</td><td>Significantly out of position or alignment.</td><td>Severely misaligned.</td></tr>
<tr><td>Cracking</td><td>Minor cracks.</td><td>Moderate cracks or moderate map cracking. Sealed cracks.</td><td>Wide cracks or heavy map cracking. Minor or moderate shear/flexure cracks</td><td>Severe cracks or fractures. Wide shear or flexure cracks.</td></tr>
<tr><td colspan="5">When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.012" can be considered “minor”, cracks from 0.012" to 0.05" wide can be considered “moderate”, and cracks wider than 0.05" can be considered “wide”.</td></tr>
</table>

Reinforced Concrete Superstructure Elements	
Condition Rating Examples (Reinforced Concrete Superstructure Elements)	
 **Condition State 2** **Cracking on precast concrete channel beams**	 **Condition State 2** **Patching on a concrete arch spandrel cap**
 **Condition State 3** **Water saturation, rust staining, and spalling on a cast-in-place concrete T-girder**	 **Condition State 3** **Cracking, delamination, and rust staining a precast concrete channel beam**

<table>
<tr><th colspan="2">Reinforced Concrete Superstructure Elements</th></tr>
<tr><th colspan="2">Condition Rating Examples (Reinforced Concrete Superstructure Elements)</th></tr>
<tr><td>
Condition State 3
Spalling on a precast concrete channel beam</td><td>
Condition State 3
Spalling on a reinforced concrete arch</td></tr>
<tr><td>
Condition State 4
Severe spalling (and fracture) on a concrete arch spandrel wall</td><td>
Condition State 4
Severe impact damage (exposed and bent reinforcement) on a cast-in-place concrete T-girder</td></tr>
</table>

B.3.8.5 Reinforced Concrete Substructure Elements

Reinforced Concrete Substructure Elements				
#205: Reinforced Concrete Column (Each) #210: Reinforced Concrete Pier Wall (LF) #215: Reinforced Concrete Abutment (LF)		#220: Reinforced Concrete Footing (LF) #227: Reinforced Concrete Piling (Each) #234: Reinforced Concrete Pier/Bearing Cap (LF)		
These elements apply to substructure members constructed of cast-in-place or pre-cast concrete. • If impact damage is present, Element #880 (Impact Damage) must be added and rated. • If shear cracks are present on a pier cap, Element #883 (Shear Cracking) must be rated. • If settlement is evident, Element #884 (Settlement) must be added and rated. • If scour is present, Element #885 (Scour) must be added and rated.				
Item or Defect	**Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that the strength of the element has not been impacted.	Condition warrants structural review **or** structural review has determined that the strength of the element has been reduced.
Repairs	No repairs are present.	Existing repair in sound condition.	Repair recommended **or** existing repair is unsound.	Immediate repairs are required.
Delamination, Spall, or Exposed Rebar	None	Delaminated. Spall 1" or less deep **and** 6" or less in diameter.	Spall deeper than 1" **or** greater than 6" in diameter. Exposed rebar with section loss.	Severe spall (deeper than 4" or rebar rusted through).
Efflorescence Rust Staining	None	Leaching without build-up (stalactites). Minor rust stains (rebar chairs).	Leaching with heavy build-up (stalactites).Rust stains indicating rebar corrosion.	Severe leaching (concrete unsound).
Scale or Abrasion	None	Aggregate exposed but remains secure	Aggregate is loose or popped out	Severe voiding (unsound).
Misalignment	None	Slightly misaligned.	Significantly misaligned.	Severely misaligned.
Decorative Veneers	Superficial deterioration	Delaminated or deteriorated.	Missing or severely deteriorated.	Loose veneer poses a safety hazard.
Settlement	None	Within tolerable limits or arrested.	Exceeds tolerable limits.	Stability of element has been reduced.
Scour	None	Within tolerable limits or counter-measures installed.	Exceeds tolerable limits but less than critical scour limits.	Exceeds the critical scour limits.
Cracking	Minor cracks.	Moderate cracks or moderate map cracking. Sealed cracks.	Wide cracks or heavy map cracking. Minor or moderate shear/flexure cracks	Severe cracks or fractures. Wide shear or flexure cracks.
When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.012" can be considered "minor", cracks from 0.012" to 0.05" wide can be considered "moderate", and cracks wider than 0.05" can be considered "wide".				

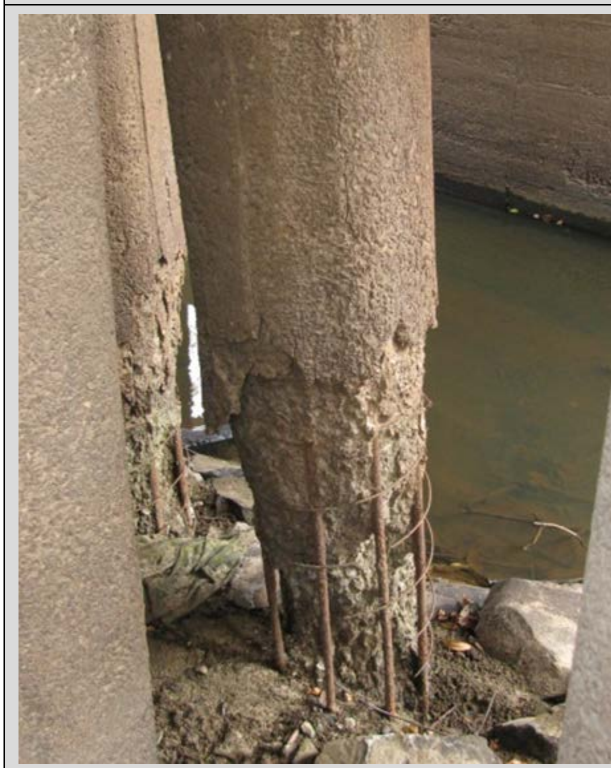
Reinforced Concrete Substructure Elements	
Condition Rating Examples (Reinforced Concrete Substructure Elements)	
 **Condition State 2** Repair on a reinforced concrete column and pier cap	 **Condition State 2** Leaching crack in the parapet wall on a reinforced concrete abutment
 **Condition State 3** Shear crack in a reinforced concrete pier cap	 **Condition State 3** Spalling on a reinforced concrete pier cap

Reinforced Concrete Substructure Elements

Condition Rating Examples (Reinforced Concrete Substructure Elements)

Condition State 3
Horizontal cracking with delamination and rust stains on the face of a reinforced concrete abutment

Condition State 3
Spalling (exposed and corroded reinforcement) on a reinforced concrete column



Condition State 4
Severe scale/spall on a reinforced concrete pile

Condition State 4
Severe spalling on a reinforced concrete pier cap

B.3.8.6 Prestressed Concrete Superstructure Elements

Prestressed Concrete Superstructure Elements

#104: Prestressed Concrete Box Girder (LF)
#109: Prestressed Concrete Girder or Beam (LF)
#115: Prestressed Concrete Stringer (LF)
#154: Prestressed Concrete Floorbeam (LF)

These elements apply to superstructure members constructed of either prestressed or post-tensioned concrete.

- If impact damage is present, Element #880 (Impact Damage) must be added and rated.
- If shear cracking is present, Element #883 (Shear Cracking) must be added and rated.

- Element #104 (Prestressed Concrete Box Girder) includes the bottom flange and web walls of post-tensioned box girders. The top flange is rated separately using Element #15 (Prestressed Concrete Top Flange).
- Element #109 (Prestressed Concrete Girder or Beam) includes the vertical portions of prestressed Bulb Tees, Double Tees, or Quad Tees. The horizontal portions are rated separately using Element #15 (Prestressed Concrete Top Flange).

Item or Defect	**Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that the strength of the element has not been impacted.	Condition warrants structural review **or** structural review has determined that the strength of the element has been reduced.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Delamination, Scale, Spall, and Exposed Rebar or Prestressing	None	Delaminated. Spall 1” or less deep **and** 6” or less in diameter.	Spall deeper than 1” **or** greater than 6” in diameter. Exposed rebar or prestressing with section loss.	Severe spall (deeper than 4”), rebar rusted through, or prestressing stands severed.
Efflorescence Rust Staining	None	Leaching without build-up (stalactites). Minor rust stains.	Leaching with heavy build-up (stalactites). Rust stains indicating rebar corrosion.	Severe leaching (concrete unsound).
Misalignment	None	Slightly misaligned.	Significantly misaligned.	Severely misaligned.
Cracking	Minor cracks.	Moderate cracks or moderate map cracking. Sealed cracks.	Wide cracks or heavy map cracking. Minor or moderate shear/flexure cracks	Severe cracks or fractures. Wide shear or flexure cracks.

When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.004" can be considered “minor”, cracks from 0.004" to 0.009" wide can be considered “moderate”, and cracks wider than 0.009" can be considered “wide”.

Prestressed Concrete Superstructure Elements

Condition Rating Examples (Prestressed Concrete Superstructure Elements)

Condition State 2
Impact damage (minor spall) on a prestressed concrete beam

Condition State 2
Draped strand cracking in the end a prestressed concrete beam

Condition State 3
Spalling on the web of a prestressed concrete beam

Condition State 3
Spalling on a bottom flange of a prestressed concrete beam

Prestressed Concrete Superstructure Elements

Condition Rating Examples (Prestressed Concrete Superstructure Elements)

Condition State 3
Scale/spall on the fascia of a prestressed concrete box beam

Condition State 3
Impact damage (spalling) on a post-tensioned concrete beam

Condition State 4
Severe spall and strand corrosion on a post-tensioned box girder

Condition State 4
Severe impact damage on a prestressed concrete beam

B.3.8.7 Prestressed Concrete Substructure Elements

<table>
<tr><th colspan="5">Prestressed Concrete Substructure Elements</th></tr>
<tr><th colspan="5">#204: Prestressed Concrete Column (Each)
#226: Prestressed Concrete Piling (Each)
#233: Prestressed Concrete Pier/Bearing Cap (LF)</th></tr>
<tr><td colspan="5">These elements apply to substructure members comprised of prestressed or post-tensioned concrete.
• If impact damage is present, Element #880 (Impact Damage) must be added and rated.
• If shear cracks are present on a post-tensioned pier cap, Element #883 (Shear Cracking) must be added and rated.
• If settlement is evident, Element #884 (Settlement) must be added and rated.
• If scour is present, Element #885 (Scour) must be added and rated.</td></tr>
<tr><th rowspan="3">Item or Defect</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Structural Review</td><td>Structural review is not required.</td><td>Structural review is not required.</td><td>Structural review is not required <u>or</u> structural review has determined that the strength of the element has not been impacted.</td><td>Condition warrants structural review <u>or</u> structural review has determined that the strength of the element has been reduced.</td></tr>
<tr><td>Repairs</td><td>No repairs are present.</td><td>Existing repair in sound condition.</td><td>Repairs recommended <u>or</u> existing repair is unsound.</td><td>Immediate repairs are required.</td></tr>
<tr><td>Delamination, Spall, or Exposed Rebar/Strands</td><td>None</td><td>Delaminated. Spall 1” or less deep and 6” or less in diameter.</td><td>Spall deeper than 1” <u>or</u> greater than 6” in diameter. Exposed rebar or strand with section loss.</td><td>Spall deeper than 4”, rebar rusted through, or severed prestressing strands.</td></tr>
<tr><td>Efflorescence Rust Staining</td><td>None</td><td>Leaching without build-up (stalactites). Minor rust stains.</td><td>Leaching with heavy build-up (stalactites).Rust stains indicating rebar corrosion.</td><td>Severe leaching (concrete unsound).</td></tr>
<tr><td>Misalignment</td><td>None</td><td>Slightly misaligned.</td><td>Significantly misaligned.</td><td>Severely misaligned.</td></tr>
<tr><td>Settlement</td><td>None</td><td>Within tolerable limits or arrested (no distress).</td><td>Exceeds tolerable limits.</td><td>Stability of element has been reduced.</td></tr>
<tr><td>Scour</td><td>None</td><td>Within tolerable limits or counter-measures installed.</td><td>Exceeds tolerable limits but less than critical scour limits.</td><td>Exceeds the critical scour limits.</td></tr>
<tr><td>Cracking</td><td>Minor cracks.</td><td>Moderate cracks or moderate map cracking. Sealed cracks.</td><td>Wide cracks or heavy map cracking. Minor or moderate shear/flexure cracks</td><td>Severe cracks or fractures. Wide shear or flexure cracks.</td></tr>
<tr><td colspan="5">When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.004" can be considered “minor”, cracks from 0.004" to 0.009" wide can be considered “moderate”, and cracks wider than 0.009" can be considered “wide”.</td></tr>
</table>

Prestressed Concrete Substructure Elements

Condition Rating Examples (Prestressed Concrete Substructure Elements)

Condition State 1
Post-tensioned pier cap with no defects

Condition State 2
Cracking on the face of a post-tensioned pier cap

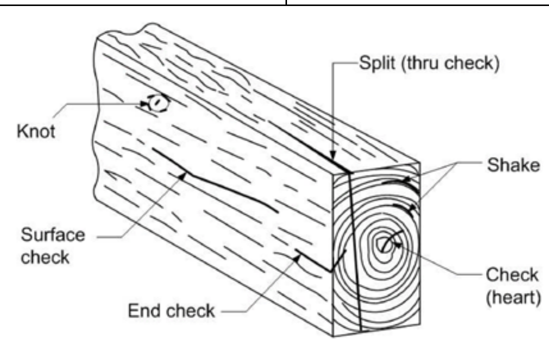
Condition State 3
Spalled end cap on a post-tensioned concrete pier cap

Condition State 4
Severe spalling on a prestressed concrete pile

B.3.8.8 Timber Superstructure Elements

Timber Superstructure Elements				
#111: Timber Girder or Beam (LF) **#117: Timber Stringer (LF)** **#135: Timber Truss (LF)**			**#146: Timber Arch (LF)** **#156: Timber Floorbeam (LF)**	
These elements apply to timber superstructure members of any type or shape. This includes sawn or glue-lam timber members. Connections on timber elements will typically include steel components (bolts, nuts, washers, connection plates, Etc.). • If impact damage is present, Element #880 (Impact Damage) must be added and rated.				
Item or Defect	**Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **<u>or</u>** structural review has determined that the strength of the element has not been impacted.	Condition warrants structural review **<u>or</u>** structural review has determined that the strength of the element has been reduced.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **<u>or</u>** existing repair is unsound.	Immediate repairs are required.
Decay, Weathering, Abrasion, or Fire Damage	Minor deterioration (no section loss).	Less than 10% section loss. No crushing or sagging.	10% to 40% section loss. Some crushing or sagging.	More than 40% section loss. Severe crushing or sagging.
Delamination (Glulam)	None	Minor	Significant	Severe
Connection (Steel)	Connection in-place and functioning as intended.	Loose fasteners, but connection is functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion.	Connection has failed (or failure is eminent).
Misalignment	None	Slightly misaligned.	Significantly misaligned.	Severely misaligned.
Shakes, Checks, or Splits	Penetrating less than 5% of the member thickness.	Penetrates 5% to 50% of the member thickness (not in a tension zone).	Penetrates more than 50% of the member thickness or more than 5% of the member thickness in a tension zone.	Penetrates through entire member or more than 25% of the member thickness in a tension zone.

- **Shake:** A separation along the grain (between the growth rings). Usually forms within a standing tree or during felling.
- **Check:** A separation perpendicular to the grain (across the growth rings). Usually results from stress due to drying shrinkage.
- **Split (or Thru Check):** A check extending further through the timber member due to tearing apart of wood cells.



Timber Superstructure Elements	
Condition Rating Examples (Timber Superstructure Elements)	
 **Condition State 2** **Moderate horizontal splitting on a sawn timber beam**	 **Condition State 2** **Minor impact damage on a Glulam timber beam**
 **Condition State 3** **Significant horizontal splitting on a sawn timber beam**	 **Condition State 3** **Horizontal splitting with internal decay (plant growth) on a sawn timber beam**

Timber Superstructure Elements	
Condition Rating Examples (Timber Superstructure Elements)	
 **Condition State 3** **Fire damage on a sawn timber beam**	 **Condition State 3** **Sawn timber beam fractured at pier bearing**
 **Condition State 4** **Severe internal decay on a sawn timber beam**	 **Condition State 4** **Severe crushing (failure) of a sawn timber beam**

B.3.8.9 Timber Substructure Elements

Timber Substructure Elements

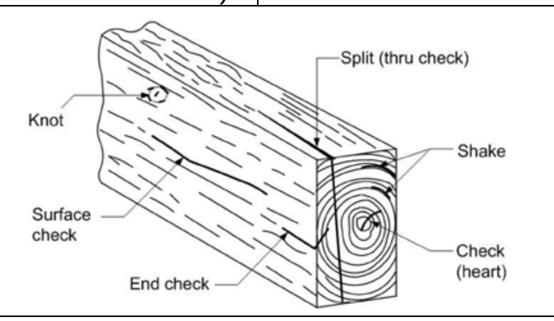
#206: Timber Columns (Each) #208: Timber Trestle Tower (LF) #216: Timber Abutment (LF)	**#228: Timber Pile (Each) #235: Timber Pier/Bearing Cap (LF)**

These elements apply to timber substructure members of any type or shape.

- If impact damage is present, Element #880 (Impact Damage) must be added and rated.
- If settlement is evident, Element #884 (Settlement) must be added and rated.
- If scour is present, Element #885 (Scour) must be added and rated.

Item or Defect	**Condition States** **1** **Good**	 **2** **Fair**	 **3** **Poor**	 **4** **Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that the strength of the element has not been impacted.	Condition warrants structural review **or** structural review has determined that the strength of the element has been reduced.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Decay, Weathering, Abrasion, or Fire Damage	Minor deterioration (no section loss).	Less than 10% section loss. No crushing or sagging.	10% to 40% section loss. Some crushing or sagging.	More than 40% section loss. Severe crushing or sagging.
Connection (Steel)	In-place and functioning as intended.	Loose fasteners, but functioning as intended.	Missing fasteners, connection is distressed.	Connection has failed (or failure is eminent).
Misalignment	None	Slightly misaligned.	Significantly misaligned.	Severely misaligned.
Settlement	None	Within tolerable limits or arrested.	Exceeds tolerable limits.	Stability of element has been reduced.
Scour	None	Within tolerable limits or counter-measures installed.	Exceeds tolerable limits but less than critical scour limits.	Exceeds the critical scour limits.
Shakes, Checks, or Splits	Penetrates less than 5% of member thickness.	Penetrates 5% to 50% of member thickness and not in a tension zone.	Penetrates more than 50% of member thickness (or more than 5% in a tension zone).	Penetrates through entire member (or more than 25% in a tension zone).

- **Shake:** A separation along the grain (between the growth rings). Usually forms within a standing tree or during felling.
- **Check:** A separation perpendicular to the grain (across the growth rings). Usually results from stress due to drying shrinkage.
- **Split (or Thru Check):** A check extending further through the timber member due to tearing apart of wood cells.



Timber Substructure Elements	
Condition Rating Examples (Timber Substructure Elements)	
 **Condition State 2** **Checking on the end of a timber pier cap**	 **Condition State 2** **Timber piling with decay at waterline (less than 10% section loss)**
 **Condition State 3** **Shell damage on a timber piling (section loss between 10% and 40%)**	 **Condition State 3** **Fire damage on a timber piling (section loss between 10% and 40%)**

<table>
<tr><th colspan="2">Timber Substructure Elements</th></tr>
<tr><th colspan="2">Condition Rating Examples (Timber Substructure Elements)</th></tr>
<tr><td>
Condition State 3
Timber pile with splitting and decay at a bracing connection</td><td>
Condition State 3
Timber cap with significant misalignment (tipped) – not bearing fully on the steel piling</td></tr>
<tr><td>
Condition State 4
Failure of abutment backing planks</td><td>
Condition State 4
Timer pile with severe decay and crushing</td></tr>
</table>

B.3.8.10 Masonry Superstructure and Substructure Elements

Masonry Superstructure and Substructure Elements

#145: Masonry Arch (LF)
#213: Masonry Pier Wall (LF)
#217: Masonry Abutment (LF)

These elements apply to structural bridge components comprised primarily of masonry. Masonry structures that have reinforced concrete components (that cannot be conveniently broken into separate elements) may be rated using masonry elements – use the reinforced concrete defect language to rate those areas.

Note: These elements should not be used for masonry arch structures that are classified as "culverts" – use Element #244 (Masonry Culvert) instead.

- If impact damage is present, Element #880 (Impact Damage) must be added and rated.
- If settlement is evident, Element #884 (Settlement) must be added and rated.
- If scour is present, Element #885 (Scour) must be added and rated.

Defects	Condition States			
	1 Good	**2 Fair**	**3 Poor**	**4 Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that the strength of the element has not been impacted.	Condition warrants structural review **or** structural review has determined that the strength of the element has been reduced.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Mortar Breakdown (Masonry)	None	Cracking or voids in less than 10% of the joints.	Cracking or voids in 10% or more of the joints.	NA
Delamination or Spall (Masonry)	None	Delamination. Spalling less than 10% loss of block thickness.	Spalling with 10% to 25% loss of block thickness.	Spalling with more than 25% loss of block thickness.
Spilt or Fracture (Masonry)	None	Block split without continuation into adjacent courses.	Fractured through adjacent courses or block split with significant offset.	Fracture or split reduces stability of structure.
Weathering or Abrasion (Masonry)	Minor weathering	Less than 10% loss of block thickness.	10% to 25% loss of block thickness.	More than 25% loss of block thickness.
Masonry Displacement	None	Block or stone is slightly misaligned.	Block or stone is significantly misaligned.	Block or stone is severely misaligned (or detached from structure).
Settlement	None	Within tolerable limits or arrested.	Exceeds tolerable limits.	Stability of element has been reduced.
Scour	None	Within tolerable limits or counter-measures installed.	Exceeds tolerable limits but less than critical scour limits.	Exceeds the critical scour limits.

Masonry Superstructure and Substructure Elements

Condition Rating Examples (Masonry Superstructure and Substructure Elements)

Condition State 2
Staining and weathering on a masonry arch

Condition State 2
Concrete repairs on a masonry arch

Condition State 3
Fracture in a masonry block continuing into adjacent courses

Condition State 3
Spalling on a masonry arch block (10% to 25% of block thickness)

<table>
<tr><th colspan="2">Masonry Superstructure and Substructure Elements</th></tr>
<tr><th colspan="2">Condition Rating Examples (Masonry Superstructure and Substructure Elements)</th></tr>
<tr>
<td>
Condition State 3
Extensive mortar loss on a masonry arch</td>
<td>
Condition State 3
Leaching through joints on a masonry arch</td>
</tr>
<tr>
<td>
Condition State 4
Masonry pier wall severely deteriorated below a truss bearing</td>
<td>
Condition State 4
Masonry pier wall severely damaged by scour</td>
</tr>
</table>

B.3.9 BEARINGS & SPECIAL FEATURE ELEMENTS

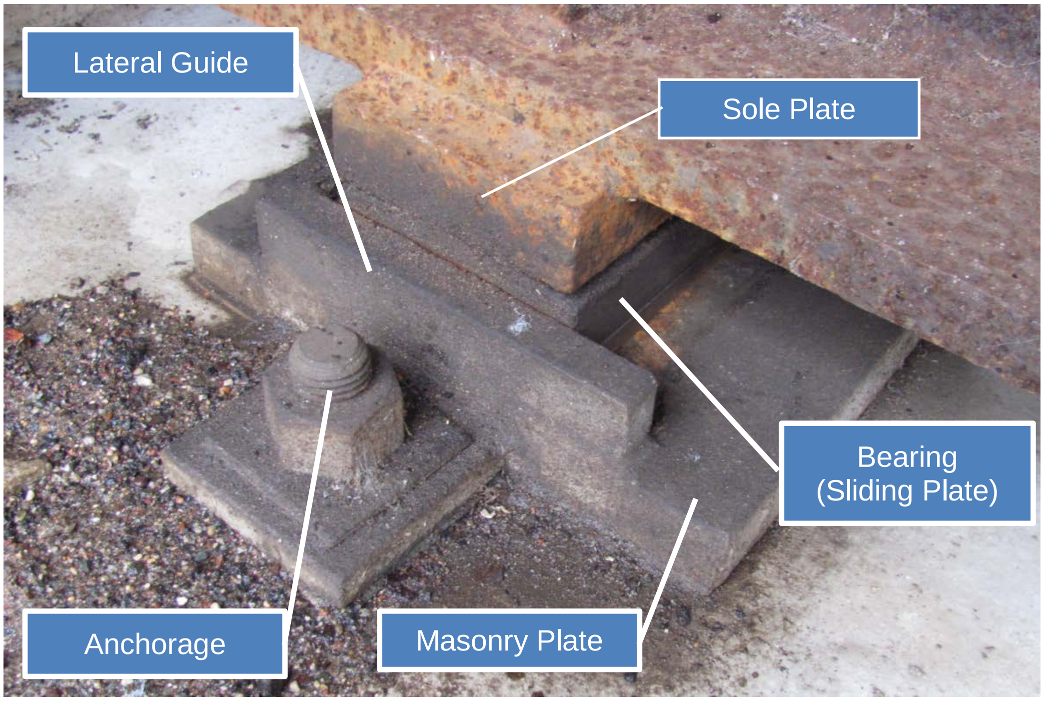
B.3.9.1 Bearing Components and Inspection Procedures

The primary function of a bearing is to transmit loads from the superstructure to the substructure. There are two basic types of bearings, expansion and fixed.

- Expansion bearings permit longitudinal movement of the superstructure due to thermal expansion and contraction. Most expansion bearings allow for rotation of the superstructure due to live load deflection. Some expansion bearings are designed to restrict lateral movement or to prevent uplift of the superstructure.
- Fixed bearings resist longitudinal movement of the superstructure due to thermal expansion and contraction. Most fixed bearings allow for rotation of the superstructure due to live load deflection, and to resist lateral movement of the superstructure.

A typical bearing assembly consists of the following components.

- **Sole Plate:** The sole plate protects the superstructure member, and transfers load from the superstructure to the bearing.
- **Bearing Device:** The bearing transfers load from the sole plate to the masonry plate. Bearings may incorporate sliding plates, rollers, rockers, pins, or elastomeric pads to allow for longitudinal or rotational movement of the superstructure.
- **Masonry Plate:** The masonry plate distributes load from the bearing to the supporting substructure unit (abutment, pier, or footing). Some bearings bear directly upon the bearing seat.
- **Anchorage:** Bearings that resist longitudinal or lateral movement (or uplift forces) require an anchorage system. This typically consists of threaded steel rods drilled (or cast) into the substructure unit.
- **Lateral Guide System:** Some expansion bearing assemblies include guides to prevent lateral movement while still allowing longitudinal expansion or contraction.



Inspection and Condition Rating of Bridge Bearings

Bearings should be examined for deterioration, function, alignment, as well as the soundness of the anchorage and substructure support. All of these factors should be taken into consideration when rating a bearing element. MnDOT uses five bearing elements, the bridge design plans may need to be referenced to verify the type and quantity of bearing elements.

- **#310 - Elastomeric Bearing (Each)**
- **#311 - Expansion Bearing (Each)**
- **#313 - Fixed Bearing (Each)**
- **#314 - Pot Bearing (Each)**
- **#315 - Disk Bearing (Each)**

The importance of inspecting and maintaining bridge bearings should not be underestimated. If ignored, seemingly minor bearing problems could result in serious structural issues.

- Bearing malfunction can damage adjacent structural elements.
- Severe bearing misalignment often indicates significant problems elsewhere on the bridge (such as substructure settlement, shifting, or tipping).
- Loss of bearing area could result in collapse of a bridge span.

The 2005 collapse of the Dunn Bridge in Albany, New York was attributed to the malfunction of the rocker bearings, combined with horizontal deflection of the supporting pier. The rocker bearings had been misaligned for a number of years prior to the collapse.

Bearing Malfunction: A common problem with expansion bearings is seizing due to corrosion or debris. Bearings are typically located below deck joints, a highly corrosive environment. Debris (such as sand, dirt, and flaking rust) can restrict expansion, accelerate corrosion, increase wear, and prevent adequate inspection. Sliding plate, roller, and rocker bearings provide numerous locations for debris and moisture to collect. Expansion bearings should be examined for obvious evidence of recent movement (such as scraped paint, wear, or fretting rust). If no movement is evident, the inspector should take bearing measurements, and examine adjacent components (such as deck joints, railings, or curb plates) for evidence of recent expansion or contraction. Bearing malfunction can also result from bearing components that are worn, misaligned, broken, loose, or missing. Contact surfaces (plates, rollers, rockers, and pins) should be examined for wear and freedom of movement. Loose bearing components may be identified by noise (or movement) when the bridge is subjected to live loads.

Severe malfunction of an elastomeric bearing

Fixed pin truss bearing with severe loss of bearing area

Corroded (possibly frozen) sliding plate bearing

Bearings – Thermal Expansion and Contraction: The magnitude of the longitudinal movement of a bridge is dependent upon three factors – the coefficient of thermal expansion (steel and concrete are similar), the temperature range, and the structure length. As temperatures in Minnesota range from -30° F up to 110° F, a bridge bearing must be able to accommodate about 1-1/8" of longitudinal movement for every 100 ft. of structure length. In Minnesota, expansion bearings are typically designed to be in the neutral (centered) position at 40° F (nationally, the neutral temperature is assumed to be 68° F).

Expansion bearings should be periodically measured to ensure that they are functioning as intended. The horizontal (longitudinal) distance from the neutral alignment should be recorded. Bearing measurements should be taken to the nearest 1/8", and the temperature at the time of the measurement should be recorded. Thermal expansion or contraction which exceeds the bearing design limits can result in bearing failure – sliding plates may tip and lock, or rocker bearings may bind. The adjacent deck, superstructure, and substructure should be examined for contacting surfaces that might be preventing proper expansion.

Bearings - Lateral Movement and Uplift: Expansion bearings are often restrained from lateral movement by guide tabs, keeper bars, pintles, pin caps, or other mechanisms. Lateral guides should be examined for binding, particularly on skewed or curved bridges. Keeper bars on roller bearings can seize due to corrosion or debris – keeper bar failure could result in misalignment of rollers. Pintles that are exposed or sheared off may indicate excessive longitudinal movement.

Lateral restraint is sometimes provided by shear keys, shear lugs, or other devices that are incorporated into end diaphragms or floorbeams. Lateral restraint systems separate from the bridge bearings may be rated using Element #855 (Secondary Members – Superstructure).

Some bearings are also designed to resist uplift of the bridge superstructure – uplift forces may be present on curved bridges, anchor spans, steel pier caps, steel arch bridges, or on short end spans of continuous bridges. An uplift restraint system may consist of tension members such as anchor bolts or eyebars, or may incorporate a counterweight. Uplift restraints should be examined for section loss, cracking, binding, or connection failure. Anchor bolts may require periodic ultrasonic examination.

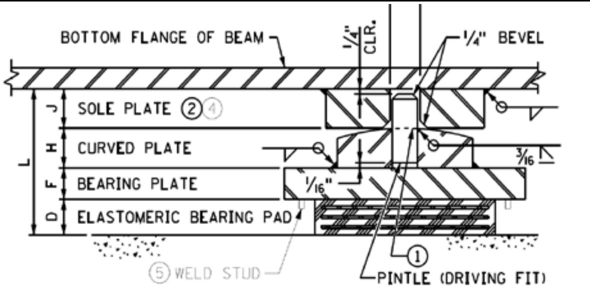
Sliding plate bearing near the design limits of expansion

Uplift (gap) on a curved plate fixed bearing

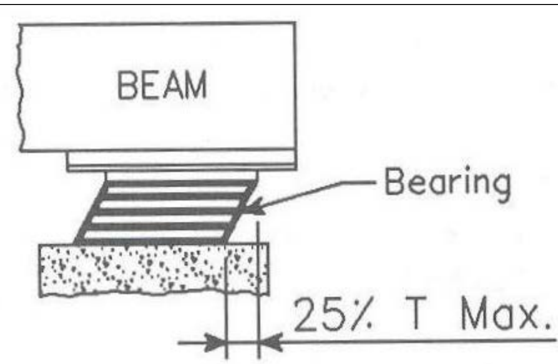
Anchor bolt failure on a fixed bearing

Bearings - Seats and Anchor Bolts: The bearing seats and anchor bolts should be examined for any evidence of deterioration or distress. Cracking or spalling of the bearing seat may indicate bearing anchorage failure – deterioration of the bearing seat can eventually result in loss of bearing area. Anchor bolts that are bent (or contacting the ends of slotted plates) may indicate excessive expansion or substructure movement. The position of bearing masonry plates should be measured and compared to the original plans, as they are sometimes reset due to substructure movement. Look for any evidence that the anchor bolts were not properly installed, such as bolts extending up too high or nuts not properly tightened.

B.3.9.2 Elastomeric Expansion Bearing (Element #310)

<table>
<tr><th colspan="2">#310: Elastomeric Expansion Bearing (Each)</th></tr>
<tr><td colspan="2">This element applies to elastomeric bearing pads that facilitate expansion by deformation. These bearings may include steel plates above or below the elastomeric pads.</td></tr>
<tr><td>
</td><td>MnDOT Spec. #3741 covers elastomeric bearing pads. The pads are comprised of alternating layers of elastomer (100% virgin chloroprene) and 1/8” thick steel plates, which are bonded together and covered.

Older elastomeric bearing pads may have fiberglass plates, or may be solid neoprene (with no internal reinforcement).</td></tr>
<tr><td></td><td>A curved steel pintle plate is usually placed on top of elastomeric pads to allow rotation due to deflection. The pintles fit into a sole plate attached to the bottom flange of the beam.

The pintle plate at left has small weldments on the underside to keep the pad from “walking”. Older elastomeric bearings may not have a pintle plate. Some elastomeric expansion bearings are restrained against lateral movement or uplift forces.</td></tr>
<tr><td>
</td><td>Elastomeric bearings can accommodate longitudinal movement up to approximately 25% of the pad thickness – the longer the span, the thicker the pad required.

While the pad deformation and orientation should correspond with the current temperature, the actual “neutral” position is the temperature when the bearing was installed. Example, a pad installed on a very hot day may always appear to be tipped in contraction.</td></tr>
<tr><td></td><td>Elastomeric bearings generally require less maintenance than mechanical expansion bearings, as they are less susceptible to debris and corrosion.

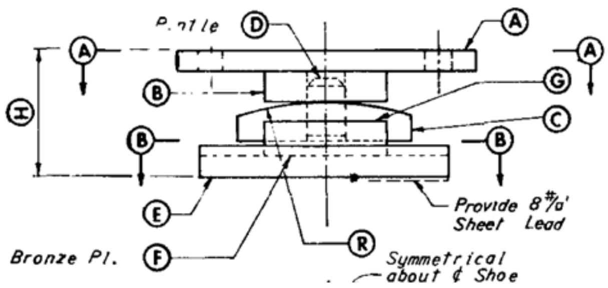
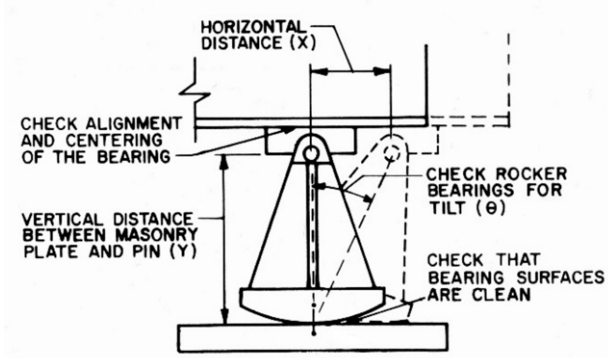
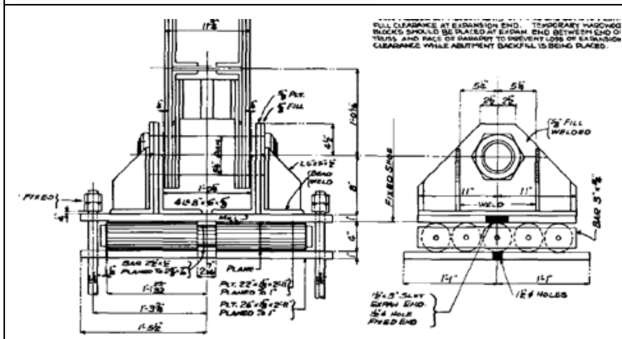
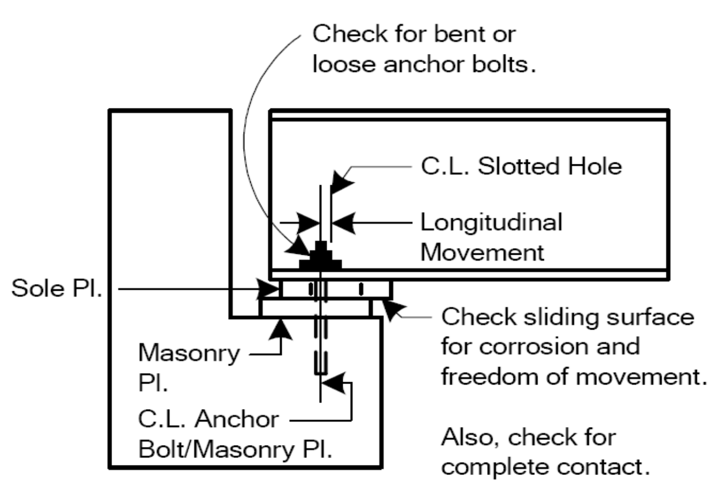
Elastomeric pads should be examined for excessive bulging, as well as splitting or tearing that expose the internal reinforcement plates.</td></tr>
<tr><td></td><td>Elastomeric pads have a tendency to “walk” out from beneath the upper plate. Any significant misalignment should be measured, noted, and monitored during future inspections.

Newer elastomeric bearings incorporate welded guides on the underside of the sole plate to keep them in position.</td></tr>
</table>

#310: Elastomeric Expansion Bearing (Each)				
Item or Defect	Structural Element Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
Bearing Movement & Structural Review	Free to move.	Minor restriction.	Restricted but not warranting structural review (no immediate structural concern).	Severe restriction - structural review is warranted. **or** resetting, repair, or replacement required.
Alignment (Deformation)	Alignment is appropriate for the current temperature.	Alignment is inconsistent for the current temperature.	Deformation is near design limits (25% of pad thickness).	Deformation is beyond design limits (25% of pad thickness).
Bearing Pad Position	Pad is properly positioned.	Pad has moved slightly (less than ½” beyond sole plate).	Pad has moved ½” to 2” beyond sole plate – resetting recommended.	Pad has moved more than 2” beyond sole plate – resetting required.
Bulging, Splitting or Tearing	None	Bulging less than 15% of pad thickness. Minor rolling along pad edges.	Bulging more than 15% of pad thickness. Splitting or tearing (internal plates exposed). Significant rolling along pad edges. Pad surfaces are not be parallel.	Splitting, bulging, de-bonding, or pad damage that severely impacts bearing function or capacity
Corrosion	None	Freckled rust (corrosion has initiated).	Section loss or pack rust is present.	Section loss severely impacts bearing function or capacity.
Plates, Restraints, or Anchor Bolts	Plates, restraints, or anchor bolts are sound, properly positioned, and functioning.	Anchor nuts loose or missing (bolts remain intact). Plates slightly misaligned. Restraint system is functioning.	Anchor bolts loose, bent or at expansion limits. Plates significantly misaligned. Welds broken. Restraints not functioning.	Anchorage or restraint failure has severely impacted bearing function or capacity. Plates severely misaligned.
Loss of Bearing Area	None	Less than 10%	10% to 25%	More than 25%

#310: Elastomeric Expansion Bearing (Each)	
Condition Rating Examples (Elastomeric Expansion Bearings)	
 **Condition State 2** **Elastomeric pads tipped in opposite directions**	 **Condition State 2** **Pad rolled up slightly on the bottom edge and moved from beneath sole plate (less than ½”)**
 **Condition State 3** **Pad has moved out from beneath the sole plate (more than ½” but less than 2”)**	 **Condition State 3** **Pad covering torn, internal plates rusting**
 **Condition State 4** **Pad has moved from beneath the curved pintle plate (nearly fallen off)**	 **Condition State 4** **Pad has moved from beneath the curved pintle plate (nearly fallen off)**

B.3.9.3 Expansion Bearing (Element #311)

#311: Expansion Bearing (Each)	
This element applies to mechanical expansion bearings of any type – such as sliding plate bearings, roller bearings, or rocker bearings. Expansion bearings allow for longitudinal movement of the superstructure due to thermal expansion and contraction. Most expansion bearings allow rotation of the superstructure due to live load deflection – some may be designed to restrict lateral movement or uplift forces.	
	Sliding plate bearings allow longitudinal movement by one steel plate sliding upon another (a curved pintle plate is sometimes included to allow for rotation). Sliding plate bearings often incorporate bronze plates or lubricants to facilitate movement. Lateral restraint may be provided by guide tabs, or by anchor bolts extending up through slots in the sole plate.
	Rocker bearings are typically comprised of a curved rocker plate (bearing on the masonry plate), that is connected to the sole plate with an upper pin. The bearing may have a single rocker or multiple rockers (“rockernest bearings”). Lateral restraint may be provided by pintles (attached to the masonry plate), pin caps, or anchor bolts extending up through slotted plates.
	A roller bearing consists of a horizontal steel cylinder that “rolls” between the sole plate and masonry plate as the superstructure expands and contracts. The bearing may have a single roller or multiple rollers (“rollernest bearing”). Lateral restraint may be provided by pintles (on the top and bottom of the roller), or keeper bars attached the ends of the rollers.
	

#311: Expansion Bearing (Each)				
Item or Defect	Structural Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Movement & Structural Review	No restriction of movement – bearing is functioning as intended.	Minor restriction (cleaning and/or lubrication recommended).	Restricted but not warranting structural review (no immediate structural concern). Cleaning and/or lubricating are required. Resetting or repairs recommended.	Severe restriction – structural review is warranted. **or** resetting, repairs, or bearing replacement are required.
Alignment	Alignment is appropriate for the current temperature.	Alignment is tolerable but is inconsistent for the current temperature	Alignment is near the design limits for expansion or contraction.	Alignment is beyond the design limits for expansion or contraction.
Primary Bearing Components	Primary bearing components are intact and properly positioned.	Primary bearing components are moderately worn or slightly misaligned.	Primary bearing components are significantly worn, damaged, or misaligned.	Primary bearing components are severely misaligned, jammed or detached.
Corrosion	None	Freckled rust (corrosion has initiated).	Section loss or pack rust is present.	Severe section loss impacts bearing function or capacity.
Connections	In place and functioning as intended.	Loose fasteners, but connection still functioning.	Missing fasteners (bolts, rivets, etc.) or broken welds.	Connection failure impacts bearing function or capacity.
Lateral Guide System, Uplift Restraints, or Anchor Bolts	Guides, restraints, or anchor bolts (if present) are sound, properly positioned, and functioning properly.	Anchor bolt nuts loose or missing (bolts remain intact). Guide or restraint system has minor deterioration but is functioning properly.	Anchor bolts loose, bent or at expansion limits. Lateral guide system moderately worn or misaligned. Uplift restraint has moderate deterioration, but is functioning properly.	Failure of anchor bolts or lateral guide system has severely impacted bearing function or capacity. Uplift restraint system has failed.
Loss of Bearing Area	None	Less than 10%	10% to 25%	More than 25%

#311: Expansion Bearing (Each)

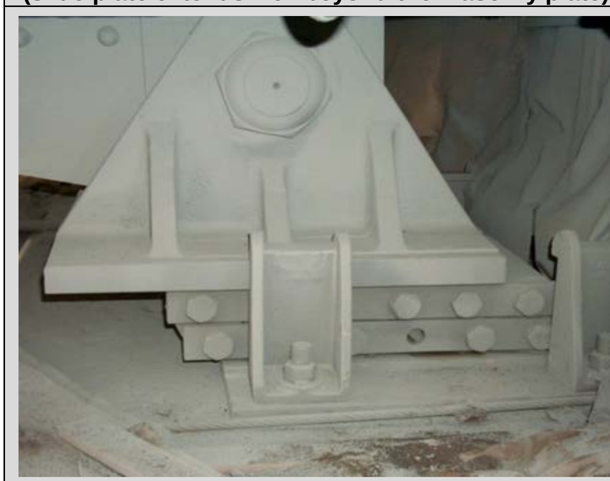
Condition Rating Examples (Expansion Bearings)

Condition State 2
Debris and surface corrosion on sliding plate bearing

Condition State 2
Surface corrosion on a rocker expansion bearing

Condition State 3
Sliding plate bearing near expansion limits (slide plate extends well beyond the masonry plate)

Condition State 3
Flaking rust and debris below rocker bearing (restriction of movement)



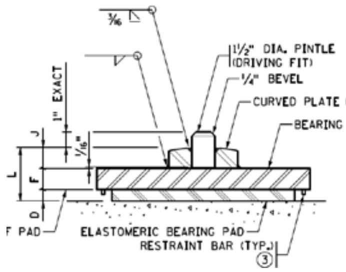
Condition State 4
Severe misalignment of rockernest bearing due to substructure movement

Condition State 4
Rocker bearing locked and sliding on the masonry plate

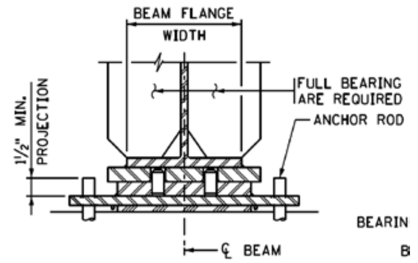
B.3.9.4 Fixed Bearing (Element #313)

#313: Fixed Bearing (Each)

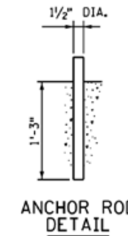
This element applies to bearings that are fixed against longitudinal movement of the superstructure. Fixed bearings may incorporate a pin, curved steel plate, or thin elastomeric pad to allow rotational movement (from live load deflection of the superstructure). Fixed bearings are typically designed to resist transverse movement, and may be designed to resist uplift forces.



Typical fixed bearing with upper curved plate and elastomeric pad.

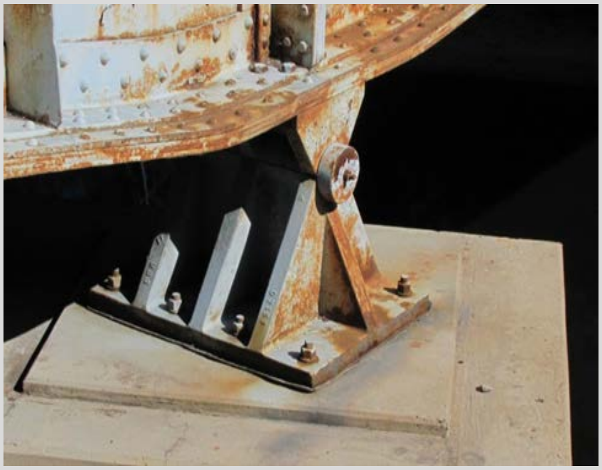


Typical fixed bearing with two anchor rods (1-1/2″ minimum projection).



Standard anchor rods are 18″ long (1-1/2″ dia.) with a 15" embedment depth.

Item or Defect	Structural Element Condition States			
	1 Good	**2 Fair**	**3 Poor**	**4 Severe**
Structural Review & Rotational Movement (If Allowed by Design)	Bearing is functioning as intended.	Minor rotational restriction (cleaning and/or lubrication recommended).	Rotational restriction not warranting structural review. Cleaning or lubricating required.	Severe rotational restriction. Structural review, repair, or replacement is required.
Primary Bearing Components	All components are intact and properly positioned.	Primary bearing components have moderate deterioration or slight misalignment.	Primary bearing components have significant deterioration or misalignment.	Primary bearing components have severe deterioration or misalignment (or have failed).
Elastomeric Pads or Lead Leveling Sheets	In place and functioning as intended.	Misaligned or extruded along the bearing plate.	Severely misaligned, deformed or extruded.	NA
Corrosion	None	Freckled rust (corrosion has initiated).	Section loss or pack rust is present.	Section loss severely impacts bearing function or capacity.
Connections	In place and functioning as intended.	Loose fasteners, but connection still functioning as intended.	Missing fasteners (bolts, rivets, etc.) or broken welds.	Connection failure severely impacts bearing function or capacity.
Anchor Bolts, Anchor Rods and Uplift Restraints	Anchor bolts and uplift restraints (if present) are properly installed.	Anchor bolts slightly misaligned. Anchor rod projects 3" to 6" above bearing.	Anchor bolts loose or bent. Anchor rod projects 6" to 10" above bearing. Uplift restraint is still functioning.	Failure of anchor bolt (or uplift restraint). Anchor rod projects more than 10" above bearing.
Loss of Bearing Area	None	Less than 10%	10% to 25%	More than 25%

#313: Fixed Bearing (Each)	
Condition Rating Examples (Fixed Bearings)	
 **Condition State 2** Surface corrosion on a fixed pin bearing	 **Condition State 2** Elastomeric pad is extruding and anchor bolt projects 4” above bearing
 **Condition State 3** Improperly installed anchor bolt extends 8” above bearing	 **Condition State 3** Flaking rust (section loss) and debris on two fixed pin bearings
 **Condition State 4** Masonry plate cracked (and supporting pier fractured) on a fixed pin bearing	 **Condition State 4** Anchor bolt failure on a fixed pin bearing (masonry plate has slid back to the parapet)

B.3.9.5 Pot and Disk Bearings (Elements #314 and #315)

#314: Pot Bearing (Each)
#315: Disk Bearing (Each)

Pot and Disk bearings allow for multi-dimensional rotational movement. These are specialized bearings used for high loads (long spans, steel pier caps, or railroad bridges). It is difficult to distinguish pot bearings from disc bearings without referencing plans or shop drawings.

- Pot bearings consist of a shallow steel piston resting within a steel cylinder, which contains a confined elastomer. Typically, only the perimeter edge of the elastomer is visible for inspection. Pot bearings are not recommended for use on railroad bridges.
- Disk bearings consist of a shallow steel piston resting within a steel cylinder, which contains a semi-spherical disc (hard plastic or steel). The “disc” is enclosed within the assembly and is typically not visible for inspection. Disk bearings are most common on railroad bridges.

Pot/Disk bearings may be “fixed” against horizontal movement (but allowing rotation), “guided expansion” (allowing horizontal expansion/contraction but lateral movement is restricted), or “non-guided expansion” (free to move in any direction).

The photo on the left shows a fixed pot bearing with uplift restraint pins.

On a typical expansion pot bearing, the upper plate has a “mirror finish stainless steel plate welded to the underside, and the lower plate has polytetrafluoroethylene (PFTE) bonded to the top surface. This combination provides an extremely low friction sliding surface (lubrication is not required).

The photo on the left shows an expansion pot bearing with a center guide key. The stainless steel plate should be examined evidence of separation (or pack rust). Look for evidence of movement, such as wear near the guide or on the stainless steel plate.

On guided expansion pot bearings, look for evidence of wear, binding, or deterioration of the guide system. The upper piston plate should be properly seated (and positioned) within the lower cylinder plate. Visible portions of the elastomer should be examined for splitting, tearing, or extrusion.

The photo on the left shows an expansion pot bearing with a guide bars on both edges. The lower plate should be examined for any wear or de-bonding of the PTFE. The presence of shavings in the photo at left indicates wear on the PTFE slide surface.

The photo on the left shows an unguided expansion pot bearing. While these bearings are designed to allow free movement in any direction, any measurable lateral movement should be noted.

Longitudinal movement can be measured by the offset between the centerline of the upper and lower plates.

#314: Pot Bearing (Each) #315: Disk Bearing (Each)				
Item or Defect	Structural Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Movement and Structural Review	No restriction of movement – bearing is functioning as intended.	Minor restriction (cleaning and/or lubrication recommended).	Restricted but not warranting structural review (no immediate structural concern). Cleaning and/or lubricating required. Resetting or repairs recommended.	Severe restriction – structural review is warranted. **or** resetting, repairs, or bearing replacement are required.
Alignment	Alignment is appropriate for the current temperature	Alignment is tolerable but is inconsistent for the current temperature.	Alignment is near the design limits for expansion or contraction.	Alignment is beyond the design limits for expansion or contraction.
Primary Bearing Components	Primary components are intact and properly positioned.	Primary bearing components are slightly worn or misaligned.	Primary bearing components are significantly worn or misaligned.	Primary bearing components are severely deteriorated, misaligned, jammed or detached.
Corrosion	None	Freckled rust (corrosion has initiated).	Section loss or pack rust is present.	Section loss severely impacts bearing function or capacity.
Connections	In place and functioning as intended.	Loose fasteners, but connection still functioning as intended.	Missing fasteners (bolts, rivets, etc.) or broken welds.	Connection failure severely impacts bearing function or capacity.
Lateral Guide System, Uplift Restraints, or Anchor Bolts	Guides, restraints, or anchor bolts (if present) are sound, and functioning properly.	Anchor bolt nuts loose or missing (bolts remain intact). Guide or restraint system has minor deterioration but is still functioning properly.	Anchor bolts loose or bent. Lateral guide system moderately worn or misaligned. Uplift restraint system has moderate deterioration, but is still functioning.	Failure of anchor bolts, lateral guide system, or uplift restraint system has severely impacted bearing function or capacity.
Loss of Bearing Area	None	Less than 10%	10% to 25%	More than 25%

#314: Pot Bearing (Each) #315: Disk Bearing (Each)	
Condition Rating Examples (Pot and Disk Bearings)	
 **Condition State 2** **Loose sole plate bolts on a fixed pot bearing**	 **Condition State 2** **Teflon strop peeling off from the guide bar on a guided expansion pot bearing**
 **Condition State 2** **Paint/galvanizing failure and surface corrosion on a fixed pot bearing**	 **Condition State 3** **Pack rust on the sliding plate on a free expansion pot bearing**
 **Condition State 3** **Teflon shavings due to wear on the sliding surface of a free expansion pot bearing**	 **Condition State 3** **Flaking rust on a free expansion pot bearing**

B.3.9.6 Pin and Hanger Assembly/Pinned Connection (Element #161)

This element applies to pin and hanger assemblies and fixed pin assemblies. This element should also be used for pin-connected trusses, arches, columns, or any pinned connection on a primary bridge structural element that is not rated under a bearing element.

Pin and Hanger Assembly on a Riveted Steel Girder Bridge

Fixed Pin Assembly on a Riveted Steel Girder Bridge

Ultrasonic Examination of a Pinned Truss Connection

On continuous steel bridges with cantilever or suspended spans (where the end of one span is supported by an adjacent span), the connection detail may consist of a pinned assembly. Pin and hanger (or fixed pin) assemblies are relatively rare in Minnesota. They are mostly present on steel multiple girder/beam bridges constructed from 1935 to 1975. A pin and hanger assembly typically consists of two vertical hanger plates with pinned connections at the top and bottom. This allows both rotation and longitudinal movement of the superstructure. Pin and hanger assemblies may incorporate a guide/restraint system to prevent lateral movement. A fixed pin assembly has only one pin. This allows rotation, but restricts longitudinal movement of the superstructure. Some bridges in Minnesota have “swivel hinges” – the center girder will have a fixed pin assembly, while the other girders will have pin and hanger assemblies.

Pinned assemblies on bridges that carry highway traffic require periodic ultrasonic examination. Pinned assemblies should be examined for deterioration, function, alignment, as well as the soundness of the adjacent superstructure support. All of these factors should be taken into consideration when rating a pinned assembly. All components of a pinned assembly (pins, plates, pin caps, nuts, washers, spacers, etc.) should be examined for wear, corrosion, defects, cracks, bending, loosening or misalignment. Note: Severe pack rust can deform hanger plates or result in failure of pinned connections.

Periodic measurements should be taken to verify the proper function of pin and hanger assemblies (be sure to record the temperature at the time of inspection). As a frozen pin will transfer additional bending stresses to the hanger plates, any significant restriction of a pin and hanger assembly should be identified and analyzed immediately. Note: While the presence of fretting rust (a red-colored dust resulting from the wearing of steel surfaces) indicates that recent movement has occurred, it may also indicate inadequate lubrication.

Pin-connected steel truss bridges are extremely rare in Minnesota – these were generally constructed prior to 1920. Steel pier columns with pinned connections (that allow the pier to tip) are sometimes found on bridges in areas with unstable soil conditions. Pinned connections are sometimes present on newer bridges, such as hanger cable connections on a suspension bridge.

#161: Pin and Hanger Assembly or Pinned Connection (Each)				
This element applies to steel pin and hanger assemblies or fixed pin connections. This element should also be used for pin-connected trusses, arches, columns, or any pinned connection on a primary bridge structural element that is not rated under a bearing element. • A pin and hanger assembly can be grouped as "1" when determining the element quantity. • As this is an NBE steel element, the coating system must be rated as a separate sub-element using Element #515 (Steel Protective Coating).				
Item or Defect	**Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Movement and Structural Review	No restriction. Pinned connection is functioning as intended.	Minor restriction (cleaning and/or lubrication recommended).	Restricted but not warranting structural review. Cleaning or lubricating required. Repairs recommended.	Severe restriction – structural review is warranted. Repair or replacement is required.
Longitudinal Alignment (Pin & Hangers)	Alignment is appropriate for the current temperature.	Alignment is tolerable but is inconsistent for the current temperature.	Expansion or contraction is near the design limits.	Expansion or contraction is beyond the design limits.
Misalignment	None	Slightly out of position or alignment.	Significantly out of proper position or alignment.	Severely out of proper position or alignment.
Pinned Connection or Pinned Assembly Components	All components are intact and properly positioned.	Plates or pins have minor wear. Cotter pins missing.	Plates or pins are significantly worn. Cap nuts are loose.	Connection has failed (or failure is eminent). Pins or plates have severe wear. Cap nuts missing.
Corrosion	None	Surface corrosion (freckled rust).	Section loss, flaking rust, or pack rust is present.	Section loss exceeds 10% of cross section.
Cracking	None	Crack has self-arrested or has been arrested.	Crack that is unlikely to propagate into a critical stress area.	Crack that has propagated into a critical stress area.
Distortion	None	Mitigated distortion.	Significant distortion.	Severe distortion

#161: Pin and Hanger Assembly or Pinned Connection

Condition Rating Examples (Pinned Connections)

Condition State 2
Paint failure and surface corrosion on a pin and hanger assembly

Condition State 3
Pin and hanger near limits of expansion, fretting rust on top pin and section loss on hanger plate

Condition State 3
Pack rust distortion on the hanger plate on a pin and hanger connection

Condition State 4
Severe pack rust and section loss on a pinned truss connection

B.3.9.7 Hinge Bearing Assemblies (Elements #850 and #851)

Hinge bearing assemblies are the connection detail on continuous bridges with cantilever joints or suspended spans (where the end of one span is supported by an adjacent span). Hinge bearings are often "cantilevered" (offset from the piers), to reduce deterioration of the substructure from leaking deck joints. In Minnesota, cantilever hinge bearings were relatively common on continuous steel multi-beam bridges constructed in the 1960's and 1970's – they are seldom used on newer bridges. Hinge bearings are sometimes used on continuous concrete box girder bridges.

Hinge bearings may be expansion (permitting longitudinal movement of the superstructure) or fixed (resisting longitudinal movement of the superstructure). Most hinge bearings are designed to allow rotation of the superstructure due to live load deflection – some are designed to restrict lateral movement of the superstructure. Hinge bearings can include a variety of bearing assembly types (rocker, roller, sliding plate, elastomeric pad, or pot bearings).

Hinge Bearing Assembly Types	
 Rocker (Expansion) Hinge Bearing	 Roller (Expansion) Hinge Bearing
 Sliding Plate (Expansion) Hinge Bearing	 Curved Plate (Fixed) Hinge Bearing

As there are no AASHTO elements for hinge bearing assemblies; MnDOT created two agency defined elements (ADEs).

- **#850: Steel Hinge Assembly:** applies to hinge bearings on steel superstructures (typically girders or beams).
- **#851: Concrete Hinge Assembly:** applies to hinge bearings on concrete superstructures (typically box girders).

Hinge bearing assemblies should be examined for deterioration, function, alignment, as well as the soundness of the superstructure support. All of these factors should be taken into consideration when rating a hinge bearing element. The following items should be emphasized when inspecting a hinge bearing assembly.

- Hinge bearing assemblies should be examined for corrosion or debris. Adjacent deck joints and deck drainage systems should be examined for leakage, clogging, or other malfunction that might be exposing the hinge bearing to water, salt, or debris.
- Hinge bearing components (rockers, rollers, sliding plates, elastomeric pads, pins, nuts, washers, cotter pins, spacers and guide tabs) should be examined for wear, corrosion, defects, cracks, bending, loosening or misalignment. Excessive movement (or noise) at the hinge bearing under live loads may indicate bearing malfunction.
- Proper function of expansion hinge bearings is a primary concern. A malfunctioning expansion hinge could damage adjacent deck, superstructure, or substructure elements. The inspector should verify that longitudinal movement is not restricted (any significant restriction should be identified and analyzed immediately). Obvious visual evidence of recent movement (such as scrape marks on contact surfaces) should be noted. The adjacent superstructure and deck should be examined for any evidence of contact that could restrict expansion. To verify proper function, periodic measurements should be taken (preferably at a clean, easily identifiable location) – be sure to record the temperature when the measurements were taken. If the hinge bearings cannot be accessed up-close, measurements can be taken at adjacent deck joints, curb plates, or railings.
- The longitudinal, lateral, and vertical alignment of the hinge bearing should be observed and noted. Misalignment of a hinge bearing may indicate significant problems elsewhere on the bridge (such as substructure settlement or tipping). On expansion hinge bearings, the longitudinal alignment should be appropriate for the current temperature, and the alignment of adjacent hinge bearings should be similar.
- The superstructure adjacent to the hinge bearing assembly should be examined for deterioration (or evidence of structural distress). On steel beams, the webs, flanges, and bearing stiffeners should be examined for corrosion, section loss, bulking, or cracking. On concrete box girders, the concrete surfaces should be examined for structural cracking, leaching, rust staining, delamination, or spalling (internal inspection of the hinge area is recommended).

Scrape marks on a sliding plate hinge bearing indicate recent movement

Misaligned hinge bearing

Hinge bearing in full expansion (beam ends contacting)

#850: Steel Hinge Bearing Assembly (Each)				
This element applies to hinge bearings on steel girders, beams, or other steel superstructure members. This includes expansion or fixed hinge bearings of any type (rocker, roller, sliding plate, or elastomeric pad). This element may also be used for any bearing assembly where a steel superstructure element bears upon another steel superstructure element. This is an “each” item, a condition state must be determined for each hinge assembly.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Movement and Structural Review	No restriction. Hinge is functioning as intended.	Minor restriction (cleaning and/or lubrication recommended).	Restricted but not warranting structural review. Cleaning or lubricating required. Repairs recommended.	Severe restriction – structural review is warranted. Resetting, repairs, or replacement are required.
Longitudinal Alignment	Alignment is appropriate for the current temperature.	Alignment is tolerable but is inconsistent for the current temperature.	Expansion or contraction is near the design limits.	Expansion or contraction is beyond the design limits.
Misalignment (Lateral)	None	Slight	Significant	Excessive
Hinge Components	All components are intact and properly positioned.	Hinge components have moderate deterioration or are slightly misaligned.	Hinge components are significantly deteriorated or misaligned.	Hinge components have severe deterioration or misalignment (jammed, detached, or otherwise failed).
Corrosion	None	Surface corrosion (freckled rust).	Section loss, flaking rust, or pack rust is present.	Section loss that severely impacts function or capacity.
Guide, Restraint, or Anchorage System	Guides, restraints, and anchorages are sound and functioning properly.	Anchor nuts loose or missing (bolts remain intact). Plates slightly misaligned. Restraint system is still functioning properly.	Anchor bolts loose, bent or at expansion limits. Plates significantly out of position. Broken welds. Restraints are not functioning properly.	Failure of anchor bolts or restraint system has severely impacted bearing function or capacity. Pintle or bearing plates severely out of position.
Loss of Bearing Area	None	Less than 10%	10% to 25%	More than 25%
Adjacent Members	Little or no deterioration.	Minor to moderate deterioration.	Extensive deterioration.	Severe or critical deterioration.

#850: Steel Hinge Bearing Assembly (Each)	
Condition Rating Examples (Steel Hinge Bearing Assembly)	
 **Condition State 2** **Minor corrosion on a sliding plate hinge**	 **Condition State 2** **Minor corrosion on a sliding plate hinge**
 **Condition State 3** **Lateral guide below hinge bearing is severely corroded (possibly restricting movement)**	 **Condition State 3** **Pack rust under a rocker expansion hinge**
 **Condition State 4** **Severe corrosion on a sliding plate hinge (severe section loss in beam web above hinge)**	 **Condition State 4** **Sliding plate hinge locked in expansion (curved slide plate tipped)**

#851: Concrete Hinge Bearing Assembly (Each)				
This element applies to hinge bearings on concrete bridges (where a concrete superstructure element bears upon another concrete superstructure element). This includes expansion or fixed hinge bearings of any type (rocker, roller, sliding plate, pot, or elastomeric pad). This is an "each" item – a condition state may be determined for each individual hinge assembly or the entire hinge joint may be rated as a unit.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Movement and Structural Review	No restriction. Hinge is functioning as intended.	Minor restriction (cleaning and/or lubrication recommended).	Restricted but not warranting structural review. Cleaning or lubricating required. Repairs recommended.	Severe restriction – structural review is warranted. Resetting, repairs, or replacement are required.
Longitudinal Alignment	Alignment is appropriate for the current temperature.	Alignment is tolerable but is inconsistent for the current temperature.	Expansion or contraction is near the design limits.	Expansion or contraction is beyond the design limits.
Lateral Misalignment	None	Slight	Significant	Excessive
Hinge Components	All components are intact and properly positioned.	Hinge components have moderate deterioration or slight misalignment.	Hinge components are significantly deteriorated or misaligned.	Hinge components have severe deterioration or misalignment (jammed, detached, or otherwise failed).
Corrosion	None	Freckled rust (corrosion has initiated).	Section loss or pack rust is present.	Section loss that severely impacts function or capacity.
Guide, Restraint, or Anchorage System	Guides, restraints, and anchorages are sound and functioning properly.	Anchor nuts loose or missing (bolts remain intact). Plates slightly misaligned. Restraint system is still functioning properly.	Anchor bolts loose, bent or at expansion limits. Plates significantly out of position. Broken welds. Restraints are not functioning properly.	Failure of anchor bolts or restraint system has severely impacted bearing function or capacity. Pintle or masonry plates severely out of position.
Loss of Bearing Area	None	Less than 10%	10% to 25%	More than 25%
Adjacent Members	Little or no deterioration.	Minor to moderate deterioration.	Extensive deterioration.	Severe or critical deterioration.

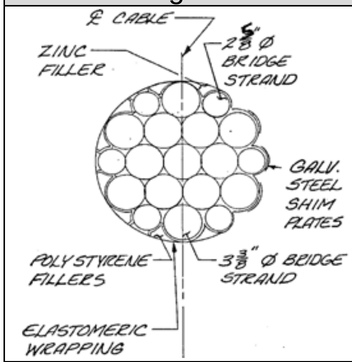
#851: Concrete Hinge Bearing Assembly (Each)	
Condition Rating Examples (Concrete Hinge Bearing Assembly)	
 **Condition State 2** Cracking on concrete adjacent to hinge adjacent concrete	 **Condition State 2** Structural retrofit at a hinge joint in a concrete box girder
 **Condition State 3** Spalling on concrete box girder adjacent to hinge	 **Condition State 3** Rust staining and cracking in concrete box girder at hinge joint
 **Condition State 4** Extensive (and severe) spalling on concrete box girder adjacent to hinge	 This bridge near Montreal (Canada) collapsed in 2006 due to failure of a concrete hinge, resulting in five fatalities

B.3.9.8 Steel Cables (Elements #147 and #148)

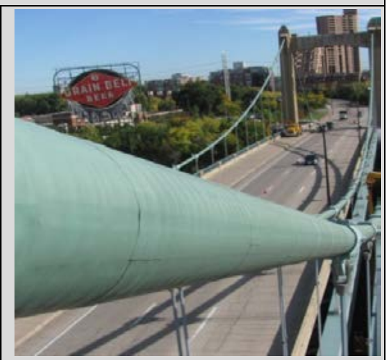
#147: Steel Main Cable (LF)

This element applies only to the primary steel support cables on suspension or cable-stayed bridges. The quantity is the total length of all main cables on the bridge, measured along the length of each main cable from anchorage to anchorage. Anchorages should be considered in the condition rating.

- Steel main cables are typically galvanized, and often have an additional protective wrapping and/or coating. The steel protective coating should be rated as a sub-element using Element #515.



A cross-section of the main suspension cables on the Hennepin Ave. bridge is shown at left. Each cable is comprised of 19 steel bridge strands. The bridge strands (3-3/8" or 2-5/8" diameter) are comprised of helically-wound galvanized wires. Except inside the underground chambers (where the strands splay out to individual anchorages), only the outer elastomeric wrapping is visible for inspection (photo on right).



Item or Defect	Structural Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review of existing defects has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** structural review has determined that the defects impact strength or serviceability.
Corrosion	None	Surface corrosion.	Section loss or pack rust.	Section loss exceeds 5% of the cross-section.
Frayed, Worn, or Damaged Cables	None	Minor wear or abrasion that has been mitigated. Minor strand or wire separation.	Active wear or abrasion at contact points. Isolated fraying or severing of individual wires. Significant strand or wire separation.	Severe wear or abrasion. Multiple wires frayed, severed or loose.
Cable Banding	Banding is intact.	Banding is loose.	Banding has failed.	NA
Vibration	Little or no vibration.	Slight (or mitigated) vibration.	Moderate vibration.	Significant vibration.
Cable Anchorage	Minor deterioration.	Moderate deterioration.	Significant deterioration. Evidence of slight cable loosening or slippage.	Severe deterioration or anchorage failure.

<table>
<tr><th colspan="5">#148: Secondary Steel Cable (Each)</th></tr>
<tr><td colspan="5">This element applies to steel cables that transfer loads from the bridge superstructure to the main cable (or arch). Examples include vertical hanger cables on suspension or tied arch bridges. The quantity may be the total number of secondary cables or the number of secondary cable “groups” (groups of cables at one location). The cable anchorages should be included in the condition rating. Secondary cables are typically steel structural strands or wire ropes comprised of galvanized wires.
• The steel protective coating should be rated as a sub-element using Element #515.</td></tr>
<tr><th rowspan="3">Item or Defect</th><th colspan="4">Structural Element Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Structural Review</td><td>Structural review is not required.</td><td>Structural review is not required.</td><td>Structural review is not required <u>or</u> structural review of existing defects has determined that strength or serviceability has not been impacted.</td><td>Condition warrants structural review <u>or</u> structural review has determined that the defects impact strength or serviceability.</td></tr>
<tr><td>Corrosion</td><td>None</td><td>Surface corrosion.</td><td>Section loss or pack rust.</td><td>Section loss exceeds 5% of the cross-section.</td></tr>
<tr><td>Frayed, Worn, or Broken Strands</td><td>None</td><td>Minor wear or abrasion that has been mitigated. Minor strand or wire separation.</td><td>Active abrasion or wear at contact points. Isolated fraying of individual wires. Significant strand or wire separation.</td><td>Severe abrasion or wear. Multiple wires frayed, severed or loose.</td></tr>
<tr><td>Cable Banding</td><td>Banding is intact.</td><td>Banding is loose.</td><td>Banding has failed.</td><td>NA</td></tr>
<tr><td>Vibration</td><td>Little or no vibration.</td><td>Slight (or mitigated) vibration.</td><td>Moderate vibration.</td><td>Significant vibration.</td></tr>
<tr><td>Cable Anchorage</td><td>Minor deterioration</td><td>Moderate deterioration (no evidence of distress).</td><td>Significant deterioration. There may be evidence of loosening or slight slippage.</td><td>Severe deterioration or anchorage failure. There may be significant slippage.</td></tr>
</table>

#148: Secondary Steel Cable (Each)	
Condition Rating Examples (Secondary Steel Cables)	
 **Condition State 2** **Minor wear on steel strand hanger cable**	 **Condition State 3** **Active abrasion at contact point (steel wire rope hanger cable wearing against a steel batten plate)**
 **Condition State 3** **Corrosion on steel strand hanger cable just above the anchorage socket**	 **Condition State 4** **Cable failure due to fractured anchorage plate**

B.3.9.9 Secondary Members (Elements #855 and #856)

#855: Secondary Members – Superstructure (1 Each)

This element applies to secondary members that are part of the bridge superstructure (such as diaphragms, bracing, or struts). This element includes any material – steel, concrete, timber, or masonry. This element may also be used for moveable bridge components (such as sheaves, trunnions, turntables, or counterweights). This element should not be used for culvert structures.

The quantity is typically listed as “1”, and should reflect the condition of the most deteriorated secondary member. The element notes should describe the secondary superstructure members present on the bridge.

- Element #515 Steel Protective Coating is not rated as a specific sub-element for secondary members. The paint condition for steel secondary elements should be included in the painted area for the most appropriate steel element.

Item or Defect	Structural Element Condition States			
	1 Good	**2 Fair**	**3 Poor**	**4 Severe**
Structural Review and Repairs	Little or no deterioration	Minor to moderate deterioration. Any repaired or reinforced areas are sound.	Extensive deterioration, but secondary member is still functioning as intended. Repairs are deteriorated.	Severe damage or deterioration. Secondary member is not functioning as intended – structural analysis or immediate repairs are required.
Steel	No corrosion.	Surface corrosion (freckled rust).	Section loss or pack rust. Minor cracks.	Advanced corrosion (severe section loss). Significant cracks.
Concrete	Minor cracking.	Moderate cracking, scale, or leaching. Minor spalls or delaminations.	Extensive cracking, scale, or leaching. Significant spalling or delamination or (exposed rebar).	Severe structural cracking or extensive spalling (exposed rebar may have severe section loss).
Timber	Minor cracking or splitting.	Moderate splits, decay, or fire damage.	Extensive splits, decay, or fire damage (minor sagging or crushing).	Advanced decay. Severe structural cracking, sagging, or crushing.
Connections	Connections are sound.	Connections have minor distress.	Connections are loosening.	Connections have failed.
Impact Damage	None	Minor dents, gouges, spalls, or scrapes.	Moderate impact damage – members bent out of plane.	Severe impact damage – members severed or severely bent.

#855: Secondary Members – Superstructure (1 Each)

Condition Rating Examples (Secondary Members – Superstructure)

Condition State 2
Surface corrosion (freckled rust) on a steel diaphragm

Condition State 2
Delamination and spall on a concrete end diaphragm (adjacent to a prestressed beam)

Condition State 3
Flaking rust (section loss) on a steel diaphragm

Condition State 3
Loose bolts on a steel diaphragm connection

Condition State 4
Truss portal brace fractured

Condition State 4
Truss portal brace severely damaged

#856: Secondary Members – Substructure (1 Each)

This element applies to secondary members that are part of the bridge substructure (such as pier bracing, crash struts, or buttresses). This element should not be used for culvert structures. This includes any material – steel, concrete, timber, or masonry.

The quantity is typically listed as “1”, and should reflect the condition of the most deteriorated secondary member. The element notes should describe the secondary substructure members present on the bridge.

- Element #515 Steel Protective Coating is not rated as a specific sub-element for secondary members. The paint condition for steel secondary elements should be included in the painted area for the most appropriate steel element.

Item or Defect	Structural Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Structural Review and Repairs	Little or no deterioration	Minor to moderate deterioration. Any repaired or reinforced areas are sound.	Extensive deterioration, but the secondary member is still functioning as intended. Repaired or reinforced areas may be unsound.	Severe damage or deterioration. Secondary member is no longer functioning as intended – structural analysis or immediate repairs are required.
Steel	No corrosion.	Surface corrosion (freckled rust).	Section loss or pack rust. Minor cracks.	Advanced corrosion (severe section loss). Significant cracks.
Concrete	Minor cracking.	Moderate cracking, scale, or leaching. Minor spalls or delaminations.	Extensive cracking, scale, or leaching. Significant spalling or delamination or (exposed rebar).	Severe structural cracking or extensive spalling (exposed rebar may have severe section loss).
Timber	Minor cracking or splitting.	Moderate splits, decay, or fire damage.	Extensive splits, decay, or fire damage (minor sagging or crushing).	Advanced decay. Severe structural cracking, sagging, or crushing.
Connections	Connections are sound.	Connections have minor distress.	Connections are loosening.	Connections have failed.
Impact Damage	None	Minor dents, gouges, spalls, or scrapes.	Moderate impact damage – members bent out of plane.	Severe impact damage – members severed or severely bent.

<table>
<tr><th colspan="2">#856: Secondary Members – Substructure (1 Each)</th></tr>
<tr><th colspan="2">Condition Rating Examples (Secondary Members – Substructure)</th></tr>
<tr><td>
Condition State 1
Concrete wall protecting a steel pier column adjacent to a railroad track</td><td>
Condition State 2
Minor Ice abrasion on a timber pier bracing plank</td></tr>
<tr><td>
Condition State 3
Spalling on a concrete pier strut</td><td>
Condition State 3
Steel pier brace bent (batten plate detached)</td></tr>
<tr><td>
Condition State 3
Fractured shear key on a concrete pier cap</td><td>
Condition State 4
Severe ice damage to timber pier bracing planks</td></tr>
</table>

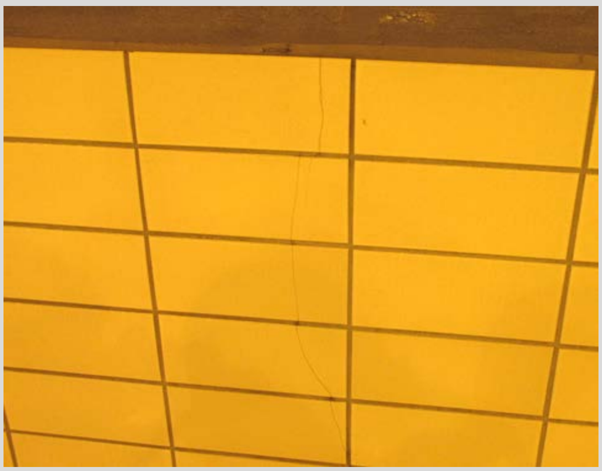
B.3.9.10 Non-Integral Retaining Wall (Element #861)

#861: Non-Integral Retaining Wall (Each)				
This element is primarily intended for retaining walls (of any material) that are adjacent to the abutment (or wingwall), but are separated by a construction joint. This will generally include retaining walls extending from the abutment/wingwall up to the approach relief joint (or end of the roadway approach). This element could be used for any other retaining walls that are important to the function or safety of the bridge. This is an "Each" quantity (one for each retaining wall present).				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review or Repairs	Structural review or repairs are not required. No previous structural repairs are present.	Structural review or repairs are not required. Any existing structural repairs are in sound condition.	Repairs may be recommended (structural review is not required) **or** Structural review has determined that strength or serviceability has not been impacted.	Condition warrants a structural review **or** Structural review has determined that the defects impact strength or serviceability.
Tipping or Settlement	None	Within tolerable limits or arrested (no structural distress).	Exceeds tolerable limits.	Stability or function has been reduced.
Concrete	Minor cracking, scaling, or leaching (no delaminations or spalls).	Moderate cracking, scaling, or leaching. Minor delamination or spalling – any exposure of reinforcement is minimal.	Extensive cracking, scaling, or leaching. Significant structural cracking. Delamination or spalling is prevalent. Exposed rebar has measurable section loss.	Severe scaling or spalling. Exposed reinforcement has severe section loss. Severe structural cracking.
Steel	Little or no corrosion.	Moderate surface corrosion. Minor flaking rust or pack rust (minimal section loss).	Extensive corrosion (measurable section loss). Minor cracks are present.	Advanced corrosion (severe section loss). Significant cracks or fractures.
Timber	Minor cracking or splitting.	Moderate splits, decay, or fire damage.	Extensive splits, decay, or fire damage – there may be some sagging or crushing.	Advanced decay. Severe structural cracking, sagging, or crushing.
Masonry	Minor weathering.	Mortar deterioration. Moderate spalling, splitting, or displacement.	Extensive mortar deterioration. Extensive spalling, splitting, or displacement.	Severe spalling, splitting, or displacement.

B.3.9.11 Tiled Surface (Element #862)

#862: Tiled Surface (SF)				
This element applies to ceramic tiled surfaces on concrete structures. This typically includes concrete rigid frame structures or NTIS tunnels, but may apply to tiled surfaces on any concrete element. The SF quantity should correspond with the total area of tiled surfaces on the structure.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Tiled Surfaces	Tiles are in good condition and securely attached.	Tile cracked but still secure. Tiles scraped, gouged or stained.	Tiles broken, delaminated or loose.	Tiles missing. Loose tiles that pose a significant safety concern.

Condition Rating Examples (Tiled Surfaces)



Condition State 2
Tile cracked (still secure)

Condition State 2
Tile Stained

Condition State 3
Delaminated Tiles (Marked with "X")

Condition State 4
Tiles missing

B.3.9.12 Decorative Facade (Element #863)

#863: Decorative Facade (LF)

This element is intended for decorative facades along the fascia of bridge structures. These facades are typically not part of the primary load path, but must support their own weight and would be subjected to wind loads and vibration. These are most commonly precast concrete panels, but could be cast-in-place concrete or comprised or other materials. This is an "LF" quantity (measured along the length of the decorative facade.

Precast concrete façade with faux masonry surface

Precast concrete façade (detail at abutment)

Fiberglass panels mounted on bridge fascia

Item or Defect	Structural Element Condition States			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review and Repairs	Little or no deterioration (no repairs present)	Minor to moderate deterioration. Any repaired or reinforced areas are sound.	Extensive deterioration. Repairs may be recommended.	Severe damage or deterioration. Structural analysis or immediate repairs are required.
Concrete	Minor cracking, scaling, or leaching (no delaminations or spalls).	Moderate cracking, scaling, or leaching. Minor delamination or spalling.	Extensive cracking, scaling, or leaching. Significant cracking. Spalling with exposed reinforcement. Significant delamination.	Severe scaling or spalling. Exposed reinforcement has severe section loss. Severe cracking.
Other Material Deterioration	None	Initiated breakdown or deterioration.	Significant deterioration.	Severe or critical deterioration.
Connections	Connections are sound.	Connections have minor corrosion or distress.	Connections have extensive corrosion. Connections are loosening.	Connections have failed.

Condition Rating Examples (Decorative Façade)

Condition State 2
Leaching crack on precast concrete panel

Condition State 3
Significant cracking and spalling on façade due to impact damage

B.3.10 CULVERT ELEMENTS

B.3.10.1 Inspection Procedures for Culverts

While the FHWA requires inspection of any structure with a total length of 20 ft. or greater, Minnesota State law requires inspection of any structure with a total length of 10 ft. or greater – thus, the MnDOT structure inventory includes many small (10 ft. to 20 ft.) culverts.

While culverts are typically designed to allow drainage below a roadway embankment, they may also serve as underpasses for vehicles, pedestrians, or livestock. Culverts are designed to support the dead load of the embankment material as well as live loads from traffic. If the embankment fill is more than 3 ft. deep, the fill is likely the primary load.

Culverts are constructed of a variety of materials, including concrete (cast-in-place or precast), corrugated steel plate, stone masonry, timber, or aluminum. The size and shape of a culvert is usually determined by the hydraulic requirements (the opening must be large enough to carry the design discharge). Culvert shapes include arch culverts, box culverts, round pipe culverts, pipe-arch culverts, or elliptical culverts. A culvert may consist of a single barrel or multiple barrels.

Culverts can be structurally classified as either “flexible” or “rigid”. Steel culverts are typically considered to be flexible – a flexible culvert derives a significant amount of structural strength from the surrounding soil (the lateral soil pressure helps to resist vertical loads). Concrete culverts are typically considered to be rigid – a rigid culvert provides its own structural strength, and does not necessarily require embankment fill.

A complete culvert inspection should include examining the culvert barrel, end treatments, waterway, embankment slopes, and the roadway. Ideally, a walk-through inspection of the entire the culvert barrel should be conducted during low water conditions (high water or ice can prevent inspection of critical areas). If an adequate walk-through inspection cannot be performed, it should be noted in the inspection report, and a complete inspection should be performed when conditions allow. If necessary, an underwater inspection may need to be performed.

During culvert inspection, two main items need to be determined - the hydraulic performance and the structural condition.

Hydraulic Performance: Poor hydraulic performance can result in excessive ponding, flooding of adjacent properties, or washouts of the embankment and roadway. The inspector should note any conditions that might reduce the hydraulic performance of the culvert. A reduction of the hydraulic performance that is not related to the structural condition of the culvert (such as sediment) would only impact the NBI channel rating.

- Poor horizontal or vertical channel alignment can reduce hydraulic efficiency, increase sedimentation, or accelerate embankment erosion. Culverts on flat grades may have excessive sediment, culverts on steep grades may have outlet scour.
- Accumulation of debris at the inlet (or excessive sedimentation within the barrel) can reduce the culvert's hydraulic capacity, accelerate embankment erosion, or alter the channel alignment. While some sedimentation is inevitable, any excessive sedimentation should be noted.
- Changes in land use such as wetland drainage, deforestation, or increased development can significantly increase the runoff (and resultant discharge) that a culvert must carry. Channel changes upstream (or immediately downstream) of the culvert can result in overtopping of the roadway. The inspector should note the high water elevation (or freeboard), as well as any evidence of overtopping.

Structural Condition: Although culverts generally deteriorate at a slower rate than bridges, poor structural condition can eventually result in load restrictions or failure. The inspector should note any evidence of structural deterioration or distress. This includes material deterioration, barrel shape, and joint misalignment/separation. Photographs are useful for comparison to previous (or future) inspections.

Material Deterioration: The inspector should inspect all visible surfaces of the culvert, and note both the extent and severity of any significant material deterioration.

- Concrete culverts should be examined for scaling, cracking, leaching, rust stains, delaminations, or spalls. Severe cracking may indicate uneven settlement or structural overloading (from traffic or excessive earth pressure). Any significant spalling (with exposed reinforcing steel) should be documented. Connection bolts on pre-cast concrete culverts should be examined for corrosion.
- Steel culverts should be examined for corrosion (particularly along the waterline). Bolted seams should be examined for cusping, loose or missing bolts, and cracking around bolt holes.
- Timber culverts should be examined for weathering, warping, decay, fire damage, insect damage, or loose connections. Defects or connections can provide openings for moisture (and eventually decay) – any evidence of decay (such as fruiting bodies, staining, or surface depressions) should be noted.
- Masonry culverts should be examined for weathering, cracks, spalls, crushing, or misalignment of the masonry blocks. The mortar joints should be examined for any deterioration.
- Aluminum culverts are relatively resistant to corrosion, but will corrode rapidly in highly alkaline environments.

Barrel Shape: As flexible culverts (steel, aluminum, or timber) rely upon the surrounding soil to provide lateral support, embankment stability is essential. Deflection or distortion of the barrel may indicate instability of the supporting soil, and may reduce the load-carrying capacity of the culvert. Significant changes in the barrel shape should be noted (and verified with field measurements).

- Deflection is caused by long-term settlement over the length of the culvert (from embankment pressure). As the center of the embankment will settle more than the side slopes, culverts often end up with a low spot below the center of the roadway (steel culverts are often designed with a camber to compensate for this).
- Distortion is any deviation from the design cross-section of the culvert barrel, which should be symmetrical, with even curvature. Barrel distortion may be caused by uneven settlement, overloading, or from damage during the initial backfilling. Distortion is more common on culverts with less than 3 ft. of embankment fill.

Joint Misalignment and Separation: Joint misalignment or separation may be caused by improper installation, undermining, uneven settlement, or embankment failure. Exfiltration or infiltration can eventually result in severe undermining or even culvert failure.

- Exfiltration is water leaking out of the culvert barrel – this can lead to “piping” (water flowing along the outside of the culvert barrel), which can eventually erode the supporting soil. The inspector should look for separated or misaligned joints and observe the culvert ends for evidence of piping.
- Infiltration is water leaking into the culvert – this can also erode the supporting soil. Infiltration can be difficult to detect, as the backfill deposits are often washed away. The inspector should look for staining at the joints on the sides and top of the culvert, or depressions above the culvert.

Like bridges, culverts must be rated using both the NBI and structural element condition ratings.

NBI Condition and Appraisal Ratings:

The overall structural condition of a culvert will be rated using the Culvert Rating (NBI Item 62). The deck, superstructure, and substructure condition ratings (NBI Items 58, 59, and 60) should all be listed as "N".

If the culvert is designed to carry water (even if the culvert barrel is normally dry) the channel should be rated using Channel and Channel Protection Condition Rating (NBI Item 61). This rating should reflect the channel alignment, as well as the presence of any sedimentation or debris. If NBI Item 61 is rated, the Waterway Adequacy Appraisal Rating (NBI Item 71) must also be rated. This item is rated primarily on the frequency of overtopping of the roadway during high water events.

Structural Element Condition Ratings: MnDOT uses seven elements specifically for culvert structures.

- **#240 – Steel Culvert (LF)**
- **#241 – Concrete Culvert (LF)**
- **#242 – Timber Culvert (LF)**
- **#243 – Other Material Culvert (LF) – Use for Aluminum or Plastic Culverts**
- **#244 – Masonry Culvert (LF)**
- **#870 – Culvert End Treatment (Each)**
- **#871 – Roadway Over Culvert (Each)**

The condition of the culvert barrel must be rated using one of the five AASHTO NBE Elements (depending upon the material type). The quantity is expressed in linear feet, as measured along the length of the barrel (multiplied by the number of barrels). If the condition varies along the length of the culvert barrel, more than one condition state may be used.

- If an arch culvert has concrete footings that are visible for inspection, they may be rated separately from the arch barrel using Element #220 (Reinforced Concrete Footing).
- MnDOT added Element #870 to rate the condition of the headwalls, wingwalls, and aprons (or any other type of culvert end treatment).
- MnDOT added Element #871 to rate the condition of the roadway above the culvert. The inspector should note any settlement or cracking of the roadway, as this may indicate culvert distortion (or voiding of backfill). On flexible (steel) culverts; look for settlement above the centerline of the culvert. On rigid (concrete) culverts, look for settlement along the edges of the culvert.
- Element #892 (Slopes and Slope Protection) should be used to rate the condition of the embankment above the culvert. Embankment erosion may be the result of channel scour or roadway drainage.
- Element #894 (Deck and Approach Drainage) should be rated for a culvert structure, even if no drainage issues are currently present.
- If applicable, the inspector should also rate Element 890 (Load Posting/Clearance Signing, Element #891 (Other Signing) and Element #893 (Guardrail).
- The MnDOT "Defect" Elements (#880: Impact Damage, #881: Steel Section Loss, #882: Steel Cracking, #883: Concrete Shear Cracking, #884: Substructure Settlement, and #885: Scour) should not be rated for culvert structures. However, the presence of these defects should be rated (and noted) under the appropriate culvert element.

B.3.10.2 Steel Culvert (Element #240)

<table>
<tr><th colspan="2">#240: Steel Culvert (LF)</th></tr>
<tr><td colspan="2">This element applies to steel culverts of any type or shape. The MnDOT coding system describes four types of steel culverts – pipe-arch, round pipe, arch, or long span/elliptical. The LF quantity is measured along the length of the culvert barrel.</td></tr>
<tr><td></td><td>Steel Pipe-Arch Culverts (MnDOT Code 315)

The most common steel culvert shape in Minnesota (around 1,000 on the bridge inventory), they were introduced around 1930.

The low-profile design requires less fill than a round pipe, and provides a wider channel during low flow.
MnDOT Standard Plates 3050B and 3051B show standard dimensions for spans from 6’-1” up to 20’-7”.</td></tr>
<tr><td>
</td><td>Steel Round Pipe Culverts (MnDOT Code 314)

The second most common steel culvert shape in Minnesota (around 250 on the bridge inventory), they were introduced around 1930.

MnDOT Standard Plates 3040F and 3041D show standard dimensions for diameters up to 10 ft. (largest in Minnesota is 19 ft. diameter).</td></tr>
<tr><td></td><td>Steel Arch Culverts (MnDOT Code 312)

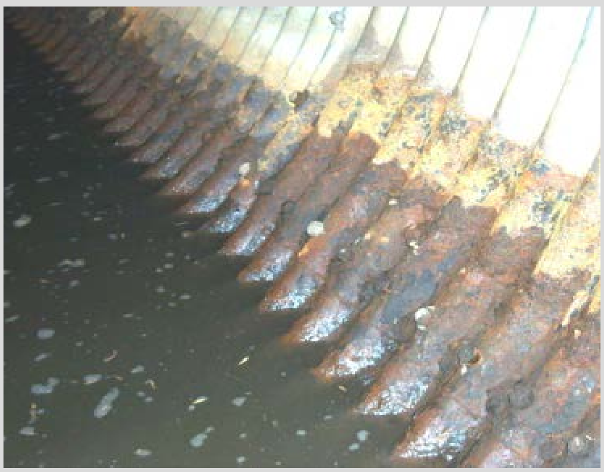
About 65 remain on the Minnesota bridge inventory – most constructed from 1930-1960 (none have been constructed since 1980).

Spans typically range from 10 ft. to 24 ft. Footings are typically reinforced concrete. Some steel arch culverts have masonry headwalls.</td></tr>
<tr><td></td><td>Steel “Long Span” or Elliptical Culverts (MnDOT Code 316)

This category includes elliptical culverts, as well as various culverts shapes with spans longer than 20 ft. (such low profile arch, high profile arch, underpass, or pear shape).

There are about 50 “long span” steel culverts on the Minnesota bridge inventory – the most common shape is elliptical. Most were constructed from 1965 to 1985 (none have been constructed since 1987). Span lengths range from 20 ft. to 33 ft.</td></tr>
</table>

#240: Steel Culvert (LF)				
As with all other steel elements, the protective coating (typically galvanized or bituminous) should be rated using Element #515 Steel Protective Coating.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review or Repairs	No structural repairs are present.	Structural review or repairs are not required. Existing structural repairs are in sound condition.	Repairs may be recommended (structural review is not required) **or** structural review has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** structural review has determined that the defects impact strength or serviceability.
Corrosion	None	Surface corrosion.	Flaking rust or section loss.	Severe section loss (holes or significant loss of thickness).
Cracking	None	Crack has been arrested or reinforced.	Crack has not been arrested, reinforced, or mitigated.	Severe crack or fracture.
Connections (Bolted Seams)	In-place and functioning.	Bolted seams have minor distress – some bolts loose or misaligned.	Bolted seams have significant distress (cusped or cocked) – some bolts missing.	Bolted seams may have failed.
Backfill Infiltration	None	Minor joint separation or backfill infiltration.	Moderate joint separation or backfill infiltration.	Severe joint separation or backfill infiltration.
Barrel Distortion	None	Slight distortion (less than 5% change from design dimensions).	Significant distortion– 5% to 15% change from design dimensions.	Severe distortion – more than 15% change from design dimensions.
Settlement (Longitudinal Deflection)	None	Slight longitudinal deflection (within tolerable limits). No structural distress.	Significant longitudinal deflection (exceeds tolerable limits).	Severe deflection – stability or function of culvert has been reduced.
Scour	None	Within tolerable limits (or counter-measures installed).	Exceeds tolerable limits but less than critical scour limits.	Exceeds the critical scour limits.

#240: Steel Culvert (LF)	
Condition Rating Examples (Steel Culverts)	
 **Condition State 2** **Minor surface corrosion along the waterline**	 **Condition State 2** **Extensive surface corrosion**
 **Condition State 3** **Flaking rust along the waterline**	 **Condition State 3** **Cracking along a bolted seam**
 **Condition State 4** **Through corrosion along the waterline**	 **Condition State 4** **Severe barrel distortion**

B.3.10.3 Concrete Culvert (Element #241)

#241: Concrete Culvert (LF)

This element applies to concrete culverts of any type or shape. The MnDOT coding system describes five concrete culvert shapes (box, pipe-arch, round pipe, arch, or rigid frame/3-sided), and also identifies precast and cast-in-place concrete culverts. The LF quantity is measured along the length of the culvert barrel.

Cast-in-Place Concrete Box Culverts (MnDOT Code 113)

CIP box culverts were used extensively in Minnesota from the early 1900's until the 1970's. There are over 2,900 on the bridge inventory. Typical spans range from 4 ft. up to 20 ft.

- Type "W" CIP box culverts were constructed prior to 1945, and have a single layer of reinforcement in the walls and ceiling.
- Type "C" CIP box culverts boxes were constructed after 1945, and have two layers of steel reinforcing, with more substantial reinforcement at the corners.

Precast Concrete Box Culverts (MnDOT Code 513)

The most common culvert type in Minnesota (around 3,500 on the bridge inventory), they were introduced in 1974.

MnDOT Standard Plans 5.395.100a-e show standard dimensions for span lengths from 6 ft. to 16 ft. and barrel heights from 4 ft. to 12 ft.

Precast box culvert sections are typically 6 ft. long, but 4 ft. sections are used on larger boxes to reduce weight. The precast sections are connected with steel tie bolts.

Precast Concrete Pipe-Arch (RCPA) Culverts (MnDOT Code 515)

Introduced in Minnesota in the 1950's, there are approximately 3,200 on the bridge inventory.

MnDOT Standard Plate 3014J shows the standards dimensions for spans ranging from 51" up to 169" (14 ft. - 1 in.). The precast sections are typically 6 ft. long and connected with steel tie rods.

Smaller RCPA culverts have a one piece end treatment (MnDOT Plate 3100G). Larger spans have a 3-section end treatment (MnDOT Plate 3114H).

#241: Concrete Culvert (LF)

Precast Concrete Round Pipe (RCP) Culverts (MnDOT Code 514)

Precast concrete round pipe (RCP) culverts came into use in the 1920’s – these are the oldest precast concrete structures in Minnesota. While RCP culverts are still commonly used in Minnesota, most of them are too small to meet the legal bridge definition (about 75 are on the bridge inventory).

MnDOT Standard Plate 3000L has standard pipe diameters from 4 ft. to 11 ft. (the segments are typically 6 ft. long). MnDOT Standard Plate 3100G shows the flared end treatments for RCP culverts.

Precast Concrete Arch Culverts (MnDOT Code 512)

Precast concrete arch culverts were introduced in Minnesota in 1981 – there are now around 70 on the bridge inventory. The footings are typically cast-in-place, while the headwalls and wingwalls are typically precast.

The MnDOT LRFD Bridge Design Manual (section 12.3.2) shows details for the “MnDOT Precast Arch” – there are 6 standard spans ranging from 24 ft. to 44 ft. (the precast sections are 6-8 ft. wide). A variety of shapes and larger span lengths are also available from several manufacturers.

Cast-in-Place Concrete Arch Culverts (MnDOT Code 112)

Cast-in-place concrete arch culverts require extensive formwork, and are no longer being constructed in Minnesota – about 40 remain on the bridge inventory (constructed from 1900 to 1960).

Typical spans range from 10 ft. to 30 ft. – the longest span is 46 ft.

Concrete Rigid Frame (3-Sided) Culverts (MnDOT Codes 108 and 508)

3-sided culverts are supported by footings (and/or pilings), and have a natural streambed. They may be pre-cast or cast-in-place. They may have a flat or arched top. These are a relatively new structure type in Minnesota (there are only about 25 on the bridge inventory). Flat-top shapes are generally limited to spans up to 30 ft. Arch top designs are available in spans up to 48 ft.

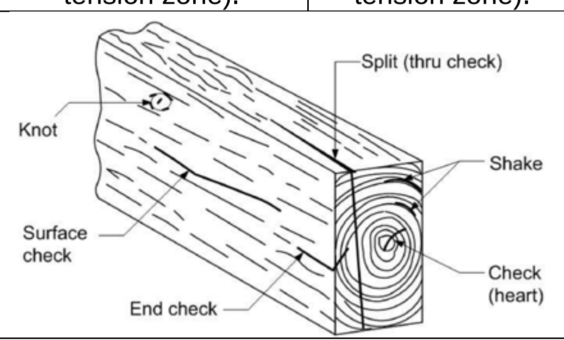
#241: Concrete Culvert (LF)				
Item or Defect	**Structural Element Condition States**			
	1 Good	**2 Fair**	**3 Poor**	**4 Severe**
Structural Review or Repairs	No structural repairs are present.	Structural review or repairs are not required. Existing structural repairs are in sound condition.	Repairs may be recommended (structural review is not required) **or** structural review has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** structural review has determined that the defects impact strength or serviceability.
Efflorescence or Rust Staining	None	Leaching without build-up or rust staining.	Leaching with heavy build-up (stalactites) or rust staining.	Severe leaching (unsound concrete).
Delamination, Spall, or Exposed Rebar	None	Delamination. Spall 1" or less deep **and** 6" or less in diameter. Exposed rebar without measurable section loss.	Spall greater than 1" deep **or** greater than 6" diameter. Exposed rebar with measurable section loss.	Spalling deeper than 4" or exposed rebar with severe section loss.
Connections (Threaded Rods or Grouted Dowel Bars)	Connections are in-place and functioning as intended.	Connection rods have minor distress. Bolts or connectors misaligned – nuts loose or missing.	Connection rods have significant distress (bolts or connectors have significant section loss).	Connection rods have failed or are missing.
Joint Misalignment or Backfill Infiltration	None	Minor joint separation, misalignment or backfill infiltration.	Moderate joint separation, misalignment or backfill infiltration.	Severe joint separation, misalignment or backfill infiltration.
Settlement	None	Within tolerable limits or arrested (no structural distress).	Exceeds tolerable limits.	Stability or function of culvert has been reduced.
Scour	None	Within tolerable limits (or counter-measures installed).	Exceeds tolerable limits but less than critical scour limits.	Exceeds the critical scour limits.
Cracking	Minor cracks.	Moderate cracks or moderate map cracking. Sealed cracks.	Wide cracks or heavy map cracking.	Severe structural cracking.
When determining condition states for the cracking defect, the inspector should consider width, spacing, location, orientation, and structural (or non-structural) nature of the cracking. Cracks less than 0.012" can be considered "minor", cracks from 0.012" to 0.05" wide can be considered "moderate", and cracks wider than 0.05" can be considered "wide".				

#241: Concrete Culvert (LF)	
Condition Rating Examples (Concrete Culverts)	
 **Condition State 2** **Minor joint separation/backfill infiltration between the segments of a precast box culvert**	 **Condition State 2** **Leaching cracks on a cast-in-place (CIP) concrete box culvert**
 **Condition State 3** **Heavy leaching on a cast-in-place (CIP) concrete box culvert**	 **Condition State 3** **Spalling (exposed rebar) on a cast-in-place (CIP) concrete box culvert**
 **Condition State 4** **Severe separation and deterioration at a construction on a cast-in-place (CIP) concrete box culvert**	 **Condition State 4** **Severe spalling on a precast concrete elliptical culvert**

B.3.10.4 Timber Culvert (Element #242)

#242: Timber Culvert (LF)				
This element applies to timber box culverts. There are about 75 timber box culverts on the Minnesota bridge inventory, constructed from 1936 to 1987. The longest span is 10 ft. (most have multiple barrels). The LF quantity is measured along the length of the culvert barrel (and multiplied by the number of barrels).				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review or Repairs	No structural repairs are present.	Structural review or repairs are not required. Existing repairs are in sound condition.	Repairs recommended (structural review not required) **<u>or</u>** structural review has determined that strength/serviceability hasn't been impacted.	Condition warrants structural review **<u>or</u>** structural review has determined that the defects impact strength or serviceability.
Decay, Weathering, Abrasion, or Fire Damage	Minor deterioration (no section loss).	Less than 10% section loss. No crushing or sagging.	10% to 40% section loss. Some crushing or sagging.	More than 40% section loss. Severe crushing or sagging.
Connection (Steel)	In-place and functioning as intended.	Loose fasteners, but functioning as intended.	Missing fasteners; broken welds; or pack rust.	Connection has failed (or failure is eminent).
Joint Misalignment or Backfill Infiltration	None	Minor joint separation, misalignment or backfill infiltration.	Moderate joint separation, misalignment or backfill infiltration.	Severe joint separation, misalignment or backfill infiltration.
Settlement (Longitudinal Deflection)	None	Slight deflection (within tolerable limits). No structural distress.	Significant longitudinal deflection (exceeds tolerable limits).	Severe deflection. Stability or function of culvert has been reduced.
Scour	None	Within tolerable limits or counter-measures installed.	Exceeds tolerable limits but less than critical scour limits.	Exceeds the critical scour limits.
Shakes, Checks, or Splits	Less than 5% of the member thickness.	5% to 50% of the member thickness (not in a tension zone).	More than 50% of member thickness (or more than 5% in a tension zone).	Through entire member (or more than 25% in a tension zone).

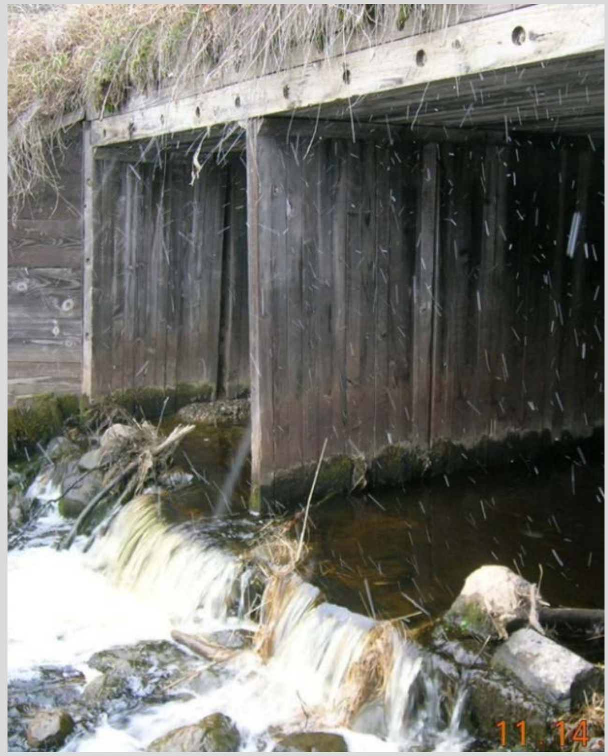
- **Shake:** A separation along the grain (between the growth rings). Usually forms within a standing tree or during felling.
- **Check:** A separation perpendicular to the grain (across the growth rings). Usually results from stress due to drying shrinkage.
- **Split (or Thru Check):** A check extending further through the timber member due to tearing apart of wood cells.



#242: Timber Culvert (LF)

Condition Rating Examples (Timber Culverts)

Condition State 2
Separation between timber members on a timber box culvert (no backfill infiltration)



Condition State 2
Evidence of decay along the waterline of a timber box culvert

Condition State 3
Wall section misaligned on a timber box culvert

Condition State 4
Separation (connection failure) between wall and ceiling on a timber box culvert

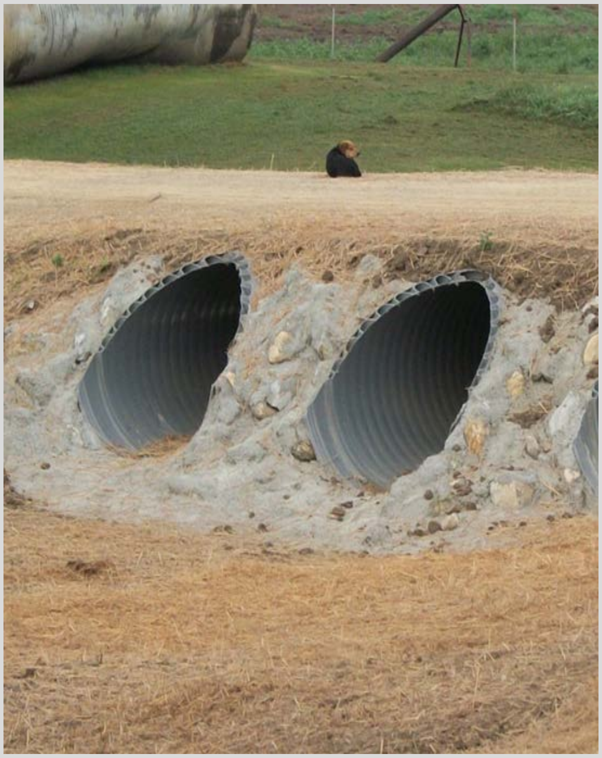
B.3.10.5 Other Material Culvert (Element #243)

#243: Other Material Culvert (LF)	
This element applies to culverts constructed of materials other than steel, concrete, timber, or masonry. Examples include aluminum box culverts or plastic culverts. The LF quantity is measured along the length of the culvert barrel.	
Aluminum Box Culverts (MnDOT Code A13) There are 14 aluminum box culverts on the Minnesota bridge inventory, constructed from 1980 to 2012. Spans range from 10 ft. to 23 ft.	**Plastic Culverts (MnDOT Code 014)** There is one plastic (Double Wall Polyethylene) pipe culvert on the Minnesota bridge inventory, constructed in 2004 (5 ft. diameter).

Item or Defect	Structural Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** Structural review has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** Structural review has determined that the defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Other Deterioration	None	Initiated breakdown or deterioration.	Significant deterioration.	Severe or critical deterioration.
Corrosion	None	Surface corrosion.	Section loss.	Severe section loss (holes).
Cracking	None	Crack has been arrested or mitigated.	Crack has not been arrested or mitigated.	Crack has reduced the strength or stability.
Connections (Bolted Seams)	Connections functioning as intended.	Minor seam distress – some bolts may be loose.	Significant seam distress – bolts may be missing.	Seams have failed.
Barrel Distortion	None	Slight distortion (less than 5% change from design dimensions).	Significant distortion (5% to 15% change from design dimensions).	Severe distortion – more than 15% change from design dimensions.
Settlement (Longitudinal Deflection)	None	Slight deflection. Within tolerable limits or arrested (no distress).	Significant deflection. Exceeds tolerable limits.	Severe deflection. Stability or function has been reduced.
Joint Misalignment or Backfill Infiltration	None	Minor joint separation, misalignment or backfill infiltration.	Moderate joint separation, misalignment or backfill infiltration.	Severe joint separation, misalignment or backfill infiltration.
Scour	None	Within tolerable limits (or counter-measures installed).	Exceeds tolerable limits but less than critical scour limits.	Exceeds critical scour limits.

#243: Other Material Culvert (LF)

Condition Rating Examples (Other Material Culverts)



Condition State 1
Plastic pipe culvert (DWPE – Double Wall Polyethylene)

Condition State 1
Aluminum Box Culvert

Condition State 3
Torn edge on an aluminum box culvert

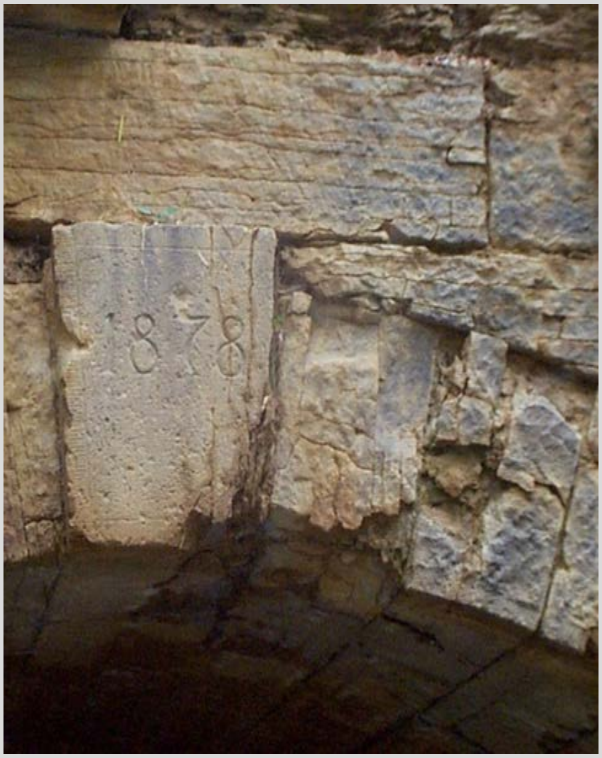
Condition State 4
Failed seam on an aluminum box culvert

B.3.10.6 Masonry Culvert (Element #244)

#244: Masonry Culvert (LF)				
This element applies to arch culverts with arch barrels comprised primary of masonry (MnDOT Code 812). There are about 37 masonry arch culverts on the Minnesota bridge inventory, constructed from 1880 to 1940. Spans range from 10 ft. to 22 ft. The LF quantity is measured along the length of the culvert barrel.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **or** structural review has determined that strength or serviceability has not been impacted.	Condition warrants structural review **or** structural review has determined that the defects impact strength or serviceability.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **or** existing repair is unsound.	Immediate repairs are required.
Mortar Breakdown (Masonry)	None	Cracking or voids in less than 10% of the joints.	Cracking or voids in 10% or more of the joints.	NA
Delamination or Spall (Masonry)	None	Delamination. Spalling less than 10% loss of block thickness.	Spalling with 10% to 25% loss of block thickness.	Spalling with more than 25% loss of block thickness.
Spilt or Fracture (Masonry)	None	Block split without continuation into adjacent courses.	Fractured through adjacent courses or block split with significant offset.	Fracture or split reduces stability of structure.
Weathering or Abrasion (Masonry)	Minor weathering.	Less than 10% loss of block thickness.	10% to 25% loss of block thickness.	More than 25% loss of block thickness.
Masonry Displacement	None	Block or stone is slightly misaligned.	Block or stone is significantly misaligned.	Block or stone is severely misaligned (or detached from structure).
Settlement	None	Within tolerable limits or arrested.	Exceeds tolerable limits.	Stability of element has been reduced.
Joint Misalignment or Backfill Infiltration	None	Minor joint separation, misalignment or backfill infiltration.	Moderate joint separation, misalignment or backfill infiltration.	Severe joint separation, misalignment or backfill infiltration.
Scour	None	Within tolerable limits (or counter-measures installed).	Exceeds tolerable limits but less than critical scour limits.	Exceeds critical scour limits.

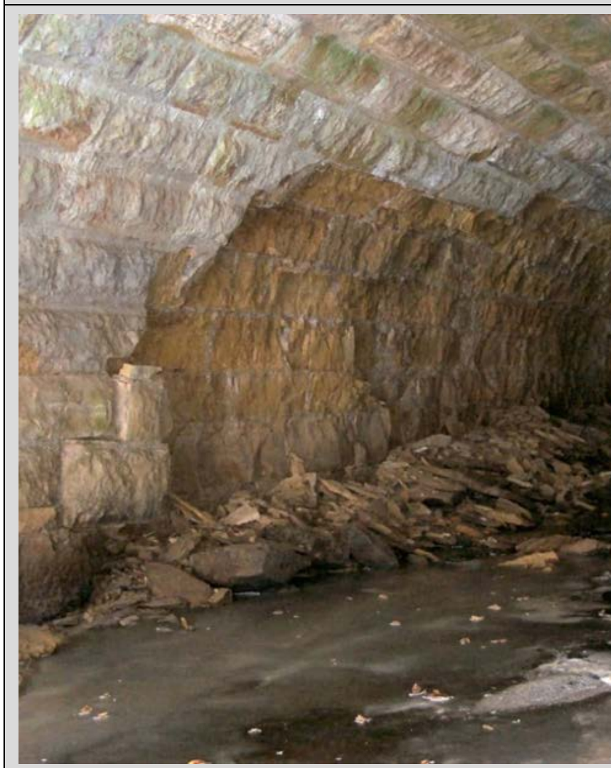
#244: Masonry Culvert (LF)

Condition Rating Examples (Masonry Culverts)



Condition State 2
Weathering of fascia blocks on a masonry arch culvert

Condition State 3
Scour (mortar missing) along the waterline on a masonry arch culvert



Condition State 4
Severe (and extensive) spalling on a masonry arch culvert

Condition State 4
Severe vertical fracture (with blocks misaligned and loose) on a masonry arch culvert

B.3.10.7 Culvert End Treatment (Element #870)

#870: Culvert End Treatment (Each)				
This element applies to culvert end treatments of any type or material. This is an "each" item, and includes headwalls, wingwalls, aprons or other end treatment components. • On single barrel culverts, the quantity will typically be 2 (one for each end). • For multiple barrel culverts with separate end treatments, the quantity will typically be twice the number of barrels (same as the plan quantity for new culverts). • Monolithic end treatments on multiple barrel culverts may be considered to be "1". • If no end treatments are present, this element does not need to be used.				
Item or Defect	**Structural Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Structural Review	Structural review is not required.	Structural review is not required.	Structural review is not required **<u>or</u>** structural review has determined that capacity or function has not been impacted.	Condition warrants structural review **<u>or</u>** structural review has determined that capacity or function has been reduced.
Repairs	No repairs are present.	Existing repair in sound condition.	Repairs are recommended **<u>or</u>** existing repair is unsound.	Immediate repairs are required.
Steel	Minor surface corrosion.	Moderate surface corrosion (minor section loss).	Extensive corrosion (measurable section loss).	Advanced corrosion (severe section loss).
Concrete	Superficial scaling.	Moderate scaling (minor spalling).	Significant spalling or extensive scaling.	Severe spalling or scale.
	Minor cracking.	Moderate cracking or light leaching.	Extensive cracking or moderate leaching.	Severe cracking or deterioration.
Timber	Minor splitting.	Moderate splitting or decay.	Extensive splitting or significant decay.	Severe splitting or advanced decay.
Masonry	Minor weathering or mortar deterioration.	Moderate weathering, spalling, or mortar deterioration.	Extensive weathering, spalling, or mortar deterioration.	Severe spalling or weathering.
Aluminum or Plastic	Superficial deterioration.	Moderate deterioration.	Significant deterioration.	Severe deterioration.
Connections	In-place and functioning as intended.	Connectors loose or missing (major components are secure).	Some connections have failed (major components may be loose).	Connection failure has significantly reduced structural integrity.
Joint Misalignment or Backfill Infiltration	None	Minor joint separation, misalignment or backfill infiltration.	Moderate joint separation, misalignment or backfill infiltration.	Severe joint separation, misalignment or backfill infiltration.
Settlement or Scour	None	Within tolerable limits or arrested.	Exceeds tolerable limits.	Stability of element has been reduced.

#870: Culvert End Treatment (Each)

Condition Rating Examples (Culvert End Treatments)

Condition State 2
Cracking and scale on a concrete headwall (three barrel steel pipe culvert)

Condition State 3
Precast headwall separated due to tree growth

Condition State 3
Extensive leaching cracks on the headwall of a cast-in-place (CIP) concrete box culvert

Condition State 3
Fractured wingwall on a cast-in-place (CIP) concrete box culvert

Condition State 4
Failed wingwall on a precast concrete box culvert

Condition State 4
Wingwall failure on a masonry arch culvert

B.3.10.8 Roadway over Culvert (Element #871

<table>
<tr><th colspan="5">#871: Roadway over Culvert (1 Each)</th></tr>
<tr><td colspan="5">This element rates the condition of the roadway running above a culvert structure. It must be rated for all culvert structures that carry vehicular traffic. This includes paved or unpaved (gravel) roadways.

• The type of wearing surface and number of traffic lanes should be noted. If possible, the year of pavement installation (or overlay) should be noted.</td></tr>
<tr><td colspan="5">Cracking or settlement of the roadway may be the result of culvert settlement, barrel distortion, or voiding of backfill. On flexible (steel) culverts; look for cracking and settlement above the centerline of the culvert. On rigid (concrete) culverts, look for cracking and settlement along the edges of the culvert.</td></tr>
<tr><th rowspan="3">Item or Defect</th><th colspan="4">Structural Element Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Roadway Condition (General)</td><td>Little or no deterioration. No patches.</td><td>Minor to moderate deterioration. Permanent patches that remain sound.</td><td>Extensive deterioration (repairs recommended). Temporary patches or deteriorated repairs.</td><td>Severe deterioration (possible safety hazard – immediate repairs required). Repair patches that have failed.</td></tr>
<tr><td>Concrete Paving</td><td>Minor cracking (no significant spalling).</td><td>Moderate cracking. Minor spalling</td><td>Significant cracking or spalling.</td><td>Severe/extensive cracking or spalling.</td></tr>
<tr><td>Bituminous Paving</td><td>Smooth and even (minor cracking – no potholes).</td><td>Moderate cracking or slight rutting (some potholes present).</td><td>Significant cracking, rutting, or uneven surface. Extensive potholes.</td><td>Severe rutting, fractures, or potholes.</td></tr>
<tr><td>Gravel Roadway</td><td>Evenly graded.</td><td>Moderately rutted or eroded.</td><td>Extensive rutting or erosion.</td><td>Severe rutting or washouts.</td></tr>
<tr><td>Roadway Settlement or Undermining</td><td>None</td><td>Slight settlement or minor undermining.</td><td>Significant settlement or undermining.</td><td>Severe settlement or undermining.</td></tr>
</table>

#871: Roadway over Culvert (1 Each)	
Condition Rating Examples (Roadway over Culvert)	
 **Condition State 1** Minor cracking in a bituminous roadway above a masonry arch culvert	 **Condition State 2** Bituminous patches (due to settlement) along both sides of a concrete box culvert
 **Condition State 3** Temporary patch due to settlement (loss of backfill above a severely corroded steel culvert)	 **Condition State 4** Severe settlement of a bituminous roadway above a collapsed steel culvert

B.3.11 DEFECT ELEMENTS

Defect elements are intended to identify specific structural problems present on a bridge. These elements are not intended for structures classified as culverts. These elements are all "Each" items – the quantity should be left as "1". These MnDOT elements are not associated with the AASHTO elements or defects – they are not reported to the FHWA.

B.3.11.1 Impact Damage (Element #880)

#880: Impact Damage (1 Each)

This element applies to primary structural bridge elements (superstructure or substructure) with impact damage. This may include bracing members on steel truss bridges. This includes any type of impact damage – such as traffic impact, flood debris, or ice dams.

- This element should remain after repairs to provide a history of impact damage to the bridge.
- This element should not be used for culvert structures, bridge railings, or guardrail.

Defect or Item	Defect Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Impact Damage (General)	Minor (superficial) impact damage.	Moderate impact damage, any significant impact damage has been analyzed and repaired.	Damage may be significant (repair may be warranted), but is not severe enough to warrant immediate structural analysis.	Immediate structural analysis is warranted.
Steel Members	Minor scrapes or dents. No heat-straightened or reinforced members.	Significant gouges. Members bent or dented, but are still functioning as intended. Members have been heat-straightened or reinforced.	Members bent out of plane but remain intact. Members have been heat-straightened more than once in the same location. Reinforced areas have significant impact damage.	Members severely damaged (bent, torn or fractured).
Concrete Members	Minor scrapes or gouges (no exposed reinforcement or tensioning cables). No patches. No significant cracking.	Significant gouges (no exposed reinforcement or tensioning cables). Patches (underlying damage has been analyzed or reinforced). Cracking has been analyzed or repaired.	Spalling with exposed reinforcement or tensioning cables (moderate damage to reinforcement or tensioning cables). Patched areas where the extent of underlying damage is unknown. Structural cracking.	Severe spalling or structural cracking. Reinforcement or tensioning cables are severely damaged.

#880: Impact Damage (1 Each)

Condition Rating Examples (Impact Damage)

Condition State 2
Heat-straightened truss vertical member

Condition State 2
High load gouges on a prestressed concrete beam

Condition State 3
Steel H-piling bent due to rock impact

Condition State 3
Ice or flood damage to a truss bottom chord

Condition State 4
Steel beam severely bent due to high load impact

Condition State 4
Prestressed beam severely damaged by high load impact

B.3.11.2 Steel Section Loss (Element #881)

#881: Steel Section Loss (1 Each)				
This element applies to bridges with primary steel members with section loss due to corrosion. This typically refers to steel superstructure members, but could also apply to steel substructure members (such as pilings) that serve as primary supports. Section loss is typically expressed as a percentage of the total cross-section area of the member (the percentages listed below are intended to be general guidelines). • The presence of flaking rust or pack rust indicates that at least some section loss is present. • This element should not be used for culvert structures.				
Structural Member	**Defect Element Condition States**			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Flanges or tension members	Less than 2% section loss of the flange cross-section area.	2% to 5% section loss of the flange cross-section area.	5% to 10% section loss of the flange cross-section area.	More than 10% section loss of the effective flange cross-section.
Webs or compression members	Less than 2% section loss (average over the full height of the web). No through corrosion.	2% to 5% section loss (average over the full height of the web). No through corrosion.	5% to 10% section loss (average over the full height of the web). Isolated through corrosion.	More than 10% section loss (average over full height of the web). Significant through corrosion.
Stiffeners, Lacing, or Batten Plates	Moderate section loss.	Extensive section loss. Isolated through corrosion.	Severe section loss. Significant through corrosion.	NA

#881: Steel Section Loss (1 Each)

Condition Rating Examples (Steel Section Loss)

Condition State 1
Pitting on girder web (less than 2% section loss averaged over full height of web plate)

Condition State 2
Pitting on girder bottom flange (2% to 5% section loss on the bottom flange)

Condition State 2
Isolated through corrosion on girder web stiffener

Condition State 3
Pitting on the top flange of a cantilever floorbeam extension (5% to 10% section loss)

Condition State 3
Pitting on girder bottom flange (5% to 10% section loss on the bottom flange)

Condition State 4
Extensive pitting and significant through corrosion in girder web

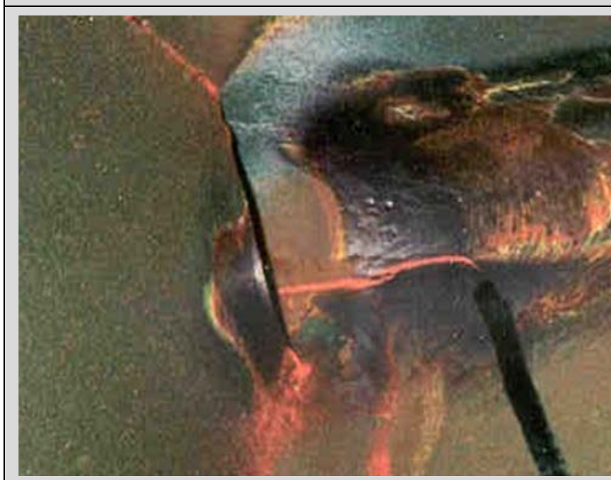
B.3.11.3 Steel Cracking (Element #882)

#882: Steel Cracking (1 Each)

This element applies only to primary steel structural members (typically superstructure). This element is intended to track the presence (and severity) of cracks due to fatigue or other causes. This element should <u>not</u> be used for culvert structures.

- This element should be rated for any bridge with a steel superstructure that has fatigue prone details of AASHTO category "C" or higher, even if no cracks are present.
- Reference the Minnesota Bridge & Structure Inspection Program Manual (BSIPM - Section D.7.10) for descriptions and photos of common fatigue prone details. Fatigue prone details present on a bridge should be noted in the inspection report under this element.
- For MnDOT (trunk highway) bridges, fatigue prone details identified by plan review are listed in SIMS under the SIA - One Column (Steel Fatigue Data) item.

<table>
<tr><th rowspan="3">Defect or Item</th><th colspan="4">Defect Element Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Cracking (Base metal on Primary Steel Structural Members)</td><td>Fatigue prone details are present on primary steel superstructure elements (no cracks are present).</td><td>Cracking has been arrested (drilled or ground out). Any resultant damage to the steel element has been repaired.</td><td>Cracking exists and has not been arrested. Note: This condition state is normally used when cracking is initially observed, or if additional cracking is observed after repairs.</td><td rowspan="2">Cracking has seriously damaged a primary steel superstructure element. Immediate repairs or structural analysis are required.</td></tr>
<tr><td>Tack Welds (on Primary Steel Structural Members)</td><td>No cracked tack welds are present.</td><td>Cracked tack weld is present, but has not yet propagated into the base metal of the primary member.</td><td>Cracked tack weld has propagated into the base metal of a primary structural member.</td></tr>
</table>

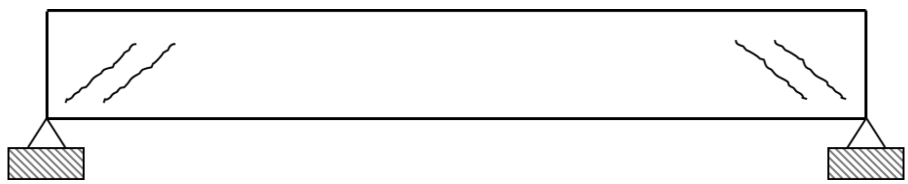
#882: Steel Cracking (1 Each)	
Condition Rating Examples (Steel Cracking)	
 **Condition State 1** **Welded cover plate on the bottom flange of a rolled steel beam (fatigue prone detail)**	 **Condition State 2** **Fractured beam web reinforced with bolted plates**
 **Condition State 2** **Crack in girder web has arrested with a drilled hole**	 **Condition State 2** **Partially cracked tack weld along connection plate (could propagate into base metal)**
 **Condition State 3** **Fatigue crack in web to flange weld at diaphragm connection (due to out-of-plane bending)**	 **Condition State 4** **Fatigue crack has propagated through beam web**

B.3.11.4 oncrete Shear Cracking (Element #883)

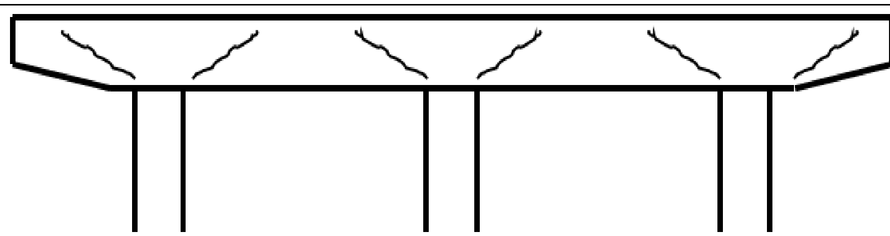
#883: Concrete Shear Cracking (1 Each)

This element tracks the presence and severity of shear cracking on concrete elements subjected to bending moment. Shear cracking is of particular concern on prestressed concrete beams designed prior to 2007 and reinforced concrete pier caps designed prior to 1984 (Element #883 has been automatically added for these bridges).

- If shear cracking is present on any prestressed or reinforced concrete superstructure element (box girders, girders, beams, T-beams, floorbeams, stringers, or slabs), or on a concrete pier cap, Element #883 must be added and rated.
- This element should <u>not</u> be used for culverts.



Expected shear crack location & orientation on a simple span concrete beam.



Expected shear crack location & orientation on a concrete pier cap.

Shear cracks can result from inadequate shear reinforcement, and typically appear as diagonal cracks near the supports (inclined towards the center of the span).

Defect or Item	Defect Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Shear Cracking (General)	No shear cracks.	Minor shear cracks.	Moderate shear cracks. Severe shear cracks that have been repaired or reinforced.	Shear cracks that reduce the structural integrity of the concrete member or the bridge.
Prestressed or Post-tensioned Concrete	No shear cracks.	Shear crack width is less than 0.004".	Shear crack width is between 0.004" and 0.009".	Shear crack width exceeds 0.009".
Reinforced Concrete	No shear cracks.	Shear crack width is less than 0.012".	Shear crack width is between 0.012" and 0.05".	Shear crack width exceeds 0.05".

#883: Concrete Shear Cracking (1 Each)

Condition Rating Examples (Concrete Shear Cracking)

Condition State 2

Shear crack (less than 0.012" wide) on a reinforced concrete pier cap

Condition State 3

Shear cracks (between 0.004" and 0.009" wide) in a prestressed concrete beam

Condition State 4

Shear crack greater than 0.05" wide in a reinforced concrete pier cap

Condition State 4

Shear crack (wider than 0.025") in a prestressed concrete beam

B.3.11.5 Substructure Settlement (Element #884)

#884: Substructure Settlement (1 Each)

This element applies to bridge substructure elements (piers, abutments, or wingwalls) that show evidence of settlement, movement, or rotation. It is intended to identify bridges that are experiencing settlement and to provide some measure of the magnitude of that settlement. This element should not be used for culvert structures.

Substructure movement is not always obvious. Inspectors should look for clues that may indicate substructure movement or tipping, such as bearing misalignment or deck expansion joints that closed tightly (or have large gaps). Check the abutment corners for evidence of the deck, superstructure, or railing contacting (preventing further expansion).

Bearing misalignment due to substructure movement (the rockers should be tipped in opposite directions at the same angle)

Finger joint open beyond design limits due to substructure movement

Concrete diaphragm offset excessively at shear key due to pier movement

Deck corner contacting the abutment end post due to abutment movement

Defect or Item	Defect Element Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Settlement, Movement, or Rotation	Minor substructure settlement, movement, or rotation.	Moderate substructure settlement, movement, or rotation (no impact to the structural integrity of the bridge). Any significant settlement has been arrested or has stabilized.	Significant substructure settlement, movement, or rotation. If not arrested, this could adversely impact the structural integrity of the bridge.	Severe substructure settlement, movement, or rotation – structural analysis is warranted.

#884: Substructure Settlement (1 Each)	
Condition Rating Examples (Substructure Settlement, Movement, or Rotation)	
 **Condition State 2** **Wingwall separation due to abutment movement**	 **Condition State 2** **Abutment end diaphragm offset and fractured due to abutment movement**
 **Condition State 3** **Significant settlement of a concrete approach pier**	 **Condition State 3** **End post fractured due to contact with deck and railing (abutment movement)**
 **Condition State 4** **Steel tube pier column severely tipped**	 **Condition State 4** **Abutment severely tipped**

B.3.11.6 Scour (Element #885)

#885: Scour (1 Each)

This element is intended to identify bridges that are experiencing scour (or have a history of scour problems) and to provide some measure of the magnitude of scour. This element also identifies scour critical bridges (and bridges requiring scour monitoring during high water events). If the MnDOT Scour Code is D, G, K, O, P, R or U, this element must be added and rated, even if no scour is currently present at the bridge.

Scour is the most common cause of bridge failure. During routine inspections, submerged substructure components should be investigated for scour by wading and probing. If the channel is too deep for inspection by wading, the bridge should be included in the state-wide underwater bridge inspection contract. This element should not be used for culvert structures.

Defect or Item	Defect Element Condition States			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Scour	No scour is evident. Bridges with a MnDOT Scour Code of D, G, K, O, P, R or U should be rated as condition 1 if no scour is currently present.	Scour exists, but is of little concern to the structural integrity of the bridge.	Scour exists that, if left unchecked, could adversely impact the structural integrity of the bridge.	Scour is significant enough to warrant analysis of the structure.
Scour Counter-measures (If Present)	Counter-measures are in good condition and are functioning as intended.	Counter-measures have minor to moderate deterioration, but are still functioning.	Counter-measures have significant damage or deterioration.	Counter-measures have failed.

Condition Rating Examples (Scour)

Condition State 2
Scour hole at abutment

Condition State 3
Pier column footing exposed due to scour

Condition State 3
Scour behind abutment (significant streambed degradation)

Condition State 4
Scour has undermined the abutment cap (further scour could wash out the approach roadway)

B.3.12 OTHER BRIDGE ELEMENTS

The elements in this section are intended to rate bridge (or culvert) components not addressed by the AASHTO NBE or BME elements. These elements are "Each" items, the quantity should be left as "1". These are MnDOT elements, they are not reported to the FHWA.

- #890: Load Posting or Vertical Clearance Signing
- #891: Other Signing
- #892: Slopes and Slope Protection
- #893: Guardrail
- #894: Deck & Approach Drainage
- #895: Sidewalk, Curb, & Median
- #899: Miscellaneous Items
- #900: Protected Species

B.3.12.1 Load Posting or Vertical Clearance Signing (Element #890)

#890: Load Posting or Vertical Clearance Signing (1 Each)

This element applies only to Load Posting signs or Vertical Clearance signs mounted on or in advance of a bridge (or culvert). If load posting and vertical clearance signing is not required, this element should not be rated.

- The actual load posted weight limits and/or posted vertical clearances present at the bridge should be documented in the element notes (and confirmed with the structure inventory).

Defect or Item	Condition States			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Signage Present and/or Correct	Required load posting or vertical clearance signing is properly installed.	All required signing is present. Placement may not be ideal.	Vertical clearance signing (at or in advance of bridge) is absent or incorrect.	Load posting signing (at or in advance of bridge) is absent or incorrect.
Damage or Deterioration	Load posting or vertical clearance signs are in good condition (superficial any damage or deterioration).	Load posting or vertical clearance signs have moderate damage or deterioration, but are still readable.	Vertical clearance signing (at or in advance of bridge) is severely damaged or unreadable. Repair or replacement is required.	Load posting signing (at or in advance of bridge) is severely damaged or unreadable. Repair or replacement is required.

Condition Rating Examples (Load Posting or Vertical Clearance Signing)

Condition State 2
Vertical Clearance sign is bent but is still readable

Condition State 4
Load posting sign is severely bent

Condition State 4
Load posting sign is not readable

B.3.12.2 Other Bridge Signing (Element #891)

#891: Other Bridge Signing (1 Each)

This element applies to all signage (except load posting or vertical clearance) mounted on the bridge or pertaining to the bridge. This includes Traffic Control Signage, Horizontal Control Signage, plow markers, or delineators. This also includes signs mounted on the bridge fascia or bridge railings. Note: While some agencies may choose to inventory and inspect bridge mounted signs separately from the bridge, the condition of bridge mounted signs should be reflected in this element rating.

Overhead sign structure mounted on bridge railing

Signs mounted on bridge fascia

Dynamic Message Sign (DMS) mounted on bridge fascia

Defect or Item	Condition States			
	1 Good	2 Fair	3 Poor	4 Severe
Bridge Closed, Narrow Bridge, One Lane Bridge, Bridge Speed Limit, or "Trucks/Vehicles Must Not Meet on Bridge" Signs	Required signing is properly installed (minor damage or deterioration).	Required signing is present (placement may not be ideal). Moderate damage or deterioration.	All required signing is present. Sign is significantly damaged or deteriorated, but is still readable.	Sign is severely damaged, unreadable, or missing. Closed bridge is not properly barricaded.
Type III Object Markers, Plow Markers, or Delineators	Required signing is properly installed (minor damage or deterioration).	Required signing is present (placement may not be ideal). Moderate damage or deterioration.	Sign is severely damaged, severely deteriorated, knocked down, or missing.	NA
Bridge Mounted Signs, Dynamic Message Signs, or Other Bridge-Related Signage	Minor damage or deterioration.	Moderate damage or deterioration.	Sign is significantly damaged, deteriorated, or is missing. DMS inoperable.	Damage or deterioration to sign, DMS, or support presents a safety hazard.

Condition Rating Examples (Other Bridge Signing)

Condition State 2
One Lane Bridge sign with several bullet holes

Condition State 3
Type III Object Marker lying on the ground

Condition State 4
Closed bridge not properly barricaded

B.3.12.3 Slopes and Slope Protection (Element #892)

#892: Slopes and Slope Protection (1 Each)

This element rates the condition of slopes and slope protection. This includes unprotected (bare dirt) slopes. This includes the slopes in front of abutments, abutment side slopes, slopes around piers, and culvert embankments. Slope protection may consist of concrete, bituminous-coated aggregate, loose riprap, grouted riprap, grout-injected fabric, gabions, or any material intended to protect slopes from erosion. Note: The inspector should attempt to determine the cause of any slope erosion (such as deck drainage or channel scour).

Defect or Item	Element Condition States			
	1	2	3	4
	Good	Fair	Poor	Severe
Deterioration or Loss of Slope Protection	Minor deterioration.	Minor to moderate deterioration or loss of protection (slight undermining).	Significant deterioration or loss of protection (significant undermining).	Severe deterioration, loss of protection, or undermining.
Erosion or Settlement	None	Minor to moderate erosion or settlement.	Significant erosion or settlement.	Severe erosion or settlement.
Exposure of Footings or Pilings	None	Minor to moderate footing exposure (no undermining of footings or piling exposure).	Significant footing exposure (slight undermining of footings or isolated piling exposure).	Severe undermining of footings and/or significant piling exposure.
Loss of Abutment or Approach Backfill	None	Isolated loss of abutment or approach backfill.	Moderate loss of abutment or approach backfill.	Significant loss of abutment or approach backfill.

Condition Rating Examples (Slopes and Slope Protection)

Condition State 2
Moderate footing exposure due to slope settlement

Condition State 3
Significant slope erosion due to approach runoff

Condition State 3
Significant undermining of concrete slope paving

Condition State 4
Footing undermined (timber piling exposed) due to slope failure

B.3.12.4 Guardrail (Element #893)

#893: Guardrail (1 Each)

This element rates the condition of guardrail above or below a bridge (or above a culvert). This includes all guardrail types (plate beam or cable), as well as guardrail end treatments or crash cushions/crash attenuators. If guardrail is required, but is not present, there is no need to rate this item; however NBI items 36B, 36C & 36D must be coded appropriately.

Defect or Item	Condition States			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Guardrail Condition	Guardrail is in good condition – no notable damage or deterioration	Guardrail has minor to moderate damage or deterioration, but is still functioning as intended to protect vehicles from impacting the bridge.	Guardrail has significant damage or deterioration. While repairs may be necessary, the conditions do not pose an immediate traffic safety hazard.	Guardrail has severe damage or deterioration (traffic safety hazard) – repair or replacement is required.

Condition Rating Examples (Guardrail)

Condition State 2
Plate beam guardrail scraped and bent

Condition State 2
Splitting and decay on timber guardrail post

Condition State 3
Plate beam guardrail torn

Condition State 4
Severe damage to guardrail end

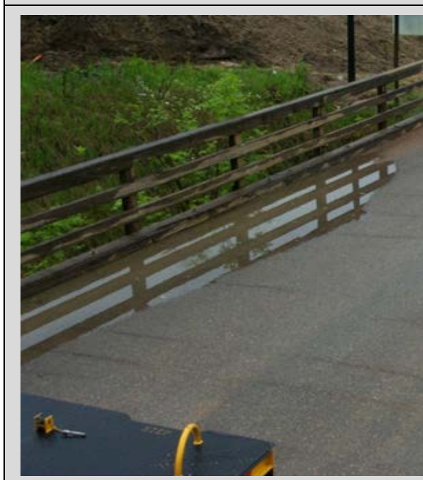
B.3.12.5 Deck and Approach Drainage (Element #894)

#894: Deck and Approach Drainage (1 Each)

This element rates the condition, function, and adequacy of the drainage system. This element should be rated for all bridge or culvert structures. This includes drainage of the deck, approaches, and areas adjacent to (or below) the bridge and drainage of the roadway travelling over a culvert structure. This includes items such as deck drains, inlets, scuppers, grates, drain troughs, downspouts, catch basins, spillways, splash aprons, ditches, or holding ponds. Note: Deck drain downspouts should extend down far enough to prevent runoff from falling onto the superstructure.

Defect or Item	Condition States			
	1	**2**	**3**	**4**
	Good	**Fair**	**Poor**	**Severe**
Drainage System (Condition and Function)	Drainage system is in good condition and functioning as intended.	Drainage system has minor damage or deterioration, but is still functioning adequately.	Drainage system has moderate damage or deterioration. Drainage system is not functioning properly. Drainage system may be clogged with debris. Drainage issues are contributing to the deterioration of bridge elements.	Drainage system has severe damage or deterioration – repairs are required. Failure of drainage system has resulted in significant deterioration of bridge elements.
Erosion	None	Minor erosion due to deck, roadway, or approach drainage.	Drainage issues have resulted in significant slope erosion.	Failure of drainage system has resulted in severe slope erosion.
Ponding	None	Minor to moderate ponding on deck, approaches, or roadway.	Significant ponding on deck, approaches, or roadway.	Severe ponding (possible safety hazard).

Condition Rating Examples (Deck and Approach Drainage)



Condition State 2
Moderate ponding on deck

Condition State 3
Drain clogged at elbow

Condition State 4
Downspout split due to freezing

B.3.12.6 Sidewalk, Curb, and Median (Element #895)

<table>
<tr><th colspan="5">#895: Sidewalk, Curb, and Median (1 Each)</th></tr>
<tr><td colspan="5">This element applies to sidewalks, curbs, and median paving on the bridge deck and approaches. This element is primarily intended to rate the top surface of sidewalks on vehicular bridge decks. The supporting deck, slab or superstructure should be rated under the appropriate structural element.
• This element does not apply to sidewalks or trails running below a bridge (that should be addressed using Element #899 - Miscellaneous).
• Concrete sidewalks with a width of 18” or less, that are integral with the concrete bridge railing, should be rated using Element #331 (Concrete Railing) instead of this element.
• This element should be used to rate the approaches to pedestrian bridges (instead of approach Elements #321, #822, or #823).</td></tr>
<tr><th rowspan="3">Defect or Item</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>General</td><td>Sidewalks, curbs, and medians are in good condition.</td><td>Sidewalks, curbs, or medians have moderate damage or deterioration (repairs are not yet required).</td><td>Sidewalks, curbs, or medians have extensive (or significant) damage or deterioration. Repairs may be required.</td><td>Sidewalks, curbs, or medians have severe damage or deterioration (immediate repairs are required).</td></tr>
<tr><td>Concrete</td><td>Minor cracking, superficial damage or deterioration.</td><td>Moderate cracking, scale, or abrasion. Isolated spalling.</td><td>Extensive (and significant) cracking, scale, or abrasion. Moderate spalling.</td><td>Severe cracking or extensive spalling.</td></tr>
<tr><td>Timber</td><td>Superficial damage or deterioration.</td><td>Moderate splitting, damage or deterioration. Any decay is isolated.</td><td>Extensive (and significant) splitting, decay, damage or other deterioration. Sections may be loose.</td><td>Severe decay, damage, or other deterioration. Sections may be missing.</td></tr>
<tr><td>Sidewalk Approach Settlement</td><td>No significant settlement.</td><td>Minor settlement (less than 1”).</td><td>Moderate settlement (1” to 2”).</td><td>Severe settlement (more than 2”).</td></tr>
</table>

B.3.12.7 Miscellaneous Items (Element #899)

<table>
<tr><th colspan="5">#899: Miscellaneous Items (1 Each)</th></tr>
<tr><td colspan="5">This element can be used to rate the condition of any bridge (or culvert) feature not adequately described by the other elements (such as lighting or utilities). This element can also be used to address general maintenance issues (such as flushing, tree trimming or graffiti).</td></tr>
<tr><th rowspan="3">Defect or Item</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>Good</th><th>Fair</th><th>Poor</th><th>Severe</th></tr>
<tr><td>Condition</td><td>Minor damage or deterioration.</td><td>Moderate damage or deterioration.</td><td>Significant damage or deterioration.</td><td>Severe damage or deterioration.</td></tr>
<tr><td>Maintenance or Repairs</td><td>No maintenance necessary.</td><td>Preventive maintenance may be recommended.</td><td>Repairs are recommended.</td><td>Immediate repairs are required.</td></tr>
</table>

B.3.12.8 Protected Species (Element #900)

#900: Protected Species (1 or Possibly 2 Each)

This element was added in 2016 for all bridges and culverts in Minnesota. It is intended to track structures with protected species nesting or roosting on them.

Birds

Most birds are protected under the federal Migratory Bird Treaty Act (MBTA), which means that they cannot be harmed during their nesting season. Swallows are the most common protected bird to nest on bridges. Several species of swallows are found in Minnesota. Cliff swallows commonly nest in large colonies on the underside of bridges located over or near water. Cliff swallow nests are made from mud pellets and are shaped like a gourd, with an elongated entrance tube. Barn swallows nest almost exclusively on man-made structures (such as bridges). Barn swallow nests are shaped like an open-top cup, and are made from mud mixed with grass (typically with a grass or feather lining).

Other protected bird species known to nest on bridges in Minnesota include: American robins; eastern phoebes; peregrine falcons; great horned owls; and long-eared owls. Any small, round, neatly constructed bird nest (or large stick nest) observed on a bridge likely indicates the presence of a protected bird species.

Note: Pigeons, house sparrows, and starlings are not protected bird species.

Bats

The northern long-eared bat was designated as a threatened species under the federal Endangered Species Act on May 4, 2015. This was primarily due to the threat posed by white-nose syndrome, a fungal disease that has devastated many bat populations in the U.S., including Minnesota.

Many species of bats, including the northern long-eared bat, will roost on bridges. They tend to prefer bridges located over or near water. Bats typically roost in any cave-like cavity on a bridge structure, often located at least 4 feet above the ground. A common roosting spot for bats is within bridge deck expansion joints (typically located at abutments or piers), or below median joints. The underside of bridge deck joints should be inspected up close with a flashlight. Other potential roosting spots include gaps between timbers deck planks, between timber beams, or inside cracks or voids in concrete or masonry bridge structures. Bats can also hang from small cracks or surface irregularities on concrete structures, including box culverts, or from connections on steel bridges.

Bridge inspectors are not expected to identify the exact bat species present on a bridge, but should determine if bats are roosting on the bridge. Aside from seeing bats directly, bridge inspectors should look for other evidence of bats, such as high-pitched squeaking or chirping coming from joints. Inspectors should also look for bat droppings (similar to mouse droppings, but less regularly-shaped) or dark urine stains on pier caps or abutment bearing seals below deck joints. Bat droppings may also be present on the slopes below median joints. Another bat clue is the strong ammonia-like smell associated with their droppings.

This element will initially be entered with a quantity of 1. If protected birds and bats are both present on a bridge, the quantity should be increased to 2, with a "1" rated under both condition state 3 and condition state 4.

Defect or Item	Condition States			
	1	2	3	4
Protected Species	New structure (not yet inspected), or structure has not been fully inspected (due to access limitations, etc.)	No evidence of protected species nesting or roosting on the structure (currently or in the recent past)	Protected bird species and/or nests (swallows, falcons, etc.) are present on the structure.	Bats or evidence of bats is present on the structure (add notes on location)

#900: Protected Species (Each)

Condition Rating Examples (Protected Species)

Condition State 3
Cliff swallow nests on the underside of a bridge

Condition State 3
Barn swallow nest on the underside of a bridge

Condition State 3
Robbin’s nest on a bridge beam

Condition State 3
Great horned owl in a large stick nest on a bridge

Condition State 4
Bats roosting on the underside of a deck joint

Condition State 4
Bats droppings on an abutment bearing seat

B.4 BRIDGE INSPECTION DOCUMENTATION

B.4.1 INSPECTION NOTES

Inspection notes are a key component of a bridge inspection report. The inspection notes should provide a clear narrative of the structural condition of the bridge, and must appropriately justify the NBI and structural element condition ratings. Thorough inspection notes will allow the Engineer/Program Administrator reviewing the report to better understand the current condition of the bridge, and determine if repairs or further structural analysis are required. If the bridge condition is accurately described, it is much easier to identify any change in condition in subsequent inspections. The quality of bridge inspection notes will generally reflect the quality of the bridge inspection, and the quality of the agency's bridge inspection program. Bridge inspection reports are legal, public documents – inspectors should keep that in mind when taking field notes and entering then in SIMS.

Notes should be taken and entered in SIMS for each bridge inspection. The extent of notes taken during an inspection will vary depending upon the size and structural complexity of the bridge, the condition of the bridge, and the change in condition since the last inspection. When creating a new inspection report in SIMS, notes may be entered in several locations.

NBI Condition Rating Notes: When a new bridge is entered into the database, the NBI Condition Ratings (Deck, Superstructure, Substructure, Channel, and Culvert) will initially be entered as "9" or "N". SIMS includes an inspection note section for each of these five condition ratings.

- Inspection notes should be entered whenever an NBI Condition Rating is changed (up or down). If no notes are present for an NBI condition rating, the inspection history should be reviewed to determine when and why the current condition rating was assigned.
- As the NBI condition ratings describe the general overall condition of a structure, the NBI notes do not need to be specific or lengthy. They should briefly explain why (and when) the NBI condition rating was changed. For example: "NBI deck rating lowered from 6 to 5 in 2016 due to delamination and spalling on underside of deck".
- Inspection notes are mandatory if an NBI condition rating (Deck, Superstructure, Substructure, Channel, Culvert, Approach Alignment, Waterway Adequacy) is "5" (fair condition) or lower.

NBI Appraisal Ratings and NBI Item 36 Notes: Notes may be entered in SIMS for the Approach Roadway Alignment Rating, the Waterway Adequacy Rating, and for NBI Items 36A, B, C & D (Safety Features).

- If the coding for the Approach Roadway Alignment or Waterway Adequacy Appraisal Ratings is changed, the notes should explain when and why this was done.
- Notes should be added for NBI Items 36A-D if the safety features are updated. If any Safety Feature is coded as "substandard", the notes should briefly describe why.

Structural Element Notes: Every structural element has a dedicated section in SIMS for entering inspection notes. It is recommend that the structural element notes include a brief description of the structural element being rated - this is particularly helpful on large or complex bridges.

- Inspection notes are mandatory for any structural element rated lower than condition state 1.
- The structural element notes should clearly describe the extent, severity, and location of any defects present on that element. As MnDOT does not track defects as separate

sub-elements, it is essential that defects be described in a consistent and quantifiable manner.

When entering an inspection report in SIMS, notes are carried over from previous inspections. Thus, it is essential that inspection notes are dated. Dated inspection notes allow the reviewer to determine changes in condition, and to identify when structural modifications were performed (or when dead loads were added to the structure).

- While the exact manner of dating inspection notes will vary, it is recommended that the year the condition was observed precede the inspection note. Example, “[2012] South fascia girder has 10 LF of surface corrosion on the exterior bottom flange, extending out from the west abutment”.
- When the condition changes during a subsequent inspection, the year the condition was first observed, as well as the year the condition last changed, should precede the inspection note. Example, “[2012/2014] South fascia girder has 15 LF of surface corrosion on the exterior bottom flange, extending out from the west abutment.”
- Old structural element notes that no longer apply to the bridge should be deleted. Example, if a deck expansion joint is replaced, notes describing the previous expansion joint should be deleted.

General Inspection Notes: Notes that do not apply to a specific structural element (or NBI item) may be placed in the “General Notes” area.

- On larger multi-span structures, the general layout of the bridge from the original construction plans should be described. Example, “Bridge runs from the south to the north, with piers and spans numbered from the south.”
- It is also helpful to describe the beam numbering system used on the bridge framing plan. Example, “Beams are numbered 1-6 starting from the west.”
- If a structure has had significant structural modifications (such as bridge widening, bridge re-decking, or a culvert extension), a brief note should describe the modifications and when they were performed.
- If high water (or snow), prevents a full inspection, it should be noted here so that a follow-up inspection can be performed.
- If a bridge carries railroad traffic (or crosses over a railroad), emergency contact information for the railroad should be provided. If possible, the railroad mile point should be noted to assist in identifying the structure to the railroad.

B.4.2 INSPECTION PHOTOGRAPHS

A digital camera is basic bridge inspection equipment. Photographs should be taken (and entered in SIMS) during each routine bridge inspection. Photos can provide an excellent illustration of changes in the condition of a bridge (or culvert) over time. Note: Photographs should not be used as a replacement for inspection notes, but rather as a way to complement the inspection notes.

Section 2.2.1 of the AASHTO Manual for Bridge Evaluation requires that these three general photographs <u>must</u> be included in the file for each bridge. Taking these three photographs during each routine inspection will ensure that each bridge file will have up-to-date photographs to meet this requirement.

1. Top view of the roadway across the bridge (or culvert)
2. A side elevation view of the bridge (or culvert)
3. An underside view of the main span (or a typical span)

1. Roadway across Bridge

2. Side Elevation View

3. Underside View

The MnDOT Bridge Office requires photos for the following situations.

- Critical findings must always be documented with photographs.
- If a primary structural element is rated as condition state 4, at least one photograph of the element is required during each routine inspection.

Other recommended photographs to take during a routine bridge inspection (or have in the bridge file) include the following.

- Significant damage or deterioration (primary elements rated as condition state 3)
- Serious safety hazards
- General and/or close-up views of primary structural elements (even if there is little or no deterioration) to provide a baseline of the general structural condition
- Structural repairs or modifications
- Load posting signing (if present)
- Height restriction signing (if present)
- Significant or unusual bridge features
- Upstream and downstream views of the channel or waterway below the bridge
- Deck expansion joint gaps
- Bearing orientation
- Safety features (railings and guardrail)
- Utilities or other ancillary items that have been added to the bridge

B.4.3 MEASURING & DOCUMENTING SECTION LOSS ON STEEL MEMBERS

Corrosion is the most common defect found on steel bridges. Any measureable loss of the original steel member cross-section due to corrosion referred to as “section loss”. Accurately measuring and documenting the extent and location of section loss is one of the primary responsibilities of the bridge inspector, and is essential in evaluating the load-carrying capacity of a steel bridge.

The bridge inspection report should accurately describe the location and extent of any significant section loss. Section loss is typically expressed as a percentage of the original cross-sectional area.

- On members subjected to axial loading (such as truss members), section loss is typically expressed as percentage of the entire member cross-section. *Example: “Truss bottom chord member L2-L3 has 15% section loss at the L2 connection.”*
- On members subjected to bending moment (such as girders or beams), section loss is typically expressed as percentage of the bottom flange, top flange, or the web cross-section. *Example: “The bottom flange of the west girder has 10% section loss at the 1st deck drain east of Pier #2.”*

When describing section loss in an inspection report, it is important that the extent of section loss not be misrepresented. For example, the bottom flange of a steel beam has a 1” diameter hole rusted through, which constitutes 15% of the total bottom flange cross-section at that location. This should not be described as “*the bottom flange has 100% section loss*”, but rather as “*the bottom flange has 15% section loss*” (or “*the bottom flange has a 1” diameter hole*”).

If the original cross-section has not yet been determined, it may be better to describe the location and dimensions of the area with section loss. *For example: “Girder #3 has 4” wide by 2” high area of pitting (up to 1/8” deep) at the west abutment bearing”.*

When should section loss measurements be performed? As a general rule, section loss measurements should be taken if the approximate section loss on a primary structural steel member exceeds 5% of the total member cross-section (or 5% of the flange or web cross-section). As it is not generally practical to accurately measure and document every area of section loss on a bridge, some judgment must be used by the inspector in prioritizing the locations where section loss measurements are taken. Highly stressed portions of the structure (such as the bottom flange near the center of a span) should be prioritized for section loss measurements. If section loss is present at similar details throughout a bridge, measurements should be taken at locations that appear to have the most severe and/or extensive section loss.

Locations where section loss is likely on bridges: The locations where corrosion (and section loss) will occur on a bridge are typically predictable – steel members exposed to salt spray or covered by debris will typically have section loss. The exact locations will vary depending upon the structural configuration and features present on the bridge – locations where corrosion (and section loss) is likely to occur include the following.

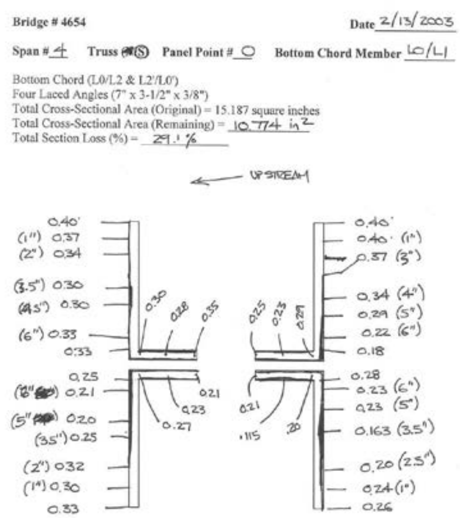
- Structural members located below deck joints
- Bearing areas
- Areas below deck drains or adjacent to downspouts
- Areas located directly above traffic (exposed to salt spray)
- Horizontal surfaces, field splices, or other details that tend to accumulate debris
- Fascia girders, beams, or stringers will typically have more corrosion and section loss than interior members – particularly along the exterior bottom flange
- On bridges with concrete decks, corrosion will tend to be localized (below deck joints or leaching cracks) – on bridges with timber decks, corrosion may be widespread

- Through truss and pony truss bridges will typically have section loss along the bottom chord, particularly at the panel point connections – section loss may be present on the truss members or gusset plates. Truss diagonal and vertical members will typically have corrosion at the railing connections, at the curb level, and at the bottom chord connections.
- Steel box girders (or other box sections) will develop internal corrosion if moisture accumulates within the box section
- Steel piling will typically have corrosion at the waterline and/or ground line

Cleaning prior to inspection: In order to properly inspect a steel member (and to determine the extent of section loss) – the steel must first be cleaned of any dirt, debris, or excess flaking rust. A large build-up of debris on a steel member indicates not only inadequate maintenance, but also indicates inadequate inspection. A bridge inspector should have ready access to cleaning tools such as a shovel, spade, whisk broom, wire brush, pick hammer, or scraper. Inspection during (or immediately after) re-painting contracts will often allow for more precise section loss measurements.

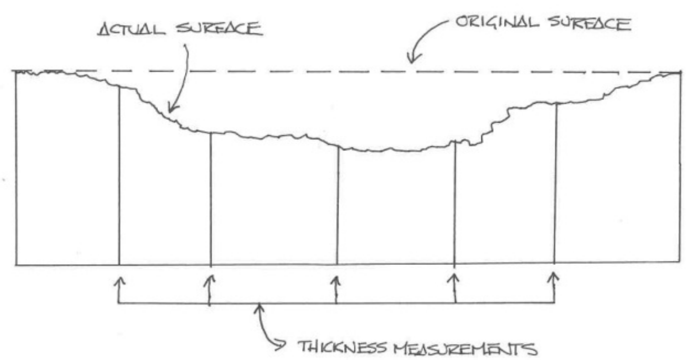
Methods of measurement: During a bridge inspection, initial section loss is often estimated (often aided by a straight edge or ruler) – as section loss advances, more precise measurements may be necessary. Calipers are a simple and inexpensive method of measuring the thickness of the remaining steel, but they may not be able to reach some locations (such as a girder web). An ultrasonic thickness gauge is the most precise and effective method of obtaining thickness measurements – this can be used in confined areas or locations where only one side of the member is accessible.

Field notes and cross-section diagrams: Field notes should be thorough, concise, and readable – they should include not only the thickness measurements, but the exact location where those measurements were taken. To determine the extent of section loss on a structural member, the original cross section area must be known. If no plans are available, measurements and thickness readings should be taken in areas without section loss to establish a basis for the section loss calculations. Plan dimensions and thicknesses should be verified. Cross-section diagrams are helpful in documenting field measurements and performing section loss calculations. If possible, blank forms (with cross section diagrams) should be prepared prior to taking field measurements. To facilitate section loss calculations, the exact location of all thickness readings should be recorded – areas with section loss should be clearly indicated.

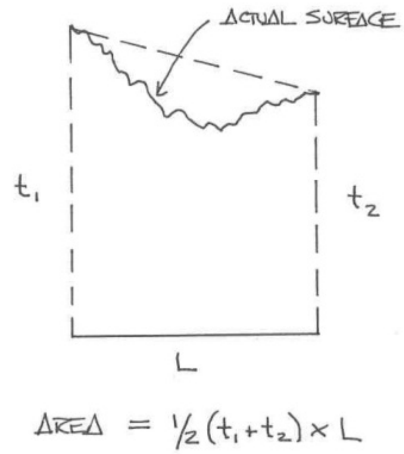


Example of cross section diagram with section loss field measurements

Section loss calculations: When performing section loss calculations, the level of accuracy will generally depend on how many thickness measurements are taken – the more measurements are taken, the greater the accuracy. One common method of calculating section loss is to simply take the average of several thickness measurements over a portion of the member cross-section. A slightly more accurate method is to divide the cross-section into trapezoidal sub-areas, based upon the exact locations of the thickness measurements – these areas are then calculated separately and added up. Whatever method is used, it should be done clearly and consistently, so the calculations can be easily checked and verified.



Cross-section showing location of thickness measurements



Trapezoidal sub-area

B.5 BRIDGE STRUCTURE TYPES AND COMPONENTS

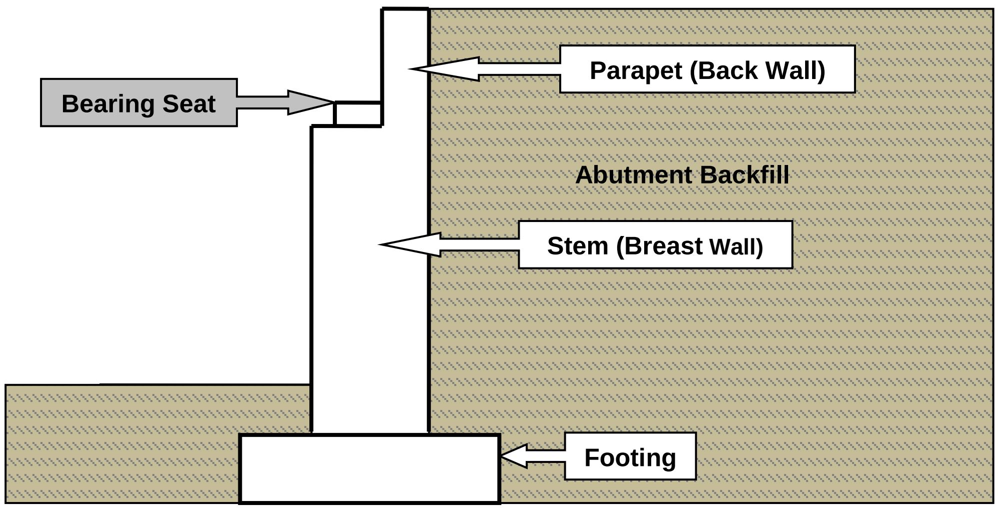
Note: This section is incomplete – it will eventually include general inspection procedures and condition rating guidelines for common bridge deck, superstructure, and substructure types. This is intended to be a condensed version of the guidelines in the Bridge Inspector's Reference Manual (BIRM).

B.5.1 SUBSTRUCTURE COMPONENTS

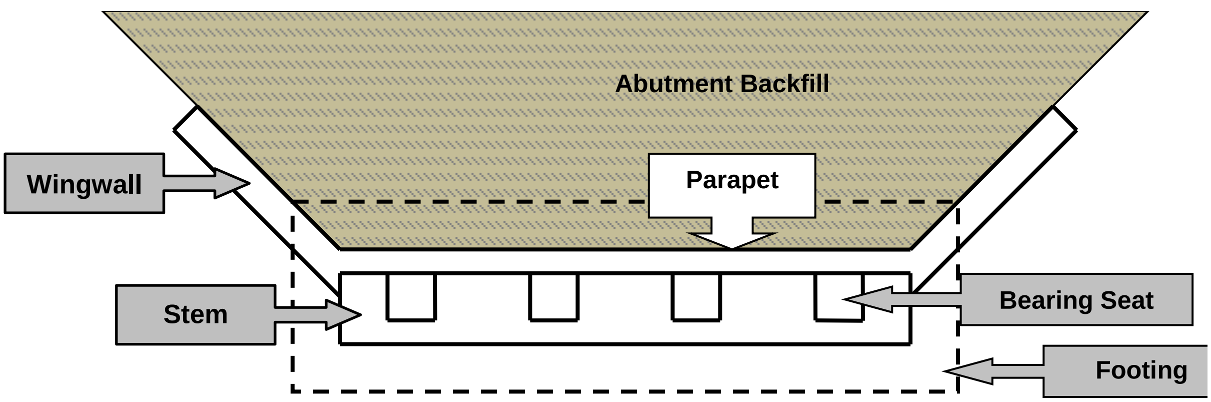
This section includes general inspection procedures and condition rating guidelines for substructure components (abutments and piers). This includes general descriptions and terminology, as well as guidelines for the proper selection of structural elements (and determining element quantities).

B.5.1.1 Concrete Abutments

Most abutments are constructed of reinforced concrete, while the overall configuration will vary, most concrete abutments share the following typical components.



Cross-section of a Typical Concrete Abutment



Plan View of a Typical Concrete Abutment

- **Stem:** The abutment stem (or breast wall) is the primary component of the abutment – it transmits the load of the bridge superstructure to the footing, and retains the abutment backfill. Only the front face is typically visible for inspection.
- **Bearing Seat:** The bearing seat provides a horizontal bearing area for the superstructure.
- **Parapet:** The parapet (or back wall) prevents backfill soil from sliding onto the bearing seat, and provides support for the deck expansion joint (or approach slab).
- **Footing:** The footing transmits the weight of the abutment, the soil loads, and the load of the bridge superstructure to the supporting soil. A footing may be supported by piling, or may transfer these loads directly to the supporting soil or rock (spread footing).
- **Wingwall:** A wingwall is a short retaining wall extending from each end of the abutment that serves to retain the side slope. The wingwall configuration (height, length, and angle from the abutment face) will vary depending upon the abutment geometry and site conditions.

General inspection procedures for concrete abutments:

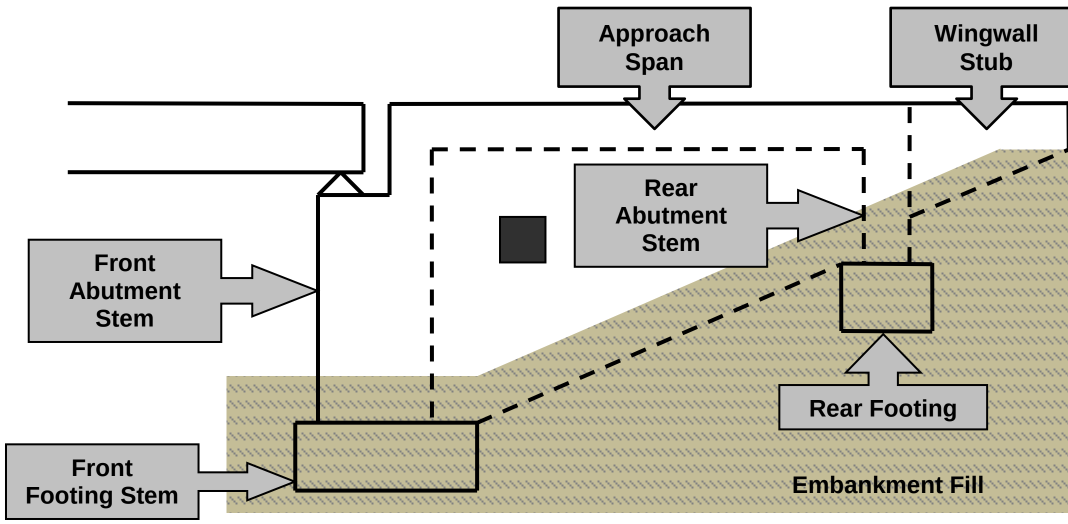
- Note any concrete deterioration (cracking, leaching, rust staining, delamination or spalling).
- Note any evidence of deck joint leakage (such as staining on the abutment face or debris on the bearing seat).
- Weep holes (typically located near the base of the stem) should be examined for proper function.
- Note any distress on the parapet (cracking, spalling or tipping) resulting from the superstructure contacting the parapet or from approach pavement thrust.
- Note any evidence of settlement, rotation, or other movement.
- Note any deterioration of the slope protection, slope erosion, undermining, or footing/piling exposure.
- If the abutment is submerged in water, probe along the front face for any evidence of scour (review the underwater inspection report, if applicable).

Condition ratings for concrete abutments: An abutment has two basic functions – to support for the bridge superstructure, and to retain the abutment backfill. The condition ratings should reflect not only the condition of the visible concrete surfaces, but also the ability of the abutment to perform these two basic functions.

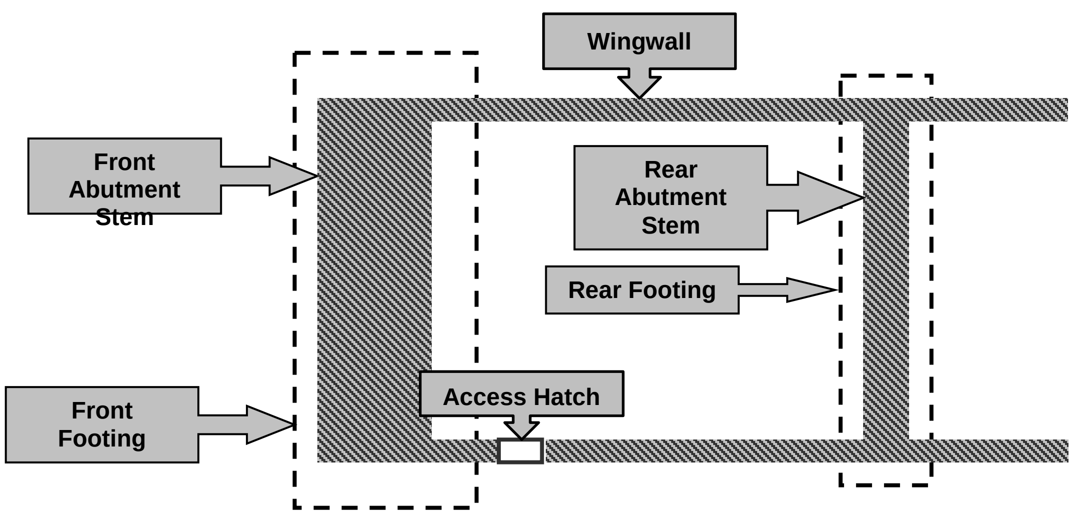
- Element #215 (Reinforced Concrete Abutment) should be used to rate the abutment stem, seat, parapet, and integral wingwalls. This is a linear foot (LF) item – the quantity is determined by measuring horizontally across the front face of the abutment and along the length of any integral wingwalls.
- As the footings (and pilings) supporting a concrete abutment are typically not visible for inspection, they are typically not rated. If the abutment footing is visible for inspection, it can be rated using Element #220 (Reinforced Concrete Footing). This is a LF item.
- If settlement, rotation, or other movement of the abutment is evident, Element #883 (Substructure Settlement and Movement) must be rated accordingly.
- If scour is present, Element #884 (Scour) must be rated accordingly.
- Element #890 (Slopes and Slope Protection) should be used to rate the condition of the abutment slopes and slope protection.

B.5.1.2 Hollow (“U-Type”) Concrete Abutments

Hollow or “U-Type” reinforced concrete abutments are actually an enclosed approach span, typically a cast-in-place concrete slab or T-girder span. The wingwalls enclose the sides of the span, creating a “hollow” abutment that appears to be solid. Access hatches are typically located on the wingwalls or parapets. Hollow abutments are intended to reduce the dead load (compared to a solid abutment) and subsequent settlement of the abutment. Note: Periodic internal inspections should be performed to assess the condition of the interior elements – confined space entry procedures are typically required.



Elevation View of a Hollow Concrete Abutment



Section View (Looking Down) of a Hollow Concrete Abutment

Element #215 (Reinforced Concrete Abutment) should be used to rate hollow “U-Type” abutments. The LF quantity is measured around the exterior perimeter (front face and side walls, including any integral wingwall extensions). An element or elements must also be selected to rate the enclosed approach span – this may include beam, deck, or slab elements.

B.5.1.3 Integral and Semi-Integral Concrete Abutments

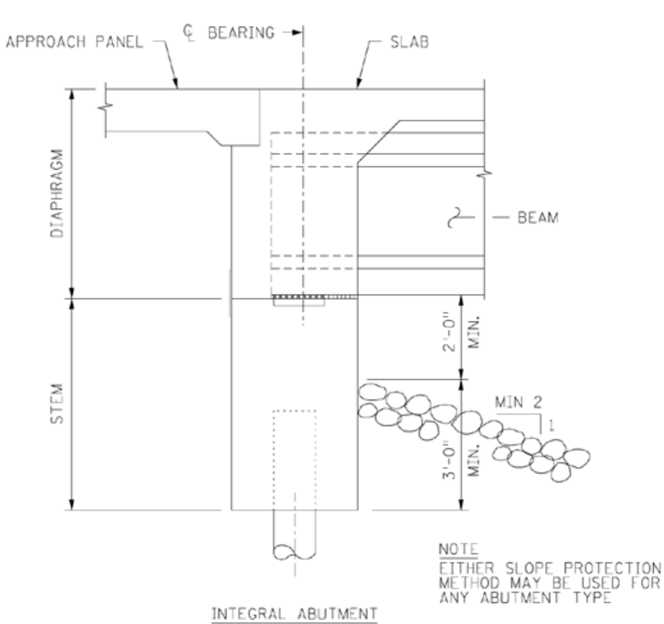
Integral and semi-integral abutments are now the preferred design for new bridges in Minnesota, as they eliminate the need for a deck expansion joint above. Traditional concrete parapet abutments are now only used when the design criteria for integral or semi-integral abutments cannot be met (see Section 11.1 in the MnDOT LRFD Bridge Design Manual).

An integral abutment consists of a concrete abutment stem supported by a single line of piles. The beams, girders, or slabs bear upon the abutment stem. A concrete diaphragm, poured with the deck, encases the beam ends, making the superstructure, deck, and often the approach panel integral with the abutment.

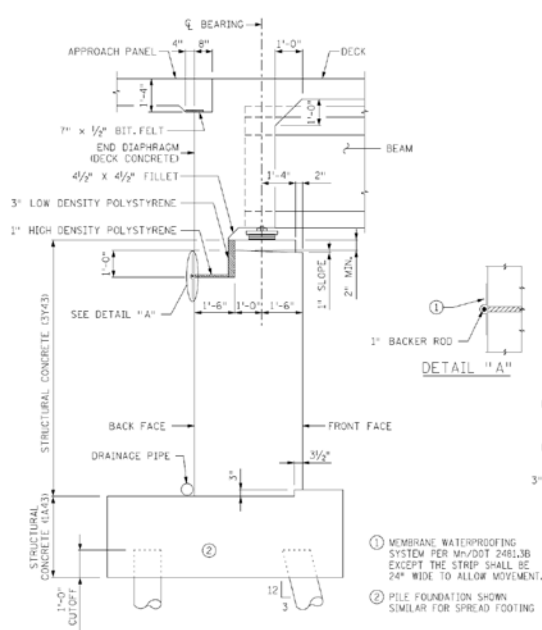
A semi-integral abutment is similar to an integral abutment in that the superstructure, deck, and approach panel are integral and expand and contract as a single unit. The primary difference is that the superstructure is supported on bearings, allowing the superstructure to move independently form the abutment stem. Another difference is that the stem footing is typically supported by multiple rows of piles.

Use the criteria below when rating the condition of an integral or semi-integral abutment.

- The abutment stem should be rated using Element #215 (Concrete Abutment) and should be considered to be part of the substructure.
- The concrete diaphragm should be rated using Element #855 (Secondary Members – Superstructure) and should be considered to be part of the superstructure.
- Bearing elements will typically be used only if bearing assemblies are present on the abutment stem and are visible for inspection.
- If integral concrete approach panels are present, Element #321 (Concrete Approach Slab) will typically be used.
- If approach relief joints are present on a bridge with integral or semi-integral abutments, it is important that Element #816 (Approach Relief Joint) be added and rated. On these bridges, the approach relief joints often must accommodate thermal expansion of the bridge as well as the adjacent roadway.



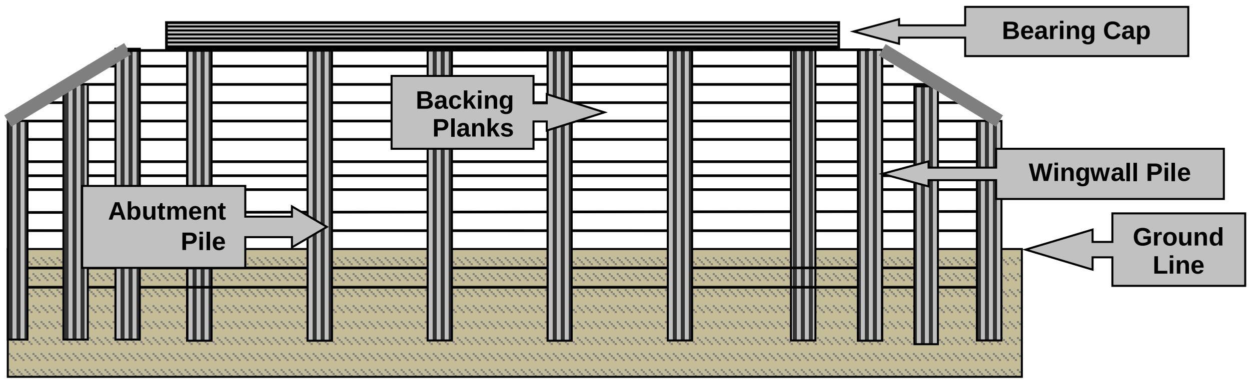
Integral Abutment (Cross Section)



Semi-Integral Abutment (Cross Section)

B.5.1.4 Timber Abutments

Timber abutments are typically comprised of three main components (backfill planks, bearing cap, and piling), which are rated using three separate structural elements. These components may be connected with bolts, straps, lag screws, nails, spikes, or drift pins. The inspector should determine the condition of each timber element, as well as the overall orientation and stability of the abutment. The presence of failed connections or misaligned members should be reflected in the element ratings. Note: If the abutment has tipped, rotated, or settled, Element #883 (Substructure Settlement and Movement) must be rated accordingly.



Front View of a Typical Timber Abutment

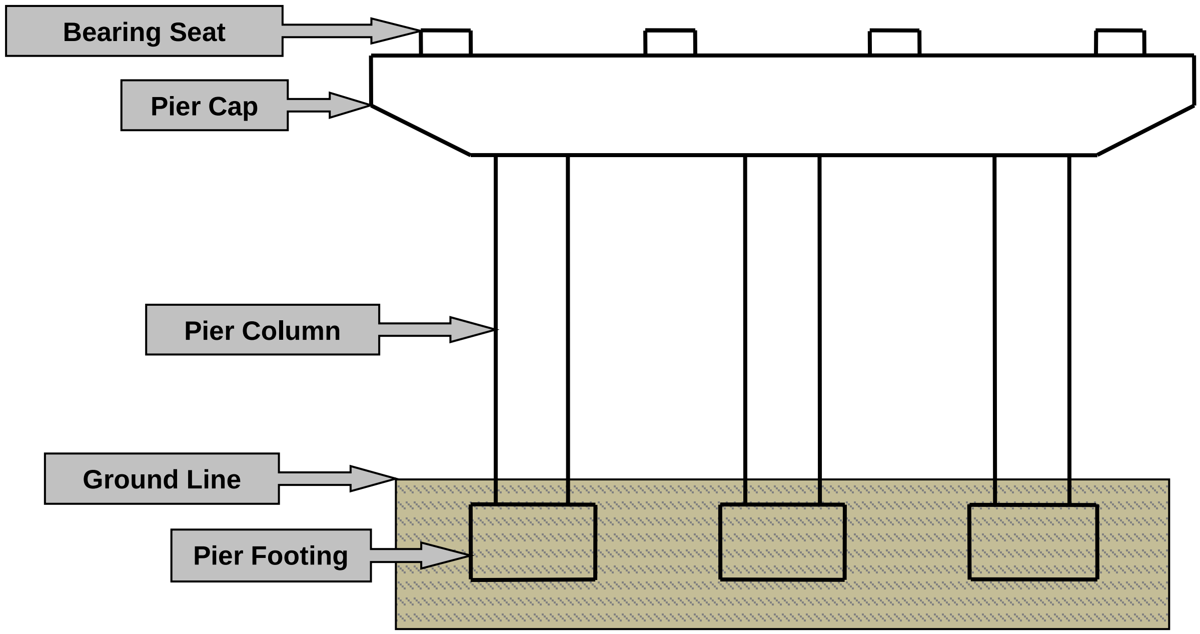
- **Backfill planks (abutment face and wingwalls)**: The backfill planks retain the abutment backfill and transfer earth pressure forces to the piling. Element #216 (Timber Abutment) should primarily reflect the condition of the backfill planks, but should also reflect the overall structural condition of the abutment. This is a linear feet (LF) item, measured across the front face of the abutment, including the length of any timber wingwalls. Backfill planks should be inspected for bulging, gaps, or voided backfill. There should be some backing planks below the ground line. If the bottom backing plank is exposed (due to erosion of stream degradation), the abutment backfill cannot be properly retained.

- **Bearing cap:** The bearing cap provides a bearing seat for the superstructure and transfers superstructure loads to the piling. Element #235 (Timber Pier Cap) should be used to rate the condition of the abutment bearing cap. This is a linear feet (LF) item, measured along the length of the cap. The total element quantity should include the abutment caps as well the pier caps (if there are any). Note: If the cap is comprised of another material (such as steel or concrete), the appropriate structural element should be selected. If the cap is not bearing properly on the pilings (twisted, offset, or gap), this should be reflected in the cap element rating.

- **Pile:** Pilings transmit superstructure loads from the bearing cap into the surrounding soil. Most timber abutments are supported by timber pile. A timber pile is a cylindrical shaft (typically 12” to 16” in diameter) driven into the ground using a pile hammer. Some timber abutment piling incorporate steel cable tie-back systems to resist the horizontal force resulting from earth pressure. Element #228 (Timber Pile) should be used to rate the condition of the abutment (and wingwall) piling. This is an “each” item – the total element quantity includes all timber piling on the bridge (abutment, wingwall, and piers). Note: If the abutment piling are comprised of another material (such as steel or concrete), the appropriate piling element should be selected. Free-standing vertical supports (not driven in the ground with a hammer) should be rated using a column element. Timber columns (Element #206) typically have a square cross-section.

B.5.1.5 Concrete Column Piers

The most common pier configuration is a reinforced concrete column pier, which is comprised of two or more columns (bearing on footings), which support a bearing cap. These piers are typically cast-in-place, and are tied together with steel reinforcement to create a rigid frame.



Typical Concrete "Column Pier" Configuration

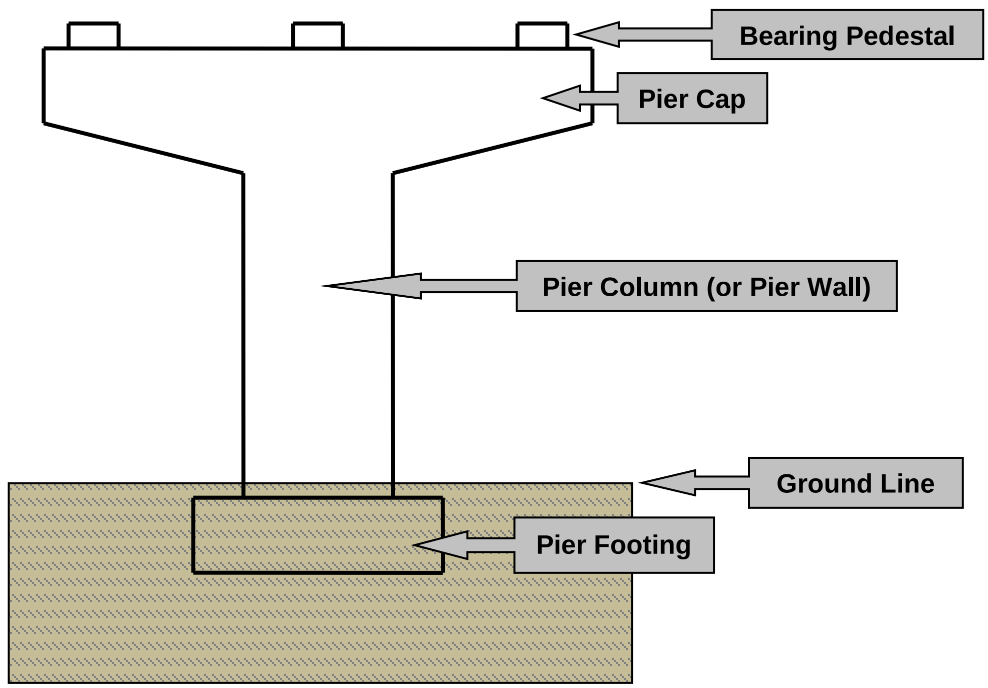
- **Pier cap:** The pier cap is the upper horizontal portion of the pier that supports the superstructure. Pier caps are subjected to bending and shear forces. The pier cap (including the bearing seats) is rated using Element #234 (Reinforced Concrete Cap). This is a "linear foot" quantity, measured along the length of the cap. If shear cracking is present, Element #883 must be added to the report and rated.
- **Pier columns:** The vertical pier columns transfer the superstructure load from the pier cap to the pier footing – they are primarily subjected to compression forces. Pier columns are rated using Element #205 (Reinforced Concrete Column). This is an "each" item, a condition rating must be determined for each specific column. Crash struts (or barriers) between the pier columns should be rated using Element #856 (Secondary Members – Substructure). This is an "each" item, the quantity can simply be left as "1".
- **Pier footings:** As most pier footings are designed to be located below grade (not visible for inspection), they are typically not rated. If footings are exposed by scour or streambed degradation, it should be brought to the attention of the agency Program Administrator (and bridge owner). Concrete footings that are visible for inspection should be rated using Element #220 (Reinforced Concrete Footing).

General inspection procedures for concrete piers:

- Note concrete deterioration (cracking, leaching, rust staining, delamination or spalling).
- Note evidence of deck joint leakage (staining on the cap or debris on the bearing seat).
- Note any evidence of settlement, tipping, rotation, or other movement.
- If the pier is submerged in water, the perimeter should be probed for evidence of scour, undermining, or footing/piling exposure (refer to the underwater inspection report, if applicable).
- Note the presence and condition of any pier protection components (such as dolphins, fenders, or crash struts).

B.5.1.6 Concrete Hammerhead Piers

A reinforced concrete hammerhead pier consists of a single column with a relatively wide cantilevered pier cap (the cap is typically tapered in depth).



Typical "Hammerhead" Pier Configuration

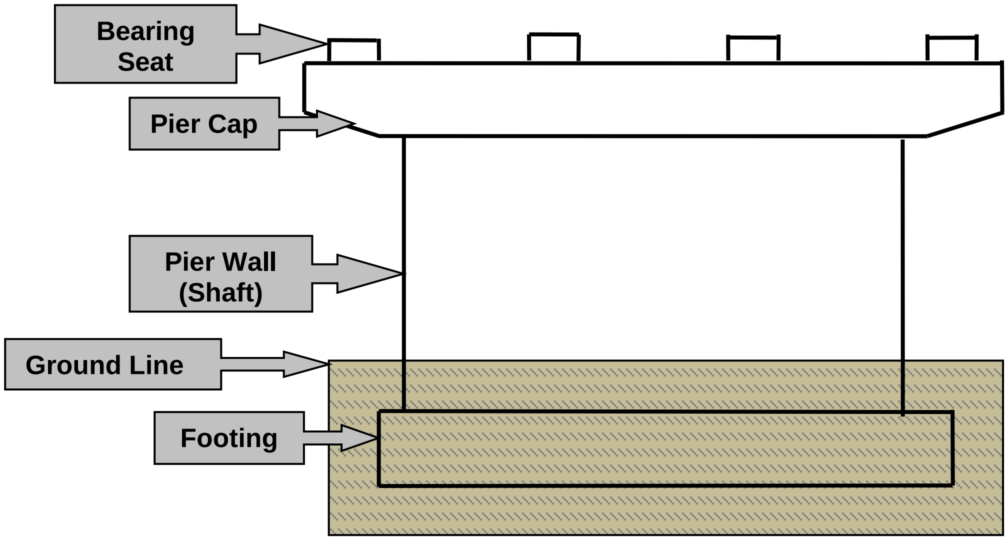
- **Pier cap:** Element #234 (Reinforced Concrete Cap) should be used to rate the cap and bearing pedestals – this is a linear foot (LF) quantity (measured along the length of the cap). The cantilever portion of the cap should be examined for any evidence of structural distress (such as shear cracking). If shear cracking is present, Element #883 (Substructure Settlement and Movement) must be added to the report and rated.

- **Pier column or Pier Walls:** The vertical portion of a hammerhead pier could consist of a column or pier wall. Element #205 (Reinforced Concrete Column) will typically be used to rate columns – this is an "each" item. If the vertical support is 10 ft. or greater in width (and wider than it is deep), it should be rated using Element #210 (Reinforced Concrete Pier Wall) – this is a LF item.

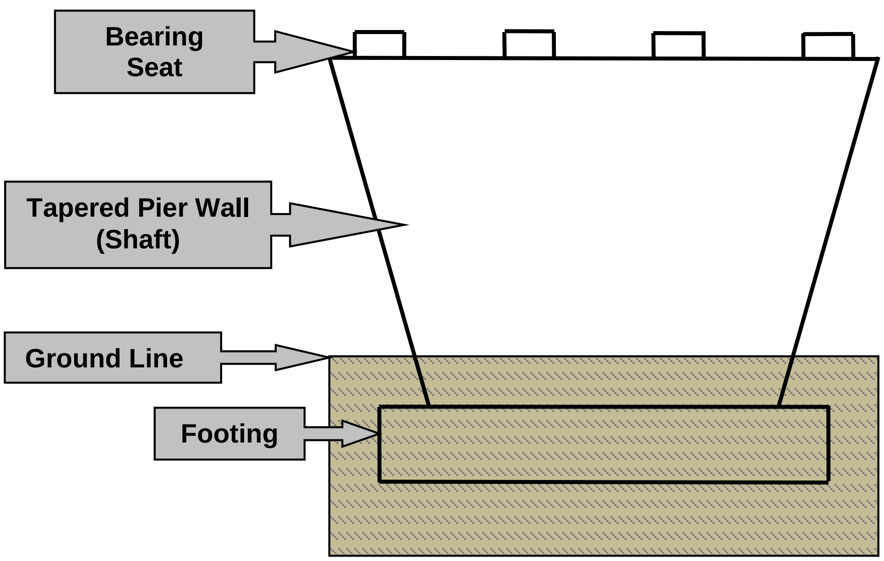
- **Pier footing:** As the pier footing (and pilings) are typically located below grade and not visible for inspection, they are not rated as a structural element.

B.5.1.7 Concrete Pier Walls

A reinforced concrete pier wall is comprised of a solid shaft (as opposed to separate columns). The shaft may be straight (vertical) or tapered. There may or may not be a pier cap.



Concrete Pier Wall – Straight (Vertical) Shaft with Pier Cap

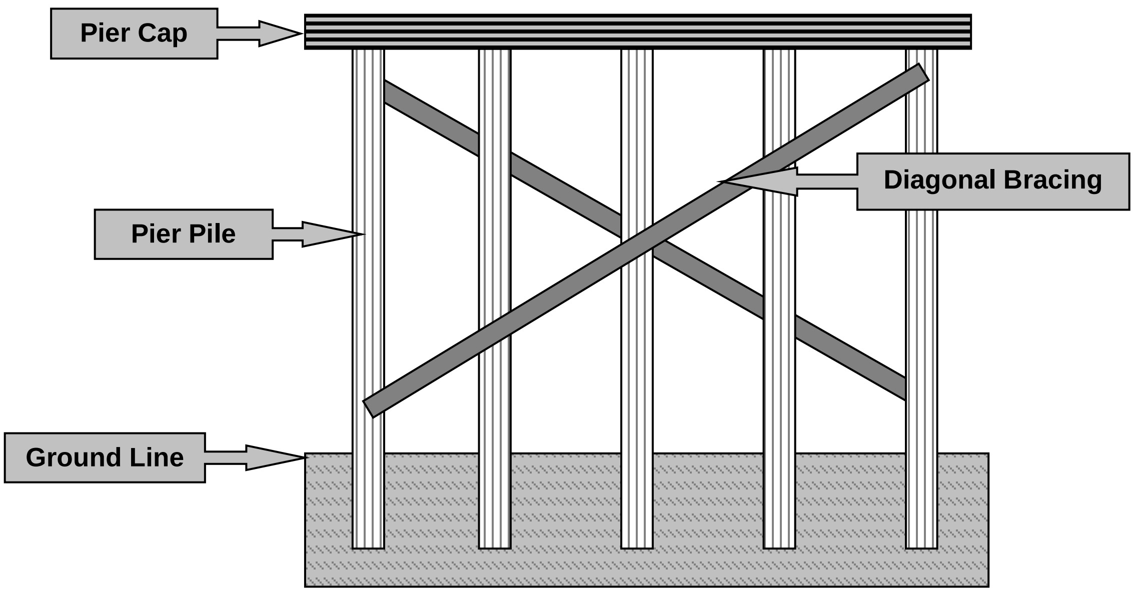


Concrete Pier Wall – Tapered Shaft without Pier Cap

- Element #210 (Reinforced Concrete Pier Wall) should be used to rate the pier wall shaft. This is a linear feet (LF) quantity (measured horizontally along the face of the pier wall (on tapered pier walls, use the widest dimension). As a general rule, pier shafts less than 10 ft. long should be rated using Element #205 (Concrete Column).
- If a pier cap is present, Element #234 (Reinforced Concrete Cap) should be used to rate the cap and bearing seats. If no cap is present, the bearing seats can be included with Element #210 (Reinforced Concrete Pier Wall). As pier footings are typically below grade and not visible for inspection, they are not rated.

B.5.1.8 Pile Bent Piers (Timber, Steel, or Concrete)

Piers comprised of two or more piling supporting a cap are known as pile bents. While typically comprised of timber, they may include steel or concrete members. The inspector should determine the condition of each element, as well as the overall orientation and stability of the pier. The presence of failed connections or misaligned members should be reflected in the element ratings. Note: If the pier has tipped, settled, or moved, Element #883 (Substructure Settlement and Movement) must be rated accordingly.



Pile Bent Pier

- **Piling:** Pier piling transmit the superstructure load from the pier cap to the supporting soil (they are mainly subjected to compression forces). Piling should be examined for impact damage or deterioration, particularly along the waterline or ground line. MnDOT has four piling elements – they are all "each" items, a single condition rating must be determined for each pile.
    - **#225: Steel Piling (Includes H-pile and CIP Piling)**
    - **#226: Prestressed Concrete Piling**
    - **#227: Reinforced Concrete Piling**
    - **#228: Timber Piling**

- **Pier Cap:** The pier cap provides a bearing seat for the superstructure, and transfers the superstructure loads to the piling. The connections between the cap and piling should be examined for any deterioration or distress. The cap material on pile bent piers may differ from the piling material. Pier cap elements are all "LF" items, measured along the length of the cap.
    - **#231: Steel Pier Cap**
    - **#234: Reinforced Concrete Pier Cap**
    - **#235: Timber Pier Cap**

- **Pier Bracing:** To prevent pile buckling, pile bent piers are often reinforced with diagonal bracing. The bracing members should be examined for deterioration, impact damage, or connection failure. Bracing members can be rated using Element #856 (Secondary Members – Substructure). This is an "each" item, the quantity can simply be left as "1".

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STATE OF MINNESOTA

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Chapter C

STRUCTURE INFORMATION MANAGEMENT SYSTEM (SIMS)

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C.1 OVERVIEW

This Chapter was intentionally left blank, it will be updated in a future revision. Contact SIMS.Help@state.mn.us for issues regarding the InspectTech Structure Information Management System (SIMS).

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Bridge and Structure Inspection Program Manual

DEPARTMENT OF TRANSPORTATION

Chapter D

RECORDING AND CODING GUIDE

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D.1 OVERVIEW

Chapter D, the Recording and Coding Guide chapter of the MnDOT Bridge and Structure Inspection Program Manual (BSIPM), is intended to provide detailed guidance of all structure inventory data required to be documented for all bridges by the State of Minnesota. An accurate bridge inventory reporting system is essential to document bridge conditions and to protect the public's safety and investment in bridge structures.

Inspector Note:
Text in this format symbolizes an important note that is applicable to a bridge inspector to alert of an item to verify in the field.

The Federal Highway Association (FHWA) bridge inventory items are outlined in numerical order in the Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges**. (FHWA Recording Guide)**. FHWA bridge inventory items referenced in this guide will be referred to by their FHWA NBI Item number. The National Bridge Inventory (NBI) is the aggregation of structure inventory and appraisal data collected by each state to fulfill the requirements of the National Bridge Inspection Standards (NBIS).

BSIPM User Note:
Text in this format indicates that another chapter of the manual may contain additional information regarding the topic.

The state of Minnesota first started a bridge inventory system in the 1930's, long before FHWA mandated a nationwide inventory system in 1971. As a result, the MnDOT bridge inventory includes numerous items that differ from those in the FHWA Recording Guide. Data Items that are applicable only to Minnesota or have been modified by MnDOT will be labeled as a MnDOT item. Those items that are reported to FHWA will be labeled as an NBI Item.

MnDOT is responsible for maintaining the inventory database for the NBI as well as the MnDOT inventory Items.

All items on the Minnesota Structure Inventory Report should be checked during routine bridge inspections. Inventory items on the SIMS SIA Edit forms can and should be updated by the inspector. Updates to all other inventory items should be submitted to the MnDOT Bridge Inventory Management Unit (BIMU). Update requests should be emailed to BIMU's group email address: #DOT_BridgeDataRequests.

This recording and coding guide was created by the MnDOT Bridge Office and is intended to assist MnDOT, FHWA, local agencies and engineering consultants to understand, update and complete a bridge inventory report. A PDF version of the BSIPM can be downloaded from the MnDOT Bridge Office website at http://www.dot.state.mn.us/bridge/inspection.html and http://www.dot.state.mn.us/bridge/bridgereports/index.html. For questions, comments, or concerns, please contact Pete Wilson at 651-366-4574 or via email at pete.wilson@state.mn.us, or contact Eric Evens at 651-366-4570 or via email at eric.evens@state.mn.us.

D.2 ABBREVIATIONS

The abbreviations and acronyms for Chapter D – Recording and Coding Guide are located in the Introduction section of the BSIPM.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) ● INVENTORY ITEMS ● NBI ITEMS

D.3 INVENTORY ITEMS

The following table lists every inventory Item in order of appearance on the SIMS SIA One Column form. Items are listed with hyperlinks to the section and page number where the item is described in this guide. Numbers in front of an item name indicate the NBI Item number.

INVENTORY ITEM NAME	SECTION NUMBER *Quick Links*	PAGE NUMBER *Quick Links*
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Bridge Name	D.7.1.4	27
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2. District	D.7.1.7	29
3. County	D.7.1.8	31
4. Place Code	D.7.1.9	33
City	D.7.1.10	33
Township	D.7.1.11	34
9. Descriptive Location	D.7.1.12	34
Section, Township, Range	D.7.1.13	35
16. Latitude	D.7.1.14	36
17. Longitude	D.7.1.15	36
21. Custodian/Maintenance Responsibility	D.7.1.16	37
22. Owner	D.7.1.17	37
Maintenance Area	D.7.1.18	38
Bridge Crew	D.7.1.19	39
27. Year Built	D.7.1.20	42
Date Opened to Traffic	D.7.1.21	42
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106. FHWA Year Reconstructed	D.7.1.23	43
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37. Historic Significance	D.7.1.27	45
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44B. Approach Span Type (Design)	D.7.2.6	51
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MN Approach Span Design	D.7.2.12	57
Approach Span Detail Definition	D.7.2.13	57
45. Number of Main Spans	D.7.2.14	58
46. Number of Approach Spans	D.7.2.15	58
Total Number of Spans	D.7.2.16	58
28A. Lanes On the Structure	D.7.2.17	58
28B. Lanes Under the Structure	D.7.2.18	59
Median on Structure	D.7.2.19	59
33. Bridge Median Type	D.7.2.20	59
34. Skew Angle	D.7.2.21	60
Direction of Skew	D.7.2.22	60
35. Structure Flared	D.7.2.23	61
48. Max Span Length	D.7.2.24	61
49. Structure Length	D.7.2.25	62
Total Length	D.7.2.26	64
112. NBIS Bridge Length	D.7.2.27	64
52. Deck Width (Out-to-Out)	D.7.2.28	64
Deck Area (Out-to-Out)	D.7.2.29	65
Roadway Area (Curb-to-Curb)	D.7.2.30	65
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Curb Height (Lt and Rt)	D.7.2.32	67
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108B. Deck Membrane Type	D.7.2.48	98
108C. Deck Rebar Protection	D.7.2.49	99
Deck Install Year	D.7.2.50	100
Wearing Surface Installation Year	D.7.2.51	100
Wear Course/Fill Depth	D.7.2.52	100
MN Actual Fill Depth	D.7.2.53	101
Beam Type (Main Span)	D.7.2.54	101
Beam Height (Main Span)	D.7.2.55	102
Number of Beam Lines (Main Span)	D.7.2.56	102
Number of Beam Lines (Approach Span)	D.7.2.57	102
Curved Bridge	D.7.2.58	102
Bifurcated	D.7.2.59	102
Radial Supports	D.7.2.60	103
Two-Girder Bridge	D.7.2.61	103
Degree of Curvature	D.7.2.62	103
Cantilever ID	D.7.2.63	103
Field Connection ID	D.7.2.64	104
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Multiple Steel Grades	D.7.2.66	105
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Steel Yield Stress 1	D.7.2.68	105
Steel Yield Stress 2	D.7.2.69	105
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60. Substructure Condition Code	D.7.4.3	120
61. Channel and Channel Protection Condition	D.7.4.4	120
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36B. Railing Transitions	D.7.5.4	128
36C. Approach Guardrail	D.7.5.5	134
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[ON] 32. Approach Roadway Width	D.7.11.16	237
[ON] 51. Bridge Roadway Width	D.7.11.17	238
[ON] MnDOT Roadway Width	D.7.11.18	239
[ON] 47. Horizontal Clearance	D.7.11.19	240
[ON] MnDOT Horizontal Clearance	D.7.11.20 and D.7.11.21	241 and 242
[ON] 11. Mile Point	D.7.11.22	243
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[ON] 20. Toll Facility	D.7.11.24	244
[ON] 26. Functional Classification	D.7.11.25	244
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76. Improvement Length	D.7.12.3	259
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94. Bridge Improvement Cost	D.7.12.5	259
95. Roadway Improvement Cost	D.7.12.6	260
96. Total Improvement Cost	D.7.12.7	260
97. Year of Improvement Cost Estimate	D.7.12.8	261
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[UNDER] Bridge Match ID	D.7.13.1	262
[UNDER] 5A. Roadway On/Under	D.7.13.2	263
[UNDER] 5B. Route Type (Route Signing Prefix)	D.7.13.3	264
[UNDER] 5C. Level of Service	D.7.13.4	264
[UNDER] 5D. Route Number	D.7.13.5	264
[UNDER] 5E. Directional Suffix	D.7.13.6	265
[UNDER] 102. Direction of Traffic	D.7.13.7	265
[UNDER] MN Roadway Class	D.7.13.8	265
[UNDER] MN Median Type	D.7.13.9	266
[UNDER] Median Width	D.7.13.10	266
[UNDER] 10. Vertical Clearance	D.7.13.11	267
[UNDER] MnDOT Vertical Clearance	D.7.13.12 and D.7.13.13	267 and 267
[UNDER] MnDOT Maximum Vertical Clearance	D.7.13.14 and D.7.13.15	268 and 268
[UNDER] MnDOT Roadway Width	D.7.13.16	269
[UNDER] 47. Horizontal Clearance	D.7.13.17	270
[UNDER] MnDOT Horizontal Clearance	D.7.13.18 and D.7.13.19	270 and 271
[UNDER] MnDOT Lateral Clearance Left	D.7.13.20	271
[UNDER] MnDOT Lateral Clearance Right	D.7.13.21	272
[UNDER] 11. Mile Point	D.7.13.22	272
[UNDER] 19. Detour Length	D.7.13.23	272
[UNDER] 20. Toll Facility	D.7.13.24	273
[UNDER] 26. Functional Classification	D.7.13.25	273
[UNDER] 28B. Lanes Under	D.7.13.26	274
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[UNDER] Inter Reg Corridor	D.7.13.34	278
[UNDER] Interchange Element	D.7.13.35	278
[UNDER] Control Section (TH Only)	D.7.13.36	278
[UNDER] Road Name	D.7.13.37	279
[UNDER] Route System (TIS)	D.7.13.38	279
[UNDER] Route Number (TIS)	D.7.13.39	280
[UNDER] Reference Point (TIS)	D.7.13.40	281
[UNDER] Linear Reference System (LRS)	D.7.13.41	281

D.4 NBI ITEMS

The following table lists all of the FHWA NBI Items in sequential order. Items are listed with hyperlinks to the section and page number where the item is described in this guide. The NBI Items are submitted in accordance with the FHWA Recording Guide. A copy of the FHWA Recording Guide is available at http://www.fhwa.dot.gov/bridge/bripub.htm. Data is submitted to FHWA on an annual basis by April 1st and contains the most current inventory and inspection data on highway bridges.

ITEM NO.	NBI ITEM NAME	SECTION LOCATION *Quick Links*	PAGE NUMBER *Quick Links*
1	State Code	D.7.1.6	28
2	Highway Agency District	D.7.1.7	29
3	County (Parish) Code	D.7.1.8	31
4	Place Code	D.7.1.9	33
5A	Record Type	D.7.11.2	231
5B	Route Signing Prefix	D.7.11.3	231
5C	Designated Level of Service	D.7.11.4	232
5D	Route Number	D.7.11.5	232
5E	Directional Suffix	D.7.11.6	232
6A	Features Intersected	D.7.1.3	27
7	Facility Carried By Structure	D.7.1.2	26
8	Structure Number	D.7.1.1	24
9	Location	D.7.1.12	34
10	Inventory Route, Min Vert Clearance	D.7.11.11	234
11	Mile Point	D.7.11.22	243
12	Base Highway Network	D.7.11.26	245
13A	LRS Inventory Route	D.7.11.33	248
13B	Subroute Number	D.7.11.33	248
16	Latitude	D.7.1.14	36
17	Longitude	D.7.1.15	36
19	Bypass/Detour Length	D.7.11.23	243
20	Toll	D.7.11.24	244
21	Maintenance Responsibility	D.7.1.16	37
22	Owner	D.7.1.17	37
26	Functional Class Of Inventory Route	D.7.11.25	244
27	Year Built	D.7.1.20	42
28A	Lanes On Structure	D.7.2.17	58
28B	Lanes Under Structure	D.7.2.18	59
29	Average Daily Traffic	D.7.11.29	246
30	Year Of Average Daily Traffic	D.7.11.30	247
31	Design Load	D.7.6.1	156
32	Approach Roadway Width	D.7.11.16	237
33	Bridge Median Type	D.7.2.20	59
34	Skew	D.7.2.21	60

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35	Structure Flared	D.7.2.23	61
36	Traffic Safety Features	D.7.5.1	122
36A	Bridge Railings	D.7.5.2	123
36B	Transitions	D.7.5.4	128
36C	Approach Guardrail	D.7.5.5	134
36D	Approach Guardrail Ends	D.7.5.6	136
37	Historical Significance	D.7.1.27	45
38	Navigation Control	D.7.9.1	183
39	Navigation Vertical Clearance	D.7.9.3	184
40	Navigation Horizontal Clearance	D.7.9.4	184
41	Structure Open/Posted/Closed	D.7.3.1	107
42A	Type of Service On Bridge	D.7.2.1	48
42B	Type of Service Under Bridge	D.7.2.2	48
43A	Main Span Kind of Material/Design	D.7.2.3	49
43B	Main Span Type of Design/Construction	D.7.2.4	50
44A	Approach Span Kind of Material/Design	D.7.2.5	50
44B	Approach Span Type of Design/Construction	D.7.2.6	51
45	Number Of Spans In Main Unit	D.7.2.14	58
46	Number Of Approach Spans	D.7.2.15	58
47	Inventory Rte Total Horz Clearance	D.7.11.19	240
48	Length Of Maximum Span	D.7.2.24	61
49	Structure Length	D.7.2.25	62
50A	Left Curb/Sidewalk Width	D.7.2.31	65
50B	Right Curb/Sidewalk Width	D.7.2.31	65
51	Bridge Roadway Width Curb-To-Curb	D.7.11.17	238
52	Deck Width, Out-To-Out	D.7.2.28	64
53	Min Vert Clear Over Bridge Roadway	D.7.8.1	172
54A	Reference Feature	D.7.8.2	172
54B	Minimum Vertical Underclearance	D.7.8.2	172
55A	Reference Feature	D.7.8.3	174
55B	Minimum Lateral Underclearance	D.7.8.3	174
56	Min Lateral Underclear On Left	D.7.8.4	176
58	Deck	D.7.4.1	119
59	Superstructure	D.7.4.2	119
60	Substructure	D.7.4.3	120
61	Channel/Channel Protection	D.7.4.4	120
62	Culverts	D.7.4.5	121
63	Method Used To Determine Operating Rating	D.7.6.2	157
64	Operating Rating	D.7.6.3	158
65	Method Used To Determine Inventory Rating	D.7.6.4	158
66	Inventory Rating	D.7.6.5	158

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ITEM NO.	NBI ITEM NAME	SECTION LOCATION *Quick Links*	PAGE NUMBER *Quick Links*
67	Structural Evaluation	D.7.5.9	146
68	Deck Geometry	D.7.5.10	147
69	Underclear, Vertical & Horizontal	D.7.5.11	150
70	Bridge Posting	D.7.6.6	159
71	Waterway Adequacy	D.7.5.12	152
72	Approach Roadway Alignment	D.7.5.13	154
75A	Type of Work Proposed	D.7.12.1	257
75B	Work Done By	D.7.12.1	257
76	Length Of Structure Improvement	D.7.12.3	259
90	Inspection Date	D.7.3.2	108
91	Designated Inspection Frequency	D.7.3.3	109
92A	Fracture Critical Details	D.7.3.9	115
92B	Underwater Inspection	D.7.3.10	116
92C	Special Inspection (Pinned Assembly)	D.7.3.11	117
93A	Fracture Critical Details Date	D.7.3.9	115
93B	Underwater Inspection Date	D.7.3.10	116
93C	Special Inspection Date (Pinned Assembly)	D.7.3.11	117
94	Bridge Improvement Cost	D.7.12.5	259
95	Roadway Improvement Cost	D.7.12.6	260
96	Total Project Cost	D.7.12.7	260
97	Year Of Improvement Cost Estimate	D.7.12.8	261
98	Border Bridge	D.7.1.28	45
98A	Neighboring State Code	D.7.1.28.1	46
98B	Percent Responsibility	D.7.1.28.2	46
99	Border Bridge Structure Number	D.7.1.29	47
100	STRAHNET Highway Designation	D.7.11.34	249
101	Parallel Structure Designation	D.7.2.43	95
102	Direction Of Traffic	D.7.11.7	233
103	Temporary Structure Designation	D.7.2.44	95
104	Highway System Of Inventory Route	D.7.11.35	250
105	Federal Lands Highways	D.7.11.36	251
106	Year Reconstructed	D.7.1.23	43
107	Deck Structure Type	D.7.2.46	97
108A	Type of Wearing Surface	D.7.2.47	98
108B	Type of Membrane	D.7.2.48	98
108C	Deck Protection	D.7.2.49	99
109	Average Daily Truck Traffic	D.7.11.37	251
110	Designated National Network	D.7.11.38	252
111	Pier/Abutment Protection (For Navigation)	D.7.9.2	183
112	NBIS Bridge Length	D.7.2.27	64
113	Scour Critical Bridges	D.7.9.10	188
114	Future Average Daily Traffic	D.7.11.31	247

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ITEM NO.	NBI ITEM NAME	SECTION LOCATION *Quick Links*	PAGE NUMBER *Quick Links*
115	**Year Of Future Avg Daily Traffic**	**D.7.11.32**	**248**
116	**Minimum Navigation Vertical Clearance Vertical Lift Bridge**	**D.7.9.5**	**184**

D.5 MN STRUCTURE INVENTORY REPORT (INTERACTIVE)

The Minnesota Structure Inventory Report below is an interactive structure inventory report. Clicking on a link will take you to that section in Chapter D. Current reports for each bridge are available on MnDOT's website at http://www.dot.state.mn.us/bridge/bridgereports/index.html.

MINNESOTA STRUCTURE INVENTORY REPORT

Bridge ID: Facility Carried By Structure over Features Intersected

+ GENERAL +	+ ROADWAY ON BRIDGE+	+ INSPECTION +
Agency Br. No. Crew	Road Name	Deficient Status
District Maint. Area	Functional Class.	Sufficiency Rating
County	ADT (YEAR)	Last Routine Insp Date
City	HCADT	Routine Insp Frequency
Township	National Highway System	Inspector Name
Desc. Loc.	Route Sys/Nbr (TIS)	Status
Sect., Twp., Range	Ref. Point (TIS)	**+ NBI CONDITION RATINGS +**
Latitude	Detour Length	Deck
Longitude	Lanes ON Bridge	Superstructure
Custodian	Control Section (TH Only)	Substructure
Owner	Function	Channel
Insp Responsibility	Type	Culverts
Year Built	Bridge Match ID	**+ NBI APPRAISAL RATINGS +**
Date Opened to Traffic	Roadway Key	Structural Evaluation
MN Year Remodeled		Deck Geometry
FHWA Year Reconstructed	**+ RDWY DIMENSIONS ON BRIDGE +**	Underclearances
Bridge Plan Location	If Divided NB-EB SB-WB	Waterway Adequacy
Potential ABC	Roadway Width	Approach Alignment
+ STRUCTURE +	Vertical Clearance	**+ SAFETY FEATURES +**
Service On	Max. Vert. Clear.	Bridge Barrier
Service Under	Horizontal Clear.	GR Transition
Main Span Type	Appr. Surface Width	Appr. Guardrail
Main Span Detail	Bridge Roadway Width	GR Termini
Appr. Span Type	Median Width On Bridge	**+ SPECIAL INSPECTIONS +**
Appr. Span Detail		Frac. Critical
Skew	**+ MISC. BRIDGE DATA +**	Underwater
Culvert Type	Structure Flared	Pinned Asbly.
Barrel Length	Parallel Structure	
Number Of Spans	Field Conn. ID	**+ WATERWAY +**
MAIN: APPR: TOTAL:	Cantilever ID	Drainage Area
Main Span Length	Foundations	Waterway Opening
Structure Length	Abut.	Navigation Control
Deck Width	Pier	Pier Protection
Deck Material	Historic Status	Nav. Vert. / Horz. Clr.
Wear Surf Type	On - Off System	Nav. Vert. Lift Bridge Clear.
Wear Surf Install Year	**+ PAINT +**	MN Scour Code
Wear Course/Fill Depth	Year Painted	Scour Evaluation Year
Deck Membrane	Painted Area	**+ CAPACITY RATINGS +**
Deck Rebars	Primer Type	Design Load
Deck Install Year	Finish Type	Operating Rating
Structure Area	**+ BRIDGE SIGNS +**	Inventory Rating
Roadway Area	Posted Load	Posting
Sidewalk Width - L/R	Traffic	Rating Date
Curb Height - L/R	Horizontal	Overweight Permit Codes
Barrier Codes - L/R	Vertical	A B C

D.6 DATA ENTRY IN SIMS

In 2011, MnDOT implemented a new Structure Information Management System (SIMS) for entering bridge inspection and structure inventory data. The use of SIMS is required for entering and approving inspection reports, and managing all bridge inspection information. The current Bridge Reports are available through MnDOT's Bridge Reports webpage. These reports are updated nightly with approved SIMS changes.

SIMS is not only an interface for inspectors to enter inspection data, but also an electronic bridge file that serves agency Program Administrators (PA). Within the SIMS program, PAs have procedures to review and maintain compliance of their bridge inspection program as directed by Minnesota Statute 165.03.

For routine and special (fracture critical, underwater, pinned assembly, and damage) inspections, the NBIS requires entry and approval of the inspection data into SIMS within **90 days** of the date of inspection for State or Federal agency bridges, and within **180 days** of the date of inspection for all other bridges.

The NBIS requires that load rating information for State Trunk Highway bridges be updated within **90 days** of the load rating date, and that load rating information for County/Local bridges be updated within **180 days** of the load rating date. For changes in load restriction or closure status the inspector should verify that NBI 41 is coded correctly.

D.7 MINNESOTA STRUCTURE INVENTORY REPORT

This section gives a detailed description for each bridge inventory item. Items are listed in the order of appearance on the SIMS SIA One Column form.

All data is recorded in feet unless otherwise noted. Data is converted to meters when submitted to FHWA.

Inspector Note:
It is the responsibility of the Bridge Inspection Team Leader to review and redline all items on the MN Structure Inventory Report that are incorrect. A copy of the markups should be sent to BIMU to be corrected or updated.

D.7.1 GENERAL INFORMATION

The general information section provides an overall description to identify the structure, including items such as the Bridge ID, location of the structure, owner information, year built, and other information to identify the structure.

D.7.1.1 Structure Number (NBI Item 8)

fe_id: 2000800 .... NBI 8: Structure Number
BRIDGE.struct_num

It is required that an official structure number be recorded. It isn't necessary to code this number according to an arbitrary national standard; MnDOT records the structure number according to its own internal processing procedures.

The structure number, or Bridge ID, must be unique for each bridge within the State, and once established should preferably never change for the life of the bridge.

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D.7.1.1.1 Current Bridge Numbering System

The current bridge numbering system used by MnDOT consists of a five or six alpha-numeric numbering system. The following table describes what these digits represent.

DIGITS	DESCRIPTION
1st and 2nd	Minnesota County Code
3rd	Type of Roadway System
4th and 5th	Sequence Number (00 through 99)
6th (if applicable)	Used If Bridge Separated Into Multiple Segments

The first two digits are based upon Minnesota's county code. **The Minnesota county codes are not the same numbering system as the NBI county codes**. Each county has a two digit number listed alphabetically from '01' (Aitkin County) to '87' (Yellow Medicine County). The complete list of the MnDOT county codes is shown in Section D.7.1.8. Use '99' for temporary structures instead of the county code.

The third digit identifies the type of roadway system as described in the following table.

IDENTIFIER	DESCRIPTION
0, 1, 2, 3, R, T, U	Trunk Highway Bridges
4, 7, 8, 9, V, W	Interstate Bridges
X, Y	Trunk Highway or Interstate Culverts
5, 6, A through H	County, City or Township Bridges
J through N, P, Q	County, City or Township Culverts

Note: The letters I, O, S, and Z are not to be used as they can be confused with the numbers 1, 0, 5, and 2.

The fourth and fifth digits make up the bridge sequence number ranging from '00' through '99'.

A sixth alpha-character (A, B, C, etc.) may be added at the end of a bridge number for those structures separated into separate segments (i.e., a "Y" shaped bridge with two ramps).

In cases of twin bridges, a westbound or southbound lane bridge is generally assigned a lower number than an eastbound or northbound lane bridge.

As of September 2006, the following numbering scheme was added for:

- Bridges or culverts without a highway over or under (e.g. pedestrian trail over stream)
- Existing bridges that have not been assigned a bridge number
- Skyways and other miscellaneous structures such as conveyors, pipelines, or buildings

  Use the format RZZZZ where:
  R = A literal character
  ZZZZ = Sequence number ('0000' thru '9999')

Past Bridge Numbering System

The State of Minnesota began assigning numbers to highway bridges after the Minnesota State Highway Commission was created in 1905. Structures built prior to MnDOT's adoption of its current numbering system received numbers based on the following (depending on when they were built).

- Bridge numbers were assigned starting with the number '10' and up to number '9999', generally in the order of the construction or repair contract.
- County, municipal, or township bridges have a five character alpha-numeric number starting with an 'L' or 'R'.
- Culverts, as well as county, municipal, or township bridges, have five digit numbers ranging between '88000' and '98999'.

D.7.1.2 Facility Carried By Structure (NBI Item 7)

fe_id: 2000700 .... NBI 7: Facility Carried by Structure
BRIDGE.facility

NBI Item 7 is the description of the facility carried by the structure. In all situations this item describes the use on the structure.

This field has a maximum limitation of 18 characters. Uppercase letters are required for all alpha-characters. Do not use apostrophes (') or ampersands (&).

Use the formal or '911' street names whenever possible. If the structure is a pedestrian bridge this item will be coded 'Pedestrian', or if applicable, the name of the trail. Consistent naming allows for consistent data query results.

There are instances when the formal or '911' street is not used. MnDOT's standard practice is to use the street name for all route systems except the following.

- 01 - ISTH
- 02 - USTH
- 03 - MNTH
- 04 - CSAH

For the above route systems the following guidance is used instead of the formal or '911' street name.

NBI ITEM 5B	ROUTE TYPE	CODE
1	Interstate Highway	I nn
2	US Highway	US nn
3	Minnesota State Highway	TH nn
4	CSAH	CSAH nn

Note: nn = route number.

See following examples:

- 190TH AVE
- 220TH ST E
- CSAH 14
- I 35E NB
  The direction should be included in this item (i.e., NB) when the bridge carries just one direction of a route.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.1.3 Features Intersected (NBI Item 6A)

fe_id: 2000610 .... NBI 6A: Feature Intersected: Narrative
BRIDGE.featint

NBI Item 6A is the description of the feature intersected by the structure. When NBI Item 5A indicates an "under" record this item describes the route and/or features under the structure. The information recorded for this item shall be the names of the features intersected by the structure. When one of the features intersected is another roadway, the route system and number, or the name of the roadway, shall appear first in the field. The names of other features shall follow, separated by a semicolon.

This field has a maximum limitation of 24 characters. Uppercase letters are required for all alpha-characters. Do not use apostrophes (') or ampersands (&). Consistent naming allows for consistent data query results.

Examples:

- BEVENS CREEK
- CSAH 41
- BENTON DR; MISS RVR; RR

See Section D.7.1.2 for MnDOT's standard practices for road names.

D.7.1.4 Bridge Name (MnDOT Item)

fe_id: 2111333 .... Bridge Name
BRIDGE.strucname

This optional item is the official designated, historic, or commonly used name associated with the structure.

Examples:

- DULUTH AREIAL LIFT BRIDGE
- ST CROIX RIVER CROSSING

D.7.1.5 Agency Bridge Number (MnDOT Item)

fe_id: 6 .... Agency Br. No.
USERBRDG.agency_bridge_n

This optional item is a number assigned to the structure by the Local Agency or bridge owner. This number is **independent** of NBI Item 8 (Structure Number), which is described in Section D.7.1.1.

This item is left blank if the Local Agency does not have an agency specific bridge numbering system. Examples of Local Agencies that have their own numbering system are St. Louis County, Polk County, and the City of Minneapolis.

D.7.1.6 State Code (NBI Item 1)

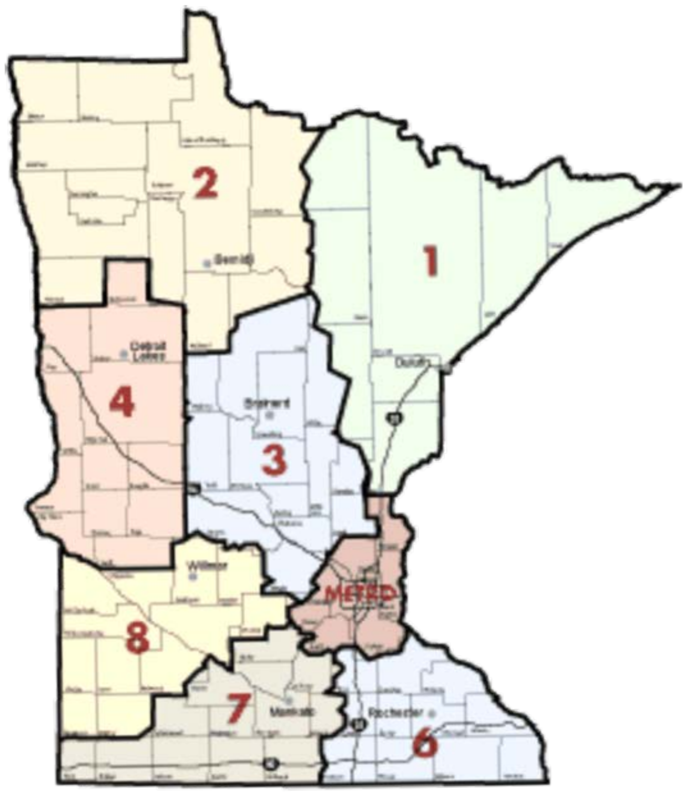
fe_id: 2000100 .... NBI 1: State Code
BRIDGE.fips_state; BRIDGE.fhwa_regn

The first two digits of this item represent the Federal Information Processing Standards (FIPS) code for States, and the third digit is the FHWA region code.

NBI Item 1 is coded '275' for Minnesota, where '27' is the FIPS code and '5' is the FHWA region code.

D.7.1.7 Highway Agency District (NBI Item 2)

fe_id: 2000200 .... NBI 2: District
BRIDGE.district



This item represents the MnDOT regional District in which the structure is located. The district number is based on where the structure is located; it isn't based on ownership, or maintenance or inspection responsibility.

Examples:

City/Township	County	District
Brainerd	Crow Wing	3
McGregor (Township of)	Aitkin	1

The MnDOT District can be determined based on the county as shown in the following table.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

COUNTY	DISTRICT	COUNTY	DISTRICT
01 – AITKIN	1 & 3	45 - MARSHALL	2
02 - ANOKA	METRO	46 - MARTIN	7
03 - BECKER	4	47 - MEEKER	8
04 - BELTRAMI	2	48 - MILLE LACS	3
05 - BENTON	3	49 - MORRISON	3
06 - BIG STONE	4	50 - MOWER	6
07 - BLUE EARTH	7	51 - MURRAY	8
08 - BROWN	7	52 - NICOLLET	7
09 - CARLTON	1	53 - NOBLES	7
10 - CARVER	METRO	54 - NORMAN	2
11 - CASS	2 & 3	55 - OLMSTED	6
12 - CHIPPEWA	8	56 - OTTER TAIL	4
13 - CHISAGO	METRO	57 - PENNINGTON	2
14 - CLAY	4	58 - PINE	1
15 - CLEARWATER	2	59 - PIPESTONE	8
16 - COOK	1	60 - POLK	2
17 - COTTONWOOD	7	61 - POPE	4
18 - CROW WING	3	62 - RAMSEY	METRO
19 - DAKOTA	METRO	63 - RED LAKE	2
20 - DODGE	6	64 - REDWOOD	8
21 - DOUGLAS	4	65 - RENVILLE	8
22 - FARIBAULT	7	66 - RICE	6
23 - FILLMORE	6	67 - ROCK	7
24 - FREEBORN	6	68 - ROSEAU	2
625 - GOODHUE	6	69 - ST. LOUIS	1
26 - GRANT	4	70 - SCOTT	METRO
27 - HENNEPIN	METRO	71 - SHERBURNE	3
28 - HOUSTON	6	72 - SIBLEY	7
29 - HUBBARD	2	73 - STEARNS	3
30 - ISANTI	3	74 - STEELE	6
31 - ITASCA	1	75 - STEVENS	4
32 - JACKSON	7	76 - SWIFT	4
33 - KANABEC	3	77 - TODD	3
34 - KANDIYOHI	8	78 - TRAVERSE	4
35 - KITTSON	2	79 - WABASHA	6
36 - KOOCHICHING	1 & 2	80 - WADENA	2
37 - LAC QUI PARLE	8	81 - WASECA	7
38 - LAKE	1	82 - WASHINGTON	METRO
39 - LAKE OF THE WOODS	2	83 - WATONWAN3	7
40 - LE SUEUR	7	84 - WILKIN	4
41 - LINCOLN	8	85 - WINONA	6
42 - LYON	8	86 - WRIGHT	3
43 - MCLEOD	8	87 - YELLOW MEDICINE	8
44 – MAHNOMEN	2 & 4		

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.1.8 County (Parish) Code (NBI Item 3) (MnDOT Item)

fe_id: 2000300 .... NBI 3: County (Parish) Code
BRIDGE.county

This item identifies the county in which the structure is located. If a bridge is located on a county line, only one county can be entered and the coding will be based on ownership of the bridge.

The following table is a list of Minnesota's 87 counties with the Minnesota two digit code and the FIPS three digit code. **The Minnesota two digit code is the number used for this item**. The Minnesota county numbering system consists of '01' through '87'. This is the system that is typically used within Minnesota State government.

The FIPS three digit codes are included in the table for information only. The FIPS county codes are given in the current version of the Census of Population and Housing – Geographic Identification Code Scheme and apply only to the dataset MnDOT submits to FHWA.

The example below shows the conversion of the MN county code to the FIPS county code for Hennepin County.

Example:

County	MN County Code	Conversion to FIPS
Hennepin	27	27*2 = 54; 54-1 = 53

The following table shows the MnDOT and FIPS County Codes.

MN COUNTY CODE	FIPS COUNTY CODE	COUNTY	MN COUNTY CODE	FIPS COUNTY CODE	COUNTY
01	001	AITKIN	45	089	MARSHALL
02	003	ANOKA	46	091	MARTIN
03	005	BECKER	47	093	MEEKER
04	007	BELTRAMI	48	095	MILLE LACS
05	009	BENTON	49	097	MORRISON
06	011	BIG STONE	50	099	MOWER
07	013	BLUE EARTH	51	101	MURRAY
08	015	BROWN	52	103	NICOLLET
09	017	CARLTON	53	105	NOBLES
10	019	CARVER	54	107	NORMAN
11	021	CASS	55	109	OLMSTEAD
12	023	CHIPPEWA	56	111	OTTER TRAIL
13	025	CHISAGO	57	113	PENNINGTON
14	027	CLAY	58	115	PINE
15	029	CLEARWATER	59	117	PIPESTONE
16	031	COOK	60	119	POLK
17	033	COTTONWOOD	61	121	POPE
18	035	CROW WING	62	123	RAMSEY
19	037	DAKOTA	63	125	RED LAKE
20	039	DODGE	64	127	REDWOOD
21	041	DOUGLAS	65	129	RENVILLE
22	043	FARIBAULT	66	131	RICE
23	045	FILLMORE	67	133	ROCK
24	047	FREEBORN	68	135	ROSEAU
25	049	GOODHUE	69	137	ST LOUIS
26	051	GRANT	70	139	SCOTT
27	053	HENNEPIN	71	141	SHERBURNE
28	055	HOUSTON	72	143	SIBLEY
29	057	HUBBARD	73	145	STEARNS
30	059	ISANTI	74	147	STEELE
31	061	ITASCA	75	149	STEVENS
32	063	JACKSON	76	151	SWIFT
33	065	KANABEC	77	153	TODD
34	067	KANDIYOHI	78	155	TRAVERSE
35	069	KITTSON	79	157	WABASHA
36	071	KOOCHICHING	80	159	WADENA
37	073	LAC QUI PARLE	81	161	WASECA
38	075	LAKE	82	163	WASHINGTON
39	077	LAKE OF THE WOODS	83	165	WATONWAN
40	079	LE SUEUR	84	167	WILKIN
41	081	LINCOLN	85	169	WINONA
42	083	LYON	86	171	WRIGHT
43	085	MCLEOD	87	173	YELLOW MEDICINE
44	087	MAHNOMEN			

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.1.9 Place Code (NBI Item 4)

fe_id: 2000400 .... NBI 4: City or Town
BRIDGE.placecode

Cities, towns, townships, villages, and other census-designated places, shall be identified using the FIPS codes given in the current version of the Census of Population and Housing – Geographic Identification Code Scheme. Code all zeros for this item if a FIPS place code isn't given in that document.

Identify whether the structure is located in a township (Section D.7.1.11) or a city (Section D.7.1.10).

Refer to Appendix C for the list of FIPS codes.

Examples:

FIPS (Place) Code	City or Township	MN City Code	MN Twp Code
460	Aitkin	25	n/a
478	Aitkin (Township of)	n/a	1001

D.7.1.10 City (MnDOT Item)

fe_id: 2111316 .... City Census Code
BRIDGE.userkey2

This item identifies the city in which the structure is located using the city census four digit code. A structure can only be listed as being in a city **or** a township. For structures located in a township, leave this item blank.

BSIPM User Note:
See Appendix C for a list of cities.

This MnDOT item differs from the FIPS code. The FIPS code is described in Section D.7.1.9 (NBI Item 4).

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

Example:

City	MN Code	FIPS Code
St Peter	3435	58036

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.1.11 Township (MnDOT Item)

fe_id: 19 .... Township
USERBRDG.township_id

This item identifies the township in which the structure is located. The five digit code contains the two digit Minnesota county code followed by three digits that represent the township within that county. A structure can only be listed as being in a city **or** a township. For structures located in a city, leave this item blank.

BSIPM User Note:
See Appendix C for a list of townships.

This MnDOT item differs from the FIPS code. The FIPS code is described in Section D.7.1.9 (NBI Item 4).

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

Example:

Township	MN Code	FIPS Code
Waconia (Township of)	10010	67450

D.7.1.12 Location (NBI Item 9)

fe_id: 2000900 .... NBI 9: Location
BRIDGE.location

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 map such as road junctions and topographical features.

Trace the route to an intersection with another roadway on an equal or higher level system (i.e. Interstate, US TH, MN TH, CSAH, or CR). Use the county line as a possible alternative.

Whenever possible, avoid using a city boundary.

This field has a maximum limitation of 25 characters. Uppercase letters are required for all alpha-characters. Do not use apostrophes (') or ampersands (&). Consistent naming allows for consistent data query results.

Examples:
- 0.2 MI N OF JCT CSAH 52
- 1.3 MI E OF JCT TH 100
- 0.5 MI N OF MISSISSIPPI RIVER

D.7.1.13 Section, Township, Range (MnDOT Item)

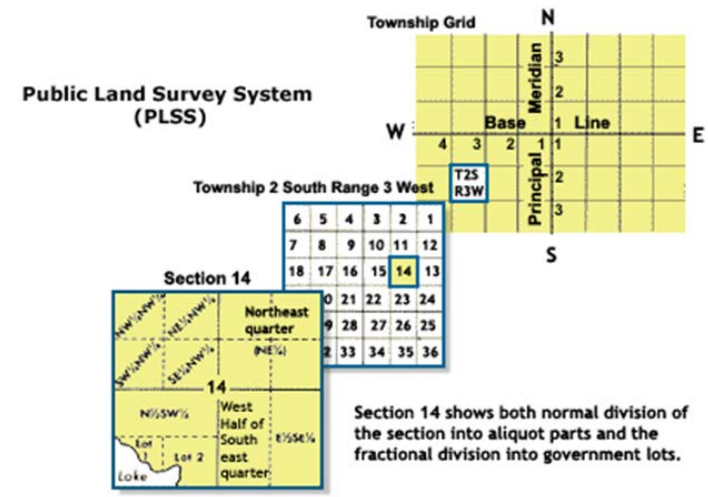
fe_id: 20 .... Sect
USERBRDG.section
fe_id: 21 .... Twp
USERBRDG.township
fe_id: 22 .... Range
USERBRDG.range

This item identifies the section, township, and range where the bridge is located. If the structure is located on a section border, MnDOT uses the following guideline.

- North – South Roadways: assign to the East section
- East – West Roadways: assign to the North section

Each township is identified with a township and range designation. Township designations indicate the location north or south of the baseline, and range designations indicate the location east or west of the Principal Meridian. For example, a township might be identified as Township 2 South, Range 3 West, which would mean that it is in the 2nd tier of townships south of a baseline, and in the 3rd column of townships west of a principal meridian.

The section, township and range can be found in the Title Block of the bridge plan, and/or on the survey sheets. If bridge plans are not available, use the MnDOT Basemap to identify and



find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

The section, township, and range are input as three separate items. Example:

Bridge Plans	SIMS Label	Format	SIMS Entry
Sec. 19	Sect.,	##	19
Twp. 29N	Twp.,	###N	029N
R. 22W	Range	##W	22W

Only a few range ids in Minnesota have 'E' as the identifier and those are in the eastern portion of Cook County. All other range ids will have 'W'.

Quick Links:
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D.7.1.14 Latitude (NBI Item 16)

fe_id: 2001610 .... NBI 16: Latitude: Degree
fe_id: 2001620 .... NBI 16: Latitude: Minute
fe_id: 2001630 .... NBI 16: Latitude: Second
BRIDGE.latitude

This item is completed by BIMU when the structure is first entered into the MnDOT inventory. Any discrepancies with this item should be reported to BIMU.

This item identifies the latitude of the structure in degrees, minutes, and seconds to the nearest hundredth of a second. The point of the coordinate may be along the centerline midpoint of the bridge in the direction of the inventory or any other consistent point of reference on the bridge that is compatible with the linear referencing system (LRS). The LRS aligns the linear reference points in all databases so information from crash statistics, pavement management, and other business data can be accurately mapped and data more easily analyzed.

FHWA requires this information for all bridges on the National Highway System (NHS), Strategic Highway Network (STRAHNET), and STRAHNET connector highways, but it is preferable to code the latitude on all systems when available. See Section D.7.11.34 for information on NBI Item 100 (STRAHNET Highway Designation) and Section D.7.11.35 for information on NBI Item 104 (Highway System of the Inventory Route).

Latitude is recorded in a degrees minutes seconds format and is separated into three different inputs in SIMS. Degrees is the first input, minutes the second, and seconds the third input. Seconds is truncated to two decimal places.

Inspector Note:
MnDOT recommends that coordinates be verified periodically at routine inspections using a global positioning system (GPS) and recoded when necessary.

Example:

GPS Coordinates	Degree	Minute	Seconds
44d23m03.06s	44	23	3.06

D.7.1.15 Longitude (NBI Item 17)

fe_id: 2001710 .... NBI 17: Longitude: Degree
fe_id: 2001720 .... NBI 17: Longitude: Minute
fe_id: 2001730 .... NBI 17: Longitude: Second
BRIDGE.longitude

This item is completed by BIMU when the structure is first entered into the MnDOT inventory. Any discrepancies with this item should be reported to BIMU.

This item is similar to Latitude (Section D.7.1.14).

Example:

GPS Coordinates	Degree	Minute	Seconds
-93d17m12.03s	-93	17	12.03

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.1.16 Maintenance Responsibility (NBI Item 21)

fe_id: 2002100 .... NBI 21: Maintenance Responsibility
BRIDGE.custodian

This item identifies the agency responsible for maintaining the structure. The codes in the following table shall be used to indicate the type of agency that has primary responsibility for maintaining the structure.

If more than one agency has equal maintenance responsibility, code the agency as it falls in the hierarchy of state, federal, county, city, railroad, and other private. Cooperative agreements may be in place to determine custodial responsibility. A copy of the agreement should be filed with MnDOT.

CODE	DISPLAY	DESCRIPTION
1	STATE HWY	State Highway Agency
2	COUNTY	County Highway Agency
3	TOWNSHIP	Town or Township Highway Agency
4	CITY	City or Municipal Highway Agency
11	STATE FOREST	State Park, Forest, or Reservation Agency
12	LOCAL PARK	Local Park, Forest or Reservation Agency
21	OTHER STATE	Other State Agencies
25	OTHER LOCAL	Other Local Agencies
26	PRIVATE	Private (other than railroad)
27	RAILROAD	Railroad
31	STATE TOLL	State Toll Authority
32	LOCAL TOLL	Local Toll Authority
60	OTHER FEDERAL	Other Federal Agencies (not listed below)
62	BIA	Bureau of Indian Affairs
64	NATL FOREST	U.S. Forest Service
66	NATL PARK	National Park Service
68	BLM	Bureau of Land Management
69	BR	Bureau of Reclamation
70	CORP ENG	Corps of Engineers (Civil)
80	UNKNOWN	Unknown

D.7.1.17 Owner (NBI Item 22)

fe_id: 2002200 .... NBI 22: Owner
BRIDGE.owner

This item identifies the agency designated as the owner of the structure. The codes in the table used for NBI Item 21 (Maintenance Responsibility) from Section D.7.1.16 shall be used to indicate the type of agency that has primary ownership of the structure.

If more than one agency has equal ownership, code the agency as it falls in the hierarchy of state, federal, county, city, railroad, and other private. Cooperative agreements may be in place to determine ownership. A copy of the agreement should be filed with MnDOT.

D.7.1.18 Maintenance Area (MnDOT Item)

fe_id: 6000046 .... Maintenance Area
BRIDGE.userkey3

This item identifies the MnDOT Maintenance Sub-Area in which the structure is located (i.e., the sub-division of a MnDOT District).

This item is only for bridges on the Trunk Highway (TH) system. The TH system is a roughly 12,000 mile network of key roads connecting communities throughout the state and is maintained by MnDOT. The TH system includes the Interstate and U.S. highway systems, as well as State highways. The bulk of funding for the TH system comes from transportation related taxes and federal aid.

This item must be coded if the structure is located on the TH system. Route System (Sections D.7.11.43 or D.7.13.38) will be coded one of the following.

- 01 - ISTH
- 02 - USTH
- 03 - MNTH

The following table lists the codes for this item.

CODE	MAINTENANCE SUB-AREA
1A	DULUTH
1B	VIRGINIA
2A	BEMIDJI
2B	CROOKSTON/THIEF RIVER FALLS
3A	BRAINERD/BAXTER
3B	ST. CLOUD
4A	DETROIT LAKES
4B	MORRIS
5A	MENDOTA
5B	MAPLEWOOD
5C	FOREST LAKE
5D	EDEN PRAIRIE
5E	PLYMOUTH
5F	SPRING LAKE PARK
6A	ROCHESTER
6B	OWATONNA
7A	MANKATO
7B	WINDOM
8A	WILLMAR
8B	MARSHALL

D.7.1.19 Bridge Crew (MnDOT Item)

fe_id: 17 .... Crew
USERBRDG.crewnumber

This inventory item is only applicable for bridges located on the Trunk Highway; and only for MnDOT Districts that have their inventory assigned to specific bridge crews. Currently only the Metro District and District 6 assign a crew to their structures. This item is left blank for MnDOT Districts 1, 2, 3, 4, 7, and 8.

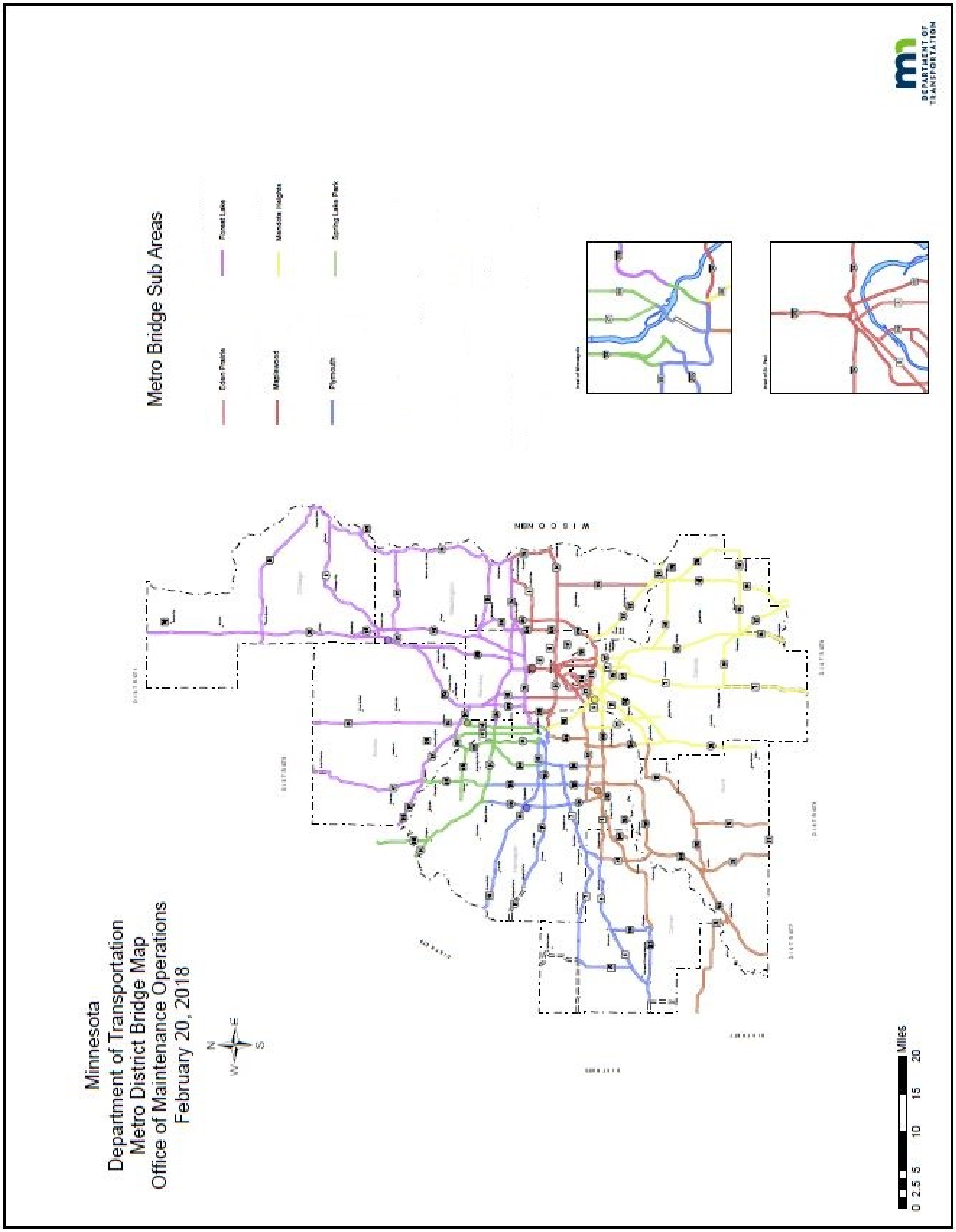
The following table lists the Metro District codes for this item. Use the map on page D-40 to determine the Metro District maintenance areas and bridge crews.

CODE	METRO DISTRICT CREW
7627	SPRING LAKE PARK
7628	EDEN PRAIRIE
7629	PLYMOUTH
7647	MENDOTA
7648	FOREST LAKE
7639	MAPLEWOOD

The following table lists the District 6 codes for this item. Use the map on page D-41 to determine bridge crews for District 6.

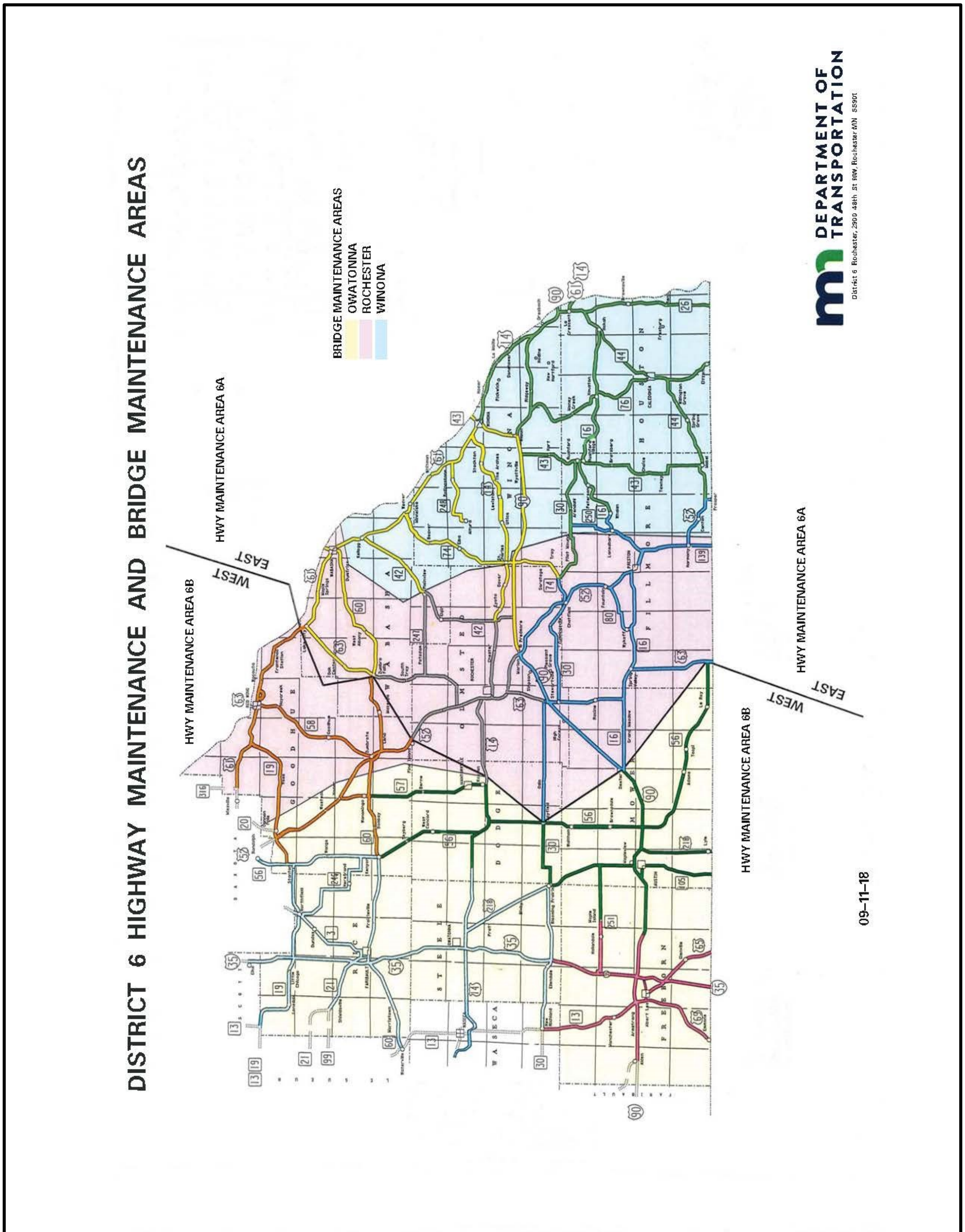
CODE	DISTRICT 6 CREW
OWAT	OWATONA
ROCH	ROCHESTER
WIN	WINONA

METRO DISTRICT MAP



Quick Links:
[MN STRUCTURE INVENTORY REPORT (Interactive)] • [INVENTORY ITEMS] • [NBI ITEMS]

DISTRICT 6 MAP



Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.1.20 Year Built (NBI Item 27)

fe_id: 2002700 .... NBI 27: Year Built
BRIDGE.yearbuilt

This item refers to the original construction. Code the four digit year shown on the bridge nameplate.

For structures without bridge nameplates, use the year of construction. This shall be the last year the construction crew was in the field.

If the year of construction is unknown, a best estimate should be based on the date on the construction plans.

D.7.1.21 Date Opened to Traffic (MnDOT Item)

fe_id: 69 .... Date Opened to Traffic
USERRWAY.date_opened_to_traffic

This item identifies the month, day, and year the structure was initially opened to traffic. This date relates to the year built, not a reconstructed/remodeled year.

D.7.1.22 MN Year Remodeled (MnDOT Item)

fe_id: 25 .... Year Remodeled
USERBRDG.year_fed_rehab

This item designates the year of the most recent reconstruction of the structure and **federal funding was not used**. The recorded year of reconstruction shall be the last year the construction crew was in the field. All four digits of the year are to be recorded. If the year of reconstruction is unknown, the best estimate should be provided based on the date on the construction plans.

Inspector Note:
It is the responsibility of the bridge inspector to verify that items have been updated on the structure inventory report after reconstruction.

Types of work considered for this item are listed below.

- Safety feature replacement or upgrading regardless if bridge dimensions are altered (i.e., bridge rail, approach guardrail or impact attenuators)
- Painting of structural steel
- Overlay of bridge deck as part of a larger highway surfacing project (i.e., 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 (i.e., adding a substructure element or extra girder)

Types of work **not** considered for this item are deck widenings or full deck replacements.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.1.23 Year Reconstructed (NBI Item 106)

fe_id: 2010600 .... NBI 106: Year Reconstructed
BRIDGE.yearrecon

For a bridge to be defined as reconstructed the type of work performed 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 State or local funds, or Federal-aid funds, were used.

Inspector Note:
It is the responsibility of the bridge inspector to verify that items have been updated on the structure inventory report after reconstruction.

The recorded year of reconstruction shall be the last year the construction crew was in the field. All four digits of the year are to be recorded. If the year of reconstruction is unknown, the best estimate should be provided based on the date on the construction plans.

Leave this item blank when the bridge reconstruction **does not** utilize federal funds. Instead, record the four digit year in MN Year Remodeled (MnDOT Item). See Section D.7.1.22.

Types of eligible work to be considered for this item are, in general, deck widenings or full deck replacements.

Types of eligible work **not** to be considered for this item are listed below.

- Safety feature replacement or upgrading regardless if bridge dimensions are altered (i.e., bridge rail, approach guardrail or impact attenuators)
- Painting of structural steel
- Overlay of bridge deck as part of a larger highway surfacing project (i.e., 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 (i.e., adding a substructure element or extra girder).

D.7.1.24 Bridge Plan Location (MnDOT Item)

fe_id: 26 .... Bridge Plan Location
USERBRDG.plan_avail_id

This item indicates whether or not bridge plans are available and identifies where the bridge plans are filed. For bridges on the TH system, these plans are located at the MnDOT Central Office and this item will be coded '1'.

CODE	DISPLAY
0	NO PLANS
1	CENTRAL
3	COUNTY
4	MUNICIPAL
5	OTHER

Note: The use of code '2' was discontinued.

D.7.1.25 Potential ABC (MnDOT Item)

fe_id: 6000043 .... ABC Suitable
USERBRDG.ABC_Suitable

The use of ABC (accelerated bridge construction) techniques can result in a significant reduction in on-site construction time as well as providing improvements in product quality, worker safety, and traveler safety. Each Trunk Highway bridge in the state (excluding culverts, railroad, and pedestrian bridges) has been evaluated, and scored. An overall weighted score was normalized to a recommendation of "Yes" or "No" regarding further consideration of ABC.

For new bridges on the TH system the default code is '0 - No'. For new bridges on the local system the default code is '2 - N/A'.

This item uses the following codes to identify potential candidates for using ABC techniques.

CODE	DESCRIPTION
0	NO
1	YES
2	N/A

D.7.1.26 Legislative District (MnDOT Item)

fe_id: 3002001 .... Legislative District
BRIDGE.userkey12

This item indicates the Minnesota Legislative District in which the structure is located. This refers to the Districts for Minnesota State Senators and Representatives.

Use the maps at https://www.sos.state.mn.us/election-administration-campaigns/data-maps/minnesota-legislative-maps/?searchTerm=legislative maps to code this item.

See following example:

City	Legislative District
North Oaks	38B

D.7.1.27 Historical Significance (NBI Item 37)

fe_id: 2003700 .... NBI 37: Historical Significance
BRIDGE.histsign

A bridge may be considered historically significant if it is a particularly unique example of the history of engineering, the crossing itself is historically significant, the bridge is associated with a historical property or area, or the bridge was associated with significant events or circumstances. A bridge typically must be at least 50 years old to be eligible for the National Register of Historic Places (NRHP).

The following table lists the codes for this item.

CODE	DESCRIPTION
1	**Bridge is on the NRHP**
2	**Bridge is eligible for the NRHP**
3	**Bridge is possibly eligible for the NRHP (requires further investigation before determination can be made) or bridge is on a State or local historic register**
4	**Historical significance is not determinable at this time**
5	**Bridge is not eligible for the NRHP**

Beginning in April 2017, MnDOT will code all new bridges entered into the inventory as '4'.

This item should be verified on a regular basis and recoded if necessary.

D.7.1.28 Border Bridge (NBI Item 98)

This item is used to indicate if a structure is located on a state or international border and the percent of shared maintenance responsibility.

If the structure is not a border bridge leave this item blank.

This 5-digit item is composed of two segments. The first three digits (NBI Item 98A and NBI Item 98), indicate the neighboring State code, and the last two digits (NBI 98B) indicate the percentage of total deck area the neighboring State is responsible for funding.

See Sections D.7.1.28.1 and D.7.1.28.2 for information on coding this item.

Examples.

Description	Code
A structure connects Minnesota with Wisconsin and Wisconsin is responsible for 45 percent of future improvement costs.	55545
A structure connects Minnesota with Canada and Canada is not responsible for any funding of future improvement costs.	CAN00
A structure connects Minnesota with North Dakota and North Dakota accepts 100% of the responsibility.	38899

The code '55545' in the first example above is entered as follows.

NBI Item	Code
98A	55
98	5
98B	45

D.7.1.28.1 Neighboring State Code (NBI Item 98A)

fe_id: 2009810 .... NBI 98A: Neighboring State Code
BRIDGE.nstatecode
fe_id: 2009800 .... NBI 98: Border Bridge
BRIDGE.n_fhwa_reg

If the structure is not on a state or international border leave this item blank.

NBI Item 98A is the two digit FIPS code for States. NBI Item 98 is the FHWA region code. The following table lists the neighboring codes applicable for Minnesota.

CODE – 98A	CODE – 98	DESCRIPTION
19	7	Iowa
38	8	North Dakota
46	8	South Dakota
55	5	Wisconsin
CAN	[blank]	Canada

D.7.1.28.2 Percent Responsibility (NBI Item 98B)

fe_id: 2009820 .... NBI 98B: Percent Responsibility
BRIDGE.bb_pct

If the structure is not on a state or international border leave this item blank.

NBI Item 98B is the percentage of funding for improvements to the existing structure when it is on a border with a neighboring state or country. Code this item with the percentage of total deck area of the existing bridge that the neighboring state is responsible for funding. If the neighboring state or country accepts 100% of the responsibility, but is still listed on the Minnesota bridge inventory, this item should be coded '99' to represent that Minnesota has no responsibility for the structure.

The State that conducts the inspection should provide data to the other State in order to keep both States' condition data and inventory data current.

D.7.1.29 Border Bridge Structure Number (NBI Item 99)

fe_id: 2009900 .... NBI 99: Border Bridge Structure Number
BRIDGE.bb_brdgeid

If the structure is not on a state or international border leave this item blank. If NBI Item 98 is blank, this item must be blank.

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

Contact the other state or country where the structure is located to get their structure number.

D.7.1.30 Railroad Abandoned Date (MnDOT Item)

fe_id: 2111340 .... RR Abandoned Date
USERBRDG.rr_date_abandon

This item is the date the railroad abandoned a highway crossing. This only applies to a railroad crossing over or under a public road – not for a railroad crossing over a waterway or valley.

If not applicable, leave this item blank.

D.7.1.31 UTM-X (MnDOT Item)

fe_id: 2111338 .... UTM-X
USERBRDG.utm_x

The UTM (Universal Transverse Mercator) coordinate system is a global system of grid-based mapping references.

D.7.1.32 UTM-Y (MnDOT Item)

fe_id: 2111339 .... UTM-Y
USERBRDG.utm_y

The UTM (Universal Transverse Mercator) coordinate system is a global system of grid-based mapping references.

D.7.2 STRUCTURE INFORMATION

This section contains detailed information about the structure such as type of service, type of design, material, skew, span lengths, number of spans, wearing surface, rail codes, and other information regarding the superstructure.

D.7.2.1 Type of Service On Bridge (NBI Item 42A)

fe_id: 2004210 .... NBI 42A: Type of Service: ON Bridge
BRIDGE.servtypon

This item identifies the type of service on the structure.

CODE	DISPLAY	DESCRIPTION
1	HIGHWAY	Highway
2	RAILROAD	Railroad
3	PED-BICYCLE	Pedestrian-Bicycle (Recreation Trail)
4	HWY;RR	Highway-railroad
5	HWY;PED	Highway-pedestrian *
6	SECOND LVL	Overpass at an interchange or second level of a multilevel interchange
7	THIRD LVL	Third level of a multilevel interchange
8	FOURTH LVL	Fourth level of a multilevel interchange
9	BUILDING	Building or Plaza
0	OTHER	Other

* The minimum width of sidewalk shall be 30 inches. If the area between the rail face and the curb is not greater than or equal to 30 inches the type of service will be coded '1 - Highway'.

D.7.2.2 Type of Service Under Bridge (NBI Item 42B)

fe_id: 2004220 .... NBI 42B: Type of Service: UNDER Bridge
BRIDGE.servtypund

This item identifies the type of service under the structure.

CODE	DISPLAY	DESCRIPTION
1	HWY;PED	Highway, with or without pedestrian
2	RAILROAD	Railroad
3	PED;BICYCLE	Pedestrian-Bicycle (Recreation Trail)
4	HWY;RR	Highway-railroad
5	STREAM	Waterway
6	HWY;STREAM	Highway-waterway
7	RR;STREAM	Railroad-waterway
8	HWY;RR;STREAM	Highway-waterway-railroad
9	RELIEF	Relief for waterway
0	OTHER	Other

D.7.2.3 Structure Type, Main – Kind of Material and/or Design (NBI Item 43A)

fe_id: 2004310 .... NBI 43A: Structure Type: Material
BRIDGE.materialmain

This FHWA coding differs from the MN Main Span Type coding used on Minnesota bridge plans and in MnDOT's LRFD Bridge Design Manual. See Section D.7.2.7 for information on MN Main Span Material (MnDOT item).

This NBI Item identifies the material type of the main span. The following table lists the FHWA codes for this item.

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.

D.7.2.4 Structure Type, Main – Type of Design and/or Construction (NBI Item 43B)

fe_id: 2004320 .... NBI 43B: Structure Type: Type
BRIDGE.designmain

This FHWA coding differs from the MN Main Span Type coding used on Minnesota bridge plans and in MnDOT's LRFD Bridge Design Manual. See Section D.7.2.8 for information on MN Main Span Design (MnDOT item).

This NBI Item identifies the superstructure design and/or construction type of the main span. The following table lists the FHWA codes for this item.

CODE	DESCRIPTION
1	SLAB
2	STRINGER/MULTI-BEAM OR GIRDER
3	GIRDER AND FLOORBEAM SYSTEM
4	TEE BEAM
5	BOX BEAM OR GIRDERS - MULTIPLE
6	BOX BEAM OR GIRDERS - SINGLE OR SPREAD
7	FRAME (EXCEPT FRAME CULVERTS)
8	ORTHOTROPIC
9	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 (Applicable only to approach spans (NBI Item 44))
21	SEGMENTAL BOX GIRDER
22	CHANNEL BEAM
00	OTHER

*Only structures designated as NTIS (National Tunnel Inspection Standards) tunnels shall use this design type.

D.7.2.5 Structure Type, Approach Spans – Kind of Material and/or Design (NBI Item 44A)

fe_id: 2004410 .... NBI 44A: Structure Type - Kind of Material/Design
BRIDGE.materialappr

This FHWA coding differs from the MN Approach Span Type. See Section D.7.2.11 for information on MN Approach Span Material (MnDOT item).

NBI Item 44A identifies the material type of the structure for the approach spans to a major bridge or for the main spans where the structural material is different. The codes are the same as those for NBI Item 43A (Structure Type, Main (Material)) and are shown in Section D.7.2.3

Only one material type shall be entered for this item. Structures with more than one approach span type shall code the most predominant type.

Code '0' if this item is not applicable.

D.7.2.6 Structure Type, Approach Span – Type of Design and/or Construction (NBI Item 44B)

fe_id: 2004420 .... NBI 44B: Structure Type - Type of Design/Construction
BRIDGE.designappr

This FHWA coding differs from the MN Approach Span Type. See Section D.7.2.12 for information on MN Approach Span Design (MnDOT item).

NBI Item 44B identifies the design type of the structure for the approach spans to a major bridge or for the main spans where the structural design is different. The codes for this item are the same as those for NBI Item 43B and are shown in Section D.7.2.4.

Only one approach span type shall be entered. Structures with more than one approach span type shall code the most predominant type.

Code '20 - Mixed Type' if more than one design types are present.

Code '0' if this item is not applicable.

D.7.2.7 MN Main Span Material (MnDOT Item)

fe_id: 2111362 .... MN Main Span Material
USERBRDG.main_span_mat_id

This item is used on Minnesota bridge plans and in MnDOT's LRFD Bridge Design Manual and differs from NBI Item 43A (Structure Type, Main – Kind of material and/or Design). Refer to Section D.7.2.3 for information on NBI Item 43A. **This item is the first digit of the MN Main Span Type**. The following table lists the codes for this MnDOT Item.

MATERIAL CODE	DISPLAY	DESCRIPTION
1	**CONC**	**Concrete**
2	**CCONC**	**Concrete (Continuous)**
3	**STEEL**	**Steel**
4	**CSTL**	**Steel (Continuous)**
5	**PRECST**	**Pre-stressed or * Pre-Cast Concrete**
6	**PRESTR**	**Pre-stressed Concrete (Continuous)**
7	**TIMBER**	**Timber**
8	**MASONRY**	**Masonry**
9	**IRON**	**Wrought or Cast Iron**
0	**OTHER**	**Other/Combination**
A	**ALUM**	**Aluminum**
P	**PSTNSD**	**Post-tensioned**
Z		**No Approach Span**

* If the main span material is '5', and the main span type is '11', '12', '13', '14', '15', '20', '21', or '22', the material will be "Pre-cast Concrete" (this may or may not be Pre-stressed Concrete).

D.7.2.8 MN Main Span Design (MnDOT Item)

fe_id: 2111363 .... MN Main Span Design
USERBRDG.main_span_type_id

This item is used on Minnesota bridge plans and in MnDOT's LRFD Bridge Design Manual and differs from NBI Item 43B (Structure Type, Main – Type of Design and/or Construction). Refer to Section D.7.2.4 for information on NBI Item 43B. **This item is the second and third digits of the MN Main Span Type**. The following table lists the codes for this MnDOT Item.

DESIGN TYPE CODE	DISPLAY	DESCRIPTION
01	**BM SPAN**	**Beam Span**
02	**LOW TRUSS**	**Low (Pony) Truss**
03	**HIGH TRUSS**	**High (Through) Truss**
04	**DECK TRUSS**	**Deck Truss**
05	**CONC THROUGH GIRDER**	**Through Girder**
06	**DECK GIRD**	**Deck Girder**
07	**BOX GIRD**	**Box Girder**
08	**RIGID FRAME**	**Rigid Frame**
09	**SLAB SPAN**	**Slab Span**
10	**VOID SLAB SP**	**Voided Slab Span**
11	**CHAN SPAN**	**Channel Beam**
12	**ARCH**	**Arch**
13	**BOX CULV**	**Box Culvert**
14	**PIPE CULVERT**	**Pipe Culvert (Round)**
15	**PIPE ARCH**	**Pipe-Arch Culvert**
16	**LONG SPAN**	**Long Span/Ellipse Culvert**
17	**TUNNEL ***	**Tunnel ***
18	**MOVEABLE**	**Movable (Swing, Bascule, or Vertical Lift)**
19	**OTHER**	**Other**
20	**DOUB TEE**	**Double Tee**
21	**QUAD TEE**	**Quad Tee**
22	**BULB TEE**	**Bulb Tee**
23	**SUSPENSION**	**Suspension**
24	**TIED ARCH**	**Tied Arch**
25	**CABLE STAY**	**Cable Stayed (or Extradosed)**
26	**INVRT TEE**	**Inverted Tee**
ZZ		**No Approach Span**

If the main span is type '11', '12', '13', '14', '15', '16', '20', '21', or '22', and the main span material is '5', the material will be "Pre-cast Concrete" (this may or may not be Pre-stressed Concrete).

* Only structures designated as NTIS (National Tunnel Inspection Standards) tunnels shall use this design type.

D.7.2.9 Design Type Conversion MN to FHWA

MN Main Span Design		NBI Item 43B	
01	Beam Span	02	Stringer/Multi-beam or Girder
02	Low Truss	10	Truss - Thru
03	High Truss	10	Truss - Thru
04	Deck Truss	09	Truss - Deck
05	Thru Girder	03	Girder and Floorbeam System
06 *	Deck Girder *	03 04 *	Girder and Floorbeam System *[steel only]* Tee Beam *[concrete only]* *
07	Box Girder	05 06 21	Box Beam or Girders - Multiple Box Beam or Girders - Single or Spread Segmental Box Girder
08	Rigid Frame	07 08	Frame (except frame culverts) Orthotropic
09	Slab Span	01	Slab
10	Slab Span (Voided)	01	Slab
11	Channel Span	22	Channel Beam
12	Arch	11	Arch - Deck
13	Box Culvert	19	Culvert (includes frame culverts)
14	Pipe Culvert (Round)	19	Culvert (includes frame culverts)
15	Pipe Arch	19	Culvert (includes frame culverts)
16	Long Span	19	Culvert (includes frame culverts)
17 **	Tunnel **	18 **	Tunnel **
18	Moveable	15 16 17	Movable - Lift Movable - Bascule Movable - Swing
19	Other	00 20	Other Mixed types(Applicable only to approach spans (NBI Item 44))
20	Double Tee	04	Tee Beam
21	Quad Tee	04	Tee Beam
22	Bulb Tee	04	Tee Beam
23	Suspension	13	Suspension
24	Tied Arch	11 12	Arch - Deck Arch - Thru
25	Cable Stay	14	Stayed Girder
26	Inverted Tee Beam	04	Tee Beam

* If the MN material type is concrete and the MN Main Span Design is '06' (deck girder) then NBI Item 43B shall be '04' (tee beam).

** Only structures designated as NTIS (National Tunnel Inspection Standards) tunnels shall use this design type.

Quick Links:
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Examples.

Main Span Type (MnDOT Item) (NBI Item 43B)	
MnDOT Code: QUAD TEE NBI Item 43B Code: 02-STRINGER/MULTI-BEAM OR GIRDER	
Description: Prestressed Quad Tee Beam	
Main Span Type (MnDOT Item) (NBI Item 43B)	
MnDOT Code: SLAB SPAN NBI Item 43B Code: 01-SLAB	
Description: Timber Slab Span	
Main Span Type (MnDOT Item) (NBI Item 43B)	
MnDOT Code: PIPE CULV NBI Item 43B Code: 19-CULVERT	
Description: Steel Pipe Culvert	

D.7.2.10 Main Span Detail Definition (MnDOT Item)

fe_id: 2111364 .... Main Span Detail Def
USERBRDG.main_span_detail_def

This item identifies specific truss or arch configurations present on the main span(s). This item is left blank if it does not apply to the structure. The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
A	PARKER	Pratt truss with a polygonal or "camelback" top chord. Commonly seen on through truss bridges.
B	PENNSYLVANIA	Subdivided Parker Truss.
C	CAMEL BACK	Parker Truss with five slopes on the top chord.
D	WARREN	Alternating diagonals forming equilateral triangles (rarely found in the pure form - see codes "E" and "F").
E	WARREN W/VERT	Warren truss with intermediate verticals. Standard pony truss design after 1912 - rarely used on through truss bridges.
F	WARR W/POLY TC	Warren truss with polygonal or "camelback" top chord. Used for pony trusses in the 1930's and long span continuous through trusses.
G	PRATT	Horizontal top and bottom chord with all diagonal members in tension. Common on through trusses.
H	PRATT HALF-HIP	Pratt truss with no end verticals used on pony trusses prior to 1912.
I	DBL INTSEC PRATT	Or "Whipple Truss".
J	BOWSTRING ARCH TRUSS	
K	K FRAME	
L	BALTIMORE	Subdivided Pratt Truss.
M	HOWE	
N	FINK	
O	KING POST	Two triangles
P	QUEEN POST	Two triangles with braced rectangle
Q	VIERENDEEL	
U	SPANDREL FILLED ARCH	Closed (Filled) Spandrel Arch (any material)
V	OPEN SPANDREL ARCH	Open Spandrel Arch (any material)
W	RAINBOW ARCH	The arch ribs begin below the deck, and then rise above the deck (also known as a "half-through arch").
X	ARCH CULVERT	

Quick Links:
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D.7.2.11 MN Approach Span Material (MnDOT Item)

fe_id: 2111365 .... MN Appr Span Material
USERBRDG.appr_span_mat_id

The coding for this MnDOT Item differs from NBI Item 44A. See Section D.7.2.5 for information on the NBI Item.

This MnDOT item (MN Approach Span Material) identifies the material type of the structure for the approach spans to a major bridge or for the main spans where the structural material is different. The codes are the same as those for MN Main Span Material (MnDOT Item) and are shown in Section D.7.2.7.

Only one material type shall be entered for this item. Structures with more than one approach span type shall code the most predominant type.

Code 'Z - No Approach Span' if this item is not applicable.

D.7.2.12 MN Approach Span Design (MnDOT Item)

fe_id: 2111366 .... MN Appr Span Design
USERBRDG.appr_span_type_id

The coding for this MnDOT Item differs from NBI Item 44B. See Section D.7.2.6 for information on the NBI Item.

This MnDOT item (MN Approach Span Design) identifies the design type of the structure for the approach spans to a major bridge or for the main spans where the structural design is different. The codes are the same as those for MN Main Span Design (MnDOT Item) and are shown in Section D.7.2.8.

Only one approach span type shall be entered. Structures with more than one approach span type shall code the most predominant type.

Code 'ZZ - No Approach Span' if this item is not applicable.

D.7.2.13 Approach Span Detail Definition (MnDOT Item)

fe_id: 81 .... Approach Span Detail
USERBRDG.appr_span_detail_def

This item identifies specific truss or arch configurations on the approach span to a major bridge or for the spans where the structural material of the main span is different. The codes are the same as those for Main Span Detail Definition (MnDOT Item) and are shown in Section D.7.2.10.

D.7.2.14 Number of Spans in Main Unit (NBI Item 45)

fe_id: 2004500 .... NBI 45: Total Number of Spans - Main Unit
BRIDGE.mainspans

This item indicates the number of spans in the main or major unit of the structure. 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.

Two or more lines of culverts that are different sizes, but otherwise the same, should be coded as multiple main spans or approach spans, whichever is appropriate.

D.7.2.15 Number of Approach Spans (NBI Item 46)

fe_id: 2004600 .... NBI 46: Total Number of Spans - Approach Spans
BRIDGE.appspans

This item indicates the number of spans in the approach unit of the structures, or the number of spans of a different material/structure type from that of the main span(s).

D.7.2.16 Total Number of Spans (MnDOT Item)

fe_id: 744 .... Total Number of Spans - Total
BrM table and field: not applicable

This item indicates the total number of spans on the bridge. This is the summation of the spans for NBI Item 45 and NBI Item 46.

D.7.2.17 Lanes On the Structure (NBI Item 28A)

fe_id: 2002810 .... NBI 28A: Number of Lanes
ROADWAY.lanes

This item identifies the number of traffic lanes being carried on the structure. This includes 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. This shall include any full width merge lanes, turn lanes, and ramp lanes if they are the entire length of the bridge and shall be independent of directionality of usage. For example, a one lane bridge carrying two directional traffic is still considered to carry only one lane on the structure.

It should be noted that for the purpose of evaluating the NBI Item 68 (Deck Geometry), any one lane bridge, not coded as a ramp (NBI Item 5C = 7), which has NBI Item 51 (Bridge Roadway Width, Curb-to-Curb) coded as 16 feet or greater shall be evaluated as two lanes.

Only the number of traffic lanes on the structure shall be recorded for NBI Item 28A. When the structure does not carry a highway (i.e. pedestrian and railroad bridges) code this item '0'.

Do not include unstripped future lanes that are currently not in service.

D.7.2.18 Lanes Under the Structure (NBI Item 28B)

fe_id: 2002820 .... NBI 28B: Lanes Under the Structure
BrM table and field: not applicable

When traffic lanes are present under the structure, the sum of all lanes specified for the routes under the structure are entered for this item on the SIA One Column form.

Enter '0' when there are no traffic lanes under the structure.

See Section D.7.13.26.

D.7.2.19 Median On Structure (MnDOT Item)

fe_id: 2111360 .... Median on Structure
USERBRDG.med_barrier_exist

This item is used simply to identify whether a median is on the bridge or not. This item differs from NBI Item 33 (Bridge Median) in Section D.7.2.20 as NBI Item 33 indicates the type of median on the bridge.

CODE	DESCRIPTION
Y	Yes, Median on Structure
N	No Median on Structure

D.7.2.20 Bridge Median Type (NBI Item 33)

fe_id: 2003300 .... NBI 33: Bridge Median
BRIDGE.bridgemed

This item indicates the type of median on the bridge. All bridges that carry one-way traffic, or two-way traffic separated only by a centerline, should be coded '0'.

CODE	DESCRIPTION
0	No median
1	Open median
2	Closed median with mountable curb (no barrier)
3	Closed median with non-mountable barrier

Non-mountable barriers are any railing and all curbs greater than six inches above the roadway surface area.

A closed median with mountable curb would allow a truck to drive over the median.

See following examples.

Open Median

Closed Median with Non-mountable Barrier

Closed Median

D.7.2.21 Skew (NBI Item 34)

fe_id: 2003400 .... NBI 34: Skew
BRIDGE.skew

This item identifies the skew angle in degrees at which the structure is constructed. The skew angle is the angle between the centerline of a pier, abutment, or culvert barrel and, a line normal (perpendicular) to the centerline of the roadway on the bridge.

The skew angle may be taken from the plans or field measurements. A "square" bridge has a skew angle of 0° and coded '0'. If the structure is curved, or the skew varies, the average skew should be recorded. If the variation is unreasonable, record '99' to indicate a major variation in skews of substructure units.

Record the skew angle to the nearest degree.

D.7.2.22 Direction of Skew (MnDOT Item)

fe_id: 82 .... Angle of Skew Direction
USERBRDG.angle_of_skew_direction

MnDOT also documents the direction the skew angle between the centerline of the substructure and the line normal (perpendicular) to the centerline of the roadway on the bridge. The letter "L" or "R" is displayed after the skew angle (see Section D.7.2.21).

CODE	DESCRIPTION
L	Left Skew
R	Right Skew

In the direction South-to-North or West-to-East, as a vehicle approaches a structure, the angle of skew will be 'L' if the vehicle's left side intersects the back face of the abutment or the outside wall of a culvert first. It will be 'R' if the vehicle's right side intersects the back face of the abutment or the outside wall of a culvert first.

Leave this item blank if the skew angle is 0° (both sides of the vehicle will intersect the back face of the abutment or the outside wall of a culvert at the same time).

Quick Links:
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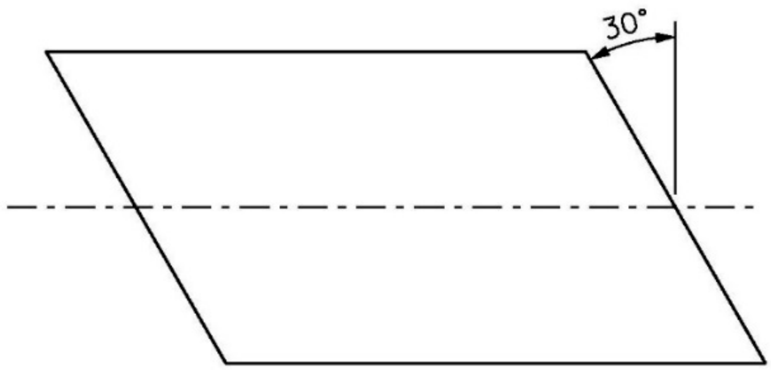
The following diagram shows a structure with a skew of 30° L.



D.7.2.23 Structure Flared (NBI Item 35)

fe_id: 2003500 .... NBI 35: Structure Flared
BRIDGE.strflared

This item indicates if the width of the structure varies or flares. Generally, such variance will result from ramps converging with or diverging from the through lanes on the structure, but there may be other causes.

MnDOT considers a minor flare to involve less than 20% of the structure length. Minor flares at ends of structures will be ignored.

CODE	DESCRIPTION
0	No flare
1	Flared

D.7.2.24 Length of Maximum Span (NBI Item 48)

fe_id: 2004800 .... NBI 48: Maximum Span Length
BRIDGE.maxspan

This item indicates the length of the longest span of the structure, as measured along the centerline of the roadway. Record to a tenth of a foot (truncate, do not round).

For single span bridges, this item is the clear open distance between abutments. For bridges with three or more spans, this is the distance between centerlines of bearings.

For tunnels, this item is the distance between inside faces of the walls, as measured along the centerline of the roadway.

For culverts, the span (inside width) is measured along the centerline of roadway regardless of the depth below grade.

Curved bridges shall be measured along the curve at the centerline of roadway.

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D.7.2.25 Structure Length (NBI Item 49)

fe_id: 2004900 .... NBI 49: Structure Length
BRIDGE.length

This item indicates the total length of the structure, as measured along the centerline of the roadway.

For bridges, this length will be measured back to back of backwalls of abutments or from paving notch to paving notch (end block).

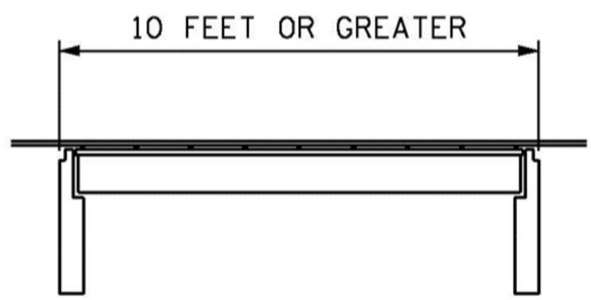
For culverts, this length is measured along the centerline of roadway regardless of the depth below grade. This measurement is taken between inside wall of culvert to inside wall of culvert. For culverts with multiple barrels, the measurement is between inside walls of the outside barrels. See the diagram below and on following pages for guidance.

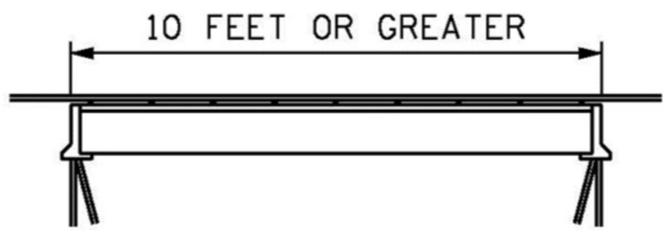
For tunnels, this length shall be measured along the centerline of the roadway running under the tunnel. Measurement is made from the back to back of the exterior walls for total length.

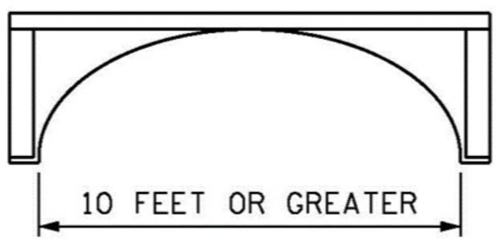
Record to a tenth of a foot (truncate, do not round).

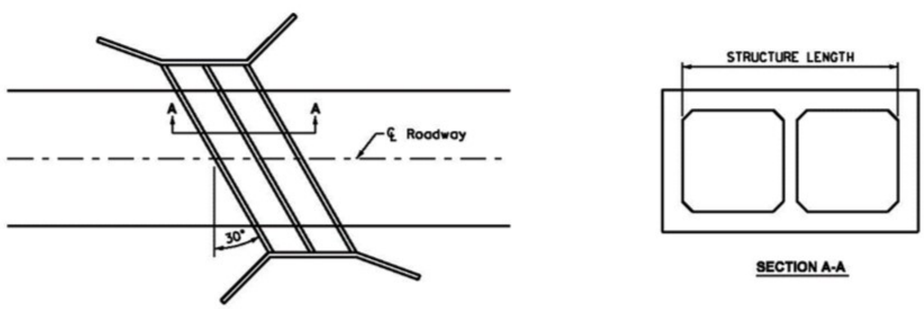
FHWA requires inspection of any bridge with a total length of more than 20 feet. Minnesota State law requires inspection of any bridge with a total length of 10 feet or greater. Therefore, the MnDOT structure inventory includes many 10 ft. to 20 ft. bridges that are not reported to FHWA.

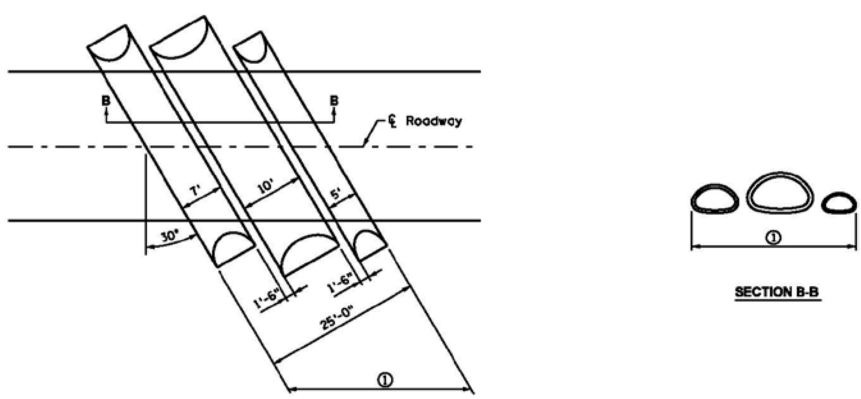
See following examples.











① STRUCTURE LENGTH = 25'/cos(30) = 28.87'

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D.7.2.26 Total Length (MnDOT Item)

fe_id: 2111368 .... Total Length
BRIDGE.tot_length

This item is the same as NBI Item 49 (Structure Length). See Section D.7.2.25 for guidance.

Record to a tenth of a foot (truncate, do not round).

D.7.2.27 NBIS Bridge Length (NBI Item 112)

fe_id: 2011200 .... NBI 112: NBIS Bridge Length
BRIDGE.nbislen

This item indicates if the structure length meets the NBIS definition of a bridge, which is 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 under copings 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.

Refer to Section D.7.2.25 for examples of structure lengths.

CODE	DESCRIPTION
Y	Yes
N	No

D.7.2.28 Deck Width, Out-to-Out (NBI Item 52)

fe_id: 2005200 .... NBI 52: Deck Width, Out-To-Out
BRIDGE.deckwidth

This item indicates the out-to-out width of the structure.

If the structure is flared "Varies" will be is displayed after the average deck width on the MN Structure Inventory Report. Minor flares at the ends of structures are ignored (see Section D.7.2.23). The minimum width for flared structures is coded.

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

Where the roadway is on fill carried across a pipe or box culvert, and the culvert headwalls do not affect the flow of traffic, code '0.0'. This is considered proper inasmuch as a filled section over a culvert simply maintains the roadway cross-section.

Record to a tenth of a foot (truncate, do not round).

For pictorial guidance on coding the deck width for different configurations, see illustrations in Section D.7.2.31.

Examples:

Deck Width	Code
34'-6"	34.5
45'-0" to 55'-0"	45.0

D.7.2.29 Deck Area (Out-to-Out) (MnDOT Item)

fe_id: 2111370 .... Deck Area Out-to-Out
BRIDGE.deck_area

This item is only applicable for bridges. It is expressed to the nearest square foot and is determined by multiplying NBI Item 52 (Deck Width, Out-to-Out) by NBI Item 49 (Structure Length). See Sections D.7.2.28 and D.7.2.25 for information on deck width and structure length, respectively.

This item is not calculated for culverts. Leave this item blank for culverts.

D.7.2.30 Roadway Area (Curb-to-Curb) (MnDOT Item)

fe_id: 38 .... Roadway Area (Curb-to-Curb)
BRIDGE.userkey1

This item is only applicable for bridges. It is expressed to the nearest square foot and is determined by multiplying NBI Item 51 (Bridge Roadway Width, Curb-to-Curb) by NBI Item 49 (Structure Length). This square footage is used for determining overlay quantities. See Sections D.7.11.17 and D.7.2.25 for information regarding roadway width and structure length, respectively.

Non-mountable medians, curbs or sidewalks, are not included in this measurement.

This item is optional for pedestrian bridges. Leave this item blank for culvert or tunnels. Note, tunnels are inspected under the National Tunnel Inspection Standards (NTIS).

D.7.2.31 Curb or Sidewalk Widths (NBI Items 50A & 50B)

fe_id: 2005010 .... NBI 50A: Curb or Sidewalk Width: Left Side
BRIDGE.lftcurbsw
fe_id: 2005020 .... NBI 50B: Curb or Sidewalk Width: Right Side
BRIDGE.rtcurbsw

This item represents the curb or sidewalk width on the structure. NBI Item 50A is coded for the left curb or sidewalk width and NBI Item 50B for the right curb or sidewalk width. MnDOT determines the direction of "Left" and "Right" by traveling across the bridge in the South-to-North or West-to-East direction.

A curb or sidewalk width is recorded when it measures a minimum of 30 inches wide and NBI Item 42A (Type of Service On Bridge) is coded '5 - Highway-pedestrian'.

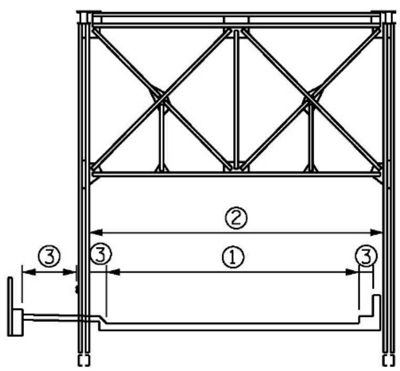
Trails that are separated by a barrier from vehicular traffic, but do not have additional depth from the deck thickness, shall not be recorded in this field.

Record to a tenth of a foot (truncate, do not round).

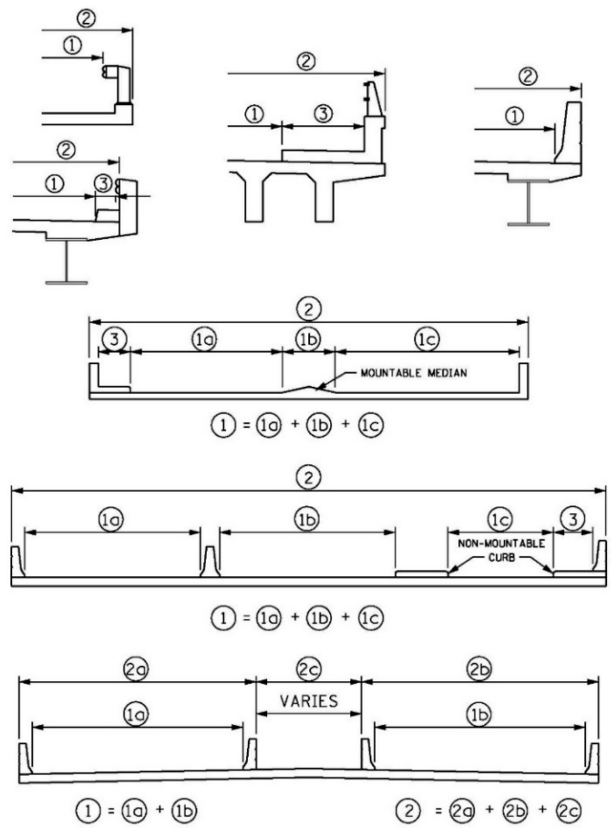
Examples:

Curb or Sidewalk Widths	NBI 50A	NBI 50B
Box Culvert with 2 feet of fill	0.0	0.0
12 foot sidewalk on right and barrier on left	0.0	12.0

See the following illustrations for guidance on determining the correct width for different curb and sidewalk configurations.



1 NBI ITEM 51 - BRIDGE ROADWAY WIDTH, CURB-TO-CURB
2 NBI ITEM 52 - DECK WIDTH, OUT-TO-OUT
3 NBI ITEM 50 - CURB OR SIDEWALK WIDTH



1 NBI ITEM 51 - BRIDGE ROADWAY WIDTH, CURB-TO-CURB
2 NBI ITEM 52 - DECK WIDTH, OUT-TO-OUT
3 NBI ITEM 50 - CURB OR SIDEWALK WIDTH

Quick Links:

D.7.2.32 Curb Height (Lt and Rt) (MnDOT Item)

fe_id: 39 .... Curb Height Left
USERBRDG.left_curb_hgt
fe_id: 40 .... Curb Height Right
USERBRDG.right_curb_hgt

This item represents the curb height, as measured from the top of the wearing surface to the top of the curb or sidewalk. "Left" and "Right" direction is based by traveling in the direction of increasing reference stationing.

Inspector Note:
Anytime a new overlay is placed on the bridge deck the curb heights shall be measured for new dimensions. Send updates to BIMU.

Record to a hundredth of a foot (truncate, do not round).

Code '0.0' for structures with only barriers.

D.7.2.33 Barrier Type (Lt and Rt) (MnDOT Item)

fe_id: 41 .... Rail Codes Left
USERBRDG.left_rail_type_id
fe_id: 42 .... Rail Code Right
USERBRDG.right_rail_type_id

The type of vehicular barriers present on a bridge is coded according to the MnDOT Barrier Code List. The following table lists the codes for this item. This table should also be used to assist in coding NBI Item 36A (Bridge Barriers) – refer to Section D.7.5.2. The MnDOT Barrier Code List includes over 50 diagrams of barrier types commonly used in Minnesota, and indicates if the barrier meets current design/safety standards.

Inspector Note:
The railing code diagrams shown in the 1995 FHWA Recording Guide are outdated, and should not be used for coding NBI Item 36A. Use the diagrams shown in the following pages.

"Left" and "Right" direction is based by traveling in the direction of increasing reference stationing. This item should be updated if the bridge barriers are reconstructed or replaced. The MnDOT Barrier Code List provides an abbreviated description listed in numerical order.

Barrier codes #20 and #45 have been eliminated, as there are no known examples of these barrier types in Minnesota.

MNDOT BARRIER CODE LIST			
CODE	DESCRIPTION	CODE	DESCRIPTION
NN	Vehicular Barriers Not Required	39	One-Line Conc Barrier w/Narrow Beam
00	Substandard Barrier (undefined)	40	Ornamental Metal Barrier
01	Meets Standards for All Speeds (undefined)	41	Open Balustrade Conc Barrier
02	Meets Standards ≤ 40 MPH (undefined)	42	One-Line Steel Bent Plate Barrier (Steel Posts)
03	One-Line Conc Barrier w/6"Brush Curb	43	Triple Beam Retrofit Guardrail
04	One-Line Conc Barrier w/Split Posts	44	Reconstructed One-Line Barrier ("J" Facing)
05	Two-Line Steel Tube Barrier (Steel Posts)	45	This code is no longer used
06	Timber Post & Beam Barrier	46	Reconstructed One-Line Barrier (2'-1" High)
07	Conc Barrier (Type "G") w/Pipe	47	Reconstructed One-Line Barrier w/Pipe
08	Conc Barrier (Type "G")	48	One-Line Conc Barrier w/6"Flush Curb
09	One-Line Conc Barrier w/Pipe	49	One-Line Conc Barrier w/10"Brush Curb
10	Conc Barrier (Type "D") w/Pipe	50	Glulam Timber Barrier
11	Conc Barrier w/Aluminum or Steel Pipe	51	Conc "P-2" Parapet w/Steel Tube (TL-4)
12	Conc Barrier w/Flat Tube	52	Structural Tube "Wyoming" Barrier (TL-4)
13	Conc Barrier w/Pipe	53	Three-Line Steel Tube Barrier (TL-4)
14	One-Line Conc Barrier w/2-Line Pipe	54	Two-Line Steel Tube Barrier (TL-2)
15	Conc Barrier (Type "D") w/2-Line Pipe	55	Timber Barrier on Conc Deck (TL-4)
16	Conc Barrier w/2-Line Flat Tube	56	Timber Barrier on Conc Deck (TL-2)
17	Conc Barrier w/2-Line Alum. or Steel Pipe	57	Conc Parapet w/Two-Line Tube (TL-4)
18	Conc Barrier w/2-Line Pipe	58	36" Single Slope Conc Barrier (TL-4)
19	Conc Barrier w/2-Line Alum. or Steel Pipe	59	42" Single Slope Conc Barrier (TL-4)
20	This code is no longer used	60	54" Single Slope Conc Barrier (TL-4)
21	Conc "P-1" Parapet w/Fence (Bikeway)	61	36" Split Median Conc Barrier (TL-4)
22	Conc Barrier (Type "F" or "J")	62	42" Split Median Conc Barrier (TL-4)
23	Conc Barrier (Type "F" or "J") w/Pipe	63	54" Split Median Conc Barrier (TL-4)
24	Precast Barrier (Type "J") w/Straight Anchors	64	36" Solid Median Conc Barrier (TL-4)
25	Precast Barrier (Type "J") w/Hooked Anchors	65	42" Solid Median Conc Barrier (TL-4)
26	Laminated Timber Barrier (Type "F" or "J")	66	54" Solid Median Conc Barrier (TL-4)
27	Conc Parapet w/Two-Pipe Rail (Bikeway)	67	Design T-3 Curb Mount Ornamental Metal Rail w/Fence
28	Conc P-1 Parapet w/Metal Rail (Bikeway)	68	Conc Barrier (TL-4)
29	Reconstructed One-Line Barrier (2'-4" High)	69	Conc Barrier (TL-2)
30	Conc Barrier (Type "F" or "J") w/Fence		
31	Two-Line Conc Barrier		
32	Steel Angle Barrier (Steel Posts)		
33	Conc Through-Girder Bridge		
34	Steel Through-Girder Bridge		
35	Steel Pipe Barrier (Steel or Conc Posts)		
36	Solid Conc Barrier		
37	Steel Plate-Beam Guardrail w/ Timber Posts		
38	Timber Plank Barrier		

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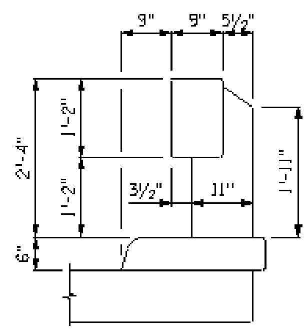
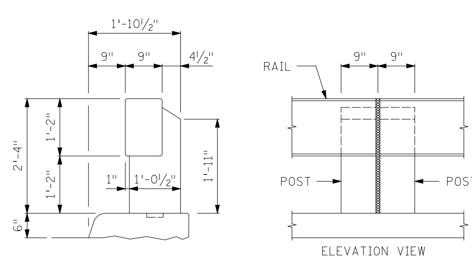
MNDOT BRIDGE BARRIER CODES		
CODE	**DESCRIPTION**	**DIAGRAM (OR NARRATIVE)**
NN	**Vehicular Barriers Not Required** NBI 36A Bridge Barriers = N	Use this code for pedestrian bridges, railroad bridges, or culvert structures that do not require barriers.
00	**Substandard For All Speeds** NBI 36A Bridge Barriers = 0	Barrier cannot be accurately described by any of the type codes in this table. This code should also be used if vehicular barriers are required but are not present.
01	**Meets Standards For All Speeds** NBI 36A Bridge Barriers = 1	Barrier cannot be accurately described by any of the type codes in this table.
02	**Does Not Meet Standards ≥ 45 MPH** NBI 36A Bridge Barriers = 0 **(Meets Standards ≤ 40 MPH)** NBI 36A Bridge Barriers = 1	Barrier cannot be accurately described by any of the type codes in this table.
03	**One-Line Concrete Barrier with 6" High Brush Curb (9" Projection)** ***Meets Standards For All Speeds ***** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☑ ☐ No Geometrics (≥ 45 MPH) ** Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Top rail beam must be at least 9" wide to meet 10-kip design requirements.* *** For speeds ≥ 45 MPH, if the curb projection cannot exceed 9".*	 1 LINE CONC. RAILING FOR 6" BRUSH CURB CODE #03
04	**One-Line Concrete Barrier with Split Posts** ***Does not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☑ ☐ No Geometrics (≥ 45 MPH) ** Yes☐ ☑ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Top rail beam must be at least 9" wide to meet 10-kip design requirements.* *** 1" post setback is a snagging hazard.*	 1 LINE CONC. RAILING W/SPLIT POSTS CODE #04

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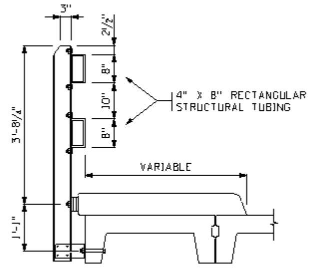
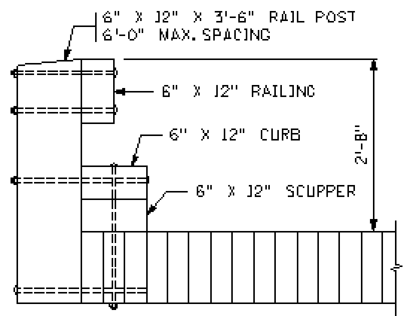
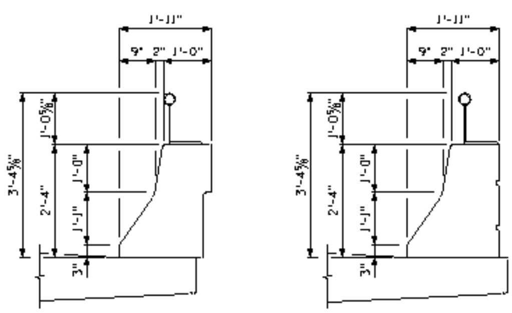
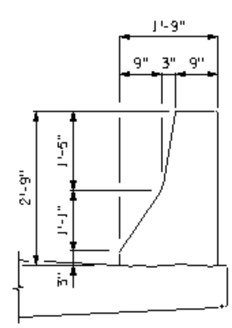
05	**Two-Line Steel Tube Barrier with Steel Posts** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested — Yes ☐ ☑ No AASHTO 10-kip Design — Yes ☐ ☑ No	 2 LINE STRUCTURAL TUBE W/STEEL POSTS CODE #05
06	**Timber Post & Beam Barrier on Timber Deck (TL-2)** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 — Yes☐ ☑ No NCHRP 350 Crash TL-2 — Yes☑ ☐ No AASHTO 10-kip Design — Yes☑ ☐ No	 TIMBER RAILING CODE #06
07	**Concrete Barrier Type "G" (General Motors) with Steel Pipe** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 — Yes☐ ☑ No AASHTO 10-kip Design — Yes☑ ☐ No Geometrics (≥ 45 MPH) * — Yes☐ ☑ No Geometrics (≤ 40 MPH) — Yes☑ ☐ No ** Pipe railing is a snagging hazard and the 2'-4"base is too short for speeds ≥ 45 MPH.*	 G. M. BARRIER W/PIPE (TYPE G) CODE #07
08	**Concrete Barrier Type "G" (early 1970's General Motors design)** ***Meets Standards For All Speeds **** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 — Yes☐ ☑ No AASHTO 10-kip Design — Yes☑ ☐ No Geometrics (≥ 45 MPH) * — Yes☑ ☐ No Geometrics (≤ 40 MPH) — Yes☑ ☐ No **Barrier must be at least 2'-8" high for speeds ≥ 45 MPH.*	 G. M. BARRIER CODE #08

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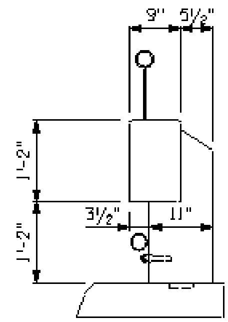
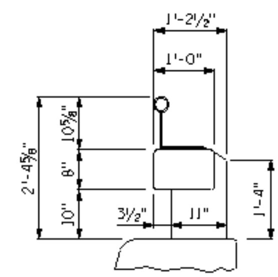
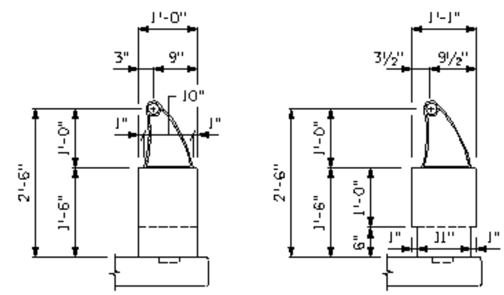
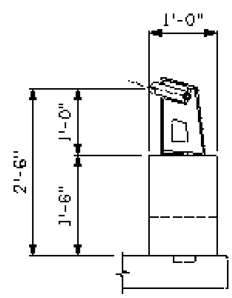
09	**One-Line Concrete Barrier with Steel Upper Pipe & Curb Pipe** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☑ ☐ No Geometrics (≥ 45 MPH) ** Yes☐ ☑ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Top rail beam must be at least 9" wide to meet 10-kip design requirements.* *** Upper pipe rail is a snagging hazard.*	 CONC. RAILING W/LINE PIPE CODE #09
10	**Concrete Barrier (Type "D") with One-Line Steel Pipe** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	 1 LINE (TYPE D) CODE #10
11	**Concrete Barrier with One-Line Aluminum or Steel Pipe** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No ** Upper pipe rail does not meet 10-kip design requirements.*	 1 LINE ALUMINUM OR STEEL CODE #11
12	**Concrete Barrier with One-Line Flat Tube** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No ** Upper tube rail does not meet 10-kip design requirements.*	 1 LINE FLAT TUBE CODE #12

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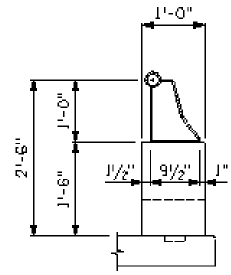
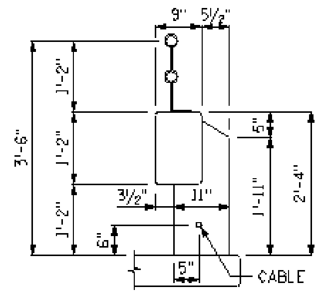
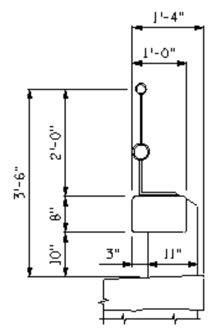
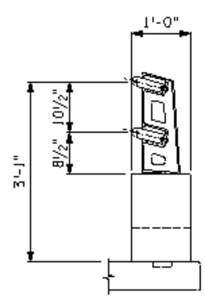
13	**Concrete Barrier with One-Line Steel Pipe** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No ** Upper pipe rail does not meet 10-kip design requirements.*	 1 LINE STEEL CODE #13
14	**Concrete Barrier with Two-Line Steel Pipe & Curb Cable** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☑ ☐ No Geometrics (≥ 45 MPH) ** Yes☐ ☑ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Top rail beam must be at least 9" wide to meet 10-kip design requirements.* *** Upper railings are a snagging hazard.*	 CONCRETE RAILING W/2 LINE PIPE & CABLE CODE #14
15	**Concrete Barrier (Type "D") with Two-Line Steel Pipe** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	 2 LINE (TYPE D) CODE #15
16	**Concrete Barrier with Two-Line Flat Tube** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes ☐ ☑ No AASHTO 10-kip Design * Yes ☐ ☑ No ** Upper tube railings do not meet 10-kip design requirements.*	 2 LINE FLAT TUBE CODE #16

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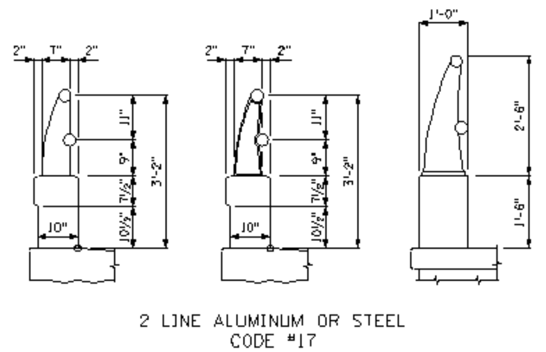
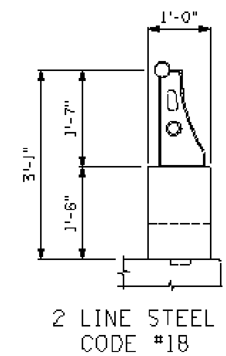
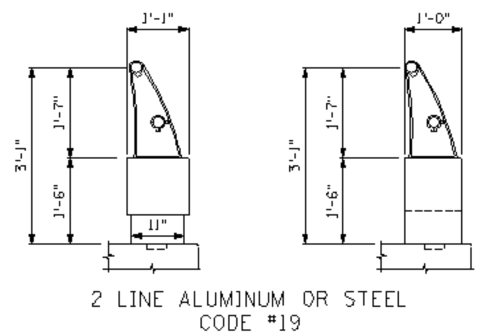
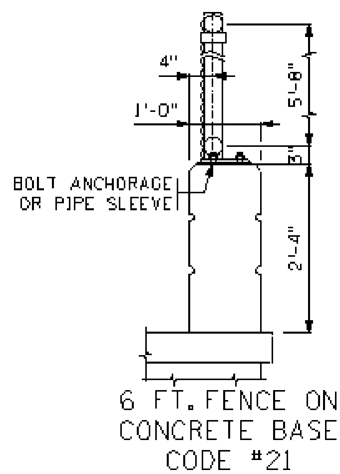
17	**Concrete Barrier with Two-Line Aluminum or Steel Pipe** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No ** Upper pipe railings do not meet 10-kip design requirements.*	
18	**Concrete Barrier with Two-Line Steel Pipe** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No ** Upper pipe railings do not meet 10-kip design requirements.*	
19	**Concrete Barrier with Two-Line Aluminum or Steel Pipe** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No ** Upper pipe railings do not meet 10-kip design requirements.*	
21	**Concrete Parapet (Type P-1) with 6 ft. Chain Link Fence (Bikeway)** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-2 Yes☐ ☑ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☐ ☑ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Fence is a snagging hazard, and the 2'-4"parapet is too short for speeds ≥ 45 MPH.*	

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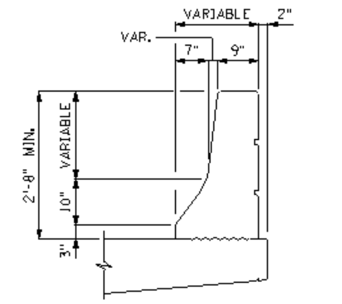
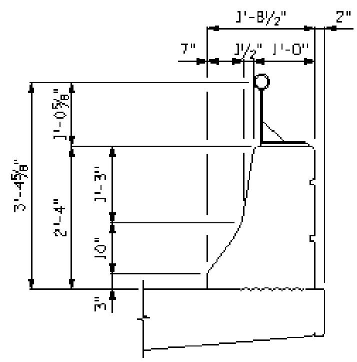
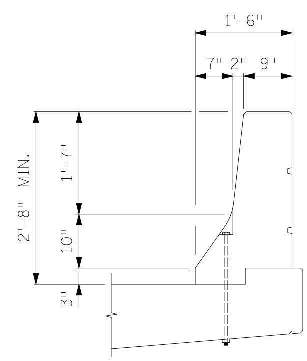
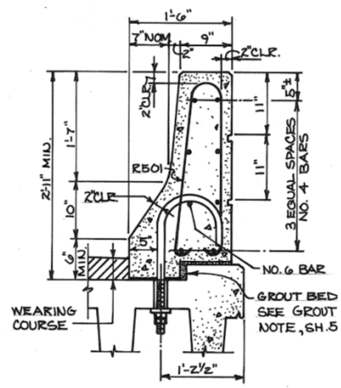
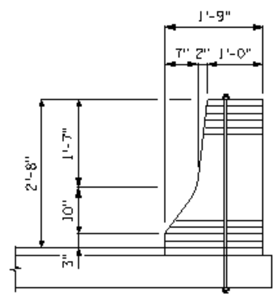
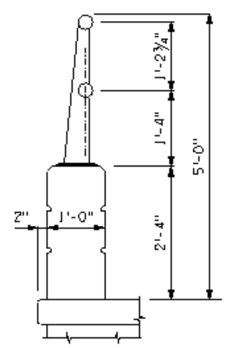
22	**Concrete Barrier Type "F" (Florida) or Type "J" (New Jersey)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	 CONCRETE RAILING (TYPE F & J) CODE #22
23	**Concrete Barrier Type "F" (Florida) or Type "J" (New Jersey) with One-Line Steel Pipe** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☐ ☑ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☐ ☑ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** The steel pipe railing is a snagging hazard and if removed, the 2'-4"concrete base is too short for speeds ≥ 45 MPH.*	 CONCRETE RAILING W/LINE PIPE (TYPE F & J) CODE #23
24	**Precast Concrete Barrier Type "F" or "J" with Straight Anchor Bolts** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☐ ☑ No AASHTO 10-kip Design * Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Substandard for speeds ≥ 45 MPH due to the questionable deck connection detail.*	 PRECAST CONCRETE RAILING (TYPE J) CODE #24

25	**Precast Barrier (Type "J") with Hooked Anchor Bolts (MnDOT Standard Plate 5-397-140)** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☐ ☑ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Substandard for speeds ≥ 45 MPH due to the questionable deck connection detail.*	
26	**Laminated Timber Barrier Type "J" (New Jersey)** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	 LAMINATED WOOD RAILING (TYPE J) CODE #26
27	**Concrete Parapet Barrier with Two-Line Pipe Railing (Bikeway)** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Teste Yes ☐ ☑No AASHTO 10-kip Design Yes ☑ ☐No Geometrics (≥ 45 MPH) * Yes ☐ ☑No Geometrics (≤ 40 MPH) Yes ☑ ☐No ** Pipe railings are a snagging hazard, the 2'-4"parapet is too short for speeds ≥ 45 MPH.*	 CONC. PARAPET & PIPE RAILING (BIKEWAY) CODE #27

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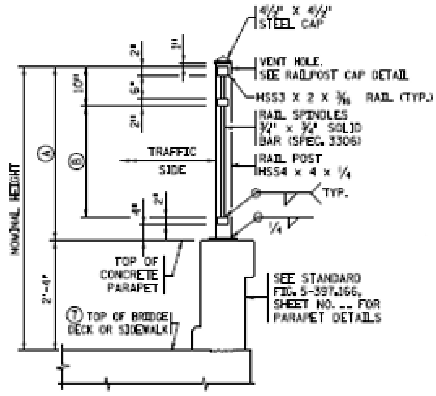
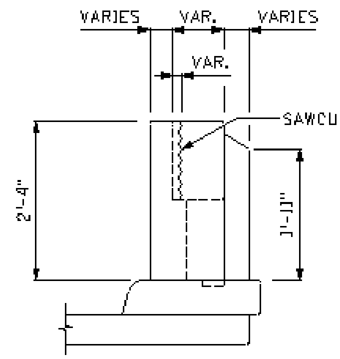
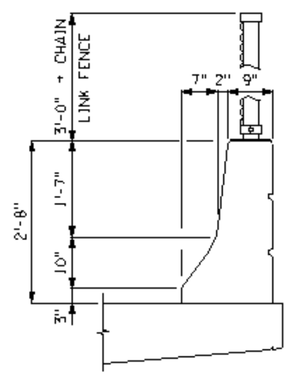
28	**Concrete Parapet (Type P-1) with Metal Railing (Type M-1) for Bikeways** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes ☐ ☑ No AASHTO 10-kip Design Yes ☑ ☐ No Geometrics (≥ 45 MPH) * Yes ☐ ☑ No Geometrics (≤ 40 MPH) Yes ☑ ☐ No ** Metal railings are a snagging hazard, the 2'-4"parapet is too short for speeds ≥ 45 MPH.*	
29	**Reconstructed One-Line Concrete Barrier (2'-4" high excluding curb)** ***Meet Standards For All Speeds **** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** For speeds ≥ 45 MPH, the total height (including curb) must be at least 2'-8" and the curb projection cannot exceed 9".*	 RECONSTRUCTED 1 LINE CONC. RAILING CODE #29
30	**Concrete Barrier Type "F" or "J" with Chain Link Fence (Bikeway)** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested * Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☐ ☑ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Substandard for speeds ≥ 45 MPH due to the fence mounted on top (snagging hazard).*	 BIKEWAY RAILING CONCRETE (TYPE J) AND FENCE CODE #30

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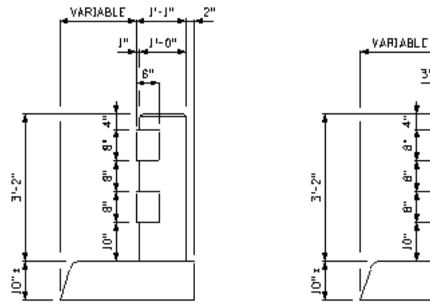
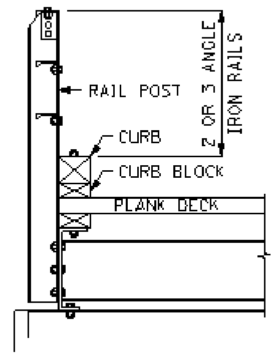
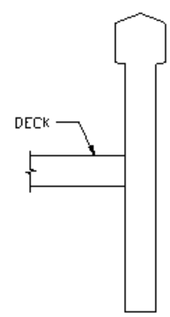
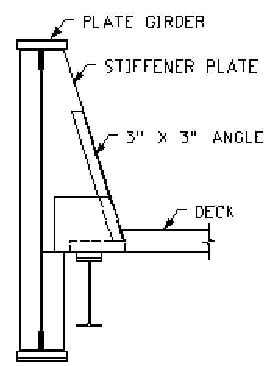
31	**Two-Line Concrete Barrier (1940's - 1950's design)** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	 2 LINE CONCRETE RAILING CODE #31
32	**Steel Angle Iron Barrier (Two-Line or Three-Line)** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	 ANGLE IRON CODE #32
33	**Concrete Through-Girder Bridge (early 1900's design)** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	 CONCRETE THRU GIRDER CODE #33
34	**Steel Through-Girder Bridge** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	 STEEL THRU GIRDER CODE #34

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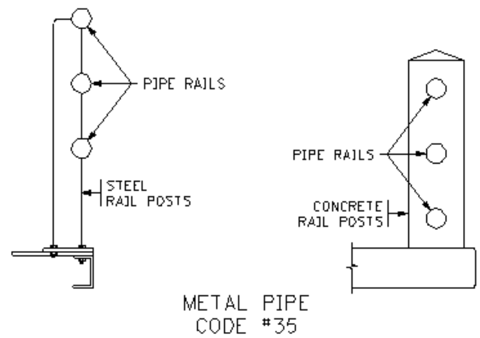
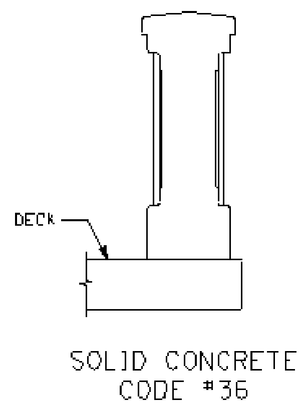
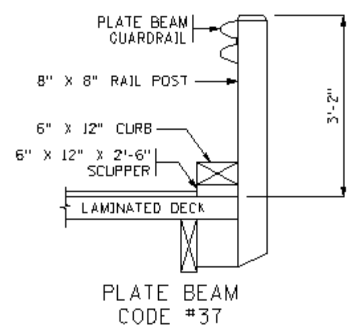
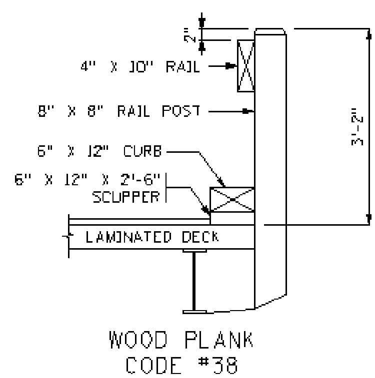
35	**Steel Pipe Barrier with Steel or Concrete Posts (1930's design)** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	
36	**Solid Concrete Barrier** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Might Meet Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 0 * NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No Geometrics (≥ 45 MPH) Yes☐ ☑ No Geometrics (≤ 40 MPH) ** Yes☑ ☐ No ** Unless an engineering analysis is performed, older (pre 1964) concrete barriers should be coded as "substandard".* *** Barrier must be at least 2'-4" high for design speeds ≤ 40 MPH.*	
37	**Steel Plate-Beam Guardrail with Timber Posts & Curb** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	
38	**Timber Plank Barrier** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	

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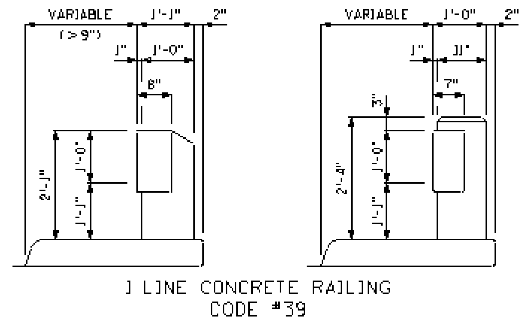
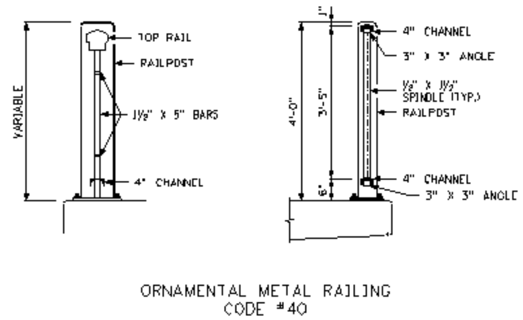
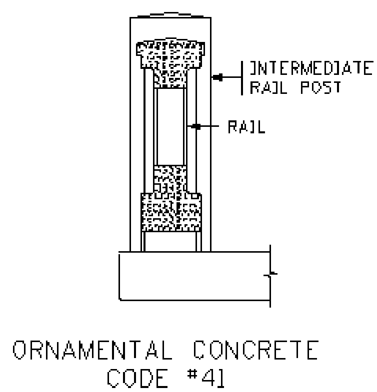
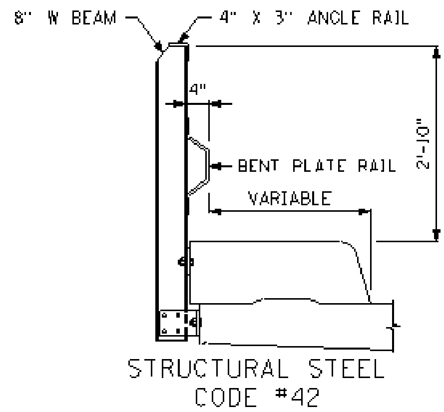
39	**One-Line Concrete Barrier (8" or 7" wide top beam)** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash TL-4 Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No *As the top rail beam thickness is less than 9", these barriers do not meet the 10-kip design requirements.*	
40	**Ornamental Metal Barrier** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	
41	**Open Balustrade Concrete Barrier** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No Geometrics (≥ 45 MPH) Yes☐ ☑ No Geometrics (≤ 40 MPH) ** Yes☑ ☐ No ** Unless an engineering analysis is performed, older (pre 1964) concrete barriers should be coded as 'substandard'.* *** Barrier must be at least 2'-4" high for design speeds ≤ 40 MPH.*	
42	**One-Line Steel Bent Plate Barrier with Steel Posts** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No	

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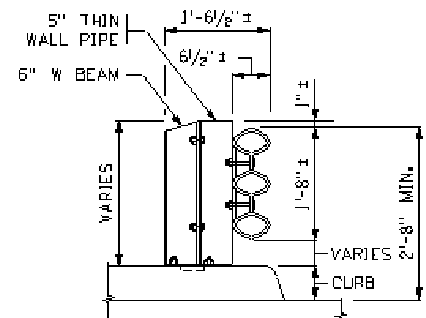
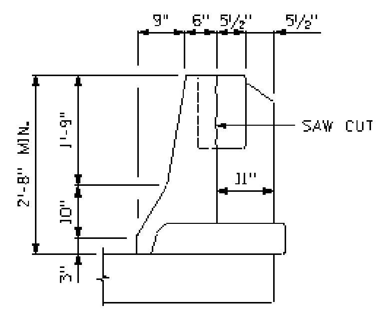
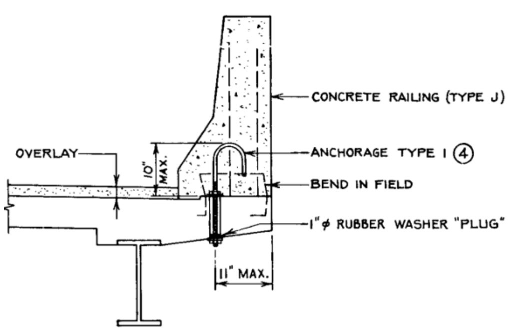
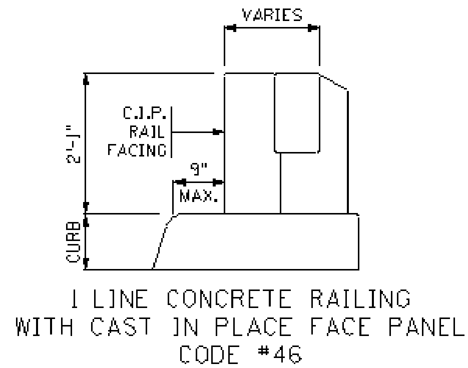
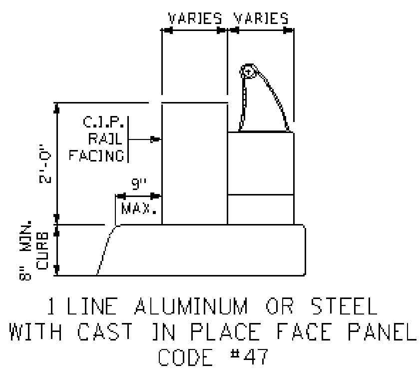
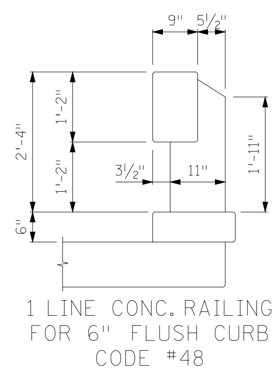
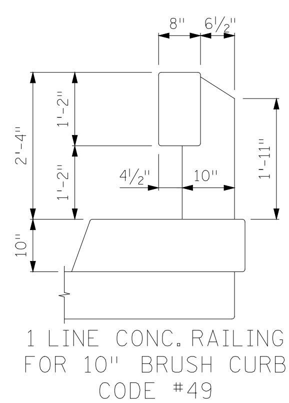
43	**Triple Beam (Thrie-Beam) Retrofit Guardrail** ***Meets Standards For All Speeds ***** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested * Yes☐ ☑ No AASHTO 10-kip Design * Yes☑ ☐ No Geometrics (≥ 45 MPH) ** Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Analysis must be performed to determine if retrofit barriers meet TL-4 and AASHTO 10-kip design requirements.* *** Rail height (including curb) must be at least 2'-8" high, and curb projection must not exceed 9" for speeds ≥ 45 MPH.*	 TRIPLE BEAM RETROFIT GUARDRAIL CODE #43
44	**Reconstructed One-Line Concrete Barrier with Type "J" (New Jersey) Facing** ***Meets Standards For All Speeds **** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Barrier must be at least 2'-8" high for speeds ≥ 45 MPH.*	 1 LINE CAST IN PLACE TYPE J BRIDGE RAIL FACING CODE #44
45	**Concrete Barrier Type "J" with Hooked Anchor Bolts (Retrofit on Existing Deck)** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Substandard for speeds ≥ 45 MPH due to the questionable deck connection detail.*	

46	**Reconstructed One-Line Concrete Barrier (2'-1" high excluding curb)** ***Meets Standards For All Speeds **** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** For speeds ≥ 45 MPH, the total height (including curb) must be at least 2'-8" and the curb projection cannot exceed 9".*	
47	**Reconstructed Concrete Barrier with One-Line Pipe** ***Meets Standards For All Speeds **** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) * Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Rail height (including curb) must be at least 2'-8" high, and curb projection must not exceed 9" for speeds ≥ 45 MPH*	
48	**One-Line Concrete Barrier with 6" High Curb (Flush with Rail)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No ** Top rail beam must be at least 9" wide to meet 10-kip design requirements.*	
49	**One-Line Concrete Barrier (8" wide top beam with 10" High Brush Curb)** ***Substandard For All Speeds*** NBI 36A Bridge Barriers = 0 NCHRP 350 Crash Tested Yes☐ ☑ No AASHTO 10-kip Design * Yes☐ ☑ No ** As the top rail beam thickness is less than 9", these barriers do not meet the 10-kip design requirements.*	

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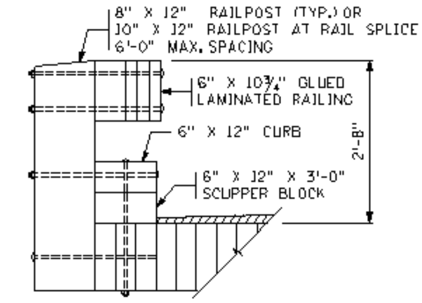
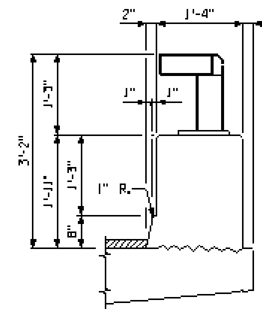
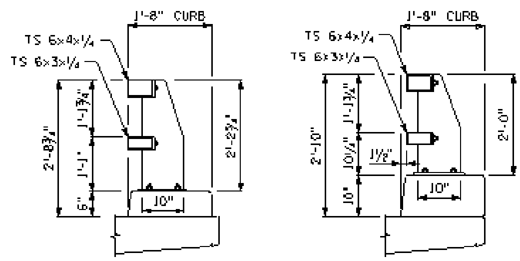
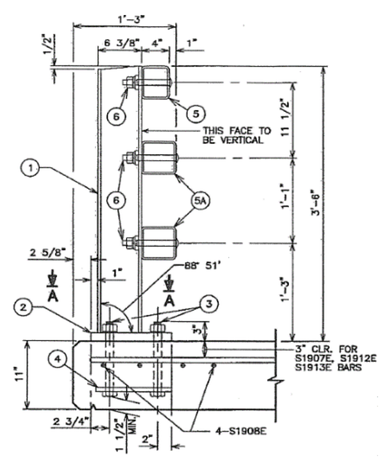
50	**Glulam Timber Post & Beam Barrier on Timber Deck (TL-2)** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☐ ☑ No NCHRP 350 Crash TL-2 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No	 GLUE LAMINATED TIMBER RAILING CODE #50
51	**Concrete Parapet (Type P-2) with Structural Steel Tube Railing** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No	 STRUCTURAL TUBE RAILING AND CONCRETE PARAPET CODE #51
52	**Structural Tube Barrier (Type "Wyoming")** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No *Upper rail beam is 6" x 4" x ¼" tubular steel, lower rail beam is 6" x 3" x ¼".*	 STRUCTURAL TUBE RAILING CODE #52
53	**Three-Line Tubular Steel Barrier (State Aid Projects)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No *5" x 5" x ¼" tubular steel rail beams (top rail beam is 4" x 4" x ¼").*	

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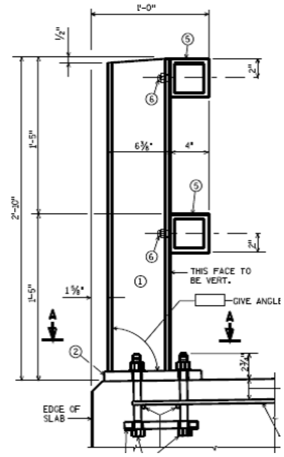
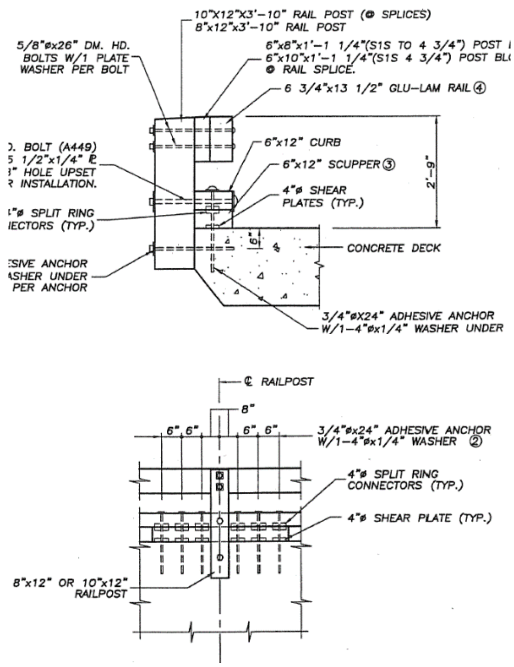
54	**Two-Line Tubular Steel Barrier (State Aid Projects)** ***Does Not Meet Standards ≥ 45 MPH*** NBI 36A Bridge Barriers = 0 ***Meets Standards ≤ 40 MPH*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 Yes☐ ☑ No NCHRP 350 Crash TL-2 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No *4" x 4" x ¼" tubular steel rail beams.*	
55	**Timber Post & Beam Barrier on Concrete Deck (TL-4) (State Aid Projects)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 NCHRP 350 Crash TL-4 * Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No ** The TL-4 design is nearly identical to the TL-2 design, but the TL-4 design requires six curb bolts adjacent to each post.*	

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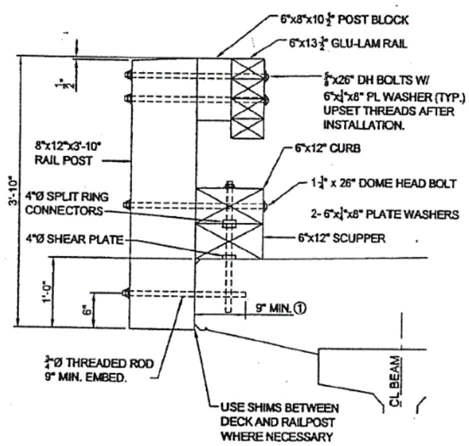
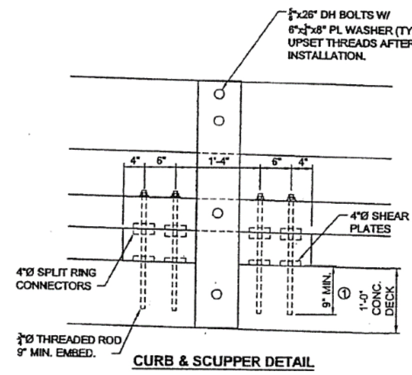
<table>
<tr>
<td>56</td>
<td>
Timber Post & Beam Barrier on Concrete Deck (TL-2)
(State Aid Projects)

Does Not Meet Standards ≥ 45 MPH
NBI 36A Bridge Barriers = 0

Meets Standards ≤ 40 MPH
NBI 36A Bridge Barriers = 1

NCHRP 350 Crash TL-4 Yes☐ ☑ No
NCHRP 350 Crash TL-2 * Yes☑ ☐ No
AASHTO 10-kip Design Yes☑ ☐ No

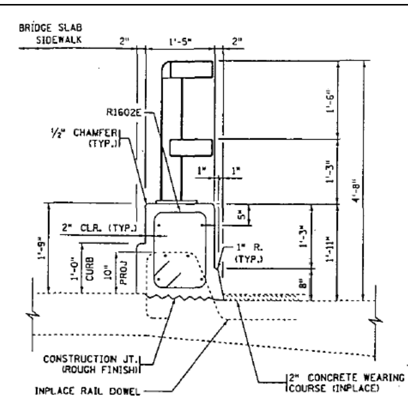
* The TL-2 design is nearly identical to the TL-4 design, but will only have 4 curb bolts adjacent to each rail post.
</td>
<td>




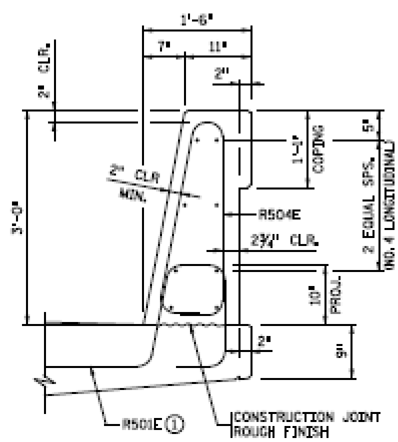
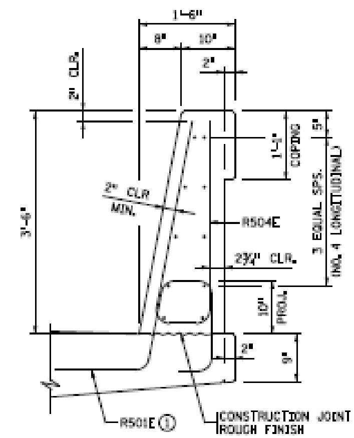
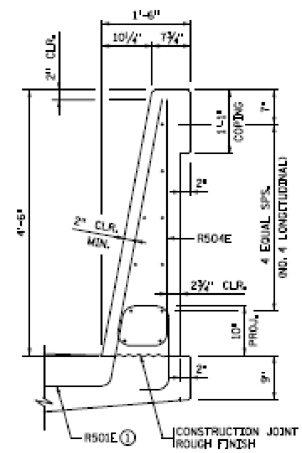
</td>
</tr>
<tr>
<td>57</td>
<td>
Concrete Parapet with Two-Line Structural Steel Tube Railing

Meets Standards For All Speeds
NBI 36A Bridge Barriers = 1

NCHRP 350 Crash TL-4 * Yes☐ ☑ No
AASHTO 10-kip Design Yes☑ ☐ No

* Although not crash tested, this design exception has been allowed due to the similarity to Code #51.
</td>
<td>


</td>
</tr>
</table>

58	**Single Slope Concrete Barrier 36" (Type S, TL-4)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 MASH Crash Tested Yes☑ ☐ No NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	
59	**Single Slope Concrete Barrier 42" (Type S, TL-4)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 MASH Crash Tested Yes☑ ☐ No NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	
60	**Single Slope Concrete Barrier 54" (Type S, TL-4)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 MASH Crash Tested Yes☑ ☐ No NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	

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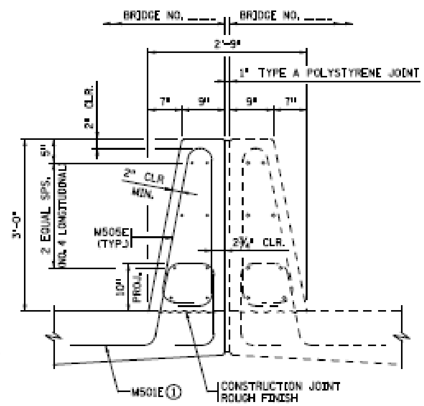
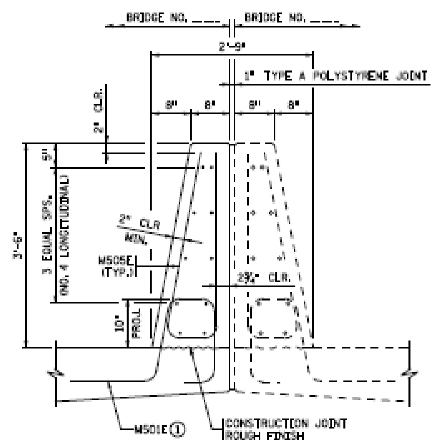
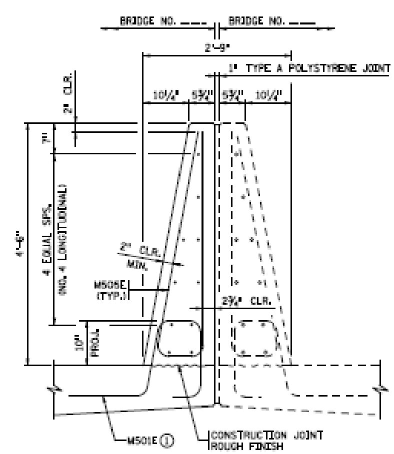
61	**Split Median Barrier 36" (Type S, TL-4)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 MASH Crash Tested Yes☑ ☐ No NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	
62	**Split Median Barrier 42" (Type S, TL-4)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 MASH Crash Tested Yes☑ ☐ No NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	
63	**Split Median Barrier 54" (Type S, TL-4)** ***Meets Standards For All Speeds*** NBI 36A Bridge Barriers = 1 MASH Crash Tested Yes☑ ☐ No NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	

<table>
<tr>
<td>64</td>
<td>
Solid Median Barrier 36"
(Type S, TL-4)

Meets Standards For All Speeds
NBI 36A Bridge Barriers = 1

MASH Crash Tested Yes☑ ☐ No
NCHRP 350 Crash TL-4 Yes☑ ☐ No
AASHTO 10-kip Design Yes☑ ☐ No
Geometrics (≥ 45 MPH) Yes☑ ☐ No
Geometrics (≤ 40 MPH) Yes☑ ☐ No
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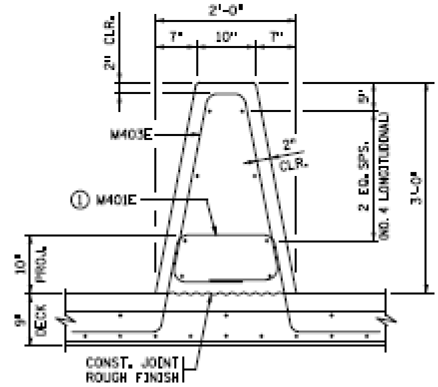
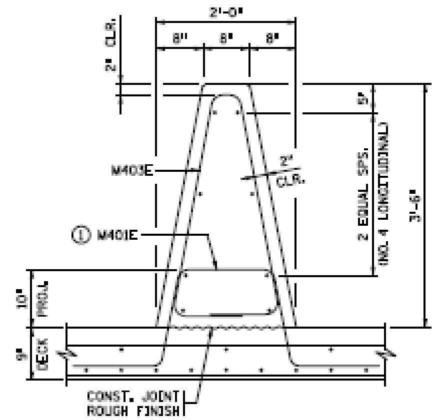


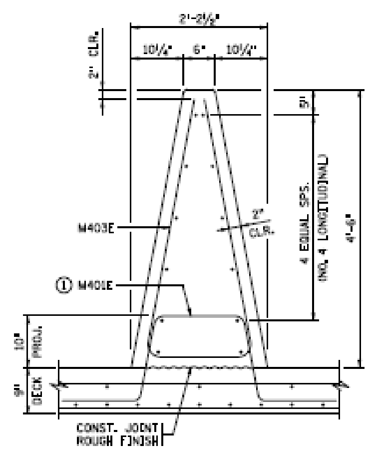
</td>
</tr>
<tr>
<td>65</td>
<td>
Solid Median Barrier 42"
(Type S, TL-4)

Meets Standards For All Speeds
NBI 36A Bridge Barriers = 1

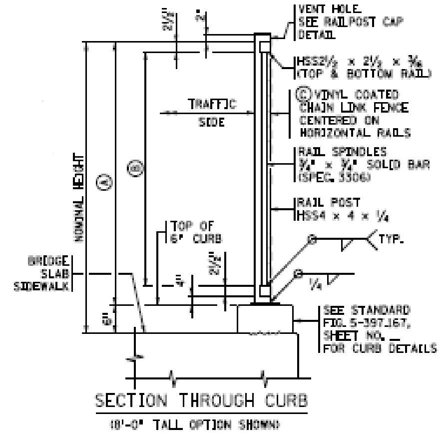
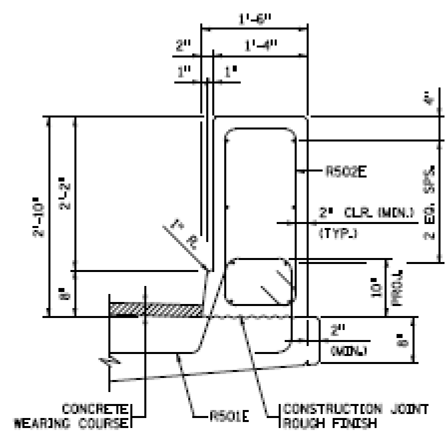
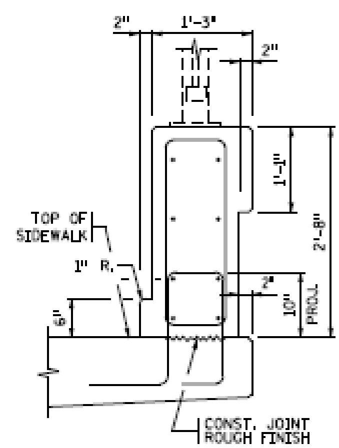
MASH Crash Tested Yes☑ ☐ No
NCHRP 350 Crash TL-4 Yes☑ ☐ No
AASHTO 10-kip Design Yes☑ ☐ No
Geometrics (≥ 45 MPH) Yes☑ ☐ No
Geometrics (≤ 40 MPH) Yes☑ ☐ No
</td>
<td>


</td>
</tr>
<tr>
<td>66</td>
<td>
Solid Median Barrier 54"
(Type S, TL-4)

Meets Standards For All Speeds
NBI 36A Bridge Barriers = 1

MASH Crash Tested Yes☑ ☐ No
NCHRP 350 Crash TL-4 Yes☑ ☐ No
AASHTO 10-kip Design Yes☑ ☐ No
Geometrics (≥ 45 MPH) Yes☑ ☐ No
Geometrics (≤ 40 MPH) Yes☑ ☐ No
</td>
<td>


</td>
</tr>
</table>

67	**Design T-3 Curb Mount Ornamental Metal Barrier with Fence** NBI 36A Bridge Barriers = 0 MASH Crash Tested Yes☐ ☑ No NCHRP 350 Crash TL-4 Yes☐ ☑ No AASHTO 10-kip Design Yes☐ ☑ No Geometrics (≥ 45 MPH) Yes☐ ☑ No Geometrics (≤ 40 MPH) Yes☐ ☑ No	
68	**Concrete Barrier (Type P-4, TL-4)** NBI 36A Bridge Barriers = 1 MASH Crash Tested Yes☑ ☐ No NCHRP 350 Crash TL-4 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	
69	**Concrete Parapet (Type P-1, TL-2)** NBI 36A Bridge Barriers = 1 MASH Crash Tested Yes☑ ☐ No NCHRP 350 Crash TL-2 Yes☑ ☐ No AASHTO 10-kip Design Yes☑ ☐ No Geometrics (≥ 45 MPH) Yes☑ ☐ No Geometrics (≤ 40 MPH) Yes☑ ☐ No	

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D.7.2.34 Pedestrian Fencing (MnDOT Item)

fe_id: 2111361 .... Ped Fencing
USERBRDG.ped_fencing_id

This item indicates if pedestrian fencing is present along any sidewalk on the bridge.

CODE	DESCRIPTION
0	Pedestrian fencing is not present
1	Pedestrian fencing is present
N	Not applicable

Use 'N' for culverts, or where traffic lanes are not under the structure.

If NBI Item 42A (Type of Service On Bridge) is coded '3 - Pedestrian-Bicycle' or '5 - Highway-Pedestrian' then the fencing is either present ('1') or it is not present ('0'). For all other NBI Item 42A codes the pedestrian fencing should be coded 'N'.

D.7.2.35 Ornamental Metal Railing (MnDOT Item)

fe_id: 2111419 .... Ornamental Metal Railing
USERBRDG.ornamental_metal_railing

This item is used to identify if the bridge railing consists of Ornamental Metal Railing.

CODE	DESCRIPTION
Y	Yes, Ornamental Railing on Bridge
N	No Ornamental Railing on Bridge

D.7.2.36 Metal Traffic Railing (MnDOT Item)

fe_id: 2111420 .... Metal Traffic Railing
USERBRDG.metal_traffic_railing

This item is used to identify if the bridge railing consists of Metal Traffic Railing.

CODE	DESCRIPTION
Y	Yes, Metal Traffic Railing on Bridge
N	No Metal Traffic Railing on Bridge

D.7.2.37 Culvert Type (MnDOT Item)

fe_id: 28 .... Culvert Type
USERBRDG.culvert_desc

Culverts are constructed of a variety of materials, including concrete (cast-in-place, or precast), corrugated steel plate, stone masonry, timber, or aluminum. The size and shape of a culvert is usually determined by the hydraulic requirements (opening must be large enough to carry the design discharge). Culvert shapes include arch culverts, box culverts, round pipe culverts, pipe-arch culverts, or elliptical culverts. A culvert may consist of a single barrel or multiple barrels.

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The item describes the culvert material, barrel dimensions, and number of barrels. If NBI Item 62 (Culverts) is coded a '0' through '9', this item shall be coded according to the following coding system depending on culvert type.

CODE	DESCRIPTION
__ DIA	**Round Pipe Diameter (in tenths of feet)**
C or W sshhz	**Cast in place concrete box ('W' Series - Old, 'C' Series - New)**
aXb	**Concrete pipe arch**
PCSTsshhz	**Precast concrete box**
cXd	**Corrugated Metal Pipe Arch**
WsshhzTIM	**Timber Box Culvert**
e x f	**Precast arch**

Notes:

- ss = Barrel span width in feet
- hh = Height in feet
- z = Number of barrels (No code needed for single barrel)
  - D = Double
  - T = Triple
  - Q= Quad
- a = Span in inches
- b = Rise in inches
- c = Span in feet and inches
- d = Rise in feet and inches
- e = Span in feet
- f = Rise in feet

Examples:

Material and Construction	Code
Cast-in-place 10ft by 8ft Concrete Box Culvert, 2 barrels	C108D
Steel Pipe Arch with a 16.6ft Main Span and 10.1ft height	16'7"X10'1"
Precast Concrete Box Double Culvert 14'-0" span width and 9'-0" height	PCST149D
Precast Concrete Pipe Arch with a span length of 10.2ft with a height of 6.4ft	122"x77"
A 1965 10.2ft by 10ft single cast-in-place concrete box culvert	W1010
Triple timber box culvert with a main span length of 6.3ft and a height of 5.25ft	W65T TIM
Steel Pipe Culvert with a main span length of 8.2ft	8.2' DIA.

D.7.2.38 Culvert Barrel Length (MnDOT Item)

fe_id: 29 .... Barrel Length
USERBRDG.culvert_barrel_lgth

This item indicates the culvert barrel length, as measured along the centerline of the culvert regardless of the depth below grade. The length does not include the apron sections of concrete culverts.

Record to the nearest foot.

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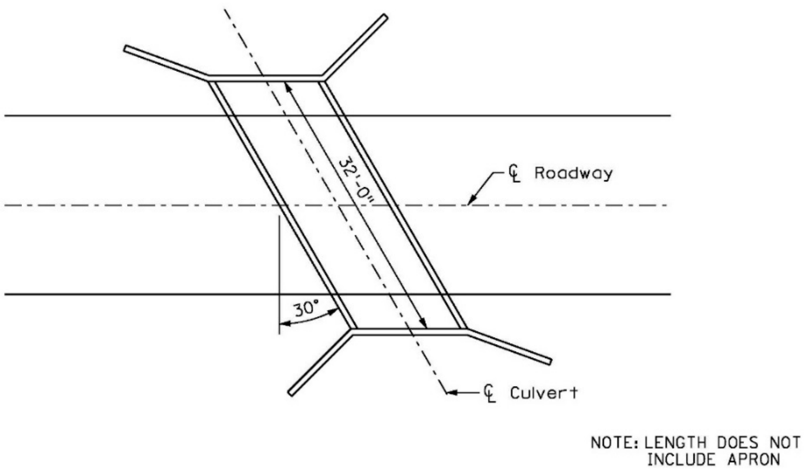
Leave this item blank if the structure is a bridge (NBI Item 43B is not coded '19').

A tunnel functioning as a bridge should not have this item or any other culvert items coded. Note, tunnels are inspected under the National Tunnel Inspection Standards (NTIS).

Example:

Culvert Barrel Length	Code
32'-0"	32



D.7.2.39 Abutment Foundation Material (MnDOT Item)

fe_id: 71 .... Abutment Material
USERBRDG.sub_abut_mat_id

This item identifies the material type of the abutment. For pile bent abutments, the piling material should be used (not the bearing cap material).

For abutments that consist of different materials, or a combination of materials, record the material that is the most scour susceptible.

The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
N	N/A	Not applicable - Used for Culverts
0	UNKNOWN	Unknown
1	CONCRETE	Concrete
2	TIMBER	Timber
3	STEEL	Steel
4	MASONRY	Masonry
5	STONE	Stone - Not Mortared
6	COMBINATION	A Combination of Material Types used in one Substructure Unit.
7	DIFFER	Abutments are Constructed of Different Material Types
8	C.I.P.	C.I.P. Piling (Sheet Shell Piling Filled with Concrete)
9	PRE STRESS CONC	Prestressed or Post Tensioned Concrete

D.7.2.40 Abutment Foundation Type (MnDOT Item)

fe_id: 86 .... Abutment Foundation
USERBRDG.sub_abut_fnd_id

This item indicates the type of foundation that supports the abutment.

For the abutments that consist of different design types, or a combination of design types, record the type of foundation that is the most scour susceptible.

A "U Type" abutment is coded for pier foundation for those structures which appear to be a single span structure but have a slab span or a deck girder abutment span. This type of structure is thus a two span bridge with no piers.

CODE	DISPLAY	DESCRIPTION
N	N/A	Not applicable
0	UNKNOWN	Type Unknown
1	SPRD/SOIL	Spread Footing on Soil
2	SPRD/ROCK	Spread Footing on Rock
3	FTNG/PILE	Footing Supported on Piling
4	PILE BENT	Pile Bent
5	U TYPE	U Type Abutment
6	CAISSON	Caissons Used as Substructure
7	MSE	Mechanically Stabilized Earth *
8	INTEGRAL	Integral
9	SEMI INTEGRAL	Semi Integral
U	UNKNOWN	Pier foundation for those structures which appear to be a 1 span structure but have a slab span or a deck girder abutment span. This type of structure is thus a 2 span bridge with no piers.

* For mechanically Stabilized Earth abutments, use '6 - Combination' for the material type and '7 - MSE' for the foundation type.

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Coding of MnDOT abutment material and type are shown in the following examples.

<table>
<tr><td>Abutment Foundation Material: TIMBER</td><td rowspan="3"></td></tr>
<tr><td>Abutment Foundation Type: PILE BENT</td></tr>
<tr><td>Description: Timber slab supported on timber piles with timber lagging.</td></tr>
<tr><td>Abutment Foundation Material: CONCRETE</td><td rowspan="3"></td></tr>
<tr><td>Abutment Foundation Type: FTG PILE</td></tr>
<tr><td>Description: Concrete footing supported on piles.</td></tr>
<tr><td>Abutment Foundation Material: STONE</td><td rowspan="3"></td></tr>
<tr><td>Abutment Foundation Type: UNKNOWN</td></tr>
<tr><td>Description: A stone abutment for a steel truss bridge built in 1885.</td></tr>
</table>

D.7.2.41 Pier Foundation Material (MnDOT Item)

fe_id: 72 .... Pier Material
USERBRDG.sub_pier_mat_id

This item identifies the material type of the piers. For pile bent piers, the piling material should be used (not the pier cap material). For piers that consist of different materials, or a combination of materials, record the material that is the most scour susceptible.

CODE	SIMS DISPLAY	DESCRIPTION
N	N/A	Not Applicable - Used for culverts or structures with no piers
1	CONCRETE	Concrete
2	TIMBER	Timber
3	STEEL	Steel
4	MASONRY	Masonry
5	STONE	Stone-Not mortared
6	COMBINATION	A combination of material types are used in one substructure unit.
7	DIFFER	Piers are constructed of different material types or the piers are constructed of different material types.
8	C.I.P.	C.I.P. Piling (Sheet Shell Piling Filled with Concrete)
9	PRE STRESS CONC	Prestressed or post tensioned concrete

D.7.2.42 Pier Foundation Type (MnDOT Item)

fe_id: 87 .... Pier Foundation
USERBRDG.sub_pier_fnd_id

This item indicates the type of foundation that supports the piers. For the piers that consist of different design types, or a combination of design types, record the type of foundation that is the most scour susceptible.

CODE	SIMS DISPLAY	DESCRIPTION
N	N/A	Not applicable
0	UNKNOWN	Type unknown
1	SPRD/SOIL	Spread footing on soil
2	SPRD/ROCK	Spread footing on rock
3	FTNG/PILE	Footing supported on piling
4	PILE BENT	Pile bent
5	U TYPE	U Type abutment
6	CAISSON	Caissons used as substructure
U	UNKNOWN	Pier foundation for those structures which appear to be a 1 span structure but have a slab span or a deck girder abutment span. This type of structure is thus a 2 span bridge with no piers.

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D.7.2.43 Parallel Structure Designation (NBI Item 101)

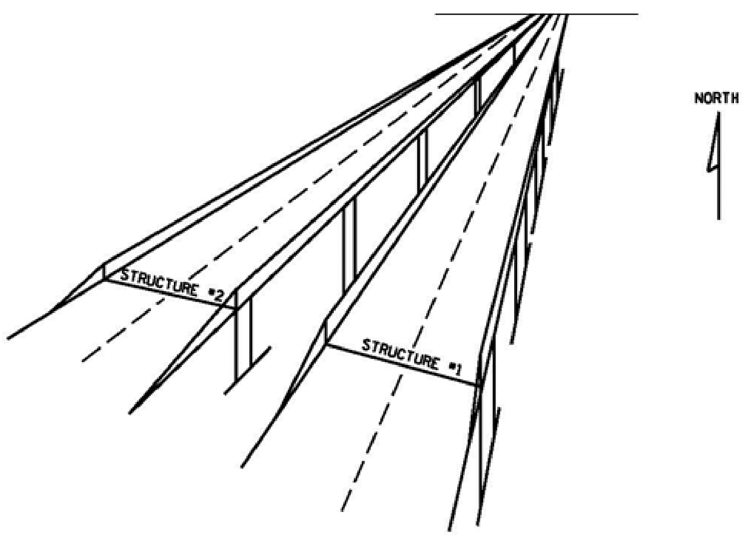
fe_id: 2010100 .... NBI 101: Parallel Structure Designation
BRIDGE.paralstruc

Code this item to indicate situations where separate structures carry the inventory route in opposite directions of travel over the same feature. Example: Bridge 27245 carries TH 610 WB (NBI 101 = 'L') and Bridge 27246 carries TH 610 EB (NBI 101 = 'R'). The lateral distance between structures has no bearing on the coding of this item. The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
R	**RIGHT**	**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	**LEFT**	**The left structure of parallel bridges. This structure carries traffic in the opposite direction.**
N	**NONE**	**No parallel structure exists.**

Example:

	Code
Structure #1	R
Structure #2	L



D.7.2.44 Temporary Structure Designation (NBI Item 103)

fe_id: 2010300 .... NBI 103: Temporary Structure Designation
BRIDGE.tempstruc

Code this item to indicate situations where temporary structures or conditions exist.

Leave this item blank if not applicable.

CODE	DESCRIPTION
	Not Applicable
T	**Temporary Structure(s) or conditions exist**

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Temporary structure(s) or conditions are those which are required to facilitate traffic flow, but are not intended to be permanent. This may occur either before or during the modification or replacement of a structure found to be deficient. Such conditions include the following:

- Bridges shored up, including additional temporary supports.
- Temporary repairs made to keep a bridge open.
- Temporary structures, temporary runarounds or bypasses.
- 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 activity, other than normal 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' to indicate a temporary structure or condition then all of the recorded data for the structure shall be coded for the condition of the structure as it would be if the temporary measures did not exist. The exceptions to this are the NBI Items listed in the following table – these NBI Items MUST be coded for the existing temporary measures.

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 (The Operating and Inventory Ratings Should be Shown as if the Temporary Measures do not Exist)**

If this item is coded 'T' you must also code MN Temporary Status (MnDOT Item). See Section D.7.2.45.

D.7.2.45 MN Temporary Status (MnDOT Item)

fe_id: 2111371 ... MN Temporary Status
USERBRDG.temp_type_id

This item indicates situations where temporary structures or conditions exist that are not intended to be a permanent structure or repair. This item relates to NBI Item 103 (Temporary Structure Designation) in Section D.7.2.44, but further identifies the location of the temporary structural repair, such as superstructure, deck, or substructure, and if the load carrying capacity of the structure has been reduced.

If NBI Item 103 is coded 'T' then MN Temporary Status must be coded '2' through '8'.

The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
	BLANK	Not applicable (left blank)
2	TEMP SUP/ MAINTAIN LOAD	Temporary repairs or temporary superstructure elements have been added to maintain load posting.
3	TEMP SUP/ REDUCED LOAD	Temporary repairs or temporary superstructure elements have been added and the posted load has been reduced.
4	TEMP DK/ MAINTAIN LOAD	Temporary repairs have been made to the deck to maintain the load capacity. This may include structural underpinning of the deck, but does not include temporary repairs to the wearing surface to maintain ride quality.
5	TEMP DECK/ REDUCED LOAD	Temporary repairs have been made to the deck and posted load capacity has been reduced. This may include structural underpinning of the deck, but does not include temporary repairs to the wearing surface to maintain ride quality.
6	TEMP SUB/ PERM REP NEEDED	Temporary repairs have been made to a substructure unit, a permanent repair is needed.
7	TEMP SUBSTR/ MAINTAIN LOAD	A temporary substructure unit has been installed to maintain legal load capacity.
8	OPEN/ LANE BARRICAD	Traffic lanes have been barricaded to keep the bridge open.

D.7.2.46 Deck Structure Type (NBI Item 107)

fe_id: 2010700 .... NBI 107: Deck Structure Type
BRIDGE.dkstructyp

This item identifies the deck system on the bridge. If more than one type of deck system is present, record the most predominant.

This item is coded 'N - Not Applicable' for culverts and filled spandrel arches.

CODE	DISPLAY	DESCRIPTION
1	C-I-P CONCRETE	Concrete (Cast-in-Place)
2	PRECAST CONCRETE	Concrete (Precast Panels)
3	OPEN GRATING	Open Grating
4	CLOSED GRATING	Closed Grating
5	STEEL PLATE	Steel Plate (includes orthotropic)
6	CORRUGATED STEEL	Corrugated Steel
7	ALUMINUM	Aluminum
8	TIMBER	Wood or Timber
9	OTHER	Other
N	N/A	Not Applicable (Structures with no Deck)

D.7.2.47 Type of Wearing Surface (NBI Item 108A)

fe_id: 2010810 .... NBI 108A: Wearing Surface
BRIDGE.dksurftype

This item identifies the type of wearing surface present on the bridge deck.

This item is coded 'N - Not Applicable' for culverts and filled spandrel arches.

CODE	DISPLAY	DESCRIPTION
1	MONOLITHIC CONC	Concrete (concurrently placed with structural deck)
2	INTEGRAL CONC	Integral Concrete (separate non-modified layer of concrete added to structural deck)
3	LATEX CONC	Latex Concrete
4	LOW SLUMP CONC	Low Slump Concrete
5	EPOXY OVERLAY	Epoxy Overlay *
6	BITUMINOUS	Bituminous **
7	TIMBER	Timber
8	GRAVEL	Gravel
9	OTHER	Other *
0	NONE	No additional concrete thickness or wearing surface is included in the bridge deck.
N	N/A	Not Applicable (Structures with no Deck)

* Includes Chip Seal Wearing Course.
** Includes Ultrathin Bonded Wearing Course (add this description to the inspection note for ELEM #510).
*** Includes Premixed Poly Conc (PPC) Wearing Course (add this description to the inspection note for ELEM #510).

D.7.2.48 Type of Membrane (NBI Item 108B)

fe_id: 2010820 .... NBI 108B: Deck Membrane
BRIDGE.dkmembtype

Concrete bridge deck deterioration is one of the most extensive bridge maintenance problems affecting the service life of bridges. One cause of the deterioration is the penetration of moisture and chlorides into the concrete with subsequent corrosion of the steel reinforcement. The use of membranes is one strategy to prevent moisture and chlorides from reaching the concrete by providing a barrier on the top of the concrete deck. The membrane is then protected from traffic by an asphalt overlay.

This item identifies the type of membrane present that typically applies only to bridge decks with bituminous overlays.

The following table lists the codes for this item.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

CODE	DISPLAY	DESCRIPTION
1	BUILT UP	Built-up (layered)
2	PREFORMED FABRIC	Preformed Fabric
3	EPOXY	Epoxy
8	UNKNOWN	Unknown
9	OTHER	Other
0	NONE	None
N	N/A	Not Applicable (No Deck)

Generally, MnDOT doesn't use membranes. Code '0' for bridge structures; code 'N' for non-bridge structures (i.e., culverts).

D.7.2.49 Deck Rebars (NBI Item 108C)

fe_id: 2010830 .... NBI 108C: Deck Protection
BRIDGE.dkprotect

Concrete bridge deck deterioration is one of the most extensive maintenance problems affecting the service life of bridges. Moisture and chloride intrusion can accelerate concrete bridge deck distress through corrosion of the steel reinforcement. This item indicates the type of deck protection system to prevent corrosion of the reinforcement that is present on the bridge.

CODE	DISPLAY	DESCRIPTION
1	EPOXY COATED REBAR	Epoxy Coated Reinforcing *
2	GALVANIZED REBAR	Galvanized Reinforcing
3	OTHER COATED REBAR	Other Coated Reinforcing
4	CATHODIC PROTECTION	Cathodic Protection
6	POLYMER	Polymer Impregnated
7	INTERNALLY SEALED	Internally Sealed
8	UNKNOWN	Unknown
9	OTHER	Other **
0	NONE	None
N	N/A	Not Applicable (applies only to structures with no deck) ***

*   Code 1 is for bridge decks with epoxy coated reinforcement only in the top layer.
** Code 9 includes stainless steel rebar.
*** Code N includes culverts and filled spandrel arches.

Corrosion of concrete bridge structures in North America did not become a significant concern until the 1960's as properly designed and constructed bridges before then rarely experienced corrosion related distress. In the 1950's, many highway agencies began applying deicing salts to highways and bridges to keep roadways free of snow and ice.

Following the increased use of deicing salts, corrosion of bridge decks was observed. The first use of epoxy coated reinforcing steel in a bridge was in 1973 in Pennsylvania. To assist in deck protection coding, if bridge plans are not available, refer to the following timeline.

Year Built	Type of Reinforcement
Prior to 1940	Single Layer of Uncoated Rebar
1940 - 1973	Two Layers of Uncoated Rebar
1973 - 1980	Top Layer Epoxy Coated/Bottom Layer Uncoated Rebar
1980 - 2009	Two Layers of Epoxy Coated Rebar
2009	Complex Bridges may use Stainless Steel Rebar

D.7.2.50 Deck Install Year (MnDOT Item)

fe_id: 36 .... Deck Rebars Install Year
USERBRDG.rebars_installed

This item identifies the year the deck was installed. All four digits of the year are to be recorded.

For new bridges record the year shown on the bridge nameplate.

For structures without bridge nameplates, or for rehabs with full deck replacements, use the year of construction. This shall be the last year the construction crew was in the field.

If the year of construction is unknown, a best estimate should be based on the date on the construction plans.

Leave this item blank if the structure type is a culvert (NBI Item 43B is coded '19').

D.7.2.51 Wearing Surface Installation Year (MnDOT Item)

fe_id: 33 .... Wear Surface Install Year
USERBRDG.deck_protect_installed

This item identifies the year in which the wear surface was installed. All four digits of the year are to be recorded.

Inspector Note:
The inspector is responsible for updating this item after the wearing surface on a deck has been overlaid or replaced.

For new bridges BIMU will record the year shown on the bridge nameplate in the construction plan; and, the year a plan was signed will be recorded for new culverts.

This item is optional for culverts.

D.7.2.52 Wearing Course/Fill Depth (MnDOT Item)

fe_id: 34 .... Wear Course/Fill Depth
USERBRDG.depth_wear_surface

Wear Course is the total depth of wearing surface material on the bridge deck.

The culvert fill depth is the total depth of fill material (including the wearing surface, if any) that is supported by the culvert.

For a culvert with a distribution slab record '2.01' for this item. Send the actual fill depth measurement (see Section D.7.2.53) to BIMU.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

Record to a hundredth of a foot (truncate, do not round).

Load rating calculations will be based upon the deck wearing surface type and depth items that are displayed on the Minnesota Structure Inventory Report. As the deck wearing surface can constitute a significant dead load it will have a significant effect upon the load carrying capacity of the bridge.

- A load rating analysis should typically be performed prior to installing a new wearing surface.
- If any changes to the wearing surface type or depth are reported during an inspection, the load rating should be reviewed – any increase in the dead load will require a new load rating.
- In some cases, excess gravel may have to be removed from a bridge deck to maintain the current posting limits.

Inspector Note:
The wearing course/fill depth should be verified at each inspection. This may affect the load-carrying capacity of the structure. Contact the PA if a new load rating should be completed.

D.7.2.53 MN Actual Fill Depth (MnDOT Item)

fe_id: 4002 .... MN Actual Fill Depth
BRIDGE.userkey13

Use this item for a culvert with a distribution slab. Send the actual fill depth measurement to BIMU.

The actual fill depth (top of culvert to top of roadway surface) is recorded to a hundredth of a foot (truncate, do not round).

Leave this item blank for bridges, and for culverts without a distribution slab.

D.7.2.54 Beam Type (Main Span) (MnDOT Item)

fe_id: 2111353 .... Beam Type Main Span
BRIDGE.userkey11 (3rd position)

Record the type of beam used for the main span of the bridge.

CODE	DESCRIPTION
I	Prestress I Beam
R	Rectangular Prestress Beam
S	Cold Rolled Steel Beam (WF series)
B	Built Up or Welded Steel Beam
O	Other

D.7.2.55 Beam Height (Main Span) (MnDOT Item)

fe_id: 2111354 .... Beam Height Main Span
BRIDGE.userkey11 (4th – 6th position)

Record the beam height for the main span beams to the nearest inch.

Example:

Description	Display
MN45 Prestressed Concrete Beams	045 (include preceding zero)

D.7.2.56 Number of Beam Lines (Main Span) (MnDOT Item)

fe_id: 2111352 .... Number Beam Lines Main Span
BRIDGE.userkey11 (1st – 2nd position)

Record the number of beams in the main span. For structures with varying number of beam lines record the most dominant number of beam lines.

Example:

Description	Display
5 Beam Lines	05 (include preceding zero)

D.7.2.57 Number of Beam Lines (Approach Span) (MnDOT Item)

fe_id: 2111418 .... No of Beam Lines (Approach Span)
USERBRDG.number_of_beam_lines_as

Record the number of beams in the approach span.

D.7.2.58 Curved Bridge (MnDOT Item)

fe_id: 2111347 .... Curved Bridge
BRIDGE.userkey10 (1st position)

This item indicates if the bridge is curved.

CODE	DESCRIPTION
Y	Yes, Curved
N	Not Curved

D.7.2.59 Bifurcated (MnDOT Item)

fe_id: 2111348 .... Bifurcated
BRIDGE.userkey10 (2nd position)

This item indicates if the bridge is bifurcated or forked.

The following table lists the codes for this item.

CODE	DESCRIPTION
Y	Yes, Bifurcated
N	Not Bifurcated

D.7.2.60 Radial Supports (MnDOT Item)

fe_id: 2111349 .... Radial Supports
BRIDGE.userkey10 (3rd position)

This item indicates if the bridge has radial supports (a support that is perpendicular to centerline of roadway).

CODE	DESCRIPTION
Y	Yes, Radial Supports
N	No Radial Supports

D.7.2.61 Two-Girder Bridge (MnDOT Item)

fe_id: 2111350 .... Two Girder Bridge
BRIDGE.userkey10 (4th position)

This item indicates if the bridge is a two girder bridge.

CODE	DESCRIPTION
Y	Yes, Two Girder Bridge
N	Not a Two Girder Bridge

D.7.2.62 Degree of Curvature (MnDOT Item)

fe_id: 2111351 .... Degree of Curvature
BRIDGE.userkey10 (5th – 17th position)

For curved bridges located on a horizontal curve, record the degree of curvature between supports. Round this value to the nearest hundredth.

For a non-curved bridge, leave this item blank.

D.7.2.63 Cantilever ID (MnDOT Item)

fe_id: 45 .... Cantilever ID
USERBRDG.cantilever_id

This item describes the type of cantilever hinge assembly present on the bridge. This item is left blank if the structure does not contain any cantilever hinge assemblies.

Only one cantilever type can be coded per bridge.

The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
F	FRICTION HINGE	Sliding Plate Hinge Bearing
P	PINNED HINGE	Hinge Pin Assembly
R	ROCKER HINGE	Rocker Hinge Bearing
S	PIN & HANGER	Pin & Hanger Assembly
N	NOT APPLICABLE /BLANK	No cantilever hinge bearings are present on the bridge (it can also simply be left blank)

D.7.2.64 Field Connection ID (MnDOT Item)

fe_id: 44 .... Field Conn ID
USERBRDG.field_connection_id

This item describes the predominate type of field connection present on the bridge. This item will only be applicable when there are field splices on a steel beam.

CODE	DESCRIPTION
1	Pinned
2	Riveted
3	Welded
4	Bolted
5	Huck Bolt
	No Splice

D.7.2.65 Hybrid Girder (MnDOT Item)

fe_id: 2111409 .... Hybrid Girder
USERBRDG.hybrid_girder

This item refers to steel girders that consist of different steel grades.

CODE	DESCRIPTION
Y	Yes, Hybrid Girder
N	Not a Hybrid Girder

Example:

Description	Code
High Performance Steel (HPS 70W) used for the bottom flange in positive moment area and typical Grade 50W for the web and top flange.	Y

D.7.2.66 Multiple Steel Grades (MnDOT Item)

fe_id: 2111410 .... Multiple Steel Grades
USERBRDG.multiple_steel_grades

This item refers to steel girder bridges that consist of different steel grades.

CODE	DESCRIPTION
Y	Yes, Multiple Steel Grades
N	Single Steel Grade

Example:

Description	Code
High Performance Steel (HPS 70W) used for the main span girders and typical Grade 50W for approach spans.	Y

D.7.2.67 Steel Specification (MnDOT Item)

fe_id: 2111411 .... Steel Spec.
USERBRDG.steel_spec_number

This item refers to the MnDOT Structural Steel Specification number and can be found in the Design Data block on the General Plan and Elevation sheet of the bridge plan.

Examples:

- 3306
- 3309

D.7.2.68 Steel Yield Stress 1 (MnDOT Item)

fe_id: 2111412 .... Yield Stress 1
USERBRDG.yield_stress

This item is to record the minimum steel yield strength of the steel girders in ksi units.

Example:

Description	Code
Grade 50W	50

D.7.2.69 Steel Yield Stress 2 (MnDOT Item)

fe_id: 2111413 .... Yield Stress 2
USERBRDG.yield_stress2

This item is used if there are multiple steel grades on a bridge and records the minimum steel yield strength not coded in Steel Yield Stress 1.

D.7.2.70 Girder Connection Type (MnDOT Item)

fe_id: 2111414 .... Girder Connection Type
USERBRDG.girder_connection_type

This item describes the predominate type of girder connection present on the bridge.

CODE	DESCRIPTION
1	Pinned
2	Riveted
3	Welded
4	Bolted
5	Huck Bolt
	No Splice

D.7.2.71 Girder Depth (Main Span) (MnDOT Item)

fe_id: 2111415 .... Girder Depth (Main Span)
USERBRDG.main_sapn_girder_depth

Record the steel girder depth for the main span in inches.

D.7.2.72 Girder Depth (Approach Span) (MnDOT Item)

fe_id: 2111416 .... Girder Depth (Approach Span)
USERBRDG.approach_span_girder_depth

Record the steel girder depth for the approach span in inches.

D.7.2.73 Girder Depth Type (Main Span) (MnDOT Item)

fe_id: 2111417 .... Girder Depth Type (Main Span)
USERBRDG.main_span_girder_depth_type

Record the type of steel girder used for the main span of the bridge.

Examples:
- Constant
- Haunched
- Variable

D.7.2.74 Design Specification Year (MnDOT Item)

fe_id: 2111421 .... Design Specification Year
USERBRDG.specification_year_used

Record the year of the Minnesota Department of Transportation "Standard Specifications for Construction" that is located under the Construction Notes on the bridge plans. All four digits of the year are to be recorded. If no bridge plans are available record as 'UNKN', which denotes the date is unknown.

Example:

Description	Code
2012 AASHTO Design Specification	2012
No bridge plans available	UNKN

D.7.3 INSPECTION INFORMATION

This section contains inspection information data about the structure such as the deficiency status, sufficiency rating, last inspection date, inspection frequency, structure status, etc.

D.7.3.1 Structure Open, Posted, or Closed to Traffic (NBI Item 41)

fe_id: 2004100 .... NBI 41: Structure Open, Posted, or Closed to Traffic
INSPEVNT.oppostcl

This item describes the current operational status of a structure (i.e., open, posted, closed). The field review could show that a structure is posted, but NBI Item 70 (Bridge Posting) may indicate that posting is not required. This is a possible and acceptable coding since NBI 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.

If posting is required, the actual posting will be displayed on the header of the Minnesota Bridge Inspection Report, and in the bottom-right corner of the Minnesota Structure Inventory Report.

Inspector Note:
During each inspection, the inspector must verify that load posting signage (if required) is in-place, correct, and readable. See page D-178 for examples of load posting signs.

The inspector should confirm that load posting signs are present both on or immediately in front of both sides of the bridge, and should note if advanced signs are present. All of these signs must display the correct weight limits. The condition of load posting signage should be rated using Element #890 (see Chapter B of the MnDOT BSIPM).

If the load posting signs are missing, or do not correlate with the inspection report, the Program Administrator should be promptly notified.

If it is apparent that load postings are not being adhered to the Program Administrator should be notified. The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
A	A - OPEN	Bridge is open to traffic (no load restrictions) - this includes pedestrian or railroad bridges.
B	B - OPEN, POSTING REQUIRED	Bridge is open to traffic - load posting is recommended but has not been legally implemented (all signs not in place).
D	D - OPEN, TEMPORARY SHORING	Bridge is open to traffic, but would be posted or closed without temporary shoring or supports.
E	E - OPEN, TEMPORARY STRUCTURE	Bridge is open to traffic, but is a temporary structure intended to carry legal loads until the original structure is rehabilitated (or a new structure is constructed).
G	G - NEW BRIDGE, NOT OPEN YET	New structure - not yet open to traffic.
K	K - CLOSED	Bridge is closed to all traffic.
P	P - POSTED FOR LOAD	Bridge is posted with a load restriction. This includes bridges with more than one restriction, or temporary bridges with a load restriction.
R	R - POSTED FOR OTHER LOAD-CAPACITY RESTRICTION	Bridge is posted with other load-capacity restrictions (such as speed, number of vehicles on bridge, etc.).

When bridge records are updated with new load ratings and load posting is required, BIMU will code NBI 41 as ‘B - Open, Posting Required’.

Inspector Note:
The bridge inspector is responsible for updating a status change in SIMS. An example of a status change is from 'B' to 'P' once the correct signage has been installed.

D.7.3.2 Inspection Date (NBI Item 90)

fe_id: 2009000 .... NBI 90: Date of Inspection
INSPEVNT.inspdate

This item refers only to the routine inspection and indicates the day, month, and year on which the most recent routine bridge inspection was performed. Only the month and year are reported to the FHWA. For inspections that occur over multiple days the last day the inspection crew was in the field is recorded. An effort should be made to schedule equipment use to minimize time lag between first and last days of an inspection.

A routine inspection is a 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.

In April 2017, BIMU began using the open to traffic date as the "dummy" inspection date when a new bridge is entered into the system. The "dummy" inspection report is used to populate the bridge record with inventory and inspection items, and is not an actual field inspection.

D.7.3.3 Designated Inspection Frequency (NBI Item 91)

fe_id: 2009100 .... NBI 91: Designated Inspection Frequency
INSPEVNT.brinspfreq

BSIPM User Note:
See Chapter A, Section A.5.1 for additional information regarding initial inspections.

This item refers only to the routine inspection frequency. All structures are assigned a routine inspection frequency based on the condition of the bridge or culvert.

This item consists of two digits that represent the number of months between designated inspections of the structure. A leading zero is included when necessary.

Examples:

Description	Display
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

The routine inspection frequency for bridges and culverts shall be established in accordance with the following criteria.

INITIAL INSPECTION (3 or 6 month frequency)
All newly constructed structures must receive an initial inspection. The initial inspection serves to document the structural and functional conditions of the bridge or culvert, and to provide verification of inventory information that has been entered into SIMS by the Bridge Inventory Management Unit.

Upon opening the structure to the public an initial inspection must be completed by a certified Team Leader within 3 or 6 months. Initial routine inspection frequencies are assigned as follows.

- 3 month frequency for State and Federally owned bridges and culverts.
- 6 month frequency for all other bridges and culverts.

After the completion of the initial inspection all newly constructed bridges or culverts BIMU will assign a routine inspection frequency of 24 months.

ANNUAL INSPECTION (12 month frequency)
Structures not meeting the biennial inspection conditions shall be inspected on a 12 month frequency (or less depending on the condition of the structure).

The following bridges must be inspected annually:

- Highway bridges that have fracture critical elements.
- Railroad bridges over public roadways with non-load path redundant superstructures.

BIENNIAL INSPECTION (24 month frequency)
After the completion of the initial inspection all newly constructed bridges or culverts are assigned a routine inspection frequency of 24 months.

Bridges and culverts (including railroad and pedestrian bridges) can be inspected at an interval not to exceed 24 months if the following conditions are met.

- NBI Condition and Appraisal Ratings are '5' or greater for:
- Deck (NBI Item 58)
- Superstructure (NBI Item 59)
- Substructure (NBI Item 60)
- Culvert (NBI Item 62)
- Structural Evaluation (NBI Item 67)

QUADRENNIAL INSPECTION (48 month frequency)
Culverts (including pedestrian underpasses) may be inspected at an interval not to exceed 48 months if the following conditions are met.

- NBI Item 43B (Structure Type, Main – Type of Design and/or Construction) must be '19' (Culvert).
- NBI Item 41 (Structure Open, Posted, or Closed to Traffic) must be 'A' (Open, No Restriction).
- NBI Item 113 (Scour Critical Bridges) must be 'N', '8', '5', or '9' and MN Scour Code must be 'A', 'C', 'E', 'H', 'I', 'K', 'L', 'M', or 'N'.
- NBI Condition and Appraisal Ratings must be '6' or greater for:
- Culverts (NBI Item 62)
- Channel and Channel Protection (NBI Item 61)
- Structural Evaluation (NBI Item 67)
- The culvert must have a load rating on file.
- If the structure length is 20 ft or greater the Inventory load rating must be equal to or greater than HS 20.
- The minimum fill depth above the top of culvert must be 2 feet or greater.

To request a change to inspection frequencies the Agency Program Administrator should submit an Inspection Frequency Change Request Form, which is available on the MnDOT Bridge Office website at http://www.dot.state.mn.us/bridge/bridgereports/index.html and http://www.dot.state.mn.us/bridge/inspection.html.

When a bridge or culvert no longer meets the condition criteria for a 24 or 48 month inspection frequency it will be assigned the appropriate frequency based on criteria. District and Local Agency Program Administrators will be notified of these changes to the inspection frequency. Reduction in inspection frequency (i.e., 48 months to 24 months, or 24 months to 12 months) shall occur when any of the established criteria for the existing interval is no longer met.

Severe weather, concern for Team Leaders safety, concern for inspection quality, the need to optimize scheduling with other bridges, or other unique situations may be cause to adjust the scheduled inspection date. The adjusted date should not extend more than one month beyond the documented inspection frequency for bridges on a 24 month frequency or three months for bridges on a 12 month inspection frequency without documented justification. Subsequent inspections must adhere to the previously established interval.

In addition to the criteria listed in this section, Bridge Owners and/or Program Administrators should consider other factors that have a bearing on the appropriate inspection frequency, such as age of structure, rate of critical element deterioration, traffic characteristics, scour susceptibility, experience with similar structure types, or in-place warranties. Reduction in inspection frequency (i.e., 24 months to 12 months) may be determined by the Program Administrator in regards to routine inspections, or by the Structural Evaluation Engineer in the case of Fracture Critical, Underwater, or special inspections based on inspection findings.

It should be noted that bridges will also require special non-scheduled inspections after unusual physical traumas such as floods, fires, or collisions, etc. 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 fires an in-depth inspection may be warranted as directed by the Program Administrator. 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.

D.7.3.4 Redundant Railroad Bridge (MnDOT Item)

fe_id: 2111355 .... Redundant RR Bridge
BRIDGE.userkey14

This item indicates if the railroad structure is redundant. A non-redundant RR bridge must be inspected on a 12 month frequency.

CODE	DESCRIPTION
Y	Yes, Redundant
N	Not Redundant
	Not Applicable

This item can be left blank if not applicable.

D.7.3.5 Inspector Name (MnDOT Item)

fe_id: Report Controlled
INSPEVNT.inspname

This item shows the inspector name identified as the primary inspector in the most recent inspection in the SIMS program. This item is completed by the program.

D.7.3.6 Userkey (MnDOT Item)

fe_id: 23 .... Userkey
BRIDGE.createuserkey

This item identifies the agency responsible for ensuring that the structure is regularly inspected.

Inspection responsibility is based on the roadway authority in the hierarchy of State, Federal, county, city, railroad, and other private. Example, a bridge located on or over a Trunk Highway (or within the TH right-of-way) is inspected by MnDOT.

An exception to this occurs when a Cooperative Agreement is in place assigning inspection jurisdiction to another agency. A copy of the agreement should be filed with MnDOT.

A complete list of agencies and their corresponding userkey can be found in Appendix B.

Examples:

Agency Responsible for Inspection	**Code**
City of Burnsville	138
MnDOT District 7	22

D.7.3.7 Deficient Status

This item is calculated by the program and is not an editable field.

The deficiency status of a structure identifies if the structure is structurally deficient (S.D.), functionally obsolete (F.O.), or adequate (ADEQ). The following sections define structurally deficient and functionally obsolete structures. It must be noted that, based on the criteria used, a bridge could be both structurally deficient and functionally obsolete.

The status field however, provides the option of running a query in which a bridge designated as functionally obsolete is not structurally deficient. In other words, functionally obsolete bridges are exclusive of structurally deficient bridges.

The status field definition of bridge deficiencies is limited only to those bridges which are 10 years or older and are 20 feet or greater in length.

DISPLAY	DESCRIPTION
S.D.	**Structurally Deficient**
F.O.	**Functionally Obsolete**
ADEQ	**Not Deficient or Obsolete**

Any discrepancies should be reported to BIMU.

D.7.3.7.1 Structurally Deficient

fe_id: 2011710 .... Unofficial Structurally Deficient
INSPEVNT.nbi_rating

This item is calculated by the program and is not an editable field.

This item identifies if a bridge is structurally deficient. This item only applies to bridges that carry vehicular traffic. Railroad and pedestrian bridges are excluded and is displayed on the Bridge Reports as 'N/A'.

FHWA designates a bridge as structurally deficient if it meets at least one of the following conditions.

- An NBI condition rating of '4' or less for NBI Item 58 (Deck), NBI Item 59 (Superstructure), NBI Item 60 (Substructure), or NBI Item 62 (Culverts); or
- An appraisal rating of '2' or less for NBI Item 67 (Structural Evaluation *); or
- An appraisal rating of '2' or less for NBI Item 71 (Waterway Adequacy) and NBI Item 42B (Type of Service Under Bridge) is coded as one of the following.
  - '0 - Other'
  - '5 - Waterway'
  - '6 - Highway-Waterway'
  - '7 - Railroad-Waterway'
  - '8 - Highway-Waterway-Railroad'
  - '9 - Relief for Waterway'

* NBI Item 67 (Structural Evaluation) is calculated by the program. A new bridge load capacity rating that significantly reduces NBI Item 66 (Inventory Rating) may result in a bridge being designated as structurally deficient.

FHWA recently established a "10-year rule" that prevents bridges from remaining classified as structurally deficient after a major reconstruction project. Bridges with NBI Item 27 (Year Built) or NBI Item 106 (Year Reconstructed) within the past 10 years of the current date will not be considered to be a deficient bridge, and will not be eligible for Federal Highway Bridge Replacement and Rehabilitation Program funds.

The following table lists the codes for this item.

CODE	DESCRIPTION
Y	Yes, Structurally Deficient
N	Not Structurally Deficient

D.7.3.7.2 Functionally Obsolete

fe_id: 2012000 .... Unofficial Functionally Obsolete
INSPEVNT.nbi_rating

This item is calculated by the program and is not an editable field.

This item identifies if a bridge is functionally obsolete. This item only applies to bridges that carry vehicular traffic. Railroad and pedestrian bridges are excluded and is displayed on the Bridge Reports as 'N/A'.

FHWA designates a bridge as functionally obsolete if it meets at least one of the five following conditions.

- An appraisal rating of '3' or less for NBI Item 68 (Deck Geometry); or
- An appraisal rating of '3' or less for NBI Item 72 (Approach Roadway Alignment); or
- An appraisal rating of '3' for NBI Item 67 (Structural Evaluation); or
- An appraisal rating of '3' for NBI Item 71 (Waterway Adequacy) and NBI Item 42B (Type of Service Under Bridge) is coded as one of the following.
  - '0 - Other'
  - '5 - Waterway'

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  - '6 - Highway-Waterway'
  - '7 - Railroad-Waterway'
  - '8 - Highway-Waterway-Railroad'
  - '9 - Relief for Waterway'; or
- An appraisal rating of '3' or less for NBI Item 69 (Underclearances , Vertical and Horizontal) and NBI Item 42B (Type of Service Under Bridge) is coded as one of the following:
  - '0 - Other'
  - '1 - Highway, with or without Pedestrian'
  - '2 - Railroad'
  - '4 - Highway-Railroad'
  - '6 - Highway-Waterway'
  - '7 - Railroad-Waterway'
  - '8 - Highway-Waterway-Railroad'

A bridge designated as structurally deficient is excluded from consideration as being functionally obsolete.

CODE	DESCRIPTION
Y	Yes, Structurally Deficient
N	Not Structurally Deficient

D.7.3.8 Sufficiency Rating

fe_id: 2011810 .... Unofficial Sufficiency Rating
INSPEVNT.suff_rate

This item is calculated by the program and is not an editable field.

The bridge sufficiency rating is a based upon a percentage scale of 0% through 100% (with 100% being an entirely sufficient bridge). The bridge sufficiency rating is used to establish funding eligibility and priority for bridge replacement and rehabilitation. As a general rule, to be eligible for bridge rehabilitation a sufficiency rating of 80% or less is required, and to be eligible for bridge replacement a sufficiency rating of 50% or less is required.

The bridge sufficiency rating takes into consideration the structural adequacy, functional capacity, and essentiality for public use of the bridge. The formula is explained in detail in Appendix B of the FHWA Recording Guide. While the NBI condition ratings are a key component of the bridge sufficiency rating, only NBI superstructure, substructure, or culvert condition ratings of '5' or less will significantly reduce the bridge sufficiency rating. Other factors used to calculate the bridge sufficiency rating include the inventory load carrying capacity, the NBI appraisal ratings, the ADT, NBI Item 36 (Traffic Safety Features), and the detour length.

The bridge sufficiency rating is calculated for bridges and culverts that carry vehicular traffic – any discrepancies should be reported to BIMU. The bridge sufficiency rating is not calculated for railroad or pedestrian bridges.

D.7.3.9 Fracture Critical Details (NBI Items 92A & 93A)

fe_id: 2111666 .... Part III - Fracture Critical Yes No
fe_id: 2009210 .... NBI 92A: Critical Features: Fracture Critical Details Frequency
fe_id: 2009310 .... NBI 93A: Critical Feature Inspection Date: Fracture Critical Details
BRIDGE.userkey6

A fracture critical (FC) structure is a structure that is not load path redundant and has at least one FC member or member component. Fracture critical members (FCM) or member components are steel tension members or steel tension components of members whose failure would be expected to result in collapse of or partial collapse of the structure. A FCM lacks redundancy and when it fails there is no alternate load path or member to which the failed member can shed its load. FC inspections of non-redundant structure members that are determined to be FC shall receive an in-depth FC inspection at an interval not to exceed 24 months.

BSIPM User Note:
See Chapter A, Section A.5.4 for additional information regarding fracture critical inspections.

Only bridges carrying vehicular traffic are designated as FC. Railroad and pedestrian bridges are currently excluded.

This Item consists of three data fields on the SIA and SIA One Column forms. The fields are "Y/N", "Freq", and "Date".

If a FC inspection is required these fields are coded as follows.

- Y/N: 'Y'.
- Freq: The number of months between FC inspections is recorded. Current guidelines for the maximum allowable interval between inspections is 24 months. Some structures may require more frequent inspections. A leading zero is included when necessary.
- Date: The month, day, and year of the FC inspection is recorded.

If a FC inspection is not required "Y/N" is coded 'N' and the other two data fields are left blank.

See following example.

Description	Code
A steel pony truss on a township road with a most recent FC inspection was completed June 21, 2011. 	Y 24 06/21/2011

D.7.3.10 Underwater Inspection (NBI Items 92B & 93B)

fe_id: 2111667 .... Part III - Underwater Yes No
fe_id: 2009220 .... NBI 92B: Critical Features: Underwater Inspection Frequency
fe_id: 2009320 .... NBI 93B: Critical Feature Inspection Date: Underwater Inspection
BRIDGE.userkey9

Underwater (UW) inspections are required for bridge elements that cannot be visibly evaluated during periods of low flow or examined by feel for condition, integrity, and safe load capacity due to excessive water depth and turbidity. These elements shall be inspected at an interval not to exceed 48 months (some structures may require more frequent inspections).

Inspector Note:
If all structural elements were not visibly evaluated due to high water for the past 5 years, notify the Program Administrator that the bridge should be included in the next underwater contract.

If the water is shallow, the bridge can be inspected with waders; in deeper water, diving inspections are required.

This Item consists of three data fields on the SIA and SIA One Column forms. The fields are "Y/N", "Freq", and "Date".

BSIPM User Note:
See Chapter A, Section A.5.8 for additional information regarding underwater inspections.

If a UW inspection is required these fields are coded as follows.

- Y/N: 'Y'.
- Freq: The number of months between UW inspections is recorded. Beginning in 2016, and continuing into the future, MnDOT will administer the UW inspection contracts for all Trunk Highway, County, City, and Township bridges to ensure UW inspections are performed on a 48 month interval.
- Date: The month, day, and year of the UW inspection is recorded.

If a UW inspection is not required "Y/N" is coded 'N' and the other two fields are left blank.

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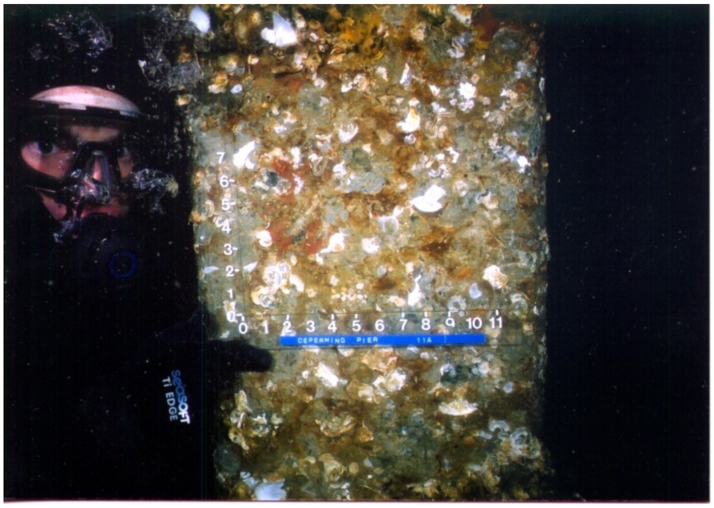
Example:

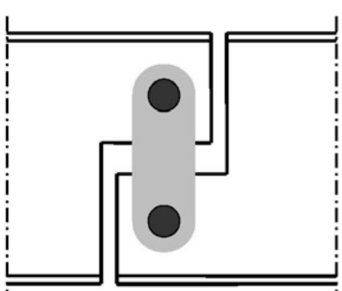
Description	Code
A county bridge whose underwater inspection was completed July 15, 2014. 	Y 48 07/15/2014

D.7.3.11 Special Inspection: Pinned Assembly Inspection (NBI Items 92C & 93C)

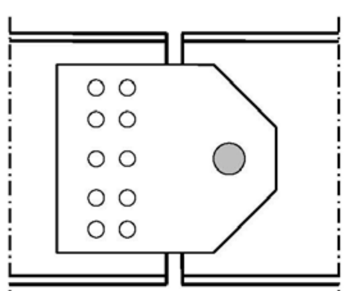
fe_id: 2111669 .... Part III - Spec Feat Yes No
fe_id: 53 .... NBI 92C: Critical Features: Special Inspection Frequency
fe_id: 52 .... NBI 93C: Critical Feature Inspection Date: Special Inspection
BRIDGE.userkey7

BSIPM User Note:
See Chapter A, Section A.5.7 for additional information regarding special inspections.

On continuous steel bridges with cantilever or suspended spans (where the end of one span is supported by an adjacent span), the connection detail may consist of a pinned assembly. A pinned and hanger assembly typically consists of two vertical hanger plates with pinned connection at the top and bottom – this allows both rotation and longitudinal movement of the superstructure. A fixed pin assembly typically consists of a single pin – this allows rotation, but restricts longitudinal movement of the structure.



Pin & Hanger Assembly



Fixed Pin Assembly

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

Pin and Hanger Assemblies or single "Hinge Pin" assemblies require specialized non-destructive testing (NDT) inspections at intervals not to exceed 60 months. NDT for pinned assemblies is typically done using ultrasonic examination. These NDT inspections are required even if the structure is load path redundant and the failure of a single pinned connection may not result in collapse of the structure.

NDT is used to supplement the visual inspection by providing information regarding the condition of bridge components that are not detectable by a visual inspection alone. NDT is a generic name given to repeatable processes applied to components or structures to determine the condition of the structures material without compromising structural integrity.

This item consists of three data fields on the SIA and SIA One Column forms. The fields are 'Y/N", "Freq", and "Date".

If the structure consists of a pinned assembly these fields are coded as follows.

- Y/N: 'Y'.
- Freq: The number of months between NDT inspections is recorded. Current guidelines for the maximum allowable interval between inspections is 60 months.
- Date: The month, day, and year of the NDT inspection is recorded.

If a NDT inspection is not required "Y/N" is coded 'N' and the other two data fields are left blank.

Example:

Description	**Code**
A steel beam span on a state highway, with a pin and hanger on one end and hinge pins on the other requiring inspection every 60 months with the last NDT inspection on May 1, 2010.	Y 60 06/01/2010

D.7.3.12 Complex Bridge Inspection (MnDOT Item)

fe_id: 6000005 .... Complex - Inspection Date
fe_id: 6000006 .... Complex - Inspection Frequency
BrM fields not available at this time.

A complex structure is defined as movable, suspension, cable stayed, and other bridges with unusual characteristics. Only a bridge that carries vehicular traffic can be designated as "Complex". Railroad and pedestrian bridges are currently excluded.

BSIPM User Note:

See Chapter A, Section A.5.5 for information regarding complex inspections.

There are three complex bridges (or bridges with complex components) in the state of Minnesota. The three complex bridges are the Hennepin Avenue Bridge (Hennepin County), the Duluth Aerial Lift Bridge (City of Duluth), and the Stillwater Lift Bridge (MnDOT).

Each complex bridge shall have its own complex inspection procedure and frequency, as determined by the bridge owner.

D.7.4 NBI CONDITION RATINGS

The following five bridge condition ratings should be reviewed during each inspection. These NBI items rate the current condition of the deck, superstructure, substructure, channel or the culvert.

Inspector Note:
MnDOT initially codes these ratings, if applicable, as '9' for all new structures. It is the responsibility of the inspector to update these ratings during the initial inspection.

D.7.4.1 Deck Condition Rating (NBI Item 58)

fe_id: 2005800 .... NBI 58: Deck
INSPEVNT.dkrating

This item describes the overall general condition rating of the deck (or slab) – this includes the underside of the deck as well as the wearing surface. The condition of the wearing surface/protective system, railings, curbs or sidewalks, joints, expansion devices, and deck drains shall not be considered in this rating. However, their condition should be noted on the inspection form.

Inspector Note:
For bridges where the deck and the superstructure are composed as a single piece (rigid frame, slab, or voided slab), the condition rating shall have the same code for NBI Item 58 (Deck) and NBI Item 59 (Superstructure).

Decks integral with the superstructure will be rated as a deck only and not how they may influence the superstructure rating (i.e., deck girder, T-beam, box girder, etc.). Similarly, the superstructure of an integral deck type bridge will not influence the deck rating.

BSIPM User Note:
Rate and code the condition in accordance with the table in Chapter B – Bridge Inspection Field Manual.

The primary function of the bridge deck is to transmit the wheel loads to the supporting members. It also provides a support for curbs, walkway, railings, medians, expansion joints, and provides a surface to transmit vehicles and drainage off the bridge.

D.7.4.2 Superstructure Condition Rating (NBI Item 59)

fe_id: 2005900 .... NBI 59: Superstructure
INSPEVNT.suprating

This item describes the overall general condition of the superstructure. It includes all structural components located above (and including) the bearings.

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

Inspector Note:
For bridges where the deck and the superstructure are composed as a single piece (rigid frame, slab, or voided slab), the condition rating shall have the same code for NBI Item 58 (Deck) and NBI Item 59 (Superstructure).

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BSIPM User Note:
Rate and code the condition in accordance with the table in Chapter B – Bridge Inspection Field Manual.

On bridges where the deck is integral with the superstructure, the superstructure condition rating may be affected by the deck condition.

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

D.7.4.3 Substructure Condition Rating (NBI Item 60)

fe_id: 2006000 .... NBI 60: Substructure
INSPEVNT.subrating

This item describes the overall general condition of the substructure. It includes all structural components located below the bearings.

BSIPM User Note:
Rate and code the condition in accordance with the table in Chapter B – Bridge Inspection Field Manual.

D.7.4.4 Channel and Channel Protection Condition Rating (NBI Item 61)

fe_id: 2006100 .... NBI 61: Channel and Channel Protection
INSPEVNT.chanrating

This rating should reflect the overall general condition of the waterway flowing below the bridge or running through the culvert – even if the channel is occasionally dry. This rating can be based upon findings from routine visual inspections, soundings, or underwater inspections.

This rating includes the channel and banks below the bridge, as well as immediately upstream and downstream of the bridge (typically those areas visible from the bridge). Changes in the channel such as aggradation (rising of the channel due to sedimentation), degradation (lowering of the channel due to erosion), or lateral stream migration that might adversely affect the bridge should be considered in this rating.

The presence of drift in the channel, debris lodged against the bridge, or sediment inside culvert barrels should also be considered in this rating.

If the bridge is over a navigable waterway (NBI Item 38 will be coded '1'), the condition of substructure protection devices (such as dolphins, fenders, and shear walls) must be rated using NBI Item 111.

BSIPM User Note:
Rate and code the condition in accordance with the table in Chapter B – Bridge Inspection Field Manual.

D.7.4.5 Culverts Condition Rating (NBI Item 62)

fe_id: 2006200 .... NBI 62: Culvert
INSPEVNT.culvrating

This rating should reflect the overall general condition of the culvert. If a structure is classified as a culvert, the NBI condition ratings for deck, superstructure, and substructure must be rated 'N'.

BSIPM User Note:
Rate and code the condition in accordance with the table in Chapter B – Bridge Inspection Field Manual.

D.7.5 NBI APPRAISAL RATINGS

The items in the NBI Appraisal Ratings section are used to evaluate a bridge in relation to the roadway system of which it is a part of. The structure is compared to a new structure constructed according to current standards for that particular type of road as further defined in this section, except for NBI Item 72 (Approach Roadway Alignment). For information on NBI Item 72 see Section D.7.5.13

NBI Items 67, 68, 69, and 71 will be coded with a one digit code that indicates the appraisal rating for the item. The following table lists the codes for these items.

APPRAISAL RATINGS, NBI ITEMS 67, 68, 69, 71	
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 NBI Items 67, 68 and 69 according to the tables provided in the FHWA Recording Guide and included in this Chapter. These tables and the table for NBI Item 71 shall be used 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 'N' is not valid for use with NBI 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 - New Bridge, Not Open Yet' for NBI Item 41 (Structure Open, Posted, or Closed to Traffic).

D.7.5.1 Traffic Safety Features (NBI Item 36)

NBI Item 36 describes the adequacy of the bridge barriers and approach guardrail from the aspect of current traffic safety standards (refer to the FHWA Recording Guide., pages 19 - 21). During a bridge inspection, sufficient information should be recorded to determine the adequacy of these four safety features described in extensive detail in the following sections.

Inspector Note:

This section will be updated in accordance with AASHTO's Manual for Assessing Safety Hardware (MASH) criteria after the MASH standards are implemented.

- NBI Item 36A - Bridge Barriers
- NBI Item 36B - Transitions (between approach guardrail and bridge barrier)
- NBI Item 36C - Approach Guardrail
- NBI Item 36D - Approach Guardrail Ends

The following table lists the codes for these four items.

CODE	DISPLAY	DESCRIPTION
0	0 - SUBSTANDARD *	Inspected feature does not meet currently acceptable standards or a traffic safety feature is required but none is present.
1	1 - MEETS STANDARDS	Inspected feature meets currently acceptable standards.
N	N - NOT REQUIRED	Not applicable or a traffic safety feature is not required.

* The coding for NBI Item 36A is based upon current standards for new construction or rehabilitation. Upgrading of an existing traffic safety feature coded '0-Substandrad' is generally required only when Federal or State-Aid funding is used for a bridge (or roadway) improvement project.

NBI Item 36 refers only to the roadway traveling on a bridge or over a culvert. All four items should be coded 'N - Not Required' for railroad or pedestrian bridges.

The coding of NBI Item 36 should not consider traffic damage or deterioration.

BSIPM User Note:

Any damage or deterioration on the bridge barriers or guardrail should be noted and rated using the appropriate element. See Chapter B, Section B.3 Structural Element Condition Ratings.

NBI Item 36 can have a slight effect on the Bridge Sufficiency Rating, but only for bridges with a sufficiency rating of 50% or greater (refer to the FHWA Recording Guide, page B-9). If two of these four items are coded '0 - Substandard' it will result in a 1% reduction, if three are coded '0 - Substandard' it will result in a 2% reduction, and if all four are coded '0 - Substandard' it will result in a 3% reduction.

Quick Links:
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Disclaimer: The initial entry coding for NBI Item 36 should not be assumed to be correct. The existing coding of NBI Item 36 should not be the final determinant when deciding if safety features are required, or if existing safety features meet current design standards. A review and analysis of the safety features present on a bridge should be conducted prior to any bridge improvement project.

Inspector Note:
Coding for Traffic Safety Features should be reviewed during each bridge inspection.

D.7.5.2 Bridge Barriers (NBI Item 36A)

fe_id: 2003610 .... NBI 36A: Traffic Safety Features: Bridge Railings
INSPEVNT.railrating

NBI Item 36A indicates if the bridge barriers meet current traffic safety standards. Bridge barriers must meet specific geometric criteria, must be strong enough to sustain vehicle impact, and must be capable of smoothly redirecting a vehicle after impact. With few exceptions, all vehicular bridges require barriers – if no barriers are present NBI Item 36A will typically be coded '0 - Substandard'. Railroad or pedestrian bridges should be coded 'N - Not Required'.

Culverts: If the embankment above a culvert structure is of sufficient depth to allow guardrail to be installed along the roadway, which is not directly connected to the culvert, NBI Item 36A should be coded 'N - Not Required. If guardrail is attached directly to a culvert it should be considered to be a "bridge barrier" and NBI Item 36A must be coded '0 - Substandard' or '1 - Meets Standards'.

CODE	DISPLAY	DESCRIPTION
0	**0 - SUBSTANDARD ***	**Inspected feature does not meet currently acceptable standards or a traffic safety feature is required but none is present.**
1	**1 - MEETS STANDARDS**	**Inspected feature meets currently acceptable standards.**
N	**N - NOT REQUIRED**	**Not applicable or a traffic safety feature is not required.**

* The coding for NBI Item 36A is based upon current standards for new construction or rehabilitation. Upgrading of an existing traffic safety feature coded '0-Substandrad' is generally required only when Federal or State-Aid funding is used for a bridge (or roadway) improvement project.

FHWA requires that bridge barriers used on NHS Federal-aid projects meet full-scale crash-test criteria in accordance with the guidelines contained in the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features".

Current design standards for bridge barriers are available in the AASHTO LRFD Bridge Specifications (Section 13), and MnDOT's LRFD Bridge Design Manual (Chapter 13). The American Association of State Highway and Transportation Officials (AASHTO) defines six crash test levels for which bridge barriers (and guardrail) should be designed, based upon traffic and site conditions.

- TL-1 (very low volume, low speed local streets)

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- TL-2 (local and collector roads with favorable site conditions, reduced posted speeds, and small numbers of heavy vehicles)
- TL-3 (high speed arterial highways with very low mixtures of heavy vehicles and favorable site conditions)
- TL-4 (high speed highways, freeways, expressways and Interstate highways with a mixture of trucks and heavy vehicles)
- TL-5 (similar to TL-4 where large trucks make up a significant portion of the average daily traffic or unfavorable site conditions exist)
- TL-6 (high center of gravity vehicles, such as tanker trucks, combined with unfavorable site conditions)

Table 13.2.1 (Standard Rail Applications) in MnDOT's LRFD Bridge Design Manual outlines the approved applications for bridge railing designs currently used in Minnesota – it displays the AASHTO test level and the speed limits for which these rail types are used.

To determine the appropriate coding for NBI Item 36A the type of vehicular barrier present on the bridge should be confirmed, and design speed (or posted speed, whichever is greater) of the roadway traveling on the bridge must be determined. For a bridge barrier to be considered as "meeting standards", it must either meet the crash test standards outlined in NCHRP Report 350, or meet the 10-kip design load requirements from the AASHTO Standard Specifications. Depending upon the roadway design speed (or posted speed, whichever is greater), the barrier must also meet specific geometric criteria. The general barrier criteria for low speed and high speed roadways are as follows:

- Design speeds ≥ 45 MPH
  - Must meet either TL-4 crash test or 10 kip AASHTO design specifications
  - 2'-8" minimum height
  - Curb projection (beyond face of rail) must not exceed 9"
  - No snagging hazards
- Design speeds ≤ 40 MPH
  - Must meet either TL-2 crash test or 10 kip AASHTO design specifications
  - 2'-4" minimum height

Inspector Note:
For MnDOT Barrier Codes refer to Section D.7.2.33.

For structures on the NHS, national standards are set by regulation. For those structures not on the NHS, MnDOT has set its own standards. Refer to Section D.7.2.33, which displays the current barrier codes (along with diagrams of each type) – the table will indicate if the barrier meets standards for all speeds, for speeds ≤ 40 MPH, or if the barrier is considered to be substandard for all speeds. The commentary in the table will also indicate (with a ☑ next to "yes" or "no") if the barrier meets each of the four criteria listed below.

- NCHRP 350 Crash Tested
- AASHTO 10-kip Design Requirements
- Geometric Requirements (≥ 45 MPH)
- Geometrics (≤ 40 MPH)

Inspector Note:
On low speed roadways bridge barriers mounted on a sidewalk might not require upgrading (the sidewalk must be at least 6 ft. wide, with a curb height between 8" and 10").

There is no requirement or obligation to upgrade existing bridge barriers unless Federal or State-Aid bridge improvement funding is used on the bridge.

D.7.5.3 Guardrail Requirements

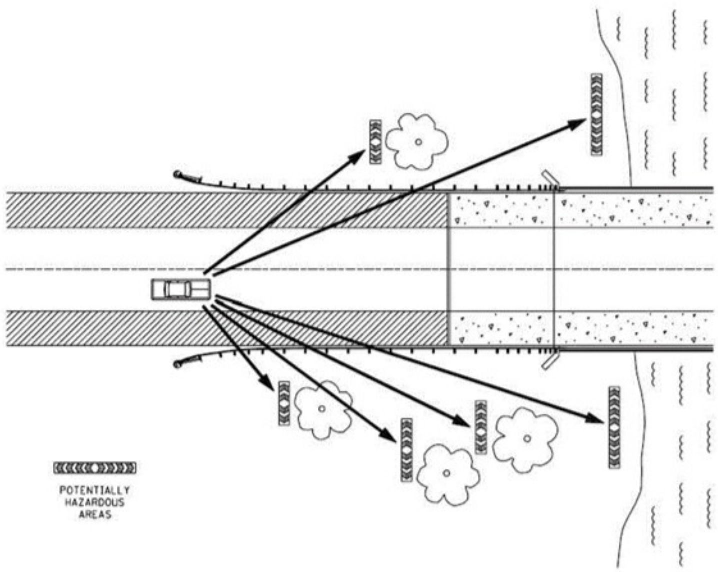
Prior to coding NBI Items 36B (Transition), 36C (Approach Guardrail), and 36D (Approach Guardrail Ends), it must first be determined if current construction standards would require installation of guardrail on the bridge approaches, or along the roadway traveling over the culvert. If it is determined that guardrail is not required, these three items should be coded 'N - Not Required'.

It is important to note that installation or upgrading of guardrail on an existing bridge or culvert is typically only required during a bridge or roadway improvement project.

D.7.5.3.1 For Bridges

The end of a bridge barrier is a fixed object hazard that normally warrants the installation of approach guardrail, and there are typically other hazards present on a bridge approach. While guardrail may also be warranted on the roadway traveling under a bridge, NBI Items 36B, 36C, and 36D only address the roadway traveling on the bridge.

See following diagram.



Potential Hazards at a Bridge Approach (Figure 10-7.01E – MnDOT's Road Design Manual)

Bridges on the Minnesota State Trunk Highway System:

For bridges on the Minnesota State Trunk Highway system, Route System (MnDOT Item) is coded '01 - Interstate Highways', '02 - US Highways', or '03 - Minnesota State Highways' – the current guardrail requirements are outlined in Chapter 10-7.01.05 of MnDOT's Road Design Manual. Guardrail is required on bridge approaches unless all of the following criteria are met.

- The bridge is located within the limits of a municipality;
- The bridge site is located where design speeds are less than 40 mph;

- The roadway is either an urban section with curbs and sidewalk or on a rural section in which the bridge roadway width equals or exceeds the width of the approach roadway (including shoulders).

Bridges on the County/Local System:

For bridges on County highways, Township roads, City streets, or other roadways not on the Minnesota State Trunk Highway system, current guardrail requirements are outlined in Minnesota Rule 8820.9920 (Minimum Design Standards; Rural and Suburban Undivided Roadways; New or Reconstruction Projects). Guardrail is required to be installed at all bridges where:

- the design speed [or posted speed] exceeds 40 mph, and
- the existing ADT exceeds 400 or the bridge clear width is less than the sum of the lane and shoulder widths.

D.7.5.3.2 For Culverts

Culvert ends often warrant the installation of guardrail as the culvert headwalls and wingwalls are a fixed object, the culvert end represents a sudden drop-off, and deep water is often present at culvert ends.

Culverts on the Minnesota Trunk Highway System:

For culverts on the State TH system, Route System (MnDOT Item) is coded '01 - Interstate Highways', '02 - US Highways', or '03 - Minnesota State Highways') – the current guardrail requirements are outlined in Chapter 10-7.01.04 of MnDOT's Road Design Manual. The manual states that hazards within the "roadside clear zone" (including culvert ends) typically warrant guardrail.

The roadside clear zone is measured from the edge of the travel lane. This distance will vary depending upon the embankment slope geometry, design speed, radius of horizontal curvature, the ADT, and the presence of curbs (a vaulting hazard). Chapter 4-6.04 of MnDOT's Road Design Manual provides a detailed description of roadside clear zones. It includes criteria, figures, graphs, and tables for determining the required clear zone distance, and includes examples of clear zone distance calculations.

To provide a rough estimate of minimum roadside clear zone distances, a portion of Table 4.6.04A of MnDOT's Road Design Manual is shown following this paragraph. This table is only intended to quickly identify existing culverts without guardrail that should be coded as requiring guardrail for NBI Item 36. Any final calculations of clear zone distances should be based upon the criteria and tables in Chapter 4-6.04 of MnDOT's Road Design Manual. Questions regarding the calculation of the roadside clear zone distances should be directed to the MnDOT Design Standards Unit via email at DesignStandards@dot.state.mn.us.

CLEAR ZONE DISTANCES FOR CULVERT ENDS (STRAIGHT ROADWAYS) BASED UPON TABLE 4.6.04A IN MNDOT'S ROAD DESIGN MANUAL					
DESIGN SPEED	ADT	EMBANKMENT SLOPE (RISE OVER RUN)			
		1:10	1:6	1:5	1:4**
40 MPH*	< 1,500	11 ft.	12 ft.	13 ft.	14 ft.
	1,500-6,000	13 ft.	14 ft.	15 ft.	16 ft.
	>6,000	14 ft.	15 ft.	16ft.	17 ft.
45 MPH	< 1,500	14 ft.	15 ft.	17 ft.	20 ft.
	1,500-6,000	15 ft.	17 ft.	19 ft.	22 ft.
	>6,000	17 ft.	19 ft.	21 ft.	25 ft.
50 MPH	< 1,500	16 ft.	18 ft.	19 ft.	23 ft.
	1,500-6,000	18 ft.	20 ft.	21 ft.	26 ft.
	>6,000	20 ft.	22 ft.	24 ft.	29 ft.
55 MPH	< 1,500	23 ft.	25 ft.	29 ft.	33 ft.
	1,500-6,000	25 ft.	28 ft.	31 ft.	36 ft.
	>6,000	28 ft.	31 ft.	34 ft.	40 ft.
60 MPH	< 1,500	26 ft.	29 ft.	31 ft.	38 ft.
	1,500-6,000	29 ft.	32 ft.	35 ft.	42 ft.
	>6,000	31 ft.	35 ft.	38 ft.	46 ft.
70 MPH	< 1,500	29 ft.	32 ft.	35 ft.	43
	1,500-6,000	31 ft.	35 ft.	39 ft.	47
	>6,000	34 ft.	38 ft.	42 ft.	51

* Guardrail is generally not required if the design speed is less than 40 mph.
** Slopes steeper than 1:4 are not considered to be "recoverable".

Culverts on the County/Local System:

For culverts not on the Minnesota State Trunk Highway system, Chapters 10-7.01 and 4-6.04 of MnDOT's Road Design Manual can also be used for determining when guardrail is required. Additional guidance for low ADT roads (less than 1,500) is provided by Minnesota Rule 8820.9920 (Minimum Design Standards; Rural and Suburban Undivided Roadways; New or Reconstruction Projects).

The following table is only intended to quickly identify existing culverts without guardrail that should be coded as requiring guardrail for NBI Item 36.

CLEAR ZONE DISTANCES FOR CULVERT ENDS (BASED UPON MINNESOTA RULE 8820.9920)				
ADT	RECOVERY AREA*	DESIGN SPEED (MPH)	IN-SLOPE (RISE OVER RUN)	ROADWAY SURFACE
< 50	7 ft.	30-60	1:3	Aggregate
50 - 149	9 ft.	40-60	1:4	Aggregate
150 - 749	15 ft.	40-60	1:4	Paved
750 - 1,499	25 ft.	40-60	1:4	Paved
>1,500	30 ft.	40-60	1:4	Paved

* The "recovery" area is the obstacle-free area (measured from edge of traffic lane). For suburban (defined in Minnesota Rule 8820.0200) roadways, the recovery area may be reduced to 10 ft. (for ADT < 1,000) or reduced to 20 feet (for ADT ≥ 1,000). If the posted speed limit is 40 mph or less, the recovery area may be reduced to 10 feet.

D.7.5.4 Transitions (NBI Item 36B)

fe_id: 003620 ...... NBI 36B: Traffic Safety Features: Transitions
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Whenever semi-rigid approach guardrail connects to a rigid bridge barrier, a "crash-worthy" transition is needed. Approach guardrail must be firmly attached to the bridge barrier or end post, gradually stiffened as it nears the bridge, and configured such that impacting vehicles will not "snag" or "pocket". NBI Item 36B indicates if the transition from the approach guardrail to the bridge barrier meets current safety standards.

Inspector Note:
MnDOT initially codes this item as '0 – Substandard' for all new bridges. It is the responsibility of the inspector to update this item during the initial inspection.

See Section D.7.5.3 to determine if current construction standards would require installation of guardrail on the bridge approaches or along the roadway traveling over the culvert.

CODE	DISPLAY	DESCRIPTION
0	0 - SUBSTANDARD	Inspected feature does not meet currently acceptable standards or a traffic safety feature is required but none is present.
1	1 - MEETS STANDARDS	Inspected feature meets currently acceptable standards.
N	N - NOT REQUIRED	Not applicable or a traffic safety feature is not required.

If guardrail is required (based upon current standards for new construction) but is not present, NBI Item 36B should be coded '0 - Substandard'.

If approach guardrail is present on the roadway on the bridge, NBI Item 36B must (with very few exceptions) be coded '0 - Substandard' or '1 - Meets Standards'.

If guardrail is present on the roadway over a culvert, and is not directly connected to the culvert structure, NBI Item 36B can be coded 'N – Not Required.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

Railroad or pedestrian bridges should be coded 'N - Not Required.

Inspector Note:

NBI Item 36B only applies to the roadway traveling on the bridge (not under the bridge). The rating does not take into consideration any collision damage or deterioration - the actual condition should be rated using guardrail Element #893 (see Chapter B).

General requirements for the installation and upgrading of bridge approach guardrail transitions are outlined in Chapter 10.7.01.05 of MnDOT's Road Design Manual. Crash-worthy transitions are required at all new bridges, or on existing bridges if the barriers are reconstructed, when the design speed is 40 mph or greater. When a bridge is located within the limits of roadway reconditioning or reconstruction project, existing transitions must be upgraded if the design speed is 40 mph or greater, and the ADT is greater than 1,500. Approved bridge approach guardrail transitions are shown in MnDOT's Standard Plans, series 600 (Safety Features & Special Structures).

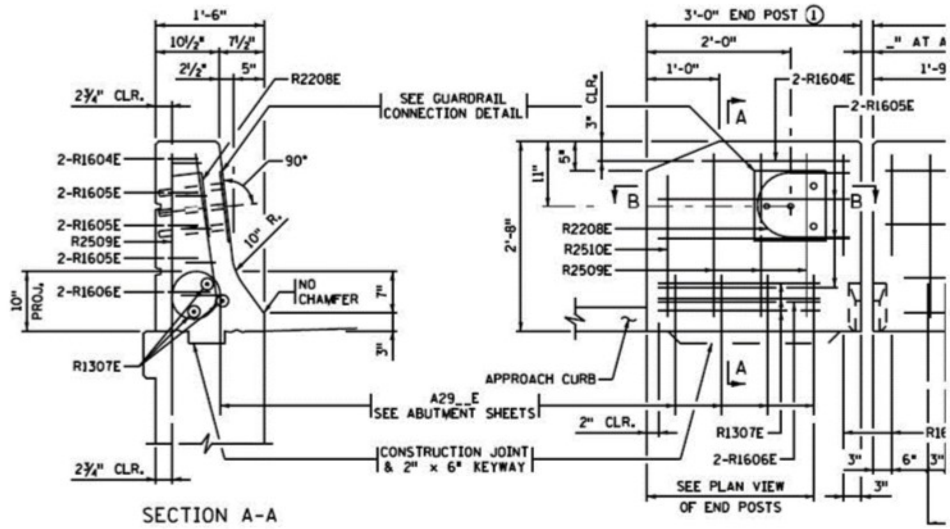
D.7.5.4.1 Guardrail Transition Checklist

A guardrail transition includes several components, and includes an area extending 20 - 25 feet from the bridge barrier connection. If any component of the approach guardrail transition does not meet current standards, NBI Item 36B will be coded '0 - Substandard'. The following checklist may be used as a general guide for determining if a guardrail transition meets current design standards:

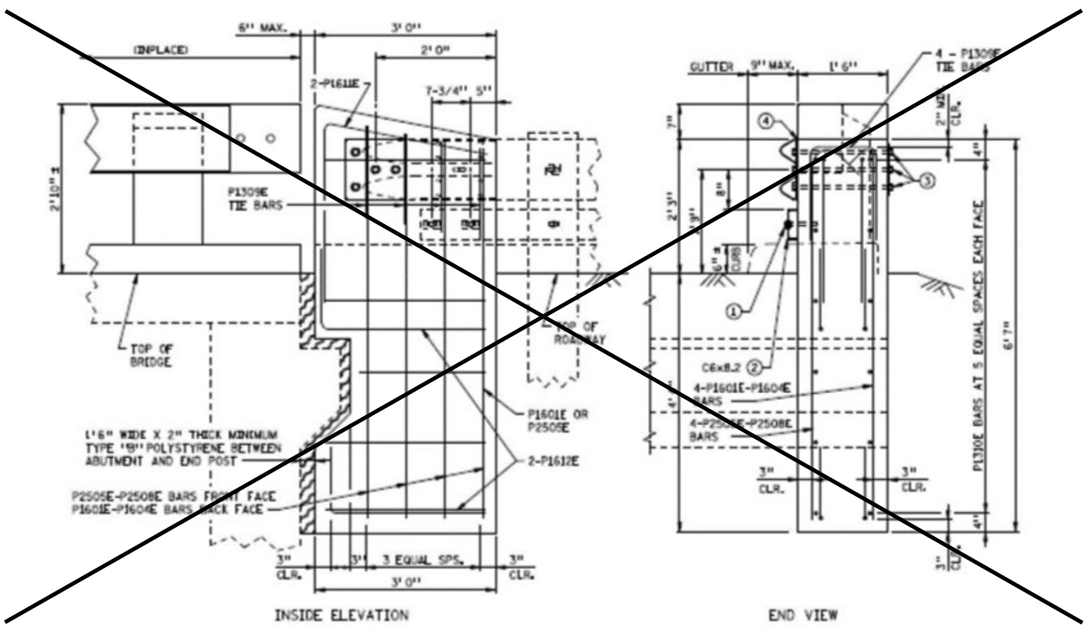
- The bridge barrier end post should be at least three feet long and at least 1.5 feet thick (at the base);
- A 4-bolt guardrail connection (MnDOT Standard Plate 8318C) should be present;
- The plate-beam guardrail should be "double-nested" for the 12.5 feet nearest the bridge;
- A curb transition or rub rail should be present below the guardrail at the bridge connection;
- The curb projection (if any) beyond the front face of the guardrail should not exceed nine inches;
- The guardrail post spacing should gradually reduce over the last 20 - 25 feet nearest to the bridge;
- The two guardrail posts closest to the bridge should be a heaver design (eight feet deep post).

D.7.5.4.2 Guardrail Transition Details

Bridge Barrier End Posts: The bridge barrier or end post must provide a sufficient anchorage for the guardrail. Current MnDOT standards require the end post to be at least 3 feet long, 18 inches thick (at the base), and 2'-8" high (at the downstream end). While slightly smaller end posts (with adequate reinforcement) might be sufficient, any transition with an end post smaller than the current standard design should be coded '0 - Substandard'. When upgrading the approach guardrail on an existing bridge, a new end post may need to be constructed ~~(see MnDOT Standard Plan 5-297.609)~~.



End Post Design for Concrete "F" Rail – MnDOT Bridge Detail Plan 5-397.114

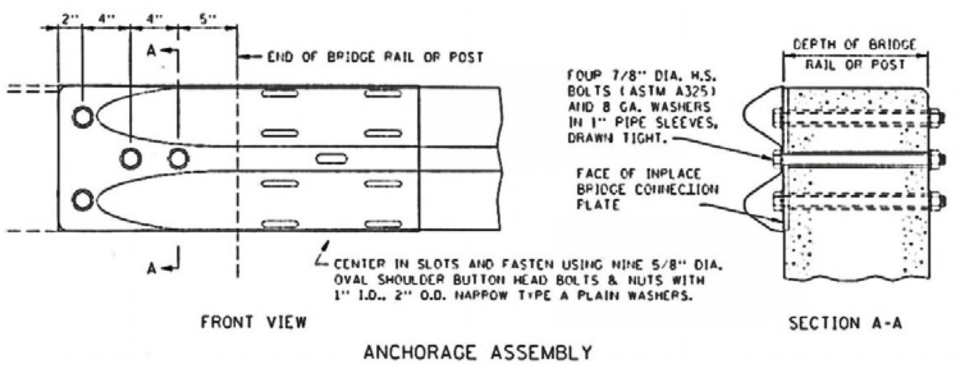


~~Retrofit Bridge End Post – MnDOT Standard Plan 5-297.609~~

There currently is no standard for end post upgrades on existing bridges. Plan sheets for each project show details to attach the end post to the abutment and match the shape of the in place barrier.

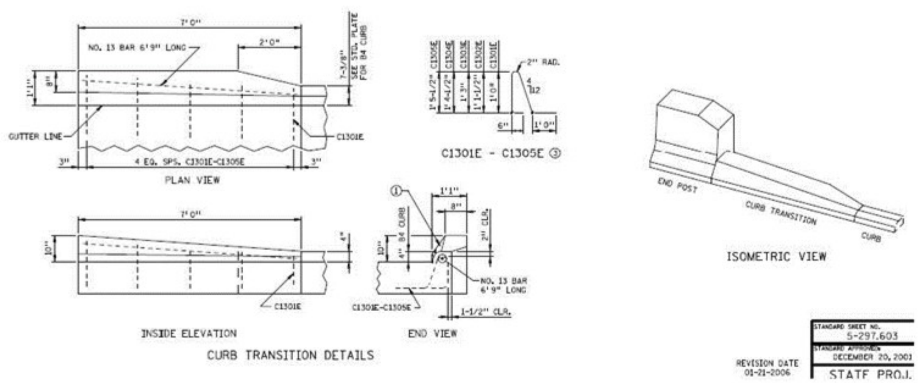
Railing Connection Details: The standard 4-bolt detail for the plate-beam guardrail connection to a bridge barrier/end post is shown on MnDOT Standard Plate 8318C (see following diagram) – this replaced an older 2-bolt connection. Unless otherwise approved by an engineering analysis, any transition without the standard 4-bolt guardrail connection should be coded '0 - Substandard'.

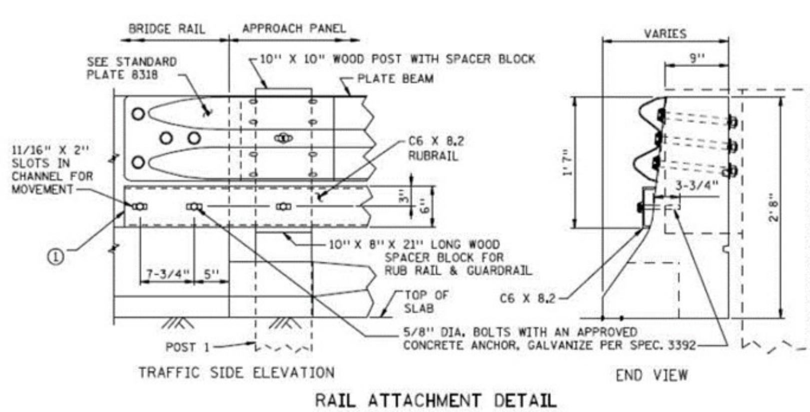
Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) ● INVENTORY ITEMS ● NBI ITEMS



MnDOT Standard Plate 8318C: 4-Bolt Plate-Beam Guardrail Connection to Bridge

Curb Transitions and Rub Barriers: To prevent an impacting vehicle from snagging on the bridge end post, a guardrail transition should include either a curb transition or a rub-rail (located just below the guardrail at the bridge connection). If neither is present, the transition should generally be coded '0 - Substandard'. On new bridges, the approach curb will gradually transition from 4 inches high to 10 inches high over the 7 feet adjacent to the bridge. Upgraded transitions on existing bridges without a curb transition will typically employ a rub-rail. This is a six inch steel channel running from the bridge end post over the length of the transition (typically around 25 feet). See following diagrams.



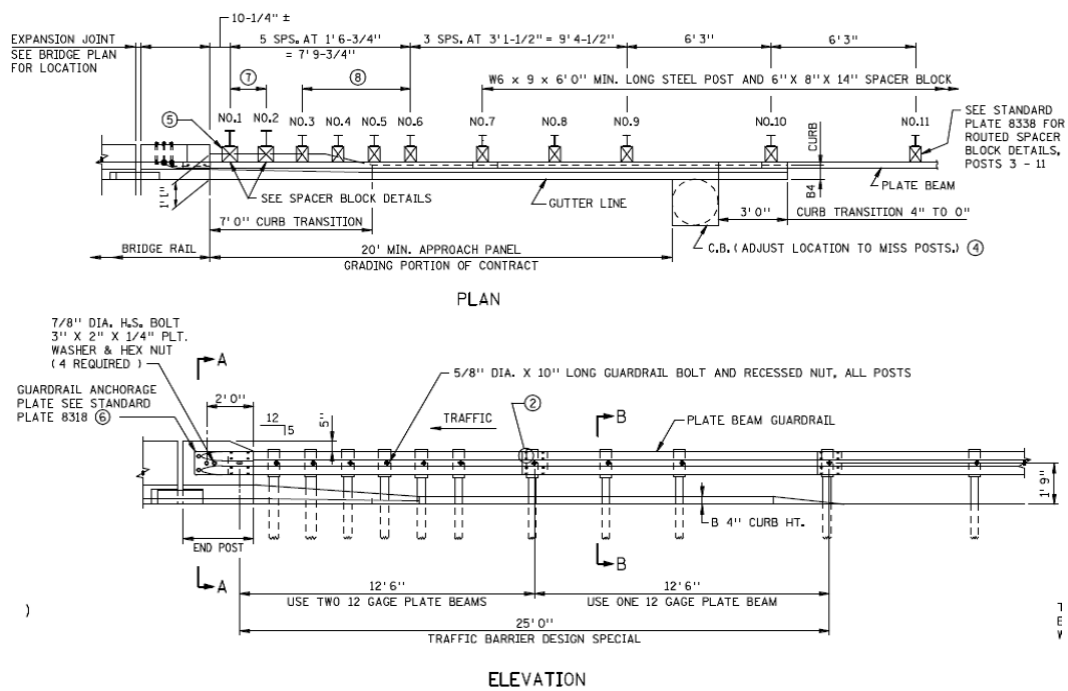


Curb transition on a bridge approach (From MnDOT Standard Plan 5-297.603)
Rub Rail Connection to Existing J-Rail (from MnDOT Standard Plan 5-297.606)

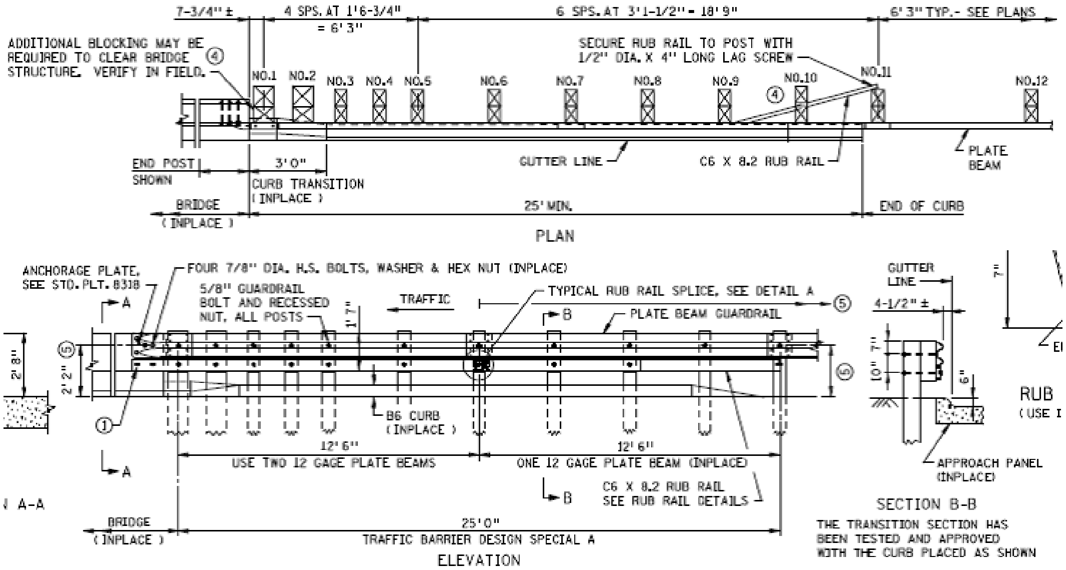
Approach Guardrail Transition Layouts: Approved bridge approach guardrail transitions are shown in MnDOT's [Standard Plans,](https://standardplans.dot.state.mn.us/StdPlan.aspx)series 600 (Safety Features & Special Structures). The post spacing (and other details) on these plans will vary, but they generally include a reduced post spacing starting 20 - 25 feet from the end of the bridge, and require two nested W-Beam sections for the first 12.5 feet adjacent to the bridge. Unless otherwise approved by an engineering analysis, any transition which does not conform to one of the MnDOT Standard Plans should be coded '0 - Substandard'. Some of the MnDOT Standard Plans for guardrail transitions are listed and/or diagramed below. These and others can be found at https://standardplans.dot.state.mn.us/StdPlan.aspx.

- 5-297.601 Guardrail Installations At Medians and End Treatments
- 5-297.603 New W-Beam Transition to Concrete F-Rail (Steel Post)
- 5-297.605 New W-Beam Transition to Concrete F-Rail (Wood Post)
- 5-297.606 Upgraded W-Beam Transition to Existing Concrete J-Rail (Wood Post)
- 5-297.607 New W-Beam Transition to Existing Concrete J-Rail (Wood Post)
- 5-297.609 New W-Beam Transition to One-Line Concrete Rail with New End Post (Wood Post)
- 5-297.614 W-Beam Transition to Thrie-Beam Guardrail (for Bull Nose Medians)
- 5-297.617 Upgraded W-Beam Transition to Existing One-Line Concrete Rail
- 5-297.618 New W-Beam Transition to Existing Concrete J-Rail (Steel Post)
- 5-297.619 New W-Beam Transition to One-Line Concrete Rail with New End Post (Steel Post)
- 5-297.686 Steel Box Beam Guardrail Transition to Concrete F-Rail

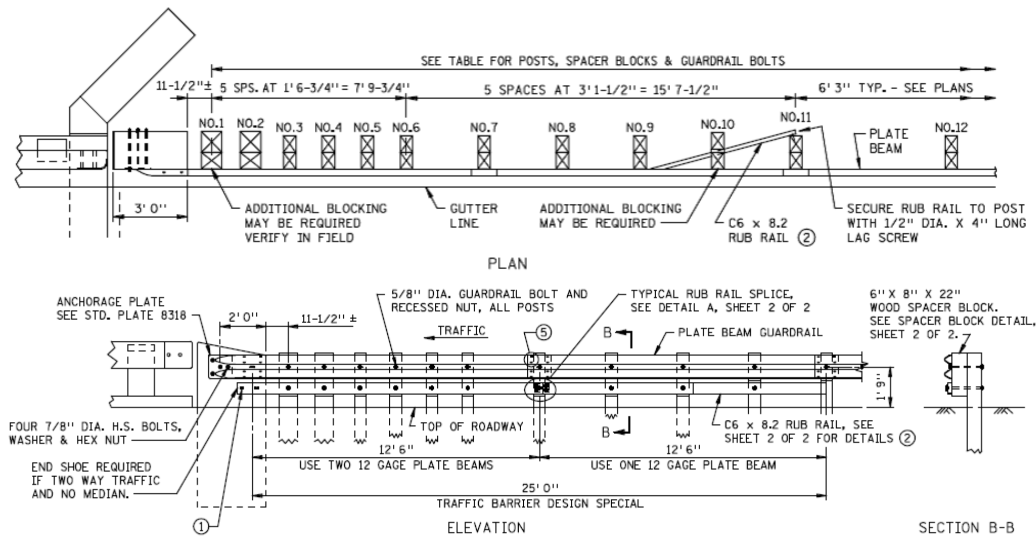
See following diagrams.



Details from MnDOT Standard Plan 5-297.603 – W-Beam Transition to Concrete F-Rail (Steel Post)



Detail from MnDOT Standard Plan 5-297.606 – Upgraded Transition to Existing J-Rail (Wood Post)



Detail from MnDOT Standard Plan 5-297.609 – Transition to Existing One-Line Rail w/New End Post

D.7.5.5 Approach Guardrail (NBI Item 36C)

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NBI Item 36C indicates if the approach guardrail on a bridge (or the guardrail on the roadway over a culvert) meets current safety standards. Approach guardrail should have adequate length and structural qualities to shield motorists from the barrier ends (and other hazards at the bridge site) and must be capable of safely redirecting an impacting vehicle. NBI Item 36C generally applies to the section of guardrail between the Transition (NBI Item 36B) and the Approach Guardrail Ends (NBI Item 36D).

Inspector Note:
MnDOT initially codes this item as '0 –Substandard' for all new bridges. It is the responsibility of the inspector to update this item during the initial inspection.

See Section D.7.5.3 to determine if current construction standards would require installation of guardrail on the bridge approaches or along the roadway traveling over the culvert.

CODE	DISPLAY	DESCRIPTION
0	**0 - SUBSTANDARD**	**Inspected feature does not meet currently acceptable standards or a traffic safety feature is required but none is present.**
1	**1 - MEETS STANDARDS**	**Inspected feature meets currently acceptable standards.**
N	**N - NOT REQUIRED**	**Not applicable or a traffic safety feature is not required.**

If guardrail is required (based upon current standards for new construction) but is not present, NBI Item 36C should be coded '0 - Substandard'.

Railroad or pedestrian bridges should be coded 'N - Not Required.

The standard types of guardrail used by MnDOT are outlined in Chapter 10-7.02 of MnDOT's Road Design Manual. If guardrail is required on a bridge approach, a structural plate-beam (W-beam) guardrail is typically installed. While Thrie-Beam guardrail or box beam guardrail could also be used on bridge approaches, they have only been used to a limited extent in Minnesota. 3-cable guardrail (MnDOT Standard Plate 8330) is not generally used on bridge approaches, but may be used to protect culverts in instances where deflection is not a constraint. Cable guardrail should not be installed along embankments steeper than 1:2, around the inside of a curve greater than 4 degrees or any place where the installation does not develop tension in the cable upon impact. Guardrails should effectively perform the following functions.

Inspector Note:
NBI Item 36C only applies to the roadway traveling on the bridge (not under the bridge), the rating does not take into consideration any collision damage or deterioration - the actual condition should be rated using guardrail Element #893 (see Chapter B).

- Prevent a standard vehicle from rising over, breaking through or wedging under the installation;
- Prevent or reduce the severity of a collision with a fixed object;

- Minimize the departure angle of a redirected errant vehicle to reduce the likelihood of a secondary collision with following or adjacent vehicles;
- Achieve these objectives while minimizing damage to the vehicle and injury to the occupants;
- Protect abutting property owners and users from vehicle encroachment where there is a high likelihood of vehicles leaving the roadway.

D.7.5.5.1 Structural Plate-Beam (W-Beam) Guardrail

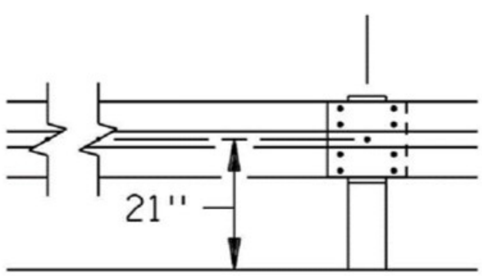
A structural plate-beam (W-Beam) guardrail is the most commonly used traffic barrier in Minnesota and throughout the nation (see Chapter 10-7.02.01 of MnDOT's Road Design Manual). This guardrail derives its name from the "W" shaped cross-section of the steel plate-beam.

Structural plate-beam guardrail is a "semi-rigid" system. Impact is resisted by a combination of bending and tension of the steel rail acting with the posts. Steel plate-beam may be used with timber posts (Standard Plate 8307) or steel posts (Standard Plate 8338). Design "A", with post spacing of 12.5 feet, is used where the design speed is less than 50 mph, and Design "B", with a post spacing of 6.25 feet, is used where design speeds are 50 mph or greater.

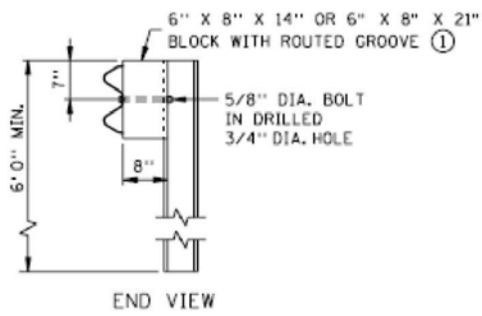
The centerline of plate-beam guardrail should typically be 1.75 feet (21 inches) high – a variation of three inches from the nominal height is generally acceptable. On plate-beam guardrail transitions to existing concrete J-Rail, the guardrail centerline height gradually increases through the transition to 2.17 feet (26 inches) high at the railing connection (see MnDOT standard plans 5-297.606 and 5-297.607). These transition designs also include a rub rail below the plate-beam guardrail.

The following checklist may be used to determine if structural plate-beam guardrail meets standards.

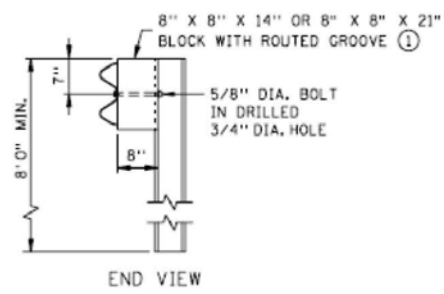
- The centerline of plate-beam should be between 18 inches and 24 inches high (with a generally acceptable variation of three inches from the nominal height);
- Maximum post spacing should be 6.25 feet (50 mph or greater) or 12.5 feet (less than 50 mph);
- The slope should not be steeper than 1:10 (extending at least 2 feet behind the guardrail);
- The guardrail layout should correspond with MnDOT's Standard Plans, series 600 (Safety Features & Special Structures),
- The overall length of the guardrail installation must be adequate for the site conditions (as defined in Chapter 10-7.03 of MnDOT's Road Design Manual).



The centerline of plate-beam guardrail should typically be 21" high
(a 3" variance is acceptable)



W 6 x 9 steel guardrail post



w 8 x 21 steel guardrail post

D.7.5.6 Approach Guardrail Ends (NBI Item 36D)

fe_id: 2003640 .... NBI 36D: Traffic Safety Features: Approach Guardrail Terminal
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As the exposed ends of plate-beam guardrail installations are themselves a hazard, the "upstream" ends must have acceptable end treatments. NBI Item 36D indicates if the approach guardrail terminations on a bridge, or the guardrail terminations on the roadway over a culvert, meet current safety standards.

Inspector Note:
MnDOT initially codes this item as "0-Substandard" for all new bridges. It is the responsibility of the inspector to update this item during initial inspection.

See Section D.7.5.3 to determine if current construction standards would require installation of guardrail on the bridge approaches or along the roadway traveling over the culvert.

The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
0	**0 - SUBSTANDARD**	**Inspected feature does not meet currently acceptable standards or a traffic safety feature is required but none is present.**
1	**1 - MEETS STANDARDS**	**Inspected feature meets currently acceptable standards.**
N	**N - NOT REQUIRED**	**Not applicable or a traffic safety feature is not required.**

If approach guardrail is present on the roadway traveling on a bridge or over a culvert, NBI Item 36D must be coded either '0 - Substandard' or '1 - Meets Standards'.

If guardrail is required on a bridge or over a culvert, but is not present – NBI Item 36D should be coded '0 - Substandard'.

Railroad or pedestrian bridges should be coded 'N - Not Required'.

This item indicates the adequacy of the approach guardrail terminations in regard to current standards (MnDOT guardrail termination standards are outlined in MnDOT's Road Design Manual, Chapter 10-7.02.06). The rating of this item does not consider the actual condition of the approach guardrail end.

Inspector Note:
NBI Item 36D only applies to the roadway traveling on the bridge (not below the bridge), the rating does not take into consideration any collision damage or deterioration - the actual condition should be rated using guardrail Element #893 (see Section B of the BSIPM).

The twisted end treatment and ETL have been used on plate-beam guardrail for many years. Today, these no longer meet current crash test criteria, as they present a "launching" hazard.

See following examples.

Approach Guardrail Termination (NBI Item 36D)	
Code: '0 – Substandard'	
Description: Twisted End Treatment Does not meet current crash test criteria.	
Approach Guardrail Termination (NBI Item 36D)	
Code: '0 – Substandard'	
Description: Eccentric Loader Breakaway Cable Terminal (ELT) Does not meet current crash test criteria.	

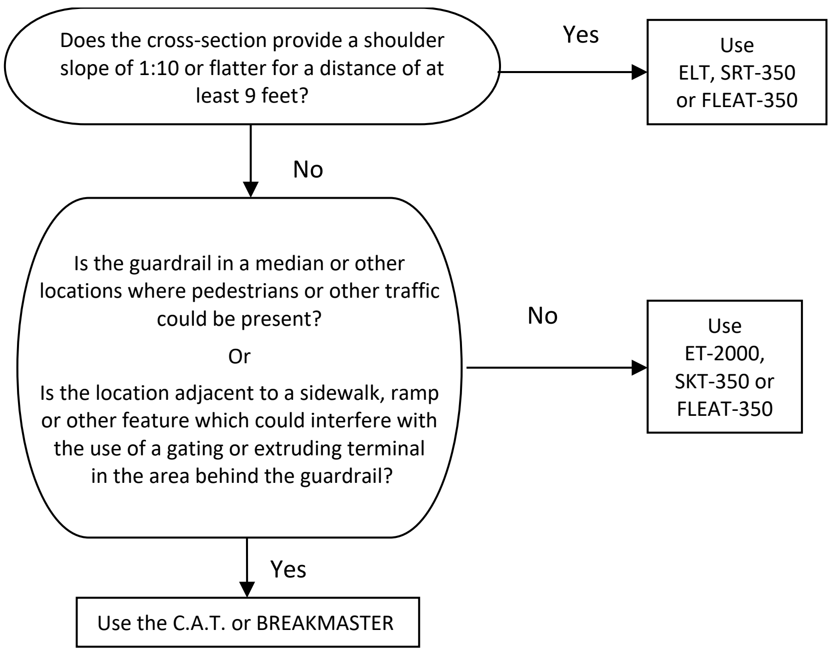
D.7.5.7 Guardrail Terminals and Crash Cushions (Selection Flow Chart)

Chapter 10-7.02.06 of MnDOT's Road Design Manual provides guidance for selecting the appropriate end terminal treatment, guidelines for updating existing guardrail ends, and lists approved guardrail terminations. These include the following:

- Slotted Rail Terminal (SRT-350);

- Flared Energy Absorbing Terminal (FLEAT-350);
- Sequential Kinking Terminal (SKT-350);
- Extruding Terminal (ET-2000 and ET-Plus);
- Crash Cushion Attenuating Terminal (CAT);
- BRAKEMASTER Crash Cushion/End Terminal;

NBI Item 36D can be coded '1 - Meets Standards' if any of the end treatments listed above are present. Other end treatments, crash cushions, or impact attenuators meeting the crash-test criteria outlined in the National Cooperative Highway Research Program (NCHRP) Report 350 could also be coded '1 - Meets Standards'. On divided highways with two adjacent bridges, the median guardrail will typically have a "bull nose" terminal (see MnDOT Standard Plan 5-297.611).

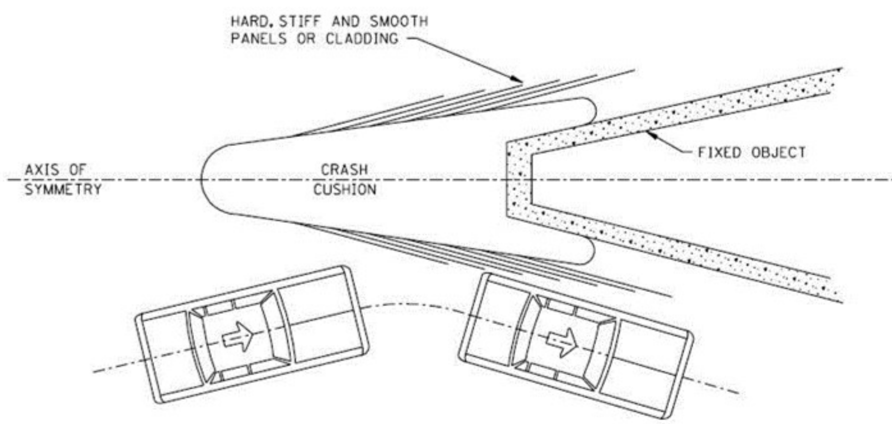


End Treatment Selection Flow Chart (MnDOT's Road Design Manual – Figure 10-7.02H)

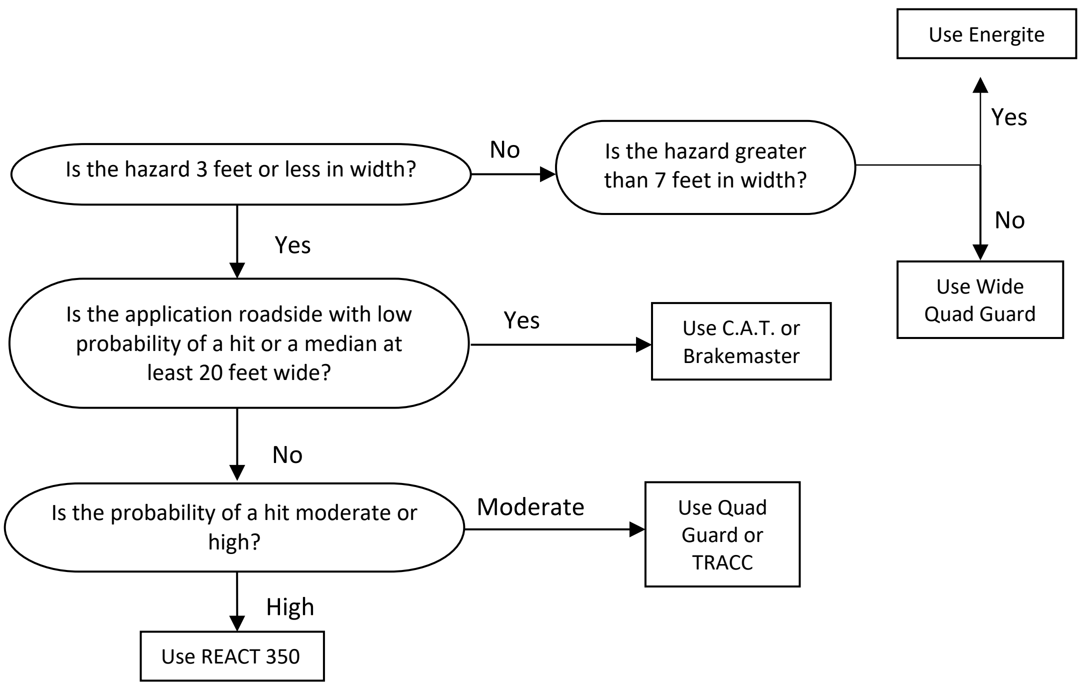
A flow chart for selecting the appropriate termination for plate-beam guardrail is shown in Figure 10-7.02H in MnDOT's Road Design Manual. At most locations, a flared terminal such as the ELT, SRT-350 or the FLEAT-350 should be used. If there is not sufficient room for a four foot flare and 1:10 slope grading, a tangent terminal such as the ET-2000/ET-Plus, SKT-350 or the variable flare FLEAT-350 should be used. However, as these terminals allow vehicles to pass behind the terminal, and rapidly extrude guardrail off to the side, they should not be used on narrow medians or where pedestrians may be present. At locations where none of the other systems are appropriate, the CAT or the BRAKEMASTER can be used. Regardless of which terminal design is used, it is important that the system be properly installed and that proper grading be provided in order for the terminal to function as intended. The presence of curbs higher than four inches can be a problem, as none of these terminals have been tested in this configuration.

Crash Cushions: Crash cushions (also known as crash attenuators) are explained in Chapter 10-8.0 of MnDOT's Road Design Manual. Crash cushions may be used in gore areas or medians where guardrail cannot be adapted due to the site restrictions. They are often installed on bridge decks where elevated roadways split or merge. The selection of a particular type of crash cushion will depend upon such factors as the obstacle width, the available space, and the relative probability of impact. Some crash cushions are designed to withstand multiple impacts without maintenance. A flow chart for the selection of crash cushions is shown in Figure 10-8.06A of MnDOT's Road Design Manual.

See following diagrams.



General diagram showing a crash cushion



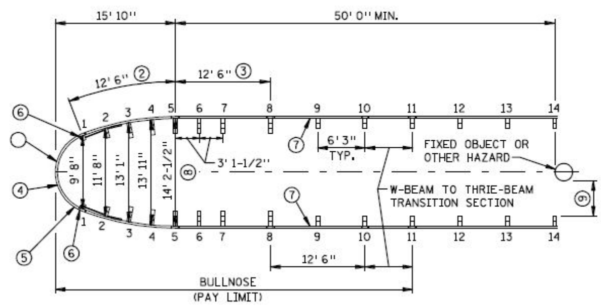
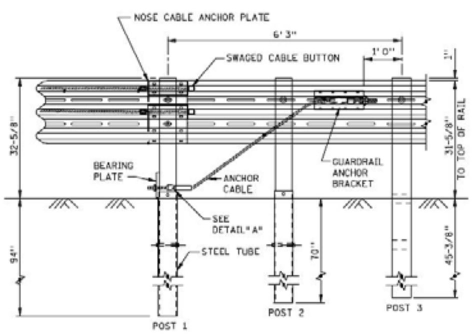
Crash Cushion Selection Flow Chart (MnDOT's Road Design Manual – Figure 10-8.06A)

D.7.5.8 Guardrail Terminals and Crash Cushions (Identification Table)

Table D.7.5.6.3-1 displays examples of guardrail terminals and crash cushions/attenuators for which NBI Item 36D could be coded '1 - Meets Standards'. This table is not intended to be a list of approved products, but is simply intended to aid in the identification of the guardrail terminations and/or crash cushions present on a bridge. Most of the end treatments and crash cushions shown in this table are patented, proprietary systems. Only the manufacturer (or an authorized representative) can provide the most recent and properly updated descriptions, designs, photos, or installation/maintenance manuals for these systems.

Additional information may be obtained electronically from the manufacturers' website. They will usually provide hard copies by customer request. These manufacturers offer a variety of products not shown in this table which also meet NCHRP 350 standards. Any questions regarding specific guardrail terminations or crash cushions should be directed to the MnDOT Design Standards Unit via email at DesignStandards@dot.state.mn.us.

Table D.7.5.6.3-1 - Examples of Guardrail Terminals & Crash Cushions

Terminal/Cushion Type	Photo/Diagram
Thrie Beam Bull Nose Terminal (Median of Divided Highways) MnDOT Standard Sheet 5-297-611 The W-Beam guardrail will transition to Thrie Beam guardrail before forming the "Bull Nose" end treatment	 PLAN VIEW DETAILS OF BULLNOSE
	 ELEVATION BULL NOSE ASSEMBLY

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

Table D.7.5.6.3-1 Examples of Guardrail Terminals & Crash Cushions

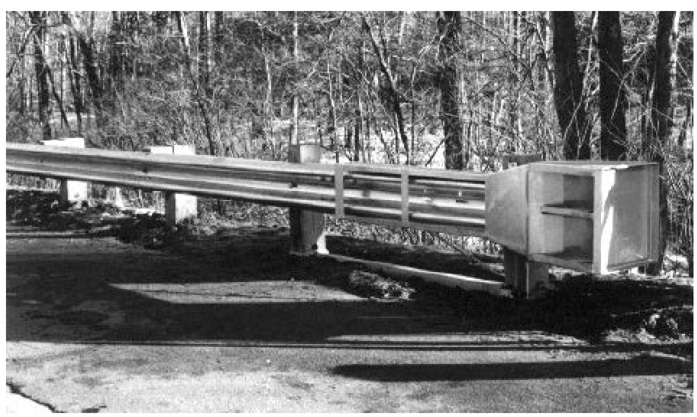
Terminal/Cushion Type	Photo/Diagram
SRT-350™ Slotted Rail Guardrail Terminal (Flared) Requires a flat (1:10) shoulder at least 9 feet wide. Should not be on narrow medians or adjacent to a sidewalk. Trinity Highway Products, LLC. Dallas, Texas highwayguardrail.com	
FLEAT-350™ Flared Energy Absorbing Guardrail Terminal Flare can vary from 2.5 feet to 4 feet. Should not be on narrow medians or adjacent to a sidewalk. Road Systems, Inc. Big Spring, Texas roadsystems.com	
SKT-350™ Sequential Kinking Guardrail Terminal Should not be on narrow medians or adjacent to a sidewalk. Road Systems, Inc. Big Spring, Texas roadsystems.com	

Table D.7.5.6.3-1 Examples of Guardrails & Crash Cushions

Terminal/Cushion Type	Photo/Diagram
ET-2000™ Extruding Guardrail Terminal Should not be on narrow medians or adjacent to a sidewalk. Trinity Highway Products, LLC. Dallas, Texas highwayguardrail.com	
ET-Plus™ Extruding Guardrail Terminal Should not be on narrow medians or adjacent to a sidewalk. Trinity Highway Products, LLC. Dallas, Texas highwayguardrail.com	
CAT™ Crash Attenuating Guardrail Terminal or Crash Cushion May be as a guardrail terminal adjacent to a sidewalk. This crash cushion design is generally recommended for hazards 3 feet or less in width with a low probability of impact, or on medians at least 20 feet wide. Concrete anchorage or pad is not required. Trinity Highway Products, LLC. Dallas, Texas highwayguardrail.com	

Table D.7.5.6.3-1 Examples of Guardrail Terminals & Crash Cushions

Terminal/Cushion Type	Photo/Diagram
BRAKEMASTER® Guardrail Terminal or Crash Cushion May be as a guardrail terminal adjacent to a sidewalk. This crash cushion design is generally recommended for hazards 3 feet or less in width with a low probability of impact, or on medians at least 20 feet wide. Concrete anchorage or pad is not required. Energy Absorption Systems, Inc. Chicago, Illinois energyabsorption.com	
QuadGuard® Crash Cushion/Crash Attenuator This crash cushion design is generally recommended for hazards 3 feet or less in width with a moderate probability of impact, or on medians at least 20 feet wide. Requires a level concrete anchorage. Energy Absorption Systems, Inc. Chicago, Illinois energyabsorption.com	

Table D.7.5.6.3-1 Examples of Guardrail Terminals & Crash Cushions

Terminal/Cushion Type	Photo Diagram
QuadGuard® (Wide) Crash Cushion/Crash Attenuator This crash cushion design is generally recommended for hazards wider than 3 feet but less than 7 feet Requires a level concrete anchorage. Energy Absorption Systems, Inc. Chicago, Illinois energyabsorption.com	
TRACC™ Crash Cushion/Crash Attenuator This crash cushion design is generally recommended for hazards 3 feet or less in width with a moderate probability of impact, or on medians at least 20 feet wide. Requires a level concrete anchorage. Trinity Highway Products, LLC. Dallas, Texas highwayguardrail.com	

Table D.7.5.6.3-1 Examples of Guardrail Terminals & Crash Cushions

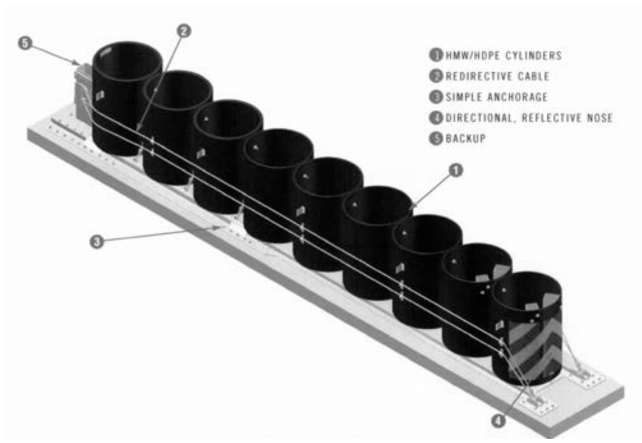
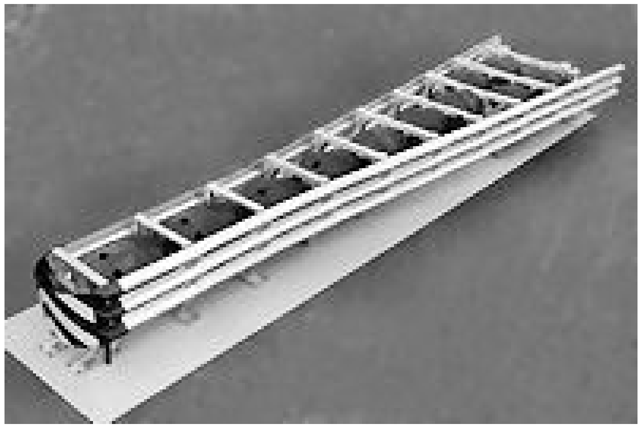
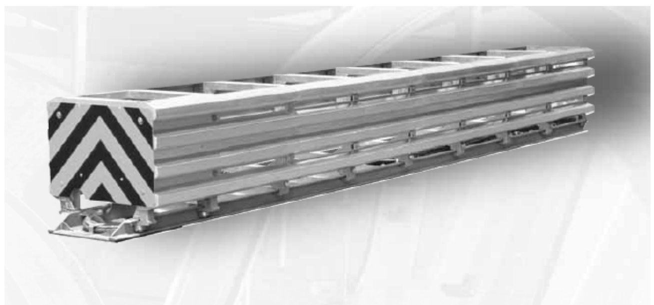
Terminal/Cushion Type	Photo Diagram
ENERGITE® Crash Cushion/Crash Attenuator This crash cushion design is generally recommended for hazards wider than 7 feet The layout of the sand-filled barrels (200 lb. and 400 lb. size) must be approved by an engineer. Energy Absorption Systems, Inc. Chicago, Illinois energyabsorption.com	
REACT 350® Crash Cushion/Crash Attenuator This crash cushion design is generally recommended for hazards 3 feet or less in width with a high probability of impact (it can withstand multiple impacts without resetting or repair). Incorporates plastic cylinders and a cable system - requires a level concrete anchorage. Energy Absorption Systems, Inc. Chicago, Illinois energyabsorption.com	

Table D.7.5.6.3-1 Examples of Guardrail Terminals & Crash Cushions

Terminal/Cushion Type	Photo Diagram
TAU II® Crash Cushion/Crash Attenuator Incorporates barrel-shaped energy absorbing cartridges. Requires a level concrete anchorage. Barrier Systems, Inc. Rio Vista, California barriersystemsinc.com	
SCI-100GM® Crash Cushion/Crash Attenuator Incorporates a cable and hydraulic cylinders system. Requires a level concrete anchorage. SCI Products, Inc. Work Area Protection Corporation St. Charles, Illinois workareaprotection.com	

D.7.5.9 Structural Evaluation (NBI Item 67)

fe_id: 2006700 .... NBI 67: Structural Evaluation
INSPEVNT.strrating

This rating is a general assessment of the overall bridge condition and structural capacity, taking into account all major structural deficiencies. This appraisal rating is based on the NBI condition ratings of the Superstructure and Substructure, or Culvert, and the average daily traffic (ADT) on the bridge and the inventory load rating.

The condition of the deck should have little influence on this appraisal rating, except in cases of a concrete slab span, concrete deck girder, box girder, "T" girder, or similar structures where the deck is an integral part of the superstructure.

This item is calculated by the Edit/Update Program based on Table 1, and cannot be coded by the bridge inspector. See page D-121 for code descriptions.

The following specifications are used by the Edit/Update Program to calculate the rating code:

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

The lower rating code for values between those listed in the table is used.

All bridges on the Interstate system shall be evaluated using the ADT column of > 5000 regardless of the actual ADT on the bridge.

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).

D.7.5.10 Deck Geometry (NBI Item 68)

fe_id: 2006800 .... NBI 68: Deck Geometry
INSPEVNT.deckgeom

This item is calculated by the Edit/Update Program based on Table 2A & 2B, Table 2C & 2D, and Table 2E, and cannot be coded by the bridge inspector. See page D-121 for code descriptions.

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This appraisal rating is a general assessment of the bridge deck geometry. It is determined using the curb-to-curb deck width, number of lanes, and the ADT on the bridge – the vertical clearance above the bridge roadway is also taken into consideration.

The overall rating for deck geometry includes two evaluations.

- The curb-to-curb (or face-to-face of bridge rail width) using Table 2A & 2B,or Table 2C & 2D;
- The minimum vertical clearance over the bridge roadway using Table 2E.

The lower of the codes obtained from these tables shall be used.

When an individual table lists several deck geometry rating codes for the same roadway width under a specific ADT, use the lower code. 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 is coded '6'. The lower code for values between those listed in the table is used.

The curb-to-curb (or face-to-face or rail) dimension shall be taken from NBI Item 51 (Bridge Roadway Width, Curb-to-Curb). NBI Item 53 (Minimum Vertical Clearance Over Bridge Roadway) shall be used to evaluate the vertical clearance. The values provided in the tables are for inventory coding 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; Two Way Traffic ADT (Both Directions)						Bridge Roadway Width 1 Lane; Two-Way Traffic ADT (Both Directions)	
	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:

- Use the lower rating code for values between those listed in the table.
- Dimensions are in feet.

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- For one lane of one-way traffic, Table 2A is used.
- For three or more undivided lanes of two-way traffic, use Table 2C, Other Multilane Divided Facilities.
- 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.
- 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 One-Way Traffic Ramps Only	
	Interstate and Other Divided Freeways		Other Multilane Divided Facilities			
	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:

- Use the lower rating code for values between those listed in the tables.
- Dimensions are in feet.
- Use Table 2C, other Multilane Divided Facilities, for 3 or more undivided lanes of two-way traffic.

TABLE 2E RATING BY COMPARISON OF NBI ITEM 53 MINIMUM VERTICAL CLEARANCE OVER BRIDGE ROADWAY AND NBI 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	Any width less than required for a rating code of 3 and structure is open.		
0	Bridge closed.		

Note:

- Use the lower rating code for values between those listed in the table.

D.7.5.11 Underclearances, Vertical and Horizontal (NBI Item 69)

fe_id: 2006900 .... NBI 69: Underclearances, Vertical and Horizontal
INSPEVNT.underclr

This item is calculated by the Edit/Update Program based on Table 3A and Table 3B, and cannot be coded by the bridge inspector. See page D-121 for code descriptions.

This appraisal rating is a general assessment of the vertical and horizontal clearances on and under the bridge. It is determined using the clearances listed in the bridge inventory – the functional class of the roadway is also taken into consideration.

This indicates the evaluation of the vertical and horizontal underclearances from the through roadway to the superstructure and substructure units, respectively. Code 'N' unless the bridge is over a highway or railroad. NBI Item 54 (Minimum Vertical Underclearance), NBI Item 55 (Minimum Lateral Underclearance on Right), and NBI Item 56 (Minimum Lateral Underclearance on Left) shall be used to evaluate this item. The functional classification to be used in the table is for the underpassing route. Therefore, the functional classification must be obtained from the record for the route under the bridge, see NBI Item 5 (Inventory Route). 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 use in Table 3A and Table 3B.

TABLE 3A
RATING BY COMPARISON OF NBI 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:

- Use the lower rating code for values between those listed in the tables.
- 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.

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

Minimum Lateral Underclearance							
Under-clearance Rating Code	Functional Class						Railroad
	One-Way Traffic				Two-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:

- Use the lower rating code for values between those listed in the tables.
- Dimensions are in feet.
- When acceleration or deceleration lanes or ramps are provided under two-way traffic, use the value from the right ramp column to determine code.
- 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.

D.7.5.12 Waterway Adequacy (NBI Item 71)

fe_id: 2007100 .... NBI 71: Waterway Adequacy
INSPEVNT.wateradeq

This rating is a general assessment of the waterway opening with respect to the passage of flow under the bridge. This rating is based upon the frequency of "overtopping" of the bridge and approach (and the resultant traffic delays) – the functional classification (NBI Item 26) of the roadway is also taken into consideration. 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). The descriptions given in the following table denote the following:

Inspector Note:
When a new bridge or culvert is added to the MnDOT bridge database, this item will initially be coded '9'. As this coding may not be appropriate, this item should always be reviewed.

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Chance of Overtopping:	Remote:	Greater than 100 years
	Slight:	11 to 100 years
	Occasional:	3 to 10 years
	Frequent:	Less than 3 years
Traffic Delays:	Insignificant:	Minor inconvenience (impassable for a few hours)
	Significant:	Traffic delays of up to several days
	Severe:	Long term traffic delays with resulting hardship

"Freeboard" is defined as the distance from the bottom of the superstructure to the water surface (at the water level of the 50-year frequency design storm).

Typical appraisal code values and descriptions of the waterway adequacy are given in the following table.

Functional Classification			
Principal Arterials-Interstates, Freeways, or Expressways	**Other Principal and Minor Arterial and Major Collectors**	**Minor Collectors and Local Roads**	**Description**
N	N	N	Bridge not over a waterway.
9	9	9	Bridge deck and roadway approaches above floodwater elevations (high water). Chance of overtopping is remote.
8	8	8	Bridge deck above roadway approaches. Slight chance of overtopping roadway approaches. Greater than 3 ft. of freeboard.
6	6	7	Bridge deck above roadway approaches. Slight chance of overtopping bridge deck and roadway approaches. 2 to 3 ft. of freeboard.
4	4	6	Bridge deck above roadway approaches. Occasional overtopping of roadway approaches with insignificant traffic delays. 1 to 2 ft. of freeboard.
3	4	5	Bridge deck above roadway approaches. Occasional overtopping of roadway approaches with significant traffic delays. Less than 1 ft. of freeboard.
2	3	4	Occasional overtopping of roadway approaches with significant traffic delays.
2	2	3	Frequent overtopping of 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.

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D.7.5.13 Approach Roadway Alignment (NBI Item 72)

fe_id: 2007200 .... NBI 72: Approach Roadway Alignment
INSPEVNT.appralign

This item is a general assessment of the approach roadway alignment with respect to the alignment of the bridge deck, and identifies those bridges that do not function properly or adequately due to the approach alignment. While the coding for this item will typically remain constant, it should be reviewed if the bridge approaches have been reconstructed.

Inspector Note:
This rating only applies to the roadway **on the bridge** and is not be used to rate the roadway under the bridge.

Inspector Note:
Speed reductions necessary because of structure width (and not due to approach alignments) shall not be considered in evaluating this item.

Railroad or pedestrian bridges crossing over a roadway are to be coded 'N'.

It is not intended that the approach roadway alignment be compared to current standards but rather to the existing highway alignment.

The rating criteria are based upon how the alignment of the bridge approaches relate to the alignment of the adjacent roadway. 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 is '6'.

Inspector Note:
When a new bridge or culvert is added to the MnDOT bridge database, this item will initially be coded '9'. An appropriate coding should be determined for any structure currently coded '9'.

The following table lists the codes for this item.

CODE	DESCRIPTION
N	Not Applicable (use for railroad or pedestrian bridges).
9	*New Structure – an appropriate rating code should be determined.*
8	No speed reduction required.
7	Minor sight distance problems with no speed reduction required.
6	Very minor speed reduction required (less than 5 MPH for a typical vehicle using the roadway).
5	Minor speed reduction required (5 MPH for a typical vehicle using the roadway).
4	Significant speed reduction required (6-10 MPH for a typical vehicle using the roadway).
3	Intolerable alignment requiring a substantial reduction in the operating speed (11-20 MPH for a typical vehicle using the roadway).
2	Severe vertical or horizontal alignment problems, such as a sharp vertical or horizontal curve immediately adjacent to the bridge (speed reduction greater than 20 MPH for a typical vehicle using the roadway).
1	This rating code should not be used.
0	Bridge Closed.

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Approach alignments are shown in the following examples.

<table>
<tr><td>Approach Roadway Alignment
(NBI Item 72)</td><td rowspan="3"></td></tr>
<tr><td>Code: 8</td></tr>
<tr><td>Description:
No speed reduction required when approaching bridge.</td></tr>
<tr><td>Approach Roadway Alignment
(NBI Item 72)</td><td rowspan="3"></td></tr>
<tr><td>Code: 5</td></tr>
<tr><td>Description:
Minor speed reduction required when approaching bridge.</td></tr>
<tr><td>Approach Roadway Alignment
(NBI Item 72)</td><td rowspan="3"></td></tr>
<tr><td>Code: 2</td></tr>
<tr><td>Description:
Severe vertical alignment requiring vehicle to slow down by 20 mph.</td></tr>
</table>

D.7.6 LOAD RATINGS

All bridges in Minnesota open to the public, carrying cars and trucks, and having spans of 10 feet or greater are load rated. This includes all county, township, city, and private bridges. Railroad bridges are load rated by the operating railroad since they control railroad loads. For railroad bridges, only the design railroad load is recorded in the inventory. Bridges that carry pedestrians or recreational traffic are rated only in special cases.

BSIPM User Note:
Pedestrian and railroad bridges typically won't be load rated, and BIMU will code only the MN Operating Rating Type and the MN Inventory Rating Type. All other items are to be left blank. If other items are coded the Structural Evaluation (NBI Item 67) will calculate to a low rating. Any discrepancies should be reported to BIMU.

Culverts, with spans of 10 feet or greater, are also rated. Rate box culverts with a clear span of 20 feet or more as bridges, **not** with Form 90. However, precast concrete arches on footings (Type 512) with spans up to 43.0 feet, may be rated as culverts using Form 90. Refer to Article 7.5 of the MnDOT Bridge Load Rating and Evaluation Manual.

New bridges should be rated by the LRFR method prior to the bridge being opened to traffic. Throughout the life of a bridge a new rating should be calculated whenever a change occurs (based upon information gathered during bridge inspections) that would significantly affect the rating. Use the LRFR methodology when re-rating structures.

A load rating report (along with any calculations) must be retained in the bridge owner's files. A copy of the load rating report should be submitted to BIMU. The load rating reports are used to update items detailed in the following sections.

Refer to the MnDOT Bridge Load Rating and Evaluation Manual for detailed rating information.

D.7.6.1 Design Load (NBI Item 31)

fe_id: 2003100 .... NBI 31: Design Load
BRIDGE.designload

This item indicates the standard AASHTO truck live load for which the structure was designed. The numerical value of the railroad loading should be recorded on the rating form. Classify any other loading, when feasible, using the nearest equivalent of the loadings given in the following table.

CODE	ENGLISH DESCRIPTION	CODE	ENGLISH DESCRIPTION
0	Unknown	7	Pedestrian
1	H 10	8	Railroad
2	H 15	9	HS 25
3	HS 15	A	HL 93 (LRFD)
4	H 20	B	Greater than HL93
5	HS 20	C	Other
6	HS 20 + Mod		

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D.7.6.2 Method Used to Determine Operating Rating (NBI Item 63)

fe_id: 2006300 .... NBI 63: Method Used to Determine Operating Rating
BRIDGE.ortype

The following table lists the codes for this item, which indicate the load rating method used to determine NBI Item 64 (Operating Rating). See Section D.7.6.3 for information on NBI Item 64.

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 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 HL93 Loading
A	Assigned Rating Based on Load Factor Design (LFD) Reported in Metric Tons
B	Assigned Rating Based on Allowable Stress Design (ASD) Reported in Metric Tons
C	Assigned Rating Based on Load and Resistance Factor Design (LRFD) Reported in Metric Tons
D	Assigned Ratings Based on Load Factor Design (LFD) Reported by Rating Factor (RF) Using MS18 Loading
E	Assigned Rating Based on Allowable Stress Design (ASD) Reported by Rating Factor (RF) Using MS18 Loadings
F	Assigned Ratings Based on Load and Resistance Factor Design (LRFD) Reported by Rating Factor (RF) Using HL93 Loadings

Code '0' is to be used when the load rating is determined by field evaluation and documented engineering judgment, typically done when plans are not available or in cases of severe deterioration. Field evaluation and engineering judgment ratings must be documented. Code '5' is to be used when the bridge has not been load rated or load rating documentation does not exist.

The majority of bridges on the Minnesota bridge inventory are rated using the Load Factor method. The Load and Resistance Factor Rating (LRFR) method (code '8') is used on newer bridges designed according to LRFD Bridge Design Specifications using the HL 93 design load. The Allowable Stress rating method is typically used only for timber or masonry bridges. The load testing method is seldom (if ever) used in Minnesota, and would be limited to special situations.

D.7.6.3 Operating Rating (NBI Item 64)

fe_id: 2006401 .... NBI 64: Operating Rating: Tons
BRIDGE.orload

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.

Bridges that are determined not capable of carrying 3 tons shall be closed.

MnDOT is required to report all operating ratings to FHWA in metric units.

For HS ratings, the value for this item is obtained by multiply the HS truck rating (see MN Operating Rating in Section D.7.6.8) by a factor of 1.8 to get MS tons. The metric rating is recorded to the nearest tenth of a ton.

For RF ratings no conversion is necessary. Record to the nearest hundredth of a decimal.

Examples:

MN Operating Rating Type	MN Operating Rating	NBI Item 64
2 - HS TRUCK	46.2	83.2
3 - HL - 93	1.436	1.44

D.7.6.4 Method Used to Determine Inventory Rating (NBI Item 65)

fe_id: 2006500 .... NBI 65: Method Used to Determine Inventory Rating
BRIDGE.irtype

This item uses the same codes used for NBI Item 63 (Method Used to Determine Operating Rating). See Section D.7.6.2 for coding information.

D.7.6.5 Inventory Rating (NBI Item 66)

fe_id: 2006601 .... NBI 66: Inventory Rating: Tons
BRIDGE.irload

The inventory rating, will result in a load level which can safely utilize an existing structure for an indefinite period of time.

MnDOT is required to report all inventory ratings to FHWA in metric units.

For HS ratings, the value for this item is obtained by multiply the HS truck rating (see MN Inventory Rating in Section D.7.6.10) by a factor of 1.8 to get MS tons. The metric rating is recorded to the nearest tenth of a ton.

For RF ratings no conversion is necessary. Record to the nearest hundredth of a decimal.

See following examples.

Inspector Note:
When a new bridge or culvert is added to the MnDOT bridge database, and load rating forms are not on file, this item will initially be coded '25.0' for HS or '1.00' for RF.

MN Inventory Rating Type	MN Inventory Rating	NBI Item 66
2 - HS TRUCK	27.7	49.9
3 - HL - 93	1.126	1.13

D.7.6.6 Bridge Posting (NBI Item 70)

fe_id: 2007000 .... NBI 70: Bridge Posting
BRIDGE.posting

The NBIS require the posting of load limits only if the maximum legal load configurations in the State exceed 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 NBI Item 67 (Structural Evaluation) in that NBI Item 67 uses NBI Item 66 (Inventory Rating), while the bridge posting requirement is based on NBI Item 64 (Operating Rating).

Although posting a bridge for load carrying capacity is required only when the maximum legal load exceeds the operating rating, the highway agency may choose to post at a lower level. This posting practice may appear to produce conflicting coding when NBI Item 41 (Structure Open, Posted or Closed to Traffic) is coded to show the bridge as actually posted at the site and NBI Item 70 (Bridge Posting) is coded as bridge posting is not required. Since different criteria are used for coding these two items, this coding is acceptable and correct when the highway agency elects to post at less than the Operating Rating. NBI 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 values in the following table 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

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.6.7 MN Operating Rating Type (MnDOT Item)

fe_id: 2111342 .... MN Operating Rating Type
BRIDGE.altormeth

This item indicates the method used in determining the operating load rating. It represents the loading used for the most current load rating and can differ from the design loading.

The following table lists the codes for this item.

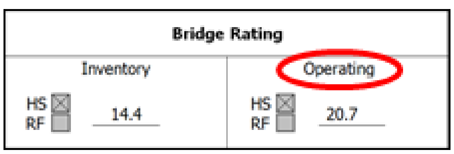
CODE	ENGLISH DESCRIPTION
0	H Truck
2	HS Truck
3	HL - 93
7	Railroad
8	Pedestrian, Special

D.7.6.8 MN Operating Rating (MnDOT Item)

fe_id: 2111341 .... MN Operating Rating
BRIDGE.altorload

This item is the value entered on MnDOT rating forms.

The diagram below depicts where the Operating rating can be found on these forms.



Inspector Note:
When a new bridge is added to the MnDOT bridge database, and load rating forms are not on file, this item will initially be coded with the Operating Rating shown in the Design Data block on the construction plan. A new culvert is coded according to the guidelines found on MnDOT Form 90.

This item is not applicable to railroad or pedestrian bridges; leave this item blank.

D.7.6.9 MN Inventory Rating Type (MnDOT Item)

fe_id: 1 .... MN Inventory Rating Type
BRIDGE.altirmeth

This item indicates the method used in determining the inventory load rating. It represents the loading used for the most current load rating and can differ from the design loading.

CODE	ENGLISH DESCRIPTION
0	H Truck
2	HS Truck
3	HL - 93
7	Railroad
8	Pedestrian, Special

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

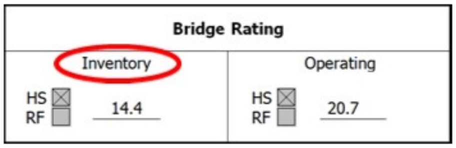
D.7.6.10 MN Inventory Rating (MnDOT Item)

fe_id: 2 .... MN Inventory Rating
BRIDGE.altirload

This item is the value entered on MnDOT rating forms.

The diagram below depicts where the Inventory rating can be found on these forms.

Inspector Note:
When a new bridge or culvert is added to the MnDOT bridge database, and load rating forms are not on file, this item will initially be coded HS 25.0 or RF 1.00.



This item is not applicable to railroad or pedestrian bridges; leave this item blank.

D.7.6.11 Posting (MnDOT Item)

fe_id: 91 .... POSTING VEH:
USERBRDG.post_capac_veh
fe_id: 92 .... POSTING SEMI:
USERBRDG.post_capac_semi
fe_id: 93 .... POSTING DBL:
USERBRDG.post_capac_dbl

This item indicates what the load restriction signage at the bridge should read. If no posting is required, this item will be left blank. This information is displayed on the Minnesota Bridge Inspection Report.

If load posting is required there should be values in one, two, or all three data fields.

Inspector Note:
For any bridge carrying vehicular traffic, the posting should be verified with these values during each inspection. For bridges posted for other values or missing posting, rate Element #890 in Condition State '4' and notify the Program Administrator and bridge owner immediately.

The values (in tons) represent as follows.

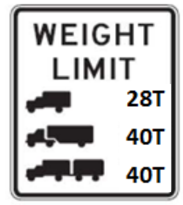
First Input (VEH)	1 - 2 digits indicating posting is required for single vehicle load
Second Input (SEMI)	1 - 2 digits indicating posting is required for semi-trailer load
Third Input (DBL)	1 - 2 digits indicating posting is required for double bottom load

The following examples depict where the load posting values can be found on the MnDOT rating forms, along with the corresponding sign that should be installed in the field.

See following examples:

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

Load Posting	Required ☒		
	Not Required ☐		
Sign	TONS		
R12-1A ☐			
R12-5a ☐			
R12-5 ☒	28 M3	40 M3S2	40 M3-3
R12-X11 ☐		45	



R12-5

Posting (tons) VEH: 28 SEMI: 40 DBL: 40

Load Posting	Required ☒		
	Not Required ☐		
Sign	TONS		
R12-1A ☐			
R12-5a ☒	9		
R12-5 ☐	M3	M3S2	M3-3
R12-X11 ☐		45	

R12-5A

Posting (tons) VEH: 9 SEMI: DBL:

The NBIS and Minnesota State law require that bridges be posted if the maximum legal load exceeds the load permitted on the structure under the operating rating stress level. The AASHTO manual states that a bridge should be capable of carrying a minimum of 3 tons. Bridges that are determined not capable of carrying 3 tons shall be closed.

Posting signs are shown on page D-178. For more detailed sign standards and guidelines, refer to MnDOT's Traffic Engineering Manual and the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD).

D.7.6.12 Rating Date (MnDOT Item)

fe_id: 57 .... Rating Date
BRIDGE.ratingdate

This item is entered when the agency submits the load rating form to BIMU for inventory updating.

For structures carrying vehicular traffic, the month, day, and year that the most recent load rating was completed is entered. Leave this item blank for non-vehicular carrying structures.

If the load rating date is not recorded, and the structure carries vehicular traffic, this indicates that a load rating has not yet been performed, or the load rating report form has not yet been submitted to BIMU. To identify bridges where no rating date is recorded, use MnDOT's Bridge Report: Load Posting and Rating Report.

- Select Bridge Lists

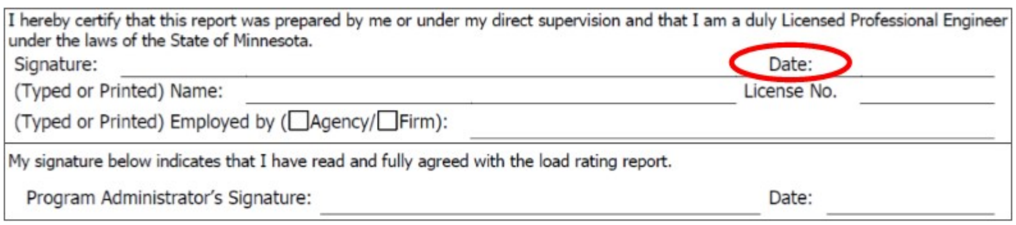
- Select Bridge Rating and Posting List
- Choose an Inspection Agency
- Choose a Sort Order
- Click on View Report. The report will list any bridge carrying vehicular traffic (railroad and pedestrian bridges are excluded from this list) without a load rating date. "NOT ON FILE" will be displayed in the rating date column.

The load rating date should be compared with the bridge inspection report to determine if the bridge has deteriorated significantly since the last load rating, or if additional dead load has been added since the last load rating.

The load rating date should be compared to the wearing surface installation year, and the year the bridge was remodeled or rehabilitated – these may indicate that dead load has been added since the last load rating.

The diagram below depicts where the load rating date can be found on the MnDOT rating form.

The following diagram is from Form RC-CL.


I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.
Signature: Date:
(Typed or Printed) Name: License No.
(Typed or Printed) Employed by (☐Agency/☐Firm):
My signature below indicates that I have read and fully agreed with the load rating report.
Program Administrator's Signature: Date:

Example:

Date of Load Rating	Input
December 12, 2012	12/12/2012

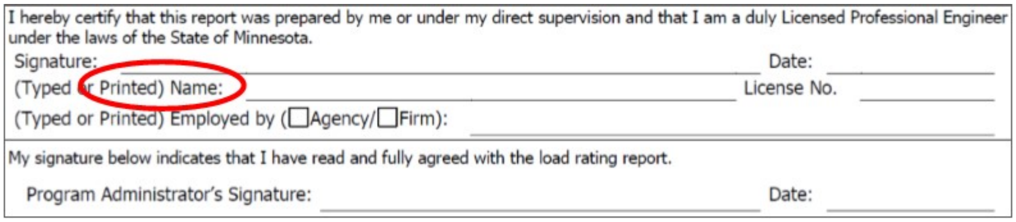
D.7.6.13 Rater's Initials (MnDOT Item)

fe_id: 2111332 .... Rater's Initials
BRIDGE.rater_ini

This item is entered when the agency submits the load rating form to BIMU for inventory updating.

Record the initials of the load rating engineer responsible for performing the most current load rating which can be found on the MnDOT rating form.

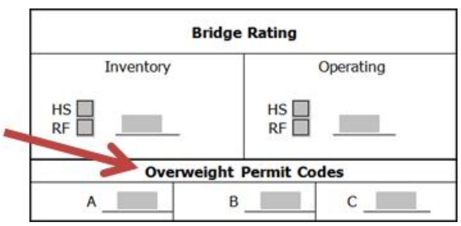
The following diagram is from Form RC-CL.


I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.
Signature: Date:
(Typed or Printed) Name: License No.
(Typed or Printed) Employed by (☐Agency/☐Firm):
My signature below indicates that I have read and fully agreed with the load rating report.
Program Administrator's Signature: Date:

D.7.6.14 Overweight Permit Codes (MnDOT Item)

fe_id: 58 .... Permit Code A
USERBRDG.permit_code_48k
fe_id: 59 .... Permit Code B
USERBRDG.permit_code_60k
fe_id: 60 .... Permit Code C
USERBRDG.permit_code_72k

The three overweight permit codes (A, B and C) are used by MnDOT's Commercial Vehicle Operations (CVO) to route overweight permit loads on state Trunk Highways. Under certain conditions, the OFCVO may issue permits for vehicles exceeding the maximum legal weight limit (outlined in Minnesota Statute 169).


Bridge Rating
Inventory
Operating
HS ☐
RF ☐
HS ☐
RF ☐
Overweight Permit Codes
A
B
C

MnDOT rating forms (RC-TH, PIR-TH, and RC-CL) display overweight permit codes:

New bridges are entered into the MnDOT database as follows.

- TH bridges are coded '1'.
- TH culverts are coded 'N'.
- All other structures are coded 'N'.

The overweight permit codes for this item are shown in the following table.

CODE	DESCRIPTION
X	Denied
1	No restriction
2	Vehicle shall travel down center of bridge
3	Maximum vehicle speed of 5 mph
4	Restrictions 2 & 3 combined
5	The bridge deck shall be planked
6	See special check - contact Bridge Ratings Engineer, MnDOT Bridge Office
7	Need District engineer approval
N	Not applicable

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

Refer to Appendix F: MN Permit Live Load Models of the MnDOT Bridge Load Rating and Evaluation Manual for diagrams of Minnesota standard permit trunks – G-80 models.

D.7.7 PAINT SYSTEM INFORMATION

The following items track the paint system present on a steel bridge superstructure. Four paint items are displayed on the Minnesota Structure Inventory Report – the year painted, the painted area, the primer coat type, and the finish coat type. The painted area is also displayed on the Minnesota Bridge Inspection Report. This information is useful for planning long term bridge painting projects and for identifying bridges with hazardous substances (such red lead primer).

These paint items typically apply only to steel superstructure members, but could also apply to steel substructure members (such as pier caps, columns or pilings) if they share the same paint system as the steel superstructure. These items do not apply to steel railings.

The following table lists the common paint systems used on steel bridges in Minnesota since 1912. While 3-coat paint systems (prime coat, intermediate coat, and finish coat) have been used since 1929, only the prime coat type and finish coat type are currently tracked in the inventory.

BRIDGE PAINT SYSTEMS COMMONLY USED IN MINNESOTA				
Years of Use	**Paint System Spec #**	**Primer Coat**	**Intermediate Coat**	**Finish Coat**
1912-1917	93	Red Mineral Paint	None	As approved by Engineer
1918-1928	-	Red Lead (250)	None	Graphite (253)
1929-1937	62	Red Lead (143.04)	Red Lead (143.05)	Red Lead/Carbon - 4 Colors (143.06) Aluminum - Bronze Powder (143.07)
1938-1946	2407.3I	Red Lead (3501)	Red Lead - Brown (3502) White Lead - Gray (3503)	Black Magnetic Oxide (3504) Aluminum Paste (3505) C.P. Chrome - Green (3506)
1947-1958	2476	Red Lead - Shop (3506)	Red Lead - Brown (3521)	Iron Oxide - Black Synthetic (3526)
			White Lead - Gray (3522)	Aluminum - Phenolic Resin (3527)
1959-1963	2476	Red Lead (3506)	White Lead - Gray (3522)	Aluminum - Phenolic Resin (3528)
1964-1967	2476	Red Lead (3506)	Aluminum - Phenolic Resin (3527)	Aluminum - Phenolic Resin (3528)
1968-1971	2476	Red Lead (3506)	Red Lead - Brown (3521)	Aluminum - Phenolic Resin (3528)
1972-1977	2476	Red Lead - Iron Oxide (3506)	Aluminum - Phenolic Resin (3527)	Aluminum - Phenolic Resin (3528)
1978-1994	2477	Organic Zinc-Rich (3503)	Vinyl (3505)	Aluminum - Chlorinated Rubber (3523) Vinyl (3529)
1995-1999	2478	Epoxy Zinc-Rich (3520.A)	Polyamide Epoxy (3520.B)	Aliphatic Polyurethane (3520.C)
2000-2004	2478	Shop - Inorganic Zinc (3518) Field - Epoxy Zinc-Rich (3520.A)	Polyamide Epoxy (3520.B)	Aliphatic Polyurethane (3520.C)
2005-Present	2478 (Field) 2479 (Shop)	Epoxy Zinc-Rich (3520.3A) Inorganic Zinc-Rich (3520.3B)	Epoxy or Urethane (3520.3)	

The following two photographs show the stencil marking system used to identify paint systems in the field. The set of information includes the painting date, the primer coat type and the finish coat type.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.7.1 Year Painted (MnDOT Item)

fe_id: 73 .... Year Painted
USERBRDG.year_painted

This item indicates the most recent year the steel superstructure members were painted. This could be either a full or partial bridge painting. All four digits of the year are to be recorded.

See Section D.7.7.2 for information regarding the paint area this item pertains to.

D.7.7.2 Painted Area (MnDOT Item)

fe_id: 75 .... Painted Area
USERBRDG.painted_area

This item is only for bridges with a painted steel superstructure. It is expressed to the nearest square foot, and includes steel structural members such as beams, trusses, arches, and secondary bracing. This may also include substructure members (such as pier caps, columns or pilings) if they share the same paint system as the steel superstructures. Bridge railings are not included in this item.

Inspector Note:
On bridges constructed of unpainted weathering steel, only the "high corrosion areas" (typically areas within seven feet of a deck joint) should be considered when determining the total painted area.

D.7.7.3 Primer Type (MnDOT Item)

fe_id: 46 .... Primer Type
USERBRDG.paint_primer_id

This item indicates the type of paint primer used on the bridge. Only one primer type can be entered. If more than one paint system is present, the predominant primer type should be recorded. The following table shows the primer types currently being coded. The MnDOT Specification numbers for some primer types have changed over the years.

This item will also indicate if the superstructure is comprised of weathering steel (MnDOT Spec #3309). Weathering steel has been used in bridges in Minnesota since 1938, but was initially used on a limited basis. Virtually all steel bridges constructed in Minnesota since the 1980's are weathering steel, the vast majority are fully painted. For bridges comprised of weathering steel that has been left completely unpainted, the paint primer type should be entered as "F" (Unpainted Weathering Steel). If the high corrosion areas of an unpainted weathering steel bridge are painted, the actual paint finish type should be coded.

Paint Primer Type (and Structural Steel Type) Coding					
Type of Primer	MnDOT Specification #	Specification Years	Years of Common Use	Paint Primer Type Code (Non-Weathering Steel)	Paint Primer Type Code (Weathering Steel)
Red Lead	3501 3506	1912-1971	1912-1971	1	A
Red Lead - Iron Oxide	3506	1972-1994	1972-1977	2	B
Lead Silica - Chromate	3509	1968-1994	-	3	C
Organic Zinc Rich	3503 3520.2A 3520.3A	1978-Present	1978-Present	4	D
Inorganic Zinc Rich	3518 3520.3B	1995-Present	1995-Present	5	E
Unpainted Weathering Steel	3309 *	1968-Present	-	NA	F
Moisture Cured Zinc	3520.3C	2005-Present	-	7	G
Not Applicable	NA	NA	-	X	X
Other/Unknown	NA	NA	-	0	Z

*MnDOT Specification #3309 is corrosion resistant (weathering) structural steel used for bridge construction. While this currently corresponds with ASTM A709 steel, it has pertained to other ASTM grades in the past. High performance corrosion resistant steel, such as MnDOT Specification #3317, should also be coded "weathering steel".

D.7.7.4 Finish Type (MnDOT Item)

fe_id: 47 .... Finish Type
USERBRDG.paint_finish_id

This item indicates the type of paint finish coat present on the bridge. Only one finish type can be entered. If more than one paint system is present, the predominant finish type should be listed.

For bridges comprised of weathering steel that has been left completely unpainted, the paint finish type should be entered as "K" (Unpainted Weathering Steel). If the high corrosion areas of an unpainted weathering steel bridge are painted, the actual paint finish type should be coded.

The following table shows the finish coat types currently being coded.

Paint Finish Coat Type Coding				
Type of Paint Finish Coat	**MnDOT Specification and Colors**	**Specification Years**	**Years of Common Use**	**Paint Finish Type Code**
Red Lead	**143.06 (Olive, Green, Graphite or Black)**	**1929-1937**	**1929-1937**	**A**
White Lead	**3522 (Gray)**	**1947-1967**	**-**	**B**
Lead Silica Chromate	**3522 (Brown) 3524 (Dark Green) 3525 (Foliage Green)**	**1968-1994**	**-**	**C**
Alkyd Iron Oxide	**3504 (Black) 3526 (Black)**	**1938-2004**	**1938-1958**	**D**
Phenolic Resin Iron	**NA**	**NA**	**-**	**E**
Phenolic Resin Aluminum	**143.07 (Aluminum) 3505 (Aluminum) 3527 (Aluminum)**	**1929-2004**	**1929-1977**	**F**
Chlorinated Rubber Aluminum	**3523 (Aluminum)**	**1978-1999**	**1978-1994**	**G**
Vinyl	**3529 (White and 7 Standard Colors)**	**1978-1999**	**1978-1994**	**H**
Latex	**NA**	**NA**	**-**	**I**
Enamel	**NA**	**NA**	**-**	**J**
Unpainted Weathering Steel	**3309**	**1968-Present**	**1968-Present**	**K**
Other/Unknown	**NA**	**NA**	**-**	**L**
Urethane or Polyurethane	**3520.2C & 3520.3 (White and 7 Standard Colors)**	**1995-Present**	**1995-Present**	**M**
Moisture Cured Urethane	**3533**	**2005-Present**	**-**	**N**
Not Applicable	**NA**	**NA**	**-**	**X**

D.7.7.5 Paint Specifications (MnDOT Item)

fe_id: 2111423 .... Paint Spec.
USERBRDG.paint_spec_number

Below are MnDOT's current specification numbers for possible paint used on the superstructure.

MNDOT SPECIFICATION NUMBER	TYPE OF PRIMER
3520.2	Zinc-Rich Primer
3520.3	Epoxy Zinc-Rich Paint Systems/A Epoxy Zink (Epoxy Intermediate Coat with Polyurethane Finish Coat)
3523	Aluminum (Chlorinated Rubber) Finish Coat
3526	Bridge & Guardrail Paint (Black Finish Coat)
3527	Aluminum Intermediate Coat
3528	Aluminum (Phenolic Resin) Finish Coat
3529	Vinyl Finish Coat (White Tint Base)
3529-1	Vinyl Finish Coat (Dark Blue)
3529-2	Vinyl Finish Coat (Dark Green)
3529-3	Vinyl Finish Coat (Brown)
3529-4	Vinyl Finish Coat (Charcoal Gray)
3529-5	Vinyl Finish Coat (Black)
3529-6	Vinyl Finish Coat (Light Green)
3529-7	Vinyl Finish Coat (Light Blue)
3551	Enamel Paint (Black)
3552	Enamel Paint (Dark Green)
3553	Enamel Paint (Light Green)

D.7.7.6 Paint Proportion (MnDOT Item)

fe_id: 2111424 .... Paint Proportion
BrM field not available at this time.

This item indicates the proportion of the steel superstructure that is painted.

Description	Input
Entire superstructure is painted.	Full
Partial superstructure is painted.	Partial
Superstructure is not painted	Unpainted

D.7.8 CLEARANCE AND SIGNS

This section contains information regarding critical clearances; both vertical (on and under) and horizontal (under).

For Trunk Highway bridges, if these items change the Vertical and Horizontal Bridge Underclearance Report (Revised: June 2018) shall be completed and sent to the BIMU and to the District and Transportation Permit Centers.

This section also discusses any signage (load posting, traffic control, horizontal control, or vertical clearance) required at the bridge site. This is based upon current structure inventory information – it is the responsibility of the agency with inspection jurisdiction to verify these signing requirements. Sign standards and guidelines are outlined in MnDOT's Traffic Engineering Manual and the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD). Any signage item listed as 'unknown' should be revised.

D.7.8.1 Minimum Vertical Clearance Over Bridge Roadway (NBI Item 53)

fe_id: 2005300 .... NBI 53: Minimum Vertical Clearance OVER Bridge Roadway
BRIDGE.vclrover

The information recorded for this item is the actual minimum vertical clearance over the bridge roadway, including shoulders, to any superstructure restriction. For double decked structures code the minimum, regardless whether it is pertaining to the top or bottom deck.

Record to a tenth of a foot (truncate, do not round).

When no superstructure restriction exists above the bridge roadway, or when a restriction is 100 feet or greater, code '99.9'. Pedestrian or railroad only bridges are also coded '99.9'.

D.7.8.2 Minimum Vertical Underclearance (NBI Items 54A & 54B)

fe_id: 2005410 .... NBI 54A: Minimum Vertical Underclearance: Reference Feature
BRIDGE.refvuc
fe_id: 2005420 .... NBI 54B: Minimum Vertical Underclearance
BRIDGE.vclrunder

NBI Item 54 is composed of two segments; 54A (Reference Feature) and 54B (Minimum Vertical Underclearance).

For NBI Item 54A (Reference Feature), code the reference feature under the structure from which the clearance measurement is taken. When both a highway and a railroad are under the structure, code the reference feature with the most critical dimension. Roadway criticality should govern unless the railroad clearance is less than 23'-0" and the roadway clearance is 14'-6" (legal) or greater. An explanation should be written in the inspection report to note what reference feature was coded.

CODE	DESCRIPTION
H	Highway Beneath Structure
R	Railroad Beneath Structure
N	Feature not a Highway or Railroad

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

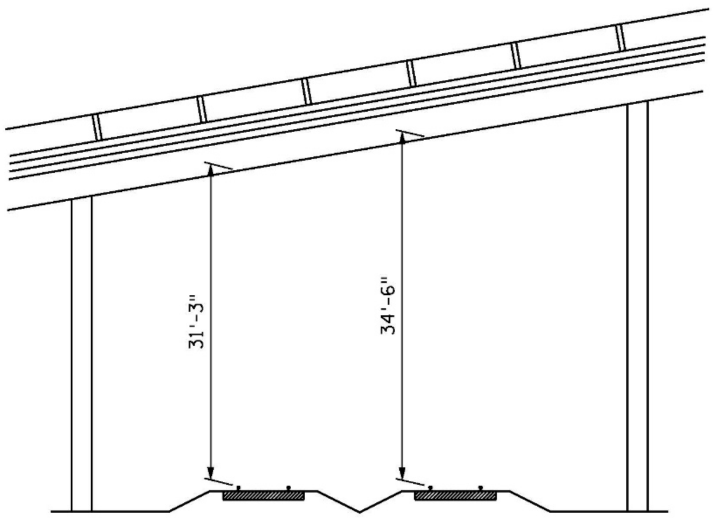
For NBI Item 54B (Minimum Vertical Underclearance), this item records the minimum vertical clearance from the roadway (travel lanes only) or railroad track beneath the structure to the underside of the superstructure.

Code the clearance that coincides with the reference feature in 54A. Code '0' if the reference feature is not a highway or railroad.

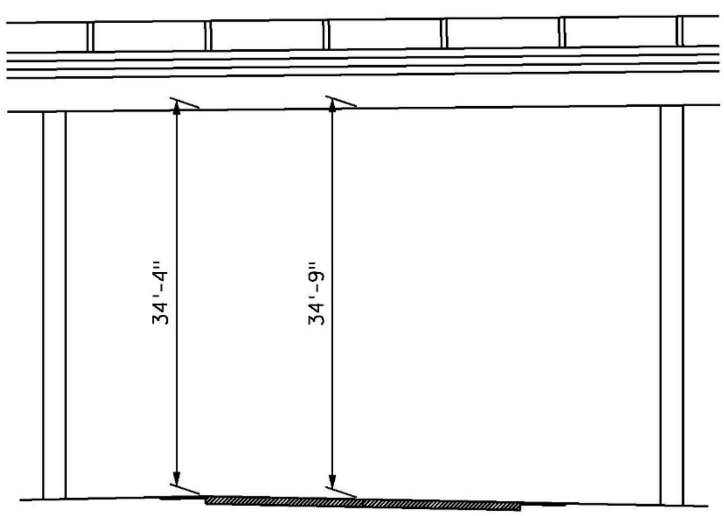
Record to a tenth of a foot (truncate, do not round).

See following examples.

Description	NBI Item 54A	NBI Item 54B
Railroad 31'-3" Beneath Structure	R	31.2



Description	NBI Item 54A	NBI Item 54B
Highway 34'-4" Beneath Structure	H	34.3



D.7.8.3 Minimum Lateral Underclearance on Right (NBI Items 55A & 55B)

fe_id: 2005510 .... NBI 55A: Minimum Lateral Underclearance on Right: Reference Feature
BRIDGE.refhuc
fe_id: 2005520 .... NBI 55B: Minimum Lateral Underclearance on Right: Minimum Lateral Underclearance
BRIDGE.hclrurt

NBI Item 55 is composed of two segments, 55A (Reference Feature) and 55B (Minimum Lateral Underclearance).

For NBI Item 55A (Reference Feature), code the reference feature under the structure from which the clearance measurement is taken. When both a highway and a railroad are under the structure, code the reference feature with the most critical dimension.

CODE	DESCRIPTION
H	**Highway Beneath Structure**
R	**Railroad Beneath Structure**
N	**Feature not a Highway or Railroad**

For NBI Item 55B (Minimum Lateral Underclearance), this item records the minimum lateral clearance under the structure on the right.

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 measure from the right edge of the through roadway.

Code the clearance that coincides with the reference feature in 54A. Code '0' if the reference feature is not a highway or railroad.

If the reference feature is a highway, the right lateral clearance is measured from the right edge of the traveled lane to the nearest substructure unit (pier, abutment, etc.), or to a rigid barrier, or to the toe of the slope steeper than 1:3. If the highway has two-way traffic separated only by the centerline the measurement recorded will be the minimum after measuring the right lateral clearance in both directions of travel.

In the case of a dual highway (divided by median or pier) the clearance for both roadways will be measured and the smaller distance shall be recorded.

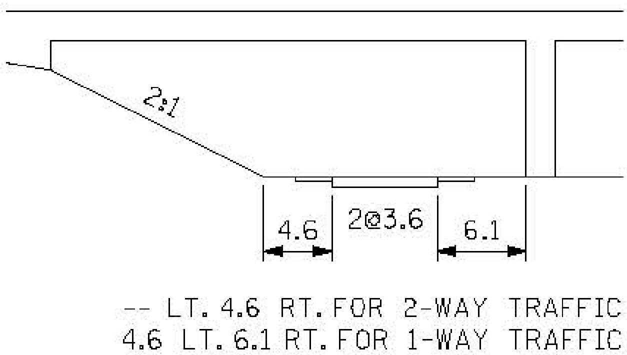
If the reference feature is a railroad, the right lateral clearance is measured from the centerline (between rails) of the right-hand track of a railroad, to the nearest substructure unit (pier, abutment, etc.), or to a rigid barrier, or to the toe of the slope steeper than 1:3.

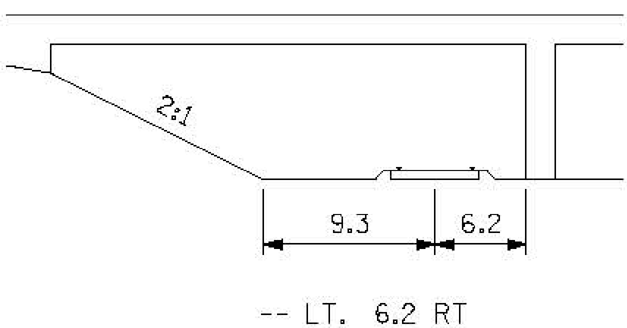
Record to a tenth of a foot (truncate, do not round).

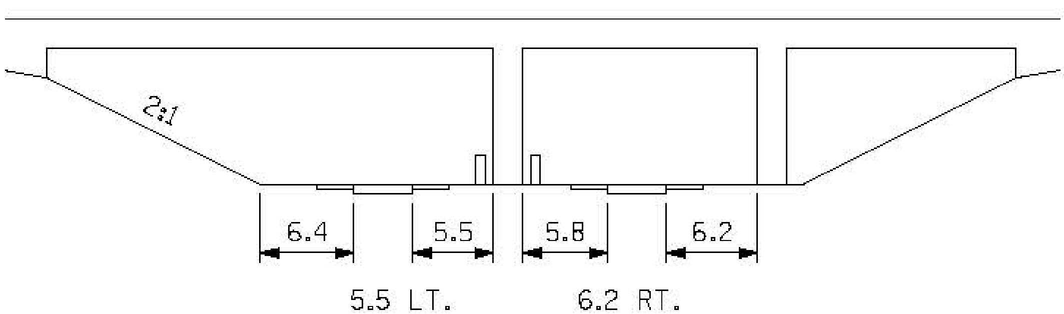
See following examples:

Description	NBI Item 55A	NBI Item 55B
Highway 20'- 3" Edge of Pavement to Pier	H	20.2
Railroad 20'- 4" Centerline to Pier	R	20.3
Creek Beneath Structure	N	0

See following diagrams.







Quick Links:
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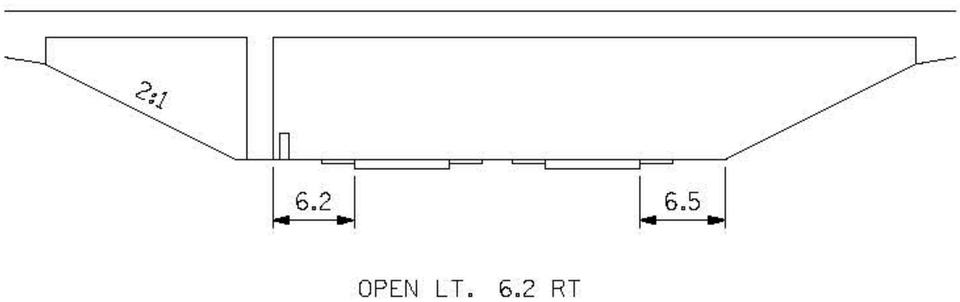
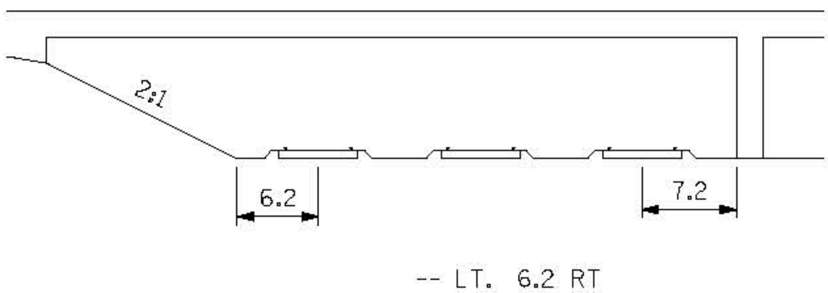
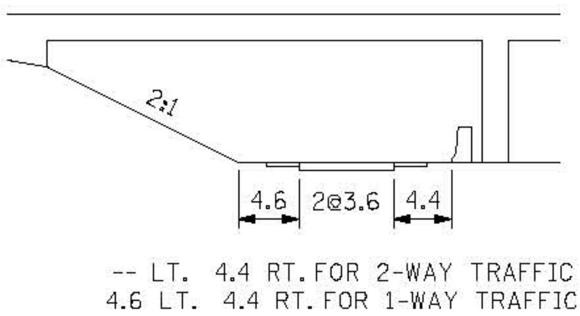






D.7.8.4 Minimum Lateral Underclearance on Left (NBI Item 56)

fe_id: 2005600 .... NBI 56: Minimum Lateral Underclearance on Left
BRIDGE.hclrult

This item only applies to one-way streets, ramps, and dual highways (divided by median or pier). This item does not apply to two-way roadways (separated only by a centerline) and railroads.

For a one-way street the left lateral clearance is measured from the left edge of the traveled lane to the nearest substructure unit (pier, abutment, etc.), or to a rigid barrier, or to the toe of the slope steeper than 1:3. Refer to examples shown under Section D.7.8.3.

In the case of a dual highway (divided by median or pier) the left lateral clearance is measured from the left edge of the traveled lane to the nearest substructure unit (pier), or to a rigid barrier, or to the toe of the slope steeper than 1:3. The measurement recorded will be the minimum after measuring the left lateral clearance in both directions of travel.

If there is no obstruction in the median area, a notation of "open" should be written in the inspection report and the clearance recorded should be the measurement from the left edge of the traveled lane to the left edge of the traveled lane in the opposite direction.

For clearances greater than 99.8 feet, code '99.8'. Code '0' to indicate not applicable.

Record to a tenth of a foot (truncate, do not round).

If bridge plans do not call out dimensions or minimum widths and are only labeled as varies, the width of that lane or shoulder should be counted as '0' until it is verified in the field. Do not make assumptions.

D.7.8.5 Posted Load (MnDOT Item)

fe_id: 48 .... Posted Load
USERBRDG.posted_sign

Minnesota Statute 165.03, Subd. 6a (c) requires that a bridge must be posted if the "maximum legal load under state law exceeds the load permitted on the structure under the operating rating stress level assigned".

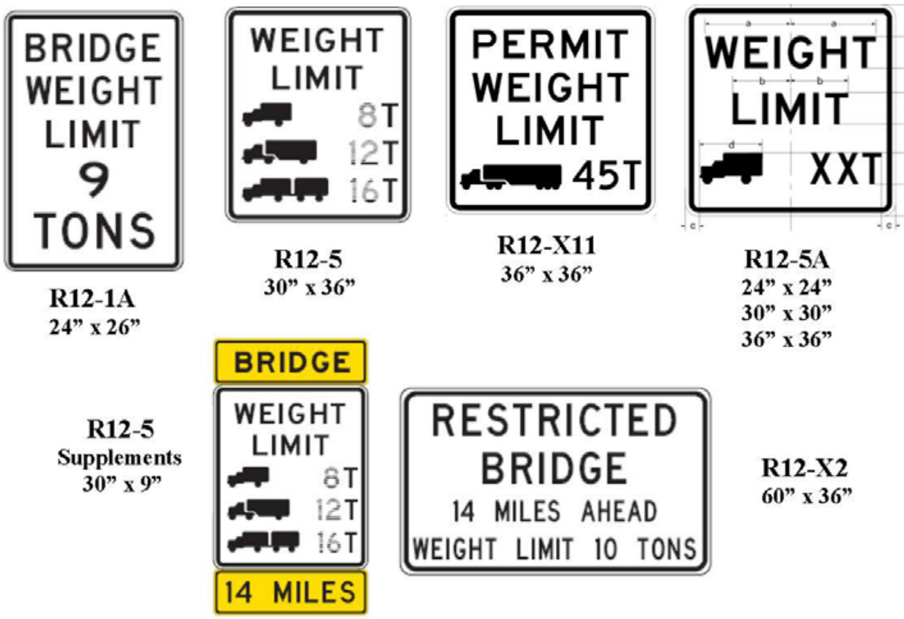
If a load rating determines that a weight restriction is required on a bridge or culvert, the type of load posting sign (as well as the specific posting limits) will be displayed on the header of the Minnesota Bridge Inspection Report and in the bottom-right corner of the Minnesota Structure Inventory Report. The load posting sign should be the same as that displayed on these reports. The load posting sign types and codes are displayed as follows.

ITEM	DISPLAY	DESCRIPTION
0	NOT REQUIRED	No Load Posting Signs are Required
1	VEHICLE ONLY	Vehicle Limit Only (Type R12-1A)
2	VEHICLE & SEMI	Vehicle and Semi-Trailer Limits (Type R12-5)
3	BRIDGE CLOSED	Bridge Closed (Type R11-2A)
4	PERMIT	Permit Weight Limit (Type R12-X11)
5	SHV	Specialized Hauling Vehicle Weight Limit (Type R12-5A)

Load posting signs (R12-1A, R12-5, R12-X11 or R12-5A) must be placed either on or immediately in front of the bridge. Advanced signs (R12-5 Supplement or R12-X2) should be placed at the nearest intersecting road, or at a wide point in the road, at which an overweight vehicle can detour or turn around.

This item only indicates the presence and type of load posting signage at the bridge site. The actual limit in tons to be used on signs is specified in Section D.7.6.6 (Bridge Posting).

See following examples of posting signs.



Examples of Load Posting Signs. See Sections 2B.58 and 2B.59 of the MN MUTDC.

When a load rating is completed and indicates a bridge is to be posted, ***the posting signs must be erected within 30 days after notification of their requirement***. If there are significant changes in the bridge condition or in the posted weight, temporary signs should be erected in the interim.

When a load rating is completed and indicates a bridge is to be posted, it is mandatory that the bridge be posted unless the Bridge Owner elects to provide expedited repairs to strengthen the bridge to carry legal loads.

Inspector Note:

Confirm that load posting signs are present either on or immediately in front of the bridge and note if advanced signs are present. If the load posting signs are missing, or the posting differs from what is shown on the inspection report, rate Element #890 in Condition State '4' and notify the PA and bridge owner immediately.

D.7.8.6 Traffic Sign (MnDOT Item)

fe_id: 49 .... Traffic
USERBRDG.sign_traffic_control

Some bridges require regulatory traffic control signs that may or may not be related to weight restrictions. Requirements for traffic control signs are coded and displayed as follows.

CODE	DISPLAY	DESCRIPTION
0	NOT REQUIRED	No Traffic Restriction Signs Required
1	SPEED LIMIT	Bridge Speed Limit (Type R2-X5)
2	ONLY 1 TRUCK	Lane Restriction (Trucks/Vehicles Must Not Meet On Bridge)
3	SPEED LIMIT & 1 TRUCK	Combination of 1 & 2

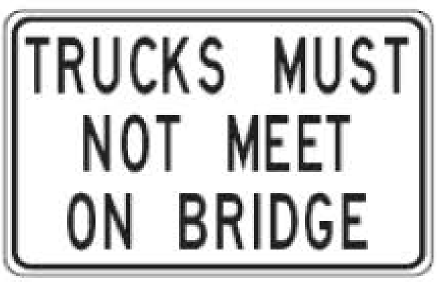
R2-X5
24" x 36"

If it is determined that a "Bridge Speed Limit" sign (R2-X5) is required, they shall be placed 100 ft. before each end of the structure. See Section 2B.13.1 of the MN MUTCD.

As outlined in Section 2B.59.1 of the MN MUTCD, a "Trucks Must Not Meet on Bridge" sign (R12-X3) should be installed in advance of bridges carrying two-way traffic if it meets at least one of the following conditions:

- The bridge roadway width is more than 18 ft. and less than 20 ft., the approach alignment is poor, and the structure type is such that commercial vehicles cannot pass safely on the bridge; or
- Where a restriction on the meeting or passing of commercial vehicles would increase the load capacity of the structure.

As outlined in Section 2B.59.1 of the MN MUTCD, a "Vehicles Must Not Meet on Bridge" sign (R12-X3a) should be installed in advance of bridges carrying two-way traffic if the bridge roadway width is 18 ft. or and less.



R12-X3
36" x 24"

R12-X3A
42" x 24"

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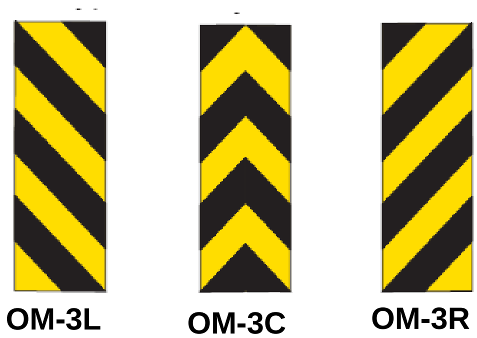
D.7.8.7 Horizontal Clearance Sign (MnDOT Item)

fe_id: 50 .... Horizontal
USERBRDG.sign_horz_control

Some bridges require horizontal restriction signage warning of limited horizontal clearance. Horizontal delineators are required when the roadway shoulders narrow as they approach the bridge. Delineators are also known as hazard markers, object markers or paddle boards.

CODE	DISPLAY	DESCRIPTION
0	NOT REQUIRED	No Horizontal Clearance Signs Required
1	OBJECT MARKERS	Type 3 Object Markers (Hazard Markers)
2	WIDTH RESTRICTION	Width Restrictions (Narrow Bridge or One Lane Bridge)
3	OBJECT MAREKRS & WIDTH	Combination of 1 & 2

Obstructions such as abutments, piers, trusses, or railings located within the width of the approach shoulders should be delineated by Object Markers. See Section 3C.3 of the MN MUTCD. Type 3 Object Markers (OM-3L, OM-3C, or OM-3R) are typically used for bridges. These signs have alternating black and yellow stripes sloping downward toward the side of the obstruction on which traffic is to pass. The inside edge of the object marker should be in line with the inner edge of the obstruction.



Type 3 Object Markers
(12" x 36")

As outlined in Section 2C.16 of the MN MUTCD, a "Narrow Bridge" sign (type W5-2 or W5-2A) should be placed in advance of a bridge (or culvert) if it meets at least one of the following conditions:

- The structure carries two-way traffic and has a roadway width greater than 18 feet, but this width is less than the approach roadway width; or
- The roadway clearance on the bridge is less than the width of the approach travel lanes (the approach shoulder width is not included).

As outlined in Section 2C.17 of the MN MUTCD, a "One Lane Bridge" sign (W5-3) should be placed in advance of bridges (or culverts) carrying two-way traffic if the bridge roadway clearance width is less than 18 feet.

W5-2
(36" x 36")

W5-3
(36" x 36")

D.7.8.8 Vertical Clearance Sign (MnDOT Item)

fe_id: 51 .... Vertical
USERBRDG.sign_vert_control

Some bridges require vertical restriction signage warning of limited vertical clearance.

CODE	DISPLAY	DESCRIPTION
N	NOT APPLICABLE	Not applicable (No Vertical Restriction)
0	NOT REQUIRED	No Vertical Clearance Signs Required (14'-6" or greater)
1	ROADWAY RESTRICTION	Vertical Clearance Restriction on Roadway (Type W12-2 or W12-2p)
2	SHOULDER RESTRICTION	Vertical Clearance Restriction on Shoulder (Arch Bridges - Type W12-X2)

The maximum vehicle height in the state of Minnesota is 13'-6". Based upon Section 2C.22 of the MN MUTCD, the "Low Clearance" (W12-2) sign shall be installed if vertical clearance under a bridge is less than 14'-6". Low clearance signs may be installed on or in advance of the structure. If the sign is mounted on the bridge, it must be the rectangular (W12-2p) sign. If the vertical clearance is less than the legal maximum vehicle height (13'-6"), advanced warning signs (W12-2 with a supplemental distance plaque) should be placed at the nearest intersecting road or at a wide point in the road at which an over height vehicle can detour or turn around.

W12-2
36" x 36"

W12-2P
84" x 24"

Low clearance signs should display the vertical clearance to the nearest 1 inch (not exceeding the actual clearance). In areas where roadways are subjected to frost heave, an allowance of

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up 3 inches may be reflected in the signing. For example, if the actual clearance is 13'-9", the signs might read 13'-6".

Bridge clearance measurements should be performed periodically, especially if the roadway has been resurfaced. The posted clearance should be noted on the inspection report to verify that it correlates with the structure inventory.

W12-X2
48" x 24"

On arch bridges, or when the underclearance varies greatly, the W12-X2 Vertical Clearance sign shall be used. The arrow indicates the location of the height specified on the sign.

D.7.8.9 Railroad Vertical Underclearance (MnDOT Item)

fe_id: 2111356 .... RR Vertical Underclearance
ROADWAY.userrwkey3

This item records the minimum vertical clearance from the centerline of the top of the railroad track beneath the structure to the underside of the superstructure.

Record to a tenth of a foot (truncate, do not round).

Leave this item blank when a railroad isn't under the structure.

D.7.8.10 Railroad Lateral Underclearance (MnDOT Item)

fe_id: 3000863 .... RR Lateral Underclearance
BRIDGE.userkey4

This item records the dimension from the centerline of the right-most rack of a railroad, to the substructure unit of the structure (pier, abutment, or toe of slope if steeper than 3:1). Record the most restrictive measurement along either direction of the railroad.

Record to a tenth of a foot (truncate, do not round).

D.7.9 WATERWAY DATA

Items in this section only apply to structures crossing over a waterway. If NBI Item 42B (Type of Service Under Bridge) is coded '5' through '9', the structure crosses a waterway. See Section D.7.2.2 for NBI Item 42B.

D.7.9.1 Navigation Control (NBI Item 38)

fe_id: 2003800 .... NBI 38: Navigation Control
BRIDGE.navcntrol

This item indicates whether or not navigation control is required. Navigation control can require a bridge permit for navigation. Use one of the following codes.

CODE	DISPLAY	DESCRIPTION
N	N/A	Not applicable, no waterway
0	NO PRMT REQD	No navigation control on waterway (bridge permit not required)
1	PERMIT REQD	Navigation control on waterway (bridge permit required)

The Minnesota waterways as described below are coded '1' for permit required. All other waterways are coded '0' for permit not required.

- The Mississippi River from Iowa until just north of the Broadway Bridge in Minneapolis is navigable.
- The Minnesota River from its juncture with the Mississippi River until just west of Savage is navigable.
- The Saint Croix River from its juncture with the Mississippi River until just north of the Alan S. King generating plant in Bayport is navigable.
- The Saint Louis River from its mouth in Lake Superior to just west of the Oliver Bridge in Duluth is navigable.

D.7.9.2 Pier or Abutment Protection (for Navigation) (NBI Item 111)

fe_id: 2011100 .... NBI 111: Pier or Abutment Protection
INSPEVNT.pierprot

This item describes the condition of the pier or abutment protection for navigation. If NBI Item 38 (Navigation Control) is coded '1', use the codes in the following table 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 NBI Item 60 (Substructure). If NBI Item 38 (Navigation Control) is coded '0' or 'N', leave this item blank to indicate it is not applicable.

CODE	SIMS DISPLAY	DESCRIPTION
1	NOT REQUIRED	Navigation protection not required
2	FUNCTIONING	In place and functioning
3	DETERIORATING	In place but in a deteriorated condition
4	EVAL SUGGESTED	In place but reevaluation of design suggested
5	EVAL SUGGESTED	None present but reevaluation suggested

D.7.9.3 Navigation Vertical Clearance (NBI Item 39)

fe_id: 2003900 .... NBI 39: Navigation Vertical Clearance
BRIDGE.navvc

If NBI Item 38 (Navigation Control) has been coded '1', record 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. This measurement will show the clearance that is allowable for navigational purposes. This is typically measured from the normal pool elevation.

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).

If the bridge is a lift span, the vertical clearance shall be measured when the bridge is in the raised or open position. Also, NBI Item 116 (Minimum Navigation Vertical Clearance, Vertical Lift Bridge) shall be coded to provide clearance in a closed position (i.e., open to vehicular traffic).

Record to the nearest tenth of a foot (always round down).

Code this item '0.0' if NBI Item 38 is coded 'N' or '0'.

D.7.9.4 Navigation Horizontal Clearance (NBI Item 40)

fe_id: 2004000 .... NBI 40: Navigation Horizontal Clearance
BRIDGE.navhc

If NBI Item 38 (Navigation Control) has been coded '1', record the minimum horizontal clearance shown on the navigation permit. This measurement may be less than the structure geometry 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.

Record to the nearest tenth of a foot (always round down).

Code this item '0.0' if NBI Item 38 is coded 'N' or '0'.

D.7.9.5 Minimum Navigation Vertical Clearance, Vertical Lift Bridge (NBI Item 116)

fe_id: 2011600 .... NBI 116: Minimum Navigation Vertical Clearance, Vertical Lift Bridge
BRIDGE.lftbrnavcl

If NBI Item 38 (Navigation Control) has been coded '1', 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.

Record to the nearest tenth of a foot (always round down).

Code this item '0.0' if NBI Item 38 is coded 'N' or '0'.

D.7.9.6 Drainage Area (MnDOT Item)

fe_id: 54 .... Drainage Area
USERBRDG.drainage_area

This item indicates the size of the drainage area upstream of the structure.

Record to the nearest tenth of a square mile.

Leave this item blank if NBI Item 38 is coded 'N'.

D.7.9.7 Waterway Opening (MnDOT Item)

fe_id: 55 .... Waterway Opening
USERBRDG.waterway_opening

This item indicates the area of the waterway opening below or through the structure.

Record to the nearest square foot.

Leave this item blank if NBI Item 38 is coded 'N'.

D.7.9.8 MN Scour Code (MnDOT Item)

fe_id: 90 .... Scour ID
USERINSP.scour_id

The FHWA requires that all vehicular bridges over water with a total length greater than 20 feet be reviewed for scour. In Minnesota, this process consists of a primary and secondary scour screening – and if necessary, a more thorough scour evaluation. MnDOT issued formal Screening Guidelines in 1990 and since that time all bridges greater than 20 feet in length have been screened. Many of the bridges on the Interstate and State systems (high priority bridges) have been evaluated by performing a scour analysis; where appropriate, countermeasures were designed and constructed. In addition, MnDOT has developed a monitoring program for both emergency and regular monitoring of bridges for scour. The "Bridge Scour Evaluation Procedure for Minnesota Bridges" can be downloaded from the MnDOT Bridge Office website at http://www.dot.state.mn.us/bridge/pdf/hydraulics/ScourGuidelines_12-09.pdf.

Inspector Note:
All newly constructed bridges should have a channel cross section completed at the first inspection.

This document outlines the scour screening and evaluation process, and includes templates for developing "Scour Plans of Action". The Scour Plan of Action (POA) is bridge specific and includes data and guidance regarding the flood elevation at which monitoring should begin, the frequency of monitoring, and the critical flood elevation for actions such as bridge closure.

- If the MN scour code is 'F', 'G', or 'J' (and the total structure length exceeds 20 feet) – additional scour analysis (and recoding) is required.

- If the MN scour code is 'G', 'K', 'O', 'P', 'R', or 'U', a "Scour Plan of Action" must be established to outline procedures for monitoring or closing the bridge during high water events. Each agency should maintain a file or notebook containing all of their Scour Plans of Action that is readily available for review during a high water or flood event. A copy of each POA must be sent to BIMU.

During the scour screening and evaluation process, bridges were coded as "low risk" based upon the assumption that there were no existing scour problems (or history of scour), and abutment slopes were adequately protected. If scour or channel problems develop on a bridge coded as "low risk" or "limited risk", the scour coding should be revised.

For new bridges, the MN scour code is obtained from the bridge plans, typically found on the Bridge Survey sheet.

It is the responsibility of the agency with inspection jurisdiction for a bridge to perform scour screenings and evaluations, and to determine the appropriate MN scour code. If a MN scour code is revised BIMU should be notified so that the code (and year of scour evaluation) can be properly updated. The agency with inspection jurisdiction should retain all documentation pertaining to scour screenings, evaluation, and coding.

A Bridge Scour POA is a written document prepared by the bridge owner 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.

For structures that cross a waterway, a cross section survey will be required for all bridges that are scour critical or have experienced scour problems in the past. The survey should be completed once to obtain a reference survey. These surveys should be kept in the bridge file and results compared to future surveys to determine stream degradation and scour.

The following table lists the codes for this item.

NBI ITEM 113	DISPLAY	DESCRIPTION	MN SCOUR CODE
N	NON WATERWAY	Bridge is not over a waterway	A
U	UNKN;EVAL	Scour calculations, evaluation and/or screening have not been made. Bridge on unknown foundations.	G
9	FND ABV WATER	Bridge foundations (including piles) are well above flood water elevations.	H
8	CULVERT	Culvert Structure: Scour calculation, evaluation, and/or screening have not been made.	E
	LOW RISK	Bridge screened, determined to be low risk for failure due to scour.	I
	LIMITED RISK	Bridge screened, determined to be of limited risk to public, monitor in lieu of evaluation and close if necessary.	K
	STBL;ABV WATER	Bridge foundations determined to be stable for calculated scour conditions; calculated scour depth from the scour prediction equations is above top of footing.	M
7	STBL;PROT INPL	Countermeasures have been installed to correct a previously existing problem with scour. Bridge is no longer scour critical. Scour countermeasures should be inspected during routine inspections (when above water of accessible by wading), during underwater inspections, after major flows, or as recommended in the Scour Action Plan. Report any changes that have occurred to countermeasures.	P
6	CLSD;NON SCR	Bridge is closed to traffic for reasons other than scour. Prior to reopening, the bridge must be evaluated for scour and the scour code must be updated.	C
	EVAL REQD	Bridge structure: Scour calculation, evaluation, and/or screening have not been made.	F
	SCOUR SUSCEPT	Bridge screened - determined to be scour susceptible (further evaluation must be completed). All substructure foundations are known.	J
5	STBL;LOW RISK	Scour evaluation complete, bridge judged to be low risk for failure due to scour.	L
	STBL;LIM SCOUR	Bridge foundations determined to be stable for calculated scour conditions; calculated scour depth from the scour prediction equations is within limits of footing or piles.	N
4	STBL;ACT REQD	Bridge foundations determined to be stable for predicted scour conditions; Scour Action Plan requires additional action.	O
3	CRIT; MONITOR	Bridge has been evaluated and is scour critical. Scour Action Plan recommends monitoring the bridge during high flows and closing if necessary.	R
2	SCR;IMM ACT	Bridge is scour critical; field review indicates that extensive scour has occurred at bridge foundations. Immediate action is required to provide scour countermeasures. Note: The scour code is equivalent to a critical deficiency.	D
	CRIT;PROT REQD	Bridge has been evaluated and is scour critical. Scour Action Plan recommends this bridge as a priority for installation of countermeasures. Until countermeasures are installed, monitor bridge during high flows and close if necessary.	U
1	CLSD; SCOUR	Bridge is closed to traffic; field review indicates that failure of piers and/or abutments due to scour is imminent or has occurred.	B

D.7.9.9 Scour Evaluation Year (MnDOT Item)

fe_id: 56 .... Scour Evaluation Year
USERINSP.scour_year

This item indicates the year in which the scour evaluation was performed.

All four digits of the year are to be recorded.

Leave this item blank if NBI Item 38 is coded 'N'

D.7.9.10 Scour Critical Bridges (NBI Item 113)

fe_id: 2011300 .... NBI 113: Scour Critical Bridges
INSPEVNT.scourcrit

This item is very similar to the MN Scour Code (MnDOT Item). Refer to the table in Section D.7.9.8 and code NBI Item 113 based on the MnDOT Scour Code.

D.7.9.11 Scour Action Plan On File (MnDOT Item)

fe_id: 2111425 .... Scour Action Plan on File
USERBRDG.scour_action_plan

This item indicates if a scour plan of action (POA), if applicable, is on file at the agency's office, and filed at BIMU.

CODE	DESCRIPTION
Y	Yes, Plan of Action on file
N	No Plan of Action

MN scour codes that require a POA are G, K, O, P, R, and U.

Leave this item blank if a Scour POA is not required, or if NBI Item 38 is coded 'N'.

D.7.10 STEEL FATIGUE DATA

Fatigue is the process by which a structural component is damaged by repeated tensile or reversal loading, even when that loading is below the allowable design stress. The stress level at which fatigue begins is greatly affected by fabrication defects (such as notches, rough cut edges, or weld inclusions) as well as specific design details.

The number of load cycles that a structural detail can withstand is governed by the stress range (difference between minimum and maximum stress in a load cycle) and the fatigue category of the detail. Several design specs have criteria for design of structures taking fatigue into account, with tables that list various structural details along with a rating from Category A (least susceptible to fatigue) to Category F (most susceptible). These tables can be found in several specs, including AASHTO (LRFD Bridge Design Specifications, Table 6.6.1.2.3-1), AWS (D1.1, Table 2.5) and AISC (Steel Construction Manual, 13th Edition, Table A-3.1).

Research into fatigue cracking over the years has expanded the base of knowledge, and design codes have been updated to reflect this new knowledge. There are many details that were common practice years ago but are no longer used today. However, bridge inspectors must be aware of these details, as they are still present in many bridges.

There are 18 fatigue-prone details that can be found in Minnesota and shall be given special attention during bridge inspections. Note, many of the bridges with fatigue-prone details are not Fracture Critical bridges. Identification of all fatigue-prone details should be done by reviewing the existing plans prior to the inspection. Bridge inspectors should be trained to identify fatigue-prone details in the field and note any additional details that may not be shown in the existing plans. These additional fatigue-prone details may have been due to construction activities during the original construction, or repairs made to the structure.

Fatigue cracks may occur at stress concentrations where the rigidity of the member changes. Examples of such locations include connection details, damaged components, material flaws, changes in a member cross-section, welds, corrosion notched sections or a combination of these features. Common connection details have been identified and have been assigned a fatigue stress category, as presented in AASHTO LRFD Bridge Design Specifications, Table 6.6.1.2.3-1. Category E' details generally have the shortest fatigue life and are most prone to fatigue cracking. Problems associated with these details are often related to weld terminations and weld defects. Tack welds, plug welds, and other welds made in the field are also susceptible to fatigue cracking. The inspection of fatigue-prone details may include non-destructive testing.

The following table and subsections describe all 18 fatigue-prone details.

CODE	DESCRIPTION
1	Transverse Stiffener Web Gap
2	Insufficient Cope radius
3	Partial Length Cover Plate
4	Shelf Plate Welded to Girder Web
5	Stringer of Truss Floorbeam Bracket
6	Welded Horizontal Stiffener
7	Haunch Insert
8	Web Penetration
9	Plug Welded Misplaced Hole
10	Field Welded Splice
11	Pin and Eyebar Truss or Pin and Hanger
12	Lateral Bracing to Girder Bottom Flange
13	Cantilever Floorbeam Bracket
14	Backing Bar
15	Intermittent Weld
16	Tack Weld
17	Tied Arch Floorbeam
18	T1 Steel (A514)

D.7.10.1 Steel Fatigue Detail Ranking (MnDOT Item)

fe_id: 2111427 .... Steel Fatigue Detail Ranking
USERBRDG.fatigue_ranking

Bridges may have more than a single fatigue prone detail type. Add up the ranking of all 18 categories to determine the Steel Fatigue Detail ranking.

D.7.10.2 Transverse Stiffener Web Gap (MnDOT Item)

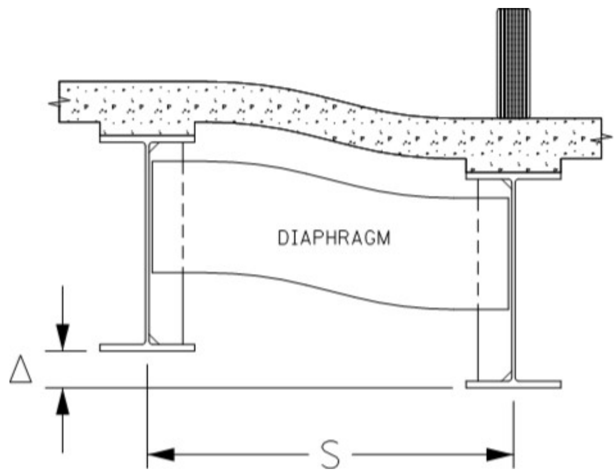
fe_id: 2111428 .... Transverse Stiffener Web Gap
USERBRDG.trans_stiffener_web_gap

Vertical stiffeners for diaphragm attachment to plate girders are not welded to the tension flange of the girder, and have the corners clipped to clear girder flange web welds. The vertical weld to the stiffener web therefore stops short of the flange. Differences in deflection (Δ) between the girders results in the diaphragm "racking", which causes the main girders to twist. High local bending stresses are developed at the ends of the vertical welds.

The following table lists the codes for this item.

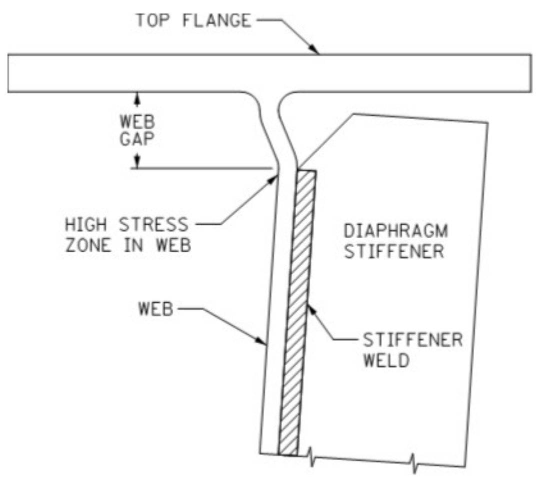
RANK	DESCRIPTION
2	Top flange > 1/2", web gap < 2", L < 80'
2	Top flange > 1/4", web gap < 1", L < 80'
2	Top flange > 1/2", web gap < 2", L < 160', Skew > 40°
2	Top flange > 1/4", web gap < 1", L < 160', Skew > 40°
1	Bottom flange (positive moment region)
1	Other web gap details not described above
0	Not Applicable

See following diagrams.



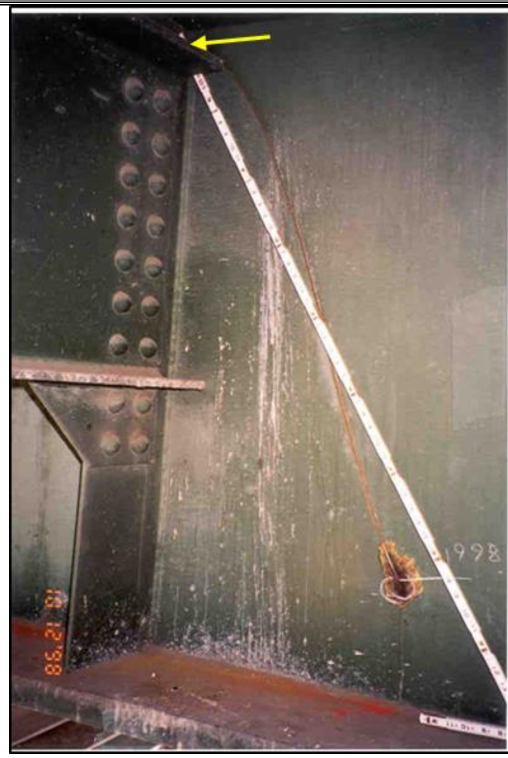
At left: Typical deck cross-section, showing "racking" of diaphragm between main girders under non-uniform loading.

At right: Detail of upper flange, showing distortion leading to cracks at the top of the flange to web stiffener weld.



See following examples.

Transverse Stiffener Web Gap AASHTO Fatigue Category: C' Description: Bridge 9800 (Lafayette): Approach span showing typical web-gap detail.	
Transverse Stiffener Web Gap AASHTO Fatigue Category: C' Description: Bridge 74848 (Owatonna): Showing cracks in stiffener weld (yellow) and the main girder flange-web weld (red, with drilled arresting hole)	

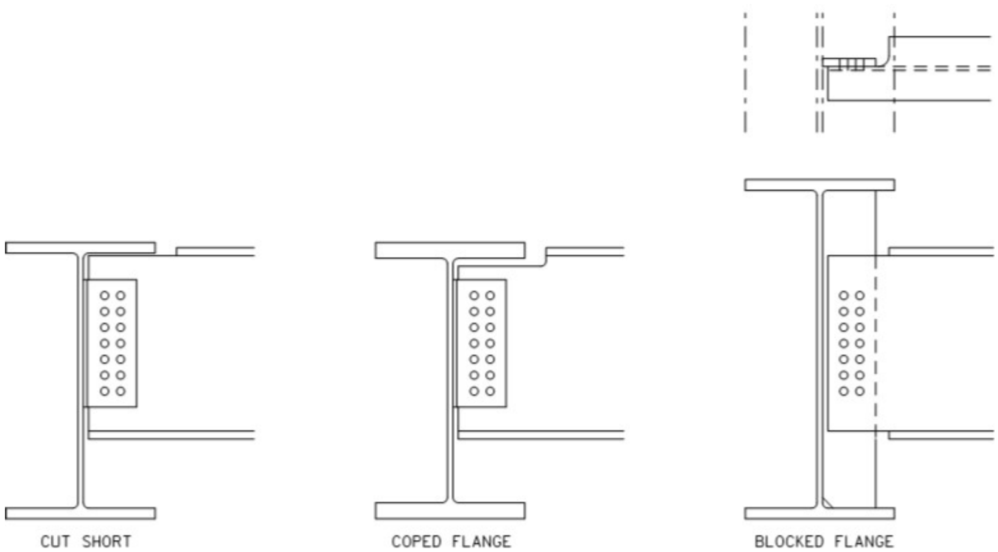
<table>
<tr><td>Transverse Stiffener Web Gap</td><td rowspan="3"></td></tr>
<tr><td>AASHTO Fatigue Category:
C'</td></tr>
<tr><td>Description:
Bridge 9340 (I-35W Minneapolis): Approach span, showing large crack in girder web that initiated from the web gap at the top of the welded stiffener (arrow).</td></tr>
<tr><td>Transverse Stiffener Web Gap</td><td rowspan="3"></td></tr>
<tr><td>AASHTO Fatigue Category:
NA</td></tr>
<tr><td>Description:
Bridge 27R18 (Devil's Triangle): Under construction, showing bolted tab plate detail used in new construction to eliminate web gap distortion.</td></tr>
</table>

D.7.10.3 Insufficient Cope Radius (MnDOT Item)

fe_id: 2111429 .... Insufficient Cope Radius
USERBRDG.insufficient_cope_rdaius_r

When beam flanges are cut or coped to facilitate attachment to another girder, the cut edge is a fatigue-prone detail. Increased sensitivity to fatigue is present if it is flame-cut (causing high residual tensile stresses), has gouges, or has a too small radius. Current design standards call for a minimum 1" radius for normal copes and 2" for copes at hinged joints. A smoothly made cope is AASHTO Fatigue Category C.

RANK	DESCRIPTION
2	**Over-cut or cut short**
1	**Transition radius < 1"**
0	**Transition radius 1" or greater**



Sketches showing various methods of coping beam flanges.

See following examples.

<table>
<tr><td>Insufficient Cope Radius</td><td rowspan="3"></td></tr>
<tr><td>AASHTO Fatigue Category:
C</td></tr>
<tr><td>Description:
Bridge 5895 (Hastings): Showing typical stringer connection to floorbeam with coped top flange. Note generous radius on cope.</td></tr>
<tr><td>Insufficient Cope Radius</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
C</td></tr>
<tr><td>Description:
Bridge 5616 (Renville County): Showing typical stringer connection to floorbeam with rough-cut coped top flange.</td></tr>
<tr><td>Insufficient Cope Radius</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
C</td></tr>
<tr><td>Description:
Bridge 9320 (Dresbach): Eastbound bridge, floorbeam FB18, showing drilled out crack originating from cut short flange.</td></tr>
</table>

Quick Links:
[MN STRUCTURE INVENTORY REPORT (Interactive)] • [INVENTORY ITEMS] • [NBI ITEMS]

Insufficient Cope Radius

AASHTO Fatigue Category: C

Description: Bridge 82815 (Forest Lake): Floorbeam FB9, showing 2" crack originating from cut short flange.

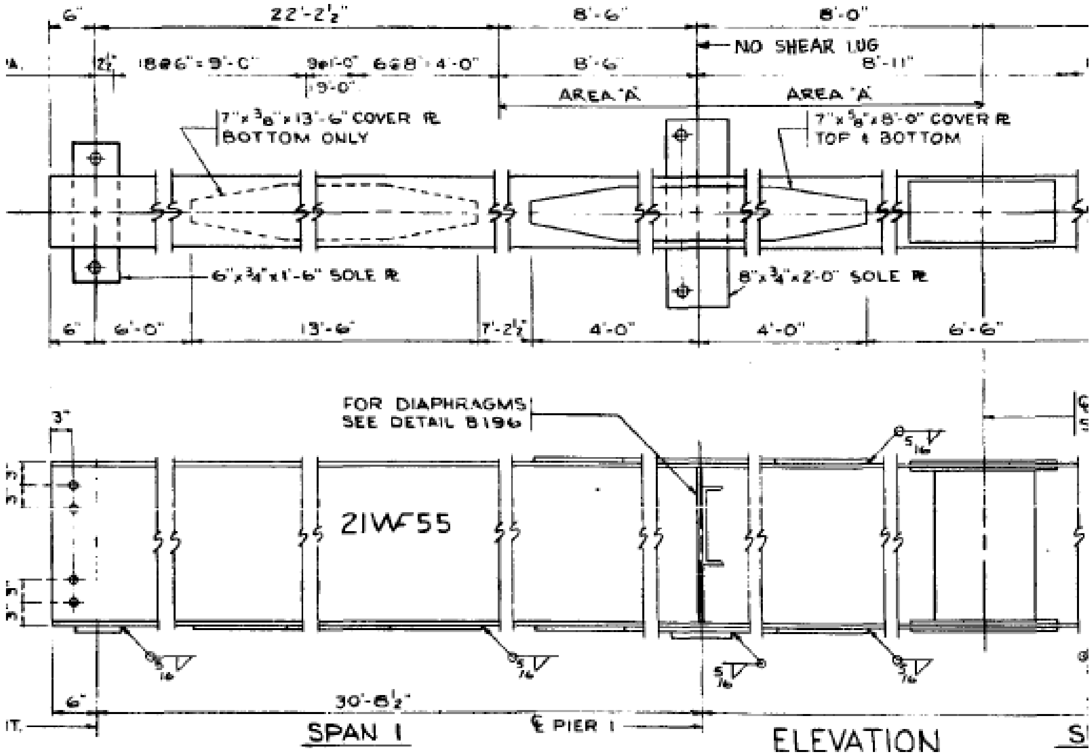
D.7.10.4 Partial Length Cover Plate (MnDOT Item)

fe_id: 2111430 .... Partial Length Cover Plate
USERBRDG.cover_plate_width

Cover plates welded to beam flanges can induce fatigue cracking at the ends of the longitudinal and transverse welds. This is the case whether or not the plates are tapered or if they are welded across the ends. For flange thickness less than or equal to 0.8 inches, the fatigue detail is AASHTO Category E. For flanges thicker than 0.8", the fatigue category is E'.

RANK	DESCRIPTION
3	Flange thickness > 0.8"
3	No end taper, wider than flange, no weld across end
2	No end taper, other cases
1	End taper
0	Not Applicable

See following diagram.



Portion of construction plan for bridge 27967 (Maple Grove), showing rolled beam with welded cover plates on top and bottom flanges. Plates are fillet welded all around, including ends.

See following examples.

Partial Length Cover Plate AASHTO Fatigue Category: B, E, E' Description: Bridge 9059 (Warroad): Cover plates welded to beam flanges with fatigue cracking at the ends of the longitudinal and transverse welds.	
Partial Length Cover Plate AASHTO Fatigue Category: B, E, E' Description: Bridge 7889 (St. Louis County): Welded cover plate on truss floorbeam. Note that cover plate is wider than the beam flange.	

Partial Length Cover Plate AASHTO Fatigue Category: B, E, E' Description: Bridge 7221 (Buyck): UT indication in top girder flange. Location is at end of welded cover plate on top flange (encased in concrete stool and deck).	
Partial Length Cover Plate AASHTO Fatigue Category: B, E, E' Description: Bridge 9276 (TH 36 over Cleveland Ave): Showing drilled-out crack in web. Crack originated at end of welded cover plate on top flange; in line with lower flange cover plate (bolted detail is top flange repair).	

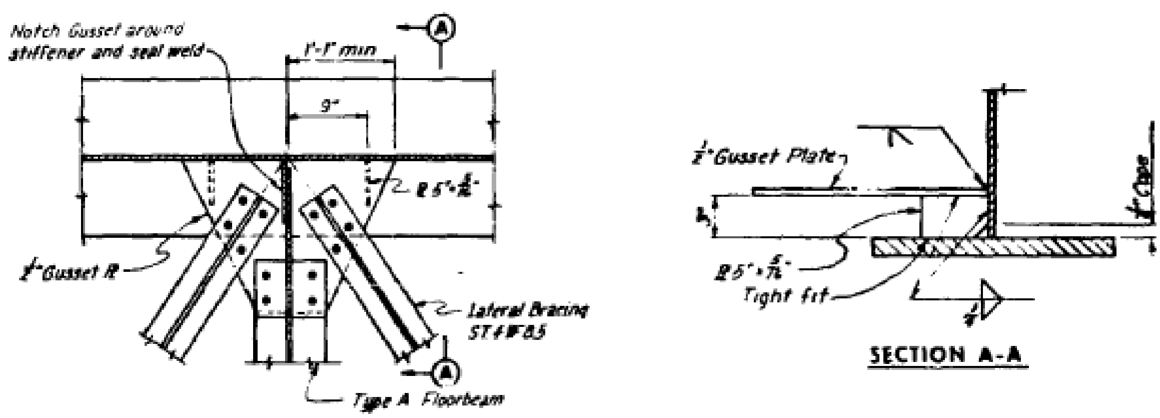
D.7.10.5 Shelf Plate Welded to Girder Web (MnDOT Item)

fe_id: 2111431 .... Shelf Plate Welded to Girder Web
USERBRDG.shelf_plate_welded_2_girderr

Horizontal shelf plates are used to attach lower diagonal bracing to truss panel points or plate girder vertical stiffeners. These can be the originating points for fatigue cracks, both at the ends of the welds and in areas where the weld intersects the vertical stiffener weld on the girder web. Horizontal shelf plates longer than 4 inches are regarded as AASHTO fatigue Category E. This category may be lowered depending on the type of weld used and whether or not there are transition radii at the ends.

RANK	DESCRIPTION
4	Intersecting plate, cope and weld not compliant with MnDOT Std.
3	Intersecting plate, cope and weld compliant with MnDOT Std. (Lp > 12 tp or 4") OR R < 6"
2	Intersecting plate, cope and weld compliant with MnDOT Std. (Lp ≤ 12 tp or 4") AND R ≥ 6"
2	No intersecting plate (Lp > 12 tp or 4") OR R < 6"
1	No intersecting plate (Lp ≤ 12 tp or 4") AND R ≥ 6"
0	Not Applicable

Where:
Lp = Length of horizontal shelf plate along girder web
tp = Thickness of horizontal shelf plate
R = Transition radius at end of shelf plate



Bridge 69825 (Duluth) drawing section, showing horizontal shelf plate welded to girder web at floorbeam locations for attachment of diagonal bracing.

See following examples.

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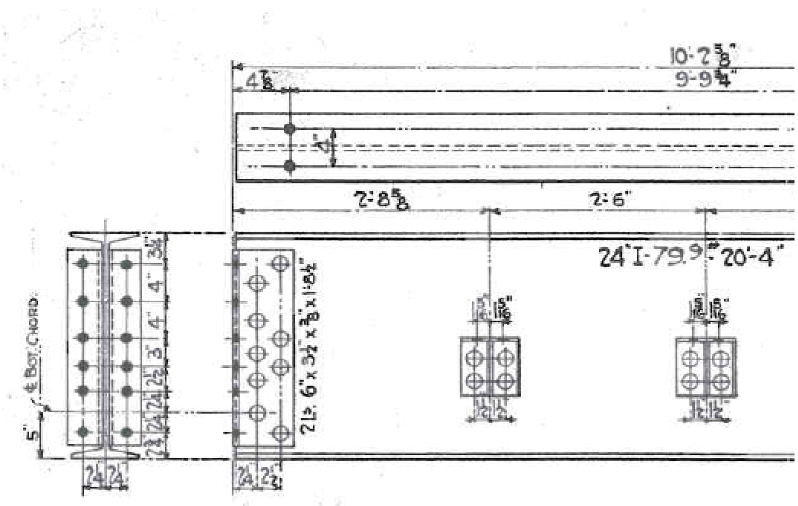
Shelf Plate Welded To Girder Web AASHTO Fatigue Category: C Description: Bridge 69810K (Duluth): Showing horizontal shelf plate and vertical stiffener. Welded intersection has been drilled out to prevent cracking (yellow arrow).	
Shelf Plate Welded To Girder Web AASHTO Fatigue Category: C Description: Bridge 9800 (Lafayette): Showing 1975 web crack in main girder that originated from intersecting welds at the stiffener/shelf plate connection (yellow arrow).	

D.7.10.6 Stringer of Truss Floorbeam Bracket (MnDOT Item)

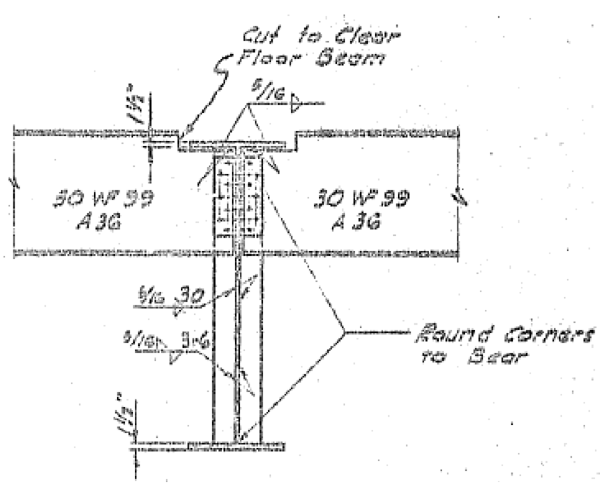
fe_id: 2111432 .... Stringer of Truss Floorbeam Bracket
USERBRDG.stringer_or_truss_floorbeam

Floorbeam connections to trusses, or stringer connections to floorbeams, are often made with angles bolted or riveted to the web. Twisting of this angle from beam loads can cause cracking in the angle.

RANK	DESCRIPTION
3	Floorbeam connection to truss panel point
1	Stringer connection to floorbeam
0	Not Applicable



Floorbeam end connection detail, from M.H.D. Standard Plan for an 80 X 20 foot low truss (1924).



Bridge 9090 (Kennedy – Grand Forks) drawing section, showing stringer to floorbeam connection detail. Note copes cut in stringers (Section 4.2).

See following examples.

Quick Links:
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<table>
<tr><td>Stringer or Truss Floorbeam Bracket</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
B, D</td></tr>
<tr><td>Description:
Bridge 4654 (Stillwater): Showing riveted angle connecting floorbeam FB2 to truss panel point L2N in Span 7.</td></tr>
<tr><td>Stringer or Truss Floorbeam Bracket</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
B, D</td></tr>
<tr><td>Description:
Bridge 5895 (Hastings): Showing angles used to connect floorbeam to truss (left) and stringer to floorbeam (right).</td></tr>
</table>

Stringer or Truss Floorbeam Bracket AASHTO Fatigue Category: B, D Description: Bridge L6116 (Duluth Aerial Lift Bridge): Showing angles used to connect stringers to floorbeams.	
Stringer or Truss Floorbeam Bracket AASHTO Fatigue Category: B, D Description: Bridge 9800 (Lafayette): Showing crack in bolted angle used to connect stringer (left) to floorbeam (right).	

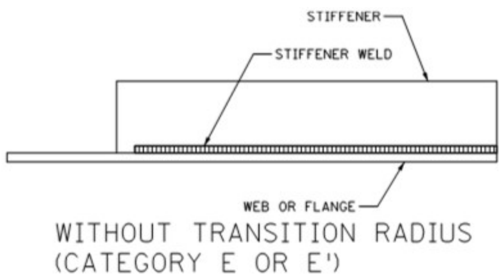
D.7.10.7 Welded Horizontal Stiffener (MnDOT Item)

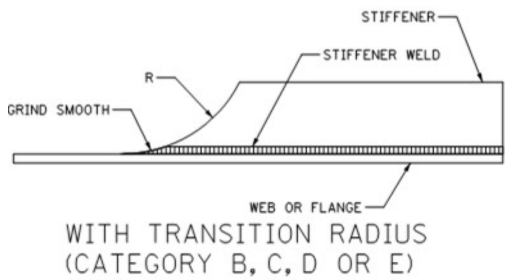
fe_id: 2111433 .... Welded Horizontal Stiffener
USERBRDG.welded_horizontal_stiffenerr

Horizontal stiffeners are used to strengthen the compression zone of the web in deep plate girders. Welded horizontal stiffeners are susceptible to cracking at the ends of the welds. Intermittently welded ("skip-welded") stiffeners are especially prone to cracks. These details are an AASHTO fatigue Category E or E' with no transition radius, and Category B, C, D or E with a transition, depending on the radius. While horizontal stiffeners are only needed in the compression zone of the web, they are often continued into the tensile region for fabrication or architectural reasons.

See following table.

RANK	DESCRIPTION
4	**Continuation through tension zone**
3	**Multiple plates welded end-to-end or vertical stiffener interrupts horizontal stiffener**
3	**Stiffener thickness > 1" and no transition radius at ends**
2	**Transition radius < 2"**
1	**Transition radius ≥ 2"**
0	**Not Applicable**





Geometry of horizontal stiffener terminations with and without transition radius.

See following examples.

Welded Horizontal Stiffener AASHTO Fatigue Category: B, C, D, E, E' Description: Bridge 9800 (Lafayette): Showing top and bottom horizontal stiffeners welded to main girder.	

Welded Horizontal Stiffener AASHTO Fatigue Category: B, C, D, E, E' Description: Bridge 62018 (Lafayette Replacement): Girder in the fabricating shop, showing horizontal stiffener with a 7" transition radius ground smooth.	

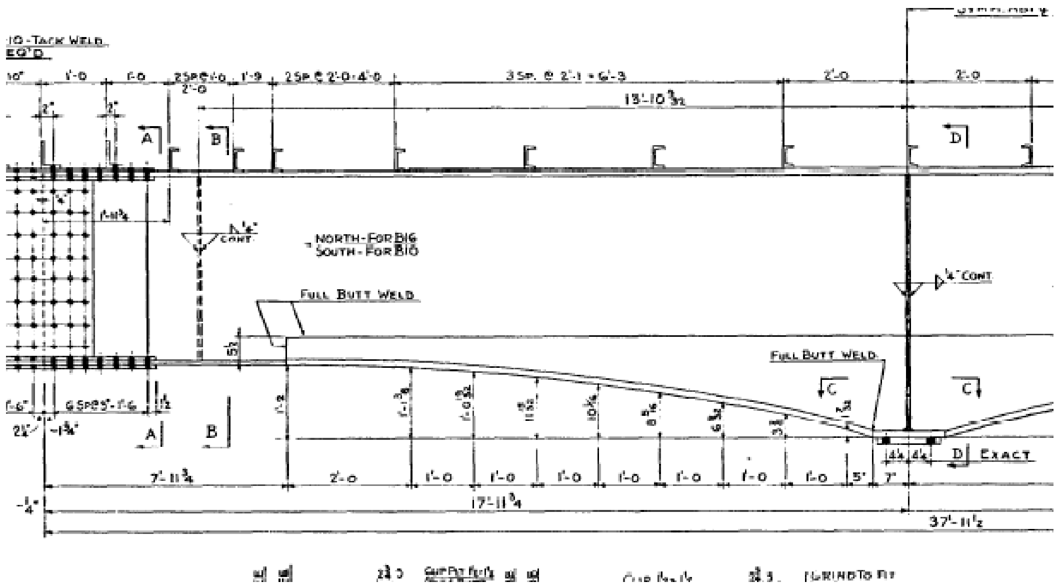
<table>
<tr><td>Welded
Horizontal Stiffener</td><td rowspan="3"></td></tr>
<tr><td>AASHTO Fatigue
Category:
B, C, D, E, E'</td></tr>
<tr><td>Description:
Bridge 9360
(Washington Avenue):
Showing horizontal
stiffeners welded to
lower portion of web.</td></tr>
<tr><td>Welded
Horizontal Stiffener</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue
Category:
B, C, D, E, E'</td></tr>
<tr><td>Description:
Bridge 9320
(Dresbach): Showing
cracked weld between
horizontal stiffener and
girder web at the
intersection with a
vertical stiffener.</td></tr>
</table>

D.7.10.8 Haunch Insert (MnDOT Item)

fe_id: 2111434 .... Haunch Insert
USERBRDG.haunch_insert

To increase girder depth locally at piers on continuous steel structures, the lower flange and part of the web of a rolled beam are sometimes removed and a welded haunch added. This can be a source of fatigue cracking, especially if partial penetration welds are used at the transverse joints.

RANK	DESCRIPTION
3	Transverse partial joint penetration (PJP) welds
2	No transverse partial joint penetration (PJP) welds
0	Not Applicable



Bridge 9790 (I-35 in Pine County) shop drawing, showing a welded haunch added to the W36X170 rolled beam. In this case, the transverse joints have complete penetration welds ("full butt welds"), not partial joint penetration (PJP) welds.

See following examples.

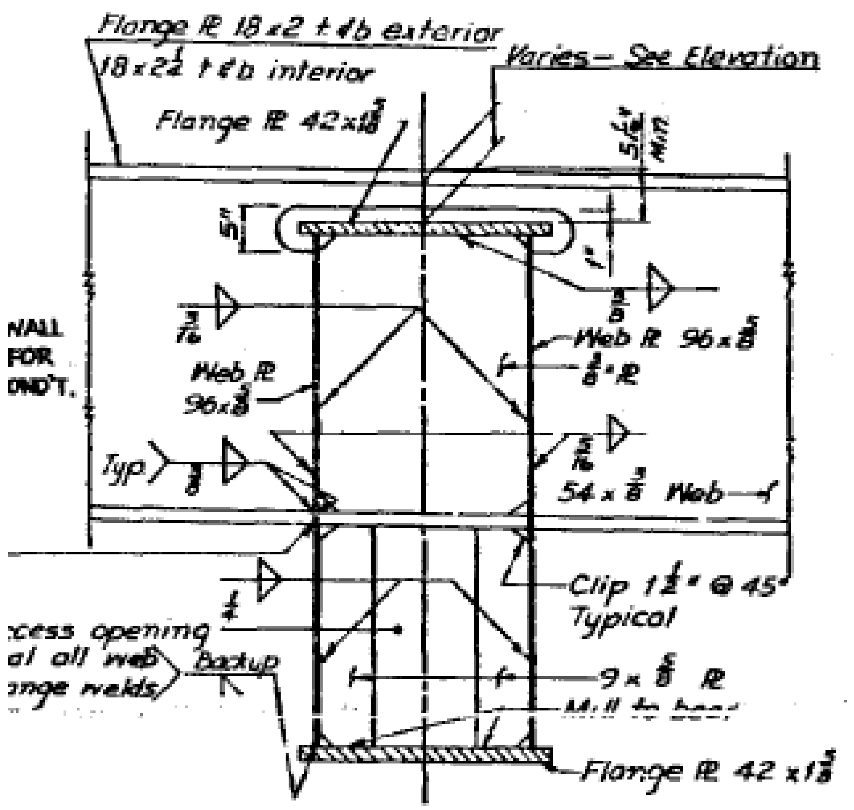
Haunch Insert	
AASHTO Fatigue Category: B, C	
Description: Bridge 6566 (Taylors Falls): Showing welded haunch. Note longitudinal weld (arrow).	
Haunch Insert	
AASHTO Fatigue Category: B, C	
Description: Bridge 6557 (Clearwater): Showing welded haunch. Arrows indicate horizontal weld. Note crack in end transverse weld that has been drilled out (circle)	

D.7.10.9 Web Penetration (MnDOT Item)

fe_id: 2111435 .... Web Penetration
USERBRDG.web_penetration_rank

In structures where girders intersect, such as on bridges with integral pier caps, cracks can sometimes be found in welds near the intersections. This detail also applies to holes cut in the web of a member to allow another member or utility line to pass through, even if they are not connected to each other.

RANK	DESCRIPTION
3	Hole cut in box girder except at pier cap
2	Intersecting girders at pier cap
1	Hole cut in open girder
0	Not Applicable



Bridge 69831 (in Duluth) design plan detail, showing intersection of a plate girder with a steel box integral pier cap. Arrow indicates location of crack shown in Photo 4.8-1.

See following examples.

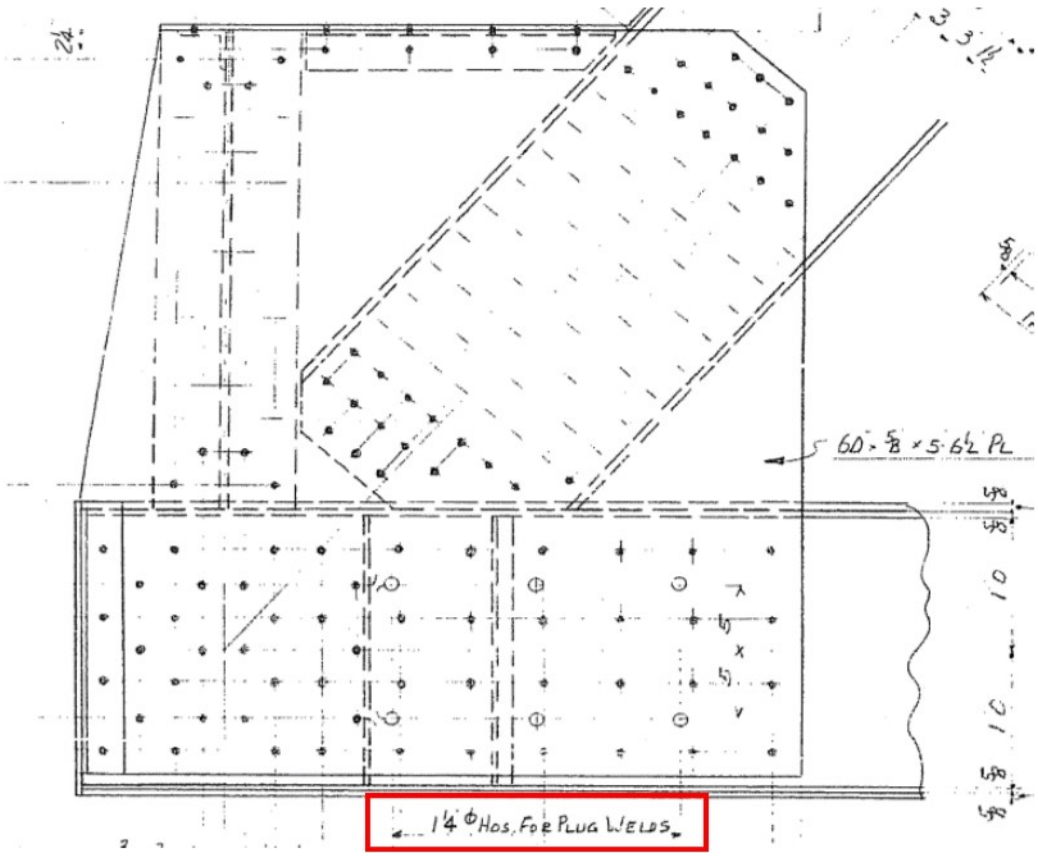
Web Penetration	
AASHTO Fatigue Category: D	
Description: Bridge 69831 (Duluth): Showing cracked stiffener weld at intersection of plate girder with box pier cap	
Web Penetration	
AASHTO Fatigue Category: D	
Description: Bridge 69801C (Duluth): Showing clearance hole in floorbeam web for electrical conduit.	

D.7.10.10 Plug Welded Misplaced Hole (MnDOT Item)

fe_id: 2111436 .... Plug Welded Misplaced Hole
USERBRDG.plug_welded_misplaced_hole_r

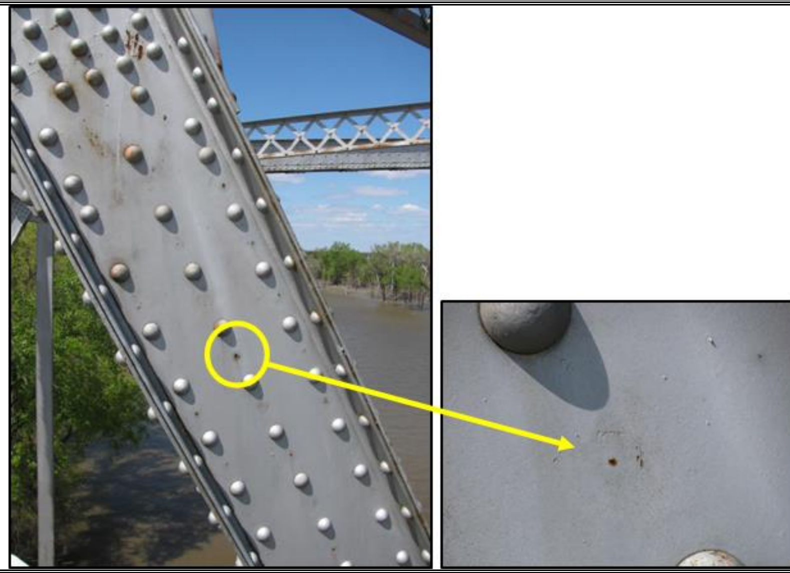
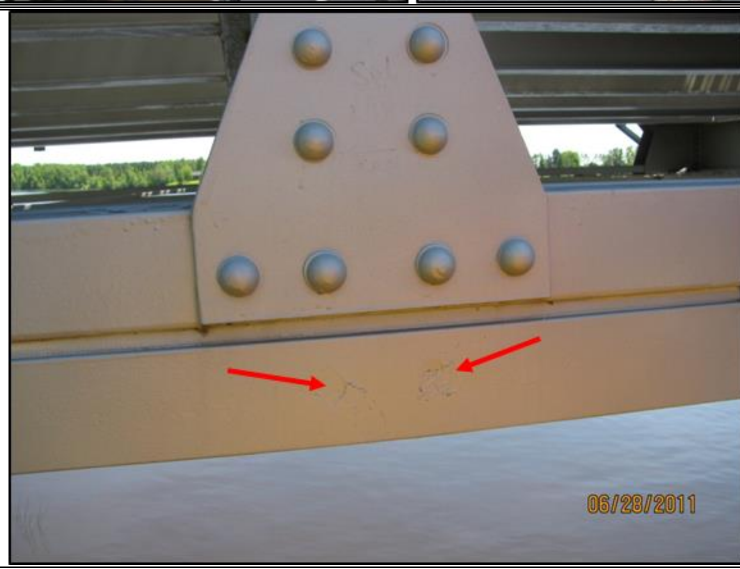
Plug welds, which have been used for structural connections and to repair misdrilled holes, are a poor fatigue detail. Although AASHTO does not show plug welds in their fatigue category tables, the MnDOT Bridge Office has determined that filled holes are an equivalent fatigue Category C. AWS D1.1 assigns fatigue Category E to structural plug welds carrying load.

RANK	DESCRIPTION
4	Misplaced holes filled by plug welding, regardless of location.
0	Not Applicable



Bridge 9090 (Kennedy Bridge in Grand Forks) shop drawing section, showing plug weld callouts for end truss panel point L0.

See following examples.

Plug Welded Misplaced Hole AASHTO Fatigue Category: C, E, F Description: Bridge 6690 (Drayton-Robbin): Showing mis-drilled holes in truss diagonal plate filled with plug welds.	
Plug Welded Misplaced Hole AASHTO Fatigue Category: C, E, F Description: Bridge 9412 (Baudette): Showing plug-welded holes in lower truss chord.	
Plug Welded Misplaced Hole AASHTO Fatigue Category: C, E, F Description: Bridge 9090 (Kennedy-Grand Forks): Showing crack due to poor fusion plug-welded gusset plate L-½.	

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Plug Welded Misplaced Hole	
AASHTO Fatigue Category: C, E, F	
Description: Bridge 9090 (Kennedy-Grand Forks): Showing crack in previous example after grinding out.	

D.7.10.11 Field Welded Splice (MnDOT Item)

fe_id: 2111437 .... Field Welded Splice
USERBRDG.field_welded_splicer

On some local bridges, field splices to floorbeams and other components were made when the bridge was widened. These welds are sometimes poorly made and can result in cracking. Most of these field modifications have little or no documentation.

RANK	DESCRIPTION
4	Field-Welded Splices are present
0	Not Applicable

See following examples.

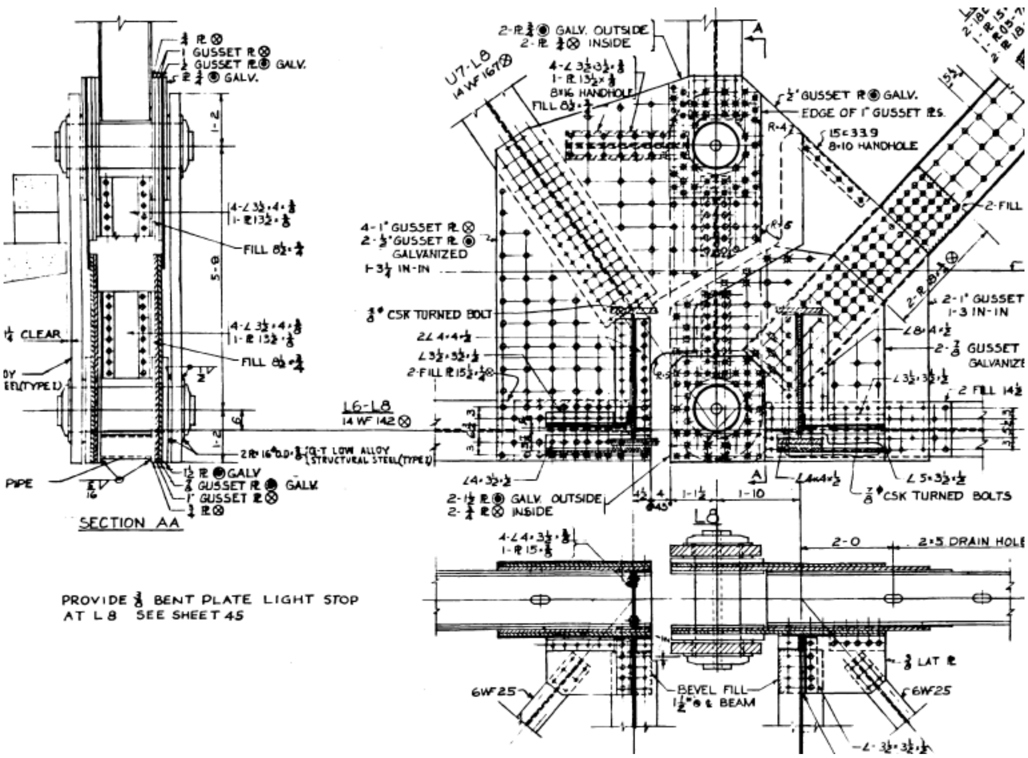
<table>
<tr><td>Field Welded Splice</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
C</td></tr>
<tr><td>Description:
Bridge 7889 (St. Louis County): Showing welded field splice on floorbeam (arrow) as well as field-welded cover plate.</td></tr>
<tr><td>Field Welded Splice</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
C</td></tr>
<tr><td>Description:
Bridge 90856 (Clay County): Showing crack in welded floorbeam field splice.</td></tr>
<tr><td>Field Welded Splice</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
C</td></tr>
<tr><td>Description:
Bridge 90856 (Clay County): Showing crack in field welded stringer bracket.</td></tr>
</table>

D.7.10.12 Pin and Eyebar Truss or Pin and Hanger (MnDOT Item)

fe_id: 2111426 .... Pin and Eyebar Truss or Pin and Hangar
USERBRDG.pin_and_eyeber_truss_rank

Truss bridges that have pin and eyebar tension members, or girder bridges with pin and hanger hinge assemblies, have a high probability of failure if fatigue cracks should develop. These are considered to be AASHTO Fatigue Category E.

RANK	DESCRIPTION
4	Pin and eyebar or Pin/Hanger assemblies are present
0	Not Applicable



Bridge 9040 (in Red Wing) plan section, showing details of the pin and hanger assembly supporting the center cantilevered span.

See following examples.

<table>
<tr><td>Pin and Eyebar Truss or Pin and Hanger</td><td rowspan="3"></td></tr>
<tr><td>AASHTO Fatigue Category:
E</td></tr>
<tr><td>Description:
Bridge 1461 (Amboy): Showing pin and eyebar lower truss chord.</td></tr>
<tr><td>Pin and Eyebar Truss or Pin and Hanger</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
E</td></tr>
<tr><td>Description:
Bridge 9040 (Red Wing): Showing pin and hanger assembly used to support the center span of the truss.</td></tr>
</table>

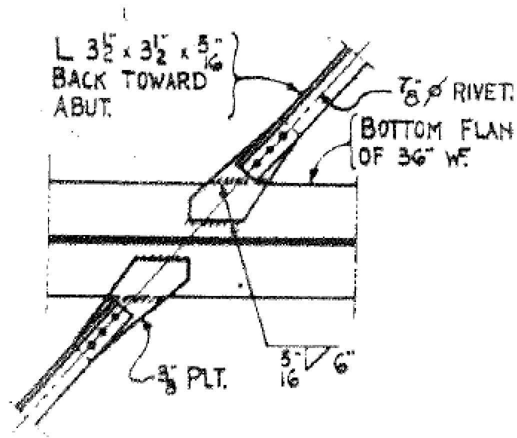
Pin and Eyebar Truss or Pin and Hanger AASHTO Fatigue Category: E Description: Bridge 9320 (Dresbach): Showing pin and hanger hinge joint between girders.	
Pin and Eyebar Truss or Pin and Hanger AASHTO Fatigue Category: E Description: Bridge 9030 (Blatnik): Showing pin and hanger assembly used to connect the main truss span (left) to the South approach span (right).	

D.7.10.13 Lateral Bracing to Girder Bottom Flange (MnDOT Item)

fe_id: 2111438 .... Lateral Bracing to Girder Bottom Flange
USERBRDG.lateral_bracing2girderbotr

Cross bracing or diaphragms welded to the bottom girder flange, instead of connected to a web stiffener, can induce fatigue cracks in the flange. Bridge 9239 is the only Minnesota Trunk Highway bridge known to have this type of detail.

RANK	DESCRIPTION
3	Lateral bracing connected to girder flange
0	Not Applicable



BRACING CONNECTION

Bridge 9239 (in Climax) plan section, showing diagonal bracing welded to girder flange.
Welds are 5/16" fillets parallel to the direction of stress in the flange.

Example.

<table>
<tr><td>Lateral Bracing to Girder Bottom Flange</td><td rowspan="3"></td></tr>
<tr><td>AASHTO Fatigue Category:
B, C, D, E</td></tr>
<tr><td>Description:
Bridge 9239 (Climax): Showing lower lateral bracing connected to bottom girder flanges.</td></tr>
</table>

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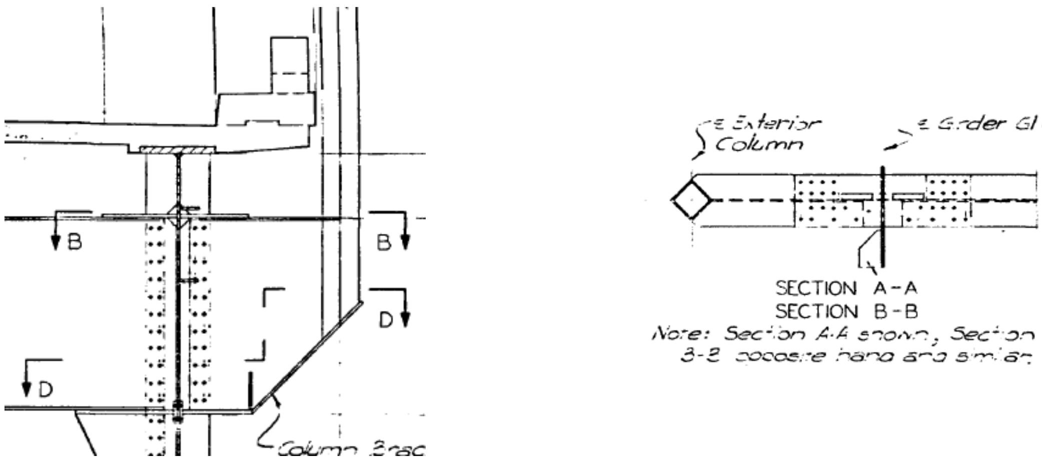
D.7.10.14 Cantilever Floorbeam Bracket (MnDOT Item)

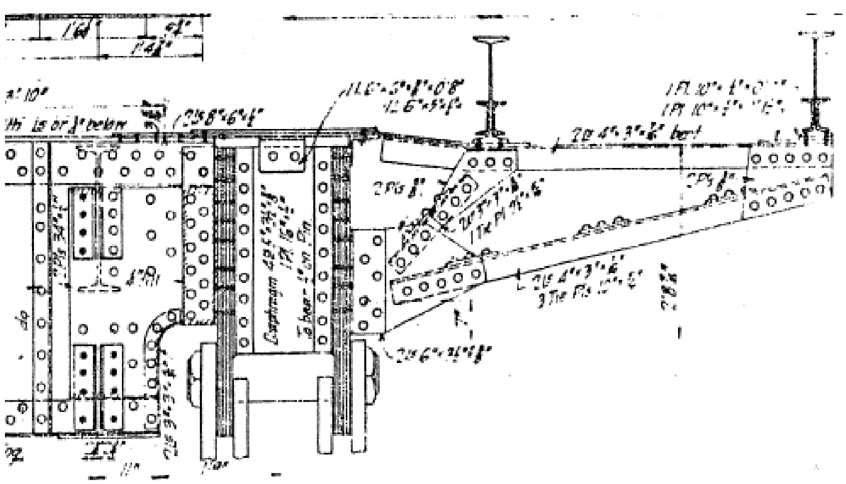
fe_id: 2111439 .... Cantilever Floorbeam Bracket
USERBRDG.cant_floorbeambracketr

This detail consists of a cantilevered bracket outside the fascia girder or truss chord, with a plate connecting the top flanges of the floorbeam and bracket across the top of the main member. These brackets support sidewalks, utilities or other secondary bridge elements. The connecting plate can be riveted, bolted or welded to the floorbeam and bracket flanges.

RANK	DESCRIPTION
3	Plate connecting top flanges of floorbeam and cantilever bracket
0	Not Applicable



Bridge 9360 (Washington Avenue) showing drawing details of cantilever bracket and top flange tie plate.



Bridge 4700 (Sorlie Bridge in Grand Forks) plan section, showing details of cantilever sidewalk bracket with tie plate over truss chord, connected to floorbeam at bearing.

See following examples.

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Cantilever Floorbeam Bracket AASHTO Fatigue Category: B, D Description: Bridge 9360 (Washington Avenue): Showing cantilever brackets supporting upper deck columns.	
Cantilever Floorbeam Bracket AASHTO Fatigue Category: B, D Description: Bridge 4700 (Sorlie): Showing cantilever sidewalk bracket connection at end of truss. Arrow shows top connecting plate.	

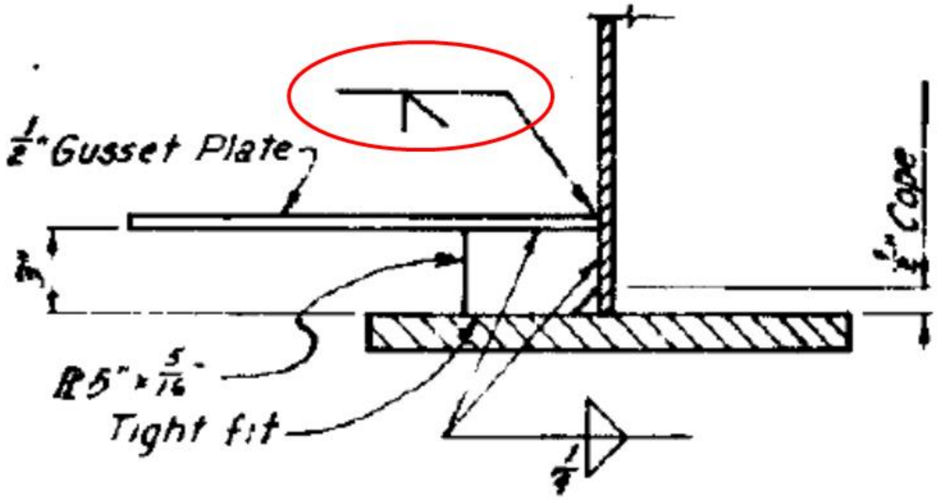
D.7.10.15 Backing Bar (MnDOT Item)

fe_id: 2111440 .... Backing Bar
USERBRDG.backing_bar

When backing bars for complete penetration welds are left in-place or not ground smooth, they can be the source of fatigue crack initiation.

RANK	DESCRIPTION
3	Backing bars left in place and not ground smooth
0	Not Applicable

See following diagram.



Bridge 69824 (in Duluth) drawing detail, showing complete joint penetration (CJP) weld callout for the shelf plate. Although a backing bar is not specifically shown, it must be used for a CJP weld accessible from only one side.

See following examples.

Backing Bar	
AASHTO Fatigue Category: B', C, D, E	
Description: Bridge 69824 (Duluth): Showing horizontal shelf plate assembly with backing bar left in place (arrow).	

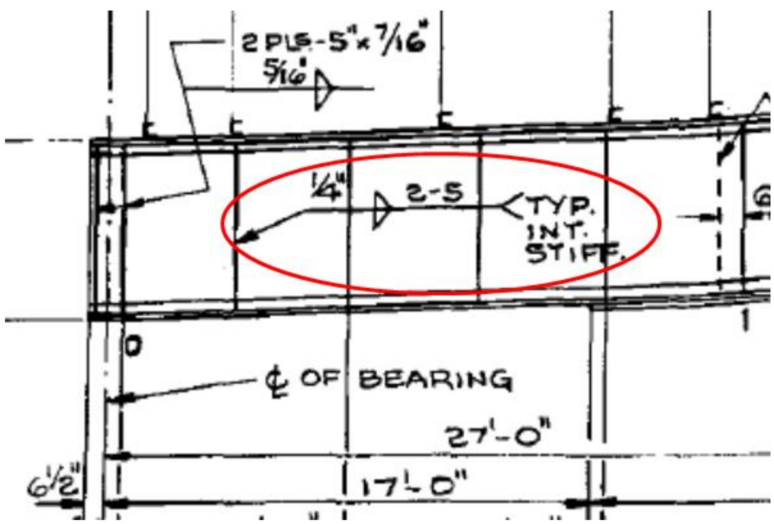
<table>
<tr><td>Backing Bar</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
B', C, D, E</td></tr>
<tr><td>Description:
Bridge 69801C (Duluth): Showing magnetic-particle indication at end of shelf plate. This is not a crack, but rather a gap between the end of the back bar and the girder web.</td></tr>
</table>

D.7.10.16 Intermittent Weld (MnDOT Item)

fe_id: 2111441 .... Intermittent Weld
USERBRDG.intermttent_weld_rank

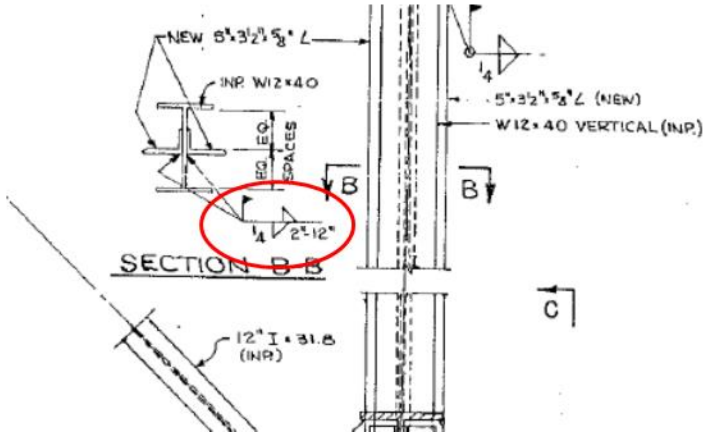
Intermittent, or "stitch" welding, is a poor fatigue detail for structural members. The ends of each weld segment are potential locations for crack initiation.

RANK	DESCRIPTION
3	**Intermittent welding is present**
0	**Not Applicable**



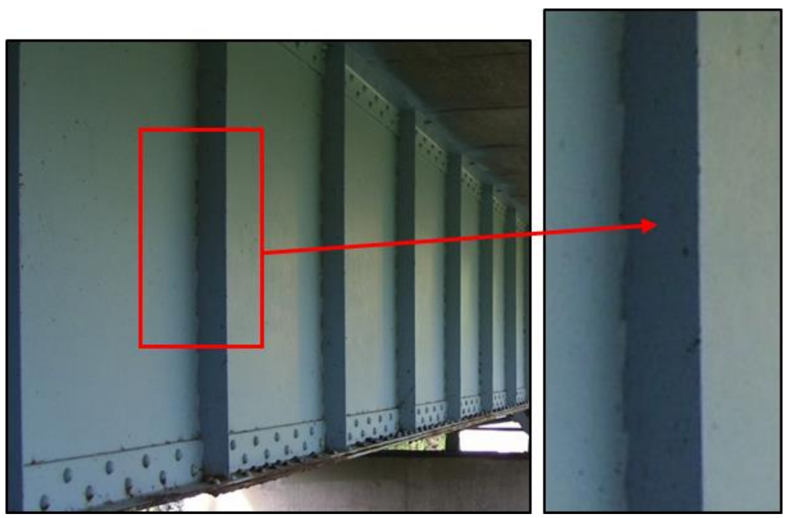
Bridge 6566 (in Taylors Falls) drawing detail, showing intermittent weld callout (1/4" fillet welds, 2" long, spaced 5" apart) for intermediate stiffeners on main girders.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS



Bridge 6646 (in Georgetown) drawing detail, showing intermittent field weld callout (1/4" staggered fillet welds, 2" long, spaced 12" apart) for U1'-L1' reinforcement.

See following examples.

<table>
<tr><td>Intermittent
Weld</td><td rowspan="3"></td></tr>
<tr><td>AASHTO Fatigue
Category:
E</td></tr>
<tr><td>Description:
Bridge 6566 (Taylors Falls): Showing intermittent welds between vertical stiffener and main girder web.</td></tr>
</table>

Intermittent Weld	
AASHTO Fatigue Category: E	
Description: Bridge 6646 (Georgetown): Showing intermittent welds used to reinforce Span 2 vertical member U1'-L1'.	

D.7.10.17 Tack Weld (MnDOT Item)

fe_id: 2111442 .... Tack Weld
USRBRDG.tack_weld_rank

Although not shown on design plans, tack welds were often used to hold structural members and plates together temporarily to align them for riveting. These welds often crack, but do not pose a significant risk unless the crack propagates into the base metal. Tack welds are an equivalent Category E' fatigue detail.

Partially cracked tack welds need to be monitored regularly, as there is a chance the crack may not stay in the weld but instead may spread into the connected members. Once a tack weld is fully cracked, there is little chance of further propagation.

RANK	DESCRIPTION
2	Tack welds are present.
0	Not Applicable

See following examples.

<table>
<tr><td>Tack Weld</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
E'</td></tr>
<tr><td>Description:
Bridge 9040 (Red Wing): Showing partially cracked tack weld between inner gusset plate and lower chord. The end of the crack has been marked for future monitoring.</td></tr>
<tr><td>Tack Weld</td><td rowspan="3"></td></tr>
<tr><td>AASHTO Fatigue Category:
E'</td></tr>
<tr><td>Description:
Bridge 6690 (Drayton-Robbin): Showing close-up of a fully cracked tack weld.</td></tr>
<tr><td>Tack Weld</td><td rowspan="3">
</td></tr>
<tr><td>AASHTO Fatigue Category:
E'</td></tr>
<tr><td>Description:
Bridge 5895 (Hastings): Showing a fully cracked tack weld between a truss gusset plate and lower chord.</td></tr>
</table>

Tack Weld	
AASHTO Fatigue Category: E'	
Description: Bridge 9030 (Blatnik): South approach span, showing a partially cracked tack weld between multiple girder flange plates.	

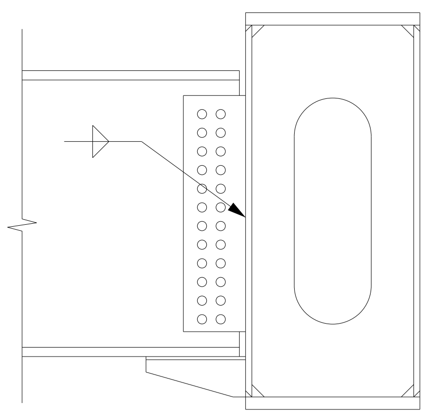
D.7.10.18 Tied Arch Floorbeam (MnDOT Item)

fe_id: 2111443 .... Tied Arch Floorbeam
USERBRDG.tied_arch_floorbeam_rank

Floorbeams connected to tie girders with a bolted/welded shear plate connection, which transfers shear but not moment, have been the source of cracks in the connecting welds. The bridge across the Mississippi River between Prairie du Chien, Wisconsin and Marquette, Iowa has experienced problems with this detail.

There are no bridges in Minnesota with this type of floorbeam/tie girder connection.

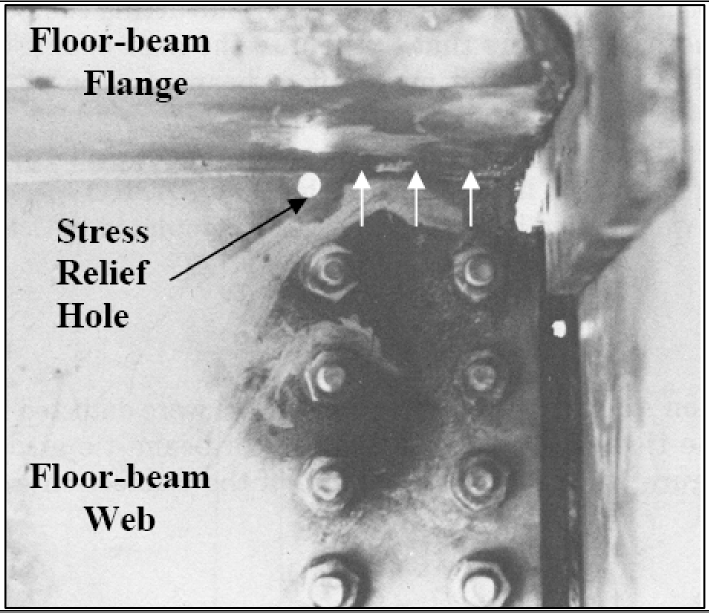
RANK	DESCRIPTION
1	Floorbeam shear connection to tied arch girder web
0	Not Applicable



Typical detail of floorbeam shear connection to tie girder.

See following example:

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

Tied Arch Floorbeam	
AASHTO Fatigue Category: C'	
Description: Cracks in floorbeam/tie girder connection on Prairie du Chien, WI bridge.	

D.7.10.19 T1 Steel (A514) (MnDOT Item)

fe_id: 2111444 .... T1 Steel (A514)
USERBRDG.a514_steel_rank

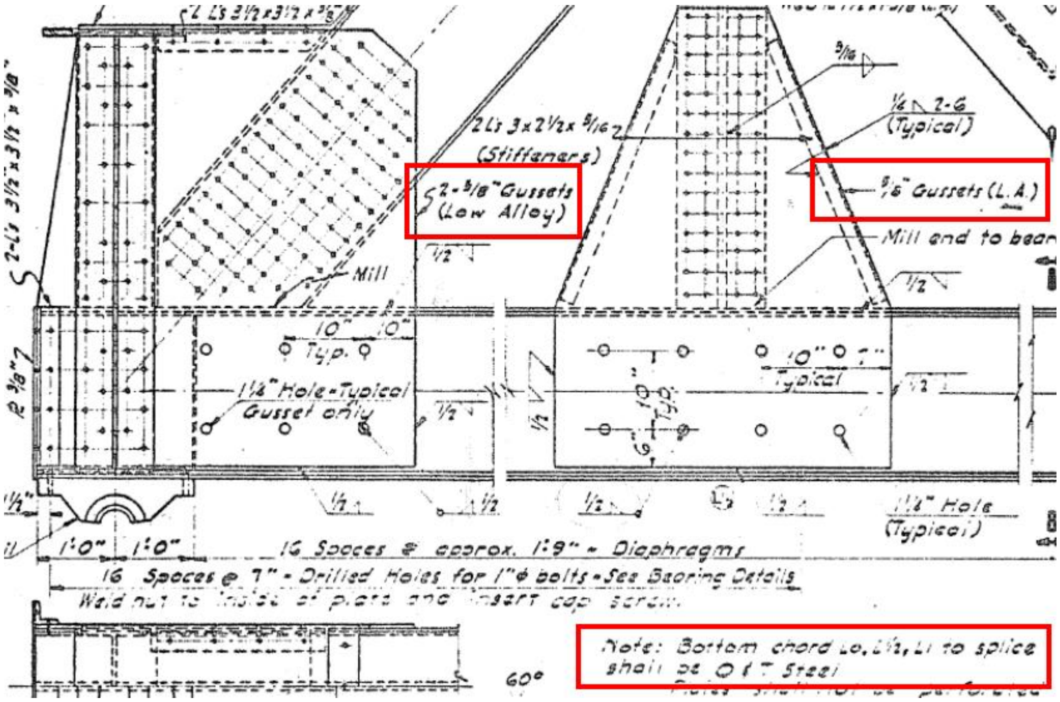
ASTM A-514 (T-1) is a high-strength, quenched and tempered (Q & T) low alloy steel developed in the 1960s. Its high yield strength (100 ksi) was attractive for reducing the weight of structures, but it proved to have low fracture toughness. It was also difficult to weld properly, leading to cracking in joints that were welded without following proper preheat procedures. In Minnesota, the only known bridges using T-1 steel are 9360 (Washington Avenue) and the outer lower chord sections of 9090 (Kennedy Bridge in Grand Forks).

RANK	DESCRIPTION
3	Bridge elements fabricated from A-514 steel
0	Not Applicable

See following diagram.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

See following diagram.



Bridge 9090 (Kennedy Bridge) drawing, showing callout for A514 steel. Bottom text reads: "Note: Bottom Chord L0, L½, L1 to splice shall be Q & T steel." Gusset plate notes refer to "Low Alloy" (L.A.) steel. Note plug weld holes in L0 and L½ gusset plates.

D.7.11 ROADWAY INFORMATION [ON]

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

Tunnels shall be coded only as an under record; that is, they shall not be coded as an on record carrying highway traffic. Note, tunnels are inspected under the National Tunnel Inspection Standards (NTIS).

A separate inventory data record must be maintained for the roadway passing on a structure, as well as individual records for each roadway traveling under a structure. When a highway is not on the structure (i.e. pedestrian and railroad bridges) an inventory data record will be maintained but will have minimal data recorded.

Inventory data for bridges often have more than one inventory sheet. For instance, an overpass bridge will have a separate inventory sheet for the roadway on the bridge, and will have additional inventory sheets for the roadway(s) under the bridge. The Bridge Reports and the SIMS print report have separate pages for each roadway.

Information for the roadway on the structure is entered on the SIA One Column form. Information for the roadway(s) under the structure is entered on the SIA - Additional Roadways form.

This section contains the roadway information for the roadway on the bridge, such as route system and number, roadway function, detour length, or Average Daily Traffic (ADT). See Section D.7.13 for roadway information under the bridge.

D.7.11.1 Bridge Match ID (MnDOT Item)

fe_id: 61 .... Bridge Match ID (TIS)
ROADWAY.userrwkey1

This item allows MnDOT to sequence the roadway records differently than NBI Item 5A for the routes on and under the bridge. MnDOT sequences the roadway records based on a hierarchy level. This allows MnDOT to find the primary route that crosses a structure, either on or under. Priorities are based on the route system.

Vehicular routes are always coded as a number, starting with '1'. Hierarchical order is defined by an ascending sort of the:

- Route System ('01 ISTH', then '02 USTH', then '03 MNTH'…)
- Then Level of Service ('01 mainline', then '02 alternate', then '03 bypass'…)
- Then Route Number (35W, then 94, the 169, etc.)
- The final tie breaker, if all else is equal then NBI 5A coding (1, 2, A, B, C, D, E…)

If the bridge carries a non-vehicular route (i.e., pedestrian, railroad, plaza) over vehicular route(s), the on record must be coded ('P' or 'R' or 'Z') and the under record "bridge match id" must be coded starting with '1' and increasing for every route using the rules above.

If the bridge carries a non-vehicular route (i.e., pedestrian, railroad, plaza) over a non-vehicular (i.e., pedestrian, railroad, plaza), the sole roadway record (on record) "bridge match id" must be coded '1'.

Never code '0'.

Never have two of the same “bridge match ids” on the same bridge.

Examples:

Description	**Code (ON)**	**Code (UNDER)**
TH 28 on the structure with TH 55 under the structure	1	2
CSAH 5 on the structure with I 35E under the structure	2	1
I 35E on the structure with TH 36 and ramps under the structure	1	2 (TH 36) 3 (TH 36 Off-Ramp) 4 (TH 36 On-Ramp)

D.7.11.2 Inventory Route, Record Type (NBI Item 5A)

fe_id: 2000510 .... NBI 5A: Inventory Route: Record Type
ROADWAY.on_under

NBI Item 5A on the SIA One Column form is a one character code ('1'), which indicates the inventory data record refers to a roadway passing on the structure.

CODE	DISPLAY	DESCRIPTION
Route On Structure	1 - ON	Route Carried on the structure

On signifies that the inventory route is carried on the structure. Each bridge structure, whether highway traffic is or isn't carried on the structure, must have a record identified with code '1'. All NBI items must be coded, unless otherwise noted, with respect to the structure and the inventory route on it.

Pedestrian and railroad bridges do not have a Route System or Route Number assigned; and therefore, do not have roadway data to record. Minimal data will be inventoried.

D.7.11.3 Inventory Type, Route Signing Prefix (NBI Item 5B)

fe_id: 2000520 .... NBI 5B: Inventory Route: Route Signing Prefix
ROADWAY.kind_hwy

This item identifies the route signing prefix for the inventory route on the structure. When two or more routes are concurrent, the highest class of route will be used. The hierarchy is in the order listed below.

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)

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.7.11.4 Inventory Route, Designated Level of Service (NBI Item 5C)

fe_id: 2000530 .... NBI 5C: Inventory Route: Designated Level of Service
ROADWAY.levl_srvc

This item identifies the designated level of service for the inventory route on the structure.

CODE	DISPLAY	DESCRIPTION
0	N/A	None of the below
1	MAINLINE	Mainline
2	ALTERNATE	Alternate
3	BYPASS	Bypass
4	SPUR	Spur
6	BUSINESS	Business
7	RAMP/WYE	Ramp or Connector
8	FRONTAGE	Service or Frontage Road

Note: The use of code '5' was eliminated, and therefore is not listed.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.5 Inventory Route, Route Number (NBI Item 5D)

fe_id: 2000540 .... NBI 5D: Inventory Route: Route Number - ROUTE
ROADWAY.routenum

This item identifies the route number, and the directional suffix (when applicable), of the inventory route on the structure. If concurrent routes are of the same hierarchy level, denoted by the route signing prefix, the lowest numbered route shall be coded.

For structures with non-numbered routes record '0'.

Example:

Description	Code
35E	35E

For bridge plans that only label the name of the road, or if the route number is unknown, use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.6 Inventory Route, Directional Suffix (NBI Item 5E)

fe_id: 2000550 .... NBI 5E: Inventory Route: Direction Suffix
ROADWAY.dirsuffix

Minnesota includes the suffix as part of the route number.

Always code this item '0 - Not Applicable'.

D.7.11.7 Direction of Traffic (NBI Item 102)

fe_id: 2010200 .... NBI 102: Direction of Traffic
ROADWAY.trafficdir

This item identifies the direction of traffic of the inventory route on the structure (identified in NBI Item 5 on the SIA One Column). The Minnesota Structure Inventory Report labels this item as "Roadway Type" as opposed to "Direction of Traffic" used in the NBI.

This item must be compatible with other traffic related items such as NBI Item 28A (Lanes On the Structure), NBI Item 29 (Average Daily Traffic), NBI Item 47 (Inventory Route, Total Horizontal Clearance) and NBI Item 51 (Bridge Roadway Width, Curb-to-Curb).

CODE	DISPLAY	DESCRIPTION
0	NOT APPLI	Highway traffic not carried
1	1 WAY TRAF	One-way traffic
2	2 WAY TRAF	Two-way traffic
3	1 LN;2WAY	One lane bridge for 2-way traffic

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.8 MN Roadway Class (MnDOT Item)

fe_id: 2111378 .... MN Roadway Class
USERRWAY.roadway_class_id

This item identifies the roadway classification according to a Minnesota coding system.

CODE	DESCRIPTION
0	No Roadway
1	Two Way Road
2	One Way Road
3	1 Roadway of Divided
4	Divided due to Median
5	Two Way Roadway with Median Obstruction (i.e., pier, barrier, etc.)
6	1 Lane Road; Two Way Traffic

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.9 MN Median Type (MnDOT Item)

fe_id: 2111391 .... Number of Medians
ROADWAY.num_median

This item is similar to NBI Item 33 (Bridge Median); however, MnDOT identifies an additional median type.

CODE	DESCRIPTION
0	No Median
1	Open Median
2	Closed Median with Mountable Curb (No Barrier)
3	Closed Median with Non-Mountable Barrier
4	Depressed Median (Usually Culverts)

See Section D.7.2.20 for information on NBI Item 33 (Bridge Median).

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.10 Median Width (MnDOT Item)

fe_id: 85 .... Median Width
USERRWAY.med_wdth_under

This item indicates the width of the median on the structure, if applicable.

Sections D.7.2.20 and D.7.11.9 (Bridge Median and MN Median Type, respectively) identify the type of median on the structure, if applicable.

This item is used for divided roadways only, regardless if median is depressed, mountable or non-mountable. If the median width is not identified in the bridge plans record '0.0'. This can be verified in the field. Do not make assumptions.

Record the minimum width to a tenth of a foot (truncate, do not round).

Leave this item blank if not applicable.

D.7.11.11 Inventory Route, Minimum Vertical Clearance (NBI Item 10)

fe_id: 2001000 .... NBI 10: Minimum Vertical Clearance
ROADWAY.vclrinv

Code the minimum vertical clearance over the inventory route on the structure. The minimum clearance for a 10 foot wide pavement or traveled part of the roadway where the clearance is the greatest shall be recorded. For structures having multiple openings, clearance for each opening shall be measured, but only the greatest of the "minimum clearances" for the openings shall be recorded, regardless of the direction of travel. This would be the practical maximum clearance.

When no restriction exists, or when the restriction is 98 feet or greater, code '99.9'.

Record to a tenth of a foot (truncate, do not round).

For pedestrian and railroad bridges leave this item blank.

D.7.11.12 Vertical Clearance, NB-EB (MnDOT Item)

fe_id: 3000864 .... MNDOT Minimum Vertical Clearance, NE
USERRWAY.vert_clr_rd1

NB-EB items are coded for each record. SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This item indicates the minimum vertical clearance from the roadway surface on the structure to any obstruction above the roadway. If there is no obstruction above the bridge roadway leave this item blank.

If the route is a one-way, or a two-way highway divided only by the centerline, this item is identical to NBI Item 10 (see Section D.7.11.11) regardless of direction of travel.

If the inventory route is a dual highway (two-way traffic divided by a barrier or by a median with a curb height equal to or greater than 6") record the vertical clearance for NB or EB (increasing reference points) in this field.

Record to the nearest tenth of a foot (always round down).

For pedestrian and railroad bridges leave this item blank.

Examples:

Description	**Code**
14.566	14.5
No Obstruction	Leave Blank

D.7.11.13 Vertical Clearance, SB-WB (MnDOT Item)

fe_id: 3000865 .... MNDOT Minimum Vertical Clearance, SW
USERRWAY.vert_clr_rd2

SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This item indicates the minimum vertical clearance from the roadway surface on the structure to any obstruction above the roadway. If there is no obstruction above the bridge roadway leave this item blank.

This field is only completed for bridges with a dual highway (two-way traffic divided by a barrier or by a median with a curb height equal to or greater than 6"). Record the vertical clearance for SB or WB (decreasing reference points) in this field.

Record to the nearest tenth of a foot (always round down).

For pedestrian and railroad bridges leave this item blank.

Examples:

Description	**Code**
14.566	14.5
No Obstruction	Leave Blank

D.7.11.14 Maximum Vertical Clearance (Over Bridge Roadway), NB-EB (MnDOT Item)

fe_id: 3000870 .... MNDOT Minimum Vertical Clearance OVER Bridge Roadway, NE
USERRWAY.vert_max_clr_rd1

NB-EB items are coded for each record. SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This item identifies the maximum amount of vertical clearance in any ten foot width of the traveled roadway (shoulders excluded) to any obstruction above the roadway. If there is no obstruction above the roadway, leave this field blank.

If the route is a one-way or an undivided two-way highway only the NB-EB field shall be coded regardless of traffic direction.

If the inventory route is a dual highway (two-way traffic divided by a barrier or by a median with a curb height equal to or greater than 6") record the vertical clearance for NB or EB (increasing reference points) in this field.

Record to a tenth of a foot (truncate, do not round).

For pedestrian and railroad bridges leave this item blank.

Examples:

Description	**Code**
14.566	14.5
No Obstruction	99.99

D.7.11.15 Maximum Vertical Clearance (Over Bridge Roadway), SB-WB (MnDOT Item)

fe_id: 3000871 .... MNDOT Minimum Vertical Clearance OVER Bridge Roadway, SW
USERRWAY.vert_max_clr_rd2

SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This field is only completed for bridges with a dual highway (two-way traffic divided by a barrier or by a median with a curb height equal to or greater than 6"). Record the vertical clearance for SB or WB (decreasing reference points) in this field.

Record to the nearest tenth of a foot (always round down).

For pedestrian and railroad bridges leave this item blank.

Examples:

Description	Code
14.566	14.5
No Obstruction	99.99

D.7.11.16 Approach Roadway Width (NBI Item 32)

fe_id: 2003200 .... NBI 32: Approach Roadway Width
ROADWAY.aroadwidth

This item represents the normal width of usable roadway approaching the structure. Usable roadway width will include the width of traffic lanes plus the widths of shoulders

Shoulders are defined as follows:

- 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.

Un-stabilized grass or dirt, with no base course, flush with, and alongside, 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.

For Trunk Highways, this will be the total value of the paved roadway and shoulder widths. For local roads, this will be the total value of the surface and shoulder widths regardless of paving.

Always use the most restrictive lane widths.

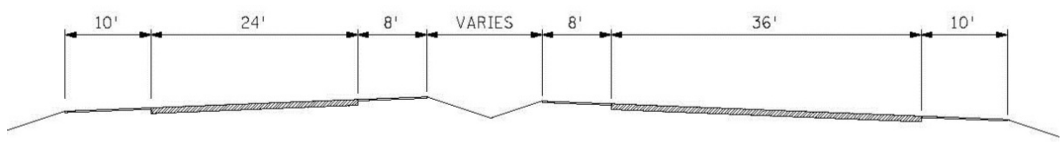
Record to a tenth of a foot (truncate, do not round).

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) ● INVENTORY ITEMS ● NBI ITEMS

Examples.

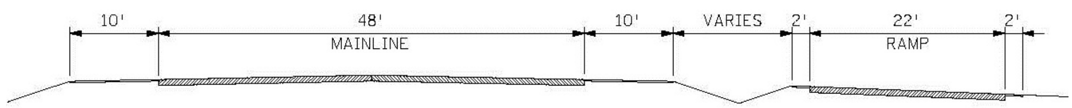
LEFT SHOULDER	LEFT ROADWAY	MEDIAN SHOULDERS	RIGHT ROADWAY	RIGHT SHOULDER	TOTAL WIDTH
4.0	--	--	16.0	6.0	26.0
6.0	--	--	36.0	12.0	54.0
12.0	48.0	30.0	48.0	12.0	150
10.0	24.0	16.0	36.0	10.0	96.0
10.0	48.0	12.0	22.0	2.0	94.0

The example below represents the cross-section for a structure in which the most restrictive approach has a total width of 96.0 feet. See table above.



Regardless of whether the median is open or closed (see Section D.7.2.20), the data coded must be compatible with the other related route and bridge data (i.e., if NBI Item 51 (Bridge Roadway Width, Curb-to-Curb) is for traffic in one direction only, then NBI 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 94.0 feet. See table above.



If bridge plans do not call out dimensions or minimum widths and are only labeled as varies, the width of that lane or shoulder should be counted as '0.0' until it is verified in the field. Do not make assumptions.

D.7.11.17 Bridge Roadway Width, Curb-to-Curb (NBI Item 51)

fe_id: 2005100 .... NBI 51: Bridge Roadway Width, Curb-To-Curb
ROADWAY.roadwidth

The information to be recorded is the most restrictive total minimum distance between curbs or rails on the structure. For structures with closed medians, and usually for double decked structures, the recorded data will be the sum of the most restrictive minimum distances for all roadways carried on the structure. Raised or non-mountable medians, open medians, and barrier widths are excluded from the summation – barrier protected bicycle and equestrian lanes are also excluded.

The data recorded for this item must be compatible with other related route and bridge data (i.e., NBI Items 28, 29, 32, etc.). The measurement should be exclusive of flared areas for ramps.

For flared structures, record the minimum width.

Code '0.0' for all culverts. Exception: Where there is a roadway restriction on the culvert itself, then record the roadway width to the restriction width. This will result in a calculated Deck Geometry appraisal value (numerical) instead of 'N'.

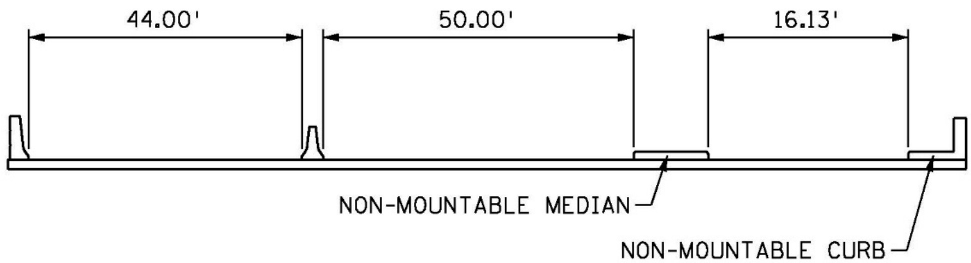
For additional pictorial guidance on coding the roadway width for different scenarios, see illustrations in Section D.7.2.31.

Record to a tenth of a foot (truncate, do not round).

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Example:

Total Roadway Width = 44+50+16.13 = 110.1 ft



D.7.11.18 Roadway Width, Curb-to-Curb (MnDOT Item)

This MnDOT item is similar to NBI Item 51 (Bridge Roadway Width, Curb-to-curb); however, this item allows the recording of each roadway width of a dual highway (two-way traffic divided by a barrier or by a median with a curb height equal to or greater than 6").

See Section D.7.11.17 for additional information on NBI Item 51.

D.7.11.18.1 Roadway Width, NB-EB

fe_id: 3000868 .... MNDOT Bridge Roadway Width, Curb-To-Curb, NE
USERRWAY.rdwy_width_rd1

NB-EB items are coded for each record. SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

If the route is a one-way or an undivided two-way highway only the NB-EB field shall be coded regardless of traffic direction.

If the inventory route is a dual highway (two-way traffic divided by a barrier or by a median with a curb height equal to or greater than 6") the NB or EB (increasing reference points) roadway width (curb-to-curb) shall be recorded in this field.

The width includes shoulders (both paved and non-paved). Median widths (all types) are not included in this measurement.

Record to a tenth of a foot (truncate, do not round).

For pedestrian and railroad bridges leave this item blank.

D.7.11.18.2 Roadway Width, SB-WB

fe_id: 3000869 .... MNDOT Bridge Roadway Width, Curb-To-Curb, SW
USERRWAY.rdwy_width_rd2

SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This field is only completed for bridges with a dual highway (two-way traffic divided by a barrier or by a median with a curb height equal to or greater than 6"). Record the SB or WB (decreasing reference points) roadway width (curb-to-curb) in this field.

The width includes shoulders (both paved and non-paved). Median widths (all types) are not included in this measurement.

Record to a tenth of a foot (truncate, do not round).

For pedestrian and railroad bridges leave this item blank.

D.7.11.19 Inventory Route, Total Horizontal Clearance (NBI Item 47)

fe_id: 2004700 .... NBI 47: Horizontal Clearance
ROADWAY.hclrinv

The total horizontal clearance for the inventory route on the structure (identified in NBI Item 5 on the SIA One Column form) should be measured and recorded. The clearance should be the available clearance measured between the restrictive features – curbs, rails, walls, or other structural features limiting the roadway (surface and shoulders).

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 is defined in two ways; use the most applicable:

- Clear distance between restrictions of the inventory route on the structure.
- Roadway surface and shoulders – when there are no restrictions.

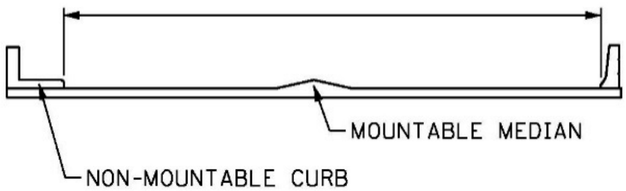
For a divided highway with a raised or non-mountable median, record the greater of the restricted widths in either direction, not both directions.

Minnesota considers curb heights greater than six inches (6") to be a restrictive feature.

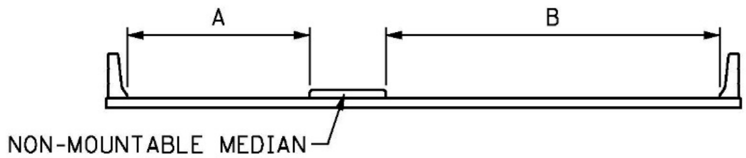
Record this item to a tenth of a foot (truncate, do not round).

Code '99.9' when there isn't an obstruction.

See following diagrams.



NO MEDIAN OR FLUSH OR MOUNTABLE MEDIAN



RAISED MEDIAN OR NON-MOUNTABLE MEDIAN
B > A ITEM 47 = B

If bridge plans do not call out dimensions or minimum widths and are only labeled as varies, the width of that lane or shoulder should be counted as '0.0' until it is verified in the field. Do not make assumptions.

D.7.11.20 Horizontal Clearance, NB-EB (MnDOT Item)

fe_id: 3000866 .... MNDOT Horizontal Clearance, NE
USERRWAY.horz_clr_rd1

NB-EB items are coded for each record. SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

Code this item for all structures with highway traffic on the structure.

For a non-divided highway, only the NB-EB field shall be coded.

For a divided highway, the NB or EB (increasing reference points) routes shall be recorded in this field.

If the roadway is on a bridge, this item identifies the horizontal distance from one railing face to the other. If the roadway is over a culvert, this is the horizontal distance between obstructions.

Record to a tenth of a foot (truncate, do not round).

Code '99.99' when there aren't any obstructions.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Examples:

Description	Code
29'- 5"	29.4
No Obstruction	99.99

D.7.11.21 Horizontal Clearance, SB-WB (MnDOT Item)

fe_id: 3000867 .... MNDOT Horizontal Clearance, SW
USERRWAY.horz_clr_rd2

SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This field is only completed for bridges that carry a divided highway on the structure.

For a divided highway, the SB or WB (decreasing reference points) routes shall be recorded in this field.

If the roadway is on a bridge, this item identifies the horizontal distance from one railing face to the other. If the roadway is over a culvert, this is the horizontal distance between obstructions.

Record to a tenth of a foot (truncate, do not round).

Code '99.99' when there aren't any obstructions.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Examples:

Description	Code
29'- 5"	29.4
No Obstruction	99.99

D.7.11.22 Mile Point (NBI Item 11)

fe_id: 2001101 .... NBI 11: Milepoint
ROADWAY.kmpost

This item is not used by MnDOT. Code '0.000' as a default.

D.7.11.23 Bypass, Detour Length (NBI Item 19)

fe_id: 2001900 .... NBI 19: Bypass Detour Length
ROADWAY.bypasslen

This item represents the detour length and should represent the total additional travel required for a vehicle which would result from closure of the bridge. The detour route will be established following allowable criteria determined by the governing authority. Some roadway authorities will not allow a designated detour over a road or structure of lesser "quality".

For Interstate, US and MN Trunk Highway detours – detour only on roadways equal to or greater, if at all possible, than the roadway in question.

Record to the nearest mile.

If a ground level bypass is available at the structure site for the inventory route, record and code the detour length as '0'. 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 the bridge is one of twin bridges and is not at an interchange, code '0' where the other twin bridge can be used as a temporary bypass with a reasonable amount of crossover grading.

A structure located on a dead end with no possible detour should be entered as 123. (123 miles converts to 199 kilometers.)

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Example:

Condition	**Code**
Diamond interchange, structure bypassable	0
Cloverleaf, not bypassable; 11.4 mile detour	11
Structure over river; 76 mile, or more, detour	76
Structure over highway, no interchange, bypass available at ground level	0
Structure on dead end road	123

D.7.11.24 Toll (NBI Item 20)

fe_id: 2002000 .... NBI 20: Toll
ROADWAY.tollfac

This item indicates if the structure is a toll bridge (or if it's located on a toll road).

Minnesota bridges are coded '1' or '3', with the vast majority coded '3'.

CODE	DESCRIPTION
1	Toll Bridge (not on a toll road) - tolls are paid specifically to use the structure
2	On Toll Road (the structure carries a toll road) - toll includes the highway & 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
5	Toll Bridge under Secretarial Agreement (separate from the highway segment)

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.

D.7.11.25 Functional Classification of Inventory Route (NBI Item 26)

fe_id: 2002600 .... NBI 26: Functional Classification of Inventory Route
ROADWAY.funcclass

This item indicates the functional classification of the inventory route on the structure.

The bridge 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.

CODE	DISPLAY	DESCRIPTION
RURAL		
01	RUR/PR ART ISTH	Principal Arterial - Interstate
02	RUR/PR ART OTH	Principal Arterial - Other
06	RUR/MINOR ART	Minor Arterial
07	RUR/MAJOR COLL	Major Collector
08	RUR/MINOR COLL	Minor Collector
09	RURAL LOCAL	Local
URBAN		
11	URB/PR ART ISTH	Principal Arterial - Interstate
12	URB/PR ART FRWAY	Principal Arterial - Other Freeways or Expressways
14	URB/OTH PR ART	Other Principal Arterial
16	URB/MINOR ART	Minor Arterial
17	URB COLL	Collector
19	URBAN LOCAL	Local

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section **D.8**.

D.7.11.26 Base Highway Network (NBI Item 12)

fe_id: 2001200 .... NBI 12: Base Highway Network
ROADWAY.onbasenet

For the inventory route identified in NBI 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**

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.

See Section D.7.11.25 to determine the Functional Classification of the bridge to help identify this item.

The Base Network is '0 - Inventory Route is not on the Base Network' if the Functional Classification is any of the following:

- 07 - Rural - Major Collector
- 08 - Rural - Minor Collector
- 09 - Rural - Local
- 16 - Urban - Minor Arterial
- 17 - Urban - Collector
- 19 - Urban - Local

The Base Network is '1 - Inventory Route is on the Base Network' if the Functional Classification is any of the following:

- 01 - Rural - Principal Arterial - Interstate
- 02 - Rural - Principal Arterial - Other
- 06 - Rural - Minor Arterial
- 11 - Urban - Principal Arterial - Interstate
- 12 - Urban - Principal Arterial - Other Freeway or Expressway
- 14 - Urban - Other Principal Arterial

This item is coded '0' when a highway is not on the structure (i.e. pedestrian and railroad bridges).

See following examples.

Functional Classification	Code
Mainline of a 12 - Urban Principal Arterial	1
Ramp of a 14 - Urban Other Principal Arterial	0
Mainline of CSAH 1	0

D.7.11.27 On - Off System (MnDOT Item)

fe_id: 88 .... On Off System
BRIDGE.on_off_sys

This item is used to help determine applicable policies, costs, and for reporting results. This item specifies whether the structure is on or off system based on NBI Item 26 (Functional Classification of Inventory Route). See Section D.7.11.25 for a list of Functional Classifications.

The following table lists the codes for this item.

CODE	DESCRIPTION	NBI ITEM 26
0	OFF	08, 09, 19
1	ON	01, 02, 06, 07, 11, 12, 14, 16, 17

This item shall be coded '0' when traffic lanes are not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.28 Traffic Sequence Number (MnDOT Item)

fe_id: 2111358 .... Traffic Sequence Number
ROADWAY.userrwkey2

This field allows the import of ADT data from another MnDOT office directly without looking it up manually. This field should be coded for the following route systems.

- ISTH – Interstate Trunk Highway
- USTH – U.S. Trunk Highway
- MNTH – Minnesota Trunk Highway
- CSAH – County State-Aid Highway
- MSAS – Municipal State-Aid Street
- CNTY – County Road

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.29 Average Daily Traffic (NBI Item 29)

fe_id: 2002900 .... NBI 29: Average Daily Traffic (ADT)
ROADWAY.adttotal

This item indicates the ADT volume for the roadway traveling on the structure. This should be the most recent ADT count available, and should include the truck traffic referred to in Section D.7.11.37 (Average Daily Truck Traffic). Trunk Highway routes are updated every other year and local roads are recommended to be updated every five years.

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: when NBI Item 28A (Lanes On the Structure) and NBI Item 51 (Bridge Roadway Width, Curb-to-Curb) are coded for each bridge separately, then the ADT must be coded for each bridge separately (i.e., half of the total ADT for the route).

If the roadway is closed, code the last ADT from before the closure occurred.

Leave this item blank when a highway is not carried on the structure (i.e., pedestrian and railroad bridges).

ADT information can be found using the MnDOT GIS Base Map. Always use the ADT given by the GIS Tool, unless the plan provides more recent ADT information. This information is not always available for smaller roadways (i.e., township routes, municipal routes, etc.). When the ADT cannot be found using the GIS map, and is not provided on the plan, this information must be requested from the agency. Code '1' until the ADT is provided by the agency.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.30 Year of Average Daily Traffic (NBI Item 30)

fe_id: 2003000 .... NBI 30: Year of ADT
ROADWAY.adtyear

This item records the year in which NBI Item 29 (Average Daily Traffic) was calculated.

Leave this item blank when a highway is not carried on the structure (i.e., pedestrian and railroad bridges).

The ADT year can be found using the MnDOT GIS Base Map. If the GIS tool does not provide this information record the year built (shown on the bridge nameplate) as the ADT year.

All four digits of the year are to be recorded.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.31 Future Average Daily Traffic (NBI Item 114)

fe_id: 2011400 .... NBI 114: Future Average Daily Traffic
ROADWAY.adtfuture

This item identifies the forecasted ADT for the inventory route on the structure (NBI Item 5 identified on the SIA One Column). This shall be projected at least 17 years but no more than 22 years from the year of inspection. 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: when NBI Item 28A (Lanes On the

Structure) and NBI 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 (i.e., half of the total for the route).

The GIS doesn't provide Future ADT. If future ADT information is not provided on the bridge plans, use the same value recorded for NBI Item 29 (Average Daily Traffic) in Section D.7.11.29.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.32 Year of Future Average Daily Traffic (NBI Item115)

fe_id: 2011500 .... NBI 115: Year of Future Average Daily Traffic
ROADWAY.adtfutyear

This item identifies the year for which the ADT in NBI Item 114 was forecasted. This shall be projected at least 17 years but should be no more than 22 years from the year of inspection.

MnDOT practice for new bridges is to add 18 years to the current year the bridge was inventoried.

All four digits of the year are to be recorded.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.33 LRS Inventory Route, Subroute Number (NBI Items 13A & 13B)

fe_id: 2001310 .... NBI 13A: Linear Reference System (LRS) - Inventory Route
ROADWAY.lrsinvrt
fe_id: 2001320 .... NBI 13B: Linear Reference System (LRS) - Subroute Number
ROADWAY.subrtnum

These items are not currently used by MnDOT. Reserved for future use.

Code NBI Item 13A as '0'. Code NBI Item 13B as '00'.

The following is for for **INFORMATIONAL USE ONLY**. FHWA usage:
If NBI Item 12 (Base Highway Network) is coded '1', the information to be recorded for this item is inventory route for the State's LRS. If NBI Item 12 has been coded '0', this entire item should be coded '0'. 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 Highway Performance Monitoring System (HPMS).

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

The 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.

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 sections 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:

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

D.7.11.34 STRAHNET Highway Designation (NBI Item 100)

fe_id: 2010000 .... NBI 100: STRAHNET Highway Designation
ROADWAY.defhwy

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

A STRAHNET is a national system of Interstate and primary highways and connectors that are important to the United States' strategic defense policy and which provide defense access, continuity and emergency capabilities for defense purposes. The STRAHNET Connectors are highways which provide access between major military installations and highways which are part of the Strategic Highway Network.

The STRAHNET is determined by the Surface Deployment and Distribution Command (SDDC – previously the Military Traffic Management Command, MTMC) in coordination with FHWA. FHWA provides data on the SDDC from the NBI regarding clearances, sufficiency ratings, condition, and load carrying capabilities on these routes. A STRAHNET map of Minnesota is available at: https://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/minnesota/mn_minnesota.pdf.

The following table lists the codes for this item.

CODE	DESCRIPTION
0	The inventory route is not on a STRAHNET route
1	The inventory route is on an Interstate STRAHNET
2	The inventory route is on a Non-Interstate STRAHNET route
3	The inventory route is on a STRAGHNET connector route

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.35 Highway System of the Inventory Route (NBI Item 104)

fe_id: 2010400 .... NBI 104: Highway System of the Inventory Route
ROADWAY.nhs_ind

For the inventory route on the structure (NBI Item 5 identified on the SIA One Column), indicate whether the inventory route is on or off the NHS. Initially, this code shall reflect an inventory route on the NHS "Interim System" description in Section 1006(a) of the 1991 ISTEA (Intermodal Surface Transportation Efficiency ACT). Upon approval of the NHS by Congress, the coding is to reflect the approved NHS.

The National Highway System consists of roadways important to the nation's economy, defense, and mobility. The NHS includes the following subsystems of roadways:

- Interstate
- Other Principal Arterials: This includes highways in rural and urban areas which provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facility
- STRAHNET: This is a network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity and emergency capabilities for defense purposes
- Major Strategic Highway Network Connectors: These are highways which provide access between major military installations and highways which are part of the Strategic Highway Network
- Intermodal Connectors: These highways provide access between major intermodal facilities and the other four subsystems making up the National Highway System.

The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
0	OFF	Inventory Route is not on the NHS
1	ON	Inventory Route is on the NHS

Do not leave this item blank. Railroad or pedestrian bridges should be coded ‘0’.

D.7.11.36 Federal Lands Highways (NBI Item 105)

fe_id: 2010500 .... NBI 105: Federal Lands Highway
ROADWAY.fedlandhwy

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

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.37 Average Daily Truck Traffic (NBI Item 109)

fe_id: 2010900 .... NBI 109: Average Daily Truck Traffic
ROADWAY.truckpct

This item represents the heavy commercial average daily truck traffic volume (HCADT) on the roadway traveling on the structure.

This does not include vans, pickup trucks, or light delivery trucks. If this information is not available, an estimate which represents the average percentage for the category of road carried on the structure may be used.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

HCADT information can be found using the MnDOT GIS Base Map for Trunk Highway bridges only. Always use the HCADT given by the GIS Tool, unless the plan provides more recent HCADT information.

This item may be left blank if NBI Item 29 (Average Daily Traffic) is less than 100, not identified on the bridge plans, and/or not available in the GIS Tool.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.38 Designated National Network (NBI Item 110)

fe_id: 2011000 .... NBI 110: Designated National Network
ROADWAY.trucknet

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 on the structure (NBI Item 5 identified on the SIA One Column), 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**

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.39 Inter Reg Corridor (MnDOT Item)

fe_id: 2111375 .... Inter Reg Corridor
BrM field not available at this time.

Leave this item blank. Reserved for future use.

D.7.11.40 Interchange Element (MnDOT Item)

fe_id: 2111399 .... Interchange Element
USERRWAY.interchange_ele

When a structure is part of a complex interchange (i.e., not a grade crossing) then this field should be coded. Each complex interchange has a unique identifier. The identifier can be a three digit numeric code or a letter followed by two numbers.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

D.7.11.41 Control Section (TH Only) (MnDOT Item)

fe_id: 67 .... Control Section (TH Only)
USERRWAY.control_section

This item is recorded only for bridges on the Minnesota State Trunk Highway system. Leave this item blank for bridges on the Local system, or if not applicable.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

A control section is usually relatively small contiguous sections of roadway tied together for MnDOT maintenance and construction purposes.

A two digit roadway section identifier is recorded for this item. The SIMS print report and Bridge Reports display the control section with four digits – the two digit roadway section identifier preceded by the two digit Minnesota county number. Each roadway section identifier, with its associated county number, identifies a portion of the Minnesota Trunk Highway system.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.42 Road Name (MnDOT Item)

fe_id: 64 .... Roadway Name or Description
ROADWAY.roadway_name

This item identifies the name of the roadway on the structure. Use the formal or '911' street name whenever possible.

This field has a maximum limitation of 33 characters. Uppercase letters are required for all alpha-characters. Do not use apostrophes (') or ampersands (&).

D.7.11.43 Route System (TIS) (MnDOT Item)

fe_id: 3002096 .... Bridge Route System
USERRWAY.bdg_route_sys_id

This item identifies the route system of the roadway according to the Minnesota coding system. In situations where two or more routes are concurrent, the highest class of route will be used.

The following table lists the codes for this item. Hierarchy is in the order listed.

CODE	SIMS DISPLAY	DESCRIPTION
01	ISTH	Interstate Trunk Highway
02	USTH	U.S. Trunk Highway
03	MNTH	Minnesota Trunk Highway
04	CSAH	County State-Aid Highway
05	MSAS	Municipal State-Aid Street
06	CMSA	County-Municipal State-Aid Street
07	CNTY	County Road
08	TWNS	Township Road
09	UTWN	Unorganized Township Road
10	MUN	City Street
11	NATP	National Park Road
12	NFD	National Forest Development Road
13	IND	Indian Reservation Road
14	SFR	State Forest Road
15	SPRK	State Park Road
16	MIL	Military Road
17	NATM	National Monument Road
18	NATW	National Wildlife Refuge Road
19	FRNT	Frontage Road
20	SGAM	State Game Preserve Road
22	RAMP	Ramp or Leg
23	PRIV	Private Jurisdiction Road

This item is similar to NBI Item 5B (see Section D.7.11.3); however, MnDOT's coding system provides additional route designations.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.44 Route Number (TIS) (MnDOT Item)

fe_id: 2111395 .... MN Route Number
USERRWAY.route_nb

This field is filled in with the following data entry mask: AAAABBBB.

The AAAA portion is "0000" for a Trunk Highway route, "nn00" for a county route where "nn" equals the Minnesota county number, or "nnnn" for a city route where "nnnn" equals the Minnesota city census code.

The following table lists the codes for this item.

CODE	DESCRIPTION	GUIDANCE FOR CODING
0000	TH Bridge	
nn00	County Route	See Section D.7.1.8 for Minnesota's County Codes
nnnn	City Route	City Census code found in Appendix C

The BBBB portion is for the actual designated route number. Include preceding zeros as needed.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Examples:

Description	Code
CSAH 140 on a Carver County bridge	10000140
TH 99 on a Trunk Highway bridge	00000099
Route 1 on a City of Burnsville bridge	05370001

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.45 Reference Point (TIS) (MnDOT Item)

fe_id: 68 .... Reference Point
USERRWAY.ref_point

This is the official MnDOT ten character reference point on the inventory route in question (Format = 999+99.999). This point is taken at the centerline centroid of the structure.

Leave this item blank when a highway is not on the structure (i.e. pedestrian and railroad bridges).

Example:

Reference Point = 099+00.991
(100+00.000 minus fifty feet or 0.0094696 equals 099+00.991).

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.11.46 Linear Reference System (LRS)

The Linear Referencing System (LRS) is a software tool built on standard Esri technology and, therefore, supports integration with other Esri products in use at MnDOT. The LRS allows the ability to 'overlay' non-spatial data for analysis, providing a foundation for data sharing. BIMU will use LRS to update changes to route systems/numbers and to update ADTs.

D.7.11.46.1 Increasing LRS Route ID

fe_id: 587 .... Increasing LRS Route ID
BrM field not available at this time.

The Route ID for the LRS will be a unique ID for a route within a jurisdiction. This field is filled in with the following data entry mask: SSGGGGGGGGGGNNNNAD. The SS portion is a 2- character code indicating the jurisdiction of the ownership of the route (Example, '01' = Interstate, '02' = U.S. Highway, '07' = County Road). The GGGGGGGGGG portion is the Geographic Names Information System (GNIS) ID for the jurisdiction of the route in the case of a trunk highway route it will be all zeros. The NNNN portion is for the actual designated route number. The A portion is an alpha for all routes; for routes such as I35E it will contain the letter at the end of the route 'number', and for all other routes it will be the dash character "-". When the direction of travel on the route is increasing the D portion will indicate this with an 'I'.

D.7.11.46.2 Increasing LRS Measure

fe_id: 586 .... Increasing LRS Measure
BrM field not available at this time.

LRS uses Cartographic Length measures. This means that the roads will be calibrated to match the 2-dimensional length of the road geometry on the map.

D.7.11.46.3 Increasing LRS Date of Last Update

fe_id: 585 .... Increasing LRS Date of Last Update
BrM field not available at this time.

This field records the mm/dd/yyyy of when increasing data was retrieved from LRS.

D.7.11.46.4 Decreasing LRS Route ID

fe_id: 584 .... Decreasing LRS Route ID
BrM field not available at this time.

The Route ID for the LRS will be a unique ID for a route within a jurisdiction. This field is filled in with the following data entry mask: SSGGGGGGGGGGNNNNAD. The SS portion is a 2- character code indicating the jurisdiction of the ownership of the route (Example, '01' = Interstate, '02' = U.S. Highway, '07' = County Road). The GGGGGGGGGG portion is the Geographic Names Information System (GNIS) ID for the jurisdiction of the route in the case of a trunk highway route it will be all zeros. The NNNN portion is for the actual designated route number. The A portion is an alpha for all routes; for routes such as I35E it will contain the letter at the end of the route 'number', and for all other routes it will be the dash character "-". When the direction of travel on the route is decreasing the D portion will indicate this with a 'D'.

D.7.11.46.5 Decreasing LRS Measure

fe_id: 583 .... Decreasing LRS Measure
BrM field not available at this time.

LRS uses Cartographic Length measures. This means that the roads will be calibrated to match the 2-dimensional length of the road geometry on the map.

D.7.11.46.6 Decreasing LRS Date of Last Update

fe_id: 582 .... Decreasing LRS Date of Last Update
BrM field not available at this time.

This field records the mm/dd/yyyy of when decreasing data was retrieved from LRS.

D.7.12 IMPROVEMENT COST ESTIMATE

The following sections discuss details regarding estimated cost of improvement and the method used to determine the cost.

Inspector Note:
When a new bridge or culvert is added to the MnDOT database all improvement costs fields will be left blank.

D.7.12.1 Type of Work (NBI Items 75A &75B)

fe_id: 2644 .... Improvement Cost - Proposed Work
BRIDGE.propwork
fe_id: 2645 .... Improvement Cost - Proposed Work By
BRIDGE.workby

NBI Item 75 is composed of two segments, NBI Item 75A (Type of Work Proposed) and NBI Item 75B (Work Done By). The information to be recorded for this item will be the type of work proposed (NBI Item 75A) 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 (NBI Item 75B). A two digit number is coded for NBI Item 75A and a one digit number for NBI Item 75B.

SEGMENT	DESCRIPTION	LENGTH
75A	Type of Work Proposed	2 Digits
75B	Work Done By	1 Digit

NBI Item 75A must be coded for bridges eligible for the Highway Bridge Replacement and Rehabilitation Program. To be eligible, a bridge must carry a highway on the structure, 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. One of the following codes is used to represent the proposed work type, otherwise leave this item blank.

ITEM 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 NBI Item 75A is blank, leave NBI Item 75B blank. Otherwise, enter one of the following codes in NBI Item 75B to indicate whether the proposed work is to be done by contract or by force amount.

NBI ITEM 75B	DESCRIPTION
1	Work to be done by contract
2	Work to be done by owner's forces

Examples.

Type of Work Description	NBI 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 four 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 two feet.	361
A bridge deck is to be replaced by contract and the deck cantilever overhang extended two feet, which is the maximum that can be done without adding another line of stringers or girders to the superstructure.	371
A bridge which is no longer needed is to be demolished and an at-grade crossing built by State forces. (This code could also be used to designate incidental safety work on a bridge such as bridge rail upgrading or replacement.)	382

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D.7.12.2 Improvement Cost, Proposed Structure Type (MnDOT Item)

fe_id: 2646 .... Improvement Cost - Proposed Structure Type
USERBRDG.impr_struct_prop

This item indicates the type of the proposed improved structure.

CODE	SIMS DISPLAY	DESCRIPTION
0	NOT APPLICABLE	Not Applicable
1	BRIDGE	The proposed structure is a bridge
2	BOX CULVERT	The proposed structure is a box culvert
3	CM-SC	The proposed structure is a metal or concrete culvert

D.7.12.3 Length of Structure Improvement (NBI Item 76)

fe_id: 2007600 .... NBI 76: Length of Structure Improvement
BRIDGE.implen

This item indicates the length of the proposed improvement along the centerline of the roadway in feet. 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.

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.

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

Record to a tenth of a foot (truncate, do not round).

D.7.12.4 Improvement Width (MnDOT Item)

fe_id: 2647 .... Width of Structure Improvement
USERBRDG.impr_prop_wdth

This item indicates the roadway width of the proposed improvement.

Record to a tenth of a foot (truncate, do not round).

D.7.12.5 Bridge Improvement Cost (NBI Item 94)

fe_id: 2009400 .... NBI 94: Bridge Improvement Cost
BRIDGE.nbiimpcost

This item represents 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. Do not use this item for estimating maintenance costs.

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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.

Each highway agency is encouraged to use its best available information and established procedures to determine bridge improvement costs.

Examples:

Cost	Code
$55,850	56000
$250,000	250000
$7,451,233	7451000

D.7.12.6 Roadway Improvement Cost (NBI Item 95)

fe_id: 2009500 .... NBI 95: Roadway Improvement Cost
BRIDGE.nbirwcost

This item represents 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. 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.

D.7.12.7 Total Project Cost (NBI Item 96)

fe_id: 2009600 .... NBI 96: Total Project Cost
BRIDGE.nbitotcost

This item must be greater than or equal to the sum of NBI Item 94 (Bridge Improvement Cost) and NBI Item 95 (Roadway Improvement Cost).

This item represents the total project cost in thousands of dollars, including incidental costs not included in NBI 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 NBI Items 94 and 95. 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.

D.7.12.8 Year of Improvement Cost Estimate (NBI Item 97)

fe_id: 2009700 .... NBI 97: Year of Improvement Cost Estimate
BRIDGE.nbiyrcost

This item represents the year that the costs of work estimated in NBI Item 94 (Bridge Improvement Cost), NBI Item 95 (Roadway Improvement Cost), and NBI Item 96 (Total Project Cost) were based upon. This is the year that the improvement cost estimate was last updated. This date and the data provided for NBI Item 94 through NBI Item 96 must be current; that is, NBI Item 97 shall be no more than eight years old.

All four digits of the year are to be recorded.

Examples:

Year of Cost Estimate	Code
1988 costs	1988
2010 costs	2010

D.7.12.9 Improvement Cost Estimating Method (MnDOT Item)

fe_id: 2111407 .... Improvement Cost Estimating Method
USERBRDG.impr_est_method

This item identifies the method used to estimate the costs for NBI Item 94 (Bridge Improvement Cost), NBI Item 95 (Roadway Improvement Cost), and NBI Item 96 (Total Project Cost).

CODE	DESCRIPTION
C	Data was obtained from a computer program
P	Data was obtained from preliminary design
I	Data was furnished by the inspecting agency
N	Not applicable
Blank	No improvement estimate exists

Note, code 'P' is used only for bridges on the Minnesota Trunk Highway system and is entered by BIMU. Local agencies should never use the code 'P'.

D.7.13 ROADWAY INFORMATION [UNDER]

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 will be coded only as an under record; that is, they shall not be coded as an on record carrying highway traffic. Note, tunnels are inspected under the National Tunnel Inspection Standards (NTIS).

There are situations of a route under a structure, where the structure does not carry a highway, but may carry pedestrian traffic, a railroad, or even a building. These are coded the same as any other under record, but the on record shall have minimal data recorded.

Inventory data for bridges often have more than one inventory sheet. For instance, an overpass bridge will have a separate inventory sheet for the roadway on the bridge, and will have additional inventory sheets for the roadway(s) under the bridge. The Bridge Reports and the SIMS print report have separate pages for each roadway.

Information for the roadway on the structure is entered on the SIA One Column form. Information for the roadway(s) under the structure is entered on the SIA - Additional Roadways form.

Each route system/number under a bridge requires data to be inventoried. For example, a bridge crossing over TH 36, TH 36 On-Ramp, and TH 36 Off-Ramp would require three separate inventories to be completed.

Pedestrian and railroad bridges under the structure are not inventoried.

This section contains the roadway information for the roadway(s) under the bridge, such as route system and number, roadway function, detour length, or Average Daily Traffic (ADT). See Section D.7.11 for roadway information on the bridge.

D.7.13.1 Bridge Match ID (MnDOT Item)

fe_id: 3002881 .... OverUnderRow: Match ID
ROADWAY.userrwkey1

This item allows MnDOT to sequence the roadway records differently than NBI Item 5A for the routes on and under the bridge. MnDOT sequences the roadway records based on a hierarchy level. This allows MnDOT to find the primary route that crosses a structure, either on or under. Priorities are based on the route system.

Vehicular routes are always coded as a number, starting with '1'. Hierarchical order is defined by an ascending sort of the:

- Route System ('01 ISTH', then '02 USTH', then '03 MNTH'…)
- Then Level of Service ('01 mainline', then '02 alternate', then '03 bypass'…)
- Then Route Number (35W, then 94, the 169, etc.)
- The final tie breaker, if all else is equal then NBI 5A coding (1, 2, A, B, C, D, E…)

If the bridge carries a non-vehicular route (i.e., pedestrian, railroad, plaza) over vehicular route(s), the on record must be coded ('P' or 'R' or 'Z') and the under record "bridge match id" must be coded starting with '1' and increasing for every route using the rules above.

If the bridge carries a non-vehicular route (i.e., pedestrian, railroad, plaza) over a non-vehicular (i.e., pedestrian, railroad, plaza), the sole roadway record (on record) "bridge match id" must be coded '1'.

Never code '0'.

Never have two of the same “bridge match ids” on the same bridge.

See following examples:

Description	Code [ON]	Code [UNDER]
TH 28 on the structure with TH 55 under the structure	1	2
CSAH 5 on the structure with I 35E under the structure	2	1
I 35E on the structure with TH 36 and ramps under the structure	1	2 (TH 36) 3 (TH 36 Off-Ramp) 4 (TH 36 On-Ramp)

D.7.13.2 Inventory Route, Record Type (NBI Item 5A)

fe_id: 2110003 .... NBI5A
ROADWAY.on_under

NBI Item 5A on the SIA - Additional Roadways form is a one character numeric or alpha code that indicates the inventory data record refers to a roadway passing under the structure.

The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
Route Under Structure	2 - UNDER	A single route goes under the structure
A THROUGH Z	A - UNDER	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		
C signifies the third of multiple routes under the structure		

"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 the route. The code must be '2' or an alphabetic letter 'A' through 'Z'. Code '2' for a single route under the structure. If two or more routes go under a structure on separate roadways, the code of '2' shall not be used. Instead, code 'A', 'B', 'C', 'D', etc., consecutively for multiple routes on separate roadways under the same structure. STRAHNET routes shall be listed first.

Pedestrian and railroad bridges under the structure are not inventoried.

Example:
TH3 6 Mainline, TH 36 On-Ramp, and TH 36 Off-Ramp all run under a bridge. Each under record will be coded with the items described as follows.

Code	Roadway Description
A	TH 36 Mainline
B	TH 36 Off-Ramp
C	TH 36 On-Ramp

D.7.13.3 Inventory Route, Route Signing Prefix (NBI Item 5B)

fe_id: 2110004 .... NBI5B
ROADWAY.kind_hwy

This item identifies the route signing prefix for an inventory route under the structure. When two or more routes are concurrent, the highest class of route will be used. Hierarchy is in the order listed below.

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)

D.7.13.4 Inventory Route, Designated Level of Service (NBI Item 5C)

fe_id: 2110005 .... NBI5C
ROADWAY.levl_srvc

This item identifies the designated level of service for an inventory route under the structure. Note: The use of code '5' was eliminated, and therefore is not listed.

CODE	DISPLAY	DESCRIPTION
0	N/A	None of the below
1	MAINLINE	Mainline
2	ALTERNATE	Alternate
3	BYPASS	Bypass
4	SPUR	Spur
6	BUSINESS	Business
7	RAMP/WYE	Ramp or Connector
8	FRONTAGE	Service or Frontage Road

D.7.13.5 Inventory Route, Route Number (NBI Item 5D)

fe_id: 2110006 .... NBI5D
ROADWAY.routenum

This item identifies the route number, and the directional suffix (when applicable), of an inventory route under the structure. If concurrent routes are of the same hierarchy level, denoted by the route signing prefix, the lowest numbered route shall be coded.

For structures with non-numbered routes record '0'.

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Examples:

Description	Code
35E	35E

For bridge plans that only label the name of the road, or if the route number is unknown, use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.6 Inventory Route, Directional Suffix (NBI Item 5E)

fe_id: 3002099 .... NBI5E
ROADWAY.dirsuffix

Minnesota includes the suffix as part of the route number. Always code this item '0 - Not Applicable'.

D.7.13.7 Direction of Traffic (NBI Item 102)

fe_id: 2110037 .... NBI102
ROADWAY.trafficdir

This item identifies the direction of traffic of the inventory route under the structure (identified in NBI Item 5 on the SIA - Additional Roadways form).

This item must be compatible with other traffic related items such as NBI Item 28B (Lanes Under the Structure), NBI Item 29 (Average Daily Traffic), and NBI Item 47 (Inventory Route, Total Horizontal Clearance).

CODE	SIMS DISPLAY	DESCRIPTION
0	NOT APPLI	Highway traffic not carried
1	1 WAY TRAF	One-way traffic
2	2 WAY TRAF	Two-way traffic
3	1 LN;2WAY	One lane bridge for two-way traffic

D.7.13.8 MN Roadway Class (MnDOT Item)

fe_id: 3002341 .... OverUnderRow: Item27
USERRWAY.roadway_class_id

This item identifies the roadway classification according to a Minnesota coding system.

The following table lists the codes for this item.

CODE	DESCRIPTION
0	No Roadway
1	Two-Way Road
2	One-Way Road
3	1 Roadway of Divided
4	Divided due to Median
5	Two Way Roadway with Median Obstruction (i.e., pier, barrier, etc.)
6	1 Lane Road; Two-Way Traffic

D.7.13.9 MN Median Type (MnDOT Item)

fe_id: 3002401 .... OverUnderRow: Item29
BRIDGE.bridgemed

This item is similar to NBI Item 33 (Bridge Median); however, MnDOT identifies an additional median type.

CODE	DESCRIPTION
0	No Median
1	Open Median
2	Closed Median with Mountable Curb (No Barrier)
3	Closed Median with Non-Mountable Barrier
4	Depressed Median (Usually Culverts)

See Section D.7.2.20 for information on NBI Item 33 (Bridge Median).

D.7.13.10 Median Width (MnDOT Item)

fe_id: 3001532 .... OverUnderRow Item19
USERRWAY.med_width

This item indicates the width of the median for the inventory route under the structure, if applicable. See Section D.7.13.9 (MN Median Type) which identifies the type of median under the structure, if applicable.

This item is used for divided roadways only, regardless if median is depressed, mountable or non-mountable. If the median width is not identified in the bridge plans record '0.0'. This can be verified in the field. Do not make assumptions.

Record the minimum width to a tenth of a foot (truncate, do not round).

Leave this item blank if not applicable.

D.7.13.11 Inventory Route, Minimum Vertical Clearance (NBI Item 10)

fe_id: 2110012 .... NBI10
ROADWAY.vclrinv

Code the minimum vertical clearance from an inventory route under the structure to the obstruction above. The minimum clearance for a 10 foot wide pavement or traveled part of the roadway where the clearance is the greatest shall be recorded. For structures having multiple openings, clearance for each opening shall be measured, but only the greatest of the "minimum clearances" for the openings shall be recorded, regardless of the direction of travel. This would be the practical maximum clearance.

Record to the nearest tenth of a foot (always round down).

D.7.13.12 Vertical Clearance, NB-EB (MnDOT Item)

fe_id: 3000992 .... OverUnderRow Item5
USERRWAY.vert_clr_rd1

NB-EB items are coded for each record. SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This item indicates the minimum vertical clearance from the roadway surface under the structure to any obstruction above the roadway.

If the route is a one-way, or a two-way highway divided only by the centerline, this item is identical to NBI Item 10 (see Section D.7.13.11) regardless of direction of travel.

If the inventory route is a dual highway (two-way traffic divided by median or pier) record the vertical clearance for NB or EB (increasing reference points) in this field.

Record to the nearest tenth of a foot (always round down).

Examples:

Description	Code
14.566	14.5
No Obstruction	Leave Blank

D.7.13.13 Vertical Clearance, SB-WB (MnDOT Item)

fe_id: 3001022 .... OverUnderRow Item6
USERRWAY.vert_clr_rd2

SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This item indicates the minimum vertical clearance from the roadway surface under the structure to any obstruction above the roadway.

This field is only completed for bridges with a dual highway (two-way traffic divided by median or pier) under the structure. Record the vertical clearance for SB or WB (decreasing reference points) in this field.

Record to the nearest tenth of a foot (always round down).

Examples:

Description	Code
14.566	14.5
No Obstruction	Leave Blank

D.7.13.14 Maximum Vertical Clearance (Under Bridge), NB-EB (MnDOT Item)

fe_id: 3001052 .... OverUnderRow Item7
USERRWAY.vert_max_clr_rd1

NB-EB items are coded for each record. SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This item identifies the maximum amount of vertical clearance in any ten foot width of the traveled roadway (shoulders excluded) to any obstruction above the roadway.

If the route is a one-way or an undivided two-way highway only the NB-EB field shall be coded regardless of traffic direction.

If the inventory route is a dual highway (two-way traffic divided by a depressed median, by a 6" or greater raised median, by a pier, by a traffic barrier, or by another obstacle) record the vertical clearance for NB or EB (increasing reference points) in this field.

Record to a tenth of a foot (truncate, do not round).

Example:

Description	Code
14.566	14.5

D.7.13.15 Maximum Vertical Clearance (Under Bridge), SB-WB (MnDOT Item)

fe_id: 3001082 .... OverUnderRow Item8
USERRWAY.vert_max_clr_rd1

SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This field is only completed for bridges with a dual highway (two-way traffic divided by a depressed median, by a 6" or greater raised median, by a pier, by a traffic barrier, or by another obstacle). Record the vertical clearance for SB or WB (decreasing reference points) in this field.

Record to the nearest tenth of a foot (truncate, do not round).

Example:

Description	Code
14.566	14.5

D.7.13.16 MnDOT Roadway Width (MnDOT Item)

This MnDOT item is similar to Section D.7.11.17 NBI Item 51 (Bridge Roadway Width, Curb-to-Curb); however, this item allows the recording of roadway widths separated by other than the centerline.

D.7.13.16.1 Roadway Width, Curb-to-Curb, NB-EB

fe_id: 3000932 .... OverUnderRow Item3
USERRWAY.rdwy_width_rd1

NB-EB items are coded for each record. SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

Record this width for all structures with highway traffic under the structure. If the roadway is separated only by the centerline this item is recorded regardless of traffic direction.

For a non-divided highway only the NB-EB field shall be coded (regardless of traffic direction). For a highway divided by a depressed median, by a raised median (6" or greater), by a pier, by a traffic barrier, or by another obstacle, the NB or EB (increasing reference points) roadway width (curb-to-curb) shall be recorded in this field.

Measure the through lanes for an inventory route under the structure. This width includes shoulders (both paved and non-paved). Median widths (all types) are not included in this measurement.

Record to a tenth of a foot (truncate, do not round).

D.7.13.16.2 Roadway Width, Curb-to-Curb, SB-WB

fe_id: 3000962 .... OverUnderRow Item4
USERRWAY.rdwy_width_rd2

SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

Record this width for structures with highway traffic under the structure where traffic is separated by other than the centerline. If the roadway is separated only by the centerline this item is left blank.

For a highway divided by a depressed median, by a raised median (6" or greater), by a pier, by a traffic barrier, or by another obstacle, the SB or WB (increasing reference points) roadway width (curb-to-curb) shall be recorded in this field.

Measure the through lanes for an inventory route under the structure. This width includes shoulders (both paved and non-paved). Median widths (all types) are not included in this measurement.

Record to a tenth of a foot (truncate, do not round).

D.7.13.17 Inventory Route, Total Horizontal Clearance (NBI Item 47)

fe_id: 2111261 .... NBI47A
ROADWAY.hclrinv

The total horizontal clearance for an inventory route under the structure (identified in NBI Item 5 on the SIA - Additional Roadways form) 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 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 is defined in two ways; use the most applicable:

- Clear distance between restrictions of an inventory route under the structure.
- Roadway surface and shoulders – when there are no restrictions.

For a divided highway with a raised or non-mountable median, record the greater of the restricted widths in either direction, not both directions.

Minnesota considers curb heights greater than six inches (6") to be a restrictive feature.

Record to a tenth of a foot (truncate, do not round).

If bridge plans do not call out dimensions or minimum widths and are only labeled as varies, the width of that lane or shoulder should be counted as '0.0' until it is verified in the field. Do not make assumptions.

D.7.13.18 Horizontal Clearance, NB-EB (MnDOT Item)

fe_id: 3002066 .... OverUnderRow Item23
USERRWAY.horz_clr_rd1

NB-EB items are coded for each record. SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

For a non-divided highway under the structure, only the NB-EB field shall be coded.

For a divided highway, the NB or EB (increasing reference points) routes shall be recorded in this field.

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For an inventory route under the structure, code the horizontal distance between substructure units (abutment or pier) and a rigid barrier or the toe of a slope greater than 1:3.

Record to a tenth of a foot (truncate, do not round).

Example:

Description	Code
29'- 5"	29.4

D.7.13.19 Horizontal Clearance, SB-WB (MnDOT Item)

fe_id: 3002251 .... OverUnderRow: Item24
USERRWAY.horz_clr_rd2

SB-WB items are coded only when the route is divided. When the route is divided the NB-EB items will record data for the NB (or EB) roadway, and SB-WB items will record data for the SB (or WB) roadway.

This field is only completed for divided highways under the structure.

For a divided highway, the SB or WB (decreasing reference points) routes shall be recorded in this field.

For an inventory route under the structure, code the horizontal distance between substructure units (abutment or pier) and a rigid barrier or the toe of a slope greater than 1:3.

Record to a tenth of a foot (truncate, do not round).

Example:

Description	Code
29'- 5"	29.4

D.7.13.20 Lateral Clearance Left (MnDOT Item)

fe_id: 3001112 .... OverUnderRow Item9
USERRWAY.lat_clr_rd1

This item identifies the left lateral clearance. The left side is determined when facing in the direction of travel.

For a divided roadway, code the distance from the left edge of the traveled lane to the nearest substructure unit (i.e., pier, abutment) or any median barrier. Code the minimum measurement after measuring both directions of travel.

For a one-way roadway or one road of a divided roadway, code the distance from the outside edge of the roadway to the substructure unit.

If Lateral Clearance Right (Section D.7.13.21) is not blank and Median Width (Section D.7.13.10) is also not blank, then this field must be coded.

Code '0.0' if not applicable.

Record to a tenth of a foot (truncate, do not round).

D.7.13.21 Lateral Clearance Right (MnDOT Item)

fe_id: 3001142 .... OverUnderRow Item10
USERWAY.lat_clr_rd2

This item identifies the right lateral clearance. The right side is determined when facing in the direction of travel.

For a divided roadway, code the distance from the outside edge of the roadway to the substructure unit (i.e., pier, abutment) or to the toe of the slope. Code the minimum measurement after measuring both directions of travel.

For a one-way roadway or one road of a divided roadway, code the distance from the outside edge of the roadway to the substructure unit (i.e., pier, abutment) or to the toe of the slope.

For a two-way roadway, code the distance from the edge of the roadway to the substructure unit (i.e., pier, abutment) or to the toe of the slope. Code the minimum measurement after measuring both directions of travel.

For a railroad, the underclearance is the distance from the centerline of the right-hand railroad track to the substructure unit (i.e., pier, abutment) or toe of the slope. Again, code the minimum measurement after measuring both directions of travel.

Code '0.0' if not applicable.

Record to a tenth of a foot (truncate, do not round).

D.7.13.22 Mile Point (NBI Item 11)

fe_id: 2001100 .... NBI 11: Kilometerpoint
ROADWAY.kmpost

This item is not used by MnDOT. Code '0.000' as a default.

D.7.13.23 Bypass, Detour Length (NBI Item 19)

fe_id: 2110021 .... NBI19
ROADWAY.bypasslen

This item represents the detour length and should represent the total additional travel required for a vehicle which would result from closure of the bridge. The detour route will be established following allowable criteria determined by the governing authority. Some roadway authorities will not allow a designated detour over a road or structure of lesser "quality".

Record to the nearest mile.

If a ground level bypass is available at the structure site for the inventory route, record and code the detour length as '0'. 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 the bridge is one of twin bridges and is not at an interchange, code '0' where the other twin bridge can be used as a temporary bypass with a reasonable amount of crossover grading.

A structure located on a dead end with no possible detour should be entered as 123 (199 kilometers).

Examples:

Condition	**Code**
Diamond interchange, structure bypassable	0
Cloverleaf, not bypassable; 11.4 mile detour	11
Structure over river; 76 mile, or more, detour	76
Structure over highway, no interchange, bypass available at ground level	0
Structure on dead end road	123

D.7.13.24 Toll (NBI Item 20)

fe_id: 2002000 .... NBI20
ROADWAY.tollfac

This item refers to the toll status of the structure. See Section D.7.11.24.

All under records are coded '3'.

D.7.13.25 Functional Classification of Inventory Route (NBI Item 26)

fe_id: 2110023 .... NBI26
ROADWAY.funcclass

This item indicates the functional classification of the inventory route under the structure.

The roadway record 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.

The following table lists the codes for this item.

CODE	DISPLAY	DESCRIPTION
RURAL		
01	RUR/PR ART ISTH	Principal Arterial - Interstate
02	RUR/PR ART OTH	Principal Arterial - Other
06	RUR/MINOR ART	Minor Arterial
07	RUR/MAJOR COLL	Major Collector
08	RUR/MINOR COLL	Minor Collector
09	RURAL LOCAL	Local
URBAN		
11	URB/PR ART ISTH	Principal Arterial - Interstate
12	URB/PR ART FRWAY	Principal Arterial - Other Freeways or Expressways
14	URB/OTH PR ART	Other Principal Arterial
16	URB/MINOR ART	Minor Arterial
17	URB COLL	Collector
19	URBAN LOCAL	Local

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.26 Lanes Under the Structure (NBI Item 28B)

fe_id: 3001202 .... NBI 28B: Lanes Under the Structure: OverUnderRow
ROADWAY.lanes

This item identifies the number of traffic lanes for an inventory route under the structure. This includes all lanes carrying highway traffic (i.e., cars, trucks, buses) which are striped or otherwise operated as a full width traffic lane under the structure. This shall include any full width merge lanes, full width ramp lanes, full width auxiliary lanes, and shall be independent of directionality of usage. For example, a one lane road carrying two directional traffic is still considered to carry only one lane of traffic.

Do not include unstripped future lanes that are currently not in service.

Note: The summation of all lanes under the structure is entered on the SIA One Column form (see Section D.7.2.18).

D.7.13.27 Traffic Sequence Number (MnDOT Item)

fe_id: 3002281 .... OverUnderRow: Item25
ROADWAY.userrwkey2

This field allows the import of ADT data directly from another data source. This field should be coded for the following route systems.

- ISTH – Interstate Trunk Highway
- USTH – U.S. Trunk Highway
- MNTH – Minnesota Trunk Highway
- CSAH – County State-Aid Highway
- MSAS – Municipal State-Aid Street
- CNTY – County Road

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.28 Average Daily Traffic (NBI Item 29)

fe_id: 2110027 .... NBI29
ROADWAY.adttotal

This item indicates the ADT volume for an inventory route under the structure. This should be the most recent ADT count available, and should include the truck traffic referred to in Section D.7.13.32 (Average Daily Truck Traffic). Trunk Highway routes are updated every other year and local roads are recommended to be updated every five years.

If the roadway is closed, code the last ADT from before the closure occurred.

ADT information can be found using the MnDOT GIS Base Map. Always use the ADT given by the GIS Tool, unless the plan provides more recent ADT information. This information is not always available for smaller roadways (i.e., township routes, municipal routes, etc.). When the ADT cannot be found using the GIS map, and is not provided on the plan, this information must be requested from the agency. Code '1' until the ADT is provided by the agency.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.29 Year of Average Daily Traffic (NBI Item 30)

fe_id: 2110028 .... NBI30
ROADWAY.adtyear

This item records the year of the ADT for the route under the structure as described in Section D.7.13.28.

The ADT year can be found using the MnDOT GIS Base Map. If the GIS tool does not provide this information record the year built (shown on the bridge nameplate) as the ADT year.

All four digits of the year are to be recorded.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.30 STRAHNET Highway Designation (NBI Item 100)

fe_id: 2110035 .... NBI100
ROADWAY.defhwy

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

A STRAHNET is a national system of Interstate and primary highways and connectors that are important to the United States' strategic defense policy and which provide defense access, continuity and emergency capabilities for defense purposes. The STRAHNET Connectors are highways which provide access between major military installations and highways which are part of the Strategic Highway Network.

The STRAHNET is determined by the Surface Deployment and Distribution Command (SDDC – previously the Military Traffic Management Command, MTMC) in coordination with FHWA. FHWA provides data on the SDDC from the NBI regarding clearances, sufficiency ratings, condition, and load carrying capabilities on these routes. A STRAHNET map of Minnesota is available at https://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/minnesota/mn_minnesota.pdf.

CODE	DESCRIPTION
0	The inventory route is not on a STRAHNET route
1	The inventory route is on an Interstate STRAHNET
2	The inventory route is on a Non-Interstate STRAHNET route
3	The inventory route is on a STRAGHNET connector route

D.7.13.31 Highway System of the Inventory Route (NBI Item 104)

fe_id: 2110039 .... NBI104
ROADWAY.nhs_ind

This item is to be coded for all records in the inventory. For the inventory route under the structure (NBI Item 5 identified on the SIA - Additional Roadways form), indicate whether the inventory route is on or off the NHS. Initially, this code shall reflect an inventory route on the NHS "Interim System" description in Section 1006(a) of the 1991 ISTEA (Intermodal Surface Transportation Efficiency ACT). Upon approval of the NHS by Congress, the coding is to reflect the approved NHS.

The National Highway System consists of roadways important to the nation's economy, defense, and mobility. The NHS includes the following subsystems of roadways:

- Interstate
- Other Principal Arterials: This includes highways in rural and urban areas which provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facility.
- STRAHNET: This is a network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity and emergency capabilities for defense purposes.
- Major Strategic Highway Network Connectors: These are highways which provide access between major military installations and highways which are part of the Strategic Highway Network.
- Intermodal Connectors: These highways provide access between major intermodal facilities and the other four subsystems making up the National Highway System.

For this item, use one of the following codes.

CODE	SIMS DISPLAY	DESCRIPTION
0	OFF	Inventory Route is not on the NHS
1	ON	Inventory Route is on the NHS

D.7.13.32 Average Daily Truck Traffic (NBI Item 109)

fe_id: 2110040 .... NBI109
ROADWAY.truckpst

This item represents the heavy commercial average daily truck traffic volume (HCADT) on the roadway traveling under the structure.

This does not include vans, pickup trucks, or light delivery trucks. If this information is not available, an estimate which represents the average percentage for the category of road carried on the structure may be used.

HCADT information can be found using the MnDOT GIS Base Map for Trunk Highway bridges only. Always use the HCADT given by the GIS Tool, unless the plan provides more recent HCADT information.

This item may be left blank if NBI Item 29 (Average Daily Traffic) is less than 100, not identified on the bridge plans, and/or not available in the GIS Tool.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.33 Designated National Network (NBI Item 110)

fe_id: 2110041 .... NBI110
ROADWAY.trucknet

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 under the structure (NBI Item 5 identified on the SIA - Additional Roadways form), 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

D.7.13.34 Inter Reg Corridor (MnDOT Item)

fe_id: 3002281 .... OverUnderRow: Item26
BrM field not available at this time.

Leave this item blank. Reserved for future use.

D.7.13.35 Interchange Element (MnDOT Item)

fe_id: 30026115OverUnderRow: Item36
USERRWAY.interchange_elem

When a structure is part of a complex interchange (i.e., not a grade crossing) then this field should be coded. Each complex interchange has a unique identifier. The identifier can be a three digit numeric code or a letter followed by two numbers.

D.7.13.36 Control Section (TH Only) (MnDOT Item)

fe_id: 3000902 .... OverUnderRow Item2
USERRWAY.control_section_id

This item is recorded only for bridges on the Minnesota State Trunk Highway system. Leave this item blank for bridges on the Local system, or if not applicable.

A control section is usually relatively small contiguous sections of roadway tied together for MnDOT maintenance and construction purposes.

A two digit roadway section identifier is recorded for this item. The SIMS print report and Bridge Reports display the control section with four digits – the two digit roadway section identifier preceded by the two digit Minnesota county number. Each roadway section identifier, with its associated county number, identifies a portion of the Minnesota Trunk Highway system.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.37 Road Name (MnDOT Item)

fe_id: 3000872 .... OverUnderRow Item1
ROADWAY.roadway_name

This item identifies the name of the inventory route under the structure. Use the formal or '911' street names whenever possible.

Examples:

- 190TH AVE
- 220TH ST E

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.38 Route System (TIS) (MnDOT Item)

fe_id: 3002431 .... OverUnderRow: Item30
USERRWAY.bdg_route_sys_id

This item identifies the route system of the roadway according to the Minnesota coding system. In situations where two or more routes are concurrent, the highest class of route will be used.

The following table lists the codes for this item. Hierarchy is in the order listed.

CODE	SIMS DISPLAY	DESCRIPTION
01	ISTH	Interstate Trunk Highway
02	USTH	U.S. Trunk Highway
03	MNTH	Minnesota Trunk Highway
04	CSAH	County State-Aid Highway
05	MSAS	Municipal State-Aid Street
06	CMSA	County-Municipal State-Aid Street
07	CNTY	County Road
08	TWNS	Township Road
09	UTWN	Unorganized Township Road
10	MUN	City Street
11	NATP	National Park Road
12	NFD	National Forest Development Road
13	IND	Indian Reservation Road
14	SFR	State Forest Road
15	SPRK	State Park Road
16	MIL	Military Road
17	NATM	National Monument Road
18	NATW	National Wildlife Refuge Road
19	FRNT	Frontage Road
20	SGAM	State Game Preserve Road
22	Ramp	Ramp or Leg
23	PRIV	Private Jurisdiction Road

This item is similar to NBI Item 5B (see Section D.7.13.3); however, MnDOT's coding system provides additional route designations.

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.39 Route Number (TIS) (MnDOT Item)

fe_id: 3002491 .... OverUnderRow: Item32
USERRWAY.route_nb

This field is filled in with the following data entry mask: AAAABBBB.

The AAAA portion is "0000" for a Trunk Highway route, "nn00" for a county route where "nn" equals the Minnesota county number, or "nnnn" for a city route where "nnnn" equals the Minnesota city census code.

The following table lists the codes for this item.

CODE	DESCRIPTION	GUIDANCE FOR CODING
0000	TH Bridge	See Section D.8.1.1
nn00	County Route	
nnnn	City Route	

The BBBB portion is for the actual designated route number. Include preceding zeros as needed.

Examples:

Description	Code
CSAH 140 under a Carver County bridge	10000140
TH 99 under a Trunk Highway bridge	00000099
Route 1 under a City of Burnsville bridge	05370001
35E	0000035E

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.40 Reference Point (TIS) (MnDOT Item)

fe_id: 3001472 .... OverUnderRow Item17
USERRWAY.ref_point

This is the official MnDOT ten character reference point on the inventory route in question (Format = 999+99.999). This point is taken at the centerline centroid below the structure.

Example:

Reference Point = 099+00.991
(100+00.000 minus fifty feet or 0.0094696 equals 099+00.991)

Use the MnDOT Basemap to identify and find the correct coding for this item. MnDOT Basemap (http://mndotgis/basemap) instructions are in Section D.8.

D.7.13.41 Linear Reference System (LRS)

The Linear Referencing System (LRS) is a software tool built on standard Esri technology and, therefore, supports integration with other Esri products in use at MnDOT. The LRS allows the ability to 'overlay' non-spatial data for analysis, providing a foundation for data sharing. BIMU will use LRS to update changes to route systems/numbers and to update ADTs.

D.7.13.41.1 Increasing LRS Route ID

fe_id: 6001782 .... Increasing LRS Route ID
BrM field not available at this time.

The Route ID for the LRS will be a unique ID for a route within a jurisdiction. This field is filled in with the following data entry mask: SSGGGGGGGGGGNNNNAD. The SS portion is a 2-character code indicating the jurisdiction of the ownership of the route (Example, '01' = Interstate, '02' = U.S. Highway, '07' = County Road). The GGGGGGGGGG portion is the

Geographic Names Information System (GNIS) ID for the jurisdiction of the route in the case of a trunk highway route it will be all zeros. The NNNN portion is for the actual designated route number. The A portion is an alpha for all routes; for routes such as I35E it will contain the letter at the end of the route 'number', and for all other routes it will be the dash character "-". When the direction of travel on the route is increasing the D portion will indicate this with an ‘I’.

D.7.13.41.2 Increasing LRS Measure

fe_id: 6001783 .... Increasing LRS Measure
BrM field not available at this time.

LRS uses Cartographic Length measures. This means that the roads will be calibrated to match the 2-dimensional length of the road geometry on the map.

D.7.13.41.3 Increasing LRS Date of Last Update

fe_id: 6001784 .... Increasing LRS Date of Last Update
BrM field not available at this time.

This field records the mm/dd/yyyy of when increasing data was retrieved from LRS.

D.7.13.41.4 Decreasing LRS Route ID

fe_id: 6001785 .... Decreasing LRS Route ID
BrM field not available at this time.

The Route ID for the LRS will be a unique ID for a route within a jurisdiction. This field is filled in with the following data entry mask: SSGGGGGGGGGGNNNNAD. The SS portion is a 2-character code indicating the jurisdiction of the ownership of the route (Example, '01' = Interstate, '02' = U.S. Highway, '07' = County Road). The GGGGGGGGGG portion is the Geographic Names Information System (GNIS) ID for the jurisdiction of the route in the case of a trunk highway route it will be all zeros. The NNNN portion is for the actual designated route number. The A portion is an alpha for all routes; for routes such as I35E it will contain the letter at the end of the route 'number', and for all other routes it will be the dash character "-". When the direction of travel on the route is decreasing the D portion will indicate this with a ‘D’.

D.7.13.41.5 Decreasing LRS Measure

fe_id: 6001786 .... Decreasing LRS Measure
BrM field not available at this time.

LRS uses Cartographic Length measures. This means that the roads will be calibrated to match the 2-dimensional length of the road geometry on the map.

D.7.13.41.6 Decreasing LRS Date of Last Update

fe_id: 6001787 .... Decreasing LRS Date of Last Update
BrM field not available at this time.

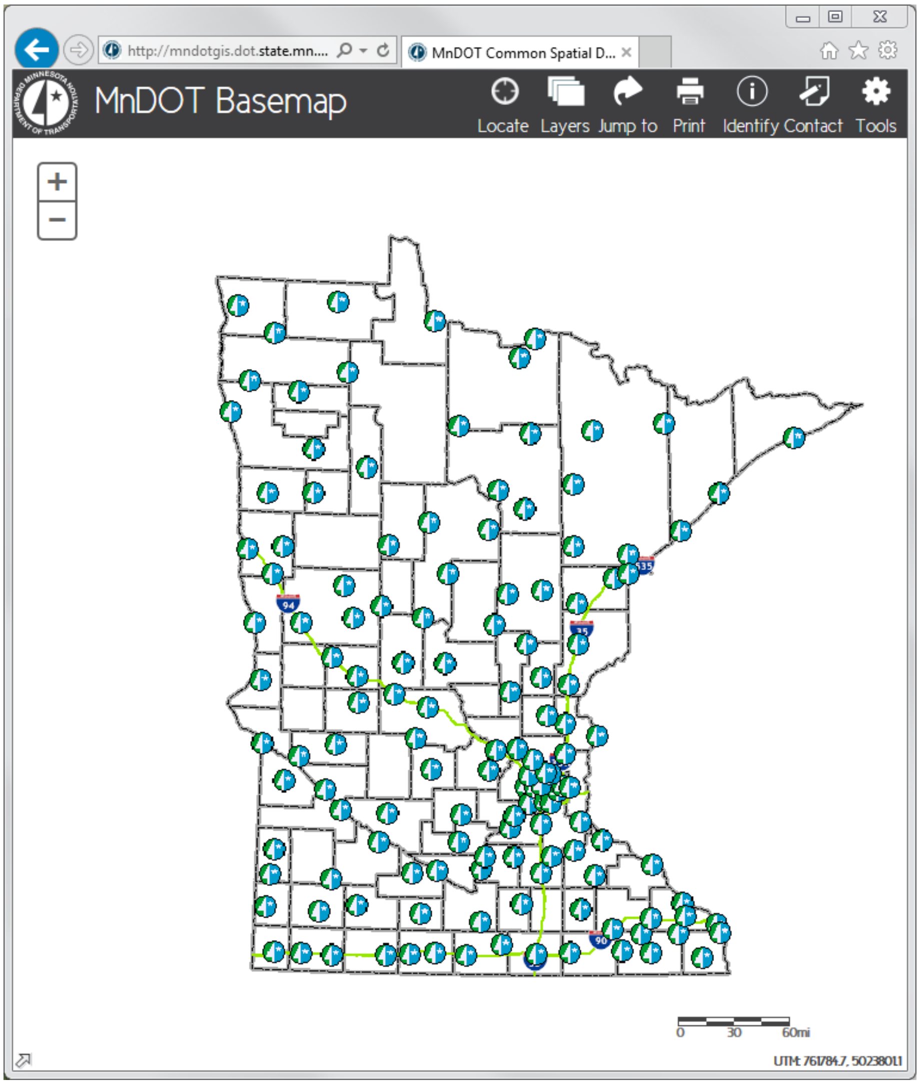
This field records the mm/dd/yyyy of when decreasing data was retrieved from LRS.

D.8 MNDOT BASEMAP

The MnDOT Basemap is an interactive on-line viewer that provides statewide GIS (Geographic Information Systems) coverage of MnDOT Basemap information, including transportation features, boundary information, and waterway locations in Minnesota.

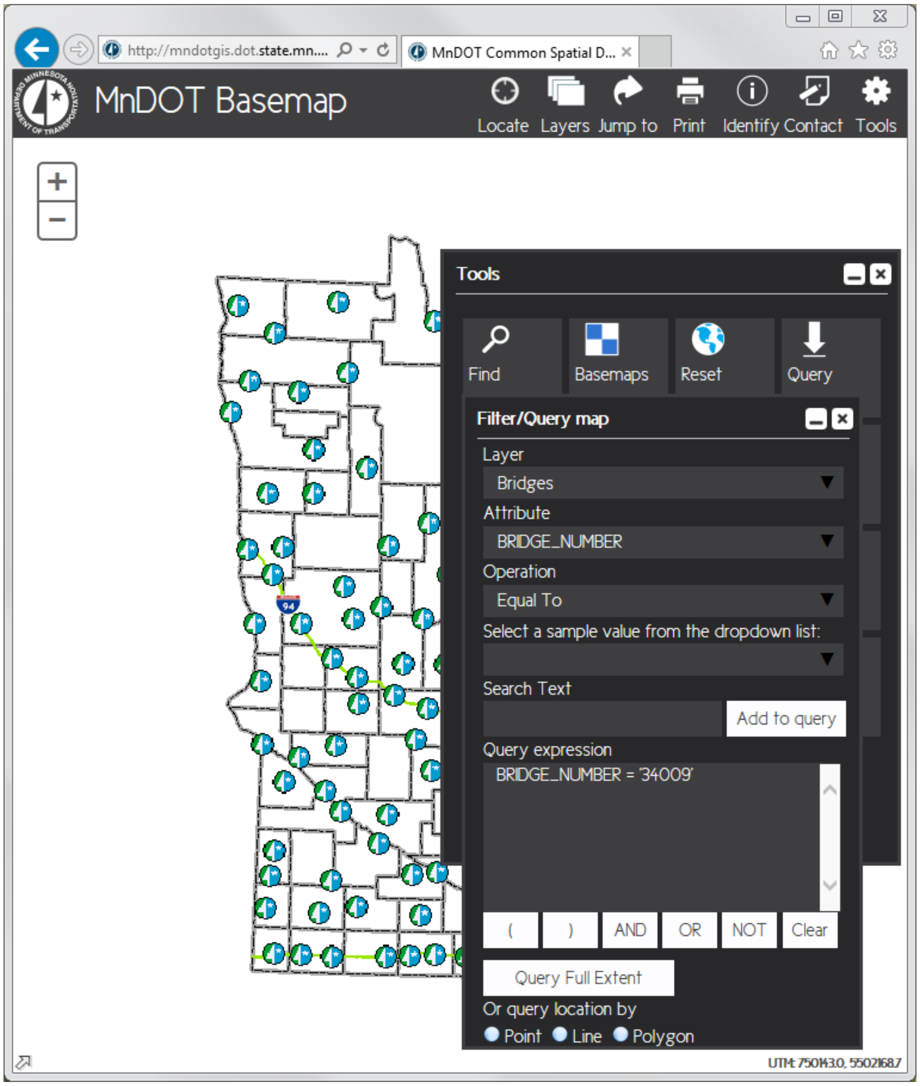
Use the MnDOT Basemap to identify and find the correct coding for the following items.

ACCESS THE MNDOT BASEMAP
http://mndotgis.dot.state.mn.us/basemap



LOCATE THE BRIDGE

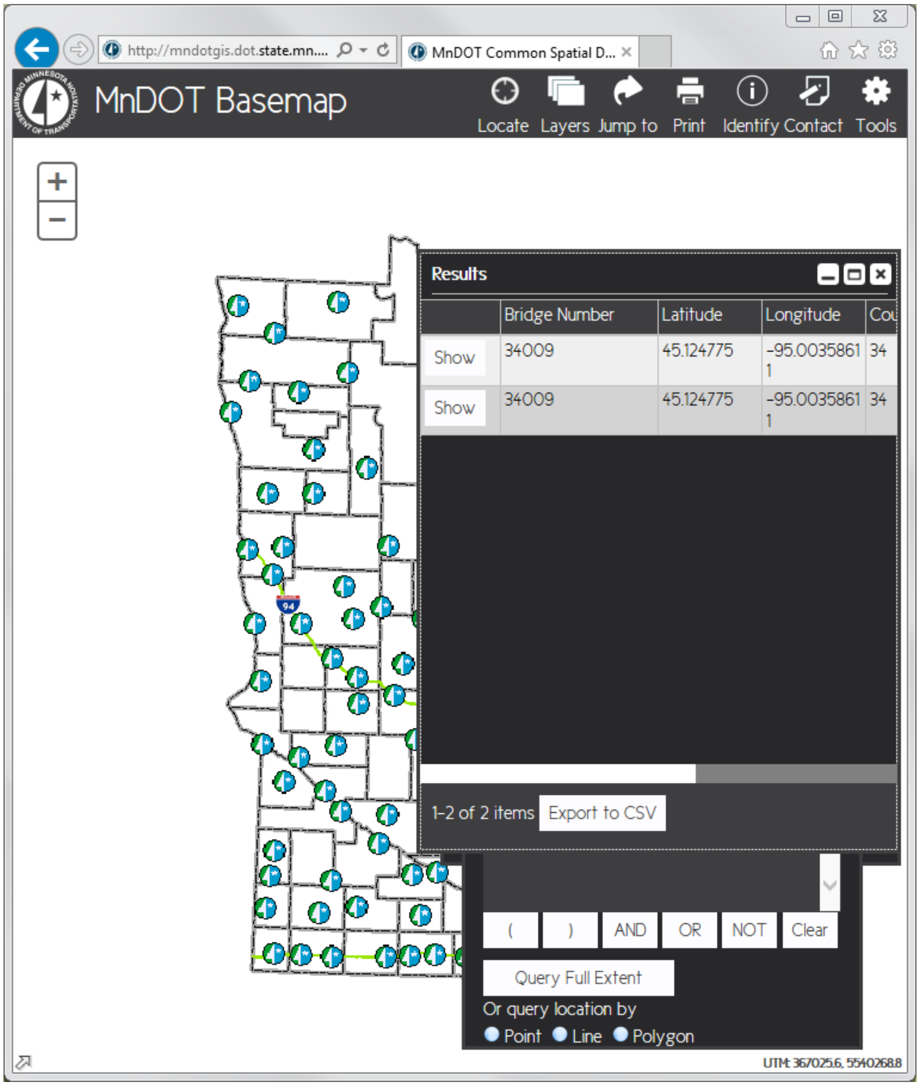
- Use the '+' icon in the upper-left corner to zoom in; or
- Use an existing bridge number to navigate to the location on the map.



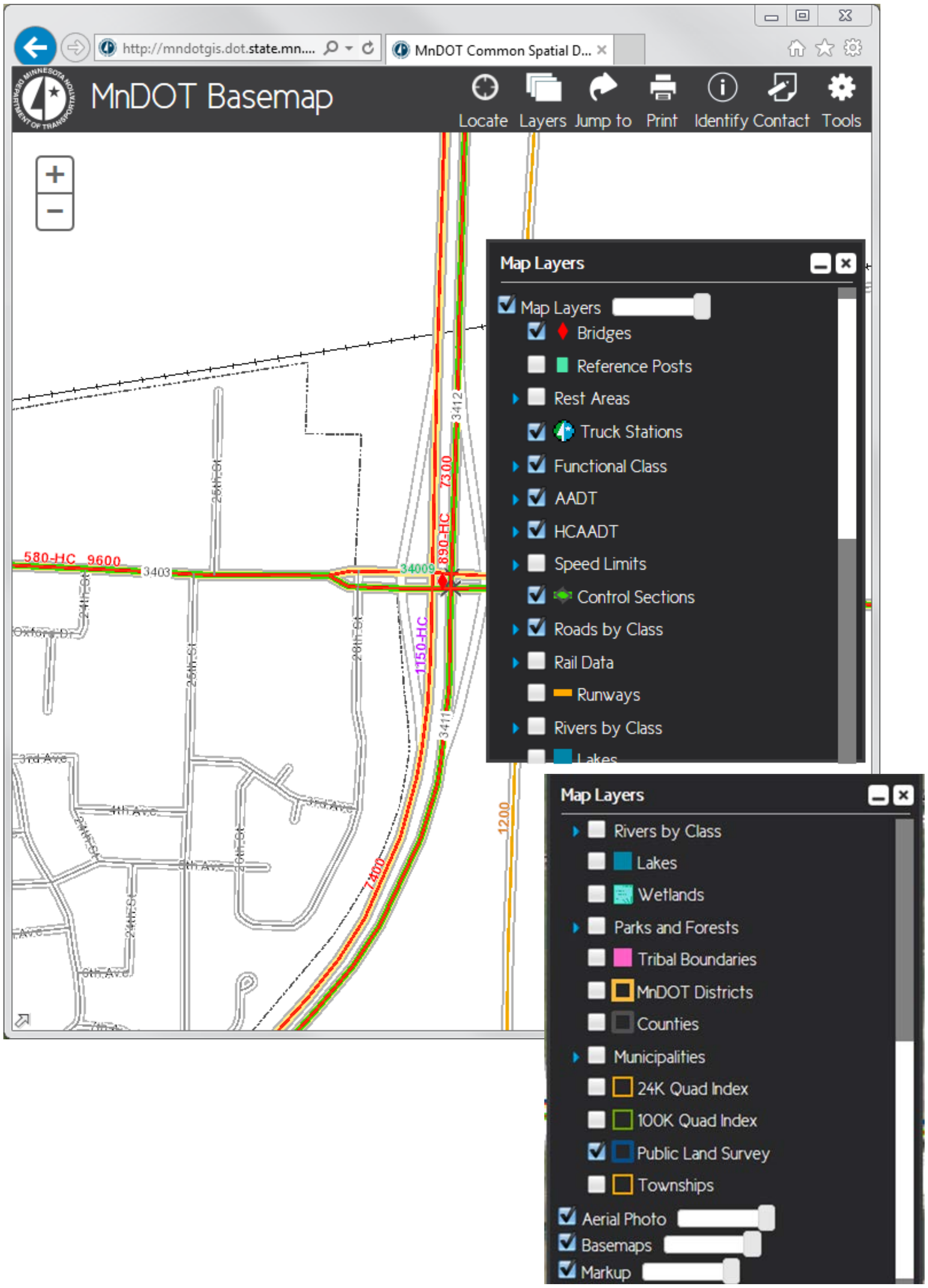
LOCATE THE BRIDGE WITH AN EXISTING BRIDGE NUMBER
Bridge 34009 (US 12 over US 71, Kandiyohi County) will be used throughout this example.

- On the menu bar, click on Tools.
- The Tools box will open. Click on Query.
- In the Filter/Query map box, use the dropdowns to fill in Layer, Attribute, and Operation.
- Click on Add to query. This will populate the Query expression.
- Next, following the expression BRIDGE_NUMBER =, key-in a bridge number.
  Note: You must enter a space, a single quote mark, the bridge number, and another single quote mark to complete the query expression. Alpha characters in a bridge number are case sensitive; you must enter as upper case.
  Example: BRIDGE_NUMBER = '34009'
- Click on Query Full Extent.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS



- A Results box will open and will have one data line for each roadway – on and under the bridge. For Bridge 34009 there is one roadway on the structure and one roadway under, therefore, the Results box displays two lines of data. Click on either of the Show buttons to have the GIS tool zoom in to the bridge location.
- Close the three boxes by clicking on the 'x' in the upper-right corner of each box.

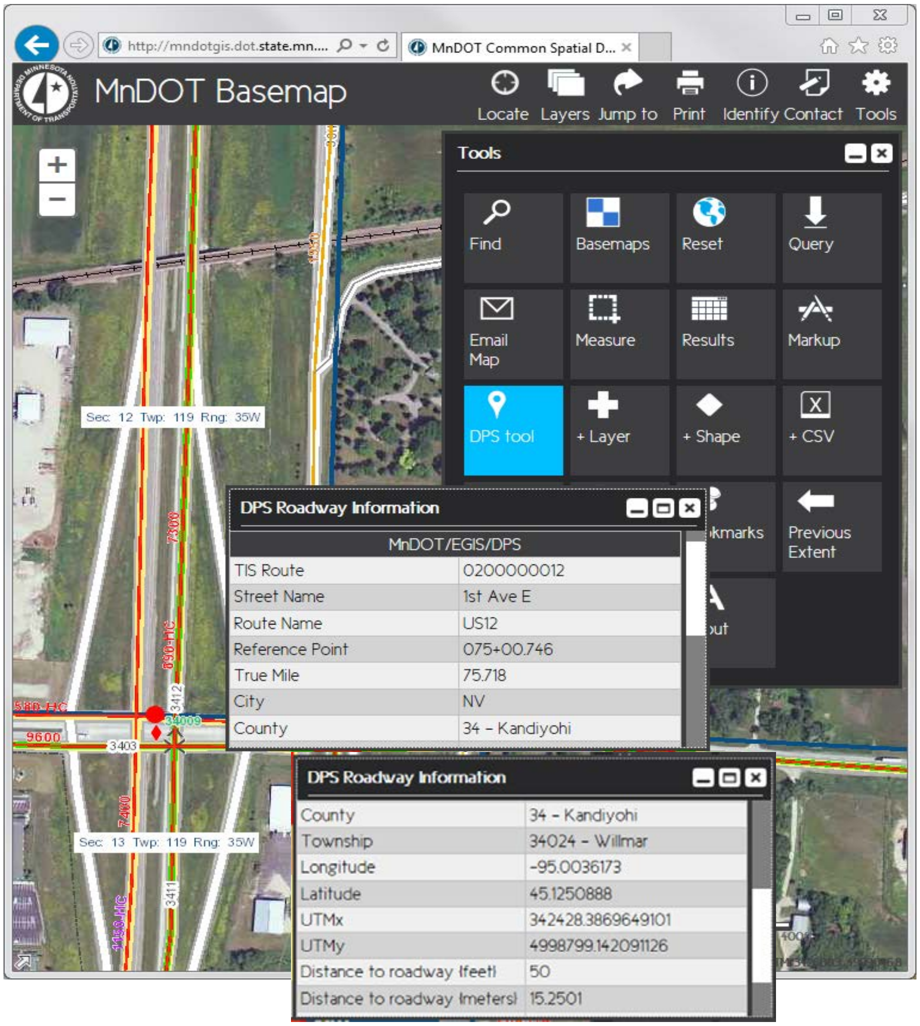


- On the menu bar, click on Layers. This will open the Map Layers box. By default the following map layers are on: Truck Stations and Roads by Class. Turn on other map layers by clicking in the box to the right of a layer (click again to turn off the layer). Turn on the following map layers: Bridges, Functional Class, AADT, HCAADT, Control Sections, Public Land Survey, and Arterial Photo. Close the dialog box by clicking on the 'x' in the upper-right corner.
- Zoom in and out with the '+' and '–' icons. In addition, to reposition the map, click on the map and drag left or right.

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.8.1 IDENTIFY ITEMS USING THE DPS TOOL

- On the menu bar, click on Tools.
- The Tools box will open. Click on DPS tool.
- Click on the map, near the center of the bridge, on the [ON] roadway.



- The DPS tool will identify the following items.

D.7.1.2	[ON] Facility Carried By Structure (NBI Item 7) = US 12 (see Section D.8.1.1, Street Name)
D.7.11.5	[ON] Inventory Route, Route Number (NBI Item 5D) = 12 (see Section D.8.1.1, TIS Route)
D.7.11.43	[ON] Route System (MnDOT Item) = 02 (see Section D.8.1.1, TIS Route)
D.7.11.44	[ON] Route Number (MnDOT Item) = 12 (see Section D.8.1.1, TIS Route)
D.7.11.45	[ON] Reference Point (MnDOT Item) = 075+00.746
D.7.1.10	City (MnDOT Item) = NV (not valid)
	– *or* –
D.7.1.11	Township (MnDOT Item) = WILLMAR

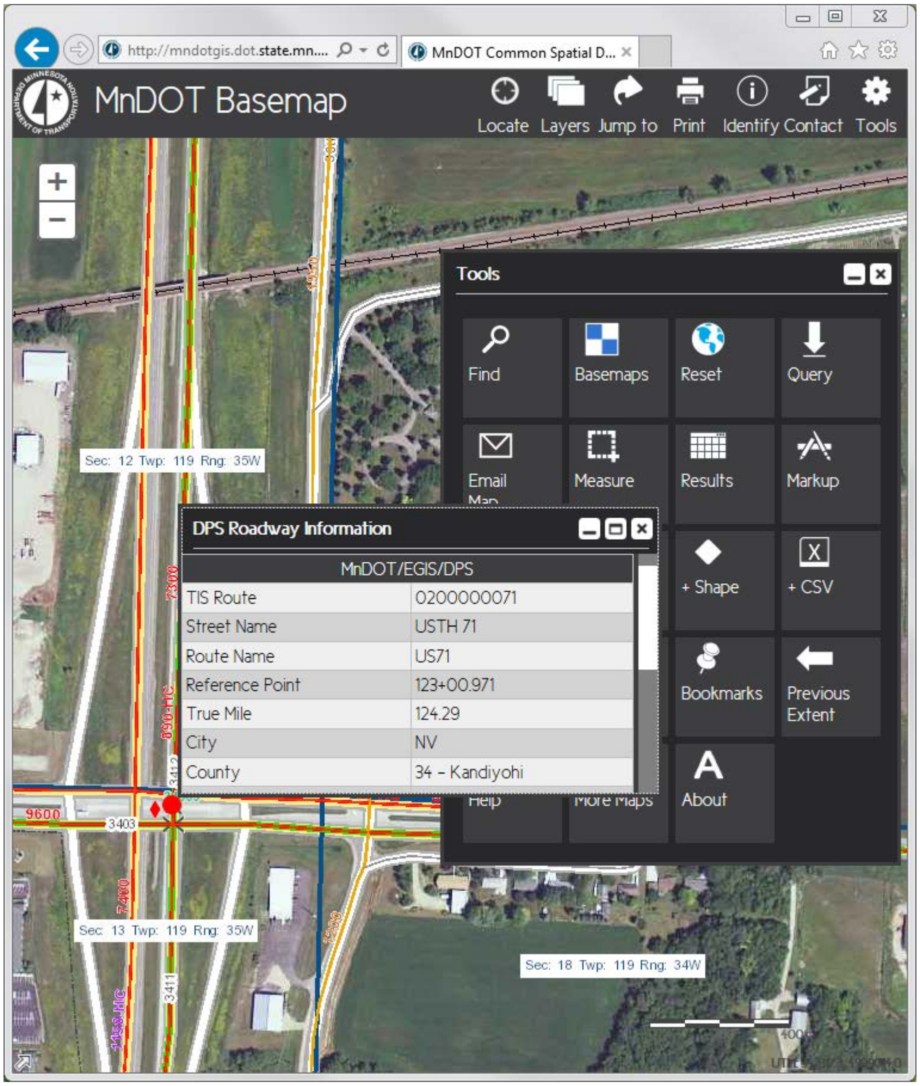
Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

D.8.1.1 TIS Route and Street Name

DPS Roadway Information

- TIS Route
  - The TIS Route is a string of ten numbers.
  - Numbers in the first two positions in this sequence indicate the Route System.
  - Numbers in positon 3-6 indicate the roadway authority.
    - 0000 indicates the roadway is on the TH system.
    - nn00 indicates the roadway is on a County system (nn denotes the County).
    - nnnn indicates the roadway is on a City system (nnnn denotes the City Census Code).
  - Numbers in position 7-10 indicate the Route Number.
- Street Name
  - There are instances when the formal or '911' street name is not used. MnDOT's standard practice is to use the Street Name for all route systems except the following.
    - 01 – ISTH
    - 02 – USTH
    - 03 – MNTH
    - 04 - CSAH

Identify the [UNDER] items in a similar manner. Click on the map, near the center of the bridge, on the [UNDER] roadway.

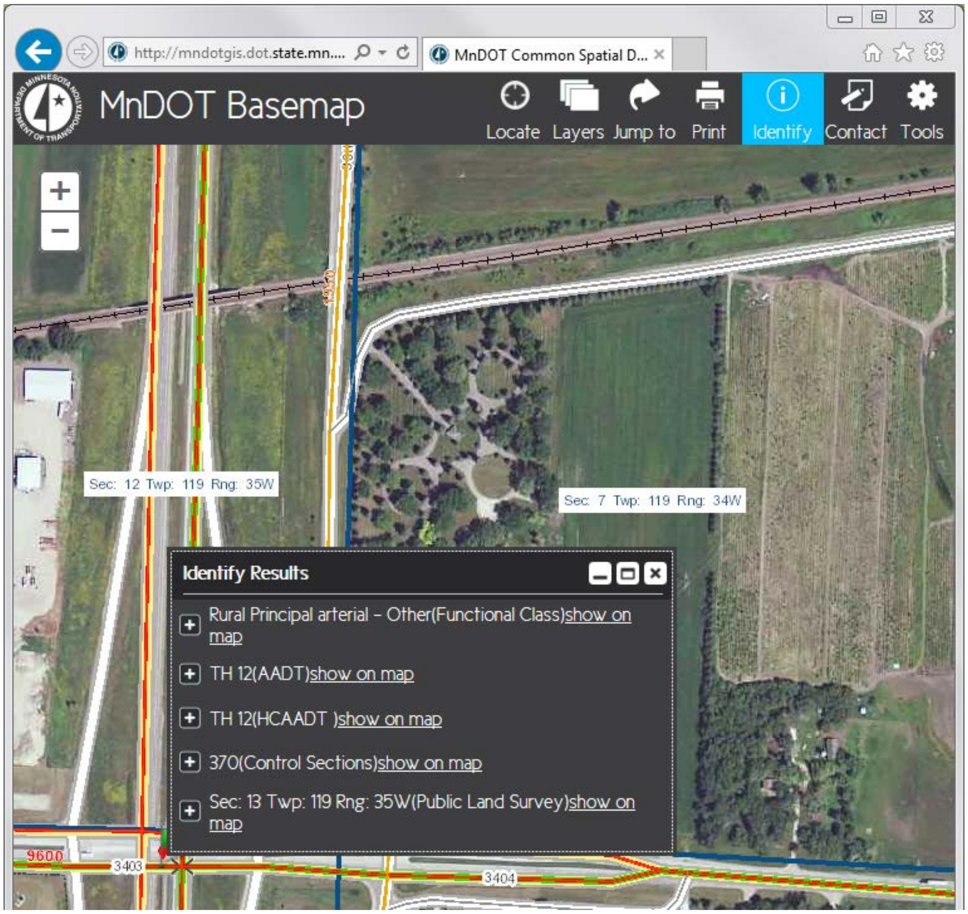


- The DPS tool will identify the following items.

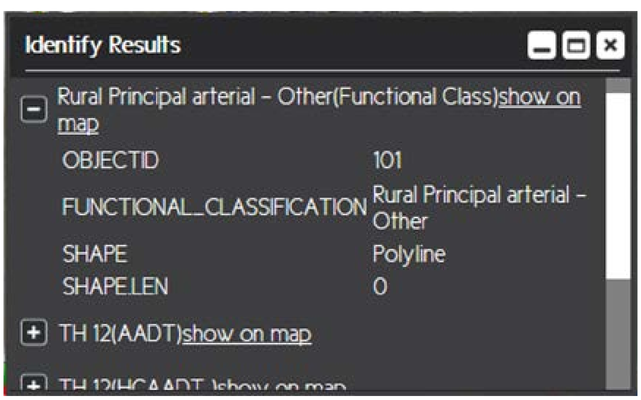
D.7.13.5 [UNDER] Inventory Route, Route Number (NBI Item 5D) = 71
(see Section D.8.1.1, TIS Route)
D.7.13.37 [UNDER] Roadway Name or Description (MnDOT Item) = US 71
(see Section D.8.1.1, Street Name)
D.7.13.38 [UNDER] Route System (MnDOT Item) = 02
(see Section D.8.1.1, TIS Route)
D.7.13.39 [UNDER] Route Number (MnDOT Item) = 71
(see Section D.8.1.1, TIS Route)
D.7.13.40 [UNDER] Reference Point (MnDOT Item) = 123+00.971

D.8.2 IDENTIFY ITEMS USING LAYERS

- On the menu bar, click on Identify.
- Click on the map, near the center of the bridge, on the [ON] roadway.

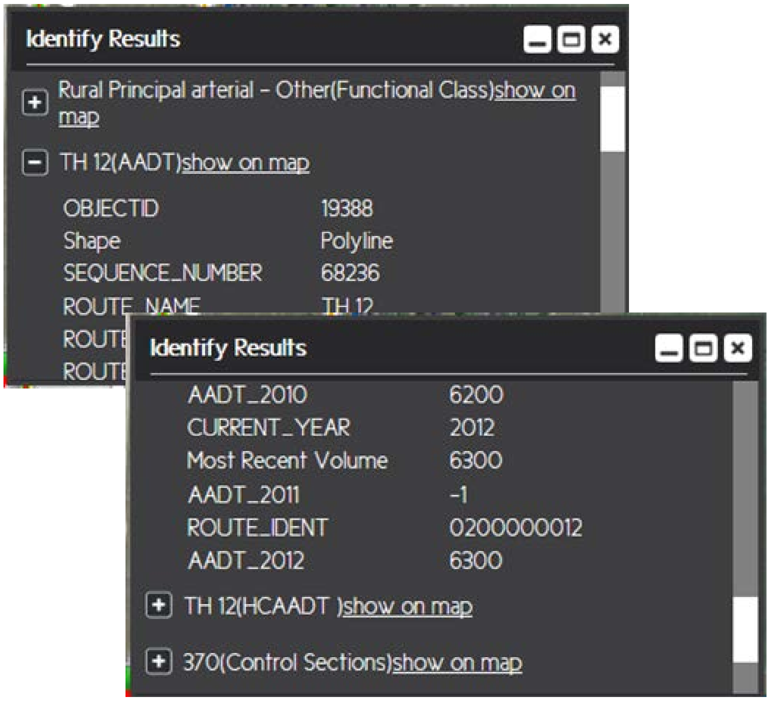


- The Identify Results box will open; expand each Layer.

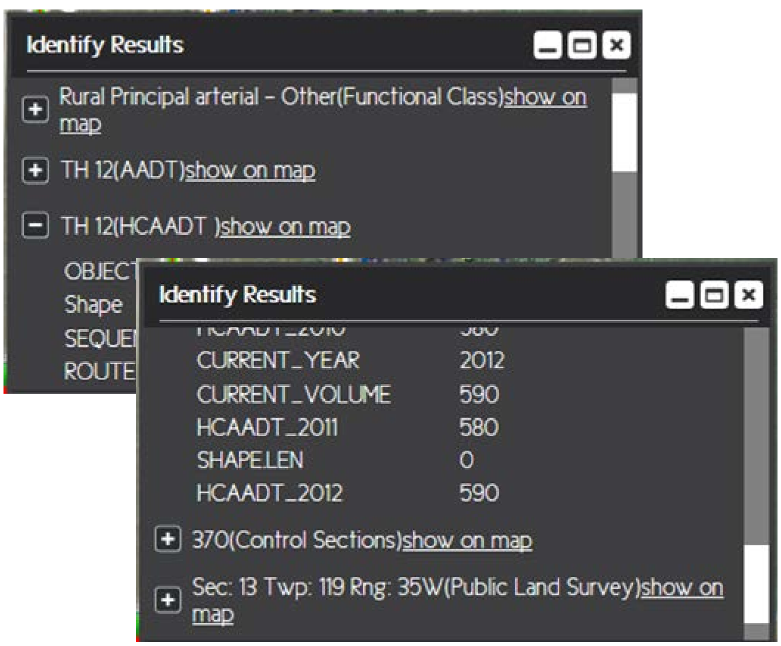


D.7.11.25 [ON] Functional Classification of Inventory Route (NBI Item 26) = Rural Principal arterial – Other

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS

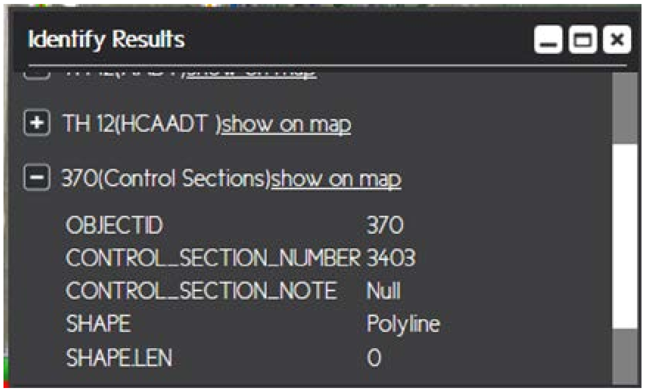


D.7.11.28 [ON] Traffic Sequence Number (MnDOT Item) = 68236
D.7.11.29 [ON] Average Daily Traffic (NBI Item 29) = 6300
D.7.11.30 [ON] Year of Average Daily Traffic (NBI Item 30) = 2012

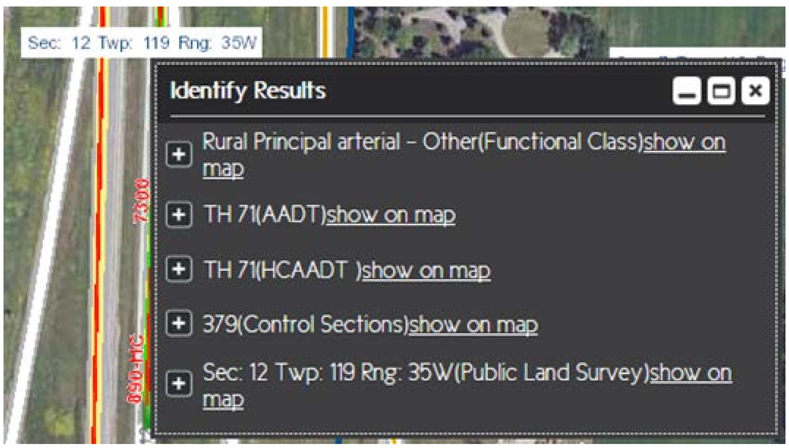


Note, this item is displayed as a % of the AADT (590/6300 x 100)
D.7.11.37 [ON] Average Daily Truck Traffic (NBI Item 109) = 9

Quick Links:
MN STRUCTURE INVENTORY REPORT (Interactive) • INVENTORY ITEMS • NBI ITEMS



D.7.11.41 [ON] Control Section (TH Only) (MnDOT Item) = 3403



D.7.1.13 Section, Township, Range (MnDOT Item) = SEC. 12, TWP 119N, R 25W

Identify the [UNDER] items in a similar manner. Click on the map, near the center of the bridge, on the [UNDER] roadway.

D.7.13.25 [UNDER] Functional Classification of Inventory Route (NBI Item 26) = Rural Principal arterial – Other
D.7.13.28 [UNDER] Average Daily Traffic (NBI Item 29) = 7300
D.7.13.29 [UNDER] Year of Average Daily Traffic (NBI Item 30) = 2012
D.7.13.32 [UNDER] Average Daily Truck Traffic (NBI Item 109) = 12
D.7.13.27 [UNDER] Traffic Sequence Number (MnDOT Item) = 2430
D.7.13.36 [UNDER] Control Section (TH Only) (MnDOT Item) = 3412

D.9 REFERENCES

FHWA Bridges & Structures: Bridge Programs Publications
http://www.fhwa.dot.gov/bridge/bripub.htm

FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (Report No. FHWA-PD-96-001)
https://www.fhwa.dot.gov/bridge/mtguide.pdf

Minnesota Legislative Maps
https://www.sos.state.mn.us/election-administration-campaigns/data-maps/minnesota-legislative-maps/?searchTerm=legislative maps

Minnesota Rule 8820.0200: Definitions
https://www.revisor.mn.gov/rules/?id=8820.0200

Minnesota Rule 8820.9920: Minimum Design Standards; Rural and Suburban Undivided; New Or Reconstruction Projects
https://www.revisor.mn.gov/rules/?id=8820.9920

Minnesota Statute 165.03, Subd. 6a (c): Bridge Load Rating and Posting
https://www.revisor.mn.gov/statutes/?id=165.03

Minnesota Statute 169: Traffic Regulations
https://www.revisor.mn.gov/statutes/?id=169

MnDOT Basemap
http://mndotgis/basemap

MnDOT Bridges and Structures: Inspection
http://www.dot.state.mn.us/bridge/inspection.html

MnDOT Bridges and Structures: Inventory
http://www.dot.state.mn.us/bridge/bridgereports/index.html

MnDOT Bridges and Structures: Inventory: Bridge Reports
https://dotapp7.dot.state.mn.us/bridgereports/Content.aspx?

MnDOT Bridge Inventory Management Unit (BIMU) group email address:
#DOT_BridgeDataRequests

MnDOT Bridge Load Rating and Evaluation Manual
http://www.dot.state.mn.us/bridge/datamanagement.html

MnDOT Bridge Scour Evaluation Procedure for Minnesota Bridges
http://www.dot.state.mn.us/bridge/pdf/hydraulics/ScourGuidelines_12-09.pdf

MnDOT LRFD Bridge Design Manual
http://www.dot.state.mn.us/bridge/lrfd.html

MnDOT Manual for Uniform Traffic Control Devices (MN MUTCD)
http://www.dot.state.mn.us/trafficeng/publ/mutcd/index.html

MnDOT Commercial Vehicle Operations (CVO)
http://www.dot.state.mn.us/cvo/

MnDOT Road Design Manual
https://roaddesign.dot.state.mn.us/roaddesign.aspx

MnDOT Standard Plans
https://standardplans.dot.state.mn.us/StdPlan.aspx

MnDOT Standard Plans group email address:
DesignStandards@dot.state.mn.us

MnDOT Traffic Engineering Manual
http://www.dot.state.mn.us/trafficeng/publ/tem

MnDOT Vertical and Horizontal Bridge Underclearance Report
http://www.dot.state.mn.us/bridge/pdf/clearanceform.pdf

National Highway System:
https://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/minnesota/mn_minnesota.pdf

STATE OF MINNESOTA

Bridge and Structure Inspection Program Manual

DEPARTMENT OF TRANSPORTATION

Chapter E

Quality Management Check Stamp

Originated By:		Date:	1-19-14
Checked By:		Date:	
Back Checked By:		Date:	
Corrected By:		Date:	
Verified By:			

QUALITY CONTROL (QC) QUALITY ASSURANCE (QA)

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E.1 OVERVIEW

The Quality Control (QC) Quality Assurance (QA) Chapter of the Bridge and Structure Inspection Program Manual (BSIPM) is intended to provide detailed guidance in order to maintain accuracy and consistency of bridge inspections and bridge inspection reporting and to evaluate program effectiveness, uniformity, and compliance with federal and state rules relating to bridge inspections.

Accuracy and consistency of data is critical to public safety and information obtained during inspections determines maintenance needs and the allocation of resources.

E.2 ABBREVIATIONS

The abbreviations and acronyms for Chapter E – Quality Control (QC) and Quality Assurance (QA) are located in the Introduction section of the BSIPM.

E.3 REFERENCES

Other inspection manuals, design manuals, technical memorandums, or federal and state laws that can be used as further guidance for quality control and quality assurance of inspecting bridges or structures are listed below.

Manual:

- Bridge and Structure Inspection Program Manual (BSIPM).
- FHWA Bridge Inspector's Reference Manual (BIRM): http://www.dot.state.mn.us/bridge/inspection.html
- AASHTO (American Association of State Highway and Transportation Officials) Manual for Bridge Evaluation: https://bookstore.transportation.org/
- FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nations Bridges: http://www.dot.state.mn.us/bridge/pdf/insp/FHWArecording,codingguide(1995).pdf
- LRFD Bridge Design Manual: http://www.dot.state.mn.us/bridge/lrfd.html
- The MnDOT Bridge Load Rating and Evaluation Manual http://www.dot.state.mn.us/bridge/index.html

Federal and State laws:

- National Bridge Inspection Standards: http://www.fhwa.dot.gov/bridge/nbis.htm
- National Bridge Inspection Standards (NBIS) Metrics: http://flh.fhwa.dot.gov/programs/fabs/reviews.htm
- Minnesota Statues Chapter 165.BRIDGES

E.4 QUALITY CONTROL

The National Bridge Inspection Standards (NBIS) require all states to collect inspection data and maintain an inventory of all public bridges. MnDOT typically inspects all state owned bridges. Non-State owned bridges are inspected by the Bridge Owner, hired consultants, or other agency jurisdictions with inspection programs. In the state of Minnesota, inspection authority is delegated by the Program Manager to local agencies under the title of Program Administrator. See Section A.8.4 for information regarding the role of the Program Administrator.

As defined by NBIS 23 § 650, subpart C:

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

Quality Control (QC) is the operational procedures that are necessary to properly conduct and maintain the quality of the bridge inspection program. QC is a system of routine technical activities to measure and control the quality of the bridge inventory data and report as it is being developed.

Products of the inspection program that are subject to QC include:

- Bridge inspection reporting process
- Inspection reports
- Bridge load ratings and associated calculations, both manual and those from software
- Scour assessments
- Plans of action for scour critical bridges
- Owner bridge files and records
- Verify that critical findings, scour critical bridge monitoring, needed maintenance, and documentation of the follow up have been addressed.
- Determine if repair or rehabilitation is recommended or needed.

E.4.1 QC ROLES AND RESPONSIBILITIES

QC is the responsibility of the institution preparing the documentation, data, calculations, conducting an inspection, or report. When QC on a program product is complete, it should be delivered to the Bridge Owner for their records. QC is a check on every document or product that is prepared by an organization.

- **Structural Evaluation Unit (SEU):** A certified Professional Engineer or others under supervision of, that conducts a structural assessment of a bridge based on inspection findings of fracture critical inspections and other inspection types as requested.
- **State Bridge Engineer (SBE):** is responsible for the overall management of the QC/QA program in the Bridge Office.
- **Program Manager (PM):** The individual in charge of the program, that has been assigned or delegated the duties and responsibilities for bridge inspection, reporting, and inventory. The Program Manager provides overall leadership and is available to inspection team leaders to provide guidance. Currently this position is held by MnDOT's Bridge Construction and Maintenance Engineer.
- **Program Administrator (PA):** A certified Professional Engineer appointed by an agency or jurisdiction to oversee the bridge inspection program and have QC responsibilities as delegated by the PM. Typically, the Program Administrator is the City or County Engineer, a consultant, or the District Bridge Engineer. In accordance with Minnesota Statute 165.03 Subd. 2, the County Highway Engineer is designated as Program Administrator for all bridges located wholly or partially within or over the right-of-way of any county or town road, or any street within a municipality that does not have a city engineer regularly employed.
- **MnDOT Bridge Inspection Engineer (BIE):** Refers to the State Bridge Inspection Engineer who is the primary statewide contact under the direction of the Program Manager for the bridge inspection program in regards to policy, manuals, certifications, training, non-destructive testing methods, fracture critical and complex bridge inspections, and critical finding reporting.
- **Bridge Rating Engineer (BRE):** Person who signs the Bridge Rating and Load Posting Report. Must meet qualifications of AASHTO MBE 6B.2.
- **Professional Engineer (PE):** An engineer licensed by the Minnesota State Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience, and Interior Design.

- **Bridge Inspection Team Leader (TL):** Personnel certified by MnDOT to conduct inspections of in-service bridges and culverts on the state, county, and local highway system throughout the state of Minnesota. A MnDOT certified Bridge Inspection TL must be present at the bridge site at all times during a bridge inspection.

E.4.2 INSPECTION PROGRAM QUALIFICATIONS

Refer to Section A.4 of the BSIPM to find the list of MnDOT qualifications and responsibilities to ensure that those listed below are certified and meet the requirements to perform their given tasks.

- Program Manager
- Program Administrator
- Bridge Inspection Team Leader
- Assistant Team Leaders
- Fracture Critical Bridge Inspector
- Complex Bridge Inspector
- Underwater Bridge Inspector

E.4.3 INSPECTION AND FREQUENCIES

MnDOT has documented the procedure for determining required inspection frequency for individual bridges and culverts. These procedures are detailed in Section A.5 “Bridge Safety Inspection Types” in the BSIPM. Inspection frequencies must be adhered to per the month and year of the previous inspection.

Severe weather, concern for Team Leaders safety, concern for inspection quality, the need to optimize scheduling with other bridges, or other unique situations may be cause to adjust the scheduled inspection date. The adjusted date should not extend more than one month beyond the documented inspection frequency for bridges on a 24 month frequency or three months for bridges on a 12 month inspection frequency without documented justification. Subsequent inspections must adhere to the previously established interval.

In addition to the above criteria, bridge owners should consider any other factors which would have a bearing on the appropriate inspection frequency, such as age of structure, rate of critical element deterioration, traffic characteristics, scour susceptibility, experience with similar structure types, or in-place warranties. Reduction in inspection frequency (i.e. 24 months to 12 months) may be determined by the Program Administrator in regards to initial or routine inspections or the Structural Evaluation Engineer in the case of Fracture Critical, Complex, Underwater, or Special inspections based on inspection findings. The inspection frequency will return to a 12 month frequency if the NBI rating of the Deck, Superstructure or Substructure is rated as a 4 or less.

In order to request a change in an established inspection frequency, a request form must be filled out and submitted to the MnDOT Bridge Office:
http://www.dot.state.mn.us/bridge/pdf/insp/inspectionfrequencychangerequestform.pdf

E.4.3.1 Winter Inspections

There are no restrictions on performing bridge inspections during winter months (December, January, and February). If certain elements are not visible or not accessible, **please note what was obscured** in the inspection report and come back to the bridge again in the spring when those elements can be properly inspected, then file an Update Report. The Update Report allows Team Leaders to change data without affecting the next inspection due date.

E.4.3.2 Inspection Notes

To warrant quality bridge inspections, ensure that comprehensive notes are provided in association with any element in a condition state 2, 3, or 4 or an NBI rating of 5 or less (deck, superstructure, substructure, channel or culvert). Provide the date the condition was noted or update the note each time an inspection is performed. Photo documentation of the condition should be included. Along with the photo and the date, include the location, description and quality of the defect noted. For complete information on how to code all NBI Condition ratings, refer to Chapter D – Recording and Coding Guide of the BSIPM.

E.4.4 INSPECTION REPORTS

QC requirements regarding bridge inspection reports are listed in the following section for each agency.

E.4.4.1 State Owned Bridges

- MnDOT Team Leaders are responsible to review the Structure Inventory Report for accuracy during inspections. The Team Leader is responsible to correct/revise any errors found in the Structure Inventory Report.
- The Team Leader and/or Program Administrator utilize the Bridge Maintenance Module in SIMS or a document of similar fashion to track maintenance tasks and schedule any necessary repairs.
- The Program Administrator will discuss with the Team Leader any items recommended in the inspection report for investigation/repair that were deemed not to require immediate action or future monitoring by the Program Administrator.
- In some Districts, the Program Administrator may delegate authority to the Bridge Maintenance Supervisor to approve maintenance tasks separately from the inspection report.
- Each inspection report along with the associated maintenance tasks are reviewed and approved by the Program Administrator in SIMS.

E.4.4.2 Non-State Owned Bridges

- Team Leaders, assigned from the Agency that owns the bridge, are responsible to review the Structure Inventory Report for accuracy during inspections. The Team Leader is responsible to correct/revise any errors found in the Structure Inventory Report.
- The Team Leader and/or Program Administrator utilize the Bridge Maintenance Module in SIMS or a document of similar fashion to track maintenance tasks and schedule any necessary repairs.
- The Program Administrator will discuss with the Team Leader any items recommended in the inspection report for investigation/repair that were deemed not to require immediate action or future monitoring by the Program Administrator.
- Each inspection report along with the associated maintenance tasks are reviewed and approved by the Program Administrator in SIMS.

E.4.5 CRITICAL FINDING AND SERIOUS SAFETY HAZARDS

A critical finding is any structural condition that, if not promptly corrected, could result in collapse (or partial failure) of a bridge or culvert. This is not limited to findings observed during a scheduled inspection, and can include traffic impact damage or flood damage. It may be necessary to restrict traffic until further evaluation can be made or until the situation is corrected. A critical finding should be thoroughly documented, and the Program Administrator (and Bridge Owner) must be notified immediately. Critical findings must also be reported to the MnDOT

Bridge Office (a report must be entered and submitted in SIMS). Refer to the reporting procedures outlined in Section A.6.2.1 of the BSIPM. *Note: A critical structural deficiency should correlate with an NBI condition rating of 2 (critical condition) for the deck, superstructure, substructure, channel, or culvert.*

A serious safety hazard refers to a non-structural condition that poses a significant safety hazard and must be addressed immediately. Examples include severely damaged railings or guardrails, or loose concrete above traffic or a pedestrian walkway. Serious safety hazards should be immediately reported to the Inspection Program Administrator and Bridge Owner, but do not need to be reported to the MnDOT Bridge Office (a separate report in SIMS is not required).

MnDOT has documented guidelines to fulfill FHWA requirements that all states develop a process to monitor critical findings found during bridge inspections. These procedures are detailed in Section A.6.2 "Critical Finding Reporting" of the BSIPM.

A standard template to report and review Critical Findings is provided in SIMS.

E.4.6 BRIDGE LOAD RATINGS

In order to maintain accuracy and consistency of bridge load ratings and insure compliance with state and federal rules relating to bridge load ratings, it is necessary to document and implement appropriate quality control measures.

It is critical to public safety and results of ratings are used to determine maintenance needs and allocation of resources.

E.4.6.1 Bridge Load Rating Documents and Manuals

The MnDOT Bridge Load Rating and Evaluation Manual (http://www.dot.state.mn.us/bridge/index.html) provides guidance for the load rating of most bridges in Minnesota including bridges on both the State and Local system. Other pertinent references include Section 6 of the AASHTO Manual for Bridge Evaluation (MBE).

E.4.6.2 Rating New Bridges

Load rating a bridge requires a Bridge Ratings Engineer (BRE) and a second BRE or a Bridge Rater (BR). One will perform the rating and fill out the rating forms in a manner as described in Section 9 of the **MnDOT Bridge Load Rating and Evaluation Manual**. The BRE that performs the rating shall sign the load rating forms as the PE. The second BRE or BR, will perform an independent check of the rating and forms and initial the forms at the completion of this check. The check shall include:

- Examine overall rating concepts
- Examine assumptions made for the modeling and rating of the bridge
- Check that correct material strengths are used
- Check that the applied dead loads (including deck thickness, overlays, railings, diaphragms, etc.) are correct
- Check live load distribution factors
- When using Virtis, check "hidden" factors such as engine settings, points of interest, etc.
- Verify critical elements
- Check that the final documentation is correctly and completely filled out.

E.4.6.3 Rerate Existing Bridges

The requirements for personnel, rerating, and documenting an existing bridge are similar to those described in Section E.4.6.2. The rerating will be based on the original rating and include changes that have occurred since the previous rating as described in 9.2.2 of the **Bridge Load Rating and Evaluation Manual.** The original input (computer) file should be preserved, and the changes applied to a copy.

The check will be similar to that of new bridge load ratings as described in Section E.4.6.2 except that it should be focused primarily on the changes that have occurred since the previous rating.

E.4.6.4 Post Bridges

For trunk highway bridges that a load rating requires the bridge to be posted, a memo will be prepared from the State Bridge Engineer to the District Engineer summarizing the rating and posting actions. For non-trunk highway bridges that require a bridge to be posted, the bridge will be posted per the requirements stated in the load rating forms.

E.4.6.5 Review Bridge Inventory for Need for Rerating

The PA shall review the Inspection Reports annually for changes that indicate a possible need for rerating a bridge. The bridges identified are to be further investigated to determine whether or not a rerating is needed.

E.4.6.6 Consultant Ratings/Re-ratings/Postings

Consultants are responsible for being familiar with the MnDOT Bridge Load Rating and Evaluation Manual. Consultants performing bridge load ratings for Bridge Owners are responsible for QC on their work for accuracy and completeness.

E.4.7 BRIDGE FILES

Bridge Owners must keep a complete, accurate, and current bridge record that includes all essential information for each individual bridge under their jurisdiction. The bridge file can be electronic, hardcopy, or a combination of both. Owners shall maintain and review their bridge files each inspection cycle to ensure the following information is provided as required by the Section 2 of the AASHTO Manual for Bridge Evaluation (MBE):

- Plans
- Specifications
- Pile Driving Reports
- Correspondence
- Photographs
- Material and Tests
- Maintenance and Repair History
- Coating History
- Accident History
- Posting
- Permit Loads
- Flood Data
- Traffic Data
- Inspection History
- Inspection Requirements
- Structure Inventory and Appraisal Sheets
- Inventories and Inspection

- Rating Records

E.4.8 SCOUR ANALYSIS AND CHANNEL CROSS-SECTIONS

Information regarding quality control of scour evaluation and channel cross-sections is located in Appendix I of the BSIPM.

E.5 QUALITY ASSURANCE

As defined by NBIS 23 § 650, subpart C:

> *Quality Assurance*. 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.

The purpose is to evaluate the policies, procedures, and operating practices to verify compliance with the NBIS and Minnesota State Laws. The compliance reviews (Section E.5.9) evaluate inspection procedures, inspector qualifications, inspection frequency, inspection files, inspection reports, inventory data, and assuring that quality requirements for each service are fulfilled.

Quality Assurance (QA) is completed to assure that the adequacy and effectiveness of the QC procedures are being met. The objective of QA is not to identify and correct deficiencies within a specific inspection report or bridge file, but to monitor and modify the bridge inspection program process to ensure that overall quality levels are maintained.

To be a constructive process, it is important for QA procedures to be independent, well documented, and clearly understood by all personnel involved.

E.5.1 QA ROLES AND RESPONSIBILITIES

Federal Highway Administration (FHWA) – The FHWA participates in an annual review of at least one Minnesota agency and a statewide annual review of the state bridge inspection program. The statewide annual review determines statewide compliance with the NBIS and includes recommendations for improvements to the program as outlined in the National Bridge Inspection Program 23 Individual Metrics implemented in 2011.

- MnDOT Bridge Office – The Bridge Office conducts annual compliance reviews of Districts and local agencies to evaluate their inspection program in areas of inspection procedures, inspector qualifications, inspection files, field inspections, and other relevant information.
- MnDOT State Aid – All Bridge Office compliance review correspondence is copied to the appropriate District State Aid representative. State Aid participates with the Bridge Office in local agency field and visit reviews when available. State Aid also assists the Bridge Office in implementing non-compliance procedures as described in Section E.5.10.

E.5.2 ROUTINE INSPECTION

Ensure that the routine inspection fully satisfies the requirements of the NBIS with respect to maximum inspection frequency, updating the structure and inventory data, and the qualifications of the inspection personnel on a sample of the Minnesota bridge inventory.

E.5.3 FRACTURE CRITICAL INSPECTION

QA is accomplished via review of all inspection reports and FHWA compliance metric reviews to NBIS, as well as structural evaluation if necessary.

E.5.4 COMPLEX BRIDGE INSPECTION

QA is accomplished via review of all inspection reports and FHWA compliance metric reviews to NBIS, as well as structural evaluation if necessary.

E.5.5 UNDERWATER INSPECTION

The consultant shall develop a Quality Management Plan that specifies how they will perform QC and QA activities throughout the duration of the project to ensure delivery of a quality product in a timely manner that conforms to established contract requirements. The Quality Management Plan shall be submitted to the State's Program Manager for approval.

E.5.6 SPECIAL INSPECTION

QA is accomplished via review of all inspection reports and FHWA compliance metric reviews to NBIS, as well as structural evaluation if necessary.

E.5.7 BRIDGE LOAD RATING

The MnDOT Bridge Office, Bridge Load Rating Unit is responsible for Quality Assurance of bridge load ratings. The Bridge Load Rating Unit is responsible for reviewing state owned bridge load rating reports. MnDOT also audits bridge load rating reports for bridges owned by local or other agencies that carry public transportation.

Program Administrators are responsible to review and sign their own bridge load rating reports.

E.5.8 BRIDGE FILES

As part of agency compliance reviews (Section E.5.9), MnDOT reviews bridge files for the following:

- Bridge plans
- Signed inspections
- Inspection Reports from past years
- Structure Inventory Reports
- Bridge related correspondence
- Bridge maintenance and repair records
- Bridge load rating summary
- When required scour action plans and channel cross sections
- Underwater, Special or Fracture Critical reports, if applicable
- Quality of Inspection Documentation
- Recent photographs (top, side and under views)

E.5.9 AGENCY COMPLIANCE REVIEW

NBIS Compliance Reviews of agency inspection programs are conducted by the MnDOT Bridge Office each year. A new process for evaluating agencies began in 2012. The review now aims to mirror the FHWA's NBIS Oversight Program - Metrics for the Oversight of the National Bridge Inspection Program (PDF) and apply this metric evaluation program to MnDOT and local agencies. The review annually assesses a compliance level for all agencies statewide based on eight of the twenty-three metrics using a series of database queries. Below are the eight metrics assessed with this method;

- #2: Qualifications of personnel – Program Administrator
- #3: Qualifications of personnel – Team Leader(s)
- #6: Routine inspection frequency – Lower risk bridges
- #7: Routine inspection frequency – Higher risk bridges
- #12: Inspection procedures – Quality Inspections
- #13: Inspection procedures – Load Rating
- #14: Inspection procedures – Post or Restrict
- #23: Inventory – Timely Updating of Data

Agencies are selected for an in-depth review based on poor performance with the eight metrics or because the agency has not had an in-depth review in the past five years. In-depth reviews incorporate the assessment of five additional metrics which require a field review and an office meeting. Below are the five additional metrics assessed during an in-depth review;

- #15: Inspection procedures – Bridge Files
- #17: Inspection procedures – Underwater
- #18: Inspection procedures – Scour Critical Bridges
- #21: Inspection procedures – Critical Findings
- #22: Inventory – Prepare and Maintain

A description of MnDOT's review process can be found on the Bridge Office web site and this link; MnDOT's NBIS Compliance Review Process (PDF)

E.5.10 AGENCY COMPLIANCE STATUS

Inspection program deficiencies specifically examined for compliance are qualifications of personnel, inspection frequency, inspection procedures, and bridge inventory. There are four levels of compliance:

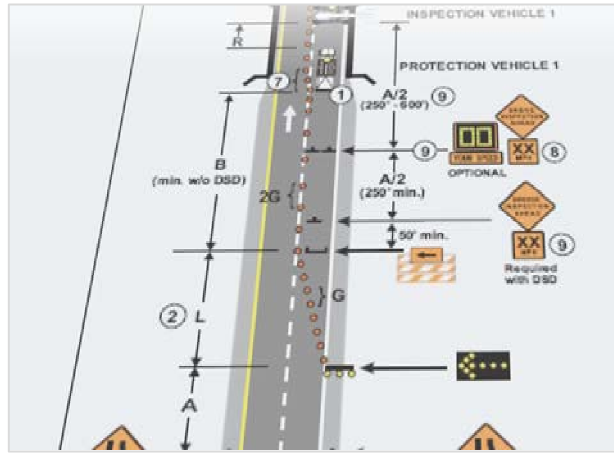
- **Compliance** – the act of adhering to NBIS regulation.
- **Substantial Compliance** – The act of adhering to the NBIS regulation with minor deficiencies. Deficiencies are expected to be corrected within 12 months or less, unless the deficiencies are related to issues that would most efficiently be corrected during the next inspection.
- **Non-Compliance** – The act of not adhering to the NBIS regulation. Identified deficiencies may adversely affect the overall effectiveness of the program. Failure to adhere to an approved plan of corrective action is also considered non-compliance.
- **Conditional Compliance** – The act of taking corrective action in conformance with the State Program Manager approved Plan of Corrective Action to achieve compliance with the NBIS. Deficiencies, if not corrected, may adversely affect the overall effectiveness of the program.

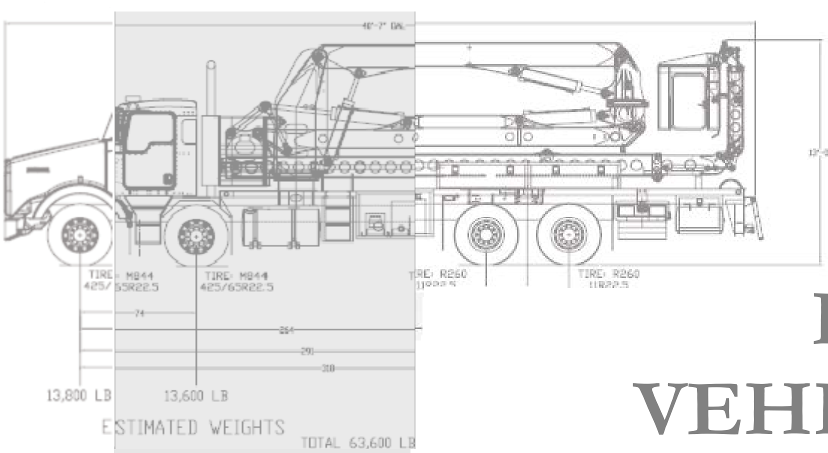
E.5.10.1 Agency Non-Compliance

Agencies deemed grossly out of compliance are required to create a Plan of Corrective Action (PCA) to self-direct itself back into compliance with the NBIS. Once this PCA is submitted, reviewed and accepted by the States Program Manager, a follow up review will be scheduled to ensure the agency is working toward their agreement. Failure to achieve compliance per the agreed upon Plan of Corrective Action can lead to further actions by the State Program Manager. These actions can include revoking the appointment of the Program Administrator.

STATE OF MINNESOTA

Bridge and Structure Inspection Program Manual





Chapter F

MNDOT INSPECTION VEHICLE POLICY MANUAL

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F.1 OVERVIEW

The MnDOT Inspection Vehicle Policy Manual Chapter of the Bridge and Structure Inspection Program Manual (BSIPM) is designed to compile and clarify the MnDOT Bridge Office snooper policies and procedures and create one document that provides all the necessary information about MnDOT's inspection access vehicles. This document contains the current policies and procedures for the operation, rental, and maintenance of MnDOT's Inspection Vehicle trucks. See the Introduction for contact information to direct questions to.

F.2 ABBREVIATIONS

The abbreviations and acronyms for Chapter F – MnDOT Inspection Vehicle Policy are located in the Introduction section of the BSIPM.

F.3 SNOOPER DESCRIPTIONS AND SPECIFICATIONS

MnDOT has six under bridge inspection vehicles designed and manufactured by Aspen Aerials. They will be referred to as snoopers for the remainder of this document.

The six bridge snoopers are assigned equipment to aid operators when they are using the bridge snoopers. All six snoopers have a generator and air compressor. All snooper baskets are plumbed for compressed air and wired for 12 and 110 volt electricity. The 12 volt electric operates whenever the truck is operating. The 110 volt electricity or compressed air can be activated by the snooper truck operator when needed. If you are planning on using compressed air in the snooper basket bring air fittings and/or adapters for your equipment as compressor fittings are not standardized.

The snoopers have additional equipment to provide truck and basket operators with tools to assist in inspection or maintenance.

The equipment assigned to each snooper is:

- Chainsaw
- Extra hardhat
- Extra fall protection
- Spotlights
- Life vests
- Wind gauge
- Sockets
- Screwdriver
- Pliers
- Crescent wrench
- Grease gun
- Life Ring for water rescue

The snooper trucks also contain high angle rescue equipment including:

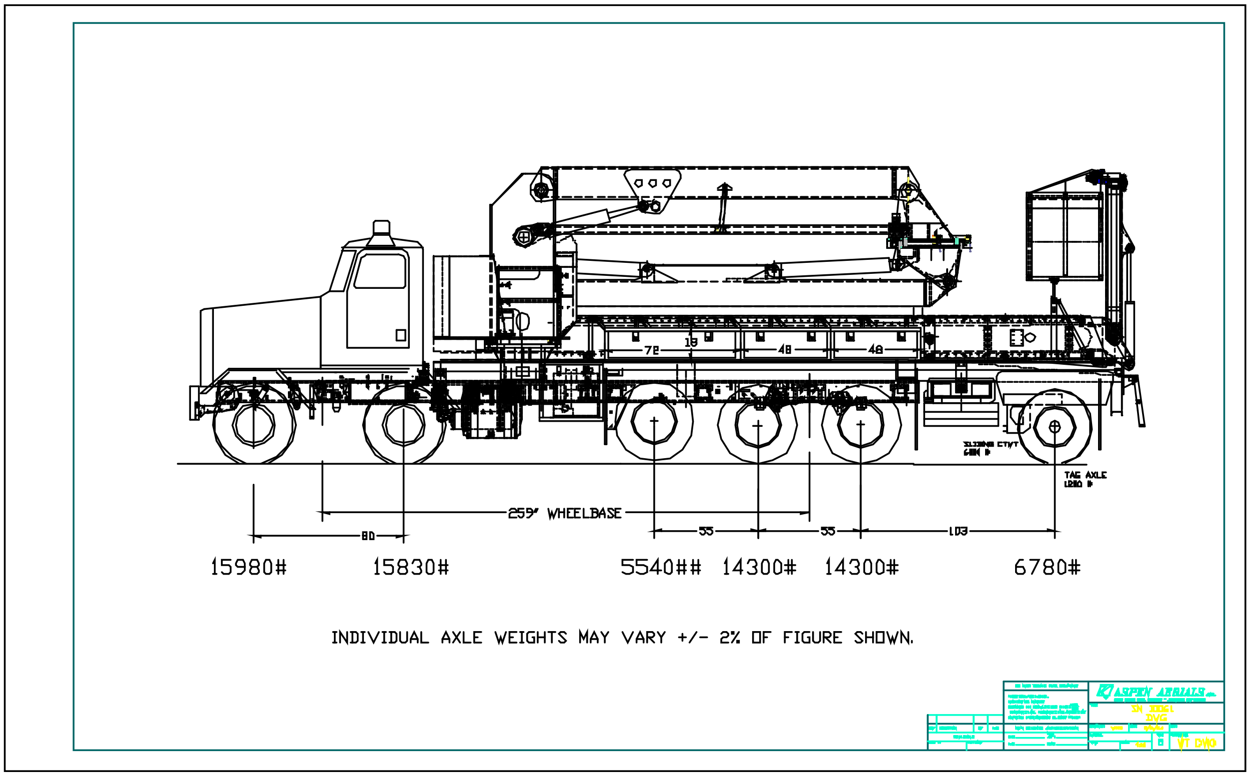
- SKED rescue sled
- Ascenders
- 2 Descenders for repelling
- 200' of rope
- Regular and 4 to 1 rescue straps
- Carabineers, pulleys and miscellaneous hardware for rigging
- Telescoping pole for basket rescue recovery

See Appendix D for further guidance on High Angle Rescue Equipment.

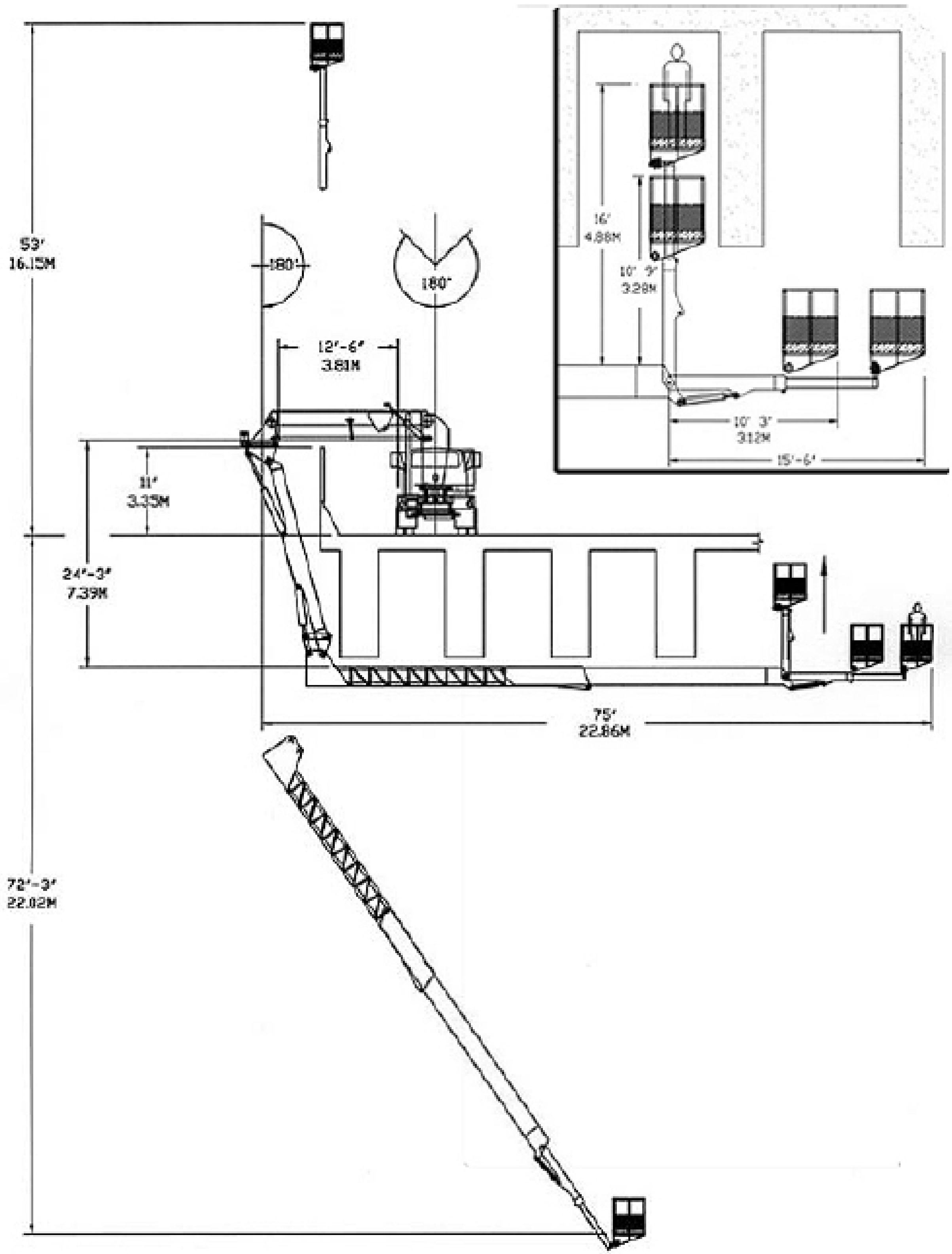
The following sections will provide more information on each of MNDOT's snooper trucks.

F.3.1 A-75 SNOOPER

MnDOT has one A-75 snooper, unit number 200615. This unit is stationed in the Metro District at the Bridge Office in Oakdale. This snooper has a maximum reach of 75 feet under a bridge, a 10 foot fence clearance and a maximum 12’-6” sidewalk clearance. It can be deployed from the right or left side of the truck. The basket capacity is 700 lbs. This vehicle has a GVW of 72,730 lbs. and a vertical clearance of 13’-6”.

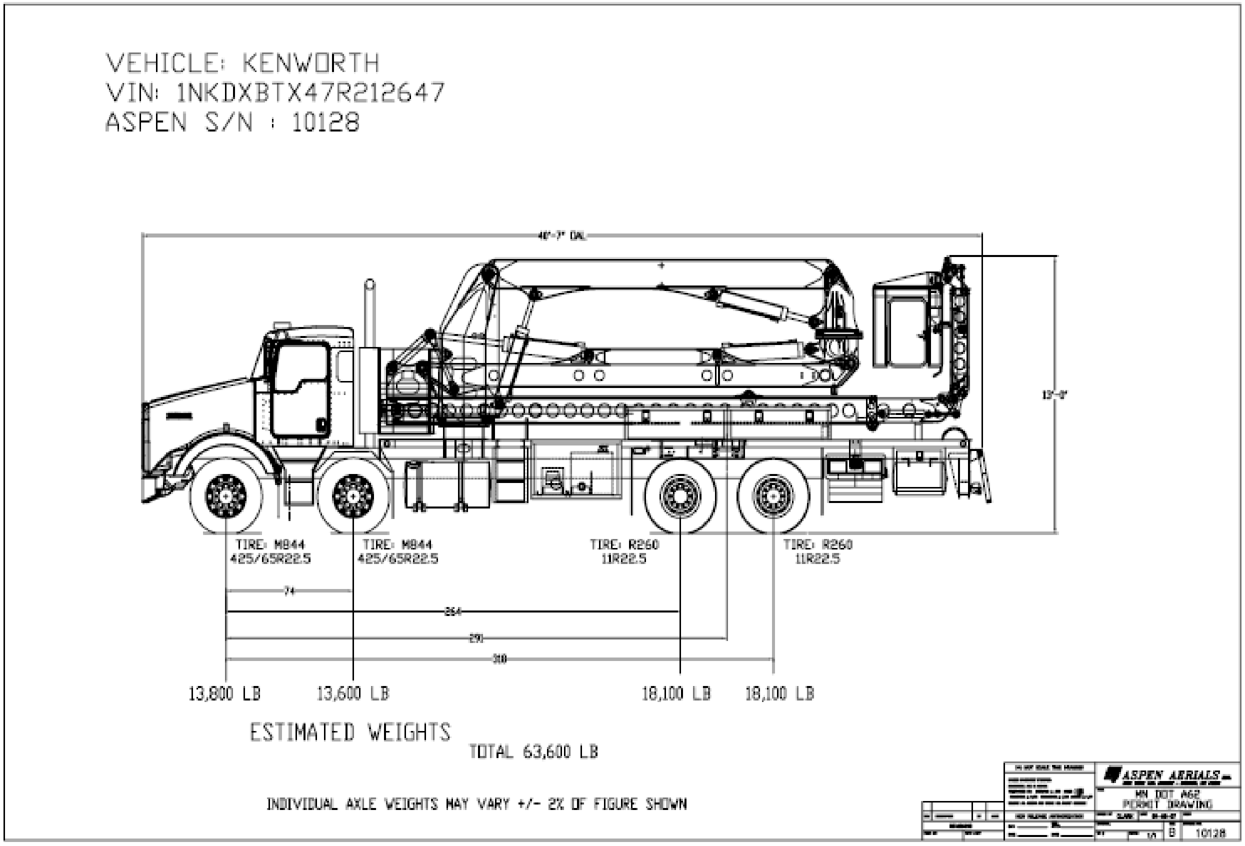


A-75 Flight path:

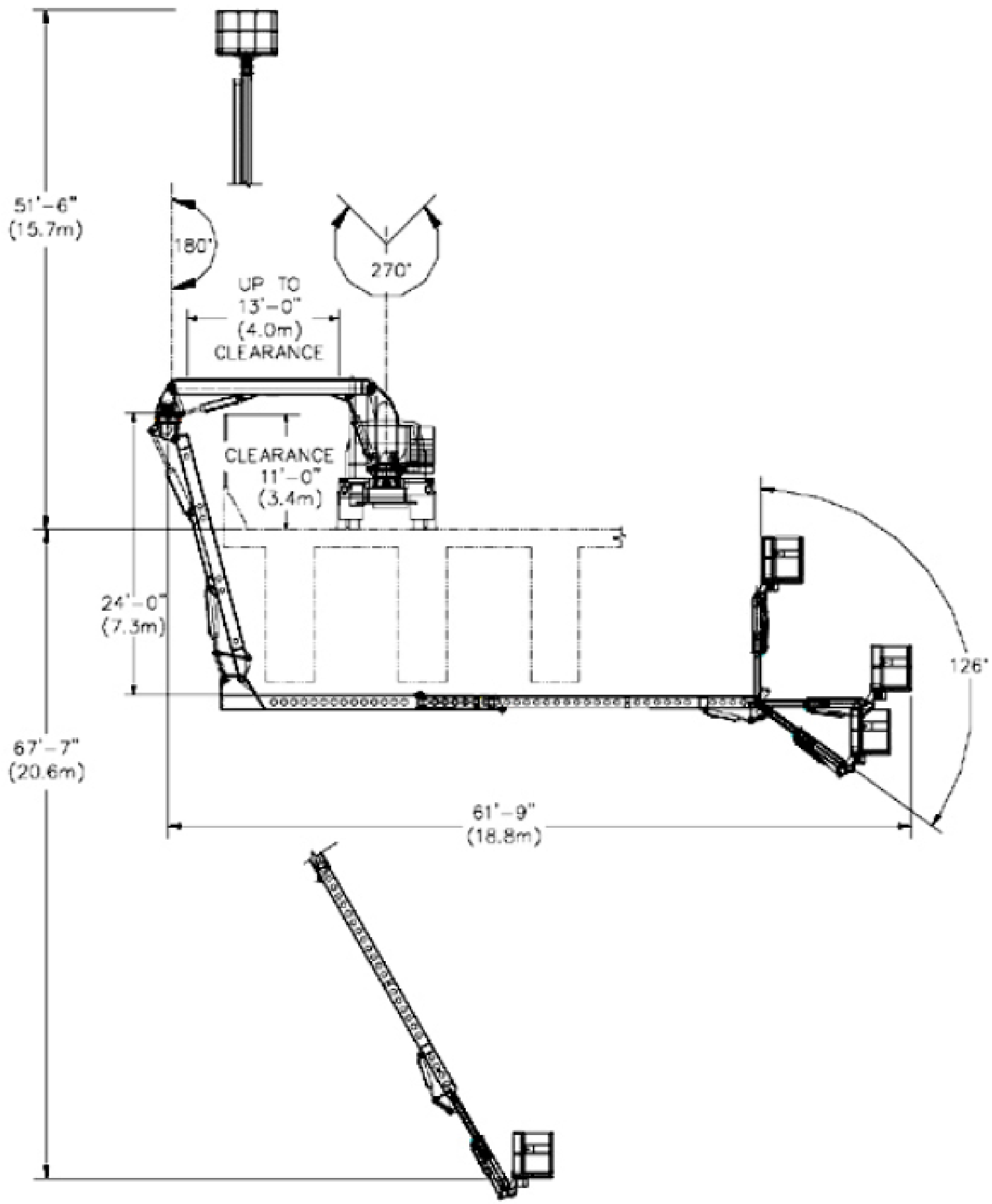


F.3.2 A-62 SNOOPER

MnDOT has four A-62 snoopers: unit number 207208 stationed in District 6 at the Rochester maintenance facility, unit 208350 stationed in District 1 at the Duluth maintenance facility, unit 211260 stationed in D3 at the St. Cloud maintenance facility, and unit 211000 in District 2 stationed at the Bemidji maintenance facility. These snoopers have a maximum reach of 62 feet under a bridge a 10 foot fence clearance and a maximum 13 foot sidewalk clearance. They can be deployed from the right or left side of the truck. The basket capacity is 600 lbs. These vehicles have a GVW of 63,600 lbs. and a vertical clearance of 13 feet.

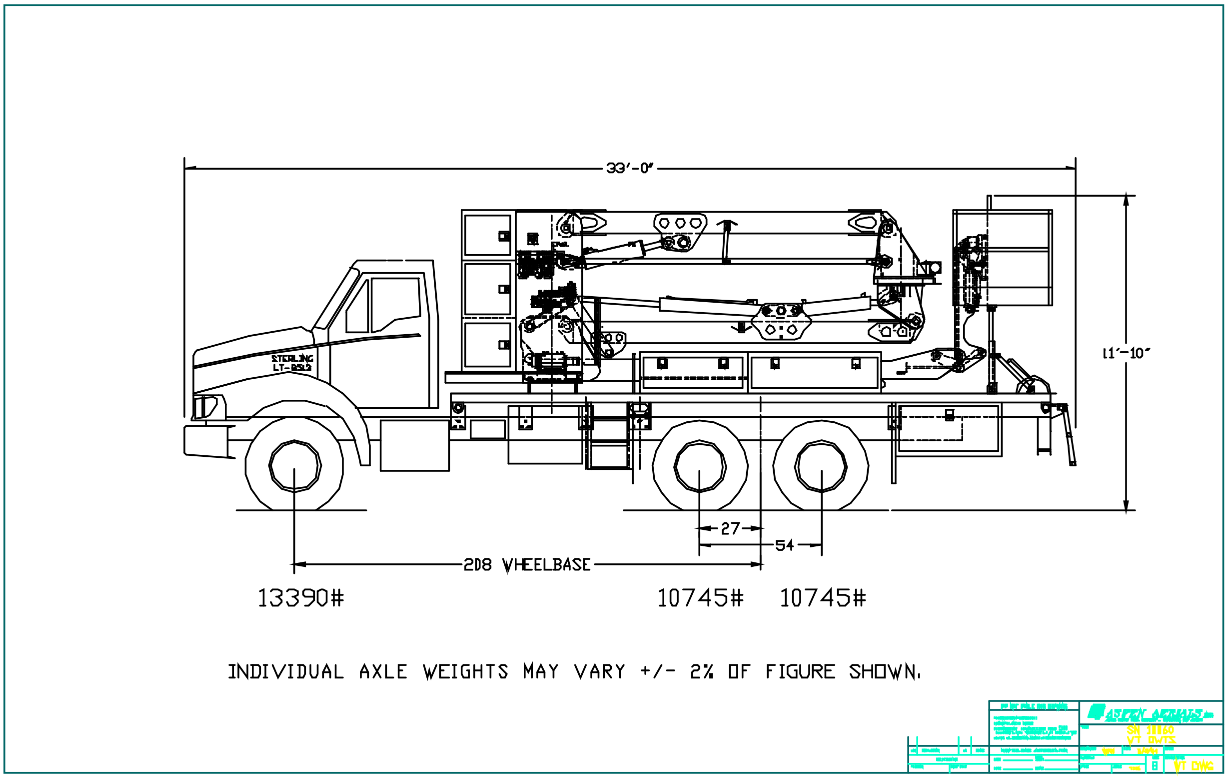


A-62 Flight path:

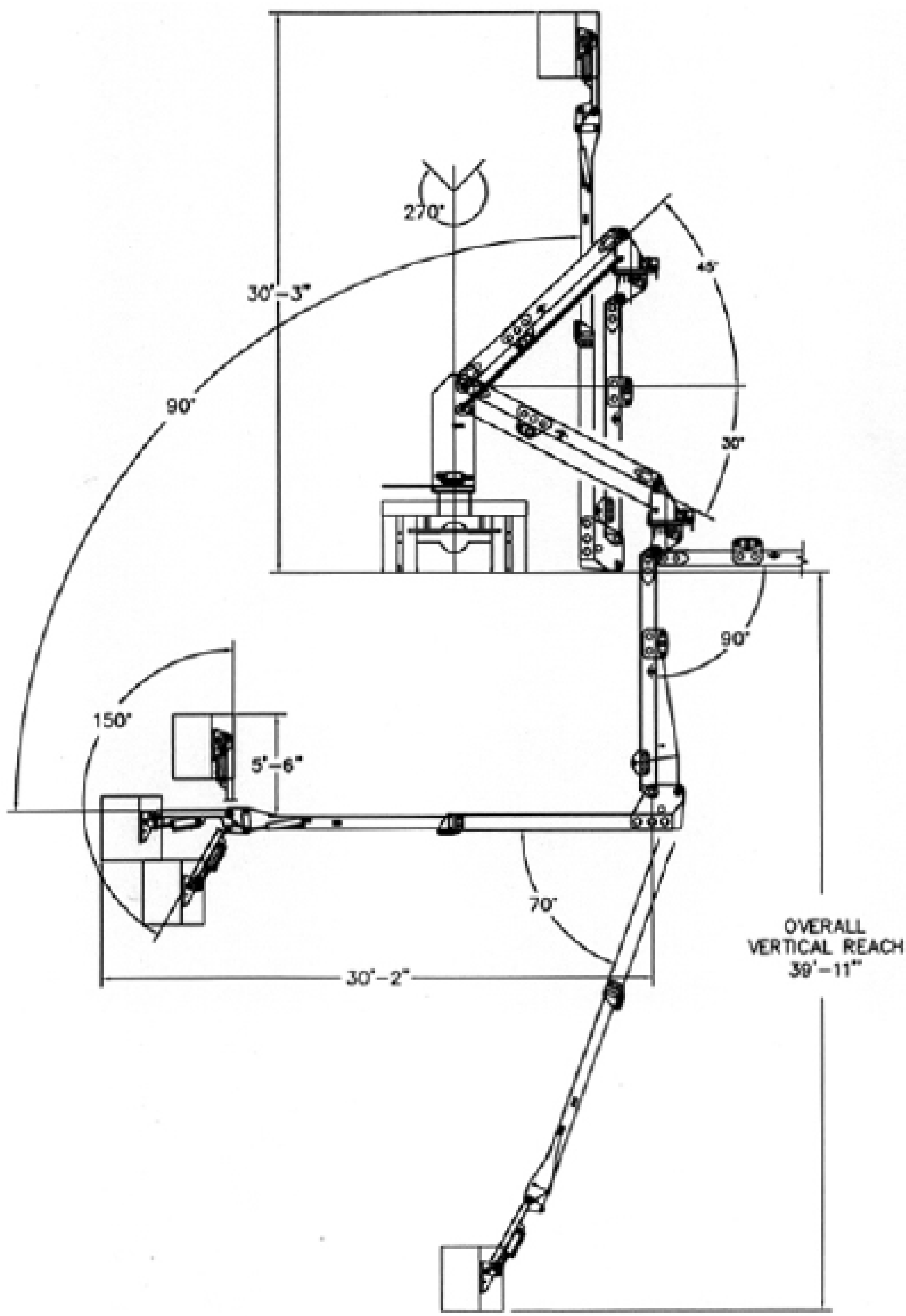


F.3.3 UB-30

MnDOT has one UB-30 snooper: unit number 200600. This unit is stationed in the Metro District at the Bridge Office in Oakdale. This snooper has a maximum reach of 30 feet under a bridge, a 10 foot fence clearance and a maximum 7'-3" sidewalk clearance. It can be deployed from the right or left side of the truck. The Basket capacity is 600 lbs. This vehicle has a GVW of 34,880 lbs. and a vertical clearance of 11'-10". This truck is designed to be used on small load posted bridges with a load posting of 18 tons or greater.



UB-30 Flight Path:



F.4 MOOG DESCRIPTIONS AND SPECIFICATIONS

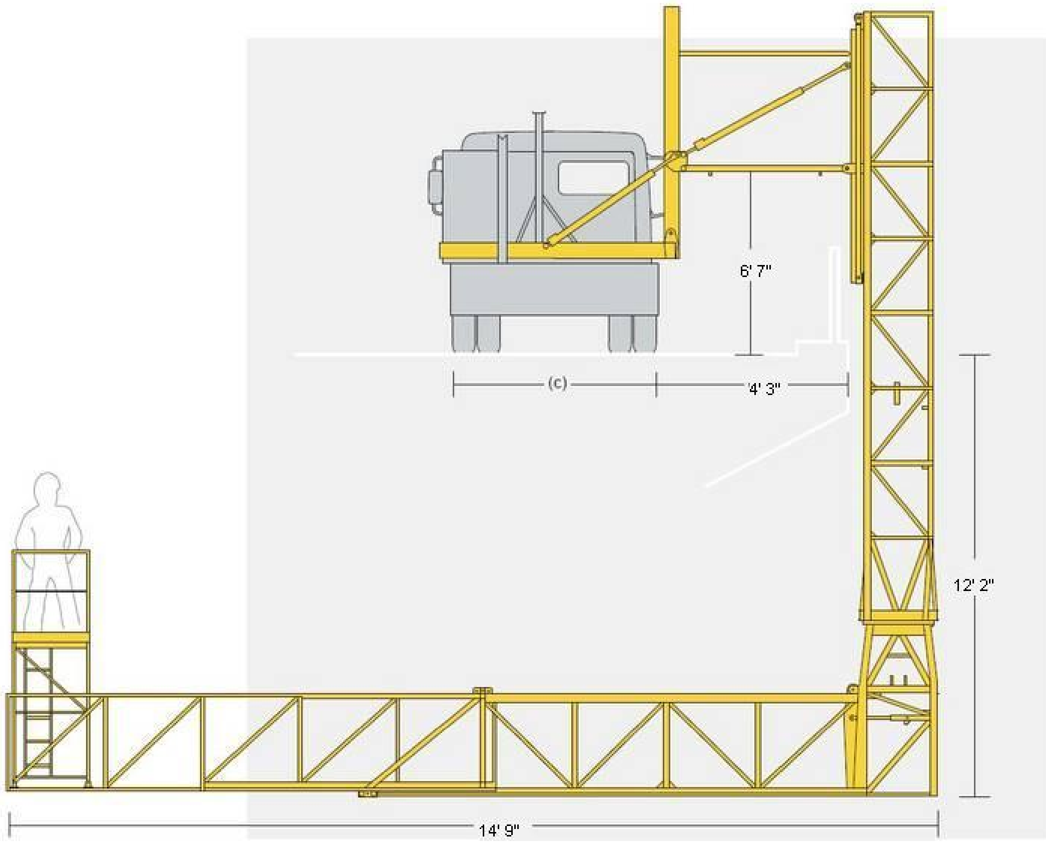
MnDOT has one MOOG under bridge inspection scaffolding trailer, unit number 209595. This unit is stationed in the Metro District at the Bridge Office in Oakdale. The MOOG is a self-propelled hydraulically powered scaffold made by MOOG in Germany. The MOOG has a maximum reach of 15 feet under a bridge and can be deployed from the right or left side of the trailer. This trailer has a GVW of 6,600lbs. This trailer is designed to be used on small load posted bridges with a load posting greater than 3 tons. The scaffolding is designed to hold a maximum weight of 600 lbs., including equipment. This equipment is operated by the C.O. Bridge Office Inspections unit. Contact Farrell Potter to schedule this equipment and an operator. Only trained personnel are qualified to operate this equipment.

The MOOG is equipped with a Honda generator that operates the MOOG. 110 volt electricity is available on the platform. The Bridge Office has a portable air compressor available; If you need to use compressed air during your inspection, request the compressor when you schedule the MOOG.

The MOOG's list of additional equipment is:

- Chainsaw
- Sandvik clearing axe
- Dewalt cordless drill

Moog Flight Path:



F.5 SNOOPER COLD WEATHER AND STORAGE POLICY

The Snoopers are hydraulically operated, and can operate in temperatures down to 32° Fahrenheit. Attempting to operate the snoopers in temperatures below 32° Fahrenheit requires extra care. When operating any MnDOT snooper in temperatures below 32° Fahrenheit, the agency requesting the snooper shall provide heated storage for the snooper and shall wash the road spray and salt from the snooper at the end of each work shift. MnDOT's bridge access equipment shall not be operated in temperatures lower than 0° Fahrenheit unless there is an emergency and approval from the Bridge Office is obtained.

F.6 QUALIFICATIONS OF SNOOPER OPERATORS

The following sections provide the requirements to become a certified operator of the snooper truck and snooper baskets as well as the disqualifications.

F.6.1 SNOOPER TRUCK OPERATOR CERTIFICATION

The process for certification of snooper truck operators per **AFSCME Council 6, Appendix K, Article 12** is as follows.

1. Posting for "Heavy Equipment Operator Selection for Training" within the bridge shops
2. Testing the most senior personnel
3. Begin training program:
    a. Attend two days training with factory representatives at Aspen Aerials.
    b. Service unit with a certified mechanic.

   c. Perform at least 40 hours of operation on each snooper unit the driver will be certified to operate, while under the supervision of a certified operator.
   d. Complete the certification process with a Supervisor or Superintendent.
   e. Complete the required paperwork and submit it to your District Employee Development Specialist (EDS).

Consult with your District training offices to proceed with this process.

Training for snooper truck operators takes place in the spring on an as-needed basis. The Bridge Office would like to maintain a regular and back-up driver for each snooper. The Bridge Office will pay for this training when they have been contacted and a need is identified. If there is a need to certify a new or back-up operator, contact Farrell Potter or Rodney Carter at the Bridge Office in Oakdale.

F.6.2 SNOOPER BASKET OPERATOR QUALIFICATIONS

The process for qualification of snooper basket operators is as follows.

1. Identify the individuals to be trained.
2. Contact your District's snooper basket operator trainer.
3. Begin the training program, the training program is located at the site listed below: http://ihub.dot.state.mn.us/training/maintenancetraining/equipment.html
   a. Once at the site read the following equipment manuals.
      - AWP-Snooper Base Truck Operator, UB30-EQ87444OT
      - AWP-Snooper Base Truck Operator, A75-EQ874442T
      - AWP-Snooper Base Truck Operator, A62-EQ874442T
   b. At the same site go to the link AWP-Snooper Basket Operator-EQ87446OT http://ihub.dot.state.mn.us/training/maintenancetraining/equip/awp/snooperBasket-EQ874460T/snooperBasket.html
   c. Complete the list of "Prerequisites" as shown.
   d. Complete the Snooper Basket Operator Training E learning Module class BRDG00039. The class can be found at MnDOT Learning Center web site shown below: http://ihub.dot.state.mn.us/learningcenter/index.html
   e. Perform a minimum of 20 hours of operation with a qualified operator.
   f. Complete qualification process with a Supervisor or Superintendent, or certified truck operator.
   g. Complete the required paperwork and submit it to your District Employee Development Specialist.

F.6.3 DISQUALIFICATION OF SNOOPER TRUCK OPERATORS

The Bridge Office shall retain the authority to disqualify any snooper truck operator who ignores safe operating procedures (as defined by **ANSI/SIA A92.8-2006 Manual of Responsibilities** located in the cab of each snooper), operates the truck in a manner that is destructive to the equipment or harmful to basket passengers and bystanders at the worksite, or fails to perform necessary maintenance or inspection of their equipment.

F.6.4 DISQUALIFICATION OF SNOOPER BASKET OPERATORS

The snooper truck drivers and basket operator trainers shall have the authority to disqualify any basket operator that ignores safe operating practices (as defined by **ANSI/SIA A92.8-2006 Manual of Responsibilities** located in the cab of each snooper), and defined in the snooper basket training class, and runs the basket in a manner that is destructive to the equipment, or harmful to basket passengers and bystanders at the worksite.

Requalification of snooper basket and truck operators will be considered on a case by case basis.

F.7 NOTICE TO ALL SNOOPER TRUCK AND BASKET OPERATORS

The following is a list of responsibilities of snooper truck and basket operators taken from **ANSI A92.8 2006 Manual of Responsibilities**.

- The driver and basket operator shall comply with the requirements for operators set forth in the ANSI A92.8 2006 Manual of Responsibilities.
- Training and retraining will comply with the requirements set forth in the **ANSI A92.8 2006 Manual of Responsibilities**, Section 10.3.
- The driver and basket operator shall read and understand all manufacturer's operating instructions and understand all labels, warnings, and instructions displayed on the unit.
- Work zone (traffic control) policies and procedures are the responsibility of everyone. A fall protection program must be maintained as set forth in MnDOT policy, and must be followed when operating this unit.
- All applicable safety requirements must be followed when operating this unit.
- The minimum crew shall consist of one qualified driver and one qualified basket operator. When the platform is deployed in an operating position, at least one qualified truck driver, knowledgeable in the procedures for the retrieval of personnel and/or the platform, shall be on the support structure at all times.
- Before the unit is used, and during use, the driver and basket operator shall check the area for operating conditions and limitations including potential hazards. See Section 10.6 in the **ANSI A92.8 2006 Manual of Responsibilities**.
- The driver and basket operator shall follow all special work site rules provided by the organization having jurisdiction over the project.
- All occupants of the unit shall wear appropriate personal safety equipment.
- Operation of the controls must be performed smoothly and evenly. Abrupt starts and stops may cause excessive wear and tear on the equipment.
- If a function (boom or turrets) stops working you have reached a limit that keeps the machine within safe operating envelope. It may be necessary to reverse that function to regain movement.
- Do not let any part of this unit come into contact with the bridge structure.
- Support of the platform in any working position shall not be dependent upon any other object(s) or structure.
- Driver and basket operators shall maintain the appropriate minimum approach distance (MAD) from energized power lines and parts as covered by 1926.550(a) (15): 10 feet from low voltage power lines and 25 feet from high voltage power lines. See Appendix E.
- The rated workload of the unit shall not be exceeded; check operator's manual for the rated capacity of each truck.
- Unsafe operating practices such as stunt driving and horseplay shall not be permitted.
- The unit shall not be used as a crane.

F.8 NOTICE TO ALL SNOOPER TRUCK OPERATORS

The following is a list of responsibilities of snooper truck operators taken from **ANSI A92.8 2006 Manual of Responsibilities**.

- The operator shall not permit unauthorized or unqualified person(s) to operate this unit.
- The operator shall not permit anyone to operate this unit without proper training.
- Do not operate this unit without properly performing the recommended scheduled maintenance and inspections as stated in the manufacturer's service manual.

- The operator shall ensure that the current Manual of Responsibilities, Operators Manual and Maintenance Manual are stored in a weather resistant storage location on the unit.
- A "Pre-Start Inspection" of this unit shall be performed before use each day at the beginning of each shift. A "Pre-Start Inspection Checklist" must be used during this process. See 10.5 **ANSI/SIA A92.8-2006 Manual of Responsibilities** located in the cab of each snooper (see also Section F.16).
- The operator shall ensure the area surrounding the unit is clear of personnel and equipment before deploying or re-cradling the platform.
- The unit shall not be deployed for operations on support structures with either slopes or grades that exceed those for which the unit is rated for by the manufacturer. See the Operator's Manual for the maximum allowable slopes and grades for each truck.
- The operator shall ensure the surface upon which the unit is to be used is capable of sustaining the load(s) imposed in any configuration the unit can attain.
- Movement of the chassis with the platform deployed shall comply with 10.10.12 in **ANSI/SIA A92.8-2006 Manual of Responsibilities**.
- Do not operate any unit in winds exceeding 35 miles per hour (56 KM/H).
- The operator shall immediately report to the Bridge Office any potentially hazardous locations which become evident during operation. Any problems that might affect the safety of the operators shall be resolved prior to continued use.
- The operator shall not alter, modify, or disable interlocks or other safety devices.
- Do not transport this unit unless the axle locks are disengaged and components are secure.
- The operator shall immediately contact the Bridge Office for guidance and assistance when they encounter any:
  1. Suspected or actual malfunctions of the unit.
  2. Hazardous or potentially unsafe conditions relating to capacity, intended use, or safe operation of the unit (as defined by **ANSI/SIA A92.8-2006 Manual of Responsibilities** located in the cab of each snooper).
     a. The operators shall not continue operation of the unit until corrective action has been taken or appropriate information received.
- The engine(s) shall be shut down while fuel tanks are being filled.

F.9 NOTICE TO ALL SNOOPER BASKET OPERATORS

The following is a list of responsibilities of snooper basket operators taken from **ANSI A92.8 2006 Manual of Responsibilities**.

- A personal fall arrest system meeting code of federal regulations (CFR) title 29 1926.502(d) shall be utilized when operating this unit (see Appendix F).
- Boarding of the platform shall be from the support surface. Climbing over the bridge railing to board the platform is permitted if you are 100% tied off during the procedure.
- The basket operator shall ensure that only tools and materials which are evenly distributed and can be safely handled by a person(s) working from the platform are transported.
- Personnel shall maintain a firm footing on the platform floor. The use of planks, ladders or any other devices on the platform for achieving additional height or reach shall be prohibited.
- Personnel are not required to use a personal flotation device (PFC) or provide a rescue boat for maintenance activities, including inspection, as long as they are 100% tied off at all times.

F.10 SNOOPER SCHEDULING

The process for scheduling a snooper or the MOOG is as follows.

1. Farrell Potter or Rodney Carter will send out an e-mail in January soliciting requests for snooper usage in the upcoming year.
2. Once this e-mail is received, sign into Microsoft Outlook calendar and click on “Open a Shared Calendar” link.
3. A box will appear; type in the shared calendar for the snooper desired to check availability. The calendar links for the snoopers are listed below.
    a. A-75 200615 : *DOT_BRIDGE Snooper 200615
    b. A-62 207208 : *DOT_BRIDGE Snooper 207208
    c. A-62 208350 : *DOT_BRIDGE Snooper 208350
    d. A-62 211260 : *DOT_BRIDGE Snooper 211260
    e. A-62 211000 : *DOT_BRIDGE Snooper 211000
    f. UB-30 200600 : *DOT_BRIDGE Snooper 200600
    g. MOOG 209595 : *DOT_BRIDGE Snooper 209595
    h. Calendar of all snooper and MOOG schedules : *DOT_BRIDGE Snooper Schedule
    i. Enter the calendar of the snooper you would like to schedule, or the snooper schedule to check which snooper is available the week you want.
4. E-mail Farrell Potter or Rodney Carter with the snooper or MOOG request and desired week/weeks you are requesting.
5. Requests are processed on a first-come-first-serve basis.
6. Any time a snooper is used for any activity the Bridge Office shall be informed, even if it is not currently scheduled to be somewhere else.

F.11 COUNTY AND LOCAL SNOOPER RENTAL PROCEDURES

Snooper Rental Contacts: Farrell Potter and Rodney Carter.

1. Snooper schedule must be checked first for availability through Farrell Potter (651) 366-4471 or Rodney Carter at (651) 366-4544. Priority for snooper time is given to Fracture Critical (FC), Complex and MnDOT District inspections first. ***Only*** MnDOT basket operators are to operate MnDOT snoopers. The respective District in which the county or city resides will provide an operator, dependent on availability of staff, who should also charge their time to the local agency TA job number (see Section F.19). District staff will also assist the snooper driver with lodging, vehicle arrangements, and overnight snooper parking as needed.

    Inspector Note:
    The Bridge Office shall be informed of the type of work the snooper is to be utilized for. The snoopers shall not be used for maintenance that has the potential to damage the basket or booms.

2. Traffic control must be provided by the Agency renting the snooper. Provide notice to local agencies concerning liability when placing and maintaining traffic control for inspection with MnDOT snoopers.
    - In circumstances where a local unit of government provides traffic control at a location where the snooper basket is in use inspecting a local bridge, the immunity of local units of government has also been waived on essentially the same terms as the waiver of immunity that applies to state government. MnDOT has established standards for traffic control to be implemented on all roadway operations in the state. Setting these standards, which are contained in the Minnesota Manual on Uniform Traffic Control Devices and the Temporary Traffic Control (TTC) Zone Layouts Field

Manual, involves a balancing of policy objectives, which qualifies for the discretionary function exception. Therefore, the defense of sovereign immunity should apply to both MnDOT and the local unit of government so long as they perform traffic control operations in conformance with these standards. If, however, the local unit of government provided traffic control in a negligent manner that was not in compliance with these standards, then it would have primary responsibility for any loss or damage that may be caused by that negligence. It is worth noting that the risk of liability does not appear to be any different in a situation involving bridge snooper equipment than in any other project where traffic control is involved. That is, the fact that MnDOT snooper equipment is in use does not increase the level of legal exposure for MnDOT if the traffic control is not properly handled.

- With respect to an employee of a local agency who provides traffic control when MnDOT's snooper equipment is in use on a local bridge, any OSHA or Worker's Compensation issues would be the responsibility of the local agency. Thus, if the employee of the local agency did not wear proper safety equipment, it would be his employer that could be cited by OSHA, not MnDOT. Similarly, if an employee of the local agency were injured while performing traffic control, any Worker's Compensation claim would be handled by his employer.
- MnDOT's basket operator on site and the snooper truck operator shall have the authority to identify unsafe or hazardous traffic control and shall be authorized to remove MnDOT personnel and equipment from the work zone until the hazards have been removed.

3. Obtain snooper expenses (amount/hour) from Robert Ellingsworth – Maintenance CS Highway Equipment Supervisor – 651-366-5704 (updated annually). As of 7/01/16, the amount per mile for snooper rental is $3.98/mi. As of 2/27/17, the mileage reimbursement expense will not be charged to the Local Agency renting the snooper but will be paid for by State Aid. The following expenses will be charged to the Agency at the rate stated. The amount for MOOG rental is $457.90/hr. The per-hour cost for a driver is $43.41 and the rate for a basket operator is $43.41 – $56.35 depending on available personnel. The Finance Department will ultimately make the determination what to bill based on the job numbers that are flagged.
4. The snooper driver and operator will charge time, expenses (which includes lodging, meals, etc.), District vehicle usage if applicable, and snooper equipment usage to the County/Local Charge ID. The job number is always TA9XXXX. XXXX is the County/Local number; see Section F.18 for further information and Section F.19 for a list of state aid charge numbers. The source code to use is 2822. The Finance Department will bill to the agency based on the job number.
5. The closest available snooper will be dispatched to minimize costs unless a specific snooper is requested due to load posting or bridge geometry.
6. The MOOG will be billed out by hours used, tracked by the hour meter on the truck. The average hour usage per bridge is 1 hour.

F.12 SNOOPER RENTAL LIABILITY AND BASKET OCCUPANT RELEASE FORM

MnDOT's retains some risk of liability with respect to some non-employees who ride in the snooper basket. The level of this risk can be managed by exercising managerial discretion to restrict the situations where persons who are not snooper basket certified are allowed in the basket. In some situations where such persons are allowed in the snooper basket, a waiver and release of claims form can be used. A Snooper Truck and Basket Activities Waiver and Release Form designed for this purpose can be found in Appendix H. Whenever non MnDOT personnel are being considered for entry in snooper basket the following information should be taken into account.

F.12.1 LEGAL CONSIDERATIONS

The Minnesota state legislature has waived the defense of sovereign immunity in certain situations. Minnesota Statutes § 3.736, known as the Tort Claims Act, is the statute whereby the State of Minnesota waived its sovereign immunity for many types of claims. However, the waiver of sovereign immunity does not include all types of claims. Subd. 3 of this statute carves-out a number of exceptions where neither the State nor its employees are liable for losses. The exception that is potentially relevant to the circumstances addressed in your questions is Subd. 3(b), under which governmental immunity is preserved for "a loss caused by the performance or failure to perform a discretionary duty, whether or not the discretion is abused."

This "discretionary function" exception to the Tort Claims Act protects the State and its employees who are making planning decisions. The cases where this provision has been interpreted by the courts evaluate whether the decision involves policy-making activities. Where the policy-making involves a balancing of social, political, or economic considerations, the conduct is afforded immunity under the discretionary function exception. Conversely, the discretionary function exception does not apply to protect activities that involve implementing a policy or performing a prescribed or ministerial function, and it also does not protect professional or scientific judgment where that judgment does not involve a balancing of policy objectives.

F.12.2 GUESTS IN A SNOOPER BASKET

Whether MnDOT could have liability in circumstances where a non-certified person suffers an injury while riding in a snooper basket will depend on the circumstances of the specific situation. In particular, the role and responsibilities of the guest will determine MnDOT's potential liability. The guests shall be divided in to four groups as follows:

- Group 1: If the guest is a MnDOT employee who has not been certified to operate the snooper basket, MnDOT's risk of liability will depend on whether there is a sound business reason for the guest to be in the basket. MnDOT should not allow untrained employees who do not have a sound business reason to ride in the basket. If there is a sound business reason, then the MnDOT employee should ensure that the guest has and uses all necessary safety equipment and has been instructed in Right to Know, Fall Protection and Right of Way Safety Training.
- Group 2: Consists of employees of another government agency that have a role with respect to bridge construction or maintenance and is performing their job duties while in the snooper basket. MnDOT's risk of liability is low. Examples might be a local official with responsibilities relating to maintenance of the bridge being inspected, a Federal Highway Administration (FHWA) employee with responsibilities relating to bridge inspections, or a state legislator who a member of a committee that deals with transportation funding. In such situations, the guest is performing his/her job. Any OSHA or Worker's Compensation matters would be addressed by the guest's employer. As with a non-certified MnDOT employee, MnDOT should ensure that the guest has and uses all necessary safety equipment and has been instructed in Right to Know, Fall Protection and Right of Way Safety Training.
- Group 3: Consists of MnDOT employees, local officials with responsibilities relating to maintenance of the bridge being inspected, an FHWA employee with responsibilities relating to bridge inspections, or a state legislator who is a member of a committee that deals with transportation funding, who have not received Right to Know, Fall Protection and Right of Way Safety Training, contractors hired to assist in bridge inspection, maintenance, or construction. Ride-alongs by persons who are not employed by MnDOT or an agency with bridge responsibilities should be strongly discouraged. In some limited circumstances, a strong case might be made that the decision to permit the person to ride in the basket involves the exercise of policy-making discretion. A contractor hired to assist in bridge inspections is one example. Such guests would be acting in the course of their

employment, and would look to their own employer for matters such as Worker's Compensation claims. For the small group of untrained employees and non-employees who may be permitted to ride in a snooper basket, a Snooper Truck and Basket Activities Waiver and Release Form found in Appendix H shall be completed to further reduce the risk. While exculpatory clauses are generally not favored in the law, they can be enforceable if they are drafted in a straightforward and clear manner and if they do not purport to release the benefited party from liability for intentional, willful or wanton actions. These riders shall not be permitted in the basket until the waiver is signed. Completed waivers shall be returned to Scott Theisen at the Bridge Office for filing.

- Group 4: Ride-alongs by persons who are not employed by MnDOT or an agency with bridge responsibilities, or working for a contractor hired to assist in bridge inspection, maintenance or construction, shall be expressly prohibited. Examples are members of the news media doing a story on bridge or a friend or family member of an employee.

Note that the waiver and release form is not needed for the first two groups discussed above. A MnDOT employee acting in the scope of his/her employment does not need to sign a waiver and release form. Similarly, employees of other agencies who have responsibilities related to the bridge safety would not need to sign a waiver, just as a local agency does not require the MnDOT snooper operator or driver to sign a waiver before working on a bridge on a local road. See Appendix H for the Snooper Truck and Basket Activities Waiver and Release Form.

F.13 SNOOPER BILLING PROCEDURES

All maintenance and upkeep for MnDOT's snoopers and MOOG are charged to: FinDeptID: T7936193, APPR: T790582, FUND: 2700.

Bridge Office personnel tracks District usage of the snooper trucks and tabulates the total weeks of snooper truck usage by each District every year. Once a year in January, Bridge Office personnel obtain labor and non-labor expenditures for the current fiscal year-to-date and the expenditures for the entire previous fiscal year. The total expenditures for the previous year are tabulated as well as the expenditures for the current year-to-date. An estimate of costs for the remainder of the current fiscal year is generated based on upcoming repairs and historic costs. This estimate is added to the year-to-date expenditures and an estimated cost for the current fiscal year is generated. The bill is then divided by District, based on a five year average District total use percentage.

The previous year's total expenditures are divided by the actual District snooper and MOOG usage to generate the exact invoice for the previous fiscal year. This exact charge is compared to the estimated invoice for that year, and a credit or deduction is added to the current Invoice.

A cover letter and invoice is then mailed to each District Engineer showing cost and either the deduction or credit from the previous fiscal year. The District Engineers sign the document if approved and give to the District Finance Department to process the payment electronically. The signed invoice and transfer authorization documentation must be sent to the Bridge Office personnel listed on the cover letter.

F.14 SNOOPER INSURANCE AND DAMAGE POLICY

MnDOT carries supplemental insurance on the seven snooper units and the MOOG. This supplemental insurance has a $10,000 deductible. The insurance is paid out of the snooper overhead account FinDeptID T7936193. This insurance is only used to pay for major repairs.

Whenever one of the snoopers or the MOOG is damaged, the District supervisor, for whom the operator who damaged the equipment works for, shall fill out an accident report and provide a copy to the Bridge Office and investigate the accident. If it is determined the equipment was damaged due to negligence or carelessness, that District shall be responsible for the cost of repairs up to the $10,000.00 insurance deductible. The District also shall be responsible for assigning any disciplinary action deemed necessary as a result of the accident investigation.

F.15 SNOOPER TRUCK TRAFFIC CONTROL POLICIES

The Bridge Office recommends a minimum lane closure width of 12 feet for lane closures that involve usage of snooper trucks. This allows room for the truck operator to safely work around the truck to deploy and retract the booms and access equipment in the storage compartments. Wider lane closures may be required to allow the snoopers to attain their maximum horizontal reach. Conditions vary greatly in the field. Sharp curves, high traffic speeds and volume, or limited visibility may require greater lane closure widths. Low traffic speeds and volume, and long sightlines may allow narrower lane closures. Consult the Temporary Traffic Control Zone Layouts - Field Manual, most current version, for guidance.

The following information pertains to liability of a local unit of government if they provide traffic control at a location where the snooper basket is in use inspecting a local bridge. The immunity of local units of government has also been waived on essentially the same terms as the waiver of immunity that applies to state government. MnDOT has established standards for traffic control to be implemented on all roadway operations in the state. Setting these standards, which are contained in the Minnesota Manual on Uniform Traffic Control Devices and the Temporary Traffic Control Zone Layouts Field Manual, seems pretty clearly to involve a balancing of policy objectives, which qualifies for the discretionary function exception. Therefore, the defense of sovereign immunity should apply to both MnDOT and the local unit of government so long as they perform traffic control operations in conformance with these standards. If, however, the local unit of government provided traffic control in a negligent manner that was not in compliance with these standards, then it would have primary responsibility for any loss or damage that may be caused by that negligence. It is worth noting that the risk of liability does not appear to be any different in a situation involving bridge snooper equipment than in any other project where traffic control is involved. That is, the fact that MnDOT snooper equipment is in use does not increase the level of legal exposure for MnDOT if the traffic control is not properly handled.

With respect to an employee of a local agency who provides traffic control when MnDOT's snooper equipment is in use on a local bridge, any OSHA or Worker's Compensation issues would be the responsibility of the local agency. Thus, if the employee of the local agency did not wear proper safety equipment, it would be his employer that could be cited by OSHA, not MnDOT. Similarly, if an employee of the local agency were injured while performing traffic control, any Worker's Compensation claim would be handled by his employer.

The controlling document when setting traffic control for snooper operations is the most current version of the Temporary Traffic Control Zone Layouts Field Manual. When more complicated traffic control situations are encountered or when the snooper stays in one area for longer periods of time (i.e. fracture critical bridge inspections, special inspections, etc.) the Snooper Operations Temporary Traffic Control Layouts should be followed. When approved, these layouts can be found at the following web site;

http://www.dot.state.mn.us/trafficeng/workzone/ttctemplates.html

Consultation with the Agency Traffic Office is advised when using these layouts. Additional traffic control layouts can also be utilized when approved by the perspective Agencies Traffic Office Engineer.

F.15.1 WORK ZONE ADVISORY SPEED LIMIT

Work zone advisory speed limits can be utilized during snooper operations when approved by the Agency Traffic Office Engineer or when stated in the specific traffic control layout. At the discretion of the Agency, a Dynamic Speed Display (DSD) can additionally be utilized in conjunction with the work zone advisory speed limit. The advisory speed plate (W13-1) shall be black legend on orange background when used in a snooper work zone. Advisory speed plates shall be a minimum 18” x 18”. When used with 36” or larger warning signs, advisory speed plates shall be a minimum of 24” x 24”. Avoid placing an advisory speed limit plate near a regulatory speed limit sign in order to prevent driver confusion. If it is physically impossible to accomplish this, the regulatory speed limit sign shall be covered for the duration of the work zone advisory speed limit. Refer to the Snooper Operations Temporary Traffic Control Layouts for placement of the warning signs, Dynamic Speed Display (DSD), advisory speed plaques and other traffic control devices.

F.15.2 PROTECTION VEHICLES

For all work zones with a snooper present the following requirements for protection vehicles shall be met.

- For bridges with a structure length over 125 feet where the snooper truck moves as part of the operation, as the snooper truck operator is prohibited from leaving the snooper truck during operation, the protection vehicle shall have an operator assigned to move the vehicle in a timely manner to maintain the proper roll ahead buffer distance at all times.
- For work zones on trunk highways with a posted speed limit of 55 mph or greater, the minimum acceptable protection vehicle shall be a Class 33 truck (a single axle dump truck with a GVW of 37,000 lbs.) with an approved crash attenuator.
- For work zones on any roadway with a posted speed limit of 35 to 55 mph, the minimum acceptable protection vehicle shall be a Class 33 truck (a single axle dump truck with a GVW of 37,000 lbs.). On non-trunk highway bridges where the ADT is less than 100, a full sized pick-up truck or equivalent with a GVW of at least 6000 lbs. is acceptable.
- For flagging operations and work zones with a posted speed limit less than 35 mph, the minimum acceptable protection vehicle shall be a full sized pick-up truck or equivalent with a GVW of at least 6000 lbs. This is applicable for trunk highway and non-trunk highway bridges.

F.16 SNOOPER PRE-TRIP INSPECTION POLICY

Prior to use each day every MnDOT bridge snooper shall have a pre-trip inspection and a post-trip inspection at the end of each day as required by code of federal regulations 49 CFR 393.95, 49 CFR 392.7, 49 CFR 392.8, 49 CFR 396.7, 49 CFR 396.11, and 49CFR 396.13. The relevant references from the code of federal regulations are included in Appendix G; complete regulations can be found in the Commercial Motor Vehicle Code of Federal Regulations book provided to each MnDOT employee during SPOT training (Snow Plow Operator Training). Below is a pre-trip checklist listing all the equipment that shall be inspected daily prior to use. Operators shall retain pre-trip inspection records for one year.

MnDOT D1
Equipment Pre-Inspection Record

BRIDGE ACCESS UNIT PRE-OPERATION INSPECTION CHECKLIST **Unit Name & Number: Snooper #**

Inspection Date & Inspection Performed By:

Operators:

MAIN ENGINE COMPARTMENT	OK	COMMENT
Engine Oil		
Coolant		
Washer Fluid		
Power Steering Fluid		
Transmission Fluid		
PTO & Hydraulic Fluid		
Drive Belts		
Air Filter Indicator		

CAB INSPECTION	OK	COMMENT
Hour Meter/Odometer Reading		
Decals		
Air Pressure		
Oil Pressure		
12 Volt Charging System		
Braking System		
Unit Power Light & Switch		
PTO Indicator Light & System		
Two Speed System		
Axle Lock Lights		
Tag Axle System & Pressure (If Installed)		
Start/Stop System (Transmission in Neutral)		
Intercom System		
Lights: 4 Ways, Head, Turn, Tail, Strobe		
Fuel Level		
Horn		

Start the truck engine, engage the PTO, set the engine to the correct RPM setting, turn on all systems for the walk around inspection

****Make sure the parking brake is engaged.***

WALK AROUND INSPECTION	OK	COMMENT
Lights: 4 Ways, Head, Turn, Tail		
Strobes, Beacons, or Sign Board		
Transmission		
Axles and Suspension (Front/Rear)		
Tires (Front/Rear)		
Axle Lock Structures and Switches (Front/Rear)		
Hydraulic Pump and Hoses		
Electrical Switches and Cables		
Air Hoses, Outlets		
Body Boxes		
Ladders and Rails		
Counterweights and Switches		
Brakes (Slack Adjusters)		
Drive Line		

AIR COMPRESSOR	OK	COMMENT
Operational Test		
Air System Hoses and Valves		
Electrical Switches and Cables		
Gauges		

GENERATOR	OK	COMMENT
Operational Test		
Electrical Wires and Connections		
Circuit Breakers and Outlets		
Instrument Panel and Meters		

HYDRAULIC TANK & OIL COOLER	OK	COMMENT
Oil Level and Gauge		
Filter and Gauge		
Structure		
Hydraulic Hoses		
Electrical Switches and Cables		

AUXILLARY ENGINE	OK	COMMENT
Hour Meter		
Fuel Filters, Oil Level & Oil Pressure		
Coolant		
Switches, Wires, Connections		
Hydraulic Pump and Hoses		

Preheat and Start Auxiliary Engine: Listen for unusual noises, check engine oil pressure, charging rate.

Shut Down Auxiliary Engine: The auxiliary engine will be started again during the operations check.

MnDOT D1

Equipment Pre-Inspection Record

Unit Name & Number: Snooper #

COMPONENT CHECKLIST: *Shaded boxes do not apply to that area of the unit.*							
***See component checklist explanations:**	**T-1**	**B-1**	**T-2**	**B-2**	**B-3**	**CATRAC B-3 TELE**	**B-4**
1. Cylinder							
2. Cylinder Anchor							
3. Structure							
4. Hyd. Lines & Fittings							
5. Electrical Cables							
6. Pivot Pin							
7. Rotations: Gear, Bearing, Gearbox, Brake, Motor							
8. Limit Switches							
9. Pressure Filter							
10. Hydraulic Valves; Unit, Axle Lock, Dump							
11. Leveling Rods							
12. Boom/Platform Rests							
13. Boom/Platform Tie-Down							
14. Decals							
15. Platform Heaters							
16. Outlets; 12 volt, 110 volt							
17.Air Hose Outlet							
18. Platform Controls							
19. Leveling System							

***COMPONENT CHECKLIST EXPLANATIONS**	
1. Cylinder	Leaks, scoring, rust pitting, cracks at pivot points
2. Cylinder Anchor	Visible cracks or damage, rusting
3. Structure	Visible cracks or damage, rusting
4. Hyd. Lines & Fittings	Oil leaks, chaffing, kinks, abrasions
5. Electrical Cables	Loose or broken wires and connections, chaffing, abrasions
6. Pivot Pin	Visible cracks or damage, rusting
7. Rotations	Wear, damage, oil leaks, broken bolts
8. Limit Switches	Bent switch arms, loose wire connections, LED functions
9. Pressure Filter	Oil leaks, check the indicator gauge
10. Hydraulic Valves	Free movement of handles & return to neutral when released
11. Leveling Rods	Cracks at pivot points, damage to rods
12. Boom/Platform Rests	Nylon wear pad secure, cracks, damage to structure
13. Boom/Platform Tie-Down	Damage to nylon strap or ratchet

***COMPONENT CHECKLIST EXPLANATIONS CONTINUED…**	
14. Decals	Unreadable, missing or damaged decals
15. Platform Heaters	Broken switches or wires, secured to platform
16. Outlets; 12 volt, 110 volt	Damaged or broken wires, secure to platform, broken covers
17.Air Hose Outlet	Damage to hoses, coupling, regulator, and gauge
18. Platform Controls	Proper operation of all functions, damage to components
19. Leveling System	Hydraulic line; wire or switch, secure to the platform

OPERATIONS CHECK & HOLDING VALVE TEST: ***The operations check MUST be performed prior to operating the unit.***

The truck should still be running with the PTO engaged.

1. Remove the boom/platform tie down devices.
2. Engage axlelocks and counterweight; (Red axlelock engaged indicator light)
3. Place the unit/axlelock selector valve in the "UNIT" position (PULL OUT)
4. Close B-2 & B-3. If you don't close B-2 & B-3 these booms may open when you raise B-1
5. Raise B-1, One Foot above the boom rests
6. Lower the platform rests to the deck
7. Lower B-4 approximately 45 degrees (If Installed)
8. Place the unit/axlelock selector valve in the "AXLELOCK" position (PUSH IN)
9. NOW PERFORM THE HOLDING VALVE TEST, WATCH FOR DRIFT.

*Operate B-1 to the "DOWN" position for 5 sec. *Operate B-2 to the "OPEN" position for 5 sec.
*Operate B-3 to the "OPEN" position for 5 sec. *Operate B-4 to the "DOWN" position for 5 sec.

10. Test the hyd. Air compressor & generator (Shut them down when complete)
11. Test the T-1 Intercom
12. Raise the platform rests and lock them into place
13. Test the truck engine start/stop system at the platform, (Red Button) Leave truck engine off
14. Test the platform intercom
15. Start the auxiliary engine
16. Use the auxiliary engine to slow the unit, this will test the auxiliary engine
17. Place the unit/axlelock selector valve in the "UNIT" position (PULL OUT)
18. Raise B-4 (If Installed)
19. Lower B-1 lightly into the rests (About 900 psi on the hydraulic gauge at T-1)
20. Place the unit/axlelock selector valve in the "AXLELOCK" position (PUSH IN)
21. Disengage the axlelocks and counterweight (Green axlelock disengage indicator light)
22. Install the boom/platform tie down device
23. Shut down the auxiliary engine

WARNING: If any one of the booms move (drift) during the holding test, perform the test again to verify which boom is drifting. The problem holding valve must be replaced before the unit is put into service **If a defect is found during inspection or operations test the unit must not be used until the defect is corrected**

F.17 SNOOPER MAINTENANCE POLICY

All MnDOT Snoopers shall receive an annual inspection during the winter months and a mid-season inspection near July 1st of each year. The inspections shall meet the criteria for annual and six month inspections as described in the equipment operator’s manual.

The snooper trucks shall be maintained by their drivers during the inspection season. The trucks should receive eight hours of routine maintenance and inspection bi-weekly. This maintenance time shall be charged to the snooper account, see Section F.19. This maintenance shall include greasing the machine following the recommendations specified in the owner’s manual and washing the entire truck to allow complete daily inspections of all required areas such as the axle locks and aerial booms. In addition after any activity that exposes the booms of the snooper to debris or heavy dust, the truck booms shall be flushed to prevent wear to pads and rollers of the telescopic third and fourth booms.

F.18 SNOOPER REPAIR PROCEDURE

Whenever non-routine repairs to any of the snooper or MOOG units are performed that require a purchase order, contact Scott Theisen or Farrell Potter with the Bridge Office inspections unit. The Bridge Office will then approve the expenditure, or ask for further clarification. No inspection unit shall be brought to Aspen Aerials for work without prior approval from the Bridge Office. Whenever maintenance is performed on any of these vehicles, time and materials should be charged to the snooper truck overhead account: FinDeptID: T7936193, APPR: T790081, FUND: 2700. In the past some time and materials have been charged to the District the truck resides in rather than the snooper ORG. Consistently charging the correct account simplifies the billing process and assures the snooper overhead bill is charged fairly to all the

Districts that use the snoopers, rather than the Districts the snoopers reside in paying for the upkeep of the unit.

The snoopers and MOOG receive a commercial vehicle inspection and annual inspection. These units also receive an annual aerial inspection by a contractor, once a year and receive a three month inspection from District mechanics part way through the inspection season. The annual aerial inspection should be scheduled with the rest of the Districts aerial equipment. The table below lists the month of the annual inspection and the three month inspection.

UNIT NUMBER	MONTH DUE	
	ANNUAL INSPECTION	THREE MONTH INSPECTION
211000	March	July
211260	April	July
208350	April	July
207208	March	July
200600	January	July
200615	February	July
88418	March	July
209595	March	

There are mechanics certified by Aspen Aerials in each District that maintains a snooper truck. Training for snooper Mechanics operators takes place in the fall on an as-needed basis. The Bridge Office would like to maintain two certified snooper mechanics in each District that maintains a snooper. The Bridge Office will pay for this training when they have been contacted and a need is identified. The Bridge Office maintains a list of mechanics that are currently certified by Aspen Aerial. If there is a need to certify a new Mechanic, contact Farrell Potter at the Bridge Office in Oakdale.

F.19 WORKING OVER RAILROAD TRACKS

Certified snooper truck operators performing work with snooper trucks in railroad right of way shall have completed railway right of way training for any railroad right of way they enter. The training shall meet with FRA 49 CFR Part 243 requirements. Personnel shall conform to all requirements introduced by this training.

The railroad right of way width varies by railroad. Typically, railroad right of way is 25 feet on each side of the tracks. If in doubt, contact the applicable railroad track owner for the exact right of way for that track. The right of way shall include all airspace over the right of way between the ground and bottom of the superstructure.

Prior to the inspection, the railroad right of way owner shall be contacted and arrangements for flaggers shall be made. No MnDOT snooper shall enter a railroad right of way without prior notification. In the event the railroad elects to allow right of way access without a flagger present the agency responsible for the work being performed shall provide spotters and communication equipment placed to allow the snooper to clear the railroad right of way if an unscheduled train appears.

F.20 SNOOPER DRIVER TIMESHEET CODING

1. Work in a District on Trunk Highway (TH) Bridges: charge to the District you are working for.

Appr – T790081	Fund – 2700
District 1 –	FinDeptID (formerly ORG) # T7939100 – Salary FinDeptID # T7949119 – Cash OT, Expenses, and Supplies
District 2 –	FinDeptID # T7949256
District 3 –	FinDeptID # T7949367 – St Cloud FinDeptID # T7949334 – Baxter FinDeptID # T7949710, App T790083, Source 0512, Project T71002 – Hotel Charges
District 4 –	FinDeptID # T7949446
District 6 –	FinDeptID # T7949624 – Rochester FinDeptID # T7949642 – Owatonna
District 7 –	FinDeptID # T7949733 – Mankato FinDeptID # T7949743 – Windom
District 8 –	FinDeptID # T7949824 – Marshall FinDeptID # T7949825 – Willmar
Metro –	FinDeptID # T7947382 Fracture Critical
Metro –	FinDeptID # T7947383 Routine Inspection

2. Work for a Local Agency or DNR: Charge to the FinDeptID T7936100.
   Appr – T791132. Fund – 2001 and the bridge number.

3. Work for a local agency on non-fracture critical bridges: Charge to the FinDeptID you reside in.
   Appr – T790081. Fund – 2700. Activity 2822, and Project ID TA9XXXX where the Project ID is the state aid project ID for each city and county. The Project ID's are located in the table in the following pages.
4. Miscellaneous work associated with a snooper ***not*** involving a bridge inspection that cannot be charged to other applicable FinDeptIDs: Charge directly to snooper account.

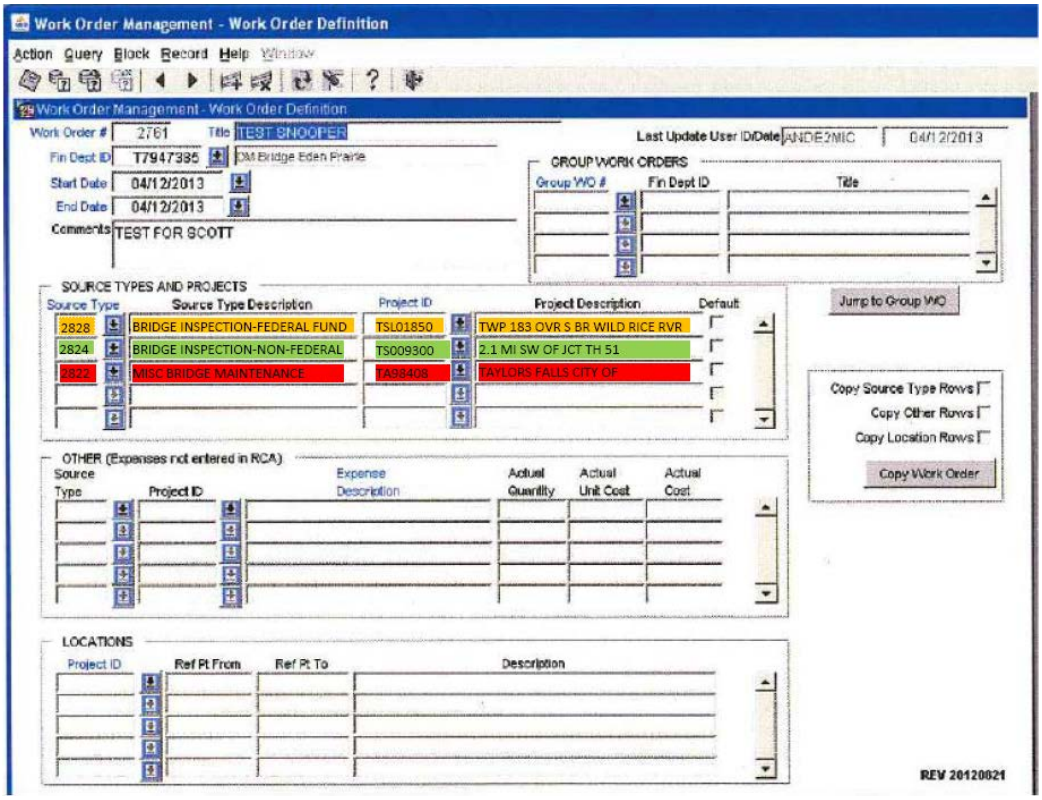
   FinDeptID – T7936193, Fund – 2700, Appr – T790081

   Source Code – determine based on type of activity performed whether it is minor repairs, training others, etc.

   Project ID – Charge to snooper number (i.e. TM91376)

   Time should only be charged to the FinDeptID – T7936193 when maintenance or other work is being performed on the snooper trucks. Once the maintenance has been completed drivers should make arrangements with their supervisor to get additional job assignments to complete their day.

For all maintenance and inspection activities which require snooper operations, the person in charge at the site must document and forward work hours (job site arrival and departure times, long day, short day, rain day, breakdown day, etc.) and other information, to the snooper operator's supervisor listed in section XVI on a weekly basis or as appropriate. The following figure shows a work order example with time sheet coding for TH bridges, County/Local Fracture Critical Bridges and time sheet coding for county local snooper rental:



- Line one, highlighted orange, is the timesheet code for the fracture critical inspection of Clay County Bridge 1850. The driver would use their own FinDeptID.
- Line two, highlighted green, is the time sheet code for the inspection of TH Bridge 9300. As this is a metro FC bridge the driver would use FinDeptID T7947382, regardless of where the driver is from.
- Line three, highlighted red, is the timesheet code for driver time during county/local rentals. The driver will use their own FinDeptID. The project ID is found in the table on the following pages. The Project Description "TAYLORS FALLS CITY OF" should be manually deleted and replaced with the bridge numbers inspected that day.

F.21 COUNTY AND LOCAL PROJECT ID NUMBERS

The following table is a list of Project ID numbers to be used for completing timesheets.

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
ADRIAN CITY OF	TA99690	CITY
AITKIN COUNTY	TA98801	COUNTY
ALBANY CITY OF	TA98687	CITY
ALBERT LEA CITY OF	TA98404	CITY
ALBERTVILLE CITY OF	TA99740	CITY
ALEXANDRIA CITY OF	TA98405	CITY
ANDOVER CITY OF	TA98498	CITY
ANNANDALE CITY OF	TA98889	CITY
ANOKA CITY OF	TA99406	CITY
ANOKA CO PARKS & RECREATION	TA98618	COUNTY
ANOKA COUNTY	TA98802	COUNTY
APPLE VALLEY CITY OF	TA98486	CITY
ARDEN HILLS CITY OF	TA99487	CITY
AUSTIN CITY OF	TA98407	CITY
BARNESVILLE CITY OF	TA99569	CITY
BARRETT CITY OF	TA99685	CITY
BATTLE LAKE CITY OF	TA99B20	CITY
BAXTER CITY OF	TA98D20	CITY
BAY LAKE TOWNSHIP	TA98640	TOWNSHIP
BECKER CITY OF	TA98688	CITY
BECKER COUNTY	TA98803	COUNTY
BELGRADE CITY OF	TA98484	CITY
BELLE PLAINE CITY OF	TA9A017	CITY
BELTRAMI COUNTY	TA98804	COUNTY
BEMIDJI CITY OF	TA98408	CITY
BEMIDJI REGIONAL AIRPORT AUTHORITY	TA98694	MISC
BEMIDJI STATE UNIV	TA99225	COLLEGE
BENTON COUNTY	TA98805	COUNTY
BERTHA CITY OF	TA99695	CITY
BIG LAKE CITY OF	TA98M20	CITY
BIG STONE COUNTY	TA98806	COUNTY
BIRD ISLAND CITY OF	TA99651	CITY
BLACKDUCK CITY OF	TA99619	CITY
BLAINE CITY OF	TA98409	CITY
BLOOMINGTON CITY OF	TA98410	CITY
BLUE EARTH COUNTY	TA98807	COUNTY
BOIS DE SIOUX WATERSHED DIST	TA98662	MISC
BOIS FORTE RESERVATION TRIBAL COUNCIL	TA99699	MISC
BRAINERD CITY OF	TA98411	CITY

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
BRAUN INTERTEC CORP	TA99692	MISC
BREEZY POINT CITY OF	TA98639	CITY
BROOKLYN CENTER CITY OF	TA99412	CITY
BROOKLYN PARK CITY OF	TA98413	CITY
BROWN COUNTY	TA98808	COUNTY
BUFFALO CITY OF	TA98519	CITY
BURNSVILLE CITY OF	TA98479	CITY
BYRON CITY OF	TA98548	CITY
CALEDONIA CITY OF	TA99553	CITY
CALLAWAY CITY OF	TA99665	CITY
CAMBRIDGE CITY OF	TA98522	CITY
CANNON FALLS CITY OF	TA99A30	CITY
CARLTON COUNTY	TA98809	COUNTY
CARVER COUNTY	TA98810	COUNTY
CASS COUNTY	TA98811	COUNTY
CASS LAKE CITY OF	TA98774	CITY
CHAMPLIN CITY ENGINEER	TA98488	CITY
CHANHASSEN CITY OF	TA98489	CITY
CHASKA CITY OF	TA99495	CITY
CHIPPEWA COUNTY	TA98812	COUNTY
CHISAGO COUNTY	TA98813	COUNTY
CHISHOLM CITY	TA98414	CITY
CIRCLE PINES CITY OF	TA99682	CITY
CLAY COUNTY	TA98814	COUNTY
CLEARWATER CITY OF	TA98663	CITY
CLEARWATER COUNTY	TA98815	COUNTY
CLOQUET CITY OF	TA98415	CITY
COHASSET CITY OF	TA99686	CITY
COKATO TOWNSHIP	TA99697	MISC
COLD SPRING CITY OF	TA98744	CITY
COLUMBIA HEIGHTS CITY OF	TA99416	CITY
COLUMBUS CITY OF	TA99739	CITY
COMFREY CITY OF	TA99622	CITY
COOK COUNTY	TA98816	COUNTY
COON RAPIDS CITY OF	TA98417	CITY
CORCORAN CITY OF	TA99721	CITY
COTTAGE GROVE CITY OF	TA99480	CITY
COURTLAND CITY OF	TA99747	CITY
COTTONWOOD COUNTY	TA98817	COUNTY
CROOKSTON CITY OF	TA98418	CITY
CROW WING COUNTY	TA98818	COUNTY
CRYSTAL CITY ENGINEER	TA99419	CITY

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
DAKOTA COUNTY	TA98819	COUNTY
DAYTON CITY OF	TA99770	CITY
DELANO CITY OF	TA98611	CITY
DETROIT LAKES CITY OF	TA98420	CITY
DODGE COUNTY	TA98820	COUNTY
DONALDSON CITY OF	TA98702	CITY
DOUGLAS COUNTY	TA98821	COUNTY
DULUTH CITY OF	TA98403	CITY
EAGAN CITY OF	TA98497	CITY
EAST BETHEL CITY OF	TA99557	CITY
EAST GRAND FORKS CITY OF	TA98421	CITY
ECKLES TOWNSHIP	TA99669	MISC
EDEN PRAIRIE CITY OF	TA98481	CITY
EDINA CITY OF	TA98422	CITY
ELK RIVER CITY OF	TA98524	CITY
EMERGENCY MEDICAL SERVICES REGULATORY BOARD	TA99707	MNSTATE
FAIRMONT CITY OF	TA98425	CITY
FALCON HEIGHTS CITY ENGINEER	TA99426	CITY
FARIBAULT CITY OF	TA98427	CITY
FARIBAULT COUNTY	TA98822	COUNTY
FARMINGTON CITY OF	TA99518	CITY
FERGUS FALLS CITY OF	TA98428	CITY
FILLMORE COUNTY	TA98823	COUNTY
FOREST LAKE CITY OF	TA99520	CITY
FOSSTON, CITY OF	TA98632	CITY
FRANCONIA TOWNSHIP	TA99693	MISC
FRAZEE CITY OF	TA99715	CITY
FREEBORN COUNTY	TA98824	COUNTY
FRIDLEY CITY OF	TA98429	CITY
FROHN TOWNSHIP	TA99742	MISC
GARRISON CITY OF	TA98643	CITY
GAYLORD CITY OF	TA99B40	CITY
GIBBON CITY OF	TA9A078	CITY
GLENCOE CITY OF	TA99556	CITY
GOLDEN VALLEY CITY OF	TA98430	CITY
GOODHUE COUNTY	TA98825	COUNTY
GRAND RAPIDS CITY OF	TA98431	CITY
GRANT COUNTY	TA98826	COUNTY
GREENFIELD CITY OF	TA99537	CITY
GREY EAGLE CITY OF	TA99664	CITY
HALSTAD CITY OF	TA98704	CITY

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
HALLOCK CITY OF	TA98600	CITY
HAM LAKE CITY OF	TA98496	CITY
HAMPTON CITY OF	TA99646	CITY
HASTINGS CITY OF	TA99432	CITY
HECTOR CITY OF	TA99724	CITY
HENDRICKS CITY OF	TA99637	CITY
HENNEPIN COUNTY	TA98827	COUNTY
HENNEPIN COUNTY PARKS a.k.a. (Three Rivers Park District)	TA98589	COUNTY
HENNEPIN COUNTY TRANSITS & COMMUNITY WORKS	TA98658	COUNTY
HENNING CITY OF	TA99719	CITY
HERMANTOWN CITY OF	TA98552	CITY
HIBBING CITY OF	TA98433	CITY
HOFFMAN CITY OF	TA98580	CITY
HOLBART TOWNSHIP	TA99559	MISC
HOLST TOWNSHIP	TA99681	MISC
HOPKINS CITY ENGINEER	TA98434	CITY
HOUSTON COUNTY	TA98828	COUNTY
HOWARD LAKE CITY OF	TA98620	CITY
HUBBARD COUNTY	TA98829	COUNTY
HUGO CITY OF	TA99555	CITY
HUTCHINSON CITY OF	TA98435	CITY
IDAHO STATE TRANSPORTATION DEPT	TA99716	OTHER STATE
ILLINOIS STATE TRANSPORTATION DEPT	TA99613	OTHER STATE
INDIAN HEALTH SVCS - BEMIDJI	TA99679	MISC
INTERSTATE ENGINEERING INC	TA99625	MISC
INVER GROVE HEIGHTS CITY OF	TA99478	CITY
ISANTI CITY OF	TA98683	CITY
ISANTI COUNTY	TA98830	COUNTY
ITASCA COUNTY	TA98831	COUNTY
JACKSON COUNTY	TA98832	COUNTY
JORDAN CITY OF	TA99513	CITY
KANABEC COUNTY	TA98833	COUNTY
KANDIYOHI COUNTY	TA98834	COUNTY
KANSAS STATE TRANSPORTATION DEPT	TA99616	NE MN STATE
KASSON CITY OF	TA98554	CITY
KITTSON COUNTY	TA98835	COUNTY
KOOCHICHING COUNTY	TA98836	COUNTY
LAC QUI PARLE COUNTY	TA98837	COUNTY
LACRESCENT CITY OF	TA98J50	CITY
LAKE CITY CITY OF	TA98436	CITY
LAKE COUNTY	TA98838	COUNTY

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
LAKE ELMO CITY OF	TA99530	CITY
LAKE OF THE WOODS COUNTY	TA98839	COUNTY
LAKE PARK CITY OF	TA99771	CITY
LAKEVILLE CITY OF	TA99490	CITY
LAMMERS TOWNSHIP	TA99738	MISC
LEECH LAKE HOUSING AUTHORITY	TA99581	MISC
LEECH LAKE BAND TRIBAL ROADS	TA98961	MISC
LESUEUR COUNTY	TA98840	COUNTY
LIBERTY TOWNSHIP	TA98666	MISC
LINCOLN COUNTY	TA98841	COUNTY
LITCHFIELD CITY OF	TA98437	CITY
LITTLE CANADA CITY ENGINEER	TA99500	CITY
LITTLE FALLS CITY OF	TA98438	CITY
LITTLEFORK CITY OF	TA99583	CITY
LONSDALE CITY OF	TA98671	CITY
LUVERNE CITY OF	TA9A111	CITY
LYON COUNTY	TA98842	COUNTY
MAHNOMEN COUNTY	TA98844	COUNTY
MAHTOMEDI CITY OF	TA99532	CITY
MANKATO CITY OF	TA98439	CITY
MANKATO STATE UNIVERSITY	TA99723	COLLEGE
MAPLE GROVE CITY OF	TA98491	CITY
MAPLE PLAIN CITY OF	TA98623	CITY
MAPLETON CITY OF	TA99689	CITY
MAPLEWOOD CITY OF	TA98440	CITY
MARSHALL CITY OF	TA98441	CITY
MARSHALL COUNTY	TA98845	COUNTY
MARTIN COUNTY	TA98846	COUNTY
MCLEOD COUNTY	TA98843	COUNTY
MEEKER COUNTY	TA98847	COUNTY
MENDOTA CITY OF	TA99550	CITY
MENDOTA HEIGHTS CITY ENGINEER	TA99442	CITY
METRO AIRPORTS COMM	TA98255	MISC
METROPOLITAN COUNCIL	TA99565	MNSTATE
MICHIGAN STATE TRANSPORTATION DEPT	TA99635	OTHER STATE
MIDDLE-SNAKE-TAMARAC RIVER	TA98100	Water Shed Dist
MILLE LACS COUNTY	TA98848	COUNTY
MINN ST ADMIN DEPT FINANCIAL MGMT & REPORT	TA99252	MNSTATE
MINN ST ADMIN DEPT PLANT MANAGEMENT	TA99251	MNSTATE
MINN ST ADMIN TRAVEL MANAGEMENT	TA99901	MNSTATE
MINN ST ADMIN VOLUNTEER SERVICE	TA99JU0	MNSTATE
MINN ST AGRICULTURE DEPT	TA99254	MNSTATE

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
MINN ST AIR NATL GUARD	TA99588	MNSTATE
MINN BALLPARK AUTHORITY	TA98674	MISC
MINN OFFICE FOR PIPELINE SAFETY	TA99729	MNSTATE
MINN OFFICE COMMERCE-INSURANCE FRAUD DIV	TA99750	MNSTATE
MINN ST CORRECTIONS CENTRAL OFFICE	TA99210	MNSTATE
MINN ST CORRECTIONS CENTRAL OFFICE	TA99931	MNSTATE
MINN ST CORRECTIONS ST CLOUD FACILITY	TA98214	MNSTATE
MINN ST CORRECTIONS STILLWATER	TA99213	MNSTATE
MINN ST DNR BOAT & WATER SAFETY	TA98269	MNSTATE
MINN ST DNR CENTRAL OFFICE-LAFAYETTE RD--ST PAUL	TA98268	MNSTATE
MINN ST DNR FIELD SERVICE-LAFAYETTE RD-ST PAUL	TA98267	MNSTATE
MINN ST DNR FORESTRY-DULUTH	TA98948	MNSTATE
MINN ST DNR LANDS & MINERALS-HIBBING	TA98564	MNSTATE
MINN ST DNR--TWO HARBORS	TA98601	MNSTATE
MINN ST DNR REGION 1-BEMIDJI	TA98261	MNSTATE
MINN ST DNR REGION 2-GRAND RAPIDS	TA98262	MNSTATE
MINN ST DNR REGION 3-BRAINERD	TA98263	MNSTATE
MINN ST DNR REGION 4-NEW ULM	TA98264	MNSTATE
MINN ST DNR-AREA OFFICE - ROCHESTER	TA98265	MNSTATE
MINN ST DNR REGION 6-WARNER RD-ST PAUL	TA98577	MNSTATE
MINN ST DNR REGION FORESTRY-WARROAD	TA98571	MNSTATE
MINN ST ENERGY & ECON DEV	TA99982	MNSTATE
MINN ST GOVERNERS OFFICE	TA99908	MNSTATE
MINN ST HEALTH DEPT OPERATIONS SERVICE	TA99245	MNSTATE
MINN ST HUMAN RIGHTS DEPT	TA99909	MNSTATE
MINN ST HUMAN SERVICES ANOKA REG SERV CENTER	TA99274	MNSTATE
MINN ST HUMAN SERVICES BRAINERD REG SERV CENTER	TA99277	MNSTATE
MINN ST HUMAN SERVICES FERGUS FALLS REG SERV	TA99273	MNSTATE
MINN ST HUMAN SERVICES MOOSE LAKE REG SERV	TA99272	MNSTATE
MINN ST HUMAN SERVICES ST PETER REG SERV CENTER	TA99270	MNSTATE
MINN ST HUMAN SERVICES WILLMAR REG TREATMENT CENTER	TA99275	MNSTATE
MINN ST HUMAN SERVICES-SEX OFFENDER PROGRAM	TA99749	MNSTATE
MINN ST LEGISLATURE HOUSE	TA99921	MNSTATE
MINN ST METRO COUNCIL	TA99220	MNSTATE
MINN ST METRO TRANSIT COMM	TA99233	MNSTATE
MINN ST MILITARY AFFAIRS DEPT	TA99907	MNSTATE

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
MINN ST POLLUTION CONTROL	TA99235	MNSTATE
MINN ST PUBLIC SAFETY CAPITOL COMPLEX SEC	TA99206	MNSTATE
MINN ST PUBLIC SAFETY CRIMINAL APPREHENSION	TA99203	MNSTATE
MINN ST PUBLIC SAFETY DRIVER & VEHICLE SERV	TA99205	MNSTATE
MINN ST PUBLIC SAFETY EMERGENCY MGMT DIV	TA99204	MNSTATE
MINN ST PUBLIC SAFETY EXECUTIVE SECURITY	TA99200	MNSTATE
MINN ST PUBLIC SAFETY FIRE MARSHALL	TA99208	MNSTATE
MINN ST PUBLIC SAFETY GAMBLING ENFORCEMENT	TA99227	MNSTATE
MINN ST PUBLIC SAFETY GOVERNORS PROTECTION	TA99229	MNSTATE
MINN ST PUBLIC SAFETY LIQUOR CONTROL	TA99240	MNSTATE
MINN ST PUBLIC SAFETY DIVISION	TA99207	MNSTATE
MINN ST PUBLIC SAFETY STATE PATROL	TA99202	MNSTATE
MINN ST TECH COLLEGES BOARD	TA99940	MNSTATE
MINN ST TRANSPORTATION DEPT	TA99712	MNSTATE
MINN ST TRANSPORTATION AERONAUTICS	TA99920	MNSTATE
MINN ST TRANSPORTATION DEPT TRUNK HIGHWAY FUND	TA99900	MNSTATE
MINN ST UNIV SYSTEM FINANCE & ACCOUNTING	TA99998	MNSTATE
MINN UNIV MPLS-BUDGET & FINANCE	TA99914	COLLEGE
MINN VALLEY TRANSIT AUTHORITY	TA98746	MISC
MINNETONKA CITY OF	TA98443	CITY
MINNETRISTA CITY OF	TA98572	CITY
MONTANA STATE TRANSPORTATION DEPT	TA99626	OTHER STATE
MONTEVIDEO CITY OF	TA98444	CITY
MONTICELLO CITY OF	TA99525	CITY
MOORHEAD CITY OF	TA98445	OTHER STATE
MORA CITY OF	TA99505	CITY
MORRIS CITY ENGINEER	TA98492	CITY
MORRISON COUNTY	TA98849	COUNTY
MOUND CITY OF	TA99717	CITY
MOUNDS VIEW CITY OF	TA99447	CITY
MOWER COUNTY	TA98850	COUNTY
MPLS CITY OF - CITY OF	TA98401	CITY
MPLS CITY OF - PARKS & REC	TA99517	CITY
MURRAY COUNTY	TA98851	COUNTY
NEW BRIGHTON CITY OF	TA98448	CITY
NEW HOPE CITY OF	TA99482	CITY
NEW LONDON CITY OF	TA99534	CITY
NEW PRAGUE CITY OF	TA98675	CITY
NEW ULM CITY OF	TA98449	CITY
NEWPORT CITY OF	TA99570	CITY
NICOLLET COUNTY	TA98852	COUNTY

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
NISSWA CITY	TA99748	CITY
NOBLES COUNTY	TA98853	COUNTY
NORMAN COUNTY	TA98854	COUNTY
NORTH BRANCH CITY OF	TA98101	CITY
NORTH DAKOTA STATE TRANSPORTATION DEPT	TA98634	OTHER STATE
NORTH MANKATO CITY OF	TA98451	CITY
NORTH ST PAUL CITY OF	TA98452	CITY
NORTHERN TOWNSHIP	TA98670	
NORTHFIELD CITY OF	TA98450	CITY
NORWOOD-YOUNG AMERICA CITY	TA99653	CITY
OAK GROVE CITY OF	TA98542	CITY
OAKDALE CITY OF	TA98485	CITY
OLMSTED COUNTY	TA98855	COUNTY
ORONO CITY ENGINEER	TA99453	CITY
ORR CITY OF	TA99732	CITY
OSSEO CITY OF	TA99506	CITY
OTSEGO CITY OF	TA98533	CITY
OTTERTAIL COUNTY	TA98856	COUNTY
OWATONNA CITY OF	TA98454	CITY
PARK RAPIDS CITY OF	TA99D70	CITY
PAUL BUNYAN DRUG TASK FORCE (BEMIDJI CITY)	TA9G462	CITY
PAYNESVILLE CITY OF	TA99773	CITY
PENNINGTON COUNTY	TA98857	COUNTY
PILLAGER CITY OF	TA99668	CITY
PINE COUNTY	TA98858	COUNTY
PINE RIVER CITY OF	TA99644	CITY
PIPESTONE COUNTY	TA98859	COUNTY
PLYMOUTH CITY OF	TA98456	CITY
POLK COUNTY	TA98860	COUNTY
POPE COUNTY	TA98861	COUNTY
PRINCETON CITY OF	TA99507	CITY
PRIOR LAKE CITY OF	TA99551	CITY
RAMSEY CITY OF	TA99499	CITY
RAMSEY COUNTY	TA98862	COUNTY
RAMSEY COUNTY PARKS & RECREATION	TA99597	COUNTY
RAMSEY COUNTY REGIONAL RAIL	TA98281	MISC
RED LAKE COUNTY	TA98863	COUNTY
RED LAKE TRIBAL ROADS PROGRAM	TA99584	MISC
RED LAKE WATERSHED DISTRICT	TA99562	MISC
RED WING CITY OF	TA98457	CITY
REDWOOD COUNTY	TA98864	COUNTY
REDWOOD FALLS CITY OF	TA98458	CITY

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
RENVILLE COUNTY	TA98865	COUNTY
RICE COUNTY	TA98866	COUNTY
RICHFIELD CITY OF	TA98652	CITY
RICHMOND CITY OF	TA99575	CITY
ROBBINSDALE CITY OF	TA99459	CITY
ROCHESTER CITY OF	TA98460	CITY
ROCHESTER COMMUNITY & TECHNICAL COLLEGE	TA98282	COLLEGE
ROCHESTER TOWNSHIP	TA99586	MISC
ROCK COUNTY	TA98867	COUNTY
ROCKFORD CITY OF	TA99648	CITY
ROCKVILLE CITY OF	TA98743	CITY
ROGERS CITY OF	TA99535	CITY
ROSEAU COUNTY	TA98868	COUNTY
ROSEAU RIVER WATERSHED DISTRICT	TA98888	MISC
ROSEMOUNT CITY OF	TA99512	CITY
ROSEVILLE CITY OF	TA99461	CITY
RUSH CITY OF	TA99545	CITY
SARTELL CITY OF	TA98508	CITY
SAUK CENTRE CITY OF	TA98727	CITY
SAUK RAPIDS CITY ENGINEER	TA98493	CITY
SAVAGE CITY OF	TA99527	CITY
SCOTT COUNTY	TA98870	COUNTY
SHAKOPEE CITY ENGINEER	TA99466	CITY
SHERBURN CITY OF	TA99745	CITY
SHERBURNE COUNTY	TA98871	COUNTY
SHEVLIN TOWNSHIP	TA99592	MISC
SHOREVIEW CITY OF	TA99467	CITY
SHOREWOOD CITY OF	TA99509	CITY
SIBLEY COUNTY	TA98872	COUNTY
SLEEPY EYE CITY	TA99741	CITY
SO ST PAUL CITY ENGINEER	TA98468	CITY
SOUTH DAKOTA STATE DOT	TA98641	OTHER STATE
SOUTHWEST STATE UNIV	TA99221	COLLEGE
SOUTHWEST TRANSIT	TA99728	MISC
SPRING LAKE PARK CITY OF	TA99483	CITY
ST ANTHONY CITY	TA98462	CITY
ST BONIFACIUS CITY	TA98680	CITY
ST CLOUD CITY OF	TA98463	CITY
ST CLOUD STATE UNIV	TA98222	COLLEGE
ST CLOUD TECHNICAL COLLEGE	TA98676	COLLEGE
ST FRANCIS CITY OF	TA98673	CITY
ST HILAIRE CITY OF	TA98701	CITY

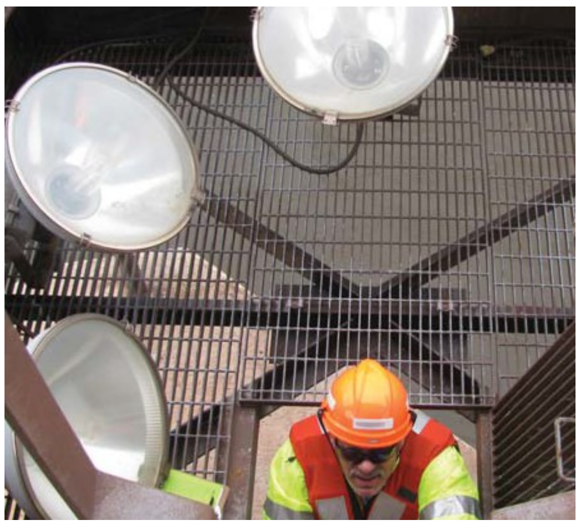
COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
ST JOSEPH CITY OF	TA98563	CITY
ST LOUIS COUNTY	TA98869	COUNTY
ST LOUIS PARK CITY OF	TA98464	CITY
ST MICHAEL CITY OF	TA98617	CITY
ST PAUL CITY OF	TA98402	CITY
ST PAUL PARK CITY OF	TA98574	CITY
ST PAUL PARKS & RECREATION DIVISION	TA98582	CITY
ST PETER CITY OF	TA98465	CITY
STATE BOARD OF ELECTRICITY	TA99282	MNSTATE
STEARNS COUNTY	TA98873	COUNTY
STEELE COUNTY	TA98874	COUNTY
STEVENS COUNTY	TA98875	COUNTY
STEWARTVILLE CITY OF	TA98461	CITY
STILLWATER CITY OF	TA99700	CITY
SUBURBAN HENNEPIN COUNTY REG PARK DIST	TA99587	COUNTY
SWIFT COUNTY	TA98876	COUNTY
SYLVAN TOWNSHIP	TA99573	MISC
TAYLORS FALLS CITY OF	TA98406	CITY
TEN LAKE TOWNSHIP	TA99737	MISC
TEXAS DOT	TA98469	STATE
THIEF RIVER FALLS CITY OF	TA98470	CITY
TODD COUNTY	TA98877	COUNTY
TOWER CITY OF	TA99733	CITY
TRAVERSE COUNTY	TA98878	COUNTY
TURTLE LAKE TOWNSHIP	TA99708	MISC
TWIN VALLEY CITY OF	TA98706	CITY
UPSALA CITY OF	TA98725	CITY
US AGRICULTURE FOREST SERVICE CASS LAKE	TA99950	FEDERAL
US FISH & WILDLIFE FORT SNELLING	TA99960	FEDERAL
US INTERIOR DEPT BUREAU INDIAN AFFAIRS-FT SNELLING ADDRESS	TA99955	FEDERAL
US VETERANS ADMINISTRATION FORT SNELLING	TA99959	FEDERAL
USDA FOREST SERV	TA99KE0	FEDERAL
UTAH DOT - STATE	TA99772	OTHER STATE
VADNAIS HEIGHTS CITY OF	TA98528	CITY
VICTORIA CITY OF	TA99684	CITY
VIRGINIA CITY OF	TA98471	CITY
WABASHA COUNTY	TA98879	COUNTY
WACONIA, CITY OF	TA98547	CITY
WADENA CITY OF	TA99P80	CITY
WADENA COUNTY	TA98880	COUNTY
WAITE PARK CITY OF	TA98529	CITY

COUNTY LOCAL PROJECT ID NUMBERS		
ALL CUSTOMERS	PROJECT ID	TYPE
WALKER, CITY OF	TA99628	CITY
WASECA CITY OF	TA98472	CITY
WASECA COUNTY	TA98881	COUNTY
WASHINGTON COUNTY	TA98882	COUNTY
WASHINGTON STATE TRANSPORTATION DEPT	TA98647	OTHER STATE
WATER & SOIL RESOURCES BOARD	TA99709	MN STATE
WATKINS CITY OF	TA99672	CITY
WATONWAN COUNTY	TA98883	COUNTY
WAVERLY CITY OF	TA98734	CITY
WAYZATA CITY OF	TA99511	CITY
WELLS CITY OF	TA99735	CITY
WEST ST PAUL CITY OF	TA98473	CITY
WHEATON CITY OF	TA9A116	CITY
WHITE BEAR LAKE CITY OF	TA99474	CITY
WHITE EARTH DEPT OF TRANSPORTATION	TA98655	CITY
WILKIN COUNTY	TA98884	COUNTY
WILLMAR CITY OF	TA98475	CITY
WINDOM, CITY OF	TA99775	CITY
WINONA CITY OF	TA98476	CITY
WINONA COUNTY	TA98885	COUNTY
WOODBURY CITY OF	TA98494	CITY
WORTHINGTON CITY OF	TA98477	CITY
WRIGHT COUNTY	TA98886	COUNTY
WYOMING CITY OF	TA99536	CITY
YELLOW MEDICINE COUNTY	TA98887	COUNTY

STATE OF MINNESOTA

Bridge and Structure Inspection Program Manual

DEPARTMENT OF TRANSPORTATION



Chapter G

INSPECTION OF HIGH MAST LIGHT POLES

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G.1 OVERVIEW

The Inspection of High Mast Light Poles Chapter in the Bridge and Structure Inspection Program Manual (BSIPM) is intended to outline the standard procedure of the inspection of high mast light poles. The procedures may be used for the inspection of new, in service or damaged high mast light poles.

G.2 ABBREVIATIONS

The abbreviations and acronyms for Chapter G – Inspection of High Mast Light Poles are located in the Introduction section of the BSIPM.

G.3 REFERENCES

Other inspection manuals that can be used as further guidance for inspecting high mast light poles are as follows:

- Federal Highway Administration (FHWA) Document "Guidelines for the Installation, Inspection, Maintenance and Repair of Structural Supports for Highway Signs, Luminaries, and Traffic Signals."

G.4 PERSONNEL REQUIREMENTS

Personnel performing high mast light pole inspections shall be familiar with the design and installation of the structures and be certified as a bridge inspection Team Leader. Personnel preforming non-destructive testing (NDT) shall be certified as an ASNT Level II or III in all applicable NDT methods.

G.5 EQUIPMENT

The following are suggested equipment to be used at inspections of high mast light poles.

- Aerial lift trucks, man lifts or other suitable access equipment may be used if it is necessary to inspect the tower structure at close proximity. Binoculars or spotting scopes may also be employed for inspection of the tower if access to the entire pole is not feasible.
- A camera capable of taking high quality images that can digitally be inserted into inspection reports shall be used.
- Non-destructive testing shall be performed using the proper equipment, including (but not limited to):
    - Ultrasonic portable flaw detectors and transducers capable of straight and angle beam testing
    - Ultrasonic digital thickness meters, capable of accurate thickness readings in all applicable materials
    - Portable magnetic particle equipment and contrasting powder
    - Liquid dye penetrant supplies
    - Cleaning tools (grinders, sanders, wire brushes, etc.) necessary to prepare metal surfaces for proper inspections
    - Proper safety equipment, including safety glasses, steel toed shoes, high visibility clothing, fall protection, traffic control devices (signs, cones, etc. where needed) and hard hats
    - Tools required to open access panels or doors

G.6 ELEMENT DESCRIPTIONS

FHWA has identified 18 elements for the inspection of "Structural Supports for Highway Signs, Luminaires, and Traffic Signals". Of those 18 elements, five are applicable to the inspection of high mast light poles. They are foundation, anchor rods, base plates, tower, and power and luminaries. A sixth element, winch system, will be added for this inspection procedure. The elements are defined below.

- **Element #1: Foundation** – This element includes foundation(s) that are constructed of reinforced concrete or steel. The condition of grout pads, if present, shall also be included in this element.
- **Element #2: Anchor Rods** – This element defines anchor rods, anchor nuts, leveling nuts, and washers connecting the column support members to the foundation.
- **Element #3: Base Plate(s)** – This element defines the base plates, flanges, gusset plates and welds at the connection of the column support(s) to the foundation(s). The elements may be painted, unpainted, or galvanized.
- **Element #4: Tower(s)** – This element includes the vertical posts, handhole covers, slip joints and circumferential welds for the column support on the structure. The element components may be painted/unpainted/galvanized steel or aluminum.
- **Element #5: Power and Luminaires** – This element defines the visual condition of any luminaries in the lighting system on the structure, as well as the visual condition of any electrical lines and boxes.
- **Element #6: Winch and Cables** – This element defines the condition of the winch and cable system used to hoist and suspend the luminaire. This includes the motor, mechanical systems, support brackets or housing, housing anchorage and cable attachments.

G.7 ELEMENT CONDITION RATINGS

FHWA recommends the following rating conditions for the inspection of "Structural Supports for Highway Signs, Luminaires, and Traffic Signals", based on Table 1.

TABLE 1		
CONDITION	**DESCRIPTION**	**FEASIBLE ACTION**
1	Element performs intended function with high degree of reliability (Good)	None
2	Element performs intended function. Some minor problems noted. (Satisfactory)	None
3	Element performs intended function with small reduction in reliability (Fair)	Repair element, increase inspection frequency, do nothing
4	Element performs intended function with significant reduction in reliability (Poor)	Repair or replacement of element within specified time frame
5	Element does not perform intended function with any degree of reliability (Critical)	Immediate repair or replacement of element
0	Not Applicable	None Steps may be needed to facilitate inspection

Each element shall be rated using the following guidelines. The designation "DN" as a feasible action denotes "do nothing".

G.7.1 ELEMENT #1: FOUNDATIONS

This element includes foundation(s) that are constructed of reinforced concrete or steel. Inspectors should assign ratings based on the overall condition of the foundation and its ability to function properly. The condition of grout pads, if present, shall also be included in this element.

ELEMENT #1: FOUNDATION CONDITION DESCRIPTION		
CODE	DESCRIPTION	FEASIBLE ACTION
1	Good Condition: The element shows no deterioration. There may be discoloration, efflorescence, and/or superficial cracking in the concrete but without effect on strength and/or serviceability. There is no evidence of active corrosion of the steel. On metal foundations, the surface coatings are sound and functioning as intended.	DN
2	Satisfactory Condition: Minor cracks and spalls may be present in the concrete foundation but there is no exposed reinforcing or surface evidence of rebar corrosion. Surface rust, surface pitting, has formed or is forming on steel foundation. Protective coatings may have minor areas of deterioration.	DN, seal cracks, minor patches, clean and resurface steel
3	Fair Condition: Some delaminations and/or spalls may be present in the concrete foundation and some reinforcing may be exposed. Corrosion of rebar may be present but loss of section is incidental and does not significantly affect the strength and/or serviceability of either the element or the high mast pole. Protective coatings have failed. Surface pitting may be present but any section loss due to active corrosion is measurable and does not warrant structural analysis. Weep holes in grout pads are clogged or not present.	DN, clean rebar, patch and/or seal, clean and resurface steel
4	Poor Condition: Advanced deterioration. Corrosion of reinforcement and/or loss of concrete section or sufficient section loss of the steel is sufficient to warrant analysis to ascertain the impact on the strength and/or serviceability of the element and/or the high mast pole.	Rehab or replace unit
5	Critical Condition: The foundation is deteriorated to the point that failure is eminent.	Replace unit
0	Unknown Condition: The foundation is buried and/or inaccessible and could not be evaluated.	Remove soil and inspect

G.7.2 ELEMENT #2: ANCHOR BOLTS

This element defines anchor bolts, anchor nuts, leveling nuts, and washers connecting the column support members to the foundation.

ELEMENT #2: ANCHOR BOLTS CONDITION DESCRIPTION		
CODE	DESCRIPTION	FEASIBLE ACTION
1	Good Condition: There is no deterioration or misalignment. The elements are fully engaged, tight, and in new or like-new condition.	DN
2	Satisfactory Condition: Minor corrosion of the elements may be present. The elements are fully engaged.	DN, clean/replace hardware
3	Fair Condition: Moderate corrosion of the elements may be present. Anchor nuts are not fully engaged or bolts are misaligned. Washers are missing (if specified on design plans). One or two loose nuts may be observed, but do not significantly affect the strength and/or serviceability of either the element or the high mast pole.	DN, clean/tighten/replace loose hardware, replace element
4	Poor Condition: Heavy corrosion of the elements may be present. Bolts may be cracked/sheared or multiple anchor nuts are loose/missing. There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of the element and/or the high mast pole.	Repair or replace element
5	Critical Condition: The element is damaged or deteriorated to the point that failure is eminent.	Replace element
0	Not Inspected: The anchor bolts are buried and/or inaccessible.	Remove soil or debris and inspect element

G.7.3 ELEMENT #3: BASE PLATES

This element defines the base plates, flanges, gusset plates and welds at the connection of the column support(s) to the foundation(s). The elements may be painted, unpainted, or galvanized.

ELEMENT #3: BASE PLATES CONDITION DESCRIPTION		
CODE	DESCRIPTION	FEASIBLE ACTION
1	Good Condition: No evidence of active corrosion. Surface coating is sound and functioning as intended to protect the metal surface.	DN
2	Satisfactory Condition: Minor surface corrosion present.	DN, clean and resurface
3	Fair Condition: Any protective coating present has failed. Surface pitting may be present but any section loss due to active corrosion is measurable and does not warrant structural analysis.	DN, clean and resurface
4	Poor Condition: Cracks may be present on the base plate to column support connection weld. Corrosion is advanced. Section loss is sufficient to warrant structural analysis to ascertain the impact on the ultimate strength and/or serviceability of the element and/or the high mast pole.	Repair or replace element
5	Critical Condition: The element is damaged or deteriorated to the point that failure is eminent.	Replace element
0	Not Inspected: Element is buried and/or inaccessible.	Remove soil or debris and inspect element

G.7.4 ELEMENT #4: TOWER

This element includes the vertical posts, handhole covers, slip joints and circumferential welds for the column support on the structure.

ELEMENT #4: TOWER CONDITION DESCRIPTION		
CODE	DESCRIPTION	FEASIBLE ACTION
1	Good Condition: No evidence of corrosion or misalignment. Elements are in new or like-new condition.	DN
2	Satisfactory Condition: Minor damage or corrosion is present with no section loss. Handhole covers or post caps are missing.	DN, repair/replace elements
3	Fair Condition: Moderate damage or corrosion is present. Standing water may be observed on the inside of the post. Column supports may be out of plumb.	DN, repair/replace elements
4	Poor Condition: Heavy damage or corrosion of elements with localized section loss. Elements may be misaligned or have severe impact damage that may warrant structural analysis to ascertain the impact on the ultimate strength and/or serviceability of the element and/or high mast pole.	Rehab or replace unit
5	Critical Condition: Deterioration is so severe that structural integrity is in doubt. Failure may be imminent.	Remove from service or replace unit

G.7.5 ELEMENT #5: POWER AND LUMINAIRES

This element defines each luminaire in the lighting system on the structure.

ELEMENT #5: POWER AND LUMINAIRES CONDITION DESCRIPTION		
CODE	DESCRIPTION	FEASIBLE ACTION
1	Good Condition: Elements is fully functional and in new or like-new condition with no significant deficiencies.	DN
2	Satisfactory Condition: Minor damage of the element may be observed. Element may be misaligned.	DN, rehab unit
3	Fair Condition: Light cover latches are broken or rusted shut. Missing cover plates. Loose, broken or missing sections of conduit. Open electrical boxes.	DN, rehab unit
4	Poor Condition: Broken or missing covers. Burned out bulbs/ballasts or missing light fixtures. Exposed wiring or unattached electrical boxes.	Rehab or replace unit
5	Critical Condition: Any damage or deterioration significant enough to threaten separation of components from the structure.	Rehab or replace unit
0	Not Inspected: Element is inaccessible.	DN, inspect when element is accessible

G.7.6 ELEMENT #6: WINCH AND CABLES

This element describes the hoisting and suspension system for the luminaire on each structure.

ELEMENT #6: WINCH AND CABLES CONDITION DESCRIPTION		
CODE	DESCRIPTION	FEASIBLE ACTION
1	Good Condition: Elements is fully functional and in new or like-new condition with no significant deficiencies.	DN
2	Satisfactory Condition: Minor damage or wear of the element may be observed.	DN, rehab unit
3	Fair Condition: Anchor bolts may be loose or missing. Element may be out of alignment. Some fraying of the cables may be occurring.	Rehab unit
4	Poor Condition: Housing may be bent or cracked. Cable anchorages may be loose, damaged or missing. Cables may be kinked, tangled or damaged.	Rehab or replace unit
5	Critical Condition: The element is damaged or deteriorated to the point that failure is eminent.	Rehab or replace unit
0	Not Inspected: Element is inaccessible.	DN, inspect when element is accessible

G.7.7 HIGH MAST LIGHT STRUCTURE

This rating should reflect the overall condition for the structure of each high mast pole.

HIGH MAST LIGHT STRUCTURES	
CODE	**DESCRIPTION**
N	Unknown Condition: Rate a high mast pole as unknown if an element could not be inspected thoroughly. If there is grout under the base plate, the high mast pole must be rated as Unknown.
9	Excellent Condition: High mast pole is in new condition (newly constructed).
8	Very Good Condition: High mast pole has very minor (and isolated) deterioration. There is no damage or misalignment to any member. • Anchorage: Anchor rods have no deterioration, there is no corrosion present. Leveling nuts are in firm contact with the base plate, and at least one thread protrudes above the tightening nut. • Concrete: Reinforced concrete has little to no deterioration. Any cracking present would be considered hairline (<1/32″), there is no leaching or surface scale. There are no areas of delamination or spalling. • Steel: The protective oxide coating is uniform and tightly adhered. All access doors are fastened properly. All welded connections are intact. • Winch: Winch has no defects.
7	Good Condition: High mast pole has minor (or isolated) deterioration. • Anchorage: anchor rods have little to no deterioration, there is no corrosion present. Leveling nuts are in firm contact with the base plate and at least one thread extends above the tightening nut. • Concrete: reinforced concrete has minor deterioration. Any cracking present would be considered hairline (<1/32″), there may be minor leaching or surface scale. There are no areas of delamination or spalling. • Steel: The protective oxide coating is uniform and tightly adhered. There are minor areas of fading, chalking, or flowering, but there is no surface corrosion. Access doors may have broken bolts but the doors function as intended. All welded connections are intact. • Winch: Winch has no defects.
6	Satisfactory Condition: High mast pole has minor to moderate deterioration. Any member that is damaged, bent, or misaligned would be considered insignificant and are intact. • Anchorage: Anchor rods have little to no deterioration, any corrosion present is minor. Leveling nuts are in firm contact with the base plate. One anchor rod may have treads not entirely through the nuts. • Concrete: Reinforced concrete has minor to moderate deterioration. Any cracking present would be considered minor (1/32″ to <1/16″), there is minor to moderate leaching or surface scale. Any areas of delamination or spalling would be considered minor. There is no exposed reinforcement. • Steel: Protective coating has minor deterioration. There are areas of surface corrosion with no areas of section loss. Welded connections are intact but may be deteriorating. The tower may be slightly out of alignment, tilted up to 1/16" in 4'. • Winch: Cable anchors may be improperly installed or adjusted. Base is sound.
5	Fair Condition: High mast pole has moderate deterioration. Members may be slightly damaged, bent, or misaligned but are intact. • Anchorage: Anchor rods have minor deterioration, any corrosion present is would be considered moderate with no section loss. One leveling or tightening nut may be loose. Multiple anchor rods may have treads not entirely through the nuts. • Concrete: Reinforced concrete has moderate deterioration. Any cracking present would be considered minor to moderate (1/16″ to <1/8″), there is moderate leaching or surface scale. Any areas of delamination or spalling would be considered moderate. Exposed reinforcement is present, but there is no section loss.

HIGH MAST LIGHT STRUCTURES	
CODE	**DESCRIPTION**
5 (Cont.)	**Fair Condition (CONTINUED):** • **Steel: Protective coating has moderate deterioration. There are significant areas of fading, chalking, or flowering. There are areas of surface corrosion with corresponding section loss that is less than 5% of the effective area. There may be loose bolted connections but none are missing. Welded connections are intact but may be deteriorated. Access doors have broken bolts and the doors are not sealed properly. The tower may be out of alignment between 1/16" in 4' and 1/8" in 4'.** • **Winch: Base is intact. There may be loss of thickness no more than 10% due to corrosion or galling.**
4	**Poor Condition: High mast pole has advanced deterioration. Members may be significantly damaged, bent or misaligned.** • **Anchorage: Anchor rods have moderate to advanced deterioration. Advanced corrosion is present with section loss that is less than 5%. Two leveling or tightening nuts may be loose.** • **Concrete: Reinforced concrete has extensive deterioration. Any cracking present would be considered moderate (>1/8"), there is leaching or surface scale. Delaminations and spalls may be prevalent. Exposed reinforcement may have corrosion, but any section loss is incidental and does not affect the strength of the member.** • **Steel: Protective coating has extensive deterioration. Surface corrosion is prevalent with corresponding section loss that is less than 10% of the effective area. There are loose bolted connections but none are missing. Welded connections are intact but deteriorated. The tower is out of alignment beyond acceptable limits, tilted at least 1/8" in 4'.** • **Winch: One tab of the winch base may be cracked. There may be loss of thickness greater than 10% due to corrosion or galling.**
3	**Serious Condition: High mast pole has severe deterioration. Members may be severely damaged, bent, or misaligned. Immediate repairs and/or engineering analysis may be required.** • **Anchorage: Anchor rods have advanced deterioration. Advanced corrosion is present with section loss that is greater than 5%. Three or more leveling or tightening nuts may be loose.** • **Concrete: reinforced concrete has severe deterioration. There is extensive cracking with leaching and surface scale. Delamination and spalls are prevalent. Exposed reinforcement has corrosion with measureable section loss. Structural analysis or immediate repairs may be necessary.** • **Steel: Protective coating has severe deterioration. Section loss may exceed 10% of the effective area. Structural analysis or immediate repairs may be necessary. Welded connections are compromised.** • **Winch: Two or more tabs of the winch base may be cracked. Cables may be kinked, tangled or damaged.**
2	**Critical Condition: Critical damage or deterioration to the high mast pole. It may be necessary to close the road adjacent to the high mast pole. Immediate notification to the Program Administrator and engineering analysis required.**
1	**Imminent Failure Condition: Major deterioration present with obvious stability issues. Immediate closure of the road adjacent to the high mast pole is required. Immediate notification to the Program Administrator and engineering analysis required.**
0	**Failed Condition: Structure is beyond repair and requires immediate removal.**

G.7.8 REPORTING

A report shall be submitted for each pole inspected. Each report shall contain, at a minimum, the following information.

- Inspection date
- Pole location
- Pole manufacturer
- Project number
- Feed point
- Pole height
- Inspection methods
- Inspectors and project engineer
- Elements inspected
- Condition rating of each element, including descriptions of deficiencies, corrective actions required and photographs of the deficient elements
- Significant findings
- Corrective actions

APPENDIX A

REQUIREMENTS FOR ROUTINE BRIDGE INSPECTION ACCESS

REQUIREMENTS FOR ROUTINE BRIDGE ACCESS

02-07-2017

The National Bridge Inspection Standards (NBIS) definition of a routine inspection is as follows.

- 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.

The AASHTO Manual for Bridge Evaluation states that “Special equipment, such as under-bridge inspection equipment, rigging or staging, is necessary for routine inspection in circumstances where its use provides for the only practical means of access to areas of the structure being monitored”.

There are times when the typical means of access for a routine inspection is not sufficient to satisfy the NBIS requirements. When routine inspection methods are not sufficient, inspections are expected to be conducted utilizing snoopers, lifts, ladders, barges, magnification optics, etc. as necessary to carefully and completely identify any condition changes.

The following requirements were created to establish criteria for when bridge owners are expected to be taking a closer look at bridges, either due to deteriorated conditions of one or more elements or the element’s location makes it difficult to assess its condition. The following criterion is for determining which bridges require enhanced inspection access techniques:

1) Any bridge that meets the following condition based criteria requires enhanced inspection access to more thoroughly evaluate the condition state of the affected element.
    a. Any bridge with a Superstructure (FHWA Item #59) or Substructure (FHWA Item #60) with an NBI condition rating of 4 or less.
    b. Any bridge with a Defect Element which represents elevated levels of deterioration per the following table:

DEFECT ELEMENT	CONDITION STATE(S)
Element #880 – Impact Damage	**2, 3, or 4**
Element #881 – Steel Section Loss	**3 or 4**
Element #882 – Steel Cracking	**2, 3, or 4**
Element #883 – Concrete Shear Cracking	**2, 3, or 4**
Element #884 – Substructure Settlement	**3 or 4**
Element #885 – Scour	**3 or 4**

c. Any bridge with the Deck, Superstructure, or Substructure Element rated in the element condition which represents advanced deterioration per the following table.

ELEMENT	CONDITION STATE(S)
Deck and Slab Elements: #12, #16, #38, #28, #29, and #30	4
Deck and Slab Elements: #13, #15, #805, #31 and #54	3 or 4
Steel Superstructure Elements: #102, #107, #113, #120, #141, #152 and #162 (*Refer to Element #881 for section loss requirements)	3 or 4
Steel Substructure Elements: #202, #207, #219, #225 and #231 (*Refer to Element #881 for section loss requirements.)	3 or 4
Reinforced Concrete Superstructure Elements: #105, #110, #116, #144 and #155	3 or 4
Reinforced Concrete Substructure Elements: #205, #210, #215, #220, #227 and #234	4
Prestressed Concrete Superstructure Elements: #104, #109, #115 and #154	3 or 4
Prestressed Concrete Substructure Elements: #204, #226 and #233	3 or 4
Timber Superstructure Elements: #111, #117, #135, #146 and #156	3 or 4
Timber Substructure Elements: #206, #208, #216, #228 and #235	3 or 4
Masonry Superstructure and Substructure Elements: #145, #213 & #217	3 or 4
Bearing and Structural Components: #310, #311, #313, #314, #315, #161, #850, #851, #147 and #148	3 or 4
Tunnel Element #860	3 or 4

2) In addition to the condition state criteria stated above, any bridge that cannot be completely and thoroughly inspected with typical routine inspection methods is required to be assessed using appropriate access equipment. The Bridge Inspection Team Leader, along with input from the Program Administrator, needs to determine which bridges require closer inspection access.

A multiple span bridge over water is an example of a bridge that requires closer inspection access. A bridge element that cannot be clearly viewed using binoculars will require closer access. Elements that cannot be sufficiently inspected from the shoulder due to multiple lanes under a bridge will require enhanced access. Examples of elements that may require enhanced access would be bridge bearings over a pier or a high wall abutment, steel hinge assemblies, pin and hanger or hinge pin assemblies, and previously identified areas of impending section loss or deterioration.

3) The inspection frequency using special access equipment should be established by the Team Leader and Program Administrator based on the criteria stated in 1 and 2 above. In some cases, it may be appropriate to perform standard ground based routine inspection and special access routine inspections on a rotating schedule. In all cases, the inspection frequency using special access equipment, must be at a minimum, once every 6 years for bridges on a 24 month inspection cycle or once every 3 years for bridges on a 12 month inspection cycle.

4) Along with accessing a bridge with elements that are difficult to reach, several types of bridges are designed where access to the interior of the member is required. Examples of this type of structure would be post tensioned box girders, steel box girders, reinforced and prestressed concrete box girders, voided abutments, and towers. If the size of the member allows and access is achievable, a post tensioned concrete box girder must be accessed from the interior during every inspection. Other types of box girders or hollow arches where the size of the member allows and access is achievable, should be inspected from the interior a minimum of every other inspection. Substructure elements like voided abutments and towers with reasonable access should be inspected a minimum of every third inspection. Fracture critical elements like pier caps, columns, or tied arches must meet the requirements of Chapter A of the BSIPM, section A.5.4 Fracture Critical Inspections.

The Team Leader is required to document in the General Notes of the Bridge Inspection Report in SIMS those elements that require closer access. Means of access (i.e. equipment utilized) and inspection frequency must be documented in SIMS.

MnDOT owned access equipment can be rented by Local Agencies by contacting the Bridge Office at 651-366-4471 or 651-366-4475. Additional information on access equipment can be found in the Bridge and Structures Inspection Program Manual under Chapter F “MnDOT Inspection Vehicle Policy Manual”. Availability of this equipment is limited.

APPENDIX B – USERKEY CODES

(MnDOT ITEM)

USERKEYS MINNESOTA AND COUNTY AGENCIES					
AGENCY	USER-KEY	AGENCY	USER-KEY	AGENCY	USER-KEY
District 1	17	Grant	209	Pope	101
District 2	18	Hennepin	67	Ramsey	102
District 3	19	Houston	68	Red Lake	103
District 4	20	Hubbard	69	Redwood	104
Metro District	221	Isanti	70	Renville	105
District 6	21	Itasca	71	Rice	106
District 7	22	Jackson	72	Rock	107
District 8	23	Kanabec	73	Roseau	108
DNR	220	Kandiyohi	74	Saint Louis	109
Mn Dept of Admn	287	Kittson	75	Scott	110
Aitkin	41	Koochiching	76	Sherburne	111
Anoka	42	Lac qui Parle	77	Sibley	112
Becker	43	Lake	78	Stearns	113
Beltrami	44	Lake of the Woods	79	Steele	114
Benton	45	Le Sueur	80	Stevens	115
Big Stone	46	Lincoln	81	Swift	116
Blue Earth	47	Lyon	82	Todd	117
Brown	48	McLeod	83	Traverse	118
Carlton	49	Mahnomen	84	Wabasha	119
Carver	50	Marshall	85	Wadena	120
Cass	51	Martin	86	Waseca	121
Chippewa	52	Meeker	87	Washington	122
Chisago	53	Mille Lacs	88	Watonwan	123
Clay	54	Morrison	89	Wilkin	124
Clearwater	55	Mower	90	Winona	125
Cook	56	Murray	91	Wright	126
Cottonwood	57	Nicollet	92	Yellow Medicine	127
Crow Wing	58	Nobles	93		
Dakota	59	Norman	94		
Dodge	60	Olmsted	95		
Douglas	61	Otter Tail	96		
Faribault	62	Pennington	97		
Fillmore	63	Pine	98		
Freeborn	64	Pipestone	99		
Goodhue	65	Polk	100		

USERKEYS
CITY AND OTHER AGENCIES

AGENCY	USER-KEY	AGENCY	USER-KEY	AGENCY	USER-KEY
Afton	128	Farmington	155	Owatonna	183
Albert Lea	129	Fergus Falls	227	Paynesville	277
Alexandria	130	Forest Lake	156	Plymouth	184
Andover	131	Fridley	236	Prior Lake	185
Anoka	210	Golden Valley	157	Ramsey	213
Arden Hills	132	Grand Rapids	158	Red Wing	187
Baxter	307	Ham Lake	159	Redwood Falls	299
Bemidji	133	Hastings	160	Robbinsdale	188
Blaine	215	Hermantown	161	Rochester	189
Bloomington	134	Hibbing	162	Rosemount	241
Brainerd	135	Hopkins	163	Roseville	295
Brooklyn Center	136	Hugo	164	Sartell	190
Brooklyn Park	137	Hutchinson	165	Sauk Rapids	226
Burnsville	138	Inver Grove Heights	166	Savage	191
Cambridge	139	La Crescent	234	Shakopee	192
Champlin	216	Lake City	244	Shoreview	193
Chanhassen	217	Lakeville	167	Shorewood	194
Chaska	140	Litchfield	168	South St Paul	195
Chisholm	141	Little Canada	169	St Anthony	196
Cloquet	142	Mankato	170	St Cloud	197
Coon Rapids	143	Maple Grove	171	St Louis Park	198
Corcoran	144	Maplewood	172	St Paul	199
Cottage Grove	145	Marshall	212	St Paul Park	235
Crookston	146	Mendota Heights	239	St Peter	200
Dayton	147	Minneapolis	173	Staples	305
Delano	292	Minnetonka	174	Stillwater	201
Detroit Lakes	148	Montevideo	175	Thief River Falls	202
Duluth	149	Moorhead	176	Victoria	240
East Bethel	218	New Brighton	177	Virginia	203
East Grand Forks	150	New Hope	178	Waite Park	204
Eden Prairie	151	New Ulm	179	Wayzata	219
Edina	152	North Branch	180	White Earth	233
Elk River	153	North Oaks	297	Willmar	205
Fairmont	154	Northfield	181	Winona	214
Faribault	211	Orono	182	Woodbury	206

USERKEYS CITY AND OTHER AGENCIES (cont.)	
AGENCY	USER-KEY
Worthington	207
Wyoming	276
Bridge Inventory Management Unit (Hart1Lis)	246
Met Council / Metro Transit (LRT)	242
Canadian National RR	301
IBM	282
MAC (Metropolitan Airports Commission)	278
MBA (Minnesota Ballpark Authority)	302
Minnesota Dakota & Western RR	288
Minnesota Power	303
RAILBANK (State Railbank)	280
TRPD (Three Rivers Park District)	279
U of M Transit	283
Wisconsin	257

APPENDIX C – CITY AND TOWNSHIP CODES

FIPS (PLACE CODES) AND MN CODES

(NBI ITEM 4) (MnDOT ITEM)

COUNTY	PLACE NAME	FIPS	CITY	TWP
Aitkin	Aitkin	00460	0025	n/a
Aitkin	Aitkin (Township of)	00478	n/a	01001
Aitkin	Ball Bluff (Township of)	03358	n/a	01002
Aitkin	Balsam (Township of)	03412	n/a	01003
Aitkin	Beaver (Township of)	04384	n/a	01004
Aitkin	Clark (Township of)	11620	n/a	01005
Aitkin	Cornish (Township of)	13330	n/a	01006
Aitkin	Farm Island (Township of)	20654	n/a	01007
Aitkin	Fleming (Township of)	21230	n/a	01008
Aitkin	Glen (Township of)	23930	n/a	01009
Aitkin	Haugen (Township of)	27602	n/a	01010
Aitkin	Hazelton (Township of)	28052	n/a	01011
Aitkin	Hill City	29096	1770	n/a
Aitkin	Hill Lake (Township of)	29114	n/a	01012
Aitkin	Idun (Township of)	30788	n/a	01013
Aitkin	Jevne (Township of)	31958	n/a	01014
Aitkin	Kimberly (Township of)	33218	n/a	01015
Aitkin	Lakeside (Township of)	34982	n/a	01016
Aitkin	Lee (Township of)	36152	n/a	01017
Aitkin	Libby (Township of)	36908	n/a	01018
Aitkin	Logan (Township of)	37844	n/a	01019
Aitkin	Macville (Township of)	39212	n/a	01021
Aitkin	Malmo (Township of)	39590	n/a	01022
Aitkin	McGrath	38996	2355	n/a
Aitkin	McGregor	39014	2360	n/a
Aitkin	Morrison (Township of)	44278	n/a	01023
Aitkin	Nordland (Township of)	46546	n/a	01024
Aitkin	Palisade	49498	2985	n/a
Aitkin	Pliny (Township of)	51694	n/a	01025
Aitkin	Rice River (Township of)	54106	n/a	01026
Aitkin	Salo (Township of)	58270	n/a	01027
Aitkin	Seavey (Township of)	59134	n/a	01028
Aitkin	Shamrock (Township of)	59368	n/a	01029
Aitkin	Spalding (Township of)	61546	n/a	01030
Aitkin	Spencer (Township of)	61654	n/a	01031
Aitkin	Tamarack	64156	3730	n/a
Aitkin	Turner (Township of)	65722	n/a	01032
Aitkin	Verdon (Township of)	66748	n/a	01033
Aitkin	Wagner (Township of)	67540	n/a	01034
Aitkin	Waukenabo (Township of)	68692	n/a	01035
Aitkin	Wealthwood (Township of)	68872	n/a	01036
Aitkin	White Pine (Township of)	70132	n/a	01037
Aitkin	Williams (Township of)	70384	n/a	01038
Aitkin	Workman (Township of)	71716	n/a	01039
Anoka	Andover	01486	0088	n/a
Anoka	Anoka	01720	0095	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Anoka	Bethel	05554	0315	n/a
Anoka	Blaine	06382	0370	n/a
Anoka	Centerville	10648	0620	n/a
Anoka	Circle Pines	11494	0675	n/a
Anoka	Columbia Heights	12700	0790	n/a
Anoka	Columbus	12718	0792	n/a
Anoka	Coon Rapids	13114	0820	n/a
Anoka	East Bethel	17486	1072	n/a
Anoka	Fridley	22814	1385	n/a
Anoka	Ham Lake	26738	1633	n/a
Anoka	Hilltop	29258	1785	n/a
Anoka	Lexington	36836	2250	n/a
Anoka	Lino Lakes	37322	2265	n/a
Anoka	Linwood (Township of)	37376	n/a	02006
Anoka	Oak Grove	47690	2889	n/a
Anoka	Ramsey	53026	3148	n/a
Anoka	Spring Lake Park	61996	3620	n/a
Anoka	St Francis	56950	3382	n/a
Becker	Atlanta (Township of)	02674	n/a	03001
Becker	Audubon	02728	0140	n/a
Becker	Audubon (Township of)	02746	n/a	03002
Becker	Burlington (Township of)	08686	n/a	03003
Becker	Callaway	09280	0560	n/a
Becker	Callaway (Township of)	09298	n/a	03004
Becker	Carsonville (Township of)	10126	n/a	03005
Becker	Cormorant (Township of)	13294	n/a	03006
Becker	Cuba (Township of)	14230	n/a	03007
Becker	Detroit (Township of)	15814	n/a	03008
Becker	Detroit Lakes	15832	0995	n/a
Becker	Eagle View (Township of)	17455	n/a	03038
Becker	Erie (Township of)	19646	n/a	03009
Becker	Evergreen (Township of)	20006	n/a	03010
Becker	Forest (Township of)	21671	n/a	03037
Becker	Frazee	22472	1370	n/a
Becker	Green Valley (Township of)	25820	n/a	03012
Becker	Hamden (Township of)	26684	n/a	03013
Becker	Height of Land (Township of)	28250	n/a	03014
Becker	Holmesville (Township of)	29816	n/a	03015
Becker	Lake Eunice (Township of)	34298	n/a	03016
Becker	Lake Park	34784	2135	n/a
Becker	Lake Park (Township of)	34802	n/a	03017
Becker	Lake View (Township of)	35144	n/a	03018
Becker	Maple Grove (Township of)	40130	n/a	03019
Becker	Ogema	48130	2905	n/a
Becker	Osage (Township of)	48778	n/a	03020
Becker	Pine Point (Township of)	51244	n/a	03021

COUNTY	PLACE NAME	FIPS	CITY	TWP
Becker	Riceville (Township of)	54142	n/a	03022
Becker	Richwood (Township of)	54376	n/a	03023
Becker	Round Lake (Township of)	56050	n/a	03024
Becker	Runeberg (Township of)	56248	n/a	03025
Becker	Savannah (Township of)	58756	n/a	03026
Becker	Shell Lake (Township of)	59512	n/a	03027
Becker	Silver Leaf (Township of)	60430	n/a	03028
Becker	Spring Creek (Township of)	61762	n/a	03029
Becker	Spruce Grove (Township of)	62212	n/a	03030
Becker	Sugar Bush (Township of)	63256	n/a	03031
Becker	Toad Lake (Township of)	65002	n/a	03032
Becker	Two Inlets (Township of)	66010	n/a	03033
Becker	Walworth (Township of)	67954	n/a	03034
Becker	White Earth (Township of)	70024	n/a	03035
Becker	Wolf Lake	71338	4165	n/a
Becker	Wolf Lake (Township of)	71356	n/a	03036
Beltrami	Alaska (Township of)	00586	n/a	04001
Beltrami	Battle (Township of)	03952	n/a	04002
Beltrami	Bemidji	05068	0290	n/a
Beltrami	Bemidji (Township of)	05086	n/a	04003
Beltrami	Benville (Township of)	05284	n/a	04004
Beltrami	Birch (Township of)	05914	n/a	04005
Beltrami	Blackduck	06256	0365	n/a
Beltrami	Buzzle (Township of)	09082	n/a	04006
Beltrami	Cormant (Township of)	13258	n/a	04007
Beltrami	Durand (Township of)	17234	n/a	04008
Beltrami	Eckles (Township of)	17954	n/a	04009
Beltrami	Frohn (Township of)	22886	n/a	04010
Beltrami	Funkley	22976	1400	n/a
Beltrami	Grant Valley (Township of)	25352	n/a	04011
Beltrami	Hagali (Township of)	26468	n/a	04012
Beltrami	Hamre (Township of)	26900	n/a	04013
Beltrami	Hines (Township of)	29348	n/a	04014
Beltrami	Hornet (Township of)	30194	n/a	04015
Beltrami	Jones (Township of)	32120	n/a	04016
Beltrami	Kelliher	32606	1990	n/a
Beltrami	Kelliher (Township of)	32624	n/a	04017
Beltrami	Lammers (Township of)	35324	n/a	04018
Beltrami	Langor (Township of)	35540	n/a	04019
Beltrami	Lee (Township of)	36170	n/a	04020
Beltrami	Liberty (Township of)	36926	n/a	04021
Beltrami	Maple Ridge (Township of)	40274	n/a	04022
Beltrami	Moose Lake (Township of)	43936	n/a	04024
Beltrami	Nebish (Township of)	45088	n/a	04025
Beltrami	Northern (Township of)	46906	n/a	04026
Beltrami	Port Hope (Township of)	52162	n/a	04028

COUNTY	PLACE NAME	FIPS	CITY	TWP
Beltrami	Quiring (Township of)	52828	n/a	04029
Beltrami	Roosevelt (Township of)	55402	n/a	04030
Beltrami	Shooks (Township of)	59926	n/a	04031
Beltrami	Shotley (Township of)	60070	n/a	04032
Beltrami	Solway	61114	3575	n/a
Beltrami	Spruce Grove (Township of)	62230	n/a	04033
Beltrami	Steenerson (Township of)	62680	n/a	04034
Beltrami	Sugar Bush (Township of)	63274	n/a	04035
Beltrami	Summit (Township of)	63328	n/a	04036
Beltrami	Taylor (Township of)	64291	n/a	04045
Beltrami	Ten Lake (Township of)	64390	n/a	04037
Beltrami	Tenstrike	64444	3755	n/a
Beltrami	Turtle Lake (Township of)	65758	n/a	04038
Beltrami	Turtle River	65794	3815	n/a
Beltrami	Turtle River (Township of)	65812	n/a	04039
Beltrami	Waskish (Township of)	68440	n/a	04043
Beltrami	Wilton	70708	4125	n/a
Beltrami	Woodrow (Township of)	71590	n/a	04040
Benton	Alberta (Township of)	00668	n/a	05001
Benton	Foley	21536	1315	n/a
Benton	Gilman	23804	1465	n/a
Benton	Gilmanton (Township of)	23822	n/a	05002
Benton	Glendorado (Township of)	24020	n/a	05003
Benton	Graham (Township of)	24812	n/a	05004
Benton	Granite Ledge (Township of)	25298	n/a	05005
Benton	Langola (Township of)	35522	n/a	05006
Benton	Mayhew Lake (Township of)	41192	n/a	05007
Benton	Maywood (Township of)	41264	n/a	05008
Benton	Minden (Township of)	42434	n/a	05009
Benton	Rice	53998	3205	n/a
Benton	Royalton	56176	3305	n/a
Benton	Sartell	58612	3470	n/a
Benton	Sauk Rapids	58684	3480	n/a
Benton	Sauk Rapids (Township of)	58702	n/a	05011
Benton	St Cloud	56896	3380	n/a
Benton	St George (Township of)	56986	n/a	05010
Benton	Watab (Township of)	68476	n/a	05012
Big Stone	Akron (Township of)	00532	n/a	06001
Big Stone	Almond (Township of)	01126	n/a	06002
Big Stone	Artichoke (Township of)	02350	n/a	06003
Big Stone	Barry	03718	0210	n/a
Big Stone	Beardsley	04204	0235	n/a
Big Stone	Big Stone (Township of)	05788	n/a	06004
Big Stone	Browns Valley (Township of)	08182	n/a	06005
Big Stone	Clinton	11980	0735	n/a
Big Stone	Correll	13384	0830	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Big Stone	Foster (Township of)	22058	n/a	06006
Big Stone	Graceville	24758	1525	n/a
Big Stone	Graceville (Township of)	24776	n/a	06007
Big Stone	Johnson	32012	1955	n/a
Big Stone	Malta (Township of)	39608	n/a	06008
Big Stone	Moonshine (Township of)	43828	n/a	06009
Big Stone	Odessa	48058	2895	n/a
Big Stone	Odessa (Township of)	48076	n/a	06010
Big Stone	Ortonville	48706	2950	n/a
Big Stone	Ortonville (Township of)	48724	n/a	06011
Big Stone	Otrey (Township of)	49120	n/a	06012
Big Stone	Prior (Township of)	52576	n/a	06013
Big Stone	Toqua (Township of)	65200	n/a	06014
Blue Earth	Amboy	01324	0085	n/a
Blue Earth	Beauford (Township of)	04330	n/a	07001
Blue Earth	Butternut Valley (Township of)	09046	n/a	07002
Blue Earth	Cambria (Township of)	09352	n/a	07003
Blue Earth	Ceresco (Township of)	10756	n/a	07004
Blue Earth	Danville (Township of)	14752	n/a	07005
Blue Earth	Decoria (Township of)	15130	n/a	07006
Blue Earth	Eagle Lake	17378	1070	n/a
Blue Earth	Garden City (Township of)	23102	n/a	07007
Blue Earth	Good Thunder	24506	1515	n/a
Blue Earth	Jamestown (Township of)	31688	n/a	07008
Blue Earth	Judson (Township of)	32210	n/a	07009
Blue Earth	Lake Crystal	34190	2095	n/a
Blue Earth	Le Ray (Township of)	36584	n/a	07010
Blue Earth	Lime (Township of)	37052	n/a	07011
Blue Earth	Lincoln (Township of)	37124	n/a	07012
Blue Earth	Lyra (Township of)	38870	n/a	07013
Blue Earth	Madison Lake	39320	2390	n/a
Blue Earth	Mankato	39878	2420	n/a
Blue Earth	Mankato (Township of)	39896	n/a	07015
Blue Earth	Mapleton	40310	2445	n/a
Blue Earth	Mapleton (Township of)	40328	n/a	07016
Blue Earth	Medo (Township of)	41498	n/a	07017
Blue Earth	Minnesota Lake	43198	2605	n/a
Blue Earth	North Mankato	47068	2855	n/a
Blue Earth	Pemberton	50200	3020	n/a
Blue Earth	Pleasant Mound (Township of)	51604	n/a	07018
Blue Earth	Rapidan (Township of)	53206	n/a	07019
Blue Earth	Shelby (Township of)	59458	n/a	07020
Blue Earth	Skyline	60754	3555	n/a
Blue Earth	South Bend (Township of)	61240	n/a	07021
Blue Earth	St Clair	56824	3375	n/a
Blue Earth	Sterling (Township of)	62716	n/a	07022

COUNTY	PLACE NAME	FIPS	CITY	TWP
Blue Earth	Vernon Center	66910	3885	n/a
Blue Earth	Vernon Center (Township of)	66928	n/a	07023
Brown	Albin (Township of)	00748	n/a	08001
Brown	Bashaw (Township of)	03826	n/a	08002
Brown	Burnstown (Township of)	08776	n/a	08003
Brown	Cobden	12394	0760	n/a
Brown	Comfrey	12772	0795	n/a
Brown	Cottonwood (Township of)	13546	n/a	08004
Brown	Eden (Township of)	18026	n/a	08005
Brown	Evan	19880	1210	n/a
Brown	Hanska	27008	1660	n/a
Brown	Home (Township of)	29960	n/a	08006
Brown	Lake Hanska (Township of)	34442	n/a	08007
Brown	Leavenworth (Township of)	36116	n/a	08008
Brown	Linden (Township of)	37214	n/a	08009
Brown	Milford (Township of)	42182	n/a	08010
Brown	Mulligan (Township of)	44746	n/a	08011
Brown	New Ulm	46042	2810	n/a
Brown	North Star (Township of)	47248	n/a	08012
Brown	Prairieville (Township of)	52342	n/a	08013
Brown	Sigel (Township of)	60160	n/a	08014
Brown	Sleepy Eye	60844	3565	n/a
Brown	Springfield	61816	3605	n/a
Brown	Stark (Township of)	62518	n/a	08015
Brown	Stately (Township of)	62590	n/a	08016
Carlton	Atkinson (Township of)	02656	n/a	09001
Carlton	Automba (Township of)	03016	n/a	09002
Carlton	Barnum	03628	0200	n/a
Carlton	Barnum (Township of)	03646	n/a	09003
Carlton	Beseman (Township of)	05518	n/a	09004
Carlton	Blackhoof (Township of)	06328	n/a	09005
Carlton	Carlton	10018	0600	n/a
Carlton	Cloquet	12160	0750	n/a
Carlton	Cromwell	13780	0850	n/a
Carlton	Holyoke (Township of)	29942	n/a	09006
Carlton	Kalevala (Township of)	32264	n/a	09007
Carlton	Kettle River	32966	2040	n/a
Carlton	Lakeview (Township of)	35162	n/a	09009
Carlton	Mahtowa (Township of)	39464	n/a	09010
Carlton	Moose Lake	43954	2650	n/a
Carlton	Moose Lake (Township of)	43972	n/a	09011
Carlton	Perch Lake (Township of)	50446	n/a	09029
Carlton	Scanlon	58936	3490	n/a
Carlton	Silver (Township of)	60232	n/a	09012
Carlton	Silver Brook (Township of)	60268	n/a	09013
Carlton	Skelton (Township of)	60664	n/a	09014

COUNTY	PLACE NAME	FIPS	CITY	TWP
Carlton	Split Rock (Township of)	61708	n/a	09015
Carlton	Thomson	64750	3765	n/a
Carlton	Thomson (Township of)	64768	n/a	09016
Carlton	Twin Lakes (Township of)	65902	n/a	09017
Carlton	Wrenshall	71788	4195	n/a
Carlton	Wrenshall (Township of)	71806	n/a	09018
Carlton	Wright	71824	4200	n/a
Carver	Benton (Township of)	05266	n/a	10001
Carver	Camden (Township of)	09406	n/a	10002
Carver	Carver	10144	0601	n/a
Carver	Chanhassen	10918	0640	n/a
Carver	Chaska	10972	0645	n/a
Carver	Cologne	12664	0785	n/a
Carver	Dahlgren (Township of)	14482	n/a	10005
Carver	Hamburg	26666	1630	n/a
Carver	Hancock (Township of)	26918	n/a	10006
Carver	Hollywood (Township of)	29726	n/a	10007
Carver	Laketown (Township of)	35108	n/a	10008
Carver	Mayer	41138	2480	n/a
Carver	New Germany	45556	2765	n/a
Carver	Norwood Young America	47520	2885	n/a
Carver	San Francisco (Township of)	58486	n/a	10009
Carver	Victoria	67036	3895	n/a
Carver	Waconia	67432	3930	n/a
Carver	Waconia (Township of)	67450	n/a	10010
Carver	Watertown	68548	4005	n/a
Carver	Watertown (Township of)	68566	n/a	10011
Carver	Young America (Township of)	72130	n/a	10012
Cass	Ansel (Township of)	01738	n/a	11001
Cass	Backus	03124	0170	n/a
Cass	Barclay (Township of)	03538	n/a	11002
Cass	Becker (Township of)	04600	n/a	11003
Cass	Bena	05104	0295	n/a
Cass	Beulah (Township of)	05572	n/a	11004
Cass	Birch Lake (Township of)	06040	n/a	11005
Cass	Blind Lake (Township of)	06454	n/a	11006
Cass	Boy Lake (Township of)	07156	n/a	11007
Cass	Boy River	07174	0425	n/a
Cass	Boy River (Township of)	07192	n/a	11008
Cass	Bull Moose (Township of)	08560	n/a	11009
Cass	Bungo (Township of)	08596	n/a	11010
Cass	Byron (Township of)	09136	n/a	11011
Cass	Cass Lake	10252	0605	n/a
Cass	Chickamaw Beach	11296	0655	n/a
Cass	Crooked Lake (Township of)	13834	n/a	11012
Cass	Deerfield (Township of)	15220	n/a	11013

COUNTY	PLACE NAME	FIPS	CITY	TWP
Cass	East Gull Lake	17630	1080	n/a
Cass	Fairview (Township of)	20366	n/a	11014
Cass	Federal Dam	20798	1265	n/a
Cass	Gould (Township of)	24686	n/a	11015
Cass	Hackensack	26378	1605	n/a
Cass	Hiram (Township of)	29366	n/a	11016
Cass	Home Brook (Township of)	29978	n/a	11017
Cass	Inguadona (Township of)	30986	n/a	11067
Cass	Kego (Township of)	32588	n/a	11018
Cass	Lake Shore	34928	2140	n/a
Cass	Leech Lake (Township of)	36224	n/a	11019
Cass	Lima (Township of)	37034	n/a	11020
Cass	Longville	38114	2310	n/a
Cass	Loon Lake (Township of)	38168	n/a	11021
Cass	Maple (Township of)	40076	n/a	11023
Cass	May (Township of)	41102	n/a	11024
Cass	McKinley (Township of)	39104	n/a	11022
Cass	Meadow Brook (Township of)	41354	n/a	11025
Cass	Moose Lake (Township of)	43990	n/a	11026
Cass	Motley	44422	2685	n/a
Cass	Pike Bay (Township of)	50848	n/a	11027
Cass	Pillager	50902	3055	n/a
Cass	Pine Lake (Township of)	51172	n/a	11028
Cass	Pine River	51280	3070	n/a
Cass	Pine River (Township of)	51298	n/a	11029
Cass	Ponto Lake (Township of)	51928	n/a	11030
Cass	Poplar (Township of)	51964	n/a	11031
Cass	Powers (Township of)	52252	n/a	11032
Cass	Remer	53782	3190	n/a
Cass	Remer (Township of)	53800	n/a	11033
Cass	Rogers (Township of)	55168	n/a	11034
Cass	Salem (Township of)	58216	n/a	11035
Cass	Shingobee (Township of)	59872	n/a	11036
Cass	Slater (Township of)	60790	n/a	11037
Cass	Smoky Hollow (Township of)	60970	n/a	11038
Cass	Sylvan (Township of)	63958	n/a	11039
Cass	Thunder Lake (Township of)	64876	n/a	11040
Cass	Torrey (Township of)	65254	n/a	11041
Cass	Trelipe (Township of)	65434	n/a	11042
Cass	Turtle Lake (Township of)	65776	n/a	11043
Cass	Wabedo (Township of)	67414	n/a	11044
Cass	Walden (Township of)	67684	n/a	11046
Cass	Walker	67792	3955	n/a
Cass	Wilkinson (Township of)	70348	n/a	11047
Cass	Wilson (Township of)	70654	n/a	11048
Cass	Woodrow (Township of)	71608	n/a	11049

COUNTY	PLACE NAME	FIPS	CITY	TWP
Chippewa	Big Bend (Township of)	05608	n/a	12001
Chippewa	Clara City	11548	0680	n/a
Chippewa	Crate (Township of)	13672	n/a	12002
Chippewa	Grace (Township of)	24722	n/a	12003
Chippewa	Granite Falls	25280	1550	n/a
Chippewa	Granite Falls (Township of)	25262	n/a	12004
Chippewa	Havelock (Township of)	27656	n/a	12005
Chippewa	Kragero (Township of)	33668	n/a	12006
Chippewa	Leenthrop (Township of)	36278	n/a	12007
Chippewa	Lone Tree (Township of)	37952	n/a	12008
Chippewa	Louriston (Township of)	38312	n/a	12009
Chippewa	Mandt (Township of)	39752	n/a	12010
Chippewa	Maynard	41210	2485	n/a
Chippewa	Milan	42146	2560	n/a
Chippewa	Montevideo	43720	2625	n/a
Chippewa	Rheiderland (Township of)	53962	n/a	12011
Chippewa	Rosewood (Township of)	55870	n/a	12012
Chippewa	Sparta (Township of)	61582	n/a	12013
Chippewa	Stoneham (Township of)	62950	n/a	12014
Chippewa	Tunsberg (Township of)	65704	n/a	12015
Chippewa	Watson	68656	4020	n/a
Chippewa	Woods (Township of)	71626	n/a	12016
Chisago	Amador (Township of)	01306	n/a	13001
Chisago	Center City	10576	0615	n/a
Chisago	Chisago City	11350	0660	n/a
Chisago	Chisago Lake (Township of)	11368	n/a	13002
Chisago	Fish Lake (Township of)	21194	n/a	13003
Chisago	Franconia (Township of)	22310	n/a	13004
Chisago	Harris	27278	1680	n/a
Chisago	Lent (Township of)	36440	n/a	13005
Chisago	Lindstrom	37304	2260	n/a
Chisago	Nessel (Township of)	45250	n/a	13006
Chisago	North Branch	46798	2845	n/a
Chisago	Rush City	56266	3310	n/a
Chisago	Rushseba (Township of)	56392	n/a	13007
Chisago	Shafer	59314	3510	n/a
Chisago	Shafer (Township of)	59332	n/a	13008
Chisago	Stacy	62320	3640	n/a
Chisago	Sunrise (Township of)	63616	n/a	13009
Chisago	Taylors Falls	64318	3745	n/a
Chisago	Wyoming	72022	4210	n/a
Clay	Alliance (Township of)	01054	n/a	14001
Clay	Barnesville	03574	0195	n/a
Clay	Barnesville (Township of)	03592	n/a	14002
Clay	Comstock	12862	0800	n/a
Clay	Cromwell (Township of)	13798	n/a	14003

COUNTY	PLACE NAME	FIPS	CITY	TWP
Clay	Dilworth	15976	1005	n/a
Clay	Eglon (Township of)	18314	n/a	14004
Clay	Elkton (Township of)	18710	n/a	14005
Clay	Elmwood (Township of)	19052	n/a	14006
Clay	Felton	20834	1270	n/a
Clay	Felton (Township of)	20852	n/a	14007
Clay	Flowing (Township of)	21482	n/a	14008
Clay	Georgetown	23498	1445	n/a
Clay	Georgetown (Township of)	23516	n/a	14009
Clay	Glyndon	24182	1485	n/a
Clay	Glyndon (Township of)	24200	n/a	14010
Clay	Goose Prairie (Township of)	24542	n/a	14011
Clay	Hagen (Township of)	26504	n/a	14012
Clay	Hawley	27746	1695	n/a
Clay	Hawley (Township of)	27764	n/a	14013
Clay	Highland Grove (Township of)	28988	n/a	14014
Clay	Hitterdal	29402	1795	n/a
Clay	Holy Cross (Township of)	29906	n/a	14015
Clay	Humboldt (Township of)	30428	n/a	14016
Clay	Keene (Township of)	32552	n/a	14017
Clay	Kragnes (Township of)	33704	n/a	14018
Clay	Kurtz (Township of)	33812	n/a	14019
Clay	Moland (Township of)	43576	n/a	14020
Clay	Moorhead	43864	2645	n/a
Clay	Moorhead (Township of)	43882	n/a	14021
Clay	Morken (Township of)	44170	n/a	14022
Clay	Oakport (Township of)	47932	n/a	14023
Clay	Parke (Township of)	49678	n/a	14024
Clay	Riverton (Township of)	54718	n/a	14025
Clay	Sabin	56554	3345	n/a
Clay	Skree (Township of)	60718	n/a	14026
Clay	Spring Prairie (Township of)	62032	n/a	14027
Clay	Tansem (Township of)	64192	n/a	14028
Clay	Ulen	66136	3840	n/a
Clay	Ulen (Township of)	66154	n/a	14029
Clay	Viding (Township of)	67054	n/a	14030
Clearwater	Bagley	03196	0180	n/a
Clearwater	Bear Creek (Township of)	04186	n/a	15001
Clearwater	Clearbrook	11746	0705	n/a
Clearwater	Clover (Township of)	12214	n/a	15002
Clearwater	Copley (Township of)	13150	n/a	15003
Clearwater	Dudley (Township of)	16462	n/a	15004
Clearwater	Eddy (Township of)	18008	n/a	15005
Clearwater	Falk (Township of)	20438	n/a	15006
Clearwater	Gonvick	24344	1500	n/a
Clearwater	Greenwood (Township of)	25910	n/a	15007

COUNTY	PLACE NAME	FIPS	CITY	TWP
Clearwater	Hangaard (Township of)	26954	n/a	15008
Clearwater	Holst (Township of)	29834	n/a	15009
Clearwater	Itasca (Township of)	31508	n/a	15010
Clearwater	La Prairie (Township of)	35630	n/a	15011
Clearwater	Leon (Township of)	36458	n/a	15012
Clearwater	Leonard	36494	2215	n/a
Clearwater	Minerva (Township of)	42452	n/a	15013
Clearwater	Moose Creek (Township of)	43918	n/a	15014
Clearwater	Nora (Township of)	46438	n/a	15015
Clearwater	Pine Lake (Township of)	51190	n/a	15016
Clearwater	Popple (Township of)	52018	n/a	15017
Clearwater	Rice (Township of)	54016	n/a	15018
Clearwater	Shevlin	59782	3530	n/a
Clearwater	Sinclair (Township of)	60502	n/a	15020
Clearwater	Winsor (Township of)	71068	n/a	15021
Cook	Grand Marais	24992	1535	n/a
Cook	Lutsen (Township of)	38550	n/a	16003
Cook	Schroeder (Township of)	58999	n/a	16001
Cook	Tofte (Township of)	65065	n/a	16002
Cottonwood	Amboy (Township of)	01342	n/a	17001
Cottonwood	Amo (Township of)	01441	n/a	17002
Cottonwood	Ann (Township of)	01666	n/a	17003
Cottonwood	Bingham Lake	05896	0340	n/a
Cottonwood	Carson (Township of)	10108	n/a	17004
Cottonwood	Comfrey	12772	0795	n/a
Cottonwood	Dale (Township of)	14608	n/a	17005
Cottonwood	Delton (Township of)	15652	n/a	17006
Cottonwood	Germantown (Township of)	23570	n/a	17007
Cottonwood	Great Bend (Township of)	25514	n/a	17008
Cottonwood	Highwater (Township of)	29060	n/a	17009
Cottonwood	Jeffers	31796	1945	n/a
Cottonwood	Lakeside (Township of)	35000	n/a	17010
Cottonwood	Midway (Township of)	42002	n/a	17011
Cottonwood	Mountain Lake	44566	2705	n/a
Cottonwood	Mountain Lake (Township of)	44584	n/a	17012
Cottonwood	Rose Hill (Township of)	55672	n/a	17013
Cottonwood	Selma (Township of)	59224	n/a	17014
Cottonwood	Southbrook (Township of)	61294	n/a	17015
Cottonwood	Springfield (Township of)	61834	n/a	17016
Cottonwood	Storden	63022	3690	n/a
Cottonwood	Storden (Township of)	63040	n/a	17017
Cottonwood	Westbrook	69250	4055	n/a
Cottonwood	Westbrook (Township of)	69268	n/a	17018
Cottonwood	Windom	70798	4130	n/a
Crow Wing	Baxter	04042	0225	n/a
Crow Wing	Bay Lake (Township of)	04096	n/a	18001

COUNTY	PLACE NAME	FIPS	CITY	TWP
Crow Wing	Brainerd	07300	0435	n/a
Crow Wing	Breezy Point	07516	0447	n/a
Crow Wing	Center (Township of)	10567	n/a	18002
Crow Wing	Crosby	13924	0860	n/a
Crow Wing	Crosslake	13978	0865	n/a
Crow Wing	Crow Wing (Township of)	14122	n/a	18003
Crow Wing	Cuyuna	14428	0880	n/a
Crow Wing	Daggett Brook (Township of)	14464	n/a	18004
Crow Wing	Deerwood	15346	0950	n/a
Crow Wing	Deerwood (Township of)	15364	n/a	18006
Crow Wing	Emily	19286	1190	n/a
Crow Wing	Fairfield (Township of)	20240	n/a	18007
Crow Wing	Fifty Lakes	21032	1285	n/a
Crow Wing	Fort Ripley	21932	1335	n/a
Crow Wing	Fort Ripley (Township of)	21950	n/a	18008
Crow Wing	Gail Lake (Township of)	23012	n/a	18009
Crow Wing	Garrison	23192	1410	n/a
Crow Wing	Garrison (Township of)	23210	n/a	18010
Crow Wing	Ideal (Township of)	30734	n/a	18011
Crow Wing	Irondale (Township of)	31202	n/a	18012
Crow Wing	Ironton	31274	1900	n/a
Crow Wing	Jenkins	31832	1950	n/a
Crow Wing	Jenkins (Township of)	31850	n/a	18013
Crow Wing	Long Lake (Township of)	37988	n/a	18016
Crow Wing	Manhattan Beach	39806	2415	n/a
Crow Wing	Maple Grove (Township of)	40148	n/a	18017
Crow Wing	Mission (Township of)	43468	n/a	18018
Crow Wing	Nisswa	46348	2835	n/a
Crow Wing	Nokay Lake (Township of)	46384	n/a	18019
Crow Wing	Oak Lawn (Township of)	47824	n/a	18020
Crow Wing	Pelican (Township of)	50092	n/a	18021
Crow Wing	Pequot Lakes	50416	3030	n/a
Crow Wing	Perry Lake (Township of)	50542	n/a	18022
Crow Wing	Platte Lake (Township of)	51496	n/a	18023
Crow Wing	Rabbit Lake (Township of)	52855	n/a	18024
Crow Wing	Riverton	54736	3225	n/a
Crow Wing	Roosevelt (Township of)	55420	n/a	18025
Crow Wing	Ross Lake (Township of)	55978	n/a	18026
Crow Wing	St Mathias (Township of)	57328	n/a	18027
Crow Wing	Timothy (Township of)	64930	n/a	18029
Crow Wing	Trommald	65506	3800	n/a
Crow Wing	Wolford (Township of)	71374	n/a	18030
Dakota	Apple Valley	01900	0102	n/a
Dakota	Burnsville	08794	0537	n/a
Dakota	Castle Rock (Township of)	10306	n/a	19001
Dakota	Coates	12376	0755	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Dakota	Douglas (Township of)	16228	n/a	19002
Dakota	Eagan	17288	1063	n/a
Dakota	Empire (Township of)	19376	n/a	19004
Dakota	Eureka (Township of)	19871	n/a	19005
Dakota	Farmington	20618	1255	n/a
Dakota	Greenvale (Township of)	25802	n/a	19006
Dakota	Hampton	26864	1640	n/a
Dakota	Hampton (Township of)	26882	n/a	19007
Dakota	Hastings	27530	1686	n/a
Dakota	Inver Grove Heights	31076	1886	n/a
Dakota	Lakeville	35180	2150	n/a
Dakota	Lilydale	37016	2255	n/a
Dakota	Marshan (Township of)	40724	n/a	19008
Dakota	Mendota	41678	2532	n/a
Dakota	Mendota Heights	41696	2535	n/a
Dakota	Miesville	42092	2550	n/a
Dakota	New Trier	46024	2805	n/a
Dakota	Nininger (Township of)	46330	n/a	19009
Dakota	Northfield	46924	2850	n/a
Dakota	Randolph	53098	3155	n/a
Dakota	Randolph (Township of)	53116	n/a	19010
Dakota	Ravenna (Township of)	53260	n/a	19011
Dakota	Rosemount	55726	3285	n/a
Dakota	Sciota (Township of)	59008	n/a	19012
Dakota	Sunfish Lake	63544	3715	n/a
Dakota	Vermillion	66802	3875	n/a
Dakota	Vermillion (Township of)	66820	n/a	19013
Dakota	Waterford (Township of)	68530	n/a	19014
Dakota	West St Paul	69700	n/a	n/a
Dodge	Ashland (Township of)	02512	n/a	20001
Dodge	Blooming Prairie	06580	0380	n/a
Dodge	Canisteo (Township of)	09640	n/a	20002
Dodge	Claremont	11566	0685	n/a
Dodge	Claremont (Township of)	11584	n/a	20003
Dodge	Concord (Township of)	12934	n/a	20004
Dodge	Dodge Center	15994	1010	n/a
Dodge	Ellington (Township of)	18764	n/a	20005
Dodge	Hayfield	27872	1700	n/a
Dodge	Hayfield (Township of)	27890	n/a	20006
Dodge	Kasson	32498	1980	n/a
Dodge	Mantorville	39986	2425	n/a
Dodge	Mantorville (Township of)	40004	n/a	20007
Dodge	Milton (Township of)	42380	n/a	20008
Dodge	Ripley (Township of)	54502	n/a	20009
Dodge	Vernon (Township of)	66892	n/a	20010
Dodge	Wasioja (Township of)	68404	n/a	20011

COUNTY	PLACE NAME	FIPS	CITY	TWP
Dodge	West Concord	69304	4060	n/a
Dodge	Westfield (Township of)	69448	n/a	20012
Douglas	Alexandria	00928	0065	n/a
Douglas	Alexandria (Township of)	00946	n/a	21001
Douglas	Belle River (Township of)	04924	n/a	21002
Douglas	Brandon	07336	0440	n/a
Douglas	Brandon (Township of)	07354	n/a	21003
Douglas	Carlos	09964	0595	n/a
Douglas	Carlos (Township of)	09982	n/a	21004
Douglas	Evansville	19898	1215	n/a
Douglas	Evansville (Township of)	19916	n/a	21005
Douglas	Forada	21608	1320	n/a
Douglas	Garfield	23120	1405	n/a
Douglas	Holmes City (Township of)	29798	n/a	21006
Douglas	Hudson (Township of)	30374	n/a	21007
Douglas	Ida (Township of)	30716	n/a	21008
Douglas	Kensington	32768	2015	n/a
Douglas	La Grand (Township of)	33992	n/a	21009
Douglas	Lake Mary (Township of)	34730	n/a	21010
Douglas	Leaf Valley (Township of)	36062	n/a	21011
Douglas	Lund (Township of)	38510	n/a	21012
Douglas	Millerville	42254	2565	n/a
Douglas	Millerville (Township of)	42272	n/a	21013
Douglas	Miltona	42398	2580	n/a
Douglas	Miltona (Township of)	42416	n/a	21014
Douglas	Moe (Township of)	43558	n/a	21015
Douglas	Nelson	45106	2735	n/a
Douglas	Orange (Township of)	48472	n/a	21016
Douglas	Osakis	48796	2955	n/a
Douglas	Osakis (Township of)	48814	n/a	21017
Douglas	Solem (Township of)	61078	n/a	21018
Douglas	Spruce Hill (Township of)	62248	n/a	21019
Douglas	Urness (Township of)	66406	n/a	21020
Faribault	Barber (Township of)	03520	n/a	22001
Faribault	Blue Earth	06688	0390	n/a
Faribault	Blue Earth City (Township of)	06706	n/a	22002
Faribault	Bricelyn	07678	0455	n/a
Faribault	Brush Creek (Township of)	08380	n/a	22003
Faribault	Clark (Township of)	11638	n/a	22004
Faribault	Delavan	15472	0965	n/a
Faribault	Delavan (Township of)	15490	n/a	22005
Faribault	Dunbar (Township of)	17108	n/a	22006
Faribault	Easton	17738	1085	n/a
Faribault	Elmore	18998	1170	n/a
Faribault	Elmore (Township of)	19016	n/a	22007
Faribault	Emerald (Township of)	19268	n/a	22008

COUNTY	PLACE NAME	FIPS	CITY	TWP
Faribault	Foster (Township of)	22076	n/a	22009
Faribault	Frost	22940	1390	n/a
Faribault	Jo Daviess (Township of)	31976	n/a	22010
Faribault	Kiester	33056	2045	n/a
Faribault	Kiester (Township of)	33074	n/a	22011
Faribault	Lura (Township of)	38528	n/a	22012
Faribault	Minnesota Lake	43198	2605	n/a
Faribault	Minnesota Lake (Township of)	43216	n/a	22013
Faribault	Pilot Grove (Township of)	50974	n/a	22014
Faribault	Prescott (Township of)	52432	n/a	22015
Faribault	Rome (Township of)	55348	n/a	22016
Faribault	Seely (Township of)	59206	n/a	22017
Faribault	Verona (Township of)	66946	n/a	22018
Faribault	Walnut Lake (Township of)	67864	n/a	22019
Faribault	Walters	67900	3965	n/a
Faribault	Wells	69106	4045	n/a
Faribault	Winnebago	70924	4140	n/a
Faribault	Winnebago City (Township of)	70978	n/a	22020
Fillmore	Amherst (Township of)	01396	n/a	23001
Fillmore	Arendahl (Township of)	02098	n/a	23002
Fillmore	Beaver (Township of)	04402	n/a	23003
Fillmore	Bloomfield (Township of)	06544	n/a	23004
Fillmore	Bristol (Township of)	07804	n/a	23005
Fillmore	Canton	09802	0590	n/a
Fillmore	Canton (Township of)	09820	n/a	23006
Fillmore	Carimona (Township of)	09910	n/a	23007
Fillmore	Carrolton (Township of)	10090	n/a	23008
Fillmore	Chatfield	11008	0650	n/a
Fillmore	Chatfield (Township of)	11026	n/a	23009
Fillmore	Fillmore (Township of)	21068	n/a	23010
Fillmore	Forestville (Township of)	21860	n/a	23011
Fillmore	Fountain	22094	1345	n/a
Fillmore	Fountain (Township of)	22112	n/a	23023
Fillmore	Harmony	27188	1675	n/a
Fillmore	Harmony (Township of)	27206	n/a	23012
Fillmore	Holt (Township of)	29852	n/a	23013
Fillmore	Jordan (Township of)	32156	n/a	23014
Fillmore	Lanesboro	35450	2175	n/a
Fillmore	Mabel	38888	2353	n/a
Fillmore	Newburg (Township of)	45466	n/a	23015
Fillmore	Norway (Township of)	47392	n/a	23016
Fillmore	Ostrander	49030	2970	n/a
Fillmore	Peterson	50596	3045	n/a
Fillmore	Pilot Mound (Township of)	51010	n/a	23017
Fillmore	Preble (Township of)	52396	n/a	23018
Fillmore	Preston	52450	3115	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Fillmore	Preston (Township of)	52468	n/a	23019
Fillmore	Rushford	56284	3315	n/a
Fillmore	Rushford Village	56302	3320	n/a
Fillmore	Spring Valley	62104	3630	n/a
Fillmore	Spring Valley (Township of)	62122	n/a	23020
Fillmore	Sumner (Township of)	63418	n/a	23021
Fillmore	Whalan	69808	4080	n/a
Fillmore	Wykoff	71950	4205	n/a
Fillmore	York (Township of)	72076	n/a	23022
Freeborn	Albert Lea	00694	0045	n/a
Freeborn	Albert Lea (Township of)	00712	n/a	24001
Freeborn	Alden	00838	0055	n/a
Freeborn	Alden (Township of)	00856	n/a	24002
Freeborn	Bancroft (Township of)	03466	n/a	24003
Freeborn	Bath (Township of)	03934	n/a	24004
Freeborn	Carlston (Township of)	10000	n/a	24005
Freeborn	Clarks Grove	11674	0700	n/a
Freeborn	Conger	12952	0805	n/a
Freeborn	Emmons	19340	1195	n/a
Freeborn	Freeborn	22526	1375	n/a
Freeborn	Freeborn (Township of)	22544	n/a	24006
Freeborn	Freeman (Township of)	22634	n/a	24007
Freeborn	Geneva	23354	1435	n/a
Freeborn	Geneva (Township of)	23372	n/a	24008
Freeborn	Glenville	24056	1475	n/a
Freeborn	Hartland	27404	1685	n/a
Freeborn	Hartland (Township of)	27422	n/a	24009
Freeborn	Hayward	27944	1705	n/a
Freeborn	Hayward (Township of)	27962	n/a	24010
Freeborn	Hollandale	29636	1820	n/a
Freeborn	London (Township of)	37916	n/a	24011
Freeborn	Manchester	39716	2410	n/a
Freeborn	Manchester (Township of)	39734	n/a	24012
Freeborn	Mansfield (Township of)	39950	n/a	24013
Freeborn	Moscow (Township of)	44404	n/a	24014
Freeborn	Myrtle	44890	2715	n/a
Freeborn	Newry (Township of)	45934	n/a	24015
Freeborn	Nunda (Township of)	47608	n/a	24016
Freeborn	Oakland (Township of)	47788	n/a	24017
Freeborn	Pickerel Lake (Township of)	50722	n/a	24018
Freeborn	Riceland (Township of)	54088	n/a	24019
Freeborn	Shell Rock (Township of)	59548	n/a	24020
Freeborn	Twin Lakes	65920	3820	n/a
Goodhue	Belle Creek (Township of)	04816	n/a	25001
Goodhue	Bellechester	04798	0265	n/a
Goodhue	Belvidere (Township of)	05032	n/a	25002

COUNTY	PLACE NAME	FIPS	CITY	TWP
Goodhue	Cannon Falls	09730	0585	n/a
Goodhue	Cannon Falls (Township of)	09748	n/a	25003
Goodhue	Cherry Grove (Township of)	11188	n/a	25004
Goodhue	Dennison	15706	0985	n/a
Goodhue	Featherstone (Township of)	20780	n/a	25005
Goodhue	Florence (Township of)	21392	n/a	25006
Goodhue	Goodhue	24398	1505	n/a
Goodhue	Goodhue (Township of)	24416	n/a	25007
Goodhue	Hay Creek (Township of)	27818	n/a	25008
Goodhue	Holden (Township of)	29546	n/a	25009
Goodhue	Kenyon	32840	2025	n/a
Goodhue	Kenyon (Township of)	32858	n/a	25010
Goodhue	Lake City	34172	2091	n/a
Goodhue	Leon (Township of)	36476	n/a	25011
Goodhue	Minneola (Township of)	43072	n/a	25012
Goodhue	Pine Island	51136	3065	n/a
Goodhue	Pine Island (Township of)	51154	n/a	25013
Goodhue	Red Wing	53620	3175	n/a
Goodhue	Roscoe (Township of)	55492	n/a	25014
Goodhue	Stanton (Township of)	62428	n/a	25015
Goodhue	Vasa (Township of)	66640	n/a	25016
Goodhue	Wacouta (Township of)	67486	n/a	25021
Goodhue	Wanamingo	67972	3975	n/a
Goodhue	Wanamingo (Township of)	67990	n/a	25017
Goodhue	Warsaw (Township of)	68242	n/a	25018
Goodhue	Welch (Township of)	69052	n/a	25019
Goodhue	Zumbrota	72328	4230	n/a
Goodhue	Zumbrota (Township of)	72346	n/a	25020
Grant	Ashby	02422	0125	n/a
Grant	Barrett	03682	0205	n/a
Grant	Delaware (Township of)	15508	n/a	26001
Grant	Elbow Lake	18458	1125	n/a
Grant	Elbow Lake (Township of)	18476	n/a	26002
Grant	Elk Lake (Township of)	18620	n/a	26003
Grant	Erdahl (Township of)	19538	n/a	26004
Grant	Gorton (Township of)	24650	n/a	26005
Grant	Herman	28646	1750	n/a
Grant	Hoffman	29474	1800	n/a
Grant	Land (Township of)	35396	n/a	26006
Grant	Lawrence (Township of)	35882	n/a	26007
Grant	Lien (Township of)	36998	n/a	26008
Grant	Logan (Township of)	37862	n/a	26009
Grant	Macsville (Township of)	39194	n/a	26010
Grant	Norcross	46492	2840	n/a
Grant	North Ottawa (Township of)	47140	n/a	26011
Grant	Pelican Lake (Township of)	50128	n/a	26012

COUNTY	PLACE NAME	FIPS	CITY	TWP
Grant	Pomme de Terre (Township of)	51838	n/a	26013
Grant	Roseville (Township of)	55816	n/a	26014
Grant	Sanford (Township of)	58468	n/a	26015
Grant	Stony Brook (Township of)	62986	n/a	26016
Grant	Wendell	69142	4050	n/a
Hennepin	Bloomington	06616	0385	n/a
Hennepin	Brooklyn Center	07948	0460	n/a
Hennepin	Brooklyn Park	07966	0465	n/a
Hennepin	Champlin	10846	0630	n/a
Hennepin	Chanhassen	10918	0640	n/a
Hennepin	Corcoran	13168	0825	n/a
Hennepin	Crystal	14158	0870	n/a
Hennepin	Dayton	15022	0930	n/a
Hennepin	Deephaven	15148	0935	n/a
Hennepin	Eden Prairie	18116	1094	n/a
Hennepin	Edina	18188	1105	n/a
Hennepin	Excelsior	20078	1225	n/a
Hennepin	Golden Valley	24308	1495	n/a
Hennepin	Greenfield	25622	1565	n/a
Hennepin	Greenwood	25918	1580	n/a
Hennepin	Hanover	26990	1655	n/a
Hennepin	Hassan (Township of)	27476	n/a	27001
Hennepin	Hopkins	30140	1835	n/a
Hennepin	Independence	30842	1875	n/a
Hennepin	Long Lake	38006	2300	n/a
Hennepin	Loretto	38222	2320	n/a
Hennepin	Maple Grove	40166	2430	n/a
Hennepin	Maple Plain	40256	2440	n/a
Hennepin	Medicine Lake	41462	2505	n/a
Hennepin	Medina	41480	2510	n/a
Hennepin	Minneapolis	43000	2585	n/a
Hennepin	Minnetonka	43252	2610	n/a
Hennepin	Minnetonka Beach	43270	2612	n/a
Hennepin	Minnetrista	43306	2617	n/a
Hennepin	Mound	44476	2690	n/a
Hennepin	New Hope	45628	2770	n/a
Hennepin	Orono	48580	2940	n/a
Hennepin	Osseo	49012	2965	n/a
Hennepin	Plymouth	51730	3105	n/a
Hennepin	Richfield	54214	3210	n/a
Hennepin	Robbinsdale	54808	3230	n/a
Hennepin	Rockford	55006	3240	n/a
Hennepin	Rogers	55186	3250	n/a
Hennepin	Shorewood	60016	3540	n/a
Hennepin	Spring Park	62014	3625	n/a
Hennepin	St Anthony	56680	3360	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Hennepin	St Bonifacius	56770	3365	n/a
Hennepin	St Louis Park	57220	3405	n/a
Hennepin	Tonka Bay	65164	3775	n/a
Hennepin	Wayzata	68818	4035	n/a
Hennepin	Woodland	71500	4180	n/a
Houston	Black Hammer (Township of)	06292	n/a	28001
Houston	Brownsville	08218	0505	n/a
Houston	Brownsville (Township of)	08236	n/a	28002
Houston	Caledonia	09226	0555	n/a
Houston	Caledonia (Township of)	09244	n/a	28003
Houston	Crooked Creek (Township of)	13816	n/a	28004
Houston	Eitzen	18368	1115	n/a
Houston	Hokah	29510	1805	n/a
Houston	Hokah (Township of)	29528	n/a	28005
Houston	Houston	30230	1840	n/a
Houston	Houston (Township of)	30248	n/a	28006
Houston	Jefferson (Township of)	31814	n/a	28007
Houston	La Crescent	33866	2070	n/a
Houston	La Crescent (Township of)	33884	n/a	28008
Houston	Mayville (Township of)	41228	n/a	28009
Houston	Money Creek (Township of)	43648	n/a	28010
Houston	Mound Prairie (Township of)	44512	n/a	28011
Houston	Sheldon (Township of)	59494	n/a	28012
Houston	Spring Grove	61852	3610	n/a
Houston	Spring Grove (Township of)	61870	n/a	28013
Houston	Union (Township of)	66208	n/a	28014
Houston	Wilmington (Township of)	70564	n/a	28015
Houston	Winnebago (Township of)	70960	n/a	28016
Houston	Yucatan (Township of)	72166	n/a	28017
Hubbard	Akeley	00496	0030	n/a
Hubbard	Akeley (Township of)	00514	n/a	29001
Hubbard	Arago (Township of)	01918	n/a	29002
Hubbard	Badoura (Township of)	03178	n/a	29003
Hubbard	Clay (Township of)	11682	n/a	29026
Hubbard	Clover (Township of)	12232	n/a	29004
Hubbard	Crow Wing Lake (Township of)	14140	n/a	29005
Hubbard	Farden (Township of)	20528	n/a	29006
Hubbard	Fern (Township of)	20942	n/a	29007
Hubbard	Guthrie (Township of)	26360	n/a	29008
Hubbard	Hart Lake (Township of)	27386	n/a	29009
Hubbard	Helga (Township of)	28340	n/a	29010
Hubbard	Hendrickson (Township of)	28466	n/a	29011
Hubbard	Henrietta (Township of)	28556	n/a	29012
Hubbard	Hubbard (Township of)	30338	n/a	29013
Hubbard	Lake Alice (Township of)	34046	n/a	29014
Hubbard	Lake Emma (Township of)	34262	n/a	29033

COUNTY	PLACE NAME	FIPS	CITY	TWP
Hubbard	Lake George (Township of)	34388	n/a	29015
Hubbard	Lake Hattie (Township of)	34460	n/a	29016
Hubbard	Lakeport (Township of)	34838	n/a	29017
Hubbard	Laporte	35612	2180	n/a
Hubbard	Mantrap (Township of)	40022	n/a	29018
Hubbard	Nevis	45340	2745	n/a
Hubbard	Nevis (Township of)	45358	n/a	29019
Hubbard	Park Rapids	49768	2995	n/a
Hubbard	Rockwood (Township of)	55132	n/a	29020
Hubbard	Schoolcraft (Township of)	58972	n/a	29021
Hubbard	Steamboat River (Township of)	62618	n/a	29027
Hubbard	Straight River (Township of)	63076	n/a	29022
Hubbard	Thorpe (Township of)	64804	n/a	29023
Hubbard	Todd (Township of)	65038	n/a	29024
Hubbard	White Oak (Township of)	70114	n/a	29025
Isanti	Athens (Township of)	02602	n/a	30001
Isanti	Bradford (Township of)	07246	n/a	30002
Isanti	Braham	07282	0430	n/a
Isanti	Cambridge	09370	0570	n/a
Isanti	Cambridge (Township of)	09388	n/a	30003
Isanti	Dalbo (Township of)	14572	n/a	30004
Isanti	Isanti	31328	1905	n/a
Isanti	Isanti (Township of)	31346	n/a	30005
Isanti	Maple Ridge (Township of)	40292	n/a	30006
Isanti	North Branch (Township of)	46816	n/a	30007
Isanti	Oxford (Township of)	49354	n/a	30008
Isanti	Spencer Brook (Township of)	61672	n/a	30009
Isanti	Springvale (Township of)	62086	n/a	30010
Isanti	St Francis	56950	n/a	n/a
Isanti	Stanchfield (Township of)	62347	n/a	30011
Isanti	Stanchfield CDP	62356	n/a	n/a
Isanti	Stanford (Township of)	62374	n/a	30012
Isanti	Wyanett (Township of)	71896	n/a	30013
Itasca	Alvwood (Township of)	01288	n/a	31001
Itasca	Arbo (Township of)	01936	n/a	31002
Itasca	Ardenhurst (Township of)	02044	n/a	31003
Itasca	Balsam (Township of)	03430	n/a	31004
Itasca	Bearville (Township of)	04276	n/a	31006
Itasca	Bigfork	05698	0330	n/a
Itasca	Blackberry (Township of)	06220	n/a	31008
Itasca	Bovey	07048	0410	n/a
Itasca	Bowstring (Township of)	07102	n/a	31009
Itasca	Calumet	09316	0565	n/a
Itasca	Carpenter (Township of)	10072	n/a	31010
Itasca	Cohasset	12412	0765	n/a
Itasca	Coleraine	12502	0780	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Itasca	Deer River	15310	0945	n/a
Itasca	Deer River (Township of)	15328	n/a	31011
Itasca	Effie	18260	1110	n/a
Itasca	Feeley (Township of)	20816	n/a	31012
Itasca	Good Hope (Township of)	24362	n/a	31013
Itasca	Goodland (Township of)	24452	n/a	31014
Itasca	Grand Rapids	25118	1545	n/a
Itasca	Grattan (Township of)	25460	n/a	31016
Itasca	Greenway (Township of)	25892	n/a	31017
Itasca	Harris (Township of)	27296	n/a	31018
Itasca	Iron Range (Township of)	31256	n/a	31019
Itasca	Keewatin	32570	1985	n/a
Itasca	Kinghurst (Township of)	33272	n/a	31020
Itasca	La Prairie	35648	2185	n/a
Itasca	Lake Jessie (Township of)	34568	n/a	31021
Itasca	Lawrence (Township of)	35900	n/a	31022
Itasca	Liberty (Township of)	36944	n/a	31041
Itasca	Lone Pine (Township of)	37934	n/a	31023
Itasca	Marble	40418	2460	n/a
Itasca	Marcell (Township of)	40472	n/a	31024
Itasca	Max (Township of)	41066	n/a	31025
Itasca	Moose Park (Township of)	44008	n/a	31026
Itasca	Morse (Township of)	44332	n/a	31027
Itasca	Nashwauk	44980	2725	n/a
Itasca	Nashwauk (Township of)	44998	n/a	31028
Itasca	Nore (Township of)	46582	n/a	31029
Itasca	Oteneagen (Township of)	49048	n/a	31030
Itasca	Pomroy (Township of)	51856	n/a	31031
Itasca	Sago (Township of)	56644	n/a	31032
Itasca	Sand Lake (Township of)	58360	n/a	31033
Itasca	Spang (Township of)	61564	n/a	31034
Itasca	Squaw Lake	62284	3635	n/a
Itasca	Stokes (Township of)	62914	n/a	31035
Itasca	Taconite	64048	3725	n/a
Itasca	Third River (Township of)	64606	n/a	31036
Itasca	Trout Lake (Township of)	65596	n/a	31037
Itasca	Wabana (Township of)	67360	n/a	31038
Itasca	Warba	68080	3985	n/a
Itasca	Wawina (Township of)	68800	n/a	31039
Itasca	Wildwood (Township of)	70306	n/a	n/a
Itasca	Wirt (Township of)	71194	n/a	31040
Itasca	Zemple	72184	4220	n/a
Jackson	Alba (Township of)	00604	n/a	32001
Jackson	Alpha	01162	0070	n/a
Jackson	Belmont (Township of)	04978	n/a	32002
Jackson	Christiania (Township of)	11476	n/a	32003

COUNTY	PLACE NAME	FIPS	CITY	TWP
Jackson	Delafield (Township of)	15436	n/a	32004
Jackson	Des Moines (Township of)	15769	n/a	32005
Jackson	Enterprise (Township of)	19484	n/a	32006
Jackson	Ewington (Township of)	20042	n/a	32007
Jackson	Heron Lake	28700	1755	n/a
Jackson	Heron Lake (Township of)	28718	n/a	32008
Jackson	Hunter (Township of)	30482	n/a	32009
Jackson	Jackson	31562	1930	n/a
Jackson	Kimball (Township of)	33146	n/a	32010
Jackson	La Crosse (Township of)	33902	n/a	32011
Jackson	Lakefield	34316	2105	n/a
Jackson	Middletown (Township of)	41948	n/a	32012
Jackson	Minneota (Township of)	43108	n/a	32013
Jackson	Okabena	48184	2915	n/a
Jackson	Petersburg (Township of)	50578	n/a	32014
Jackson	Rost (Township of)	55996	n/a	32015
Jackson	Round Lake (Township of)	56068	n/a	32016
Jackson	Sioux Valley (Township of)	60574	n/a	32017
Jackson	Weimer (Township of)	69016	n/a	32018
Jackson	Wilder	70258	4095	n/a
Jackson	Wisconsin (Township of)	71212	n/a	32020
Kanabec	Ann Lake (Township of)	01702	n/a	33001
Kanabec	Arthur (Township of)	02296	n/a	33002
Kanabec	Braham	07282	0430	n/a
Kanabec	Brunswick (Township of)	08344	n/a	33003
Kanabec	Comfort (Township of)	12754	n/a	33004
Kanabec	Ford (Township of)	21644	n/a	33005
Kanabec	Grass Lake (Township of)	25406	n/a	33006
Kanabec	Grasston	25424	1555	n/a
Kanabec	Hay Brook (Township of)	27782	n/a	33007
Kanabec	Hillman (Township of)	29132	n/a	33008
Kanabec	Kanabec (Township of)	32300	n/a	33009
Kanabec	Knife Lake (Township of)	33560	n/a	33010
Kanabec	Kroschel (Township of)	33776	n/a	33011
Kanabec	Mora	44044	2655	n/a
Kanabec	Ogilvie	48166	2910	n/a
Kanabec	Peace (Township of)	50002	n/a	33012
Kanabec	Pomroy (Township of)	51874	n/a	33013
Kanabec	Quamba	52756	3140	n/a
Kanabec	South Fork (Township of)	61348	n/a	33014
Kanabec	Whited (Township of)	69988	n/a	33015
Kandiyohi	Arctander (Township of)	01990	n/a	34001
Kandiyohi	Atwater	02692	0135	n/a
Kandiyohi	Blomkest	06490	0375	n/a
Kandiyohi	Burbank (Township of)	08614	n/a	34002
Kandiyohi	Colfax (Township of)	12538	n/a	34003

COUNTY	PLACE NAME	FIPS	CITY	TWP
Kandiyohi	Dovre (Township of)	16336	n/a	34004
Kandiyohi	East Lake Lillian (Township of)	17702	n/a	34005
Kandiyohi	Edwards (Township of)	18242	n/a	34006
Kandiyohi	Fahlun (Township of)	20150	n/a	34007
Kandiyohi	Gennessee (Township of)	23390	n/a	34008
Kandiyohi	Green Lake (Township of)	25694	n/a	34009
Kandiyohi	Harrison (Township of)	27314	n/a	34010
Kandiyohi	Holland (Township of)	29600	n/a	34011
Kandiyohi	Irving (Township of)	31292	n/a	34012
Kandiyohi	Kandiyohi	32372	1965	n/a
Kandiyohi	Kandiyohi (Township of)	32390	n/a	34013
Kandiyohi	Lake Andrew (Township of)	34064	n/a	34014
Kandiyohi	Lake Elizabeth (Township of)	34226	n/a	34015
Kandiyohi	Lake Lillian	34676	2130	n/a
Kandiyohi	Lake Lillian (Township of)	34694	n/a	34016
Kandiyohi	Mamre (Township of)	39662	n/a	34017
Kandiyohi	New London	45682	2775	n/a
Kandiyohi	New London (Township of)	45700	n/a	34018
Kandiyohi	Norway Lake (Township of)	47464	n/a	34019
Kandiyohi	Pennock	50344	3025	n/a
Kandiyohi	Prinsburg	52558	3125	n/a
Kandiyohi	Raymond	53296	3165	n/a
Kandiyohi	Regal	53710	3185	n/a
Kandiyohi	Roseland (Township of)	55708	n/a	34020
Kandiyohi	Roseville (Township of)	55834	n/a	34021
Kandiyohi	Spicer	61690	3600	n/a
Kandiyohi	St Johns (Township of)	57076	n/a	34022
Kandiyohi	Sunburg	63454	3710	n/a
Kandiyohi	Whitefield (Township of)	70078	n/a	34023
Kandiyohi	Willmar	70420	4110	n/a
Kandiyohi	Willmar (Township of)	70438	n/a	34024
Kittson	Arveson (Township of)	02386	n/a	35001
Kittson	Cannon (Township of)	09676	n/a	35002
Kittson	Caribou (Township of)	09874	n/a	35003
Kittson	Clow (Township of)	12340	n/a	35004
Kittson	Davis (Township of)	14950	n/a	35005
Kittson	Deerwood (Township of)	15382	n/a	35006
Kittson	Donaldson	16030	1015	n/a
Kittson	Granville (Township of)	25370	n/a	35007
Kittson	Hallock	26576	1615	n/a
Kittson	Hallock (Township of)	26594	n/a	35008
Kittson	Halma	26612	1620	n/a
Kittson	Hampden (Township of)	26846	n/a	35009
Kittson	Hazelton (Township of)	28070	n/a	35010
Kittson	Hill (Township of)	29078	n/a	35011
Kittson	Humboldt	30446	1860	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Kittson	Jupiter (Township of)	32228	n/a	35012
Kittson	Karlstad	32444	1970	n/a
Kittson	Kennedy	32732	2005	n/a
Kittson	Lake Bronson	34136	2090	n/a
Kittson	Lancaster	35378	2165	n/a
Kittson	Norway (Township of)	47410	n/a	35015
Kittson	Pelan (Township of)	50074	n/a	35016
Kittson	Percy (Township of)	50452	n/a	35017
Kittson	Richardville (Township of)	54196	n/a	35019
Kittson	Skane (Township of)	60646	n/a	35022
Kittson	South Red River (Township of)	61456	n/a	35030
Kittson	Spring Brook (Township of)	61744	n/a	35023
Kittson	St Joseph (Township of)	57112	n/a	35020
Kittson	St Vincent	58144	3450	n/a
Kittson	St Vincent (Township of)	58162	n/a	35021
Kittson	Svea (Township of)	63652	n/a	35024
Kittson	Tegner (Township of)	64336	n/a	35025
Kittson	Teien (Township of)	64354	n/a	35026
Kittson	Thompson (Township of)	64642	n/a	35027
Koochiching	Big Falls	05680	0325	n/a
Koochiching	International Falls	31040	1880	n/a
Koochiching	Littlefork	37592	2290	n/a
Koochiching	Mizpah	43540	2620	n/a
Koochiching	Northome	47122	2865	n/a
Koochiching	Ranier	53134	3160	n/a
Lac qui Parle	Agassiz (Township of)	00352	n/a	37001
Lac qui Parle	Arena (Township of)	02062	n/a	37002
Lac qui Parle	Augusta (Township of)	02800	n/a	37003
Lac qui Parle	Baxter (Township of)	04060	n/a	37004
Lac qui Parle	Bellingham	04960	0275	n/a
Lac qui Parle	Boyd	07138	0420	n/a
Lac qui Parle	Camp Release (Township of)	09550	n/a	37005
Lac qui Parle	Cerro Gordo (Township of)	10774	n/a	37006
Lac qui Parle	Dawson	14968	0925	n/a
Lac qui Parle	Freeland (Township of)	22616	n/a	37007
Lac qui Parle	Garfield (Township of)	23138	n/a	37008
Lac qui Parle	Hamlin (Township of)	26774	n/a	37009
Lac qui Parle	Hantho (Township of)	27044	n/a	37010
Lac qui Parle	Lac qui Parle (Township of)	33848	n/a	37011
Lac qui Parle	Lake Shore (Township of)	34946	n/a	37012
Lac qui Parle	Louisburg	38258	2325	n/a
Lac qui Parle	Madison	39266	2385	n/a
Lac qui Parle	Madison (Township of)	39284	n/a	37013
Lac qui Parle	Manfred (Township of)	39788	n/a	37014
Lac qui Parle	Marietta	40526	2465	n/a
Lac qui Parle	Maxwell (Township of)	41084	n/a	37015

COUNTY	PLACE NAME	FIPS	CITY	TWP
Lac qui Parle	Mehurin (Township of)	41516	n/a	37016
Lac qui Parle	Nassau	45016	2730	n/a
Lac qui Parle	Perry (Township of)	50524	n/a	37017
Lac qui Parle	Providence (Township of)	52702	n/a	37018
Lac qui Parle	Riverside (Township of)	54646	n/a	37019
Lac qui Parle	Ten Mile Lake (Township of)	64408	n/a	37020
Lac qui Parle	Walter (Township of)	67882	n/a	37021
Lac qui Parle	Yellow Bank (Township of)	72058	n/a	37022
Lake	Beaver Bay	04456	0240	n/a
Lake	Beaver Bay (Township of)	04474	n/a	38001
Lake	Crystal Bay (Township of)	14194	n/a	38002
Lake	Fall Lake (Township of)	20456	n/a	38003
Lake	Silver Bay	60250	3545	n/a
Lake	Silver Creek (Township of)	60304	n/a	38004
Lake	Stony River (Township of)	62995	n/a	38032
Lake	Two Harbors	65956	3830	n/a
Lake of the Woods	Baudette	04024	0220	n/a
Lake of the Woods	Lakewood (Township of)	35208	n/a	69039
Lake of the Woods	Myhre (Township of)	44887	n/a	n/a
Lake of the Woods	Prosper (Township of)	52672	n/a	n/a
Lake of the Woods	Roosevelt	55438	3265	n/a
Lake of the Woods	Township 157-30	65298	n/a	39006
Lake of the Woods	Township 158-30	65300	n/a	39012
Lake of the Woods	Wheeler (Township of)	69849	n/a	n/a
Lake of the Woods	Williams	70402	4105	n/a
Le Sueur	Cleveland	11872	0725	n/a
Le Sueur	Cleveland (Township of)	11890	n/a	40001
Le Sueur	Cordova (Township of)	13204	n/a	40002
Le Sueur	Derrynane (Township of)	15760	n/a	40003
Le Sueur	Elysian	19160	1185	n/a
Le Sueur	Elysian (Township of)	19178	n/a	40004
Le Sueur	Heidelberg	28214	1720	n/a
Le Sueur	Kasota	32462	1975	n/a
Le Sueur	Kasota (Township of)	32480	n/a	40005
Le Sueur	Kilkenny	33110	2050	n/a
Le Sueur	Kilkenny (Township of)	33128	n/a	40006
Le Sueur	Lanesburgh (Township of)	35468	n/a	40007
Le Sueur	Le Center	36134	2205	n/a
Le Sueur	Le Sueur	36746	2235	n/a
Le Sueur	Lexington (Township of)	36872	n/a	40008
Le Sueur	Mankato	39878	2420	n/a
Le Sueur	Montgomery	43738	2630	n/a
Le Sueur	Montgomery (Township of)	43756	n/a	40009
Le Sueur	New Prague	45808	2795	n/a
Le Sueur	Ottawa (Township of)	49174	n/a	40010
Le Sueur	Sharon (Township of)	59386	n/a	40011

COUNTY	PLACE NAME	FIPS	CITY	TWP
Le Sueur	Tyrone (Township of)	66100	n/a	40012
Le Sueur	Washington (Township of)	68350	n/a	40013
Le Sueur	Waterville	68584	4010	n/a
Le Sueur	Waterville (Township of)	68602	n/a	40014
Lincoln	Alta Vista (Township of)	01180	n/a	41001
Lincoln	Arco	01972	0105	n/a
Lincoln	Ash Lake (Township of)	02476	n/a	41002
Lincoln	Diamond Lake (Township of)	15940	n/a	41003
Lincoln	Drammen (Township of)	16372	n/a	41004
Lincoln	Hansonville (Township of)	27026	n/a	41005
Lincoln	Hendricks	28430	1730	n/a
Lincoln	Hendricks (Township of)	28448	n/a	41006
Lincoln	Hope (Township of)	30104	n/a	41007
Lincoln	Ivanhoe	31526	1925	n/a
Lincoln	Lake Benton	34100	2085	n/a
Lincoln	Lake Benton (Township of)	34118	n/a	41008
Lincoln	Lake Stay (Township of)	35054	n/a	41009
Lincoln	Limestone (Township of)	37106	n/a	41010
Lincoln	Marble (Township of)	40436	n/a	41011
Lincoln	Marshfield (Township of)	40760	n/a	41012
Lincoln	Royal (Township of)	56158	n/a	41013
Lincoln	Shaokatan (Township of)	59377	n/a	41014
Lincoln	Tyler	66046	3835	n/a
Lincoln	Verdi (Township of)	66730	n/a	41015
Lyon	Amiret (Township of)	01432	n/a	42001
Lyon	Balaton	03250	0185	n/a
Lyon	Clifton (Township of)	11926	n/a	42002
Lyon	Coon Creek (Township of)	13078	n/a	42003
Lyon	Cottonwood	13564	0840	n/a
Lyon	Custer (Township of)	14392	n/a	42004
Lyon	Eidsvold (Township of)	18332	n/a	42005
Lyon	Fairview (Township of)	20384	n/a	42006
Lyon	Florence	21410	1310	n/a
Lyon	Garvin	23228	1415	n/a
Lyon	Ghent	23660	1450	n/a
Lyon	Grandview (Township of)	25154	n/a	42007
Lyon	Island Lake (Township of)	31400	n/a	42008
Lyon	Lucas (Township of)	38438	n/a	42010
Lyon	Lynd	38708	2350	n/a
Lyon	Lynd (Township of)	38726	n/a	42011
Lyon	Lyons (Township of)	38834	n/a	42012
Lyon	Marshall	40688	2475	n/a
Lyon	Minneota	43126	2595	n/a
Lyon	Monroe (Township of)	43666	n/a	42013
Lyon	Nordland (Township of)	46564	n/a	42014
Lyon	Rock Lake (Township of)	55042	n/a	42015

COUNTY	PLACE NAME	FIPS	CITY	TWP
Lyon	Russell	56428	3330	n/a
Lyon	Shelburne (Township of)	59440	n/a	42016
Lyon	Sodus (Township of)	61042	n/a	42017
Lyon	Stanley (Township of)	62392	n/a	42018
Lyon	Taunton	64264	3740	n/a
Lyon	Tracy	65308	3785	n/a
Lyon	Vallers (Township of)	66496	n/a	42019
Lyon	Westerheim (Township of)	69412	n/a	42020
Mahnomen	Beaulieu (Township of)	04366	n/a	44001
Mahnomen	Bejou	04672	0255	n/a
Mahnomen	Bejou (Township of)	04690	n/a	44002
Mahnomen	Chief (Township of)	11314	n/a	44003
Mahnomen	Clover (Township of)	12250	n/a	44004
Mahnomen	Gregory (Township of)	25946	n/a	44005
Mahnomen	Heier (Township of)	28232	n/a	44006
Mahnomen	Island Lake (Township of)	31418	n/a	44007
Mahnomen	La Garde (Township of)	33956	n/a	44008
Mahnomen	Lake Grove (Township of)	34424	n/a	44009
Mahnomen	Mahnomen	39392	2400	n/a
Mahnomen	Marsh Creek (Township of)	40742	n/a	44010
Mahnomen	Oakland (Township of)	47806	n/a	44011
Mahnomen	Pembina (Township of)	50218	n/a	44012
Mahnomen	Popple Grove (Township of)	52054	n/a	44013
Mahnomen	Rosedale (Township of)	55618	n/a	44014
Mahnomen	The Ranch CDP	64547	n/a	n/a
Mahnomen	Twin Lakes (Township of)	65929	n/a	44015
Mahnomen	Waubun	68674	4025	n/a
Mahnomen	West Roy Lake CDP	69690	n/a	n/a
Marshall	Agder (Township of)	00388	n/a	45001
Marshall	Alma (Township of)	01072	n/a	45002
Marshall	Alvarado	01252	0080	n/a
Marshall	Argyle	02134	0115	n/a
Marshall	Augsburg (Township of)	02764	n/a	45003
Marshall	Big Woods (Township of)	05842	n/a	45004
Marshall	Bloomer (Township of)	06535	n/a	45005
Marshall	Boxville (Township of)	07120	n/a	45006
Marshall	Cedar (Township of)	10360	n/a	45007
Marshall	Como (Township of)	12808	n/a	45008
Marshall	Comstock (Township of)	12880	n/a	45009
Marshall	Donnelly (Township of)	16066	n/a	45010
Marshall	Eagle Point (Township of)	17414	n/a	45011
Marshall	East Park (Township of)	17756	n/a	45012
Marshall	East Valley (Township of)	17864	n/a	45013
Marshall	Eckvoll (Township of)	17972	n/a	45014
Marshall	Espelie (Township of)	19736	n/a	45015
Marshall	Excel (Township of)	20060	n/a	45016

COUNTY	PLACE NAME	FIPS	CITY	TWP
Marshall	Foldahl (Township of)	21500	n/a	45017
Marshall	Fork (Township of)	21878	n/a	45018
Marshall	Grand Plain (Township of)	25046	n/a	45019
Marshall	Grygla	26216	1595	n/a
Marshall	Holt	29870	1830	n/a
Marshall	Holt (Township of)	29888	n/a	45020
Marshall	Huntly (Township of)	30572	n/a	45021
Marshall	Lincoln (Township of)	37142	n/a	45022
Marshall	Linsell (Township of)	37340	n/a	45023
Marshall	Marsh Grove (Township of)	40778	n/a	45025
Marshall	Middle River	41912	2545	n/a
Marshall	Middle River (Township of)	41930	n/a	45026
Marshall	Moose River (Township of)	44026	n/a	45027
Marshall	Moylan (Township of)	44692	n/a	45028
Marshall	Nelson Park (Township of)	45142	n/a	45029
Marshall	New Folden (Township of)	45538	n/a	45030
Marshall	New Maine (Township of)	45718	n/a	45031
Marshall	New Solum (Township of)	45970	n/a	45032
Marshall	Newfolden	45520	2760	n/a
Marshall	Oak Park (Township of)	47878	n/a	45033
Marshall	Oslo	48976	2960	n/a
Marshall	Parker (Township of)	49696	n/a	45034
Marshall	Rollis (Township of)	55330	n/a	45035
Marshall	Sinnott (Township of)	60520	n/a	45036
Marshall	Spruce Valley (Township of)	62266	n/a	45037
Marshall	Stephen	62698	3660	n/a
Marshall	Strandquist	63112	3695	n/a
Marshall	Tamarac (Township of)	64138	n/a	45038
Marshall	Thief Lake (Township of)	64552	n/a	45039
Marshall	Valley (Township of)	66514	n/a	45040
Marshall	Vega (Township of)	66676	n/a	45041
Marshall	Veldt (Township of)	66694	n/a	45042
Marshall	Viking	67090	3900	n/a
Marshall	Viking (Township of)	67108	n/a	45043
Marshall	Wanger (Township of)	68044	n/a	45044
Marshall	Warren	68170	3990	n/a
Marshall	Warrenton (Township of)	68206	n/a	45045
Marshall	West Valley (Township of)	69772	n/a	45046
Marshall	Whiteford (Township of)	70096	n/a	45047
Marshall	Wright (Township of)	71842	n/a	45048
Martin	Cedar (Township of)	10378	n/a	46001
Martin	Center Creek (Township of)	10594	n/a	46002
Martin	Ceylon	10792	0625	n/a
Martin	Dunnell	17180	1060	n/a
Martin	East Chain (Township of)	17522	n/a	46003
Martin	Elm Creek (Township of)	18854	n/a	46004

COUNTY	PLACE NAME	FIPS	CITY	TWP
Martin	Fairmont	20330	1240	n/a
Martin	Fairmont (Township of)	20348	n/a	46005
Martin	Fox Lake (Township of)	22256	n/a	46006
Martin	Fraser (Township of)	22436	n/a	46007
Martin	Galena (Township of)	23030	n/a	46008
Martin	Granada	24884	1530	n/a
Martin	Jay (Township of)	31778	n/a	46009
Martin	Lake Belt (Township of)	34082	n/a	46010
Martin	Lake Fremont (Township of)	34334	n/a	46011
Martin	Manyaska (Township of)	40058	n/a	46012
Martin	Nashville (Township of)	44962	n/a	46013
Martin	Northrop	47212	2875	n/a
Martin	Ormsby	48562	2935	n/a
Martin	Pleasant Prairie (Township of)	51622	n/a	46014
Martin	Rolling Green (Township of)	55258	n/a	46015
Martin	Rutland (Township of)	56500	n/a	46016
Martin	Sherburn	59620	3525	n/a
Martin	Silver Lake (Township of)	60412	n/a	46017
Martin	Tenhassen (Township of)	64372	n/a	46018
Martin	Trimont	65470	3795	n/a
Martin	Truman	65668	3810	n/a
Martin	Waverly (Township of)	68746	n/a	46019
Martin	Welcome	69070	4040	n/a
Martin	Westford (Township of)	69466	n/a	46020
McLeod	Acoma (Township of)	00136	n/a	43001
McLeod	Bergen (Township of)	05338	n/a	43002
McLeod	Biscay	06112	0355	n/a
McLeod	Brownton	08254	0510	n/a
McLeod	Collins (Township of)	12610	n/a	43003
McLeod	Glencoe	23948	1470	n/a
McLeod	Glencoe (Township of)	23966	n/a	43004
McLeod	Hale (Township of)	26540	n/a	43005
McLeod	Hassan Valley (Township of)	27494	n/a	43006
McLeod	Helen (Township of)	28304	n/a	43007
McLeod	Hutchinson	30644	1865	n/a
McLeod	Hutchinson (Township of)	30662	n/a	43008
McLeod	Lester Prairie	36728	2230	n/a
McLeod	Lynn (Township of)	38798	n/a	43009
McLeod	Penn (Township of)	50308	n/a	43010
McLeod	Plato	51460	3090	n/a
McLeod	Rich Valley (Township of)	54322	n/a	43011
McLeod	Round Grove (Township of)	56032	n/a	43012
McLeod	Silver Lake	60376	3550	n/a
McLeod	Stewart	62788	3665	n/a
McLeod	Sumter (Township of)	63436	n/a	43013
McLeod	Winsted	71086	4150	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
McLeod	Winsted (Township of)	71104	n/a	43014
Meeker	Acton (Township of)	00154	n/a	47001
Meeker	Cedar Mills	10468	0610	n/a
Meeker	Cedar Mills (Township of)	10486	n/a	47002
Meeker	Collinwood (Township of)	12628	n/a	47003
Meeker	Cosmos	13420	0835	n/a
Meeker	Cosmos (Township of)	13438	n/a	47004
Meeker	Danielson (Township of)	14698	n/a	47005
Meeker	Darwin	14842	0915	n/a
Meeker	Darwin (Township of)	14860	n/a	47006
Meeker	Dassel	14878	0920	n/a
Meeker	Dassel (Township of)	14896	n/a	47007
Meeker	Eden Valley	18134	1095	n/a
Meeker	Ellsworth (Township of)	18818	n/a	47008
Meeker	Forest City (Township of)	21734	n/a	47009
Meeker	Forest Prairie (Township of)	21842	n/a	47010
Meeker	Greenleaf (Township of)	25730	n/a	47011
Meeker	Grove City	26126	1590	n/a
Meeker	Harvey (Township of)	27440	n/a	47012
Meeker	Kingston	33344	2063	n/a
Meeker	Kingston (Township of)	33362	n/a	47013
Meeker	Litchfield	37448	2275	n/a
Meeker	Litchfield (Township of)	37466	n/a	47014
Meeker	Manannah (Township of)	39698	n/a	47015
Meeker	Swede Grove (Township of)	63832	n/a	47016
Meeker	Union Grove (Township of)	66226	n/a	47017
Meeker	Watkins	68620	4015	n/a
Mille Lacs	Bock	06814	0400	n/a
Mille Lacs	Bogus Brook (Township of)	06850	n/a	48001
Mille Lacs	Borgholm (Township of)	07012	n/a	48002
Mille Lacs	Bradbury (Township of)	07210	n/a	48003
Mille Lacs	Dailey (Township of)	14500	n/a	48004
Mille Lacs	East Side (Township of)	17810	n/a	48005
Mille Lacs	Foreston	21824	1330	n/a
Mille Lacs	Greenbush (Township of)	25586	n/a	48006
Mille Lacs	Hayland (Township of)	27908	n/a	48007
Mille Lacs	Isle	31472	1920	n/a
Mille Lacs	Isle Harbor (Township of)	31490	n/a	48008
Mille Lacs	Kathio (Township of)	32516	n/a	48009
Mille Lacs	Lewis (Township of)	36782	n/a	48010
Mille Lacs	Milaca	42110	2555	n/a
Mille Lacs	Milaca (Township of)	42128	n/a	48011
Mille Lacs	Milo (Township of)	42326	n/a	48012
Mille Lacs	Mudgett (Township of)	44710	n/a	48013
Mille Lacs	Onamia	48310	2930	n/a
Mille Lacs	Onamia (Township of)	48328	n/a	48014

COUNTY	PLACE NAME	FIPS	CITY	TWP
Mille Lacs	Page (Township of)	49480	n/a	48015
Mille Lacs	Pease	50056	3005	n/a
Mille Lacs	Princeton	52522	3120	n/a
Mille Lacs	Princeton (Township of)	52540	n/a	48016
Mille Lacs	South Harbor (Township of)	61384	n/a	48017
Mille Lacs	Wahkon	67558	3940	n/a
Morrison	Agram (Township of)	00406	n/a	49001
Morrison	Bellevue (Township of)	04942	n/a	49003
Morrison	Bowlus	07066	0415	n/a
Morrison	Buckman	08416	0520	n/a
Morrison	Buckman (Township of)	08434	n/a	49004
Morrison	Buh (Township of)	08506	n/a	49005
Morrison	Culdrum (Township of)	14248	n/a	49007
Morrison	Cushing (Township of)	14356	n/a	49032
Morrison	Darling (Township of)	14806	n/a	49008
Morrison	Elmdale	18872	1165	n/a
Morrison	Elmdale (Township of)	18890	n/a	49009
Morrison	Flensburg	21266	1300	n/a
Morrison	Genola	23444	1440	n/a
Morrison	Granite (Township of)	25244	n/a	49010
Morrison	Green Prairie (Township of)	25784	n/a	49011
Morrison	Harding	27098	1665	n/a
Morrison	Hillman	29150	1775	n/a
Morrison	Hillman (Township of)	29168	n/a	49012
Morrison	Lakin (Township of)	35252	n/a	49013
Morrison	Lastrup	35720	2195	n/a
Morrison	Leigh (Township of)	36350	n/a	49014
Morrison	Little Falls	37556	2285	n/a
Morrison	Little Falls (Township of)	37574	n/a	49015
Morrison	Morrill (Township of)	44224	n/a	49016
Morrison	Motley	44422	2685	n/a
Morrison	Motley (Township of)	44440	n/a	49017
Morrison	Mount Morris (Township of)	44602	n/a	49018
Morrison	Parker (Township of)	49714	n/a	49019
Morrison	Pierz	50776	3050	n/a
Morrison	Pierz (Township of)	50794	n/a	49020
Morrison	Pike Creek (Township of)	50866	n/a	49021
Morrison	Platte (Township of)	51478	n/a	49022
Morrison	Pulaski (Township of)	52720	n/a	49023
Morrison	Randall	53080	3150	n/a
Morrison	Richardson (Township of)	54178	n/a	49025
Morrison	Ripley (Township of)	54520	n/a	49026
Morrison	Rosing (Township of)	55906	n/a	49027
Morrison	Royalton	56176	3305	n/a
Morrison	Scandia Valley (Township of)	58918	n/a	49028
Morrison	Sobieski	61006	3570	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Morrison	Swan River (Township of)	63760	n/a	49029
Morrison	Swanville	63778	3720	n/a
Morrison	Swanville (Township of)	63796	n/a	49030
Morrison	Two Rivers (Township of)	66028	n/a	49031
Morrison	Upsala	66334	3850	n/a
Mower	Adams	00190	0010	n/a
Mower	Adams (Township of)	00208	n/a	50001
Mower	Austin	02908	0150	n/a
Mower	Austin (Township of)	02926	n/a	50002
Mower	Bennington (Township of)	05176	n/a	50003
Mower	Brownsdale	08164	0495	n/a
Mower	Clayton (Township of)	11728	n/a	50004
Mower	Dexter	15886	1000	n/a
Mower	Dexter (Township of)	15904	n/a	50005
Mower	Elkton	18728	1150	n/a
Mower	Frankford (Township of)	22328	n/a	50006
Mower	Grand Meadow	25010	1540	n/a
Mower	Grand Meadow (Township of)	25028	n/a	50007
Mower	Lansing (Township of)	35576	n/a	50008
Mower	Le Roy	36620	2225	n/a
Mower	Le Roy (Township of)	36638	n/a	50009
Mower	Lodi (Township of)	37808	n/a	50010
Mower	Lyle	38654	2345	n/a
Mower	Lyle (Township of)	38672	n/a	50011
Mower	Mapleview	40346	2450	n/a
Mower	Marshall (Township of)	40706	n/a	50012
Mower	Nevada (Township of)	45322	n/a	50013
Mower	Pleasant Valley (Township of)	51640	n/a	50014
Mower	Racine	52882	3145	n/a
Mower	Racine (Township of)	52900	n/a	50015
Mower	Red Rock (Township of)	53584	n/a	50016
Mower	Rose Creek	55600	3280	n/a
Mower	Sargeant	58576	3465	n/a
Mower	Sargeant (Township of)	58594	n/a	50017
Mower	Taopi	64210	3735	n/a
Mower	Udolpho (Township of)	66118	n/a	50018
Mower	Waltham	67918	3970	n/a
Mower	Waltham (Township of)	67936	n/a	50019
Mower	Windom (Township of)	70816	n/a	50020
Murray	Avoca	03052	0155	n/a
Murray	Belfast (Township of)	04708	n/a	51001
Murray	Bondin (Township of)	06922	n/a	51002
Murray	Cameron (Township of)	09460	n/a	51003
Murray	Chanarambie (Township of)	10882	n/a	51004
Murray	Chandler	10900	0635	n/a
Murray	Currie	14320	0875	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Murray	Des Moines River (Township of)	15778	n/a	51005
Murray	Dovray	16300	1035	n/a
Murray	Ellsborough (Township of)	18782	n/a	51007
Murray	Fenton (Township of)	20888	n/a	51008
Murray	Fulda	22958	1395	n/a
Murray	Hadley	26450	1610	n/a
Murray	Holly (Township of)	29690	n/a	51009
Murray	Iona	31094	1890	n/a
Murray	Iona (Township of)	31112	n/a	51010
Murray	Lake Sarah (Township of)	34892	n/a	51011
Murray	Lake Wilson	35198	2155	n/a
Murray	Leeds (Township of)	36260	n/a	51012
Murray	Lime Lake (Township of)	37088	n/a	51013
Murray	Lowville (Township of)	38402	n/a	51014
Murray	Mason (Township of)	40958	n/a	51015
Murray	Moulton (Township of)	44458	n/a	51016
Murray	Murray (Township of)	44854	n/a	51017
Murray	Shetek (Township of)	59764	n/a	51018
Murray	Skandia (Township of)	60628	n/a	51019
Murray	Slayton	60808	3560	n/a
Murray	Slayton (Township of)	60826	n/a	51020
Murray	The Lakes CDP	64543	n/a	n/a
Nicollet	Belgrade (Township of)	04744	n/a	52001
Nicollet	Bernadotte (Township of)	05410	n/a	52002
Nicollet	Brighton (Township of)	07732	n/a	52003
Nicollet	Courtland	13582	0845	n/a
Nicollet	Courtland (Township of)	13600	n/a	52004
Nicollet	Granby (Township of)	24902	n/a	52005
Nicollet	Lafayette	33920	2075	n/a
Nicollet	Lafayette (Township of)	33938	n/a	52006
Nicollet	Lake Prairie (Township of)	34856	n/a	52007
Nicollet	Le Sueur	36746	2235	n/a
Nicollet	Mankato	39878	2420	n/a
Nicollet	New Sweden (Township of)	45988	n/a	52008
Nicollet	Nicollet	46150	2820	n/a
Nicollet	Nicollet (Township of)	46168	n/a	52009
Nicollet	North Mankato	47068	2855	n/a
Nicollet	Oshawa (Township of)	48922	n/a	52010
Nicollet	Ridgely (Township of)	54430	n/a	52011
Nicollet	St Peter	58036	3435	n/a
Nicollet	Traverse (Township of)	65416	n/a	52012
Nicollet	West Newton (Township of)	69556	n/a	52013
Nobles	Adrian	00262	0015	n/a
Nobles	Bigelow	05644	0320	n/a
Nobles	Bigelow (Township of)	05662	n/a	53001
Nobles	Bloom (Township of)	06508	n/a	53002

COUNTY	PLACE NAME	FIPS	CITY	TWP
Nobles	Brewster	07660	0450	n/a
Nobles	Dewald (Township of)	15850	n/a	53003
Nobles	Dundee	17144	1055	n/a
Nobles	Elk (Township of)	18602	n/a	53004
Nobles	Ellsworth	18836	1160	n/a
Nobles	Graham Lakes (Township of)	24848	n/a	53005
Nobles	Grand Prairie (Township of)	25100	n/a	53006
Nobles	Hersey (Township of)	28736	n/a	53007
Nobles	Indian Lake (Township of)	30878	n/a	53008
Nobles	Kinbrae	33236	2060	n/a
Nobles	Larkin (Township of)	35666	n/a	53009
Nobles	Leota (Township of)	36566	n/a	53010
Nobles	Lismore	37412	2270	n/a
Nobles	Lismore (Township of)	37430	n/a	53011
Nobles	Little Rock (Township of)	37682	n/a	53012
Nobles	Lorain (Township of)	38204	n/a	53013
Nobles	Olney (Township of)	48274	n/a	53014
Nobles	Ransom (Township of)	53152	n/a	53015
Nobles	Round Lake	56086	3300	n/a
Nobles	Rushmore	56338	3325	n/a
Nobles	Seward (Township of)	59260	n/a	53016
Nobles	Summit Lake (Township of)	63400	n/a	53017
Nobles	Westside (Township of)	69718	n/a	53018
Nobles	Wilmont	70582	4120	n/a
Nobles	Wilmont (Township of)	70600	n/a	53019
Nobles	Worthington	71734	4190	n/a
Nobles	Worthington (Township of)	71752	n/a	53020
Norman	Ada	00172	0005	n/a
Norman	Anthony (Township of)	01774	n/a	54001
Norman	Bear Park (Township of)	04222	n/a	54002
Norman	Borup	07030	0405	n/a
Norman	Flom (Township of)	21320	n/a	54003
Norman	Fossum (Township of)	22022	n/a	54004
Norman	Gary	23246	1420	n/a
Norman	Good Hope (Township of)	24380	n/a	54005
Norman	Green Meadow (Township of)	25766	n/a	54006
Norman	Halstad	26630	1625	n/a
Norman	Halstad (Township of)	26648	n/a	54007
Norman	Hegne (Township of)	28178	n/a	54008
Norman	Hendrum	28484	1735	n/a
Norman	Hendrum (Township of)	28502	n/a	54009
Norman	Home Lake (Township of)	29996	n/a	54010
Norman	Lake Ida (Township of)	34532	n/a	54011
Norman	Lee (Township of)	36188	n/a	54012
Norman	Lockhart (Township of)	37790	n/a	54013
Norman	Mary (Township of)	40868	n/a	54015

COUNTY	PLACE NAME	FIPS	CITY	TWP
Norman	McDonaldsville (Township of)	38978	n/a	54014
Norman	Perley	50506	3040	n/a
Norman	Pleasant View (Township of)	51658	n/a	54016
Norman	Rockwell (Township of)	55114	n/a	54017
Norman	Shelly	59566	3520	n/a
Norman	Shelly (Township of)	59584	n/a	54018
Norman	Spring Creek (Township of)	61780	n/a	54019
Norman	Strand (Township of)	63094	n/a	54020
Norman	Sundal (Township of)	63508	n/a	54021
Norman	Twin Valley	65938	3825	n/a
Norman	Waukon (Township of)	68728	n/a	54022
Norman	Wild Rice (Township of)	70276	n/a	54023
Norman	Winchester (Township of)	70762	n/a	54024
Olmsted	Byron	09154	0550	n/a
Olmsted	Cascade (Township of)	10180	n/a	55001
Olmsted	Chatfield	11008	0650	n/a
Olmsted	Dover	16264	1030	n/a
Olmsted	Dover (Township of)	16282	n/a	55002
Olmsted	Elmira (Township of)	18962	n/a	55003
Olmsted	Eyota	20114	1230	n/a
Olmsted	Eyota (Township of)	20132	n/a	55004
Olmsted	Farmington (Township of)	20636	n/a	55005
Olmsted	Haverhill (Township of)	27692	n/a	55006
Olmsted	High Forest (Township of)	28880	n/a	55007
Olmsted	Kalmar (Township of)	32282	n/a	55008
Olmsted	Marion (Township of)	40616	n/a	55009
Olmsted	New Haven (Township of)	45610	n/a	55010
Olmsted	Orion (Township of)	48526	n/a	55011
Olmsted	Oronoco	48598	2942	n/a
Olmsted	Oronoco (Township of)	48616	n/a	55012
Olmsted	Pine Island	51136	3065	n/a
Olmsted	Pleasant Grove (Township of)	51550	n/a	55013
Olmsted	Quincy (Township of)	52792	n/a	55014
Olmsted	Rochester	54880	3235	n/a
Olmsted	Rochester (Township of)	54898	n/a	55015
Olmsted	Rock Dell (Township of)	54988	n/a	55016
Olmsted	Salem (Township of)	58234	n/a	55017
Olmsted	Stewartville	62806	3670	n/a
Olmsted	Viola (Township of)	67270	n/a	55018
Otter Tail	Aastad (Township of)	00100	n/a	56001
Otter Tail	Amor (Township of)	01468	n/a	56002
Otter Tail	Aurdal (Township of)	02836	n/a	56003
Otter Tail	Battle Lake	03970	0215	n/a
Otter Tail	Blowers (Township of)	06652	n/a	56004
Otter Tail	Bluffton	06778	0395	n/a
Otter Tail	Bluffton (Township of)	06796	n/a	56005

COUNTY	PLACE NAME	FIPS	CITY	TWP
Otter Tail	Buse (Township of)	08938	n/a	56006
Otter Tail	Butler (Township of)	08974	n/a	56007
Otter Tail	Candor (Township of)	09622	n/a	56008
Otter Tail	Carlisle (Township of)	09946	n/a	56009
Otter Tail	Clitherall	12088	0740	n/a
Otter Tail	Clitherall (Township of)	12106	n/a	56010
Otter Tail	Compton (Township of)	12844	n/a	56011
Otter Tail	Corliss (Township of)	13240	n/a	56012
Otter Tail	Dalton	14626	0895	n/a
Otter Tail	Dane Prairie (Township of)	14644	n/a	56013
Otter Tail	Dead Lake (Township of)	15076	n/a	56014
Otter Tail	Deer Creek	15184	0940	n/a
Otter Tail	Deer Creek (Township of)	15202	n/a	56015
Otter Tail	Dent	15724	0990	n/a
Otter Tail	Dora (Township of)	16120	n/a	56016
Otter Tail	Dunn (Township of)	17162	n/a	56017
Otter Tail	Eagle Lake (Township of)	17396	n/a	56018
Otter Tail	Eastern (Township of)	17576	n/a	56019
Otter Tail	Edna (Township of)	18224	n/a	56020
Otter Tail	Effington (Township of)	18278	n/a	56021
Otter Tail	Elizabeth	18566	1135	n/a
Otter Tail	Elizabeth (Township of)	18584	n/a	56022
Otter Tail	Elmo (Township of)	18980	n/a	56023
Otter Tail	Erhard	19556	1200	n/a
Otter Tail	Erhards Grove (Township of)	19574	n/a	56024
Otter Tail	Everts (Township of)	20024	n/a	56025
Otter Tail	Fergus Falls	20906	1275	n/a
Otter Tail	Fergus Falls (Township of)	20924	n/a	56026
Otter Tail	Folden (Township of)	21518	n/a	56027
Otter Tail	Friberg (Township of)	22796	n/a	56028
Otter Tail	Girard (Township of)	23840	n/a	56029
Otter Tail	Gorman (Township of)	24632	n/a	56030
Otter Tail	Henning	28520	1740	n/a
Otter Tail	Henning (Township of)	28538	n/a	56031
Otter Tail	Hobart (Township of)	29420	n/a	56032
Otter Tail	Homestead (Township of)	30050	n/a	56033
Otter Tail	Inman (Township of)	31004	n/a	56034
Otter Tail	Leaf Lake (Township of)	35990	n/a	56035
Otter Tail	Leaf Mountain (Township of)	36008	n/a	56036
Otter Tail	Lida (Township of)	36980	n/a	56037
Otter Tail	Maine (Township of)	39500	n/a	56038
Otter Tail	Maplewood (Township of)	40364	n/a	56039
Otter Tail	New York Mills	46060	2815	n/a
Otter Tail	Newton (Township of)	46006	n/a	56040
Otter Tail	Nidaros (Township of)	46240	n/a	56041
Otter Tail	Norwegian Grove (Township of)	47482	n/a	56042

COUNTY	PLACE NAME	FIPS	CITY	TWP
Otter Tail	Oak Valley (Township of)	48004	n/a	56043
Otter Tail	Orwell (Township of)	48742	n/a	56044
Otter Tail	Oscar (Township of)	48850	n/a	56045
Otter Tail	Otter Tail (Township of)	49228	n/a	56046
Otter Tail	Ottertail	49210	2975	n/a
Otter Tail	Otto (Township of)	49264	n/a	56047
Otter Tail	Paddock (Township of)	49408	n/a	56048
Otter Tail	Parkers Prairie	49732	2990	n/a
Otter Tail	Parkers Prairie (Township of)	49750	n/a	56049
Otter Tail	Pelican (Township of)	50110	n/a	56050
Otter Tail	Pelican Rapids	50164	3015	n/a
Otter Tail	Perham	50470	3035	n/a
Otter Tail	Perham (Township of)	50488	n/a	56051
Otter Tail	Pine Lake (Township of)	51208	n/a	56052
Otter Tail	Richville	54340	3220	n/a
Otter Tail	Rothsay	56014	3295	n/a
Otter Tail	Rush Lake (Township of)	56320	n/a	56053
Otter Tail	Scambler (Township of)	58864	n/a	56055
Otter Tail	St Olaf (Township of)	57382	n/a	56054
Otter Tail	Star Lake (Township of)	62554	n/a	56056
Otter Tail	Sverdrup (Township of)	63688	n/a	56057
Otter Tail	Tordenskjold (Township of)	65218	n/a	56058
Otter Tail	Trondhjem (Township of)	65524	n/a	56059
Otter Tail	Tumuli (Township of)	65686	n/a	56060
Otter Tail	Underwood	66172	3845	n/a
Otter Tail	Urbank	66388	3855	n/a
Otter Tail	Vergas	66766	3870	n/a
Otter Tail	Vining	67216	3910	n/a
Otter Tail	Wadena	67504	3935	n/a
Otter Tail	Western (Township of)	69430	n/a	56061
Otter Tail	Woodside (Township of)	71644	n/a	56062
Pennington	Black River (Township of)	06364	n/a	57001
Pennington	Bray (Township of)	07444	n/a	57002
Pennington	Deer Park (Township of)	15292	n/a	57004
Pennington	Goodridge	24470	1510	n/a
Pennington	Goodridge (Township of)	24488	n/a	57005
Pennington	Hickory (Township of)	28808	n/a	57006
Pennington	Kratka (Township of)	33740	n/a	57008
Pennington	Mayfield (Township of)	41156	n/a	57009
Pennington	Norden (Township of)	46510	n/a	57010
Pennington	North (Township of)	46762	n/a	57011
Pennington	Numedal (Township of)	47590	n/a	57012
Pennington	Polk Centre (Township of)	51802	n/a	57013
Pennington	Reiner (Township of)	53746	n/a	57014
Pennington	River Falls (Township of)	54574	n/a	57015
Pennington	Rocksbury (Township of)	55060	n/a	57016

COUNTY	PLACE NAME	FIPS	CITY	TWP
Pennington	Sanders (Township of)	58342	n/a	57017
Pennington	Silverton (Township of)	60448	n/a	57018
Pennington	Smiley (Township of)	60898	n/a	57019
Pennington	St Hilaire	57022	3385	n/a
Pennington	Star (Township of)	62482	n/a	57020
Pennington	Thief River Falls	64570	3760	n/a
Pennington	Wyandotte (Township of)	71878	n/a	57021
Pine	Arlone (Township of)	02188	n/a	58001
Pine	Arna (Township of)	02224	n/a	58002
Pine	Askov	02548	0130	n/a
Pine	Barry (Township of)	03736	n/a	58003
Pine	Birch Creek (Township of)	05986	n/a	58004
Pine	Bremen (Township of)	07552	n/a	58005
Pine	Brook Park	07984	0470	n/a
Pine	Brook Park (Township of)	08002	n/a	58006
Pine	Bruno	08290	0515	n/a
Pine	Bruno (Township of)	08308	n/a	58007
Pine	Chengwatana (Township of)	11098	n/a	58008
Pine	Clover (Township of)	12268	n/a	58009
Pine	Crosby (Township of)	13942	n/a	58010
Pine	Danforth (Township of)	14680	n/a	58011
Pine	Dell Grove (Township of)	15598	n/a	58012
Pine	Denham	15670	0980	n/a
Pine	Finlayson	21122	1290	n/a
Pine	Finlayson (Township of)	21140	n/a	58013
Pine	Fleming (Township of)	21248	n/a	58014
Pine	Henriette	28574	1745	n/a
Pine	Hinckley	29294	1790	n/a
Pine	Hinckley (Township of)	29312	n/a	58015
Pine	Kerrick	32912	2035	n/a
Pine	Kerrick (Township of)	32930	n/a	58016
Pine	Kettle River (Township of)	32984	n/a	58017
Pine	Mission Creek (Township of)	43486	n/a	58018
Pine	Munch (Township of)	44764	n/a	58019
Pine	New Dosey (Township of)	45484	n/a	58020
Pine	Nickerson (Township of)	46132	n/a	58021
Pine	Norman (Township of)	46618	n/a	58022
Pine	Ogema (Township of)	48148	n/a	58023
Pine	Park (Township of)	49660	n/a	58024
Pine	Partridge (Township of)	49876	n/a	58025
Pine	Pine City	51064	3060	n/a
Pine	Pine City (Township of)	51082	n/a	58026
Pine	Pine Lake (Township of)	51226	n/a	58027
Pine	Pokegama (Township of)	51784	n/a	58028
Pine	Rock Creek	54934	3237	n/a
Pine	Royalton (Township of)	56194	n/a	58029

COUNTY	PLACE NAME	FIPS	CITY	TWP
Pine	Rutledge	56518	3340	n/a
Pine	Sandstone	58396	3460	n/a
Pine	Sandstone (Township of)	58414	n/a	58030
Pine	Sturgeon Lake	63220	3705	n/a
Pine	Sturgeon Lake (Township of)	63238	n/a	58031
Pine	Willow River	70492	4115	n/a
Pine	Wilma (Township of)	70528	n/a	58032
Pine	Windemere (Township of)	70780	n/a	58033
Pipestone	Aetna (Township of)	00298	n/a	59001
Pipestone	Altona (Township of)	01216	n/a	59002
Pipestone	Burke (Township of)	08650	n/a	59003
Pipestone	Eden (Township of)	18062	n/a	59004
Pipestone	Edgerton	18152	1100	n/a
Pipestone	Elmer (Township of)	18908	n/a	59005
Pipestone	Fountain Prairie (Township of)	22130	n/a	59006
Pipestone	Grange (Township of)	25208	n/a	59007
Pipestone	Gray (Township of)	25478	n/a	59008
Pipestone	Hatfield	27566	1690	n/a
Pipestone	Holland	29618	1818	n/a
Pipestone	Ihlen	30806	1870	n/a
Pipestone	Jasper	31760	1940	n/a
Pipestone	Osborne (Township of)	48832	n/a	59009
Pipestone	Pipestone	51388	3080	n/a
Pipestone	Rock (Township of)	54916	n/a	59010
Pipestone	Ruthton	56482	3335	n/a
Pipestone	Sweet (Township of)	63886	n/a	59011
Pipestone	Trosky	65542	3805	n/a
Pipestone	Troy (Township of)	65614	n/a	59012
Pipestone	Woodstock	71680	4185	n/a
Polk	Andover (Township of)	01504	n/a	60001
Polk	Angus (Township of)	01648	n/a	60002
Polk	Badger (Township of)	03142	n/a	60003
Polk	Belgium (Township of)	04726	n/a	60004
Polk	Beltrami	05014	0280	n/a
Polk	Brandsvold (Township of)	07390	n/a	60005
Polk	Brandt (Township of)	07408	n/a	60006
Polk	Brislet (Township of)	07768	n/a	60007
Polk	Bygland (Township of)	09118	n/a	60008
Polk	Chester (Township of)	11224	n/a	60009
Polk	Climax	11962	0730	n/a
Polk	Columbia (Township of)	12682	n/a	60010
Polk	Crookston	13870	0855	n/a
Polk	Crookston (Township of)	13888	n/a	60011
Polk	East Grand Forks	17612	1075	n/a
Polk	Eden (Township of)	18080	n/a	60012
Polk	Erskine	19700	1205	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Polk	Esther (Township of)	19790	n/a	60013
Polk	Euclid (Township of)	19862	n/a	60014
Polk	Fairfax (Township of)	20204	n/a	60015
Polk	Fanny (Township of)	20510	n/a	60016
Polk	Farley (Township of)	20564	n/a	60017
Polk	Fertile	20978	1280	n/a
Polk	Fisher	21158	1295	n/a
Polk	Fisher (Township of)	21176	n/a	60018
Polk	Fosston	21986	1340	n/a
Polk	Garden (Township of)	23066	n/a	60019
Polk	Garfield (Township of)	23156	n/a	60020
Polk	Gentilly (Township of)	23480	n/a	60021
Polk	Godfrey (Township of)	24254	n/a	60022
Polk	Grand Forks (Township of)	24938	n/a	60023
Polk	Gully	26270	1600	n/a
Polk	Gully (Township of)	26288	n/a	60025
Polk	Hammond (Township of)	26810	n/a	60026
Polk	Helgeland (Township of)	28358	n/a	60027
Polk	Higdem (Township of)	28844	n/a	60028
Polk	Hill River (Township of)	29186	n/a	60029
Polk	Hubbard (Township of)	30356	n/a	60030
Polk	Huntsville (Township of)	30590	n/a	60031
Polk	Johnson (Township of)	32030	n/a	60032
Polk	Kertsonville (Township of)	32948	n/a	60033
Polk	Keystone (Township of)	33002	n/a	60034
Polk	King (Township of)	33254	n/a	60035
Polk	Knute (Township of)	33614	n/a	60036
Polk	Lengby	36404	2210	n/a
Polk	Lessor (Township of)	36692	n/a	60037
Polk	Liberty (Township of)	36962	n/a	60038
Polk	Lowell (Township of)	38330	n/a	60039
Polk	McIntosh	39050	2365	n/a
Polk	Mentor	41714	2540	n/a
Polk	Nesbit (Township of)	45214	n/a	60040
Polk	Nielsville	46258	2825	n/a
Polk	Northland (Township of)	47032	n/a	60041
Polk	Onstad (Township of)	48418	n/a	60042
Polk	Parnell (Township of)	49840	n/a	60043
Polk	Queen (Township of)	52774	n/a	60044
Polk	Reis (Township of)	53764	n/a	60045
Polk	Rhinehart (Township of)	53980	n/a	60046
Polk	Roome (Township of)	55384	n/a	60047
Polk	Rosebud (Township of)	55564	n/a	60048
Polk	Russia (Township of)	56446	n/a	60049
Polk	Sandsville (Township of)	58432	n/a	60050
Polk	Scandia (Township of)	58882	n/a	60051

COUNTY	PLACE NAME	FIPS	CITY	TWP
Polk	Sletten (Township of)	60880	n/a	60052
Polk	Sullivan (Township of)	63310	n/a	60053
Polk	Tabor (Township of)	64030	n/a	60054
Polk	Trail	65344	3790	n/a
Polk	Tynsid (Township of)	66064	n/a	60056
Polk	Vineland (Township of)	67198	n/a	60057
Polk	Winger	70870	4135	n/a
Polk	Winger (Township of)	70888	n/a	60058
Polk	Woodside (Township of)	71662	n/a	60059
Pope	Bangor (Township of)	03502	n/a	61001
Pope	Barsness (Township of)	03754	n/a	61002
Pope	Ben Wade (Township of)	05302	n/a	61003
Pope	Blue Mounds (Township of)	06760	n/a	61004
Pope	Brooten	08092	0485	n/a
Pope	Chippewa Falls (Township of)	11332	n/a	61005
Pope	Cyrus	14446	0885	n/a
Pope	Farwell	20690	1260	n/a
Pope	Gilchrist (Township of)	23750	n/a	61006
Pope	Glenwood	24074	1480	n/a
Pope	Glenwood (Township of)	24092	n/a	61007
Pope	Grove Lake (Township of)	26162	n/a	61008
Pope	Hoff (Township of)	29456	n/a	61009
Pope	Lake Johanna (Township of)	34586	n/a	61010
Pope	Langhei (Township of)	35504	n/a	61011
Pope	Leven (Township of)	36764	n/a	61012
Pope	Long Beach	37970	2295	n/a
Pope	Lowry	38366	2330	n/a
Pope	Minnewaska (Township of)	43342	n/a	61013
Pope	New Prairie (Township of)	45844	n/a	61014
Pope	Nora (Township of)	46456	n/a	61015
Pope	Reno (Township of)	53854	n/a	61016
Pope	Rolling Forks (Township of)	55240	n/a	61017
Pope	Sedan	59188	3505	n/a
Pope	Starbuck	62500	3650	n/a
Pope	Villard	67144	3905	n/a
Pope	Walden (Township of)	67702	n/a	61018
Pope	Westport	69628	4065	n/a
Pope	Westport (Township of)	69646	n/a	61019
Pope	White Bear Lake (Township of)	69952	n/a	61020
Ramsey	Arden Hills	02026	0110	n/a
Ramsey	Blaine	06382	0370	n/a
Ramsey	Falcon Heights	20420	1245	n/a
Ramsey	Gem Lake	23318	1430	n/a
Ramsey	Lauderdale	35738	2200	n/a
Ramsey	Little Canada	37502	2280	n/a
Ramsey	Maplewood	40382	2455	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Ramsey	Mounds View	44530	2695	n/a
Ramsey	New Brighton	45430	2755	n/a
Ramsey	North Oaks	47104	2860	n/a
Ramsey	Roseville	55852	3290	n/a
Ramsey	Shoreview	59998	3535	n/a
Ramsey	Spring Lake Park	61996	3620	n/a
Ramsey	St Anthony	56680	3360	n/a
Ramsey	St Paul	58000	3425	n/a
Ramsey	Vadnais Heights	66460	3865	n/a
Ramsey	White Bear (Township of)	69916	n/a	62001
Ramsey	White Bear Lake	69970	4090	n/a
Red Lake	Brooks	08038	0475	n/a
Red Lake	Browns Creek (Township of)	08146	n/a	63001
Red Lake	Emardville (Township of)	19196	n/a	63002
Red Lake	Equality (Township of)	19502	n/a	63003
Red Lake	Garnes (Township of)	23174	n/a	63004
Red Lake	Gervais (Township of)	23588	n/a	63005
Red Lake	Lake Pleasant (Township of)	34820	n/a	63006
Red Lake	Lambert (Township of)	35270	n/a	63007
Red Lake	Louisville (Township of)	38276	n/a	63008
Red Lake	Oklee	48202	2920	n/a
Red Lake	Plummer	51712	3100	n/a
Red Lake	Poplar River (Township of)	52000	n/a	63009
Red Lake	Red Lake Falls	53476	3170	n/a
Red Lake	Red Lake Falls (Township of)	53494	n/a	63010
Red Lake	River (Township of)	54538	n/a	63011
Red Lake	Terrebonne (Township of)	64498	n/a	63012
Red Lake	Wylie (Township of)	71986	n/a	63013
Redwood	Belview	05050	0285	n/a
Redwood	Brookville (Township of)	08074	n/a	64001
Redwood	Charlestown (Township of)	10936	n/a	64002
Redwood	Clements	11836	0720	n/a
Redwood	Delhi	15544	0970	n/a
Redwood	Delhi (Township of)	15562	n/a	64003
Redwood	Gales (Township of)	23048	n/a	64004
Redwood	Granite Rock (Township of)	25316	n/a	64005
Redwood	Honner (Township of)	30068	n/a	64006
Redwood	Johnsonville (Township of)	32048	n/a	64007
Redwood	Kintire (Township of)	33434	n/a	64008
Redwood	Lamberton	35288	2160	n/a
Redwood	Lamberton (Township of)	35306	n/a	64009
Redwood	Lucan	38420	2335	n/a
Redwood	Milroy	42362	2575	n/a
Redwood	Morgan	44116	2660	n/a
Redwood	Morgan (Township of)	44134	n/a	64010
Redwood	New Avon (Township of)	45412	n/a	64011

COUNTY	PLACE NAME	FIPS	CITY	TWP
Redwood	North Hero (Township of)	46996	n/a	64012
Redwood	Paxton (Township of)	49894	n/a	64013
Redwood	Redwood Falls	53656	3180	n/a
Redwood	Redwood Falls (Township of)	53674	n/a	64014
Redwood	Revere	53908	3200	n/a
Redwood	Sanborn	58306	3455	n/a
Redwood	Seaforth	59098	3495	n/a
Redwood	Sheridan (Township of)	59656	n/a	64015
Redwood	Sherman (Township of)	59692	n/a	64016
Redwood	Springdale (Township of)	61798	n/a	64017
Redwood	Sundown (Township of)	63526	n/a	64018
Redwood	Swedes Forest (Township of)	63868	n/a	64019
Redwood	Three Lakes (Township of)	64822	n/a	64020
Redwood	Underwood (Township of)	66190	n/a	64021
Redwood	Vail (Township of)	66478	n/a	64022
Redwood	Vesta	66982	3890	n/a
Redwood	Vesta (Township of)	67000	n/a	64023
Redwood	Wabasso	67396	3925	n/a
Redwood	Walnut Grove	67846	3960	n/a
Redwood	Wanda	68008	3980	n/a
Redwood	Waterbury (Township of)	68494	n/a	64024
Redwood	Westline (Township of)	69538	n/a	64025
Redwood	Willow Lake (Township of)	70474	n/a	64026
Renville	Bandon (Township of)	03484	n/a	65001
Renville	Beaver Falls (Township of)	04546	n/a	65002
Renville	Birch Cooley (Township of)	05968	n/a	65003
Renville	Bird Island	06076	0350	n/a
Renville	Bird Island (Township of)	06094	n/a	65004
Renville	Boon Lake (Township of)	06976	n/a	65005
Renville	Brookfield (Township of)	07912	n/a	65006
Renville	Buffalo Lake	08488	0530	n/a
Renville	Cairo (Township of)	09208	n/a	65007
Renville	Camp (Township of)	09478	n/a	65008
Renville	Crooks (Township of)	13852	n/a	65009
Renville	Danube	14716	0900	n/a
Renville	Emmet (Township of)	19322	n/a	65010
Renville	Ericson (Township of)	19628	n/a	65011
Renville	Fairfax	20222	1235	n/a
Renville	Flora (Township of)	21374	n/a	65012
Renville	Franklin	22364	1355	n/a
Renville	Hawk Creek (Township of)	27728	n/a	65013
Renville	Hector	28124	1715	n/a
Renville	Hector (Township of)	28142	n/a	65014
Renville	Henryville (Township of)	28610	n/a	65015
Renville	Kingman (Township of)	33290	n/a	65016
Renville	Martinsburg (Township of)	40832	n/a	65017

COUNTY	PLACE NAME	FIPS	CITY	TWP
Renville	Melville (Township of)	41624	n/a	65018
Renville	Morton	44368	2680	n/a
Renville	Norfolk (Township of)	46600	n/a	65019
Renville	Olivia	48256	2925	n/a
Renville	Osceola (Township of)	48868	n/a	65020
Renville	Palmyra (Township of)	49606	n/a	65021
Renville	Preston Lake (Township of)	52486	n/a	65022
Renville	Redwood Falls	53656	3180	n/a
Renville	Renville	53890	3195	n/a
Renville	Sacred Heart	56572	3350	n/a
Renville	Sacred Heart (Township of)	56590	n/a	65023
Renville	Troy (Township of)	65632	n/a	65024
Renville	Wang (Township of)	68026	n/a	65025
Renville	Wellington (Township of)	69088	n/a	65026
Renville	Winfield (Township of)	70852	n/a	65027
Rice	Bridgewater (Township of)	07714	n/a	66001
Rice	Cannon City (Township of)	09712	n/a	66002
Rice	Dennison	15706	0985	n/a
Rice	Dundas	17126	1050	n/a
Rice	Erin (Township of)	19682	n/a	66003
Rice	Faribault	20546	1250	n/a
Rice	Forest (Township of)	21680	n/a	66004
Rice	Lonsdale	38150	2315	n/a
Rice	Morristown	44296	2675	n/a
Rice	Morristown (Township of)	44314	n/a	66005
Rice	Nerstrand	45196	2740	n/a
Rice	Northfield	46924	2850	n/a
Rice	Northfield (Township of)	46942	n/a	66006
Rice	Richland (Township of)	54250	n/a	66007
Rice	Shieldsville (Township of)	59854	n/a	66008
Rice	Walcott (Township of)	67666	n/a	66009
Rice	Warsaw (Township of)	68278	n/a	66010
Rice	Webster (Township of)	68962	n/a	66011
Rice	Wells (Township of)	69124	n/a	66012
Rice	Wheatland (Township of)	69826	n/a	66013
Rice	Wheeling (Township of)	69862	n/a	66014
Rock	Battle Plain (Township of)	03988	n/a	67001
Rock	Beaver Creek	04492	0245	n/a
Rock	Beaver Creek (Township of)	04510	n/a	67002
Rock	Clinton (Township of)	11998	n/a	67003
Rock	Denver (Township of)	15742	n/a	67004
Rock	Hardwick	27116	1670	n/a
Rock	Hills	29204	1780	n/a
Rock	Jasper	31760	1940	n/a
Rock	Kanaranzi (Township of)	32336	n/a	67005
Rock	Kenneth	32750	2010	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Rock	Luverne	38564	2340	n/a
Rock	Luverne (Township of)	38582	n/a	67006
Rock	Magnolia	39338	2395	n/a
Rock	Magnolia (Township of)	39356	n/a	67007
Rock	Martin (Township of)	40796	n/a	67008
Rock	Mound (Township of)	44494	n/a	67009
Rock	Rose Dell (Township of)	55654	n/a	67010
Rock	Springwater (Township of)	62140	n/a	67011
Rock	Steen	62662	3655	n/a
Rock	Vienna (Township of)	67072	n/a	67012
Roseau	Badger	03160	0175	n/a
Roseau	Barnett (Township of)	03610	n/a	68001
Roseau	Barto (Township of)	03808	n/a	68002
Roseau	Beaver (Township of)	04420	n/a	68003
Roseau	Cedarbend (Township of)	10414	n/a	68005
Roseau	Deer (Township of)	15166	n/a	68006
Roseau	Dewey (Township of)	15868	n/a	68007
Roseau	Dieter (Township of)	15958	n/a	68008
Roseau	Enstrom (Township of)	19466	n/a	68009
Roseau	Falun (Township of)	20492	n/a	68010
Roseau	Golden Valley (Township of)	24326	n/a	68011
Roseau	Greenbush	25604	1560	n/a
Roseau	Grimstad (Township of)	26036	n/a	68012
Roseau	Hereim (Township of)	28628	n/a	68013
Roseau	Huss (Township of)	30626	n/a	68014
Roseau	Jadis (Township of)	31634	n/a	68015
Roseau	Lake (Township of)	34010	n/a	68037
Roseau	Laona (Township of)	35594	n/a	68016
Roseau	Lind (Township of)	37196	n/a	68017
Roseau	Malung (Township of)	39644	n/a	68018
Roseau	Mickinock (Township of)	41894	n/a	68019
Roseau	Moose (Township of)	43900	n/a	68020
Roseau	Moranville (Township of)	44080	n/a	68021
Roseau	Nereson (Township of)	45178	n/a	68022
Roseau	Palmville (Township of)	49588	n/a	68023
Roseau	Pohlitz (Township of)	51748	n/a	68024
Roseau	Polonia (Township of)	51820	n/a	68025
Roseau	Poplar Grove (Township of)	51982	n/a	68026
Roseau	Reine (Township of)	53728	n/a	68027
Roseau	Roosevelt	55438	3265	n/a
Roseau	Roseau	55546	3275	n/a
Roseau	Ross (Township of)	55942	n/a	68028
Roseau	Skagen (Township of)	60610	n/a	68029
Roseau	Soler (Township of)	61096	n/a	68030
Roseau	Spruce (Township of)	62158	n/a	68031
Roseau	Stafford (Township of)	62338	n/a	68032

COUNTY	PLACE NAME	FIPS	CITY	TWP
Roseau	Stokes (Township of)	62932	n/a	68033
Roseau	Strathcona	63130	3700	n/a
Roseau	Warroad	68224	3995	n/a
Scott	Belle Plaine	04834	0270	n/a
Scott	Belle Plaine (Township of)	04852	n/a	70001
Scott	Cedar Lake (Township of)	10450	n/a	70003
Scott	Credit River (Township of)	13726	n/a	70004
Scott	Elko New Market	18662	1140	n/a
Scott	Helena (Township of)	28322	n/a	70005
Scott	Jackson (Township of)	31580	n/a	70006
Scott	Jordan	32174	1960	n/a
Scott	Louisville (Township of)	38294	n/a	70007
Scott	New Market (Township of)	45754	n/a	70008
Scott	New Prague	45808	2795	n/a
Scott	Prior Lake	52594	3130	n/a
Scott	Sand Creek (Township of)	58324	n/a	70010
Scott	Savage	58738	3485	n/a
Scott	Shakopee	59350	3515	n/a
Scott	Spring Lake (Township of)	61978	n/a	70011
Scott	St Lawrence (Township of)	57184	n/a	70009
Sherburne	Baldwin (Township of)	03286	n/a	71001
Sherburne	Becker	04618	0250	n/a
Sherburne	Becker (Township of)	04636	n/a	71002
Sherburne	Big Lake	05752	0335	n/a
Sherburne	Big Lake (Township of)	05770	n/a	71003
Sherburne	Blue Hill (Township of)	06742	n/a	71004
Sherburne	Clear Lake	11764	0710	n/a
Sherburne	Clear Lake (Township of)	11782	n/a	71005
Sherburne	Elk River	18674	1145	n/a
Sherburne	Haven (Township of)	27674	n/a	71007
Sherburne	Livonia (Township of)	37754	n/a	71008
Sherburne	Orrock (Township of)	48670	n/a	71009
Sherburne	Palmer (Township of)	49534	n/a	71010
Sherburne	Princeton	52522	3120	n/a
Sherburne	Santiago (Township of)	58522	n/a	71011
Sherburne	St Cloud	56896	3380	n/a
Sherburne	Zimmerman	72238	4222	n/a
Sibley	Alfsborg (Township of)	00982	n/a	72001
Sibley	Arlington	02152	0120	n/a
Sibley	Arlington (Township of)	02170	n/a	72002
Sibley	Bismarck (Township of)	06130	n/a	72003
Sibley	Cornish (Township of)	13348	n/a	72004
Sibley	Dryden (Township of)	16426	n/a	72005
Sibley	Faxon (Township of)	20726	n/a	72006
Sibley	Gaylord	23300	1425	n/a
Sibley	Gibbon	23678	1455	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Sibley	Grafton (Township of)	24794	n/a	72007
Sibley	Green Isle	25658	1570	n/a
Sibley	Green Isle (Township of)	25676	n/a	72008
Sibley	Henderson	28394	1725	n/a
Sibley	Henderson (Township of)	28412	n/a	72009
Sibley	Jessenland (Township of)	31922	n/a	72010
Sibley	Kelso (Township of)	32714	n/a	72011
Sibley	Le Sueur	36746	2235	n/a
Sibley	Moltke (Township of)	43612	n/a	72012
Sibley	New Auburn	45376	2750	n/a
Sibley	New Auburn (Township of)	45394	n/a	72013
Sibley	Severance (Township of)	59242	n/a	72014
Sibley	Sibley (Township of)	60124	n/a	18028
Sibley	Transit (Township of)	65380	n/a	72016
Sibley	Washington Lake (Township of)	68368	n/a	72017
Sibley	Winthrop	71122	4155	n/a
St Louis	Alango (Township of)	00568	n/a	69001
St Louis	Alborn (Township of)	00820	n/a	69002
St Louis	Alden (Township of)	00874	n/a	69003
St Louis	Angora (Township of)	01612	n/a	69004
St Louis	Arrowhead (Township of)	02278	n/a	69005
St Louis	Ault (Township of)	02818	n/a	69006
St Louis	Aurora	02872	0145	n/a
St Louis	Babbitt	03106	0165	n/a
St Louis	Balkan (Township of)	03322	n/a	69007
St Louis	Bassett (Township of)	03880	n/a	69008
St Louis	Beatty (Township of)	04294	n/a	69009
St Louis	Biwabik	06148	0360	n/a
St Louis	Biwabik (Township of)	06166	n/a	69010
St Louis	Breitung (Township of)	07534	n/a	69011
St Louis	Brevator (Township of)	07606	n/a	69012
St Louis	Brookston	08056	0480	n/a
St Louis	Buhl	08524	0535	n/a
St Louis	Canosia (Township of)	09784	n/a	69013
St Louis	Cedar Valley (Township of)	10540	n/a	69014
St Louis	Cherry (Township of)	11134	n/a	69015
St Louis	Chisholm	11386	0665	n/a
St Louis	Clinton (Township of)	12016	n/a	69016
St Louis	Colvin (Township of)	12736	n/a	69017
St Louis	Cook	13006	0810	n/a
St Louis	Cotton (Township of)	13528	n/a	69018
St Louis	Culver (Township of)	14284	n/a	69019
St Louis	Duluth	17000	1040	n/a
St Louis	Duluth (Township of)	17018	n/a	69020
St Louis	Elmer (Township of)	18944	n/a	69022
St Louis	Ely	19142	1180	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
St Louis	Embarrass (Township of)	19232	n/a	69023
St Louis	Eveleth	19934	1220	n/a
St Louis	Fairbanks (Township of)	20186	n/a	69024
St Louis	Fayal (Township of)	20762	n/a	69025
St Louis	Field (Township of)	20996	n/a	69026
St Louis	Fine Lakes (Township of)	21086	n/a	69027
St Louis	Floodwood	21338	1305	n/a
St Louis	Floodwood (Township of)	21356	n/a	69028
St Louis	Fredenberg (Township of)	22508	n/a	69029
St Louis	French (Township of)	22724	n/a	69030
St Louis	Gilbert	23714	1460	n/a
St Louis	Gnesen (Township of)	24218	n/a	69031
St Louis	Grand Lake (Township of)	24956	n/a	69032
St Louis	Great Scott (Township of)	25550	n/a	69033
St Louis	Greenwood (Township of)	25928	n/a	69035
St Louis	Halden (Township of)	26522	n/a	69034
St Louis	Hermantown	28682	1752	n/a
St Louis	Hibbing	28790	1765	n/a
St Louis	Hoyt Lakes	30302	1850	n/a
St Louis	Industrial (Township of)	30932	n/a	69036
St Louis	Iron Junction	31238	1895	n/a
St Louis	Kelsey (Township of)	32696	n/a	69037
St Louis	Kinney	33416	2065	n/a
St Louis	Kugler (Township of)	33794	n/a	69038
St Louis	Lakewood (Township of)	35234	n/a	69039
St Louis	Lavell (Township of)	35774	n/a	69040
St Louis	Leiding (Township of)	36332	n/a	69041
St Louis	Leonidas	36530	2220	n/a
St Louis	Linden Grove (Township of)	37250	n/a	69042
St Louis	McDavitt (Township of)	38960	n/a	69043
St Louis	McKinley	39140	2370	n/a
St Louis	Meadowlands	41372	2495	n/a
St Louis	Meadowlands (Township of)	41390	n/a	69044
St Louis	Midway (Township of)	42056	n/a	69045
St Louis	Morcom (Township of)	44098	n/a	69047
St Louis	Morse (Township of)	44350	n/a	69048
St Louis	Mountain Iron	44548	2700	n/a
St Louis	Ness (Township of)	45232	n/a	69049
St Louis	New Independence (Township of)	45664	n/a	69050
St Louis	Normanna (Township of)	46708	n/a	69052
St Louis	North Star (Township of)	47255	n/a	69071
St Louis	Northland (Township of)	47050	n/a	69053
St Louis	Orr	48634	2945	n/a
St Louis	Owens (Township of)	49336	n/a	69054
St Louis	Pequaywan (Township of)	50389	n/a	69072
St Louis	Pike (Township of)	50830	n/a	69055

COUNTY	PLACE NAME	FIPS	CITY	TWP
St Louis	Portage (Township of)	52090	n/a	69056
St Louis	Prairie Lake (Township of)	52306	n/a	69057
St Louis	Proctor	52630	3135	n/a
St Louis	Rice Lake (Township of)	54060	n/a	69058
St Louis	Sandy (Township of)	58450	n/a	69059
St Louis	Solway (Township of)	61132	n/a	69060
St Louis	Stoney Brook (Township of)	62968	n/a	69061
St Louis	Sturgeon (Township of)	63202	n/a	69063
St Louis	Toivola (Township of)	65146	n/a	69064
St Louis	Tower	65272	3780	n/a
St Louis	Van Buren (Township of)	66586	n/a	69065
St Louis	Vermilion Lake (Township of)	66784	n/a	69066
St Louis	Virginia	67288	3915	n/a
St Louis	Waasa (Township of)	67342	n/a	69067
St Louis	White (Township of)	69898	n/a	69068
St Louis	Willow Valley (Township of)	70510	n/a	69069
St Louis	Winton	71140	4160	n/a
St Louis	Wuori (Township of)	71869	n/a	69070
Stearns	Albany	00622	0035	n/a
Stearns	Albany (Township of)	00640	n/a	73001
Stearns	Ashley (Township of)	02530	n/a	73002
Stearns	Avon	03070	0160	n/a
Stearns	Avon (Township of)	03088	n/a	73003
Stearns	Belgrade	04762	0260	n/a
Stearns	Brockway (Township of)	07840	n/a	73004
Stearns	Brooten	08092	0485	n/a
Stearns	Clearwater	11800	0715	n/a
Stearns	Cold Spring	12484	0775	n/a
Stearns	Collegeville (Township of)	12592	n/a	73005
Stearns	Crow Lake (Township of)	14032	n/a	73006
Stearns	Crow River (Township of)	14086	n/a	73007
Stearns	Eden Lake (Township of)	18098	n/a	73008
Stearns	Eden Valley	18134	1095	n/a
Stearns	Elrosa	19088	1175	n/a
Stearns	Farming (Township of)	20600	n/a	73010
Stearns	Freeport	22652	1380	n/a
Stearns	Getty (Township of)	23606	n/a	73011
Stearns	Greenwald	25874	1575	n/a
Stearns	Grove (Township of)	26090	n/a	73012
Stearns	Holding (Township of)	29564	n/a	73013
Stearns	Holdingford	29582	1810	n/a
Stearns	Kimball	33164	2055	n/a
Stearns	Krain (Township of)	33722	n/a	73014
Stearns	Lake George (Township of)	34406	n/a	73015
Stearns	Lake Henry	34478	2115	n/a
Stearns	Lake Henry (Township of)	34496	n/a	73016

COUNTY	PLACE NAME	FIPS	CITY	TWP
Stearns	Le Sauk (Township of)	36656	n/a	73017
Stearns	Luxemburg (Township of)	38618	n/a	73018
Stearns	Lynden (Township of)	38780	n/a	73019
Stearns	Meire Grove	41534	2515	n/a
Stearns	Melrose	41570	2520	n/a
Stearns	Melrose (Township of)	41588	n/a	73021
Stearns	Millwood (Township of)	42308	n/a	73022
Stearns	Munson (Township of)	44800	n/a	73023
Stearns	New Munich	45772	2785	n/a
Stearns	North Fork (Township of)	46960	n/a	73024
Stearns	Oak (Township of)	47644	n/a	73025
Stearns	Paynesville	49966	3000	n/a
Stearns	Paynesville (Township of)	49984	n/a	73026
Stearns	Raymond (Township of)	53314	n/a	73027
Stearns	Richmond	54268	3215	n/a
Stearns	Rockville	55078	3245	n/a
Stearns	Roscoe	55510	3270	n/a
Stearns	Sartell	58612	3470	n/a
Stearns	Sauk Centre	58648	3475	n/a
Stearns	Sauk Centre (Township of)	58666	n/a	73034
Stearns	Spring Hill	61888	3615	n/a
Stearns	Spring Hill (Township of)	61906	n/a	73035
Stearns	St Anthony	56698	3362	n/a
Stearns	St Augusta	56724	3363	n/a
Stearns	St Cloud	56896	3380	n/a
Stearns	St Joseph	57130	3395	n/a
Stearns	St Joseph (Township of)	57148	n/a	73031
Stearns	St Martin	57238	3410	n/a
Stearns	St Martin (Township of)	57256	n/a	73032
Stearns	St Rosa	58072	3440	n/a
Stearns	St Stephen	58090	3445	n/a
Stearns	St Wendel (Township of)	58198	n/a	73033
Stearns	Waite Park	67612	3945	n/a
Stearns	Wakefield (Township of)	67630	n/a	73036
Stearns	Zion (Township of)	72256	n/a	73037
Steele	Aurora (Township of)	02890	n/a	74001
Steele	Berlin (Township of)	05374	n/a	74002
Steele	Blooming Prairie	06580	0380	n/a
Steele	Blooming Prairie (Township of)	06598	n/a	74003
Steele	Clinton Falls (Township of)	12052	n/a	74004
Steele	Deerfield (Township of)	15256	n/a	74005
Steele	Ellendale	18746	1155	n/a
Steele	Havana (Township of)	27638	n/a	74006
Steele	Lemond (Township of)	36386	n/a	74007
Steele	Medford	41426	2500	n/a
Steele	Medford (Township of)	41444	n/a	74008

COUNTY	PLACE NAME	FIPS	CITY	TWP
Steele	Meriden (Township of)	41750	n/a	74009
Steele	Merton (Township of)	41840	n/a	74010
Steele	Owatonna	49300	2980	n/a
Steele	Owatonna (Township of)	49318	n/a	74011
Steele	Somerset (Township of)	61150	n/a	74012
Steele	Summit (Township of)	63364	n/a	74013
Stevens	Alberta	00676	0040	n/a
Stevens	Baker (Township of)	03232	n/a	75001
Stevens	Chokio	11440	0670	n/a
Stevens	Darnen (Township of)	14824	n/a	75002
Stevens	Donnelly	16084	1020	n/a
Stevens	Donnelly (Township of)	16102	n/a	75003
Stevens	Eldorado (Township of)	18494	n/a	75004
Stevens	Everglade (Township of)	19970	n/a	75005
Stevens	Framnas (Township of)	22274	n/a	75006
Stevens	Hancock	26936	1645	n/a
Stevens	Hodges (Township of)	29438	n/a	75007
Stevens	Horton (Township of)	30212	n/a	75008
Stevens	Moore (Township of)	43846	n/a	75009
Stevens	Morris	44242	2670	n/a
Stevens	Morris (Township of)	44260	n/a	75010
Stevens	Pepperton (Township of)	50380	n/a	75011
Stevens	Rendsville (Township of)	53818	n/a	75012
Stevens	Scott (Township of)	59044	n/a	75013
Stevens	Stevens (Township of)	62752	n/a	75014
Stevens	Swan Lake (Township of)	63724	n/a	75015
Stevens	Synnes (Township of)	63976	n/a	75016
Swift	Appleton	01864	0100	n/a
Swift	Appleton (Township of)	01882	n/a	76001
Swift	Benson	05212	0300	n/a
Swift	Benson (Township of)	05230	n/a	76002
Swift	Camp Lake (Township of)	09532	n/a	76003
Swift	Cashel (Township of)	10216	n/a	76004
Swift	Clontarf	12124	0745	n/a
Swift	Clontarf (Township of)	12142	n/a	76005
Swift	Danvers	14734	0905	n/a
Swift	De Graff	15418	0955	n/a
Swift	Dublin (Township of)	16444	n/a	76006
Swift	Edison (Township of)	18206	n/a	76007
Swift	Fairfield (Township of)	20258	n/a	76008
Swift	Hayes (Township of)	27854	n/a	76009
Swift	Hegbert (Township of)	28160	n/a	76010
Swift	Holloway	29672	1825	n/a
Swift	Kerkhoven	32876	2030	n/a
Swift	Kerkhoven (Township of)	32894	n/a	76011
Swift	Kildare (Township of)	33092	n/a	76012

COUNTY	PLACE NAME	FIPS	CITY	TWP
Swift	Marysland (Township of)	40904	n/a	76013
Swift	Moyer (Township of)	44674	n/a	76014
Swift	Murdock	44818	2710	n/a
Swift	Pillsbury (Township of)	50920	n/a	76015
Swift	Shible (Township of)	59818	n/a	76016
Swift	Six Mile Grove (Township of)	60592	n/a	76017
Swift	Swenoda (Township of)	63904	n/a	76018
Swift	Tara (Township of)	64228	n/a	76019
Swift	Torning (Township of)	65236	n/a	76020
Swift	West Bank (Township of)	69214	n/a	76021
Todd	Bartlett (Township of)	03790	n/a	77001
Todd	Bertha	05482	0310	n/a
Todd	Bertha (Township of)	05500	n/a	77002
Todd	Birchdale (Township of)	06022	n/a	77003
Todd	Browerville	08110	0490	n/a
Todd	Bruce (Township of)	08272	n/a	77004
Todd	Burleene (Township of)	08668	n/a	77005
Todd	Burtrum	08902	0540	n/a
Todd	Clarissa	11602	0690	n/a
Todd	Eagle Bend	17342	1065	n/a
Todd	Eagle Valley (Township of)	17450	n/a	77007
Todd	Fawn Lake (Township of)	20708	n/a	77008
Todd	Germania (Township of)	23552	n/a	77009
Todd	Gordon (Township of)	24578	n/a	77010
Todd	Grey Eagle	26000	1585	n/a
Todd	Grey Eagle (Township of)	26018	n/a	77011
Todd	Hartford (Township of)	27368	n/a	77012
Todd	Hewitt	28754	1760	n/a
Todd	Iona (Township of)	31130	n/a	77013
Todd	Kandota (Township of)	32408	n/a	77014
Todd	Leslie (Township of)	36674	n/a	77015
Todd	Little Elk (Township of)	37538	n/a	77016
Todd	Little Sauk (Township of)	37718	n/a	77017
Todd	Long Prairie	38060	2305	n/a
Todd	Long Prairie (Township of)	38078	n/a	77018
Todd	Moran (Township of)	44062	n/a	77019
Todd	Osakis	48796	2955	n/a
Todd	Reynolds (Township of)	53926	n/a	77020
Todd	Round Prairie (Township of)	56122	n/a	77021
Todd	Staples	62446	3645	n/a
Todd	Staples (Township of)	62464	n/a	77022
Todd	Stowe Prairie (Township of)	63058	n/a	77023
Todd	Swanville	63778	3720	n/a
Todd	Turtle Creek (Township of)	65740	n/a	77024
Todd	Villard (Township of)	67162	n/a	77025
Todd	Ward (Township of)	68098	n/a	77026

COUNTY	PLACE NAME	FIPS	CITY	TWP
Todd	West Union	69736	4075	n/a
Todd	West Union (Township of)	69754	n/a	77027
Todd	Wykeham (Township of)	71932	n/a	77028
Traverse	Arthur (Township of)	02314	n/a	78001
Traverse	Browns Valley	08200	0500	n/a
Traverse	Clifton (Township of)	11944	n/a	78002
Traverse	Croke (Township of)	13762	n/a	78003
Traverse	Dollymount (Township of)	16012	n/a	78004
Traverse	Dumont	17090	1045	n/a
Traverse	Folsom (Township of)	21554	n/a	78005
Traverse	Lake Valley (Township of)	35126	n/a	78006
Traverse	Leonardsville (Township of)	36512	n/a	78007
Traverse	Monson (Township of)	43684	n/a	78008
Traverse	Parnell (Township of)	49858	n/a	78009
Traverse	Redpath (Township of)	53548	n/a	78010
Traverse	Tara (Township of)	64246	n/a	78011
Traverse	Taylor (Township of)	64300	n/a	78012
Traverse	Tintah	64948	3770	n/a
Traverse	Tintah (Township of)	64966	n/a	78013
Traverse	Walls (Township of)	67828	n/a	78014
Traverse	Wheaton	69844	4085	n/a
Traverse	Windsor (Township of)	70834	n/a	78015
Wabasha	Bellechester	04798	0265	n/a
Wabasha	Chester (Township of)	11242	n/a	79001
Wabasha	Elgin	18530	1130	n/a
Wabasha	Elgin (Township of)	18548	n/a	79002
Wabasha	Gillford (Township of)	23786	n/a	79003
Wabasha	Glasgow (Township of)	23894	n/a	79004
Wabasha	Greenfield (Township of)	25640	n/a	79005
Wabasha	Hammond	26828	1635	n/a
Wabasha	Highland (Township of)	28952	n/a	79006
Wabasha	Hyde Park (Township of)	30680	n/a	79007
Wabasha	Kellogg	32642	1995	n/a
Wabasha	Lake (Township of)	34028	n/a	79008
Wabasha	Lake City	34172	2091	n/a
Wabasha	Mazeppa	41282	2490	n/a
Wabasha	Mazeppa (Township of)	41300	n/a	79009
Wabasha	Millville	42290	2570	n/a
Wabasha	Minneiska	43036	2590	n/a
Wabasha	Minneiska (Township of)	43054	n/a	79010
Wabasha	Mount Pleasant (Township of)	44620	n/a	79011
Wabasha	Oakwood (Township of)	48022	n/a	79012
Wabasha	Pepin (Township of)	50362	n/a	79013
Wabasha	Plainview	51424	3085	n/a
Wabasha	Plainview (Township of)	51442	n/a	79014
Wabasha	Wabasha	67378	3920	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Wabasha	Watopa (Township of)	68638	n/a	79015
Wabasha	West Albany (Township of)	69178	n/a	79016
Wabasha	Zumbro (Township of)	72292	n/a	79017
Wabasha	Zumbro Falls	72310	4225	n/a
Wadena	Aldrich	00892	0060	n/a
Wadena	Aldrich (Township of)	00910	n/a	80001
Wadena	Blueberry (Township of)	06670	n/a	80002
Wadena	Bullard (Township of)	08542	n/a	80003
Wadena	Leaf River (Township of)	36026	n/a	80005
Wadena	Lyons (Township of)	38852	n/a	80006
Wadena	Meadow (Township of)	41336	n/a	80007
Wadena	Menahga	41660	2525	n/a
Wadena	Nimrod	46294	2830	n/a
Wadena	North Germany (Township of)	46978	n/a	80008
Wadena	Orton (Township of)	48688	n/a	80009
Wadena	Red Eye (Township of)	53422	n/a	80010
Wadena	Rockwood (Township of)	55150	n/a	80011
Wadena	Sebeka	59152	3500	n/a
Wadena	Shell River (Township of)	59530	n/a	80012
Wadena	Staples	62446	3645	n/a
Wadena	Thomastown (Township of)	64624	n/a	80013
Wadena	Verndale	66874	3880	n/a
Wadena	Wadena	67504	3935	n/a
Wadena	Wadena (Township of)	67522	n/a	80014
Wadena	Wing River (Township of)	70906	n/a	80015
Waseca	Alton (Township of)	01198	n/a	81001
Waseca	Blooming Grove (Township of)	06562	n/a	81002
Waseca	Byron (Township of)	09172	n/a	81003
Waseca	Elysian	19160	1185	n/a
Waseca	Freedom (Township of)	22598	n/a	81004
Waseca	Iosco (Township of)	31166	n/a	81005
Waseca	Janesville	31706	1935	n/a
Waseca	Janesville (Township of)	31724	n/a	81006
Waseca	New Richland	45862	2800	n/a
Waseca	New Richland (Township of)	45880	n/a	81007
Waseca	Otisco (Township of)	49084	n/a	81008
Waseca	St Mary (Township of)	57274	n/a	81009
Waseca	Vivian (Township of)	67324	n/a	81010
Waseca	Waldorf	67756	3950	n/a
Waseca	Waseca	68296	4000	n/a
Waseca	Wilton (Township of)	70744	n/a	81011
Waseca	Woodville (Township of)	71698	n/a	81012
Washington	Afton	00316	0020	n/a
Washington	Bayport	04114	0230	n/a
Washington	Baytown (Township of)	04132	n/a	82001
Washington	Birchwood Village	06058	0345	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Washington	Cottage Grove	13456	0837	n/a
Washington	Dellwood	15616	0975	n/a
Washington	Denmark (Township of)	15688	n/a	82002
Washington	Forest Lake	21770	1325	n/a
Washington	Grant	25334	1553	n/a
Washington	Grey Cloud Island (Township of)	25982	n/a	82005
Washington	Hastings	27530	1686	n/a
Washington	Hugo	30392	1855	n/a
Washington	Lake Elmo	34244	2100	n/a
Washington	Lakeland	34622	2120	n/a
Washington	Lakeland Shores	34658	2125	n/a
Washington	Landfall	35414	2170	n/a
Washington	Mahtomedi	39428	2405	n/a
Washington	May (Township of)	41120	n/a	82007
Washington	Newport	45790	2790	n/a
Washington	Oak Park Heights	47914	2890	n/a
Washington	Oakdale	47680	2888	n/a
Washington	Pine Springs	51316	3075	n/a
Washington	Scandia	58900	3487	n/a
Washington	St Marys Point	57292	3415	n/a
Washington	St Paul Park	58018	3430	n/a
Washington	Stillwater	62824	3675	n/a
Washington	Stillwater (Township of)	62842	n/a	82010
Washington	West Lakeland (Township of)	69520	n/a	82011
Washington	White Bear Lake	69970	4090	n/a
Washington	Willernie	70366	4100	n/a
Washington	Woodbury	71428	4173	n/a
Watonwan	Adrian (Township of)	00280	n/a	83001
Watonwan	Antrim (Township of)	01810	n/a	83002
Watonwan	Butterfield	08992	0545	n/a
Watonwan	Butterfield (Township of)	09010	n/a	83003
Watonwan	Darfur	14770	0910	n/a
Watonwan	Fieldon (Township of)	21014	n/a	83004
Watonwan	La Salle	35702	2190	n/a
Watonwan	Lewisville	36818	2245	n/a
Watonwan	Long Lake (Township of)	38024	n/a	83005
Watonwan	Madelia	39230	2380	n/a
Watonwan	Madelia (Township of)	39248	n/a	83006
Watonwan	Nelson (Township of)	45124	n/a	83007
Watonwan	Odin	48094	2900	n/a
Watonwan	Odin (Township of)	48112	n/a	83008
Watonwan	Ormsby	48562	2935	n/a
Watonwan	Riverdale (Township of)	54556	n/a	83009
Watonwan	Rosendale (Township of)	55780	n/a	83010
Watonwan	South Branch (Township of)	61276	n/a	83012
Watonwan	St James	57040	3390	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Watonwan	St James (Township of)	57058	n/a	83011
Wilkin	Akron (Township of)	00550	n/a	84001
Wilkin	Andrea (Township of)	01522	n/a	84002
Wilkin	Atherton (Township of)	02620	n/a	84003
Wilkin	Bradford (Township of)	07264	n/a	84004
Wilkin	Brandrup (Township of)	07372	n/a	84005
Wilkin	Breckenridge	07462	0445	n/a
Wilkin	Breckenridge (Township of)	07480	n/a	84006
Wilkin	Campbell	09496	0575	n/a
Wilkin	Campbell (Township of)	09514	n/a	84007
Wilkin	Champion (Township of)	10828	n/a	84008
Wilkin	Connelly (Township of)	12970	n/a	84009
Wilkin	Deerhorn (Township of)	15274	n/a	84010
Wilkin	Doran	16156	1025	n/a
Wilkin	Foxhome	22202	1350	n/a
Wilkin	Foxhome (Township of)	22220	n/a	84011
Wilkin	Kent	32786	2020	n/a
Wilkin	Manston (Township of)	39968	n/a	84013
Wilkin	Meadows (Township of)	41408	n/a	84014
Wilkin	Mitchell (Township of)	43522	n/a	84015
Wilkin	Nashua	44944	2720	n/a
Wilkin	Nilsen (Township of)	46276	n/a	84016
Wilkin	Nordick (Township of)	46528	n/a	84017
Wilkin	Prairie View (Township of)	52324	n/a	84018
Wilkin	Roberts (Township of)	54826	n/a	84019
Wilkin	Rothsay	56014	3295	n/a
Wilkin	Sunnyside (Township of)	63562	n/a	84020
Wilkin	Tanberg (Township of)	64174	n/a	84021
Wilkin	Tenney	64426	3750	n/a
Wilkin	Wolverton	71392	4170	n/a
Wilkin	Wolverton (Township of)	71410	n/a	84022
Winona	Altura	01234	0075	n/a
Winona	Dakota	14518	0890	n/a
Winona	Dresbach (Township of)	16408	n/a	85001
Winona	Elba	18386	1120	n/a
Winona	Elba (Township of)	18404	n/a	85002
Winona	Fremont (Township of)	22688	n/a	85003
Winona	Goodview	24524	1520	n/a
Winona	Hart (Township of)	27350	n/a	85004
Winona	Hillsdale (Township of)	29222	n/a	85005
Winona	Homer (Township of)	30032	n/a	85006
Winona	La Crescent	33866	2070	n/a
Winona	Lewiston	36800	2240	n/a
Winona	Minneiska	43036	2590	n/a
Winona	Minnesota City	43144	2600	n/a
Winona	Mount Vernon (Township of)	44656	n/a	85007

COUNTY	PLACE NAME	FIPS	CITY	TWP
Winona	New Hartford (Township of)	45592	n/a	85008
Winona	Norton (Township of)	47374	n/a	85009
Winona	Pleasant Hill (Township of)	51568	n/a	85010
Winona	Richmond (Township of)	54286	n/a	85011
Winona	Rollingstone	55276	3255	n/a
Winona	Saratoga (Township of)	58558	n/a	85014
Winona	St Charles	56788	3370	n/a
Winona	St Charles (Township of)	56806	n/a	85013
Winona	Stockton	62896	3685	n/a
Winona	Utica	66424	3860	n/a
Winona	Utica (Township of)	66442	n/a	85015
Winona	Warren (Township of)	68188	n/a	85016
Winona	Whitewater (Township of)	70168	n/a	85017
Winona	Wilson (Township of)	70690	n/a	85018
Winona	Winona	71032	4145	n/a
Winona	Wiscoy (Township of)	71230	n/a	85020
Wright	Albertville	00730	0050	n/a
Wright	Albion (Township of)	00766	n/a	86001
Wright	Annandale	01684	0090	n/a
Wright	Buffalo	08452	0525	n/a
Wright	Buffalo (Township of)	08470	n/a	86002
Wright	Chatham (Township of)	11062	n/a	86003
Wright	Clearwater	11800	0715	n/a
Wright	Clearwater (Township of)	11818	n/a	86004
Wright	Cokato	12430	0770	n/a
Wright	Cokato (Township of)	12448	n/a	86005
Wright	Corinna (Township of)	13222	n/a	86006
Wright	Dayton	15022	0930	n/a
Wright	Delano	15454	0960	n/a
Wright	Franklin (Township of)	22400	n/a	86008
Wright	French Lake (Township of)	22760	n/a	86009
Wright	Hanover	26990	1655	n/a
Wright	Howard Lake	30284	1845	n/a
Wright	Maple Lake	40220	2435	n/a
Wright	Maple Lake (Township of)	40238	n/a	86010
Wright	Marysville (Township of)	40940	n/a	86011
Wright	Middleville (Township of)	41966	n/a	86012
Wright	Monticello	43774	2635	n/a
Wright	Monticello (Township of)	43792	n/a	86013
Wright	Montrose	43810	2640	n/a
Wright	Otsego	49138	2972	n/a
Wright	Rockford	55006	3240	n/a
Wright	Rockford (Township of)	55024	n/a	86015
Wright	Silver Creek (Township of)	60340	n/a	86016
Wright	South Haven	61402	3585	n/a
Wright	St Michael	57346	3420	n/a

COUNTY	PLACE NAME	FIPS	CITY	TWP
Wright	Stockholm (Township of)	62878	n/a	86018
Wright	Victor (Township of)	67018	n/a	86019
Wright	Waverly	68764	4030	n/a
Wright	Woodland (Township of)	71554	n/a	86020
Yellow Medicine	Burton (Township of)	08884	n/a	87001
Yellow Medicine	Canby	09604	0580	n/a
Yellow Medicine	Clarkfield	11656	0695	n/a
Yellow Medicine	Echo	17900	1090	n/a
Yellow Medicine	Echo (Township of)	17918	n/a	87002
Yellow Medicine	Florida (Township of)	21464	n/a	87003
Yellow Medicine	Fortier (Township of)	21914	n/a	87004
Yellow Medicine	Friendship (Township of)	22832	n/a	87005
Yellow Medicine	Granite Falls	25280	1550	n/a
Yellow Medicine	Hammer (Township of)	26792	n/a	87006
Yellow Medicine	Hanley Falls	26972	1650	n/a
Yellow Medicine	Hazel Run	28016	1710	n/a
Yellow Medicine	Hazel Run (Township of)	28034	n/a	87007
Yellow Medicine	Lisbon (Township of)	37394	n/a	87008
Yellow Medicine	Minnesota Falls (Township of)	43180	n/a	87009
Yellow Medicine	Norman (Township of)	46636	n/a	87010
Yellow Medicine	Normania (Township of)	46690	n/a	87011
Yellow Medicine	Omro (Township of)	48292	n/a	87012
Yellow Medicine	Oshkosh (Township of)	48940	n/a	87013
Yellow Medicine	Porter	52144	3110	n/a
Yellow Medicine	Posen (Township of)	52180	n/a	87014
Yellow Medicine	Sandnes (Township of)	58378	n/a	87015
Yellow Medicine	Sioux Agency (Township of)	60538	n/a	87016
Yellow Medicine	St Leo	57202	3400	n/a
Yellow Medicine	Stony Run (Township of)	63004	n/a	87017
Yellow Medicine	Swede Prairie (Township of)	63850	n/a	87018
Yellow Medicine	Tyro (Township of)	66082	n/a	87019
Yellow Medicine	Wergeland (Township of)	69160	n/a	87020
Yellow Medicine	Wood Lake	71446	4175	n/a
Yellow Medicine	Wood Lake (Township of)	71464	n/a	87021

APPENDIX D
HIGH ANGLE RESCUE EQUIPMENT

HIGH ANGLE RESCUE EQUIPMENT

The following is a list of equipment basket operators and passengers should consider carrying to maximize their chance of recovery in case of a catastrophic failure or accident. This equipment should only be used by personnel who have been trained in its proper use. The equipment is available in each snooper truck. The minimum high angle rescue equipment required in the basket when operating the snooper baskets are the 4 to 1 rescue strap and the telescoping rescue pole. The following list is more equipment that should be considered during snooper operation.

The bag with the ½ in. sterling 150’ rescue rope (Photo 1). Inside the bag with the rope, or on a locking carabineer attached to either the bag or an anchorage point in the snooper basket should be the Petzl I’D descender belay device (Photo 2), left and right hand Petzl ascenders/carabineers (Photo 3) with an orange (short) and blue (long) prusik (Photo 4), and the rescue strap with utility shears (Photo 5).

The rescue ropes carabineer should be attached to the baskets anchor point immediately upon starting the under bridge maintenance or inspection task. The rope bag measures 10” – 12” wide by approx. 18 “tall and there should be room for the above mentioned equipment if you should want to keep it all bagged together. The rope and equipment if kept together should not interfere with the inspection or maintenance task being performed.

Photo 1 Bag with ½” Sterling 150’ Rescue Rope

Photo 2 Petzl I’D Descender Belay Device

Photo 3 Left and Right Hand Petzl Ascenders/Carabineers

Photo 4 orange (short) and blue (long) prusik

Photo 5 Rescue Strap with utility Shears

APPENDIX E

OSHA REGULATIONS PERTAINING TO WORK NEAR OVERHEAD POWER LINES

OSHA REGULATIONS PERTAINING TO WORK NEAR OVERHEAD POWER LINES

1926.550(a) (15)

Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

1926.550(a) (15) (i)
For lines rated 50 kV or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet.

1926.550(a) (15) (ii)
For lines rated over 50 kV minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV over 50 kV or twice the length of the line insulator, but never less than 10 feet.

1926.550(a) (15) (iii)
In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV and 10 feet for voltages over 50 kV up to and including 345 kV and 16 feet for voltages up to and including 750 kV.

APPENDIX F
CODE OF FEDERAL REGULATIONS
TITLE 29 1926.502(D)

CODE OF FEDERAL REGULATIONS TITLE 29 1926.502(D)

§ 1926.502 29(d) CFR Ch. XVII (7–1–01 Edition)

(d) Personal fall arrest systems. Personal fall arrest systems and their use shall comply with the provisions set forth below. Effective January 1, 1998, body belts are not acceptable as part of a personal fall arrest system. Note: The use of a body belt in a positioning device system is acceptable and is regulated under paragraph (e) of this section.

(1) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(2) Connectors shall have a corrosion resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

(3) Dee-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds (22.2 kN).

(4) Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(5) Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member. Effective January 1, 1998, only locking type snaphooks shall be used.

(6) Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

- (i) directly to webbing, rope or wire rope;
- (ii) to each other;
- (iii) to a Dee-ring to which another snaphook or other connector is attached;
- (iv) to a horizontal lifeline; or
- (v) to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

(7) On suspended scaffolds or similar work platforms with horizontal lifelines which may become vertical lifelines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline.

(8) Horizontal lifelines shall be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of at least two.

(9) Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds (22.2 kN).

(10) (i) Except as provided in paragraph (d)(10)(ii) of this section, when vertical lifelines are used, each employee shall be attached to a separate lifeline.

(ii) During the construction of elevator shafts, two employees may be attached to the same lifeline in the hoistway, provided both employees are working atop a false car that is equipped with guardrails; the strength of the lifeline is 10,000 pounds [5,000 pounds per employee attached] (44.4 kN); and all other criteria specified in this paragraph for lifelines have been met.

(11) Lifelines shall be protected against being cut or abraded.

(12) Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(13) Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(14) Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers.

(15) Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds (22.2 kN) per employee attached, or shall be designed, installed, and used as follows:

(i) as part of a complete personal fall arrest system which maintains a safety factor of at least two; and

(ii) under the supervision of a qualified person.

(16) Personal fall arrest systems, when stopping a fall, shall:

(i) limit maximum arresting force on an employee to 900 pounds (4 kN) when used with a body belt;

(ii) limit maximum arresting force on an employee to 1,800 pounds (8 kN) when used with a body harness;

(iii) be rigged such that an employee can neither free fall more than 6 feet (1.8 m), nor contact any lower level;

(iv) bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 m); and,

(v) have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 m), or the free fall distance permitted by the system, whichever is less.

NOTE: If the personal fall arrest system meets the criteria and protocols contained in Appendix C to subpart M, and if the system is being used by an employee having a combined person and tool weight of less than 310 pounds (140 kg), the system will be considered to be in compliance with the provisions of paragraph (d)(16) of this section. If the system is used by an employee having a combined tool and body weight of 310 pounds (140 kg) or more, then the employer must appropriately modify the criteria and protocols of the Appendix to provide proper protection for such heavier weights, or the system will not be deemed to be in compliance with the requirements of paragraph (d)(16) of this section.

(17) The attachment point of the body belt hall be located in the center of the wearer's back. The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.

(18) Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

(19) Personal fall arrest systems and components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.

(20) The employer shall provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves.

(21) Personal fall arrest systems shall be inspected prior to each use for wear, damage and other deterioration, and defective components shall be removed from service.

(22) Body belts shall be at least one and five-eighths (1⅝) inches (4.1 cm) wide.

(23) Personal fall arrest systems shall not be attached to guardrail systems, nor shall they be attached to hoists except as specified in other subparts of this part.

(24) When a personal fall arrest system is used at hoist areas, it shall be rigged to allow the movement of the employee only as far as the edge of the walking/working surface of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(25) Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the

snaphook keeper by the connected member. As of January 1, 1998, only locking type snaphooks shall be used.

(26) Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:
- (i) directly to webbing, rope or wire rope;
- (ii) to each other;
- (iii) to a Dee-ring to which another snaphook or other connector is attached;
- (iv) to a horizontal lifeline; or
- (v) to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

(27) Positioning device systems shall be inspected prior to each use for wear, damage, and other deterioration, and defective components shall be removed from service.

(28) Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

APPENDIX G
COMMERCIAL MOTOR VEHICLE PRE-TRIP AND POST-TRIP INSPECTION REQUIREMENTS

COMMERCIAL MOTOR VEHICLE PRE-TRIP AND POST-TRIP INSPECTION REQUIREMENTS

Description

Federal regulations require pre-trip and post-trip inspections of vehicles by drivers or operators of commercial motor vehicles. A written driver vehicle inspection report is required.

Regulatory Reference

49 CFR § 393.95	Emergency equipment on all power units
49 CFR § 392.7	Equipment, inspection and use
49 CFR § 392.8	Emergency equipment, inspection and use
49 CFR § 396.7	Unsafe operations forbidden
49 CFR § 396.11	Driver vehicle inspection report(s)
49 CFR § 396.13	Driver inspection

Applies to:

The cited regulations apply to all commercial motor vehicles, motor carriers and drivers of commercial motor vehicles.

General Requirements:

(1) Pre-Trip Inspection.

(a) 49 CFR § 396.13 requires that before driving a [commercial] motor vehicle, the driver shall be satisfied that the vehicle is in safe operating condition, review the last driver vehicle inspection report (DVIR), and sign the DVIR (only if defects or deficiencies were noted by the driver who prepared the DVIR, to acknowledge that the driver has reviewed it and that there is a certification that the required repairs have been performed).

(b) 49 CFR § 392.7 states that no commercial motor vehicle shall be driven unless the driver is satisfied that the following parts and accessories are in good working order:

- Service brakes, including trailer brake connections;
- Parking (hand) brake
- Steering mechanism;
- Lighting devices and reflectors;
- Tires
- Horn
- Windshield wiper(s)
- Rear-vision mirrors
- Coupling devices

(c) 49 CFR § 392.8 states that no commercial motor vehicle shall be driven unless the driver is satisfied that the emergency equipment required by § 393.95 includes a properly charged, inspected and operable fire extinguisher; at least one spare electrical fuse or other overload protective device, for each kind and type used; and warning devices for stopped vehicle – typically, for trucks transporting LP-gas, approved reflective triangles.

(d) Related to pre-trip inspections, 49 CFR § 396.7 states that a motor vehicle shall not be operated in such a condition as to likely cause an accident or breakdown of the vehicle. Un-related to pre-trip inspections, the regulation continues, "*Exemption:* Any motor vehicle discovered to be in an unsafe condition while being operated on the highway may be continued in operation only to the nearest place where repairs can be made, and only if such operation is less hazardous to the public than to permit the vehicle to remain on the highway."

(2) Post-trip inspection. 49 CFR § 396.11 requires motor carriers to require drivers to perform a post-trip inspection if each commercial motor vehicle operated by the driver at the completion of each day's work. The driver is required to complete a written driver vehicle inspection report (DVIR) for each commercial motor vehicle operated. (See **Compliance Guide No. DOT 11** in this reference for detailed DVIR requirements.)

Training Requirements:

Although the regulations do not specify training requirements, drivers should be trained on pre-trip and post-trip vehicle inspection requirements and DVIR requirements in connection with DOT hazmat employee function specific training.

Maintenance and Review

Managers and supervisors can promote compliance efforts by conducting spot-checks of driver vehicle inspections and routine reviews of DVIRs.

Additional Information and Resources

Propane Delivery, Certification Area 2.0, Certified Employee Training Program, National Propane Gas Association, Lisle, IL

Initial OSHA and DOT Training: For the Handling and Transport of Hazardous Materials, Propane Education and Research Council, Washington, DC

ITS PROFORM SERIES, for documenting DVIR and monthly inspections, Industrial Training Services, Inc., Murray, KY

APPENDIX H
SNOOPER TRUCK AND BASKET ACTIVITIES
WAIVER AND RELEASE FORM

Minnesota Department of Transportation
Snooper Truck and Basket Activities
Waiver and Release

NAME ______________________________________ PHONE NUMBER ______________________
Last First Middle

ADDRESS __________________________________ EMPLOYER ___________________________

CITY ___________________ STATE ____________ ZIP __________ D.O.B. _________________

BE IT KNOWN, that I, ______________________________, on ___________________________
(Printed Name) (Date)
being of lawful age and of sound mind, state that I am aware that circumstances, events, dangers or hazards may arise or occur while I am a passenger in a snooper truck or snooper basket and/or accompanying employees of MnDOT in the performance of their duties that could expose me to harm and may result in injury, loss, damage or death. I expressly agree that my participation in these activities is at my own risk and that I am not required by MnDOT in any way to participate in these activities.

On behalf of myself and my heirs, administrators, executors and assigns, I hereby waive and release the right to assert any claim or action against the State of Minnesota, its Commissioner of Transportation, and all of its respective officers, employees, agents, successors and assigns, both individually and in any representative capacity, for any injury, loss, damage, or cost to my person and/or property, including injuries resulting in death, arising out of any accidents or events occurring while a passenger in a MnDOT snooper truck and basket and/or accompanying employees of MnDOT in the performance of their duties, unless such injury is due to willful or wanton acts by the State of Minnesota, its Commissioner of Transportation, its officers, employees, agents successors or assigns.

I further agree to indemnify, defend and hold harmless the State of Minnesota, its Commissioner of Transportation and all of its respective officers, employees, agents, successors and assigns, both individually and in any representative capacity, from any and all claims that may arise or are attributable directly or indirectly to me in conjunction with my accompanying an employee of MnDOT in a snooper truck and basket, whether or not the loss is due to negligence on the part of the State of Minnesota or its employees.

I have read the above, and I fully understand the legal significance of my signature, and I have received a copy of this waiver and release. This waiver and release will be governed by the laws of the State of Minnesota.

SIGNED: ___________________________________

Permission is hereby granted to the above named person and whose signature is affixed to this form to ride as a passenger in a snooper truck and/or basket and accompany employees of MnDOT in the performance of their duties on ______________________________.
(Date of ride-along)
APPROVED BY MN/DOT SUPERVISOR

____
(Supervisor's signature) (Date and Time)
Updated 04/01/14

APPENDIX I
BRIDGE SCOUR PLAN OF ACTION (POA) CHECK SHEET

BRIDGE SCOUR PLAN OF ACTION (POA) CHECK SHEET

9/19/2012

FHWA has recommended that local agency POAs be reviewed for completeness and sufficient content to ensure adequate implementation in the event of flooding. This check sheet will provide guidance on the recommended content of POAs when performing QA/QC reviews.

<u>Scour Codes B, D, G, R, or U</u>
Key items to be addressed:

General Information

- ☐ Location Information
- ☐ Approval Signature
- ☐ Scour Critical Elevation table

Recommended Action

- ☐ When to inspect, specify water surface elevation, flow rate (discharge) or precipitation event.
- ☐ How often to monitor (frequency), hourly to daily.
- ☐ How to monitor, method used to make measurements. Confirm the agency has any equipment required to monitor according to their plan.
- ☐ What to look for, typically scour critical elevation.
- ☐ What to do if scour critical elevation is found. Typically either an action such as close the bridge or designating the person that will make any decisions as to what action to take.

Bridge Closure Plan – HIGH IMPORTANCE

- ☐ Notification list and phone numbers, must be kept up to date. Can refer to a separate contact list sheet to make it easier to keep POAs up to date.
- ☐ Detour Plan: can be a list, map, or standard procedures. Closure plans will be commensurate with the importance of the roadway (ADT, routes available), and standard agency practice for roadway closures.

Secondary items to be addressed (optional):

- ☐ History
- ☐ Monitoring Traffic Control Plan

<u>Scour Code K</u>
K bridges that are single span and low ADT are recommended, but not required to have a scour critical elevation table. In lieu of the table, critical observations may be used to monitor. See template for details.
Key items to be addressed:

General Information

- ☐ Location Information
- ☐ Approval Signature
- ☐ Scour Critical Elevation table, or critical observations for single span/low ADT/gravel roads (see template for additional information).

Recommended Action

- ☐ When to inspect, specify water surface elevation, flow rate (discharge) or precipitation event.
- ☐ How often to monitor (frequency), hourly to daily.
- ☐ How to monitor, method used to make measurements. Confirm the agency has any equipment required to monitor according to their plan.
- ☐ What to look for, typically scour critical elevation.

- What to do if scour critical elevation or critical observations are found. Typically either an action such as close the bridge or designating the person that will make any decisions as to what action to take.

Bridge Closure Plan – HIGH IMPORTANCE

- Notification list and phone numbers; must be kept up to date. Can refer to a separate contact list sheet to make it easier to keep POAs up to date.
- Detour Plan: can be a list, map, or standard procedures. Closure plans will be commensurate with the importance of the roadway (ADT, routes available), and standard agency practice for roadway closures.

Secondary items to be addressed (optional):

- History
- Monitoring Traffic Control Plan

<u>Scour Codes O or P</u>

Key items to be addressed:

General Information

- Location Information
- Approval Signature

Recommended Action

- When to inspect, typically after a major flood event and during routine inspections.
- What to look for, typically missing or damaged riprap, lateral migration or other site concerns.
- What to do if a problem is found.

Secondary items to be addressed (optional):

- History
- Reason POA is required
- Scour Critical Elevation table

<u>Cross Sections – HIGH IMPORTANCE</u>

Cross sections are required for bridges coded: R, D, U; and/or if the NBIS #61 = 3 or lower (corresponds to smart flag 2 or 3), or if required in the POA (see templates for more information). Cross sections are recommended for all bridges but not required.

- Are cross sections being taken for the following bridges (required): R, D, U; and/or if the NBIS #61 = 3 or lower?
- Are cross-sections being taken at a reasonable frequency? Make sure they are available in the bridge file.
- Are cross-sections being compared over time?

<u>Implementation – HIGH IMPORTANCE</u>

- Where there flood events in your county?
- During flood events was the POA followed? Was the “when to monitor” trigger reached, if yes was monitoring done?
- Are you implementing your POA?

<u>Review Comments:</u>

APPENDIX J
MINNESOTA BRIDGE AND STRUCTURES INCIDENT REPOSNSE PLAN

MINNESOTA BRIDGE AND STRUCTURES INCIDENT RESPONSE PLAN

PURPOSE:

The purpose of this document is to establish and implement a mandatory state-wide Bridge and Structures Incident Response Plan, so that the appropriate certified personnel and equipment are dispatched to the bridge or structure when an incident occurs, and to ensure the incident is properly investigated, documented, reported, and response/repair action plans are developed and implemented in a timely, complete and accurate manner. While this plan applies to all bridges owned by MnDOT, local agencies are strongly advised to adopt this plan and function accordingly with the goal of timely, complete, and accurate investigation, documentation and implementation of action plans as needed for bridges and structures.

BACKGROUND:

Incident management is defined in the Federal Highway Administration's (FHWA) Incident Management Handbook as "the systematic, planned, and coordinated use of human, institutional, mechanical, and technical resources to reduce the duration and impact of incidents, and improve the safety of motorists, crash victims, and incident responders." Bridge owners are expected to manage events/incidents and respond appropriately.

A bridge or structural asset incident is anything that affects or could affect the structural integrity of the asset and may include impact damage, critical deterioration, scour, or a public safety hazard such as falling deck concrete or damaged rails. These types of incidents initiate a damage inspection, which for bridges will require a Damage Report in the state Structure Information Management System (SIMS). A damage inspection is defined by the National Bridge Inspection Standards (NBIS) – 23CFR 650 Subpart C as an unscheduled inspection to assess structural damage resulting from environmental factors or human actions. If damage to the bridge structure is deemed critical as defined in the NBIS, the critical finding reporting process should be followed as stated in the Minnesota Bridge and Structure Inspection Program Manual (BSIPM) Section A.6.2.

In addition to bridges and culverts, other structural assets included in this plan are overhead sign structures, high mast tower lights, retaining walls, noise walls, and mast arm pole standards used with traffic signals systems.

Response to an incident includes dispatching the appropriate personnel and equipment, activating the appropriate communication links and motorist information media as soon as there is reasonable certainty that an incident is present, documenting and reporting findings, and preparing and implementing any necessary repair action plan.

RESPONSE REQUIREMENT:

When a bridge or structure incident occurs, qualified bridge personnel must be notified immediately so that they can assess the bridge or structure and take appropriate actions to ensure the safety of the traveling public.

If qualified bridge personnel are not immediately notified once a bridge or structure event occurs, the MnDOT Bridge Construction and Maintenance Engineer will initiate contact with the district and will arrange an after action discussion with district and Bridge Office personnel to review what process improvements may be appropriate.

REASONING:

Per the NBIS, only a state certified Team Leader, or federally certified bridge safety inspector, is qualified to assess the condition of the damage to the bridge and determine appropriate follow-up actions. However, many times throughout the state, a roadway maintenance supervisor or other staff is notified of a bridge or structure incident by State Patrol, which may or may not be forwarded to the MnDOT Bridge Maintenance Supervisor for trunk highway bridges. As a result, damage to a bridge may go unanalyzed and/or unrepaired for days if not up to a year. Sending a person to an incident who is not qualified and placing them in the role of assessing the bridge or structure may increase the duration and impact of the incident as well as compromise safety and exposes the department to risk that can otherwise be avoided through appropriate notification and coordination of response.

RESPONSIBILITIES:

State Patrol Dispatch – initial point of contact from the first responder, which may be a citizen, an officer, a maintenance worker, etc. State Patrol Dispatch is responsible for sharing incident/event information with the emergency contacts identified for the geographic area.

MnDOT Bridge Maintenance Supervisor – supervises MnDOT bridge maintenance operations, is responsible for the implementation of the district bridge repair and maintenance program and the district bridge safety inspection program, and is required to coordinate bridge emergency damage inspection and/or repairs regardless of date or time of day. The Bridge Maintenance Supervisor should be the first point of contact for a bridge or structure incident. **If contacted first, the Bridge Maintenance Supervisor shall also notify the Area Maintenance Supervisor.**

MnDOT Area Maintenance Supervisor – supervises day-to-day maintenance activities with the truck stations to maintain and preserve Minnesota highways, roadsides, structures and facilities so they are safe, structurally sound, convenient to use and are aesthetically pleasing. **If the Area Maintenance Supervisor is contacted first regarding bridge damage, he/she must contact the Bridge Maintenance Supervisor immediately.**

MnDOT District Bridge Engineer – provides structural and hydraulic leadership for the District.

MnDOT Bridge Office – provides structural and hydraulic leadership for MnDOT Districts, consultants and other units of government, with services for the design, construction, inspection, and maintenance of Minnesota's bridges and structures. In the event the Incident Management Plan is not followed accordingly, the MnDOT Bridge Office's Bridge Construction and Maintenance Engineer will conduct an After Action Review as stated in the standard letter format at the end of this document.

MnDOT Bridge Construction and Maintenance Engineer – manages bridge construction, safety inspection, and maintenance standards development and activities and is responsible for initiating contact with district staff if any aspect of this plan is not being successfully implemented.

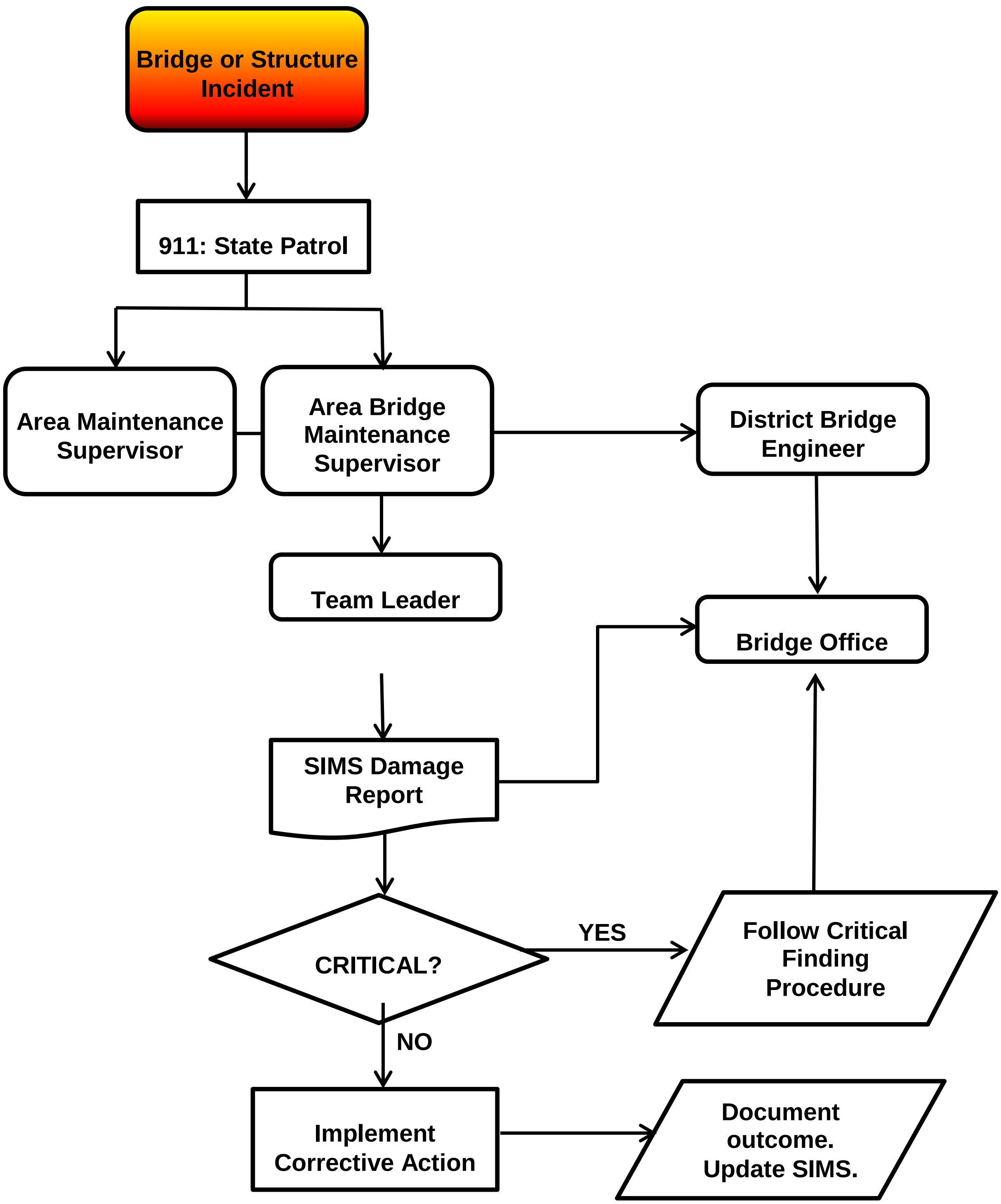
Local Agency Bridge Engineer – A certified Professional Engineer appointed by an agency or jurisdiction to oversee the bridge inspection program and have quality control responsibilities as delegated by the MnDOT Bridge Office. This appointed engineer, also known as the Program Administrator per the BSIPM, is the City or County Engineer, or a consultant. In accordance with Minnesota Statute 165.03 Subd. 2, the County Highway Engineer is designated as

Program Administrator for all bridges located wholly or partially within or over the right-of-way of any county or town road, or any street within a municipality that does not have a city engineer regularly employed.

After Action Review – An after action review is a meeting to review actions made and to discuss actions which could have occurred for a specific recent event. After action meetings can occur at any level of the organization when a review and assessment of event response actions would have value for the work group in future situations. If immediate contact is not made to qualified bridge personnel when a bridge or structure event occurs, the MnDOT Bridge Construction and Maintenance Engineer will initiate contact with the district and arrange an after action review with district and Bridge Office personnel to review what process improvements may be appropriate.

RESPONSE PROCEDURE DIAGRAM:

Metro contacts are maintained by Metro Dispatch – 651/234-7110. All other District contacts are maintained in Google Earth for State Patrol notification by the MnDOT Office of Maintenance. For a complete list of bridge emergency contacts click here.



APPENDIX K
BRIDGE INCIDENT – AFTER ACTION REVIEW

Bridge Office
3485 Hadley Avenue
Oakdale, MN 55128

DEPARTMENT OF TRANSPORTATION

Memo

To: **Recipient's Name**
[INSERT TITLE – ADE OR AME DEPENDING ON DISTRICT ORG STRUCTURE]

From: **Ed Lutgen, P.E.**
State Bridge Construction and Maintenance Engineer

Date: **July 15, 2015 – DRAFT**

RE: Bridge Incident – After Action Review
Bridge: [INSERT BRIDGE NUMBER],
Date of Incident: [INSERT DATE]

The Bridge Office was informed of an incident that occurred on [INSERT DATE] at Bridge [INSERT BRIDGE NUMBER]. It is my understanding that a Bridge Maintenance Supervisor was not notified of the incident immediately. In accordance with the guidelines set forth in the MnDOT Bridge and Structures Incident Response Plan:

> *"When a bridge incident occurs, qualified MnDOT bridge personnel need to be notified immediately in order to ensure the safety of the traveling public."*

Per the National Bridge Inspection Standards (NBIS), only a state certified Team Leader, or federally certified bridge safety inspector, is qualified to assess the condition of the bridge. As outlined in the incident response plan, State Patrol Dispatch must immediately contact the Bridge Maintenance Supervisor following an incident involving a bridge. The Bridge Maintenance Supervisor will ensure that qualified personnel are immediately sent to inspect the bridge and will also notify the Area Maintenance Supervisor of the incident.

The purpose of the Bridge and Structure Incident Response Plan is to establish a consistent and compliant, statewide procedure for documenting and responding to incidents so that the appropriate certified personnel and equipment are dispatched to the bridge when an incident occurs. The Bridge Office maintains oversight responsibility to confirm compliance with these guidelines. The Bridge Maintenance Supervisor was not notified of this incident immediately and therefore, the Bridge Office will conduct an After Action Review to analyze what happened and why it happened, with the ultimate goal of improving the process for future incidents.

Thank you in advance for your prompt attention to this concern. I will contact you shortly to schedule the After Action Review. If you have any questions or would like to share any information immediately, please feel free to contact me.

cc:
SBE
AME
District Bridge Engineer