

ARKANSAS DEPARTMENT OF TRANSPORTATION

BRIDGE INSPECTION GUIDELINES



Guidance Document Approval

This Bridge Inspection Guidance Document aims to provide guidance and direction concerning the inspection and documentation of bridges in Arkansas. Any major modifications to the ARDOT Bridge Inspection Guidelines require approval under the direction of the Bridge Inspection Program Oversight Committee with concurrence with Arkansas Department of Transportation's (ARDOT) Bridge Operations Division and the Federal Highway Administration (FHWA). This Bridge Inspection Guidance Document will be reviewed and updated as needed by the State Bridge Inspection Program Manager or designated representative. ARDOT reserves the right to make interim updates to the procedures to address lessons learned, evolving approaches, updates to federal, state, local laws, regulations, and policies, provided updates are reviewed with ARDOT and FHWA oversight.

Recommended By: Andrew Nanneman
ARDOT Program Manager
State Bridge Operations Engineer

Date: 7/1/2026

Approved By: P.D. McQuinn
FHWA State Bridge Engineer

Date: 7/1/2026.



Bridge Inspection Guidelines

Table of Contents

Contents

GUIDANCE DOCUMENT APPROVAL	2
TABLE OF CONTENTS.....	3
LIST OF APPENDICES.....	11
CHAPTER 1 INTRODUCTION.....	13
1.1 OVERVIEW	14
1.2 PURPOSE AND HISTORY	14
1.2.1 Purpose of this Document.....	14
1.2.2 Scope of this Document.....	14
1.2.3 History of the Arkansas Bridge Inspection Program.....	15
1.3 DEFINITIONS, ACRONYMS, AND ABBREVIATIONS	16
1.3.1 Definitions	16
1.3.2 Acronyms	17
1.3.3 Abbreviations.....	18
1.4 FORMAT AND REFERENCES	18
1.4.1 Format.....	18
1.4.2 References.....	18
1.5 QUALITY ASSURANCE	20
1.5.1 Quality Assurance Overview	20
1.5.2 District Quality Assurance.....	20
1.5.3 Bridge Inspection Program Quality Assurance	21
1.6 QUALITY CONTROL	21
1.6.1 Quality Control Overview	21
1.6.2 District Level Quality Control.....	21
1.6.3 Bridge Operations Quality Control.....	22
1.6.4 Bridge Inspection Program Quality Control.....	22
1.7 PROGRAM FUNDING	23
1.8 LOCAL OWNED BRIDGE INSPECTION	23
CHAPTER 2 INSPECTION PROGRAM REQUIREMENTS	24
2.1 INSPECTION PROGRAM ORGANIZATION	25
2.2 PERSONNEL	25
2.2.1 ARDOT Positions Meeting NBIS Position Requirements	25
2.2.2 Advanced Bridge Inspector Responsibilities.....	26
2.2.3 Underwater Inspection Divers	26
2.3 TRAINING.....	27
CHAPTER 3 INSPECTION TYPES AND DOCUMENTATION	28
3.1 INSPECTION FREQUENCIES	29
3.1.1 Overview	29
3.1.2 Summary of Inspection Frequencies	29

3.1.3	<i>Inspection Interval Tolerance</i>	33
3.2	ELEMENT LEVEL INSPECTIONS	33
3.3	INITIAL ROUTINE	33
3.3.1	<i>Assigning New Bridge Numbers</i>	33
3.3.2	<i>New Alignment Structure Inspection</i>	34
3.3.3	<i>Structure Under Stage Construction Inspection</i>	34
3.3.4	<i>Existing Structure Being Replaced</i>	34
3.3.5	<i>Bridge Archiving and Change of Ownership Requirements</i>	34
3.4	ROUTINE	35
3.5	NSTM	35
3.6	UNDERWATER	36
3.6.1	<i>Overview of ARDOT Underwater Inspections</i>	36
3.6.2	<i>NBIS Underwater Procedures</i>	37
3.6.3	<i>Underwater Imaging Technology Inspection</i>	38
3.7	UNDERWATER TYPE 2	38
3.7.1	<i>Overview of Underwater Type 2</i>	38
3.7.2	<i>Requirements</i>	39
3.7.3	<i>Documenting Scour Concerns</i>	40
3.8	DAMAGE/ACCIDENT	41
3.9	SPECIAL	42
3.10	SCOUR MONITORING	42
3.11	UNDER CLEARANCE	42
3.12	OTHER SPECIAL RECURRING	43
3.13	IN-DEPTH	43
3.14	POSTING SIGN VERIFICATION	44
CHAPTER 4	INSPECTION PROCEDURES	45
4.1	FILE NAMING CONVENTION	46
4.2	ASSET FILES	48
4.2.1	<i>General:</i>	48
4.2.2	<i>NSTM Files</i>	48
4.2.3	<i>Underwater Files:</i>	49
4.2.4	<i>Historical Records</i>	49
4.3	REPORT FILES	49
4.3.1	<i>General:</i>	49
4.3.2	<i>Drawing Files:</i>	49
4.3.3	<i>NSTM Files:</i>	49
4.3.4	<i>Underwater Files:</i>	50
4.3.5	<i>Load Rating Files:</i>	50
4.4	REQUIRED INSPECTION PHOTOS	50
4.4.1	<i>Initial and Routine Inspection Photos</i>	50
4.4.2	<i>NSTM Inspection Photos</i>	51
4.4.3	<i>Underwater/Underwater Type 2 Inspection Photos</i>	52

4.5	REQUIRED INSPECTION NOTES	52
4.5.1	State Owned Structure Note Placement Procedure	52
4.5.2	Locally Owned Structure Note Placement Procedures	53
4.6	DRAWING REQUIREMENTS	54
4.6.1	Overview	54
4.6.2	Deck Details	54
4.6.3	Superstructure Details	54
4.6.4	Substructure Details	55
4.6.5	Channel Drawings	55
4.6.6	Box Culverts	55
4.6.7	Pipe Culverts	55
4.6.8	Trusses	56
4.6.9	Arches	56
4.6.10	Railcars	56
CHAPTER 5	RESTRICTIONS	57
5.1	GENERAL RESTRICTION INFORMATION	58
5.1.1	New Structures	58
5.1.2	Rehabilitated/Repaired Structures	58
5.1.3	Serviceability	58
5.1.4	Bridge Closures	59
5.1.5	Tracking Bridge Weight Posting Issues	59
5.1.6	Post Load Rating Process Flowchart	59
5.1.7	Bridge Posting Signs	59
5.2	NON-STATE OWNED (LPA) BRIDGES	59
5.2.1	Bridge Closure for Non-State-Owned Bridges	59
5.2.2	Posting Changes for Non-State-Owned Bridges	61
5.2.3	Posting Issues Identified for Non-State-Owned Bridges	62
5.2.4	Posting Sign Materials for Non-State-Owned Bridges	62
5.3	ABANDONMENT OR REMOVAL FROM NBIS INVENTORY	62
5.4	STATE-OWNED BRIDGES	63
5.4.1	Bridge Closure for State-Owned Bridges	63
5.4.2	Posting for State-Owned Bridges	63
5.4.3	Notification of State Route Postings for Local Stakeholders	63
CHAPTER 6	REPAIRS AND MAINTENANCE	65
6.1	OVERVIEW	66
6.1.1	Inspector Workflow for Maintenance Needs	66
6.1.2	Locally Owned Maintenance Repairs	67
6.1.3	State Owned Maintenance Repairs	68
6.2	MAINTENANCE PRIORITIES	69
6.2.1	Overview of Priority Codes	69
6.2.2	Priority Code A	70
6.2.3	Priority Code B	70
6.2.4	Priority Code C	70

6.2.5	Priority Code D	70
6.3	CRITICAL FINDINGS	71
6.3.1	Overview of Critical Findings.....	71
6.3.2	Critical Finding Workflow	71
6.3.3	Critical Finding Follow Up Action.....	72
6.4	ROUTINE MAINTENANCE NEEDS	72
6.5	WEIGHT POSTINGS	73
6.6	FLAMMABLE MATERIAL.....	73
CHAPTER 7	BRIDGE COMPONENTS	74
7.1	STEEL.....	75
7.1.1	Steel Terminology.....	75
7.1.2	NSTM Procedure.....	76
7.1.3	Visual Inspection	77
7.1.4	Non-Destructive Steel Inspection Techniques	77
7.1.5	Pin and Hanger Assemblies.....	78
7.1.6	Steel Failure Mechanics.....	80
7.1.7	Fatigue Cracking	80
7.1.8	Welds	80
7.1.9	Crack Prone Areas	82
7.1.10	Riveted and Bolted Details.....	82
7.1.11	Out-of-Plane Distortion	83
7.1.12	Corrosion	84
7.1.13	When Steel Measurements Are Needed	85
7.1.14	Truss Bridge.....	87
7.2	CONCRETE	87
7.2.1	Delamination	88
7.2.2	Reinforced Concrete.....	88
7.2.3	Reinforced Concrete Slab Spans Lengthening	89
7.2.4	Prestressed Concrete	90
7.2.5	Concrete Channel Beams.....	92
7.3	TIMBER.....	94
7.3.1	Timber Bridge Overview	94
7.3.2	Visual Signs of Deterioration.....	94
7.3.3	Sounding and Probing Techniques	96
7.3.4	Drilling and Coring Techniques	96
CHAPTER 8	SNBI AND ELEMENTS	97
8.1	ARDOT – SNBI GUIDANCE	98
8.1.1	Introduction.....	98
8.1.2	Codes Applicable to Decks of Different Materials	99
8.1.3	Codes Applicable to Superstructure of Different Materials	101
8.1.4	Codes Applicable to Substructures of Different Materials	103
8.2	ARDOT – AGENCY FIELDS	105

8.3	ARDOT ELEMENT INSPECTIONS	105
8.3.1	<i>Introduction.....</i>	<i>105</i>
8.3.2	<i>Decks and Slabs.....</i>	<i>105</i>
8.3.3	<i>Abutments.....</i>	<i>106</i>
8.3.4	<i>Intermediate Bents.....</i>	<i>107</i>
8.3.5	<i>Bridge Rails.....</i>	<i>109</i>
8.3.6	<i>Joints.....</i>	<i>109</i>
8.3.7	<i>Element Level Condition States</i>	<i>109</i>
8.3.8	<i>Material Specific, Defect Severity Descriptions.....</i>	<i>110</i>
8.3.9	<i>Weathering Steel Protective Coating.....</i>	<i>111</i>
8.4	DEFECT HEIARCHY	112
CHAPTER 9	ENGINEERING ANALYSIS AND EMERGENCY RESPONSE	115
9.1	LOAD RATING OVERVIEW	116
9.2	LOAD RESTRICTIONS	116
9.3	LOAD TESTING	116
9.4	SCOUR APPRASIAL PROCEDURES	116
9.4.1	<i>Overview and History.....</i>	<i>116</i>
9.4.2	<i>Scour Procedures Overview</i>	<i>117</i>
9.4.3	<i>Scour Appraisal</i>	<i>119</i>
9.4.4	<i>Observed Scour.....</i>	<i>119</i>
9.4.5	<i>Scour Assessment.....</i>	<i>120</i>
9.4.6	<i>Scour Evaluation</i>	<i>121</i>
9.5	SCOUR TRIGGER INSPECTIONS.....	122
9.5.1	<i>EmergencyX Inspections</i>	<i>122</i>
9.5.2	<i>Local Bridge Owner Scour Monitoring.....</i>	<i>122</i>
9.6	EARTHQUAKE RESPONSE PLAN	123
9.6.1	<i>Overview</i>	<i>123</i>
9.6.2	<i>Initial Earthquake Response Alerting.....</i>	<i>124</i>
9.6.3	<i>Earthquake Response Activation</i>	<i>124</i>
9.6.4	<i>EmergencyX Assignments and Inspections.....</i>	<i>124</i>
CHAPTER 10	INSPECTION OF ANCILLARY STRUCTURES	125
10.1	SIGN STRUCTURES.....	126
10.1.1	<i>Major Sign Structure Inspection Overview.....</i>	<i>126</i>
10.1.2	<i>The 5 Major Classifications of Sign Structures</i>	<i>126</i>
10.1.3	<i>Types of Inspection for Major Sign Structures.....</i>	<i>127</i>
10.1.4	<i>Inspection Procedures for Major Sign Structures.....</i>	<i>127</i>
10.1.5	<i>Documentation for Major Sign Structures.....</i>	<i>130</i>
10.1.6	<i>Example Drawings of 5 Major Sign Structures</i>	<i>131</i>
10.2	HIGH MAST POLES.....	136
10.2.1	<i>High Mast Light Pole Inspection.....</i>	<i>136</i>
10.2.2	<i>Major Classifications for High Mast Light Poles.....</i>	<i>136</i>
10.2.3	<i>Types of Inspection for High Mast Light Poles.....</i>	<i>136</i>

10.2.4	<i>Inspection Procedures for High Mast Light Poles</i>	136
10.2.5	<i>Documentation for High Mast Light Poles</i>	138
10.3	NON-BRIDGE LENGTH STRUCTURES	138
10.4	MSE WALLS	138
CHAPTER 11 TUNNELS		139
11.1	TUNNEL OVERVIEW	140
11.2	QUALIFICATIONS	140
11.3	PROCEDURES	140
CHAPTER 12 INSPECTION ACCESS		142
12.1	INSPECTION ACCESS OVERVIEW	143
12.2	UAVS (DRONES)	143
12.2.1	<i>Overview:</i>	143
12.2.2	<i>Minimum Requirements</i>	144
12.2.3	<i>Safety Guidelines</i>	144
12.2.4	<i>Use Cases for UAVs:</i>	144
12.2.5	<i>Data Gathered with UAVs:</i>	144
12.3	UNDERWATER DRONE	145
12.4	RAILROADS	145
APPENDICES		147
1.A	BRIDGE INSPECTION PROGRAM CHARGES	148
1.B	DISTRICT CONSTRUCTION ENGINEER QA FORM	152
1.C	QUALITY ASSURANCE YEARLY PROCEDURES	154
1.D	AUTOMATED QUALITY CONTROL DATA CHECKS	157
2.A	INSPECTION PROGRAM ORGANIZATIONAL CHART	161
3.A	NSTM INSPECTX HOW TO DOCUMENT	163
3.B	MEMORANDUM BRIDGE VERTICAL CLEARANCE	171
4.A	STANDARD NOTE TAKING CONVENTION	173
5.A	POST LOAD RATING PROCESS FLOWCHART	187
5.B	BRIDGE WEIGHT LIMIT SIGN COMBINATIONS	189
5.C	CURRENT BRIDGE POSTING SIGN AND VALUES	191
5.D	LEGACY BRIDGE POSTING SIGN AND VALUES	193
6.A	MAINTENANCE NEED GUIDANCE AND EXAMPLES	195
6.B	MEMORANDUM FLAMMABLE MATERIALS	233
8.A	GUIDANCE FOR CHANNEL AND CHANNEL PROTECTION	238
8.B	SNBI Q&A	268
9.A	CULVERT SCOUR ASSESSMENT WORKSHEET	276
9.B	BRIDGE SCOUR ASSESSMENT WORKSHEET	284
9.C	SCOUR PLAN OF ACTION WORKSHEET	298

12.A UNDER BRIDGE INSPECTION UNIT PROCEDURES	302
CHAPTER LPA LOCAL PUBLIC AGENCY REQUIREMENTS	306
LPA.1 OVERVIEW	307
LPA.1.1 Purpose of this Document.....	307
LPA.1.2 Local Bridge Inspection Program Background.....	307
LPA.1.3 ARDOT Responsibilities	307
LPA.1.4 Definition and Examples of Bridge Length Structures.....	308
LPA.1.5 Providing Details for Bridges Constructed by the Local Government	310
LPA.1.6 Bridge Abandonment or Removal from Inventory	310
LPA.2 BRIDGE MAINTENANCE NEEDS	310
LPA.2.1 Overview of Priority Codes	311
LPA.3 BRIDGE WEIGHT RESTRICTIONS	311
LPA.3.1 Posting Changes for Non-State-Owned Bridges.....	311
LPA.3.2 Posting Issues Identified for Non-State-Owned Bridges	312
LPA.3.3 Evidence of Posting Deficiency Correction.....	312
LPA.3.4 Posting Sign Material Assistance	313
LPA.4 BRIDGE CLOSURE	313
LPA.4.1 Reopening a Structure.....	313
LPA.5 SCOUR CRITICAL BRIDGES	314
LPA.6 PROGRAM FUNDING AND BILLING	314
LPA.6.1 Location of ARDOT District Headquarters.....	315
LPA ATTACHMENTS	317
LPA Concurrence Letter.....	318
LPA Maintenance Repair Documentation Form 8	320
LPA Sign Request Form.....	322
Scour Plan of Action Concurrence Letter	324
LPA Scour Plan of Action Event Monitoring Form	326



Bridge Inspection Guidelines

List of Appendices

<u>1.A BRIDGE INSPECTION PROGRAM CHARGES</u>	148
<u>1.B DISTRICT CONSTRUCTION ENGINEER QA FORM</u>	152
<u>1.C QUALITY ASSURANCE YEARLY PROCEDURES</u>	154
<u>1.D AUTOMATED QUALITY CONTROL DATA CHECKS</u>	157
<u>2.A INSPECTION PROGRAM ORGANIZATIONAL CHART</u>	161
<u>3.A NSTM INSPECTX HOW TO DOCUMENT</u>	163
<u>3.B MEMORANDUM BRIDGE VERTICAL CLEARANCE</u>	171
<u>4.A STANDARD NOTE TAKING CONVENTION</u>	173
<u>5.A POST LOAD RATING PROCESS FLOWCHART</u>	187
<u>5.B BRIDGE WEIGHT LIMIT SIGN COMBINATIONS</u>	189
<u>5.C CURRENT BRIDGE POSTING SIGN AND VALUES</u>	191
<u>5.D LEGACY BRIDGE POSTING SIGN AND VALUES</u>	193
<u>6.A MAINTENANCE NEED GUIDANCE AND EXAMPLES</u>	195
<u>6.B MEMORANDUM FLAMMABLE MATERIALS</u>	233
<u>8.A GUIDANCE FOR CHANNEL AND CHANNEL PROTECTION</u>	238
<u>8.B SNBI Q&A</u>	268
<u>9.A CULVERT SCOUR ASSESSMENT WORKSHEET</u>	276
<u>9.B BRIDGE SCOUR ASSESSMENT WORKSHEET</u>	284
<u>9.C SCOUR PLAN OF ACTION WORKSHEET</u>	298
<u>12.A UNDER BRIDGE INSPECTION UNIT PROCEDURES</u>	302
<u>LPA ATTACHMENTS</u>	317
<i><u>LPA Concurrence Letter</u></i>	318
<i><u>LPA Maintenance Repair Documentation Form 8</u></i>	320
<i><u>LPA Sign Request Form</u></i>	322
<i><u>Scour Plan of Action Concurrence Letter</u></i>	324
<i><u>LPA Scour Plan of Action Event Monitoring Form</u></i>	326



Bridge Inspection Guidelines

Chapter 1 Introduction

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

1.1 OVERVIEW

This Bridge Inspection Guidance Document is to establish a uniform and formal procedure for the bridge inspection process for the Arkansas Department of Transportation (ARDOT) and to comply with the Code of Federal Regulations, Part 650 Subpart C. These guidelines and requirements provide for regular and systematic inspection of bridges on, under, or over public highways and streets in the interest of public safety and protection of public investments in such structures.

The ARDOT Bridge Inspection Guidance Document is a combination of guidelines, example forms, charts, policies, and procedures designed to aid all bridge inspection related personnel. This manual is used in conjunction with the reference documents in section 1.4.2. Links to documents are provided in 1.4.2 References.

1.2 PURPOSE AND HISTORY

1.2.1 Purpose of this Document

The ultimate objectives of the Bridge Inspection Program are to facilitate safe travel over public bridges and maximize benefits from the use of public funds. Bridge inspection data is the foundation for the entire bridge management system. Information obtained during the inspection will be used to determine needed maintenance and repairs, identify preservation needs, prioritize rehabilitations and replacements, allocate resources, and evaluate and improve design for new bridges. The accuracy and consistency of the inspection and documentation are vital because it impacts programming and management of the bridge inventory and affects public safety.

This Document is not intended to supplant proper training or the exercise of judgment by the Inspector or the Program Manager. Following established guidelines and practices, Bridge Inspectors use their specialized training and experience to enter inspection data into the inspection software. The District Bridge Construction Engineer serves as the Local Program Manager, supervises the inspection process, and is responsible for the accuracy of the District reports. Bridge Division's Inventory and Rating Section utilizes the information gathered by the Bridge Inspector to perform a detailed review and load rating. Bridge data is submitted at least annually by the Bridge Management Section to the FHWA Washington Office, where it is compiled to form the National Bridge Inventory (NBI) report to Congress.

1.2.2 Scope of this Document

These bridge inspection guidelines are intended to serve as a framework for ARDOT staff and contracted consultants involved in inspection of structures in Arkansas. The guidelines are organized into 13 chapters. Each chapter is further divided into sections to account for any specific consideration. The primary chapters can be grouped broadly as follows:

Chapters 1-2:	Introduction, General policies, Personnel Responsibilities
Chapters 3-4:	Inspection Types and Procedures
Chapters 5-6:	Restrictions and Maintenance
Chapters 7-8:	ARDOT Inspection Specifications
Chapter 9:	Engineering Analysis and Emergency Response

Chapters 10-12:	Other Structures and Access
Chapter LPA:	Local Public Agency Requirements
Appendices:	Supporting Information for the Above Chapters

1.2.3 [History of the Arkansas Bridge Inspection Program](#)

Federal law required all states to develop and implement a bridge inspection program following the 1967 collapse of the Silver Bridge over the Ohio River that resulted in 46 deaths. As a result of this bridge failure, the Federal-Aid Highway Act of 1968 required the Secretary of Transportation, with the state highway agencies, to develop National Bridge Inspection Standards (NBIS). The Act also required each state to establish and maintain a current inventory of all bridges on the Federal-Aid Highway System. The Surface Transportation Assistant Act of 1978 significantly expanded the program to require all bridge length structures on the public highway system (state, county, and city) to be inspected.

In January 1985, ARDOT's Bridge Inspection Program was significantly reorganized to address the workload and more effectively use its personnel. The District Construction Engineer was designated as the District Bridge Inspection Engineer. This position was designated to be responsible for coordinating and monitoring the program at the District level. Full-time District Bridge Inspectors were designated to perform the inventory and inspection of bridges within the District. Also, as part of this reorganization, the Structures Inventory and Rating Section in Bridge Division was created to consolidate the functions of report processing and load capacity rating. The Heavy Bridge Maintenance Section (now the Bridge Operations Division) was assigned the coordination of the Bridge Inspection Program. Local governments were made aware that failure to comply with their posting responsibilities could result in Federal Aid Highway Funding loss.

Until 2004 inspections and bridge data was primarily paper based in Arkansas. In July 2004, inspection data was entered into a computer program called PONTIS. PONTIS served as the Bridge Management file, and queries were able to be run from its database.

FHWA introduced a bridge safety initiative in 2011 with subsequent revisions to systematically perform Quality Assurance (QA). The initiative measures are a data-driven, risk-based review and analysis of 23 metrics that determine how states perform their bridge inspection programs.

In May 2011, the State Heavy Bridge Maintenance Engineer (now the State Bridge Operations Engineer) was designated as the Arkansas Bridge Inspection Program Manager. The Staff Heavy Bridge Maintenance Engineer (now the Assistant Division Head of Bridge Operations) was appointed the Assistant to the Bridge Inspection Program Manager. The District Construction Engineers were assigned to be the District Bridge Inspection Program Managers. These title changes were made to better define the roles and responsibilities of personnel involved with the bridge inspection program.

In June 2011, the Bridge Management Engineer position (now the Section Head of Bridge Management) was transferred from the Bridge Division to the Maintenance Division to develop a bridge management program. The process started with improvements to the maintenance activities database to track maintenance needs, critical findings, and completed work on bridges.

In June 2014, the Department hired Bentley to provide the next generation of bridge inspection software (InspectTech) and integrate the maintenance needs database into the bridge inspection software. The software included an iPad app for the collection of field data with capabilities to sync with the web-based platform. Besides mobile data collection, it provided inspection management, performance measure management, maintenance need management, and MAP-21 compliance. The software was put into production on March 2, 2015.

In January 2020, the Department hired Asset Intelligence to provide the current bridge inspection and management system, InspectX. InspectX allows for a cloud-based database.

In July of 2023, the Department formed the Bridge Operations Division out of the Heavy Bridge Maintenance section to be the program managers for the State of Arkansas.

In 2025, the Department adopted emergencyX software. This software is used by the Bridge Inspection Program to monitor bridges susceptible to flooding concerns, and it is the Department planning and response software for earthquake damage regarding bridge evaluation.

1.3 DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

1.3.1 Definitions

The National Bridge Inspection Standards (NBIS) as outlined in the Code of Federal Regulations Part 650 Subpart C defines most of the definitions used within this document. [NBIS Definitions](#)

- **Advanced Bridge Inspector:** is a Department title given to the mid-level position of bridge inspector. ARDOT uses career advancement process to promote entry level Bridge Inspectors to Advanced Bridge Inspectors once they have proven to meet certain criteria and demonstrate their level of knowledge. This title may or may not be qualified as a FHWA Team Leader.
- **Assistant or Assistant Bridge Inspector:** is any individual assisting the Team Leader in the inspection activities. This can be ARDOT's "Bridge Inspector" or "Advanced Bridge Inspector" or another title in this role.
- **Bridge Inspector (entry level title):** is a Department title given to an entry level position for a bridge inspector within a District or within the Bridge Operations Division.
- **bridge inspector (one that inspects bridges):** This term is often used in general to refer to all individuals working as a Statewide, Senior, Assistant, Assistant, Advanced, or Bridge Inspector.
- **Bridge Operations Inspectors or Bridge Operations Inspection Teams:** Bridge Operations Division personnel responsible for inspection of major or complex bridges statewide. These individuals also perform quality assurance inspections.
- **District Bridge Inspectors or District Bridge Inspection Teams:** District personnel responsible for inspection of bridges within the Department's 10 Districts.
- **District Construction Engineer:** is a Department title for the supervisor of Resident Engineering offices and the District Bridge Inspection Teams. This positions helps to coordinate bridge inspection related information to local public agency bridge owners.
- **Local Public Agency:** is a local government such as a city or county referenced in this document to own and maintain bridge structures on public roadways.

- **Senior Bridge Inspector:** is a Department title given to the highest position of bridge inspector within one of the 10 Districts. These positions meet the FHWA team leader requirements.
- **Side Drain Structure:** Structures adjacent to the State Highway System that are bridge length and are known to carry public, commercial, industrial, or major farm transportation. They will be inventoried, assigned a bridge number, and inspected under the bridge inspection program. Even though bridge length in nature, all other side drain structures will be considered minor drainage structures.
- **Statewide Bridge Inspector:** is a Department title given to the highest position of bridge inspector within the Bridge Operations Division. These positions meet the FHWA team leader requirements.

These terms are specifically defined here to help interpret the guidance presented in this document:

- **May:** The term “may” indicates a criterion that is usable. Other suitably documented, verified, and approved criteria may be used in a manner consistent with the applicable specifications.
- **Shall:** The term “shall” indicates a requirement for compliance with applicable specifications.
- **Should:** The term “should” indicates a strong preference for a given criterion.

1.3.2 [Acronyms](#)

The following acronyms may or may not be used within this document. These acronyms are important for bridge inspection personnel to be familiar with.

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
ADTT	Average Daily Truck Traffic
AISC	American Institute of Steel Construction
ARDOT	Arkansas Department of Transportation
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BIP	Bridge Inspection Program
BIPOC	Bridge Inspection Program Oversight Committee
BIPTC	Bridge Inspection Program Technical Committee
BrM	Bridge Management (AASHTOWare software)
BrR	Bridge Rating (AASHTOWare software)
CFR	Code of Federal Regulations (federal law)
EV	Emergency Vehicle
FHWA	Federal Highway Administration
GVW	Gross Vehicle Weight
H-20	Highway Semi-trailer with 20-ton gross weight, the design load for ASD and LFD
HS-20	Highway Semi-trailer with 36-ton gross weight, the design load for ASD and LFD
HL-93	Highway Load from 1993, the design load for LRFD
LARS	Load Analysis Rating System (Bentley software)

LPA	Local Public Agency
LRFD	Load and Resistance Factor Design
LRFR	Load and Resistance Factor Rating
MBE	The Manual for Bridge Evaluation
MBEI	The Manual for Bridge Element Inspection
MN	Maintenance Need
NBI	National Bridge Inventory
NBIS	National Bridge Inspection Standards
NHI	National Highway Institute
NTIS	National Tunnel Inventory Standards
OSHA	Occupational Safety and Health Administration
PCA	Plan of Corrective Action (NBIS Metric Compliance)
POA	Plan of Action (Scour)
QA	Quality Assurance
QC	Quality Control
RF	Rating Factor
SHV	Specialized Hauling Vehicle
SI&A	Structure Inventory and Appraisal
SNBI	Specifications for the National Bridge Inventory
SUV	Single Unit Vehicle
USCG	United States Coast Guard
USGS	United States Geological Survey
USACE	United States Corps of Engineers
UWI	Underwater Inspection
UWType 2	Underwater Type 2 Inspection

1.3.3 [Abbreviations](#)

ft	feet
in	inches
ksi	kips per square inch
psi	pounds per square inch

1.4 **FORMAT AND REFERENCES**

1.4.1 [Format](#)

Each chapter of this manual begins with general information, followed by sections labeled numerically. Within the body of the text, references to other articles of this manual are cited directly (e.g., Section 4.5).

1.4.2 [References](#)

Where these guidelines do not provide any information on a procedure or methodology, the inspector or engineer is directed to the following manuals, current edition, in order of priority:

1. [Code of Federal Regulations – National Bridge Inspection Standards \(NBIS\)](#)
2. [Code of Federal Regulations – National Tunnel Inspection Standards \(NTIS\)](#)
3. [FHWA Specifications for the National Bridge Inventory \(SNBI\)](#)
4. Manual for Bridge Element Inspection, 2nd Edition, 2019;
 - a. Reach out to Bridge Operations for Document
5. [Bridge Inspection Reference Manual](#)
6. [Underwater Bridge Inspection Reference Manual](#)
7. [Underwater Inspection of Bridge Substructures Using Imaging Technology](#)
8. [Underwater Bridge Repair, Rehabilitation and Countermeasures Reference Manual](#)
9. [1995 FHWA "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges," 2012, 2018 Errata;](#)
10. The Manual for Bridge Evaluation, 3rd Edition, 2018 with 2020 Interim Revisions;
 - a. Reach out to Bridge Operations for Document
11. NHI Course No. 130055 "Safety Inspection of In-Service Bridges" Participant's Workbook;
12. 1986 FHWA "Inspection of NSTM Bridge Members";
13. 1986 FHWA "Culvert Inspection Manual";
14. 1989 FHWA, "Underwater Inspection of Bridges";
15. Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 6th Edition, with 2015 Interim Revisions;
 - a. Reach out to Bridge Operations for Document
16. [Metrics for the Oversight of the National Bridge Inspection Program, 2017;](#)

In the event of conflicting information or requirements between these guidelines and the National Bridge Inspection Standards (NBIS), the NBIS will govern. Inspectors and engineers are not relieved from the responsibility of complying with the NBIS even when a conflict exists. If an inspector or engineer discovers a conflict, notify the Bridge Operations Division as soon as possible.

In addition, these documents are referenced and/or are useful for bridge inspections:

- [FHWA Metrics for the Oversight of the National Bridge Inspection Program \(Metrics\)](#)
- [Standard Specifications - Arkansas Department of Transportation](#)
- [ARDOT Standard Specifications for Highway Construction \(2014\)](#)
- **ARDOT Load Rating and Posting Guidelines – Coming Soon**
- [Fatigue and Fracture Library](#)
- [Evaluation of Steel Bridge Details for Susceptibility to Constraint-Induced Fracture](#)
- [AISC Steel Construction Manual](#), 16th edition (2025)
- [Annual Book of ASTM Standards](#)
- [AWS Bridge Welding Code](#)
- [ARDOT Safety Manual](#)
- [ARDOT Bridge Standard Drawings](#)

1.5 QUALITY ASSURANCE

1.5.1 Quality Assurance Overview

Quality Assurance (QA) is a measurement of the level and consistency of the overall program. Quality assurance will measure the quality and uniformity of the inspection and documentation and identify specific items or procedures in the program where clarification, revision, or additional training is needed.

Federal Highway Administration (FHWA) QA is a bridge safety initiative that was introduced by the FHWA in 2011 with subsequent revisions to perform QA systematically. The initiative measures are a data-driven, risk-based review and analysis of 25 metrics that determine how states perform their bridge inspection programs.

https://www.fhwa.dot.gov/bridge/pubs/NBIP_Metrics_2026_INTERIM.pdf

FHWA determines the compliance levels for each of the 25 metrics by sampling and data-mining bridge inspection and inventory information across the entire state. A satisfactory rating means that the State is adhering to the NBIS regulations with perhaps a few minor, isolated deficiencies that do not affect the program's overall effectiveness. A rating of actively improving means a Plan of Corrective Action (PCA) is in place to improve noncompliant metrics. FHWA will rate the state bridge inspection program as unsatisfactory if metrics rated as noncompliant do not have a PCA or a State is not actively complying with an existing PCA.

1.5.2 District Quality Assurance

The District Construction Engineer (DCE) shall perform an annual quality assurance inspection process to identify strengths and areas for improvement. The DCE will inspect 5 bridges alongside the Bridge Operations Inspection Team performing District QA inspections. The DCE will inspect the same 5 bridges alongside the District Bridge Inspection Team. The DCE will be listed as a reviewer of each inspection and will document the differences observed between the two. This documentation will be sent to the Bridge Operations Division for file storage and follow-up action. The Bridge Operations Division will coordinate this effort with the District.

The District Construction Engineer QA inspection form can be found in [Appendix 1-B](#). This form is designed to organize the review into items the District team did well and items that team can improve. It also allows documentation of items the QA team did well and where they can improve. This review is essential to note which components may have received too much or not enough focus during the inspections.

In addition to the bridge site visits, the District Construction Engineer reviews every Maintenance item entered for any bridge. This process assures that an Engineer is aware of any severe concerns an Inspector may have on a bridge. State bridges receive additional review from the District Maintenance Engineer when they evaluate the maintenance item.

1.5.3 Bridge Inspection Program Quality Assurance

Inspection teams from Bridge Operations will independently reinspect structures in each District on an annual basis. Each year the procedures will change to focus on a subset of fields and documentation requirements. Bridge Operations maintains these yearly procedures. Once the QA inspections are completed for a District, Bridge Operations personnel shall review the inspections and compare them with the District's inspections. Variances will be documented and shared with each team for continual improvements to both the District Bridge Inspection Teams and the Bridge Operations Inspection Teams. See [Appendix 1.C](#) for details on yearly Quality Assurance procedures.

Survey questionnaires are filled out periodically to collect feedback from the bridge inspection personnel on their perception of the Inspection Program. This information is used internally to identify weaknesses, make improvements and track the progress of the bridge inspection program.

The Bridge Inspection Program Manager schedules appropriate periodic refresher training as needed. Refresher training could include NHI training, in-house training, webinars, online training, or any other training approved by the Bridge Inspection Program Oversight Committee. Bridge Inspection Program personnel should provide the Program Manager documentation of additional relevant training that may be completed beyond mandatory training. The Program Manager maintains a list through the Bridge Management Section of relevant training successfully completed by Bridge Inspectors, Assistant Bridge Inspectors, and Program Managers. This information is tracked in the inspection software.

1.6 QUALITY CONTROL

1.6.1 Quality Control Overview

ARDOT Bridge Inspection Quality Control (QC) is the enforcement of procedures intended to maintain the caliber of bridge inspection and documentation at or above the NBIS standard. Quality control is the responsibility of every person involved in the daily activities of the bridge inspection program.

The Federal Highway Administration performs yearly QC on ARDOT's bridge inspection data to look for discrepancies in data. FHWA works with ARDOT each year to explain or correct any data issues.

1.6.2 District Level Quality Control

The routine inspections in the District bridge inventory should be alternated between bridge inspecting teams. When it is not logistically feasible to rotate through the entire inventory within the District, the District Construction Engineer may implement an alternate procedure of rotating through a minimum of 50% of the inventory. This rotation of bridge inventory supports the peer-to-peer exchange of ideas and indicates if the inspection teams are performing similarly.

The District Construction Engineer, with the assistance of Bridge Operations Staff, shall do a comprehensive review of 1 inspection report per district per month. In addition, the Bridge Operations Staff will do a comprehensive review of 1 inspection report per district per month. All reviews will be documented, saved and shared with the appropriate staff for corrections to be made.

To ensure that the minimum number of routine inspections within the District bridge inventory is alternated between bridge inspection teams, the Bridge Management Section will check the percentage of rotation within each District monthly.

1.6.3 Bridge Operations Quality Control

Routine and NSTM Inspections in the Bridge Operations bridge inventory shall be alternated between bridge inspecting teams. 100% of the structures on Bridge Operations' inventory should be inspected by a different team leader every 24 months for routine inspections. NSTM inspections shall not have the same team lead for three consecutive NSTM inspections. Inspections where multiple teams collaborate, each NSTM should be inspected by a different team lead every 24 months. When it is not logistically feasible to rotate a structure or NSTM member, the teams shall notify the Bridge Inspection Program Manager. Approval by the Program Manager of failure to rotate must be documented in the inspection procedures along with justification. This rotation of bridge inventory supports the peer-to-peer exchange of ideas and indicates if the inspection teams are performing similarly.

Each Bridge Operations inspection report shall be reviewed by a Bridge Operations engineer. This will ensure documentation is done appropriately and accurately and reports are prepared in the highest professional manner.

The Bridge Inspection Software is used to manage the bridge inspection process. The system helps to eliminate errors from written reports, automates portions of the scheduling and type of inspections performed, and performs data validation checks. The database is regularly backed up, and it is part of the permanent bridge record. Changes to the database are restricted to authorized personnel only.

1.6.4 Bridge Inspection Program Quality Control

As part of the QC process, either the Assistant Bridge Inspector or Inspector shall review the inspection information entered by the other team members. The Assistant should also ask questions about if there is something that they disagree with in the report. In an ideal situation, the team will agree, but ultimately it is the team leader's responsibility.

The Team Leader shall always be on-site during the inspection. The Assistant shall always (with rare exceptions) be on site with the team leader so that two sets of trained eyes are looking at the bridge. If the Assistant cannot accompany the team leader, other personnel should accompany the team leader during the bridge inspection for safety considerations.

Only personnel qualified by NBIS standards and ARDOT requirements are used in conducting bridge inspections.

This Document contains the Department's policy and procedures for the Bridge Inspection Program. The Bridge Inspector must be fully aware of all these policies and procedures. Having one entity (the Bridge Operations Division) administrate the bridge inspection program promotes uniformity and consistency throughout the program.

Bridge Operations conducts checks on the bridge data from the bridge inspection database. Discrepancies are investigated and resolved. Procedural recommendations for improvements are made to the Program Manager where common errors are found. These are SQL data query checks that run through power automation processes. These checks send auto emails to the Bridge Management Section and are forwarded to respective parties. Each of these checks ensures that the requirements of ARDOT and FHWA are upheld in the Bridge Inspection Program. See [Appendix 1.D](#) for full list of automatic checks.

1.7 PROGRAM FUNDING

The purchase of supplies, inspection equipment, and training for the inspection program will be handled by the following procedure:

1. Each District will purchase all necessary supplies on a District Requisition charged to the District Budget and Function 1520. This is for items being taken into stock and issued to the inspection team as needed.
2. The District Storeroom's supplies to the inspection teams will be to Budget 895, Function 3400, and the appropriate Job Number and FAP Number as shown in the Appendix table.
3. Instead of the method described in 1 and 2 above, individual, small purchase items may be purchased by Confirmation Purchase Order using the District Requisition Number and described in the Accounting Manual under Section 30. Charges are to be made to Budget 895, Function 3400, and the appropriate Job Number as shown in the Appendix table.
4. Training funded by the Bridge Inspection Program will have a Job Number and FAP Number assigned to it and should be charged to Budget 895 and Function 3400.

Reference [Appendix 1.A](#) for the summary table of inspection charges and inspection equipment authorized for 895 charges.

1.8 LOCAL OWNED BRIDGE INSPECTION

ARDOT has an agreement with local owners and other agencies to be responsible for the inspection and load rating of bridge length structures on the state and locally owned public road systems in compliance with the NBIS. ARDOT will annually bill local owners 20% of the associated administration costs for the bridges under their jurisdiction. In addition, a voluntary program was developed where local owners could secure load posting materials from ARDOT at a reduced cost to ensure proper weight posting of local structures. Guidelines for local bridge owners are detailed in the [Local Public Agency Requirements Chapter](#) of this document.



Bridge Inspection Guidelines

Chapter 2 Inspection Program Requirements

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

2.1 INSPECTION PROGRAM ORGANIZATION

The Federal Highway Administration employees the position of FHWA Local Bridge Engineer. This engineer works with the Arkansas Department of Transportation to uphold the NBIS.

The Bridge Operations Division is designated by the Arkansas Department of Transportation to be entity that administers the Bridge Inspection Program in Arkansas in accordance with the NBIS. Engineers working in Bridge Operations draft policy and ensure the requirements of the NBIS are being met.

The Bridge Management Section in Bridge Operations helps to ensure data is accurate and the software programs are implemented properly for all inspection staff.

The Bridge Operations Division employs 5 statewide inspection teams that perform the inspections of over 100 of the most significant structures in the state. These teams perform underwater bridge inspections and complex bridge inspections where needed. The Bridge Operations teams help to perform quality assurance inspections in the Districts.

The Bridge Operations Division employs the Bridge Scour Section. This section of engineers and inspectors analyzes the inventory of bridges for scour concerns as required by the NBIS and helps to make recommendations for repair.

ARDOT is comprised of 10 Districts. Each District has 2 to 4 bridge inspection teams. These teams perform most of the bridge inspections for the bridges that fall in the boundaries of their respective district. The District Construction Engineer is their direct supervisor and helps coordinate information with local public agency bridge owners in collaboration with the Bridge Operations Division.

Bridge Division's Inventory and Rating Section utilizes the information gathered by the Bridge Inspector to perform a detailed review and load rating.

The inspection and analysis data is submitted at least annually by the Bridge Management Section to the FHWA Washington Office, where it is compiled to form the National Bridge Inventory (NBI) report to Congress. See [Appendix 2.A](#) for the ARDOT Bridge Inspection Program Organizational Chart.

2.2 PERSONNEL

2.2.1 [ARDOT Positions Meeting NBIS Position Requirements](#)

The State Program Manager shall be the State Bridge Operations Engineer. This position shall meet all the requirements of 23 CFR, Subpart C.

The Department policy is that District Construction Engineer (DCE) serves as the District Bridge Inspection Teams' direct supervisor and acts as the local public agency liaison for the program. After accepting a position that requires some NBIS program responsibility, the District

Construction Engineer shall complete the FHWA NHI “Safety Inspection of In-Service Bridges” comprehensive training course as availability allows. The goal is to complete this training within one year of assuming program manager responsibilities.

Senior, Statewide, or Advanced (Team Leader) Bridge Inspectors shall meet the requirements of 23 CFR, [Subpart C 650.309\(b\)](#) including successfully completion of the FHWA NHI “Safety Inspection of In-Service Bridges” comprehensive training course. Team Leader Bridge Inspectors shall provide training and mentoring to Assistant Bridge Inspectors to assist in their development. This mentoring requires the Team Lead Bridge Inspector to provide direct oversight of the Assistant Bridge Inspector during day-to-day inspection. Though the inspection is a team effort, the Team Leader Bridge Inspector retains the ultimate responsibility, and the Bridge Inspector shall retain “ownership” of the inspection documentation in the Bridge Inspection Software. A Bridge Inspector operating as Team Leader must meet the 5 years of bridge inspection experience criteria the NBIS requires; of this, at least 2.5 years must be a role in the bridge inspection program and 2.5 years can be in bridge maintenance, bridge construction or bridge design.

The “Assistant Bridge Inspector” position can be either an Advanced Grade 13 Bridge Inspector or a Grade 11 Bridge Inspector within ARDOT. A qualified Grade 11 Bridge Inspector can advance to the Grade 13 position through the career advancement process.

2.2.2 [Advanced Bridge Inspector Responsibilities](#)

The Bridge Inspection Program Oversight Committee determined the Advanced Grade 13 Bridge Inspectors may perform the following inspections as Team Leader given that they also meet all NBIS Team Leader requirements:

- Structure Inspections where Deck, Superstructure, Substructure, and Culvert condition ratings are all rated a 6 or higher.**
- Structure inspections where the structure is defined as non-bridge length or is a pedestrian structure.*
- Bridge mounted sign structure inspections.*

*Exceptions: Advanced Bridge Inspectors may not be Team Leader for structures crossing or carrying interstate traffic. Advanced Bridge Inspectors may not be Team Leader for structures requiring a UBIU for access. Advanced Bridge Inspectors may not be team leader for NSTM inspections.

**Additional Note: if the Advanced Bridge Inspector reduces the rating of the structure to a poor condition in any category, the District Construction Engineer or Bridge Operations engineer must perform a quality control review of the report.

2.2.3 [Underwater Inspection Divers](#)

The ARDOT Underwater Inspection Divers are employed within the Bridge Operations Division. The Underwater Inspection Teams working with the Bridge Operations engineers are responsible for scheduling and coordinating diving activities. One on-site diving team will consist of at least one team leader, and two of the following: Assistant Inspector, Inspector, engineer, or safety diver.

2.3 TRAINING

All bridge inspection personnel shall receive training requirements of the CFR or ARDOT requirements as detailed in this document. The Bridge Management Section maintains these training certifications.

The Bridge Operations Division will host the necessary FHWA training and refresher training required for all ARDOT Bridge Inspection personnel.

Rope access training specific to bridge climbing shall be performed with a certified rope access training consultant or other qualified personnel.

Diver Qualifications for ARDOT In-House Dive Teams:

- Candidates must receive approval from their current supervisor to participate in the dive program
- Be medically eligible to dive (Evaluated by a medical professional)
- Be employed by the Department in a bridge inspection role or another maintenance role
- Complete and pass designated Scuba or Surface supplied diving training and have a current certification
- Complete an FHWA approved underwater bridge inspection training course such as the NHI Underwater Bridge Inspection Course or be grandfathered in according to the CFR
- Be certified in CPR (2 members of team on site minimum – not required of all divers)

Divers may be exposed to hazards that include circulatory risk, respiratory risk, low visibility, hypothermia, and possible injury from falls or submerged debris. Safety of all Underwater Inspection Team members is pinnacle to daily activities, which warrants the following safety practices:

- ARDOT Bridge Inspection divers shall meet and/or exceed all OSHA specific diving regulations 1910 Subpart T.
- For further details regarding the In-House Dive Operations, contact Bridge Operations.



Bridge Inspection Guidelines

Chapter 3 Inspection Types and Documentation

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

3.1 INSPECTION FREQUENCIES

3.1.1 Overview

The ARDOT inspection program records multiple different inspection types: Initial Routine National Bridge Inventory (SNBI), Routine, NSTM, Underwater (Dive/Multi-Beam Scan), Underwater Type 2 (wading/probing), Under Record Clearance, Other Special Recurring, Accident, Scour POA, and Special. Each of these inspections has a particular purpose and is described in this chapter.

3.1.2 Summary of Inspection Frequencies

See the following table for the summary of ARDOT bridge inspection types and minimum inspection frequency requirements.

If a bridge requires a more frequent inspection in the professional opinion of the inspector, then the Inspector may reduce the frequency as necessary.

Inspection Type	Criteria	NBIS Schedule/InspectX Listed Frequency (in months)	InspectX Schedule
Routine/Primary Inspection Type			
*Extended Routine	Deck, Superstructure, Substructure, Culvert, Scour, Channel, and Channel Protection Condition Ratings All ≥ 6	48	48-month Routine
	Inventory Rating Factor ≥ 1.0		
	Fatigue Details (B.IR.02) = N		
	Highway Minimum Vertical Clearance (Item B.H.13) $\geq$ 14.0		
	Span Material (Item B.SP.04) = C01-C05 or S01-S05		
	Span Type (Item B.SP.06) = A01, B02-B03, F01-F02, G01- G08, P01-P02, or S01-S02		
	Scour Vulnerability (Item B.AP.03) = A or B		
	Bridges with Timber Primary Structural Components <u>Do</u> <u>Not</u> Qualify		
Regular Routine (includes initial)	Deck, Superstructure, Substructure, Culvert, and	24	24-month Routine

	Scour Condition ratings all > 4		
Poor Routine	One of Deck, Superstructure, Substructure, Culvert, and Scour Condition Ratings = 4	24 – Routine	24-month Routine
		24 – Other Special Recurring	24-month Other Special Recurring
		12 month offset in two inspection types	
Critically Poor Routine	One of Deck, Superstructure, Substructure, Scour Condition Ratings ≤ 3	12	12-month Routine
Posted Bridge Routine	Bridges with Load Posting Status (Item B.PS.01) = 'PA', 'PP', 'PD', 'PM' or posted in the temporary or supported condition and legally requires posting. Note: owners may post structures when it is not required. Only structures in which the posting is required fall into this category.	24	24-month Routine – offset with 24-month Posting Sign Verification Inspection
NSTM			
Extended NSTM	Year Built (Item B.W.01) ≥ 1979	Up to 48 months – Determined by criteria and Program Manager Review	Up to 48-months – Determined by criteria and Program Manager Review
	No fatigue details with finite life, history of fatigue cracks, nor pin and hanger assemblies		
	NSTM Inspection Condition (Item B.C.14) ≥ 6		
	Inventory Rating Factor (B.LR.05) ≥ 1.0		
	Program Manager to review prior to extension.		
Regular NSTM	Not meeting Extended Criteria	12	12-months
	Any NSTM where Superstructure or Substructure Condition Rating ≤ 4		

	Bridges determined by Program Manager to remain on legacy ARDOT frequency of inspections		
Simple NSTM	Not meeting Extended Criteria and determined by Engineering review to be low risk. Program Manager to review prior to extension from 12 to 24 months.	24	24-months
Underwater			
Extended Underwater (Dive)	Underwater Inspection Condition (B.C.15), Channel Condition Rating (B.C.09), Channel Protection Condition (B.C.10), and Scour Condition (B.C.11) ≥ 6	72	72-month Underwater
Regular Underwater (Dive)	Underwater Inspection Condition (B.C.15), Channel Condition Rating (B.C.09), Channel Protection Condition (B.C.10), and Scour Condition (B.C.11) > 4	60	60-month Underwater
Poor Underwater (Dive)	Underwater Inspection Condition (B.C.15) or Scour Condition (B.C.11) $= 4$	48	48-months max determined by Bridge Operations. Note: specific underwater issues can be inspected using the special or other special recurring inspection types without performing full underwater inspection.
Critically Poor Underwater (Dive)	Underwater Inspection Condition (B.C.15), Channel Condition Rating (B.C.09), Channel Protection Condition (B.C.10), and Scour Condition (B.C.11) ≤ 3	24	24-month

Underwater Type 2	Normal Updating of Channel Cross Sections and Profile. Max of 72 month should only be used in channels > 5 and no previous scour issues.	NA	Varies – 72-month max – 60-month preferred
Scour Prone Bridge Underwater Type 2	Scour Condition Rating < 5	12	12-Month UWType 2 or reference POA
POA Assessment/Evaluation	Bridge Operations staff to perform assessment as requested and as needed.	NA	Once - As Needed
Scour Monitoring	Triggered by flooding events	NA	Once - As Needed
Special			
Other Special Recurring	As needed	The Inspector should schedule an Other Special Recurring as often as needed.	If Item 92C is needed for a deficiency other than poor, the Inspector should schedule an Other Special Recurring in InspectX as often as needed.
Under Clearance Record	≤15.5'	12	Primary Routes will be collected with Lidar.
Under Clearance Record	>15.5'	24	Primary Routes will be collected with Lidar.
Accident	As needed	NA	Once – As Needed
Special	As needed	NA	Once – As Needed
Posting Sign Verification	Required when a bridge is posted, but not inspected annually	24	24-months offset by 12-months with the routine inspection

Closed Bridge	Bridges with Load Posting Status (Item B.PS.01) = 'C'	12 or more frequent	12-months (or more frequent) to verify closed status
---------------	---	---------------------	--

*For a new structure to qualify for the extended routine inspection interval, the initial inspection must be performed as well as a subsequent inspection scheduled for 24 months after the initial. Following the second documented inspection, if the structure meets the requirements of the extended routine, the inspector may move the bridge to a higher scheduled frequency.

3.1.3 Inspection Interval Tolerance

When the following tolerance is not met, the Team Leader shall document the late reason in the inspection file and alert the Bridge Operations Division and the FHWA Local Bridge Engineer.

- The acceptable tolerance for intervals of less than 24 months for the next inspection is up to two (2) months after the month in which the inspection was due.
- The acceptable tolerance for intervals of 24 months or greater for the next inspection is up to three (3) months after the month in which the inspection was due.
- Exceptions to the inspection interval tolerance due to rare and unusual circumstances must be approved by FHWA in advance of the inspection due date plus the tolerance.

All Inspections that fall 2 months late or more should have a reason documented in the drop-down box for Late Reason found on the inspection form when the inspection is completed.

3.2 ELEMENT LEVEL INSPECTIONS

For all state bridges and local bridges on the National Highway System (NHS) system, an inspection will also include an element inspection as described in the “Manual for Bridge Element Inspection” with current interims and [Chapter 8](#) of this document. The elements correlating to the inspection type shall be inspected in each inspection type. Example: NSTM inspections of NHS bridges will include element level inspections of the NSTM elements on those structures.

The inspection types of NSTM and Underwater Type 2 may be performed simultaneously during a Routine inspection.

3.3 INITIAL ROUTINE

3.3.1 Assigning New Bridge Numbers

When a bridge needs to be added to inventory, the inspector or engineer shall email the Bridge Management Section with the following information, and the bridge will be keyed into the bridge inspection software for record keeping:

- Bridge number, if assigned on a job. If not known, it will be assigned and provided to the Inspector
- Owner
- District

- County
- Latitude (decimal)
- Longitude (decimal)
- Route carried
- Planned inspection date
- Inspection frequency
- Bridge No. replaced
- Construction Job No. (If applicable)

3.3.2 [New Alignment Structure Inspection](#)

For a new structure on a new alignment and open to public traffic, an NBIS initial inspection is to be completed, and inventory data is to be documented into the inventory as soon as possible. At a minimum, it shall be completed within 90 days of the work (open to public travel) for all bridges. Completed new structures not open to traffic are not subject to the NBIS since they are considered closed. However, once a new structure is open to traffic, it is subject to the NBIS, and the inventory shall be updated with the new data within the 90-day timeframe. Where possible, the initial inventory inspection should be completed before the structure is open to traffic. This inspection can also be used to assist in completing the final punch list for the new structure.

3.3.3 [Structure Under Stage Construction Inspection](#)

Staged construction of a new structure presents additional variables in determining when to complete an NBIS inspection. For a new structure on a new alignment, the portion of the new structure open to public traffic is to be inspected regularly to ensure its safety. The safety initial inspection is to be completed in accordance with the NBIS, and there should be an explanation in the general observation comment field explaining why it was performed. Condition ratings shall be assigned and element quantities for NHS bridges shall be quantified during this inspection. If a new phase is opened to traffic that was not previously inspected, that portion of the bridge needs to be inspected within 3 months of opening to traffic in accordance with the NBIS.

3.3.4 [Existing Structure Being Replaced](#)

For an existing structure to be replaced with a new structure on a new alignment, the existing structure must be inspected per the NBIS as long as it remains in service as a highway bridge open to public traffic. For an existing structure to be replaced with a new structure on the same alignment and under staged construction, the portion of the existing/new structure open to public traffic must be inspected according to Section 3.3.3. Once the new structure is complete and carrying full traffic, the Initial Routine inspection is to be finished, and the new data is to be entered into the inventory within 90 days. The DCE or someone from the inspection team shall notify Bridge Operations' Bridge Management Section and Bridge Design Rating Section that the existing structure is no longer in service and can be archived.

3.3.5 [Bridge Archiving and Change of Ownership Requirements](#)

The following are reasons and requirements for archiving structures.

- Structure removed – The inspector or engineer shall provide photo documentation in the bridge files of the removed structure. Requester shall email bridge management section requesting removal from inventory.
- Removal due to non-bridge length – The inspector or engineer shall field verify measurements and record measurements with a CADD drawing to be included in the bridge file. The requester shall then email the Program Manager and bridge management with the request. After the Program Manager or delegated staff reviews the files and concurs, the structure may be archived.
- Removal or edit due to ownership change – In order to remove or edit a structure due to bridge ownership change, the inspector or engineer shall obtain court documents or legal statements from previous owner stating the ownership change and place them in the bridge files. The requester will then email the Program Manager and the Bridge Management Section with the request. After the Program Manager or delegated staff reviews the files and concurs, the structure may be archived or ownership changed.
- Removal due to closure – the inspector or engineer shall document permanent barricade on both ends of the structure in the bridge files. The requestor shall then email the Program Manager and the Bridge Management Section with the request. After program manager or delegated staff reviews the files and concurs, the structure may be archived.

Reference [Chapter 5 Section 5.3](#) for details on abandonment or removal from NBIS Inventory.

3.4 ROUTINE

This recurring inspection is made to assess the overall bridge condition and record any inventory changes from a previously recorded inspection. These inspections are normally performed on a 24-month frequency. However, they may be scheduled differently as directed in this document. This inspection is made to access all bridge elements with a visible observation to ascertain any deficiencies' existence and extent fully.

Inspectors performing routine inspections shall verify and update inspection and inventory data during each inspection. This includes bridge conditions, elements, photos, notes, geometry. Inspectors are expected to be aware of bridge rating, scour analysis and locational geographic information system data in the bridge file, but the inspector is not responsible for updating this data in the routine inspection.

3.5 NSTM

This is a recurring inspection scheduled for 12 months. This is a close-up, hands-on inspection performed on bridges with nonredundant steel tension member (NSTM) details. NSTM inspections shall be limited to the bridge components in question, with a full Routine inspection not being necessary unless it is scheduled. NSTM bridge inspections should be limited to only those tension-steel members whose failure might result in a partial or complete collapse of the bridge. Inspectors should make note of other maintenance issues noticed while on site during the NSTM inspection.

All bridges with NSTM elements on the public roads shall be inspected using NSTM inspection techniques. All NSTM inspection procedures will be reviewed by a professional engineer and available in the bridge file.

If a typical NSTM Inspection cannot be carried out, the cause should be noted in the late reason drop-down box found on the ARDOT Agency Form. A modified NSTM Inspection, still coded as a NSTM, should then be conducted as thoroughly as possible, followed by a Special Inspection when it becomes possible to address those items not covered in the modified NSTM Inspection.

The objective of NSTM Bridge Inspection is to evaluate, using NSTM techniques, the condition of those portions of a bridge that are considered NSTM.

By definition, NSTM Bridges are defined as non-redundant steel bridges such that failure of a single steel tension member or tension component could be expected to result in a collapse of the structure. On most NSTM Bridges, only the NSTM elements will require inspection every year, while the other bridge elements can be inspected on the regular cycle as deemed applicable for the bridge.

Types of bridges considered NSTM are typically trusses, one or two girders per span bridges, pin, and hangers on two girder bridges, steel-framed bent cap bridges, suspension bridges, railroad car bridges, and steel tied-arch bridges.

Reference [Chapter 7 Section 7.1](#) for NSTM procedure specifics.

3.6 UNDERWATER

3.6.1 Overview of ARDOT Underwater Inspections

The Federal Register proposes the following definition of Underwater inspection: Underwater inspection - Inspection of the underwater portion of a bridge substructure and the surrounding channel, which cannot be inspected visually at low water or by wading or probing, and generally requiring diving or other appropriate techniques. ARDOT employs the term Underwater Type 2 inspection to signify inspecting visually/tactilely at low water by wading or probing. ARDOT uses in-house and consultant divers for underwater inspections levels 1-3 as well as underwater imaging technology to satisfy the National Bridge Inspection Standards. This section outlines the details of these efforts.

This is a recurring inspection with a frequency of 72 months or less and shall be completed within 12 months of a bridge opening to traffic. Consultants or Bridge Operations shall perform underwater (Dive/Acoustical Imaging) inspections, and Bridge Operations or their representative shall input the information into the bridge inspection software. This inspection serves as an evaluation of those portions of a bridge below the water line and cannot be inspected visually or probed during periods of low flow or examined by feel for condition, integrity, and safe load capacity.

There are three methods used to evaluate underwater elements and channels during bridge inspections:

1. Underwater Type 2 - Wading and probing inspections typically when water is less than 5 feet. This inspection will include a channel drawing update.
2. NBIS Underwater Inspection - Dive (In-House or Consultant)
 - a. Level 1 – 100% of substructure elements will require level 1 inspection.
 - b. Level 2 – 10% of substructure elements will require hands on inspection that may or may not require cleaning. (depends on growth or surface conditions).
 - c. Level 3 – determined on a case-by-case basis.
3. Sonar Underwater Inspection - Imaging Technology

3.6.2 NBIS Underwater Procedures

Underwater Inspection includes inspection of all bridge elements in the water at the time of inspection and up to the high-water mark. Dive Inspectors will perform a visual and tactile inspection on all bridge elements from the high waterline to the channel bottom. The inspection limits will be marked and noted on the inspection drawing. Maximum depth of water is recorded around each substructure unit and any relevant deterioration will be documented and recorded.

Scour will be assessed in comparison with conditions noted in previous inspection reports, if available. Divers record sounding measurements both upstream and downstream of the bridge and note any significant deficiency to the channel within the recorded area. Scour plans of action POA's shall be reviewed and any relevant data will be recorded.

Channel meandering or any significant embankment deficiency within line of sight upstream and downstream of the bridge shall be noted.

An Inspector shall submit any bridge they feel warrants a dive to the Bridge Operations Division to be evaluated for an Underwater Inspection. Bridge Operations will determine if the bridge can be inspected with the in-house dive Inspection teams or not. If needed, the bridge will be combined with other bridges in that geographical area, and an engineering consultant firm selected to conduct a dive inspection. The current list of bridges requiring UWI is found in the bridge inspection software. This list will be expanded as district inspectors make recommendations.

When a consultant is used, they will provide the following services and use the inspection software for input of data:

- A 100% Level I inspection (visual, tactile inspection) for all bridges indicated by the project manager requiring underwater inspections (bridges continuously in water deeper than 4 feet), any deficiencies may be further evaluated by a Level II inspection at the authorization of the project manager.
- A minimum of 10% Level II inspection (detailed inspection with partial cleaning) will be performed on all steel elements indicated by the project manager, any deficiencies identified during a Level II inspection may be further evaluated by a Level III inspection at the authorization of the project manager.
- A Level III inspection (highly detailed inspection with non-destructive testing (NDT) or partially destructive testing (PDT)) will be conducted when the project manager authorizes the work.

3.6.3 Underwater Imaging Technology Inspection

ARDOT's Bridge Operations Team should conduct underwater imaging technology inspections on all bridges that require dive inspections that are accessible by boat to document the best change over time via 3D models. A channel profile will be drawn in CADD utilizing point elevations found from the 3D surface.

The Underwater Imaging Technology setup system is limited by accessibility, navigability, and adverse conditions. There are channels that are not suitable for navigation such as waterways with heavy debris, very shallow areas, spur dikes, sand wedges, and low elevation bridges. Waterways will be deemed unsuitable if there is a high risk of debris collision or channel bottom material. Other adverse conditions may exist at a bridge location such as active construction/maintenance and inclement weather. In these cases, underwater imaging can be rescheduled for a later date or consulted out for dive inspections by commercial divers as they are trained for such dive conditions.

Substructure elevations will be compared to bridge construction or reconstruction plans to find pier and contraction scour, channel migration or any other notable defects. Bridge Operations Inspection Teams will review each bridge point cloud and document and compare as-built elevations to current elevations to ensure the substructure is sound. Areas of scour will be noted with corresponding elevations. Screenshots of elevations should be provided for each pier/column/pile group in the water as well as overall review of channel. A current channel profile shall be included in the report. The report template includes at minimum the following:

- Description of work.
- Date of work performed
- Inspection crew personnel
- A description of scour and channel conditions.
- Pier scour holes will be documented by location, dimension, severity, and notable changes since last inspection or repair job such as, "scour hole at Pier 4, 3ft wide, 6 ft long, and 8 ft deep, with full footing exposure, piles visible on all faces down to 4 ft, riprap placed in 2017 is no longer present."
- For each pier/bent the report will also include information on:
 - Material type
 - Type/design of foundation
 - Protective coating present and material type
 - Inspection comments
 - Photos and measurements of that location
- A channel CADD drawing of the bridge.

3.7 UNDERWATER TYPE 2

3.7.1 Overview of Underwater Type 2

Section 3.7 details the difference between NBIS Underwater Inspection and the Underwater Type 2 (UWType 2) inspections. These inspections typically consists of wading, probing and updating of channel profile. Ideally, this recurring inspection should be scheduled along with the Routine

Inspection and during low water conditions if possible. Bridges requiring Underwater Type 2 inspections will include bridge length structures crossing waterways and not covered under an NBIS Underwater Inspection.

3.7.2 Requirements

A channel profile (channel cross sectional drawings) shall be provided for bridges requiring this type of inspection unless approval has been received by the Bridge Operations Scour Section.

All bridges requiring Underwater Type 2 Inspection will be inspected every 72 months or more frequently. The Inspector should consider scheduling every 48 months to better align with the two-year Routine inspection cycle. Steel pile bridges in a corrosive environment will have a high priority for inspection and frequency of inspection. Following emergencies - such as flood damage or substructure settlement – an Underwater Type 2 inspection will be performed. Use this type of inspection when underwater evaluation is made for:

- Channel depth or profile employing soundings using an electronic depth finder, measuring probe, or measured line with weight.
- Conditions of submerged substructure elements while wading, using a close visual or tactile (hands-on) examination and/or probing of the elements and adjacent streambed.

Soundings around piers and bents should be made on all bridges subject to scour from swift running water or where a previous flood has occurred.

Results of soundings shall be plotted in CADD showing the channel bottom in relation to footings or pile tip elevations, if available. Water surface elevation shall be recorded and labeled on the drawing. Notes should be recorded in the appropriate condition rating note field. Underwater type 2 drawings should be combined and placed under the asset files to identify a trend. The latest drawing should be placed under the inspection report files.

One method that will aid in documenting soundings is to establish a grid pattern. To establish longitudinal alignment (parallel to bridge), place two range poles set on the bank 50' from the side of the bridge 50' apart. Establish longitudinal alignment on both the upstream and downstream sides of the bridge. To establish the grid pattern for transverse alignment, use the bridge diaphragms and piers. Soundings should be made with reference to some known point of elevation on the bridge, such as the top of the cap. The actual depth at each reference point of the grid may be determined using an electronic depth finder, measuring probe, or line with weight. The electronic depth finder is more practical in swift water.

Structural components submerged in water generally of a shallow nature can easily be reached by probing rod or other tools. The probe will be one of the most useful tools available for an Underwater Type 2 Inspection in shallow water. A 12- to 15-foot-long aluminum, 3/4" diameter, telescoping pole with a pointed end is recommended. The inspector can "feel" along the side of piles and columns for weak spots and deterioration. Where areas are found to be suspect, other methods of inspection may have to be used for supplemental investigation.

3.7.3 Documenting Scour Concerns

Scour POA Inspections may use underwater inspection methods (probe/profile/wade), but they are for a specific purpose. If the inspection is documented as a Scour POA Inspection, an Underwater Type 2 inspection is not needed unless follow up inspection documentation is needed.

If an UWType 2 Inspection reveals a need for a Scour POA Evaluation inspection, the inspector must request a Scour POA inspection be performed with the following information:

Scour Deficiency Sketch in the approved format shall be generated and attached to the report if any of the following conditions are met:

- An inspection reveals scour that necessitates the need to decrease the Underwater or Underwater Type II Inspection frequency.
- A scour analysis has been requested in the inspection software due to observed scour during inspection.
- Scour/ undermining is present and Item 60 (Substructure) NBIS Condition Rating has been lowered to “4” or below.
- Scour/ undermining is present and Item B.AP.03 SNBI Condition Rating is rated “C” or below as the result of a Scour Appraisal.
- Item B.C.11 has been coded less than or equal to “4” or “U”.
- Item 113 has been coded less than or equal to “3” or “U” and scour/ undermining is present.
- A significant change in previously documented scour/ undermining is observed at time of inspection.
- Scour/ undermining is present at structures that have a Scour POA.

Scour Assessments shall be requested if any of the following conditions are met:

- Significant scour/ undermining is observed that has not been previously evaluated.
- Undocumented settlement cracks and/or substructure rotation is observed during an inspection and scour is present or infilling is suspected.
- Scour Condition Rating has been rated “4” or below.
- Substructure Condition Rating has been lowered to “4” or below due to observed scour/undermining

Scour Concern Inspection Procedures:

- Take overview photos of bents/piers with the drone (hover over bridge taking photos of the bent/pier)
- Check for any rotation along the footing/pier wall. If any rotation is present, take measurements from both sides of the pier wall and along both ends. (Make note where the measurements were taken from so that the next inspector in line will know where to measure from).
- Take measurements of exposed footing that is not undermined.
- Indicate streambed limits and type of streambed.
- Indicate the direction of flow on the drawing.

- Take measurements and draw sketches documenting the exposed and undermined footings to be attached to the report.
- Indicate piling locations and dimensions if there are any below the footing.

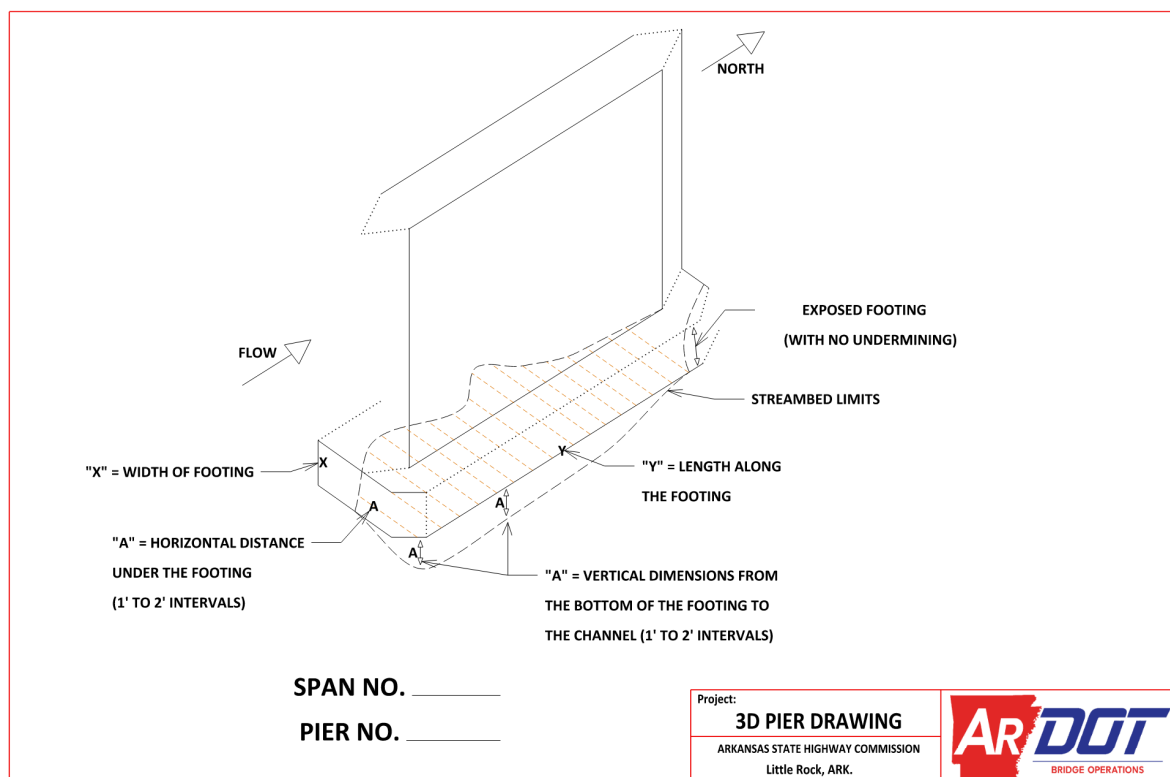


Figure 1. Example of Scour Concern Drawing Requirements

Y = Length of the footing.

X = Width of the footing.

AX = The horizontal distance for undermining along the footing (1' to 2' intervals).

AY = The vertical distance from the bottom of the footing to the channel bottom (1' to 2' intervals).

3.8 DAMAGE/ACCIDENT

An accident or damage inspection is a one-time non-recurring inspection that will be performed as necessary whenever a bridge is damaged or suspected of being damaged by an event, such as vehicle or vessel collision, fire, earthquake or other environmental factors. If the event has not changed the condition of the structure, the inspection schedule should not change. The Inspector should include documentation in the report that the bridge was inspected and record any damage found. A particular awareness of the potential for litigation must be carried out in the documentation of damage inspections.

Both District Administration and the Program Manager in Bridge Operations shall be notified of all damage inspections before, during and after the inspection. These situations present unique defects that should be evaluated by engineering staff. Bridge strikes, accidents or other types of

bridge damage typically involve questions from media, administration and outside agencies, therefore communication during accident inspections is paramount.

For an over-height bridge strike, photos along the beam are required to show any displacement. If beam displacement exists, the inspector should make every effort to document using a string line along the beam. A hands-on inspection should be performed to capture close images of the flange, web, and any other damage to discern if there are any cracks or tears.

If the damage is extreme enough to cause a load restriction on the bridge, a follow-up Special Inspection should be performed after the repairs have been completed. After this, Bridge Operations and the Bridge Rating Section shall be notified that a special inspection noting the repairs has been completed.

3.9 SPECIAL

This is a one-time inspection that does not fit into one of the other inspection categories. It should be performed as necessary. The requirements for this inspection vary depending on the need for the inspection. When a special inspection is scheduled, there should be an explanation in the inspection comment field explaining why it was performed.

3.10 SCOUR MONITORING

Scour monitoring inspections are coordinating using the emergencyX software are detailed further in [Chapter 9](#). The Plan Of Action (POA) for a scour critical bridge should be attached in Asset folder tab. If the POA calls for an inspection at a regular interval, that inspection should be coded as an Underwater Type 2 Inspection rather than a Scour POA Inspection. The scour monitoring inspection, also known as the scour POA Inspection, is a one-time inspection that will be performed as necessary whenever directed by the scour plan of action after a triggering event. Requirements for the inspection can be found in the Scour Plan of Action.

The Scour POA Inspection was created to track when an action is taken based on the scour plan of action. The Event Monitoring Form within emergencyX shall be filled out during the inspection.

If the inspection is documented as a Scour POA Inspection, then there is no need also to document it as an Underwater Type 2 inspection unless a follow up Underwater Type 2 or Scour Assessment Inspection is needed.

Local bridge owners are responsible for the scour monitoring inspections of their structures during a flooding event. ARDOT personnel will assess the structure using a scour monitoring inspection as well, but due to the limitations of personnel and location, the ARDOT inspection will not be as prompt as the local inspection. Local bridge owners shall use the SPOA Event Monitoring Form as detailed in the [Local Public Agency Requirements](#).

3.11 UNDER CLEARANCE

This is a recurring inspection that is performed to monitor the clearance of a bridge that crosses a state highway. This could be for a pedestrian bridge, railroad bridge, or other structure. A picture

of the clearance posting sign shall be included in the report. An under-clearance drawing shall be used to detail the vertical and horizontal clearance as a highway or railroad passes under the bridge. These values will be used to code clearance SNBI and Agency Fields.

By Arkansas State Law § 27-35-210, the maximum height of any vehicle on state highways is 14'-0", unless a greater height is authorized by a special permit. See details at this link: <https://media.ark.org/ardot/2023-Permit-Rules.pdf>

According to [Maintenance Memorandum 2023-01](#), "It shall be Department policy to post the actual clearance of all bridges that have a vertical roadway clearance of 15' 6" or less." ... "In addition, changes in vertical clearances due to maintenance activities should be measured by the District Bridge Inspectors and reported to the Bridge Division, Bridge Operations Division, and Permits Section as soon as possible. Bridges whose vertical clearance has been reduced to 15' 6" or less shall be posted."

All structures over public roads and railroads shall have their vertical clearance checked every two years at a minimum and recorded as part of a Routine inspection. A separate Under Clearance Record Inspection is not required when a Routine Inspection is done. When the vertical clearance is 15.5' or less, the vertical clearance shall be checked yearly at a minimum.

If a Routine is not scheduled when a clearance check is required, the clearance should be recorded as an Under Clearance Record Inspection. Bridges located along ARDOT defined Hazard Routes will have clearance data collected via LIDAR in the Bridge Operations Division to uphold the safety of employees.

3.12 OTHER SPECIAL RECURRING

Other Special Recurring is a recurring inspection for a known or suspected deficiency that does not fall under another category. This is an inspection that will typically be performed between the Routine inspections. In general, only those elements on the bridges requiring the more frequent inspection will be evaluated.

For example, finger joints may need yearly evaluation due to its condition, and the bridge has a 24-month Routine schedule. The finger joint will be evaluated in the routine inspection, so the Other Special Recurring does not need to be scheduled for that inspection. The Other Special Recurring inspection will be scheduled for 24-month frequency and offset 12 months after the Routine.

When scheduling an Other Special Recurring Inspection, add a comment in the comment box explaining why the Other Special Recurring is being performed.

3.13 IN-DEPTH

When it is necessary to fully ascertain the existence of or the extent of any serious deficiencies, In-Depth Inspection procedures will be used as part of the Routine (NBI). In-Depth inspection procedures are used to identify any serious deficiencies not readily detectable using routine inspection procedures. This may include nondestructive field tests or other material tests. For

example, pins of Pin/Hanger bridges and Pinned Truss Bridges shall receive an Ultra Sonic Inspection scheduled every 24 months.

3.14 POSTING SIGN VERIFICATION

When a bridge is posted, the condition of posting signs and applicable advanced posting signs for the bridge shall be verified annually by bridge inspection personnel. When a structure is posted and set for a frequency of inspection higher than 12 months, a posting sign verification inspection is to be performed. This inspection is intended to be offset by 12 months with a routine inspection when the routine frequency is 24 months.



Bridge Inspection Guidelines

Chapter 4 Inspection Procedures

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

4.1 FILE NAMING CONVENTION

To best organize bridge files, the following file naming convention shall be followed within the Bridge Inspection Program.

<u>File Common Name</u>	<u>Description</u>	<u>Bridge Inspection Naming Convention Template</u>	<u>File Type Required</u>
NSTM Procedure	Detailed document involving all NSTM details of inspection	NSTM_Proc_[structnum]_[date]	.doc or .pdf
NSTM Drawing	CADD drawing of all NSTM members depicted in RED	NSTM_Plans_[structnum]_[date]	.dgn
Completed Pin Document	Completed Pin Document from inspection	Pin_Doc_[structnum]_[date]	.doc
Blank Pin Document	Blank Pin Document prepared for next inspection	Pin_Doc_[structnum]_BLANK	.doc
Design Plans/Drawings	Combine all plans as 1 .pdf	Struct_Plans_[structnum]_[date]	.pdf
Reconstruction Plans	Combine all reconstruction plans as 1 pdf.	Recon_Plans_[structnum]_[date]	.pdf
Inspector's Bridge Sketch	Drawing when plans not available	Insp_Sketch_[structnum]_[date]	.dgn
Channel profile drawing/sketch	CADD drawing of channel cross sections and substructure elements	Chan_Prof_[structnum]_[date]	.dgn
Under clearance drawings/sketch	CADD drawing of vertical and	URC_Sketch_[structnum]_[date]	.dgn

	horizontal clearances		
Grid Deck Drawing	If applicable: CADD drawing depicting grid deck layout.	GridDeck_[structnum]_[date]	.dgn
Saved email correspondence	Saved email correspondence related to bridge inspection or asset	Email_[structnum]_[date]	.eml
Underwater Inspection Procedure	NBI Underwater Inspection Procedure document	UWI_Pro_[structnum]_[date]	.pdf
Repair Drawing/Detail	Documentation of drawings of repair done.	Repair_[Type]_[structnum]_[date]	.pdf or .dgn
Piling Records	Combine all piling record files as 1 pdf	Pile_Records_[structnum]_[date]	.pdf
Underwater Inspection Report	Copy of underwater inspection report	UWI_Report_[structnum]_[date]	.pdf
Combine CADD Drawing File	Single CADD File containing multiple types of drawings. (NSTM, Channel Profile, URC, etc...)	Combined_Sketches_[structnum]_[date]	.dgn
Other	Description of other in inspectX	Description_[structnum]_[date]	Any

File Naming Convention Notes

- Free pdf combiner: <https://www.adobe.com/acrobat/online/merge-pdf.html>
- Date format - use NBI format: YYYYMMDD
- Example: the NSTM procedure for bridge 05050 done March 18th, 2022, could be:

NSTM_Proc_05050_20220318.pdf

4.2 ASSET FILES

The bridge inspection software contains 6 categories/folders for files to be organized in the bridge files. These consist of General, NSTM Report Files, Underwater Files, and Historical Records.

4.2.1 General:

This folder of files shall contain the original and rehabilitated structure plans as well as other applicable information about this structure that does not categorize into one of the other folders of information.

The structure plans document shall consist of a minimum of all layout and cross-section drawings as a single PDF in accordance with the File Naming Convention section.

Types of files that should be saved in this folder include the following.

- Asset Plans
- Drawings
- Copy of the latest Load Rating Report
- Lanes Log Lane Closure
- Pin Document (If Not NSTM Member)
- AHP Request form

This folder of files shall also contain all computer-aided design drawings associated with the bridge. When there are multiple drawings associated with a single bridge, they shall be combined into one CADD file in the Combined_Sketches_[structnum]_[date] file type.

The following is a list of the most common types of drawing files that shall be saved in the asset if applicable.

- Channel Profile Drawing (dgn) is required to be updated when performing an Underwater or Underwater Type 2 inspection.
 - Combine to show multiple channel cross sections to show channel change over time (from separate inspections)
- Insp_Sketch_[structnum]_[date] (this is for inspector produced drawings when plans are not available. They shall be saved in the same dgn and pdf files).
- Under clearance (dgn)
 - Most current only
- Most updated grid deck drawing (dgn)

4.2.2 NSTM Files

The following types of files shall be saved in the bridge file asset page when NSTM inspections are required for the bridge.

- Most recent completed NSTM Procedure (pdf)
- Most recent NSTM Drawing (dgn)
- Blank Pin Document (If NSTM Member) (word)

4.2.3 Underwater Files:

This folder location shall contain the latest underwater inspection report printout. These files should also include the following.

- Underwater Channel Drawing (PDF) from UW Type 2 or UWI
- Underwater Inspection Procedures

4.2.4 Historical Records

This folder location is where all historical records should be stored. This can include geotechnical data, scour information, old email correspondence, as well as other types of historical records.

This folder location is also where documentation for files shared to local entities should be organized. The ARDOT Form 8 is a legacy type of form that contains documentation of maintenance items recommended to local owners for repair. The Local Government should use this form to provide documentation of work performed on the structure back to ARDOT.

4.3 REPORT FILES

Files associated with each inspection report shall be saved as supporting documents in the bridge inspection software. These folders/categories include General, Drawing Files, NSTM Files, Underwater Files, and Load Rating Files.

4.3.1 General:

Files saved to the general category include emails, videos, plans, pin documents and other photos not associated with another file category.

4.3.2 Drawing Files:

This folder location should contain all CADD sketches associated with the inspection. These can include the following.

- Under clearance Drawing (PDF)
- Most updated grid deck drawing (PDF)

4.3.3 NSTM Files:

All files associated specifically with a bridge inspection NSTM inspection shall be saved in this folder. This will include the following.

- NSTM Inspection Report/Procedure (PDF)
 - This report procedure combines current procedure, drawings and photographs to detail NSTM specifics of the structure.
- NSTM Drawing (pdf)

4.3.4 Underwater Files:

This folder location should contain all CADD sketches associated with the inspection. These can include the following.

- Underwater Channel Drawing (PDF)
- Underwater Inspection Procedures

Note: Underwater channel drawings should be combined and placed under the asset files to identify a trend. The latest drawing should be placed under the inspection report files.

4.3.5 Load Rating Files:

This folder shall contain all associated load rating inspection files.

Reference the ARDOT Load Rating and Posting Guidelines for more details – Coming soon.

4.4 REQUIRED INSPECTION PHOTOS

A quality inspection report contains photos of the structure and its condition. These sections contain the minimum required photographs for the 3 primary inspection types: Initial/Routine, Underwater/Underwater Type 2, and NSTM. Inspectors should always use their best judgement when taking photos for professional documentation.

4.4.1 Initial and Routine Inspection Photos

<u>Type of Photo</u>	<u>Bridge Inspection Software Photo Assignments</u>	<u>Description of Minimum Requirement</u>
Inventory (roadway)	Inspection Direction	1 photo of the bridge roadway view
Elevation	General Observation and Assigned to Primary Photo	1 photo of the entire bridge preferably with a drone
Load Posting and Advanced Load Posting Signs	SNBI Posting Status	1 photo per sign location showing sign installed or not. Advanced Load Posting Signs should be included
Typical Deck	Deck Condition Rating	1 photo showing the typical condition of the top of deck
Typical Under Surface of Deck	Deck Condition Rating	1 photo showing the typical condition of the bottom of deck
Typical Superstructure	Superstructure Condition Rating	1 photo per each superstructure span set type showing the type and condition

Typical Substructure	Substructure Condition Rating	1 photo per each substructure span set type showing the type and condition
Typical Culvert	Culvert Condition Rating	1 photo for the inlet and 1 photo for the outlet of each culvert; photo of level of sediment if not shown in inlet/outlet photos
Channel	Channel Condition Rating	1 Upstream and 1 downstream photos of the channel preferably with a drone
Channel Protection	Channel Protection Condition Rating	1 photo of the channel protection (wingwalls, riprap, vegetation, etc.)
Maintenance Needs	Each Maintenance Need	1 photo per maintenance need per inspection. Photo must be updated each inspection showing the latest condition. Only the latest and first photo of a defect should be maintained in the MN.
Routine Maintenance Needs	Check Box Maintenance	1 photo per check box maintenance where the item is marked as needing work.
Elements	Appropriate Element	Photos as provided for documentation. 1 photo required when CS4 defects are noted. Photos for CS3 defects recommended.
Utilities	Each Utility Feature	1 photo per utility including Navigational Lights

4.4.2 [NSTM Inspection Photos](#)

<u>Type of Photo</u>	<u>Bridge Inspection Software Photo Assignments</u>	<u>Description of Minimum Requirement</u>
NSTM Reference Photos	NSTM Description of Structure (Agency-128)	1 photo per non-redundant steel tension member type

NSTM Condition	NSTM Condition Rating	Photos required to support the overall rating of the NSTM condition
NSTM Defect	Appropriate NSTM Element for NHS Structures and NSTM Condition Rating for Non-NHS Structures	Photos documenting defects associated with all non-redundant steel tension members.

4.4.3 [Underwater/Underwater Type 2 Inspection Photos](#)

<u>Type of Photo</u>	<u>Bridge Inspection Software Photo Assignments</u>	<u>Description of Minimum Requirement</u>
Channel	Channel Condition Rating	Upstream and downstream photos of the channel preferably with a drone
Typical Substructure	Substructure Condition Rating	1 photo per substructure bent within the limits of the channel high water mark
Scour	Scour Condition Rating	Photos necessary to support the scour condition rating

4.5 REQUIRED INSPECTION NOTES

ARDOT documents element level inspections for all state-owned structures and locally owned structures on the NHS. Due to these differences in inspection procedures, required note placement for each is slightly different. See [Appendix 4-A](#) for the Standard Note Taking Convention.

The general observation shall contain the general inspection procedure to inspect the structure. This shall contain how the inspection was performed through access, tools, and other special considerations for the structure. This can include notes for next inspection and unique items pertaining to that bridge.

4.5.1 [State Owned Structure Note Placement Procedure](#)

All defect notes shall be placed within the element comment box for all defects corresponding to that element.

- This shall be the location for all notes on section loss, loss of bearing area, deterioration measurements, etc. for users to identify easily.

- Defect notes should be placed in applicable photo notes, the applicable element notes and the applicable maintenance need notes. A single defect note with a photo may be located up to 3 locations in the same report.
- If there is documented section loss or other deterioration that load rating would need to account for in an attached drawing, the drawing must be referenced within the element notes.

Notes shall be written for each photo taken. There shall not be any photos without a description.

Place a comment for the overall condition of each corresponding condition rating. This should provide a description as to why the NBI rating is given. The lower the rating, the more the description. Examples of condition rating notes are as follows:

- *Simple example:* Overall, the substructure units inspected are in good condition with only minor scaling along the full length of Piers 1 and 2.
- *A more detailed example:* Overall, the channel is in good condition. The upstream channel is well aligned with the substructure units. There is an accumulation of heavy timber debris and sediment extending from the waterline to channel bottom, around Pier 2 and 8 feet radially around the pier. At Pier 1, there is a large tree in the channel upstream and an old concrete substructure column and cap downstream. The banks under the bridge as well as upstream and downstream of the bridge are steeply sloped and well vegetated.

Maintenance Needs shall contain a minimum of:

- Location of all items that are recommended for repair
- Photos with associated descriptions

4.5.2 Locally Owned Structure Note Placement Procedures

In general, since ARDOT does not complete element level inspection on most locally owned structures, defect and element level notes will be documented in the appropriate component.

- Place all defect notes within the corresponding component comment box for all defects corresponding to that element. (different than state)
- Place a note for each photo taken. There shall not be any photos without a description. (same as state)
- Place a comment on the overall condition of each component.
 - This may be more concise than for state owned structures if referencing defect notes entered in the same component.
- Maintenance Needs should contain a minimum of:
 - Location of all items that need to be fixed (same as state)
 - Photos with notes (same as state)

4.6 DRAWING REQUIREMENTS

4.6.1 Overview

ARDOT Bridge Inspection Program shall utilize computer aided design and drafting (CADD) software for creating all sketches in support of bridge inspection documentation. All under clearance drawings, channel cross section drawings, and NSTM sketches shall be drawn to scale in CADD and then saved in the Bridge Inspection Software Files. Designers in the Bridge Operations Division have set up templates for each type of drawing to be used. This creates uniformity and consistency among all bridge inspection associated drawings. All drawings shall use the Bridge Inspection CADD template and the appropriate border when printing to PDFs.

When plans are not available for a bridge, the inspector shall take measurements of the structure and create a CADD drawing to scale as the documentation of the bridge. Any bridge without plans shall have drawings depicting span lengths, a cross-section of superstructure types, and details of the substructure. Pictures of hand drawings and scanned into CADD are not acceptable. The drawings shall be of such detail so that the Load Rating Section may ascertain the needed details to determine any posting needs. Drawings shall be updated as necessary to reflect changes that may affect the bridge rating.

The following items are a minimum needed to be detailed for the primary structure types.

4.6.2 Deck Details

- Curb to curb and out to out of deck dimensions
- Slab/deck thickness
- If thickness varies, this shall be detailed
- Indicate if stay-in-place forms are present.
- When present, curb/parapet/railing details – Dimensions and sizes. For rail, shapes define or give sizes.
- When wearing surface or cover is present, detail type and thickness
- If there is a steel grid deck, indicate the size of the grid as well as the thickness and height of the metal.

4.6.3 Superstructure Details

- Type, number, and the dimension of girder spacing (if all are not the same, show individual spaces)
- If steel girder designation isn't known, detail flange(s) width and thickness, web thickness, and overall depth; If a cover plate is present, show the length, width and thickness, and distance of the beginning referencing the beginning of the girder or nearest bent.
- For steel plate girders, show each flange's width, thickness, length, and the web. Sometimes there's a change in plate size on the girder length.
- For steel girders, note if shear connectors exist, if known
- Timber and RC – detail the depth and width
- Channel beams – detail unit width and depth, leg width and depth below the slab, slab thickness; grout keyway dimensions

4.6.4 Substructure Details

- Cap length, width, and depth dimensions
- Cross-section dimensions of piling or columns
- If foundation piling is present, size and spacing
- Spacing, including the distance from the end of the cap
- Footing details, if present
 - Length, width, and depth
- Main member bearing locations on the bent cap, including the distance from ends of the cap (for analyzing cap)

4.6.5 Channel Drawings

- Bridge length and individual span lengths
- Substructure foundation details shall be shown in relation to the channel
- Channel Profile (cross sections)
 - Draw historical list of all cross sections measured.
 - Only show the first and the most recent cross section. Hide all the other years.

4.6.6 Box Culverts

- Overall length, back face of wall at beginning to back face of wall at end.
- Thickness of end and intermediate walls; top and bottom slab, if possible;
- For multi-boxes: Show span lengths, center of wall to center of wall. Box sizes can be different.
- Barrel lengths
- Amount and type of cover
- Type of culvert – precast or cast-in-place

4.6.7 Pipe Culverts

- Type of material (RC, Metal, Other)
- Shape of culvert (round, arch, oval)
- Diameter (round); Height and depth (arch)
- Barrel lengths
- Layout of pipes – distance between them, number of pipes, etc.
- Amount and type of cover
- Fill depth at centerline of roadway, fill depth at edge of pavement
- Corrugation type (spiral steel, spiral aluminum, corrugated metal, structural plate)
- Thickness, length, and gage of corrugation
- Curvature of pipe (not just radius - could be original design or deflected shape, you can use a straight edge and a formula for this)
- Seam type
- See standard inspection sketch for printable sheet with all required information with illustrations

4.6.8 Trusses

- Profile view
 - Truss length
 - Panel lengths
 - Panel heights, center of floor-beam to pin at top of panel
 - Panel members configuration
- Cross section view
 - Width, center to center of trusses
 - Roadway dimensions carried by truss (similar to a span cross section)
 - Floor-beam details
 - Stringer data and location, if present. Indicate if stringers are continuous or not.
 - Provide member shape/size, & length

4.6.9 Arches

- Profile view
 - Arch length
 - Spacing of columns/vertical members
 - Vertical members heights, center of floor-beam to arch member
- Cross section view
 - Width, center to center of arch
 - Roadway dimensions carried by arch (similar to a span cross section)
 - Floor-beam data
 - Stringer data and location, if present
 - Dimensions/size for all members

4.6.10 Railcars

- Profile view
 - Overall length
 - Length of center sill sections (deep, shallow, and transitions), and distance of the beginning referencing the beginning of the girder or nearest bent.
 - Location of struts and floor beams
- Cross section view
 - Lateral spacing of members
 - Member size data
 - Decking type and size data



Bridge Inspection Guidelines

Chapter 5 Restrictions

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

5.1 GENERAL RESTRICTION INFORMATION

The NBIS requires bridges to be rated and posted for safe load carrying capacity. This chapter details the Department's requirements regarding bridge postings, bridge closures and related information.

All State-owned bridges and LPA bridges on the NHS will be physically posted for weight restrictions (if required) for both commercial vehicles and emergency vehicles. All other LPA bridges will be physically posted for weight restrictions (if required) for commercial vehicles only; the restrictions for emergency vehicles (if required) will be shown electronically through idrivearkansas.com.

5.1.1 New Structures

New Structures shall be evaluated for load carrying capacity in accordance with FHWA NBIS regulations and State laws. In accordance with the NBIS, Load ratings must be completed as soon as practical, but no later than 3 months after the initial inspection and when a change is identified that warrants a re-rating such as, but not limited to, changes in condition, reconstruction, new construction, or changes in dead or live loads.

Inspectors must request a load rating when completing the initial inspection to trigger the load rating process. Inspectors must indicate that the request for load rating is for a new structure in the comments section.

Inspectors must request a load rating at any point in the structure's life where in their professional judgement warrants the need for re-rating such as changes in condition, repair, or reconstruction.

5.1.2 Rehabilitated/Repaired Structures

Rehabilitated structures or repaired structures with the same bridge number that were previously closed to traffic due to load carrying capacity will require a new load rating prior to being open to traffic. A repaired structure shall remain at the same load posting until a new load rating can be performed.

Rebuilt/Replaced structures will fall into the new structures' requirements.

Locally owned rehabilitated structures should require a request for load rating through a record change inspection at the same time the Maintenance Need Form 8 is attached to the files if the work performed was to increase the load posting.

5.1.3 Serviceability

When it is apparent that a critical aspect of a bridge is not functioning as designed or jeopardizes the structural capacity and has an appraisal of "Poor" and the basic condition factor guidelines do not adequately cover the situation, the District Construction Engineer, an Engineer from Bridge Operations, or an Engineer from the Bridge Inventory and Rating Section should be consulted. If

the assessment warrants a condition rating other than that reflected by the condition guidelines, this should be explained in the comments area for the consultation.

5.1.4 Bridge Closures

Any structure that cannot carry a minimum live load of 3 tons requires closure according to the NBIS. Sections 5.2 and 5.4 detail the specifics of locally owned and state-owned bridge closures respectfully.

5.1.5 Tracking Bridge Weight Posting Issues

Bridge Operations shall track all bridge weight posting issues. This tracking will be used to ensure that follow-up with the owner is completed and documented for those issues more than 1 month past the required timeframe of action.

5.1.6 Post Load Rating Process Flowchart

The post load rating process flowchart represents the process of the procedures after the ratings section performs a load analysis and completes the documentation in the bridge inspection software.

See [Appendix 5.A](#) for the post load rating process flowchart.

5.1.7 Bridge Posting Signs

A bridge that is determined by engineering staff to not safely carry the state or federal legal loads, shall require weight restriction signs to be placed at and/or in advance of the bridge in accordance with the NBIS and MUTCD. ARDOT uses a combination of MUTCD sign standards to meet the posting requirements for each structure requiring weight posting.

Advanced warning posting sign placement on state owned routes should be coordinated by the Maintenance Division and District staff. In situations where multiple bridges require weight posting between state route intersections, the most restrictive bridge posting values shall be installed as the advanced warning posting values.

The District staff will be responsible for ensuring the accuracy of the advanced warning posting values when weight restrictions are updated for state owned bridges.

See weight limit signage appendices [5.B](#), [5.C](#), and [5.D](#) for ARDOT posting sign examples.

5.2 NON-STATE OWNED (LPA) BRIDGES

5.2.1 Bridge Closure for Non-State-Owned Bridges

Typically, one of the following 3 scenarios occurs, initiating a bridge closure for locally owned structures.

Scenario 1 – Inspector is certain of dangerous on-site safety concern

If the inspection reveals a dangerous situation that the inspector is certain requires immediate closing, the procedure is as follows:

1. As able, the inspector shall immediately restrict access to the bridge and inform the traveling public of the danger.
2. The Inspector shall immediately notify the owner and local law enforcement that the bridge should be closed and notify the District Construction Engineer (DCE) and the Bridge Operations Division.
3. The DCE should:
 - Immediately investigate the need to close the bridge.
 - Promptly notify the owner and the local law enforcement of his findings and whether the bridge should remain closed.
 - Promptly discuss the issue with the Bridge Operations Division and the Assistant Chief Engineer of Maintenance.
4. Bridge Division or Bridge Operations Division should promptly send official notification letters to the District by email.
5. The DCE should forward the letter and information to the local owner via Certified Mail. The DCE should also make effort to immediately call and discuss issue with the local owner.
6. An inspector shall do a site visit to update the posting status after closure is finalized with photo documentation.

Scenario 2 – Inspector is uncertain of dangerous on-site safety concern

If an inspection reveals a dangerous situation, but the inspector is not sure immediate closing is required, the procedure is as follows:

1. The Inspectors shall immediately notify the District Construction Engineer (DCE), the Bridge Operations Division and the Bridge Ratings Section.
2. The DCE should:
 - Immediately investigate the need to close the bridge.
 - If bridge closing is required, immediately as able, restrict access to the bridge and notify the owner and the local law enforcement of the need to close the bridge.
 - Promptly provide the inspection report and other appropriate information to the Bridge Ratings Section and Bridge Operations for review.
3. If determined to require closure, Bridge Division or Bridge Operations Division should send an official email notification letter to the District.
4. The DCE should forward the letter and information to the local owner via Certified Mail. The DCE should also make effort to immediately call and discuss issue with the local owner.
5. An inspector shall do a site visit to update the posting status after closure is finalized with photo documentation.

Scenario 3 – Load Rating Staff determines bridge cannot safely carry the 3 ton minimum

If the Rating Section of Bridge Division or Bridge Operations Division determines by analysis that a bridge should be closed, the following steps should be taken:

1. Bridge Division or Bridge Operations Division shall send an official email notification letter to the District.

2. The DCE shall forward the letter and information to the local owner via Certified Mail. The DCE should also make effort to immediately call and discuss issue with the local owner.
3. An Inspector shall do a site visit to update the posting status after closure is finalized with photo documentation.

If the local owner has not closed the bridge within two business days of being notified of the need for closure by any of these scenarios, the District and Bridge Operations will directly contact the local owner to persuade the owner to comply with the closure immediately. The Chief Legal Counsel of the Association of Arkansas Counties (AAC) may be notified if a county does not react in an appropriate and timely manner.

5.2.2 Posting Changes for Non-State-Owned Bridges

If a posting change by Load Rating staff requires a change in the current posting, the District Construction Engineer shall notify the Local Public Agency Owner by letter and include the required posting values for their information. All weight-posted bridges will require sign verification, and photographs taken to verify the posting status.

A local bridge that has a reduction in load carrying capacity determined by a load analysis shall have signs installed within 30 days of the update in rating per the NBIS. The bridge owner will be promptly notified verbally and with an official notification by certified mail. In addition, the local owner will receive an automated email notice on the 1st of each month of this posting issue from the inspection software until the owner has verified completion and it has been documented completed in the corresponding maintenance item. The District Construction Engineer, Bridge Operations Staff, and the Staff Structures Engineer will also receive an email about all posting issues. The email shall convey the reason for the posting change.

The District Construction Engineer shall review the email notifications for local bridges. If any posting issue has passed the required timeframe to be addressed, the District Construction Engineer shall contact the Local Owner by phone to discuss the safety concern, and a resolution plan shall be discussed. If a posting issue has passed its required timeframe of action by two months or more, the Program Manager will confer with the Assistant Chief of Operations for assistance in resolving the posting issue. The Chief Legal Counsel of the AAC shall be included in consultation for those issues involving counties.

Upon written notification by the Owner of a substantial rehabilitation, new bridge structure, or request for removal of a bridge from their inventory, ARDOT will inspect as to update the inventory.

For situations where owners choose to weight restrict a bridge, but the load rating analysis does not require load posting due to capacity, a higher frequency inspection will not be required to verify sign installation.

The public should be kept aware of the posting status of locally owned bridges. This will be accomplished by the Department by maintaining an up-to-date map showing all locally owned weight restricted bridges. This will be made available to the public through the web portal www.idrivearkansas.com.

5.2.3 [Posting Issues Identified for Non-State-Owned Bridges](#)

When a bridge is found to have a weight posting safety issue during a bridge inspection, the District Bridge Inspection staff will send a Maintenance Needs Report to inform the Owner of the deficiency within one week of the inspection. The District Inspection Staff shall instruct the Owner to submit a Maintenance Need Form 8 as documentation that the posting has been corrected. The Owner shall also be encouraged to include dated photographs showing legal signs at both ends of the bridge. The Department will accept a returned Form 8 or email notification from the Owner as documentation of completed posting. The date and means of notification shall be recorded in the bridge inspection software.

5.2.4 [Posting Sign Materials for Non-State-Owned Bridges](#)

Posting Signage for Local Owners is of upmost importance. As such, The Department will provide signs to local owners for bridges that require posting. The sign material will be charged to the appropriate bridge inspection project number in the Department's fiscal system. These sign charges will be incorporated into the annual inspection-related charges to each local public agency. The Department will make every effort to assist the local owners to get the proper signage installed within 30 days of notification. This may include sign delivery, sign sticker editing, or additional efforts.

Reference [Chapter LPA Section LPA Attachments](#) for LPA Sign Request Form.

5.3 ABANDONMENT OR REMOVAL FROM NBIS INVENTORY

According to 23 U.S.C. 101(a) (21), The term public road means “any road or street under the jurisdiction of and maintained by a public authority and open to public travel.” As such, the public authority has a responsibility to maintain any bridge that the public can traverse. To remove a bridge from the local inventory, the public authority must provide certification to the District Construction Engineer of one of the following:

- The ownership of the route is not the local entity that ARDOT has on file.
- The ownership and responsibility have been transferred to another public authority.
- The owner must maintain restricted access to the structure so that the public may not traverse the structure.
- The road is not open to public access.

When a bridge is found to be not bridge length and is currently in the system, Bridge Management requires a drawing to prove not being bridge length to archive the structure. The inspector shall place the drawing in the asset files. The inspector must document in the last inspection that the bridge is not bridge length at the time of measurement. When the bridge is posted, the District will coordinate the inventory removal process with the local owner and encourage the posting signs to be left in place.

5.4 STATE-OWNED BRIDGES

5.4.1 Bridge Closure for State-Owned Bridges

Closure for state-owned structures does not require as much coordination for the closure, but proper procedures for closure and communication must be followed.

Scenario 1 – Inspector is certain of dangerous on-site safety concern

If an inspection reveals a dangerous situation that the inspector is sure requires immediate closing, he should:

1. As able, restrict access to the bridge. Inform the traveling public of the danger.
2. Request assistance from the local maintenance yard to properly close the bridge.
3. Immediately inform the District Engineer (DE) or the DCE as well as the Bridge Operations Division.

Scenario 2 – Inspector is uncertain of dangerous on-site safety concern

If an inspection reveals a dangerous situation that the inspector is not sure requires closing, he should immediately consult the DE, DCE, Bridge Operations and Bridge Ratings Staff.

Scenario 3 – Load Rating Staff determines bridge cannot safely carry 3 the ton minimum

If the Rating Section of Bridge Division determines by load analysis that a bridge should be closed, the Rating Section should immediately inform the State Bridge Engineer, the State Bridge Operations Engineer and the DE or the DCE that immediate closure is required.

5.4.2 Posting for State-Owned Bridges

The District Maintenance Engineer shall ensure that all posting issues for state-owned bridges in their respective Districts are addressed within 30 days of notification.

State Posting issues will be checked monthly by Bridge Operations Staff and coordinated with the Districts via the post load rating process.

Bridges with posting signs will be physically verified by inspectors through the appropriate inspection type at least once per year.

If the recommended posting for a bridge decreases or the structure requires posting for the first time because of a load rating analysis, the Bridge Rating Section will notify the State Bridge Operations Engineer, Staff Structures Engineer, District Maintenance Engineer, District Construction Engineer, and Bridge Inspectors via email. The email shall convey the reason for the posting change. The Load Rating Engineer will see that a maintenance item in the bridge inspection software is updated or created as needed.

5.4.3 Notification of State Route Postings for Local Stakeholders

Upon notification from a Load Rating Engineer, that the recommended load posting for a state bridge has changed notably (from legal to restricted or other significant changes), District Staff will contact the local County Judge/City Mayor (as applicable). Depending on the severity of the

impact/load posting additional persons may be notified. This notification can be by email/call; no letters are required.

When a recent load rating analysis of a state-owned bridge recommends a reduced CMV posting to anything 20 tons or less, OR if a CMV posting below 20 tons rises significantly (5 or more tons or to above 20 tons); additional notification is required:

- District personnel will immediately contact the following applicable parties:
 - City Mayor
 - County Judge
 - County Office of Emergency Management
 - Local School Superintendent or Administrative Staff
 - Other individuals or private entities, as directed by the District Engineer
- In addition, follow-up correspondence (email and/or letter) will also be sent by the District to the above individuals/organizations for documenting purposes.
- At the discretion of the Division Head of Bridge Division, the following individuals/organizations will be contacted by the Governmental Relations Officer:
 - Applicable State Senators
 - Applicable State Representatives
 - Arkansas Trucking Association
 - Arkansas Department of Education (*This is needed for statewide school notification for travel purposes (i.e. sporting events)*)
 - Arkansas Department of Agriculture – Forestry Division

In unique instances, as deemed necessary by a Division Head, District Engineer, or Administrative Official, Public Information may need to provide a Media Notice.



Bridge Inspection Guidelines

Chapter 6 Repairs and Maintenance

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

6.1 OVERVIEW

The Arkansas Department of transportation utilizes inspection data and bridge inspectors to help make recommendations for bridge preservation and bridge maintenance. This chapter describes the details of this process and how the bridge inspection software is utilized for this business process.

The Bridge Inspection Program Technical Committee has prepared the “Maintenance Need Guidance and Examples” to provide guidance and support for bridge maintenance documentation. The document was made available for statewide use beginning in 2023. Please refer to this guide for further information or interpretation of this chapter.

Reference [Appendix 6.A](#) on Maintenance Needs Guidance and Examples.

6.1.1 [Inspector Workflow for Maintenance Needs](#)

ARDOT uses the term “Maintenance Needs” to refer to bridge work orders. These are the items that are documented primarily by bridge inspectors and recommended for repair. ARDOT uses a robust process where inspectors can see previous work orders and create new work orders alongside their NBIS bridge inspection while out in the field. Upon approval of the bridge inspection, these items are available for engineering review within the software.

Inspectors shall create a maintenance need during a bridge inspection based on their judgement and using this chapter as guidance. For existing items that have previously been documented, the inspector shall verify accuracy of the maintenance need while on site. If the item’s priority has increased, the workflow must be changed to “Open” after the inspection report is uploaded so that the DCE can “Review” the item again.

The following data items make up the main maintenance item form:

- Date Recommended – The date the maintenance item was created or changed.
- Priority – The ranking of the significance of the maintenance item.
- Status – Shows the current status of the maintenance item. See 6.1.2 and 6.1.3 for possible statuses based on the bridge owner.
- Type of work – Used to identify the type of work being recommended. These correspond primarily to ARDOT’s Maintenance Manual types of work.
 - Reference ARDOT’s [Internal Maintenance Manual](#) on ARDOT’s Internal SharePoint Site
- Component – Part of the bridge that the maintenance need is associated with.
- Assigned Crew – Optional field to list the crew being assigned the item.
- Deficiency Description – Describe the location of deficiency and a description of it.
- Date Repairs Completed – The date the repairs were completed or, if not known, the date when repairs were observed or district was notified.
- Maintenance Comments – The comments section is used to identify follow up action taken.

6.1.2 Locally Owned Maintenance Repairs

ARDOT makes every effort to inform local bridge owners of the items that need to be addressed on their structures. The workflow for a maintenance item of a local structure is simple. An inspector will document a new maintenance need or increase the priority of an existing MN in the field. From there, the District Construction Engineer will transition the item to the monitor status when he or she notifies the local owner of the issue. After repairs have been performed on City/County (LPA) bridges, local governments should complete the [Maintenance Need Repair Documentation Form 8](#) and submit it to the District to update the Maintenance Item(s). The Form 8 should be linked to one of the completed items before being marked completed and locked from changes. If the returned Form 8 indicates that major structural repairs have been carried out, a new special inspection may be required. If the bridge inspector observes or is notified that an item on a local bridge has been completed, the inspector should note the work done in the work description box and set the date repairs completed box. Inspectors should use the date inspected or were notified if the actual date is unknown. Inspectors should note in the maintenance comments box how the determination was made and the repairs were completed (observation, the notification from the owner, etc.). Set the status to “completed.” Either the inspection team or engineer may set a local bridge to “completed.”

Local Maintenance Need Status Workflow

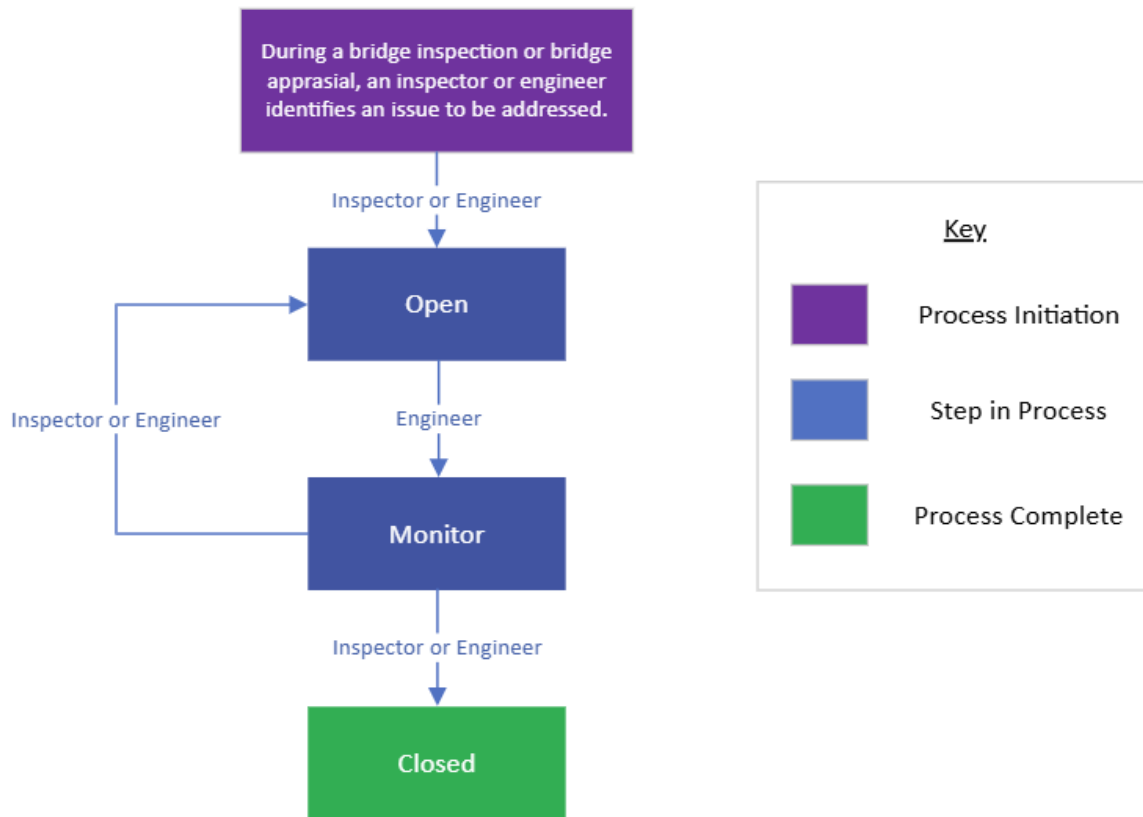


Figure 2. LPA Maintenance Need Workflow

6.1.3 State Owned Maintenance Repairs

The following flowchart shows the workflow of maintenance items in the bridge inspection software after an inspector or engineer creates an item that is recommended to be addressed. This workflow is structured for engineering review to be involved in assessing each of the issues identified. Inspectors are responsible for verifying the correct status and documentation of each maintenance item during the inspection. Engineers are responsible for reviewing and assigning items for repair in a timely manner.

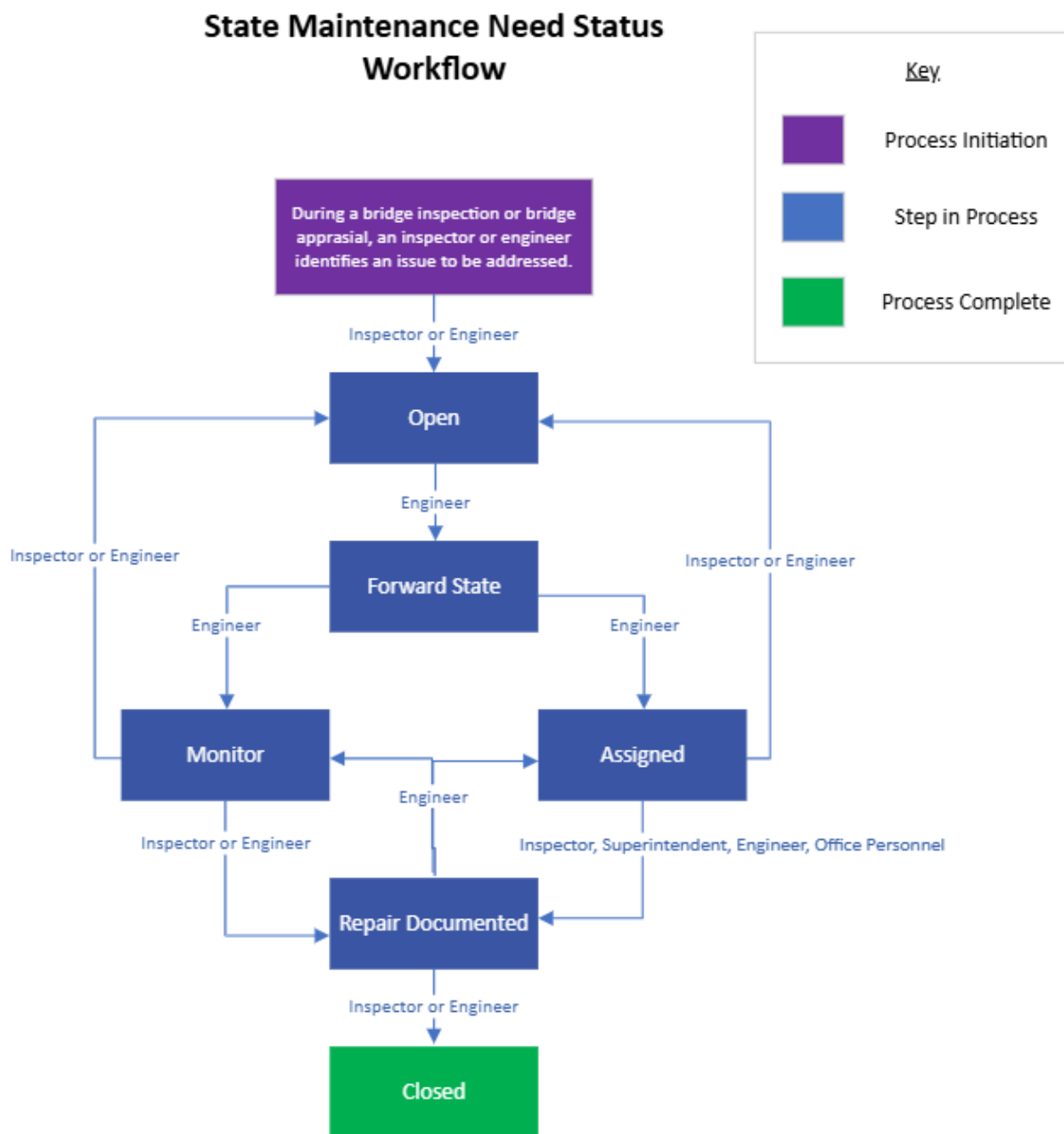


Figure 3. State Maintenance Need Workflow

6.2 MAINTENANCE PRIORITIES

6.2.1 Overview of Priority Codes

ARDOT employs the following list of priority codes to prioritize and plan for preservation and bridge maintenance activities based on importance.

- CF = Critical Finding; immediate action (see [FHWA NBIS definition](#))
 - Further details in [Section 6.3](#)

- A = Safety Deficiency; requires prompt action
- B = Pressing; pressing
- C = Important
- D = Routine

6.2.2 Priority Code A

Safety deficiency; requires prompt action.

This priority code is for deficiencies that should be prioritized and scheduled for prompt action. Examples would be bridge posting that requires more restrictions, missing weight limit signs, failed joint armor or driving surface that creates a traffic hazard; navigational lighting out or damaged; the failure of one interior timber beam in a system of 6 beams; one failed interior pile in a four-pile system; and missing posting sign. The inspector or District Construction Engineer should notify the owner as soon as possible. Pictures of A priorities shall always be taken and attached to the Maintenance Need.

If a posting issue is reported complete, the posting status shall be updated with a record change inspection by inspection staff.

6.2.3 Priority Code B

Pressing

This priority code is for deficiencies that should be prioritized and scheduled for an estimated 6-month completion goal. Examples would be potholes developing in the bridge deck; posting signs that need improvement but are still legible, bracing members that require replacing, or a crack developing at the end of a steel cover plate in a multi-beam system. If a deficiency could transition to a safety deficiency if unattended beyond a certain timeframe, then the deficiency should be completed within that timeframe. Pictures of B priorities shall always be taken and attached to the Maintenance Need.

6.2.4 Priority Code C

Important

This priority code is for deficiencies that should be prioritized and scheduled to be completed sooner than routine maintenance. Examples would be damaged bridge railing, removing drift build-up from piers, minor bolts missing in a primary member, missing advanced bridge weight limit signs, and a timber deck with a few deteriorated timbers.

6.2.5 Priority Code D

Routine

This priority code is for deficiencies that can be scheduled for repairs within regular routine maintenance activities. Examples would be minor potholes, bridge railing that needs reattachment, beam-ends rusted through at non-critical locations, etc.

6.3 CRITICAL FINDINGS

6.3.1 Overview of Critical Findings

A Critical Finding is defined by the NBIS as a structural or safety related deficiency that requires immediate action to ensure public safety. ARDOT documents critical findings as the highest priority maintenance item.

All Critical Findings should have an updated picture(s) at each inspection. Conditions that constitute a critical finding include, but are not limited to the following:

Critical Findings	Typically Identified
A partial or complete collapse of the bridge	Inspection
Structural or other defects that pose a definite and immediate public safety hazard	Inspection
A load rating of less than 3 Tons	Load Rating
Bridge is not completely closed, but closure is required	Inspection
A scour analysis results in a structural safety concern	Scour Assessment

6.3.2 Critical Finding Workflow

To record a critical finding, the inspector shall enter it into the maintenance need describing both the critical finding and its location. It shall be assigned a “CF” priority which shall be communicated through phone calls with the District and the Bridge Operations Division immediately.

When the critical finding has been entered into the bridge inspection software, it is subject to review by the District Construction Engineer. An engineer may adjust the “CF” priority as necessary depending on the severity of the maintenance item. If the “CF” priority could warrant a change in the load posting, the inspector, DCE or Bridge Operations shall immediately send an email to Bridge Load Rating Personnel for further analysis. If the finding necessitates a reduced load rating, the Rating Section will immediately notify the District, who will then address it if it is a state bridge or forward on to the local bridge owner.

It shall be the responsibility of the District Maintenance Engineer or Bridge Operations Staff to see that all “CF” priorities on state bridges are assigned promptly, and the assignment noted in the inspection software. The appropriate engineer will follow the progress of the State “CF” priority to its completion and see that corrective actions are entered into the inspection software.

If a “CF” priority involves a locally owned bridge, the bridge owner will be promptly notified verbally and with an official notification letter by certified mail.

After acting on City/County bridges, local public agencies should complete the Maintenance Needs report (or Form 8) and submit it to the District. The District Construction Engineer shall see to it that returned information is entered into the bridge inspection software. The Form 8 will be scanned and attached to one of the Maintenance Items that were completed. If the local owner reports the critical finding completed, the complete date should be filled in, and the Maintenance Item should be marked completed in the software. Any action the owner reported should also be included in the note for the Maintenance Item.

All critical findings (State and Local) shall have remarks in the “Maintenance Comments” within 1 month of becoming active. This could include an assignment of a crew or notating where the local owner has been informed.

6.3.3 Critical Finding Follow Up Action

A critical finding shall be inspected at intervals not exceeding 3 months. This can be achieved with a special inspection. In addition, the local owner shall receive an email Maintenance Needs report generated from the inspection software every month until recorded complete in the inspection software. For that reason, the Bridge Inspector shall verify that an owner email has been entered into the inspection software under the ARDOT agency item.

All critical findings shall be monitored and tracked by the Bridge Operations Division. An Engineer shall review each critical finding and document the review in the Maintenance Comments field of the Maintenance Need. If the item is not deemed an actual critical finding, it shall be reclassified as another priority. Critical Findings are communicated to FHWA monthly.

6.4 ROUTINE MAINTENANCE NEEDS

Routine maintenance needs or “Check Box Items” consist of minor, common defects which have not risen to a level warranting the specific notification, documentation, and priority level assignment as noted in the previous paragraph. Each of these items is a yes/no field with an option for comments and photos. If an item is selected as “yes” for this type of routine maintenance is being recommended, at least one supporting photo and note shall be documented.

The following is the list of routine maintenance items available for use in the bridge inspection software. These items are designed to be self-explanatory and easy to understand by all stakeholders.

- A-54 - Sealable Deck Cracks
- A-55 - Deck Washing Needed
- A-56 - Joint Cleaning/Flushing Needed
- A-57 - Girder End and Bearing Painting Needed
- A-58 - Cap Cleaning/Flushing Needed
- A-64 - Vegetation Removal Requested
- A-66 - Approach minor pothole/leveling needed
- A-59 - Joint Repair Needed
- A-60 - Full Girder Painting Needed
- A-61 - Polymer Overlay Advised

- A-62 - Hydro and LMC Advised
- A-63 - Missing/Incorrect Log Mile Signage
- A-65 - Clogged Deck Drains?

6.5 WEIGHT POSTINGS

Bridge weight postings that do not convey the needed safety warning to the traveling public shall receive an “A” priority code. An “A” priority would include missing posting signs, unreadable posting signs, and postings that reflect a weight limit above the recommended posting. Other posting issues such as obscured but readable numerals or postings shall receive a “B” priority code. Postings that reflect a weight limit below the recommended postings may receive a “D” priority at the Inspector’s or Load Rating Engineer’s discretion since it is not considered a safety issue.

Vandalism of weight posting signs shall be documented in the Maintenance Items under the Work Code using the drop-down selection “Vandalism Problem.” Other weight posting issues that are a priority “A” or “B” shall use the drop-down selection “Other Posting Problem.” All weight limit posting issues of a safety nature shall have one of these two codes to satisfy FHWA requirements for tracking these safety issues.

6.6 FLAMMABLE MATERIAL

FHWA’s 11/15/23 “Documentation and Treatment of Materials Stored Under a Highway Bridge” memorandum stresses the importance of documenting and notifying management regarding materials stored under NBIS structures. Flammable, explosive, or hazardous materials that are stored in a manner that represent a risk to the structural integrity of the bridge shall be documented as an “A” priority in inspectX with the type of work selected as “Flammable Material”. Other materials stored under a bridge that does not pose a significant risk should be documented as a “C” priority in inspectX with the type of work selected as “Flammable Material”.

Reference ARDOT’s [Memorandum on Flammable Materials](#).



Bridge Inspection Guidelines

Chapter 7 Bridge Components

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

7.1 STEEL

7.1.1 Steel Terminology

NSTM – A NSTM is a steel member in tension or with a tension element, whose failure would probably cause a portion of the entire bridge to collapse. Bridges that contain NSTMs require NSTM inspections.

Fatigue – Fatigue is the tendency of a member to fail at a stress level below its yield stress when subject to cyclical loading. Fatigue is the primary cause of failure in NSTM members. Describing the process by which a member fails when subjected to fatigue is called failure mechanics.

Redundancy – Redundancy is defined as a structural condition where there are more elements of support than are necessary for stability. Redundancy means that should a member or element fail, the load previously carried by the failed member will be redistributed to other members or elements. These other members have the capacity to carry additional load temporarily, and collapse of the structure may be avoided. On non-redundant structures, the redistribution of load may cause additional members also to fail, resulting in a partial or total collapse of the structure. There are three basic types of redundancy in bridge design:

1. **Load Path Redundancy** – Bridge designs that have three or more main load-carrying members or load paths between supports are considered load path redundant. If one member were to fail, the bridge load would likely be redistributed to the other members, and bridge failure is not expected to occur. An example of load path redundancy is a multi-girder bridge.
2. **Structural Redundancy** – Bridge designs that provide continuity of load path from span to span are referred to as structurally redundant. Continuous span arrangements consisting of three or more spans are considered structurally redundant. In the event of an interior member failure, loading from that span can be redistributed to the adjacent spans, and bridge failure may not occur. Continuous spans are structurally redundant except for the end spans, where the development of a fracture would effectively cause two hinges, one at the abutment and one at the fracture itself. This situation would lead to structural instability.

Internal Redundancy – Internal or member redundancy exists when a bridge member contains three or more elements that are mechanically fastened together so that multiple independent load paths are formed. Failure of one member element might not cause total failure of the member. Examples of internally redundant members are shown in the following figures. Internal redundancy of a member can be decreased or eliminated by repairs that involve welding. The welds provide paths for cracks to travel from one element to another

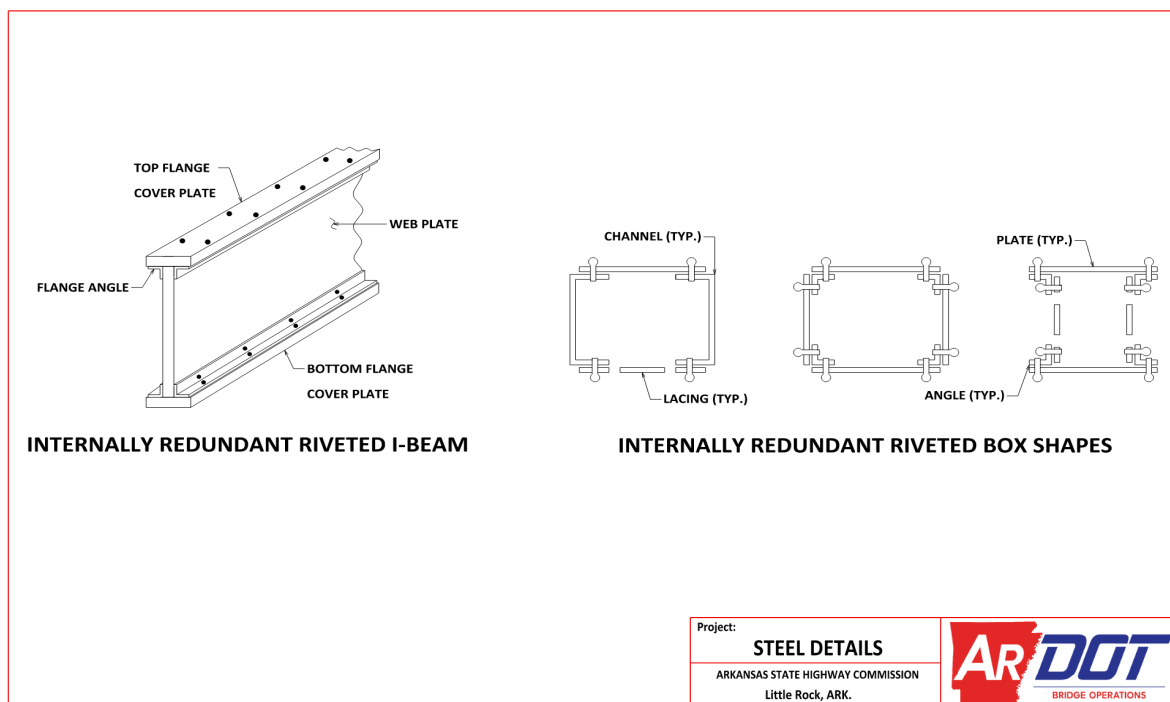


Figure 4. Steel Details

Bridge inspectors should be concerned primarily with load path redundancy. The inspector should neglect structural and internal redundancy and classify all bridges with less than three load paths as non-redundant. Non-redundant bridge configurations in tension contain NSTM members.

7.1.2 NSTM Procedure

A NSTM Procedure is required for any bridge with a NSTM member. It will be developed for each NSTM bridge and attached in Asset Details/Asset Files. See [Appendix 3.A](#) NSTM How-To Document for further details on how to create this procedure in the bridge inspection software.

Each NSTM procedure consists of a minimum of the following.

- Title page with descriptive information of the bridge and inspection equipment
- Tools necessary for inspection, including any special equipment such as non-destructive testing devices.
- NSTM reference photos
- NSTM attached drawings
- List of each NSTM on the bridge, how it was accessed, condition rating given, and general condition notes.
- Condition ratings and defect descriptive information as to the rating of that NSTM.
- Signature page and/or list of inspection personnel and what members were inspected

Upon completion or update of the NSTM inspection procedure, the inspector shall notify Bridge Operations the procedure is available for review. A professional engineer (PE) shall verify that all NSTM members have been identified and the procedure properly addresses required inspection

means and methods. Once the procedure has been approved, the Engineer shall record the approval.

All elements of NSTM bridges will be inspected by one or more of the methods of inspection listed below.

7.1.3 Visual Inspection

The most useful method of inspection is Hands-On Visual Inspection, where the inspector makes an up-close examination of each NSTM element. In most cases, this will require a mechanical lift system or ladder to get up close to examine the details. A borescope can be used in examining obscured members, and a Lever Pit Gauge can be useful in estimating section loss. A keen eye is often the best tool for finding cracks. When cracks cycle open and close, the crack surfaces rub against each other, creating a fine steel powder that easily oxidizes when exposed to the environment. This often leads to rust staining, or discoloration, as the oxidized material bleeds from the cracks. This can offer quick visual detection of problem areas but should not be used as the sole means of detection. Experience has shown that cracks have generally propagated to a depth between one-fourth and one-half the plate thickness before the paint film is broken, permitting the oxide to form. This occurs because the paint is more flexible than the underlying steel.

7.1.4 Non-Destructive Steel Inspection Techniques

Dye Penetrant Inspection (DPI) effectively finds cracks that are open to the surface of steel elements. DPI method of examination should be used where it is suspected that a crack is present in an NSTM or Fracture Prone Element. DPI testing requires training in the use of the materials and surface preparation; its use is limited to suspicious areas.

Dye penetrant is a three-part system applied to an area where a crack is suspected. Each component is usually contained in small, pressurized cans that can be easily transported in the field. The first step is cleaning/degreasing the area to remove surface contaminants; use a wire brush to remove heavy corrosion, but avoid grinding as it tends to smear out the crack. Then a liquid dye (commonly red in color) is sprayed onto the surface, and this dye seeps into the cracks. After a specified time (~60-90 seconds), the excess dye is wiped away from the surface. A white developer is then sprayed in the same area the dye was applied. The white developer then draws out the dye within the crack, clearly showing the crack.

Magnetic Particle Inspection (MPI) effectively finds cracks that are open to the surface or below the surface of steel elements. MPI method of examination should be used where it is suspected that a crack is present in an NSTM or Fracture Prone Element. MPI testing requires training in the materials, equipment, and surface preparation; it also requires a considerable amount of time to take the test. Contact Heavy Bridge Maintenance if this test needs to be used.

A location where MPI will be useful is in examining ends of stiffener plates where rust stains are coming through the paint, or the paint is cracked, and a crack in the weld is suspect.

Ultra-Sonic Inspection

This examination method requires the use of Ultrasonic Testing (UT) test equipment to examine for cracks that cannot be seen with the eye. This examination method should be used where it is suspected that a crack is present in an NSTM element.

UT for flaw detection is a nondestructive method in which high-frequency acoustic waves are introduced into a material by a transducer placed on the surface. The acoustic wave propagates through the material and is reflected by discontinuities in the material. The transducer detects the reflected acoustic waves. The resulting waveform is analyzed to identify reflections that discontinuities in the material may cause. The technology can be used to detect weld flaws such as cracks, inclusions, weld porosity, or lack of fusion.

UT technology can be applied to truss members, steel girders, or other steel bridge components with a plate-like geometry (i.e., parallel surfaces). UT is often used for determining the thickness of a test member. Thickness gauges are commonly used for the detection of section loss resulting from corrosion in steel bridge members. UT technology can also be applied to in-service bridges to detect and monitor the following:

- Cracks in steel bridge members.
- Weld flaws such as cracks, slag inclusions, weld porosity, or lack of fusion in steel bridge members.
- Cracks in steel bridge components such as pins, hangers, and eyebars.
- Fractured anchor bolts.
- The thickness of a steel plate.
- Length of a bridge pin or anchor bolt.

When truss gusset plate section loss cannot be detected or adequately quantified by traditional measurement devices (calipers, depth probe, tape-measure, etc.), UT equipment should be used to document the corrosion adequately. The thickness measurements and their locations will be thoroughly documented. This information will be included in the inspection report for reference in conducting future inspections and monitoring corrosion progress. It will be ARDOT practice to inspect gusset plates requiring UT inspection every 24 months or less as deemed necessary by the inspector.

Additional information on Nondestructive Evaluation (NDE) can be found on [FHWA's website](#).

7.1.5 [Pin and Hanger Assemblies](#)

ARDOT currently has 3 methods to evaluate pin and hanger assemblies. The first is a simple visual inspection of a pin and hangers, including joints and wind locks if present. The second is UT which is useful in determining presence of a crack. The third is measuring the actual dimensions between the pins and the distance from each pin to the end of the hanger assembly and comparing these values to the planned dimensions. This is useful in documenting wear in the assembly. See the following drawings as an example of UT inspection and documentation inspection.

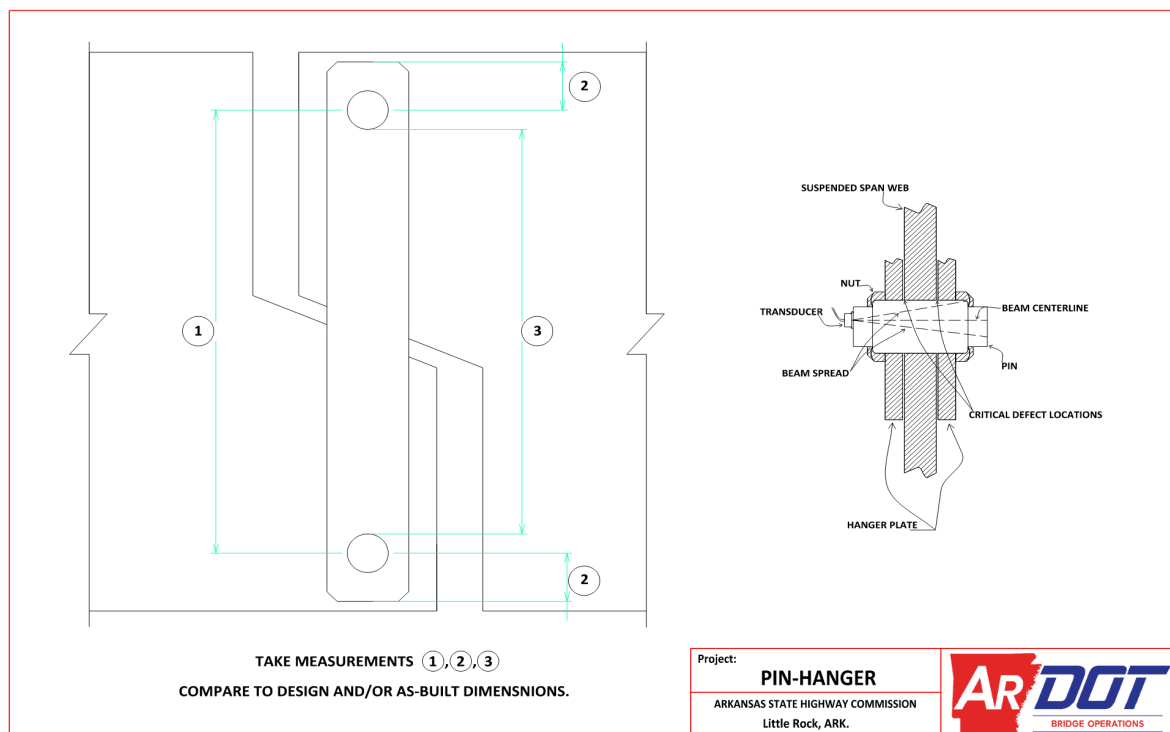


Figure 5. Pin and Hanger Documentation

An inspector should determine if movement is taking place. Corrosion can cause fixity at pin and hanger connections. This changes the structural behavior of the connection and is a source of cracking. Powdery red or black rust where surfaces rub indicates movement. It may or may not indicate appreciable section loss. An unbroken paint film across a surface where relative movement should occur indicates that the pin is frozen.

Some movement due to traffic vibration may be observable. If this movement is excessive or has significant vertical movement with live load passage, the pins or pinholes may be excessively worn. Contact the Bridge Operations as this may warrant a pin/hanger replacement.

Inspectors should examine the hanger plates for cracks due to bending of the plate from a frozen pin connection. Observe the amount of corrosion buildup between the webs of the girders and the back faces of the plates. Inspect the hanger plate for bowing or out-of-plane distortion from the webs of the girders. Any welds should be investigated for cracks. If the plate is bowed, check carefully at the point of maximum bow for cracks that a broken paint film and corrosion might indicate.

Measure the distance between the back of the hanger and the face of the web at several locations. Compare these measurements from location to location and hanger to hanger. Variations greater than 1/8 inch could indicate twisting of the hanger bars or lateral movement due to rust packing. These measurements should be carefully described and recorded in permanent notes to compare measurements taken at the next inspection.

Pins of pin/hanger bridges and pinned truss bridges should be inspected using UT equipment because most of the pin is hidden from view. Visual inspection practice doesn't reveal the potential cracks in the pins. It will be ARDOT practice to inspect pins using UT every 24 months or less as deemed necessary by the inspector unless otherwise specified by Bridge Operations and documented in the inspection procedures.

7.1.6 [Steel Failure Mechanics](#)

Steel failure mechanics involves describing the process by which a member fails when subjected to fatigue. The fatigue failure process of a member consists of three stages:

- Crack Initiation
- Crack Propagation
- Fracture

Crack Initiation - Cracks most commonly initiate from points of stress concentrations in structural details. The most critical conditions for crack initiation at structural details are those combining high-stress concentrations due to flaws, connections, and out-of-plane distortions.

Crack Propagation - Once a fatigue crack has initiated, applied cyclic stresses cause propagation, or growth, of a crack across the member's section until it reaches a critical size. At this time, the member may continue until fracture. A fatigue crack may also self arrest.

Fracture - Once a crack has initiated and propagated to a critical size, the member fractures. Fracture of a member is the separation of the member into two parts. The fracture of a critical member may cause a total or partial bridge collapse. Fracture may occur due to brittle fracture. Constraint induced fracture susceptible locations should be identified by inspectors and communicated to the Bridge Operations Division.

7.1.7 [Fatigue Cracking](#)

Most critical conditions for fatigue cracking are those which involve a combination of flaws and stress concentrations. Girders, stringers, floorbeams, diaphragms, bracing, truss members, hangers, and other members must be structurally connected. Bridge structures, particularly those that are welded, cannot be fabricated without details that cause some level of stress concentrations.

7.1.8 [Welds](#)

Welds are the connections of metal parts formed by heating the surfaces to a plastic (or fluid) state and allowing the parts to flow together and join with or without the addition of filler metal. The term base metal refers to the metal parts that are to be joined. Filler metal, or weld metal, is the additional molten metal generally used in the formation of welds. The complete assembly is referred to as a weldment. Conditions of stress concentration are often found in weldments and can be prone to crack initiation.

The four common types of welds found on bridges are groove welds, fillet welds, plug welds, and tack welds.

1. Groove Welds – Groove welds, sometimes referred to as butt welds, are used when the members to be connected are lined up edge to edge or are in the same plane. Full penetration groove welds extend through the entire thickness of the joined piece, while partial penetration groove welds do not. Weld reinforcement is the added filler metal that causes the throat dimension to be greater than the thickness of the base metal. This reinforcement is sometimes ground flush with the base metal to qualify the joint for a better fatigue strength category.
2. Fillet welds – Fillet welds connect members that overlap each other or are joined edge to face of the plate, as in plate girder assembly of web and flange plates. Fillet welds are the most common type of weld because large tolerances in fabrication are allowable when members are lapped over each other instead of fitted together as in groove welds.
3. Plug welds - Plug and slot welds pass through holes in one member to another, with weld metal filling the holes and joining the members together. Plug welds have sometimes been used to fill misplaced holes. These repairs are very likely to contain flaws and micro-cracks that can initiate fatigue cracking. AASHTO no longer permits plug welds for bridge construction.
4. Tack welds - Tack welds are small welds commonly used to hold pieces in position during fabrication or construction temporarily. They are often made carelessly, without proper procedures or preheating, and can be a fatigue-prone detail.

Both plug and tack welds are smaller than fillet and groove welds, but they can be the source of serious problems to bridges and should be investigated closely.

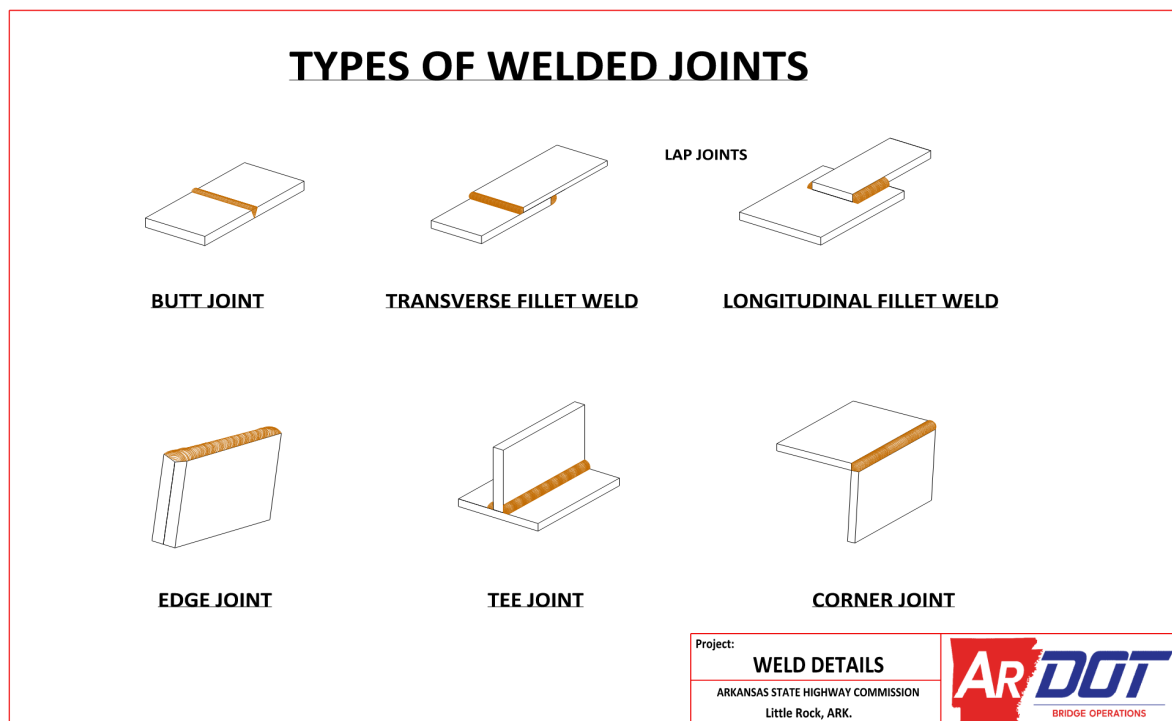


Figure 6. Weld Details

All welding processes result in high built-in residual tension stresses at or near the yield point in the weldment and the base metal adjacent to it. Load-induced stress concentrations also often occur at welded bridge connections, where these residual tensile stresses are high. This combination of stress concentration and high residual tensile stress is conducive to fatigue crack initiation. Such cracks typically begin at the weld periphery, such as at the toe of a fillet weld, where there typically can be sharp discontinuities, or at an internal discontinuity such as a slag inclusion or porosity. In the initial stages of fatigue crack growth, much of the fatigue life is expended when a crack has propagated out of the high residual tensile stress zone.

Welded details tend to be less forgiving of small weld discontinuities than riveted details because welds are more sensitive to repeated stresses. Once cracking starts to develop, it can destroy the member base metal due to the continuous path provided by the welded connections. Cracking has developed more frequently in welded bridges because of flaws that escape detection, the use of details less fatigue resistant than assumed in the design, and secondary and displacement induced stresses.

7.1.9 [Crack Prone Areas](#)

The Inspector must realize that cracks are only readily detected visually as a through crack after most of the fatigue life cycle is gone. The following areas have a higher possibility of cracking and should receive scrutiny:

- Plug welds
- Tack welds
- Out-of-Plane bending
- Nicks, notches, and indentations (Truck Impacts)
- Flange/web coping without proper radius
- Flame cuts
- Toe of a transverse stiffener that is welded to the web
- Poor quality welds
- Intersecting welds

Any web cracks discovered in a tension zone should be brought to the immediate attention of an Engineer in Bridge Operations.

Fatigue cracks can also develop at welded details in the compression regions of steel bridge members. However, when a crack propagates out of the weld tensile- residual-stress zone and into the adjacent compression region, the crack growth usually stops. Because of this, the inspection of welded details in regions of nominal compressive stress is of lower priority than in tension regions.

7.1.10 [Riveted and Bolted Details](#)

Fatigue cracking can occur at riveted or bolted details, particularly as the result of secondary or displacement-induced stresses or from assembly tack welds that have not been removed. Framing connections intended to provide only simple support, but by their function, tend to resist

bending moment, are suspect locations. Fortunately, crack growth is often inhibited by multiple element members, i.e., internal redundancy.

Most riveted bridges were constructed before the 1960's when bolted connections became common. Because of their age and the number of stress cycles already experienced, the close inspection of riveted members and connections in bridges with high truck traffic volume is necessary. In general, the locations where fatigue cracks develop in riveted bridges are similar to those in welded bridges.

7.1.11 Out-of-Plane Distortion

Deflection of floorbeams or diaphragms can cause out-of-plane distortion in the girder webs. You will see this more when you have skewed bridges where the diaphragms are not skewed and are subjected to large differential vertical deflections. If the girder flange is relatively thick and stiff against lateral displacement, most of the deflection is accommodated by bending of the web plate across a small web gap between the flanges and end of vertical connection plates.

When cracks form in planes parallel to the stresses between the flanges and end of vertical connection plates, they are not typically detrimental to the structure's performance. Even though distortion-induced cracks are usually parallel to the primary stress direction, they can turn perpendicular. Retrofits such as drilled holes are often used when cracks turn perpendicular to the primary stresses.

Once an out-of-plane bending crack is identified, it is imperative that all similar locations on the structure also be carefully inspected to search for similar damage.

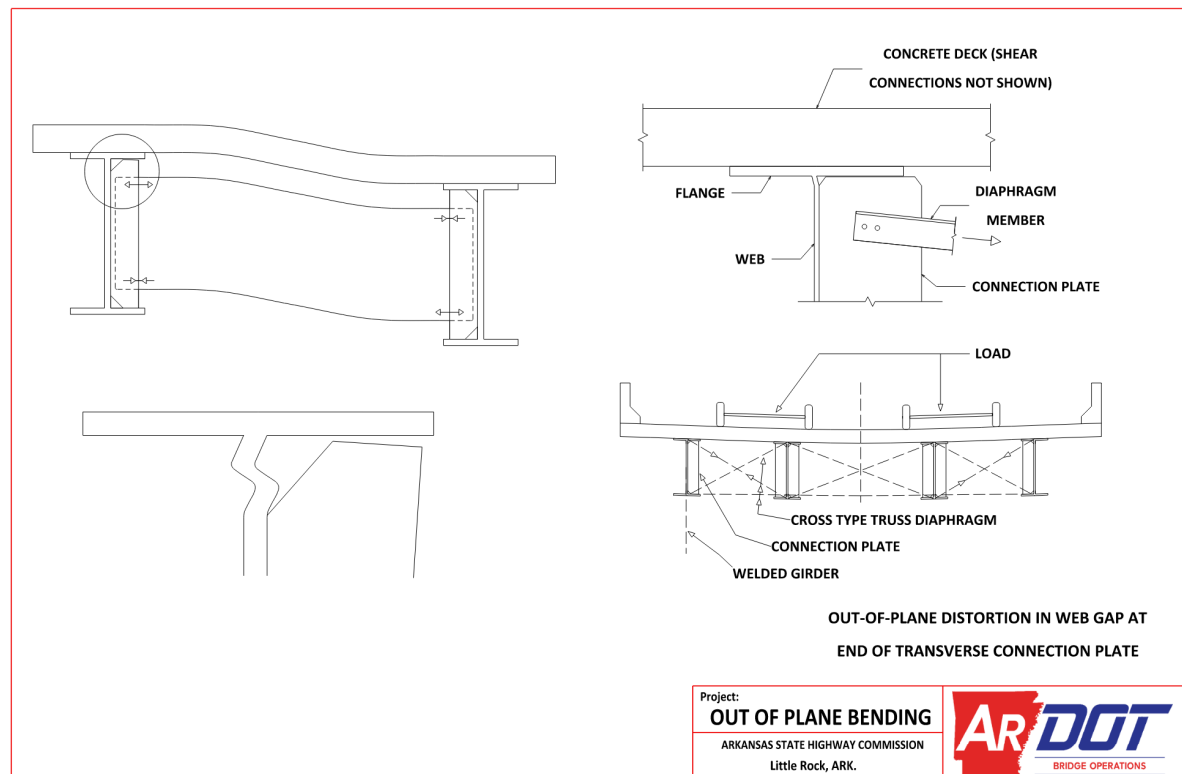


Figure 7. Out of Plane Bending

Two very common instances are in the web gap at unconnected cross-frame connection plates, that is, connection plates that are not attached to the beam or girder flanges, and at similar web gaps at floorbeam connections to main girders.

When distortion-induced cracking develops in a bridge, large numbers of cracks usually form before corrective action is taken because the cyclic stresses are often very high. As a result, many cracks form simultaneously in the structural system.

7.1.12 Corrosion

Corrosion is the most common form of defect found on steel bridges. More section loss results from corrosion than from any other cause. However, few bridge failures can be attributed solely to corrosion. Shallow surface corrosion is generally not serious but is quite common when the paint system has failed. Measurable section loss is significant as it may reduce the structural capacity of the member. 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 a percentage of the entire member cross-section. For 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 a percentage of the bottom flange, top flange, or web cross-section. For example: “the bottom flange of the girder 5 has 10% section loss at the 1st deck drain east of Pier 2”.

When describing section loss in an inspection report, it is essential that the extent of section loss is not misrepresented. For example, the bottom flange of a girder has a 1” diameter hole which constitutes 15% of the total bottom flange cross-section. While the flange has rusted entirely through at the hole, 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 of a girder 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 a 4” wide by 2” high area of pitting (up to 1/8” deep) at Abutment 1 bearing”.

7.1.13 When Steel Measurements Are Needed

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. Generally, 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). The structure's highly stressed portions (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 or extensive section loss.

Corrosion Likely Locations

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 drain 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 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 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 or ground line.

Cleaning Before Inspection

To properly inspect a steel member and determine the extent of section loss, the steel must first be cleaned of any dirt, debris, or excess flaking rust. A significant build-up of debris on a steel member indicates inadequate maintenance and 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 an inexpensive and straightforward 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 or a pit gauge is effective in obtaining thickness measurements - these can be used in confined areas or locations where only one side of the member is accessible.

Field Notes and Cross-Section Diagrams

In areas of severe section loss, field notes may be required. Field notes should be thorough, concise, and readable - they should include the thickness measurements and the exact location where those measurements were taken. The original cross-section area must be known to determine the extent of section loss on a structural member. 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 help document field measurements and perform section loss calculations. If possible, blank forms (with cross-section diagrams) should be prepared before taking field measurements. To facilitate section loss calculations, the exact location of all thickness readings should be recorded - areas with section loss should be indicated.

All cross-sections should be recorded in a CADD drawing and attached under Report Info/Picture Files/Sketch.

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 simply taking 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 should be done clearly and consistently, so the calculations can be easily checked and verified.

Cross-section showing the location of thickness measurements Trapezoidal sub-area

7.1.14 Truss Bridge

A truss bridge is two parallel trusses tied together by the floor beams and lower lateral bracing at the lower chords and the struts, portals, and upper lateral bracing at the upper chords. The trusses themselves are composed of the upper chord, the topmost member of the truss, the lower chord, the bottom member of the truss, and vertical and diagonal members that connect the upper and lower chords. Floor beams, with and without stringers, support the deck. The upper and lower lateral bracing provide lateral stability to the trusses and hold them parallel to each other.

The following drawing is a breakdown of the typical elements of a truss bridge.

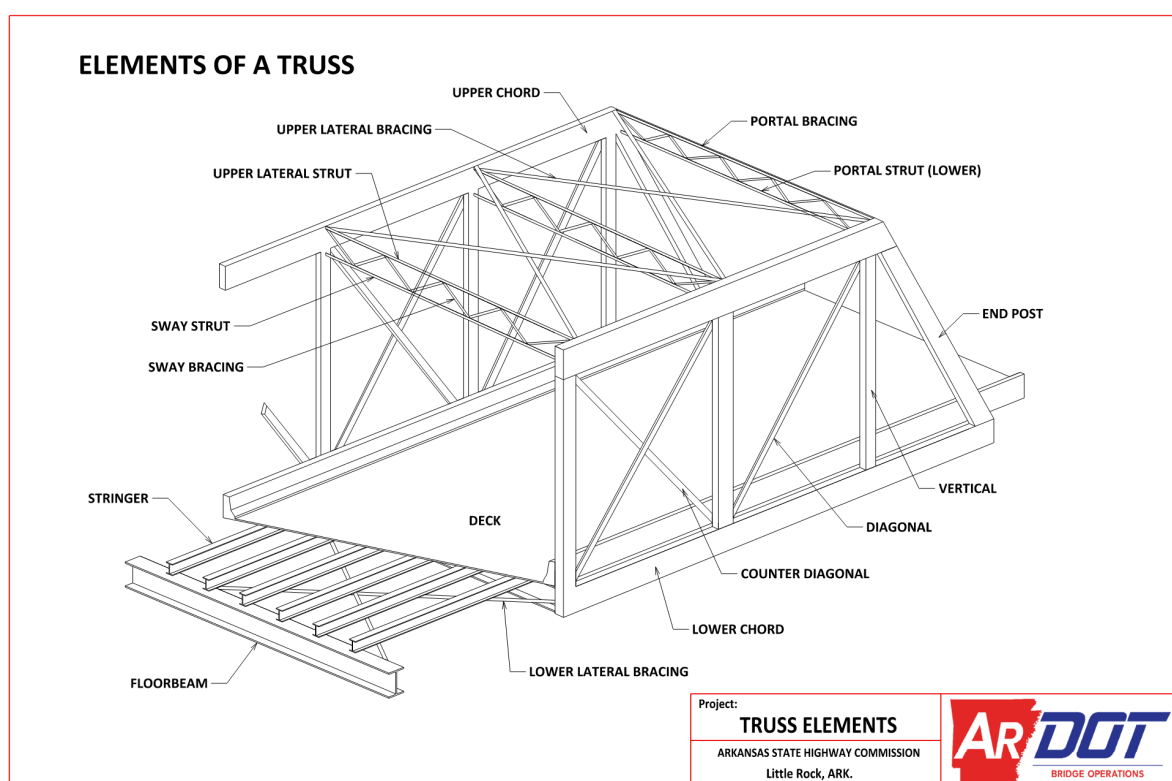


Figure 8. Truss Elements

7.2 CONCRETE

One of the most common construction materials in bridge construction is concrete. Concrete is advantageous for bridge construction due to its cost, weight, compressive strength and ability to take any shape. Concrete material deteriorates over time leading to visual defects that inspectors easily can inspect such as spalling, cracking, abrasion, scaling, efflorescence, etc. Other concrete defects such as delamination are more complicated and are more involved to properly inspect and document.

7.2.1 Delamination

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

The test procedure involves delineating sound and unsound concrete by the sound produced when struck by a metal object such as a hammer or chain. With little experience, an Inspector can begin to delineate the different sounds produced. However, it does take a trained ear to differentiate defects located further below the surface and identify the actual 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.

The chain drag is a 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 quickly with a reasonable amount of accuracy. The chain drag survey is also a low-cost alternative to other NDE methods. 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 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 need hammer sounding to provide accurate limits of the delamination. Due to the nature of the test, localized areas of delamination are more challenging to detect.

The chain drag survey entails dragging a chain over the concrete surface and listening for the audible difference between sound and unsound areas of concrete. The device typically consists of 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 differentiate and mark the unsound areas accurately. This usually involves going over a suspect area several times to identify the locations of unsound concrete. A grid system should be constructed on the deck's surface so that delaminated areas can be plotted easily. This test usually involves two people: one to drag the chain and one to do the marking.

7.2.2 Reinforced Concrete

Reinforced concrete is designed to carry the required compression while the embedded steel carries the tension. Cracking in the concrete may indicate that the steel is insufficient to carry the tension loads, so special attention is given to cracks.

The following reinforced concrete elements are considered Primary Members:

- Rigid frames (Cast-in-place and precast)
- Filled arches
- Arch ribs, spandrel columns, and spandrel walls

- Cast-in-place slabs
- Precast reinforced concrete slabs
- Cast-in-place through girders
- T-Beams (stem portion if cast-in-place, entire unit if precast)
- Channel Beams

When inspecting these types of structures, the following should be visually checked:

- Deterioration at the end of the beam can lead to loss of bearing area and local crushing of the remaining concrete.
- Near bearing areas at the ends of slabs, girders, T-beams, channel beams, etc., for spalling and cracked concrete. Any diagonal cracking in spandrel columns or at the ends of beams, girders, etc., is serious.
- Areas near supports for diagonal (shear) cracks occurring on exposed vertical surfaces and projecting diagonally toward the top of the girder, beam, etc.
- Tension areas at mid-span of simple spans for flexural cracks extending transversely across the underside of the primary member. Longitudinal flexural cracks in the deck when the primary rebars are transverse. Transverse flexural cracks in tops of beams (slab portions) at or near piers on continuous spans.
- Areas with efflorescence indicating contaminated concrete and with rust stains indicating rebar corrosion. Spalling, delaminations, and pop-outs are commonly associated with deterioration. In severe cases, rebars will be exposed; determine the section loss of any exposed rebars.
- Longitudinal cracks between adjacent channel or T-beams indicating possible broken shear keys, differential deflections under the passage of live loads, leakage, etc.
- Shear or torsional cracks at open-spandrel arch floor systems, bent cap interfaces, or in spandrel bent caps or columns. Cracks in tension areas of spandrel bent caps (i.e., mid-span at the bottom and ends at the tops).
- Deterioration of closed-spandrel arches and spandrel walls includes cracks, discoloration, spalling, exposed rebars, etc. Differential movement, change of alignment/profile, or loss of fill.
- Shear cracks in rigid frame beams (beginning at the frame legs and propagating toward the adjacent span), in the frame legs (starting at the top and propagating downward), and in the ends of frame beams at end spans.
- Flexural cracks in tension areas of rigid frames at the bottom of the frame beam at mid-span, inside faces of frame legs at mid-height, the base of each frame leg, and the outside corners of a simple-span slab frame.
- Areas at, near, or under drainage features such as scuppers, weeps, curb lines, etc., for the loss of fill or concrete deterioration.
- Areas of previous repairs, impact damage, honeycombing, scaling, and any other conditions indicating potential deterioration of concrete or rebars.

7.2.3 [Reinforced Concrete Slab Spans Lengthening](#)

Many long reinforced concrete (R.C.) slab span bridges have joint incompressibility problems and should be monitored closely. Over time, the ½" compressible joints in R.C. slab span bridges deteriorate, allowing incompressible material to enter the joints. As the bridge contracts due to

cooler weather, additional material will enter the joints. The additional material in the joint will “hold” the joint wider during the expansion that comes with warmer weather, and the bridge will “grow,” resulting in increased bridge length. It has been documented that R.C. slab span bridges, with a length of 1000', have “grown” as much as 20". This increase in bridge length can cause several problems:

- Intermediate bents may be pushed out of plumb, causing a rotating cap.
- The span on one side of the intermediate bent may be higher than the other due to the rotating cap.
- A pushed-over bent along with the bridge length growth may cause a loss of bearing area for the slab end, necessitating a helper bent to “catch” the slab span end.
- At bridge ends, you may have approach slabs pushed up, end posts broken, and guard rails damaged

Since this problem “grows” over time, it is imperative to record the ongoing movement so that precautions or remediation actions may be taken before severe consequences. The documentation may include measurements of joint widths and corresponding temperatures, remaining bearing areas at slab ends, and measurements of how much bents are out of plumb.

7.2.4 Prestressed Concrete

Prestressed concrete is a high-strength construction material engineered by introducing internal compressive stresses using high-tension steel tendons or cables, allowing it to withstand heavy loads and resist cracking. By applying this “pre-load,” the material can span greater distances, support heavier loads, and be thinner than traditional reinforced concrete, making it ideal for bridges, high-rises, and parking garages.

Most cracks in prestressed beams are potentially serious since tensile forces exist that the design might not have accounted for. Vertical or diagonal tension cracks in prestressed members are signs that the prestressing steel (tendon) has failed or is failing, and adjoining beams may be carrying the loads. This is a serious condition, and steps should be taken to ensure the bridge's stability as soon as possible.

Generally, there are three main types of structural cracks:

1. Web Shear Cracks - Diagonal tension causes a crack at or near the support. These cracks typically extend up and away from the support at an approximately 30° angle (45° if not prestressed).
2. Flexural Shear Cracks - Found between the support and maximum moment area. These cracks consist of both vertical and diagonal cracks occurring together.
3. Flexural Cracks - Usually found in the vicinity of the maximum moment. These cracks are normal to the longitudinal axis and extend vertically through the tendon locations.

Additionally, cracks occur in the ends of prestressed members due to de-tensioning forces. These cracks generally can be seen across the beam end or along the sides and bottom at the end.

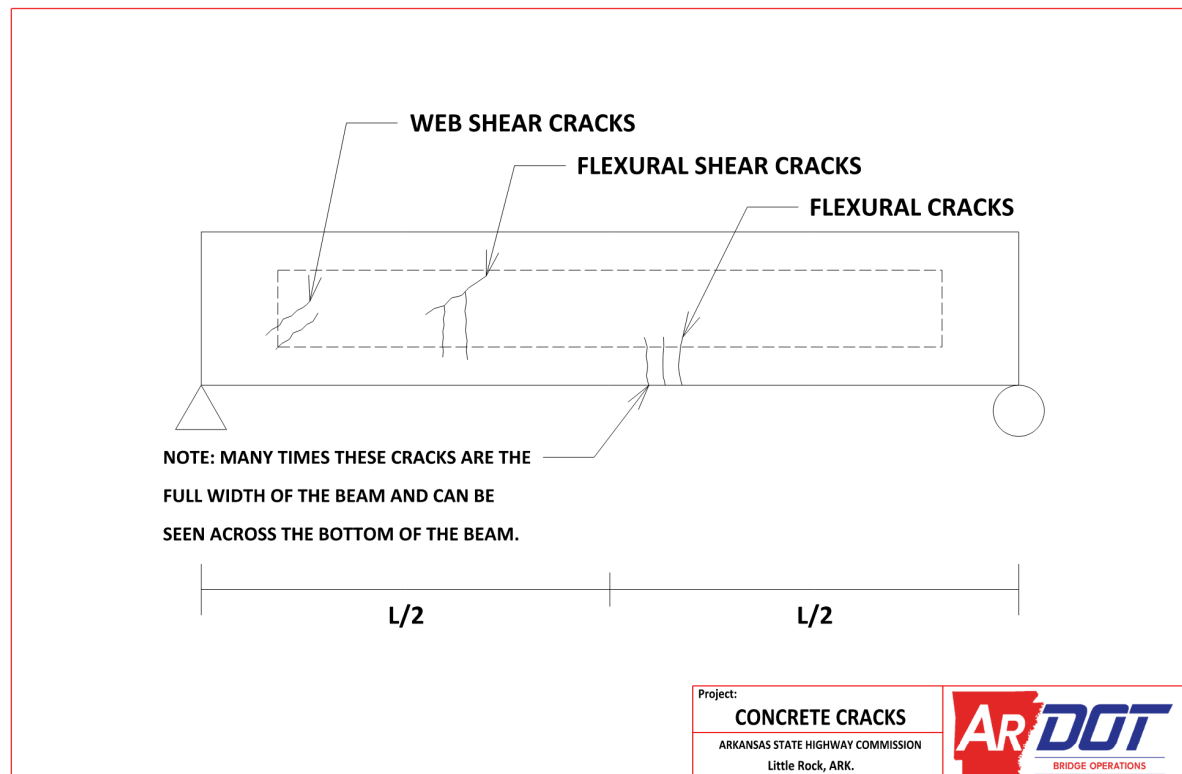


Figure 9. Concrete Cracks

When inspecting prestressed structures, the following should be visually checked:

- Any sagging by individual members could indicate overloading or loss of prestress.
- Support area for diagonal cracking (shear).
- Deterioration at the end of the beam can lead to loss of bearing area and local crushing of the remaining concrete.
- Mid-span area (maximum moment) for flexural cracks.
- Between mid-span and bearing flexural shear cracks.
- Longitudinal cracking at prestressing steel tendon levels.
- Horizontal deflections (sweep) may indicate asymmetric loading from either non-uniform prestressing forces or tendon failure.
- Spalled areas for exposed tendons.
- Shear keys for grout displacement and evidence of leakage.

In addition to the visual checks, the following activities should be performed:

- Sound the beams at the support area and mid-span location and any other areas showing deterioration.
- Evaluate and estimate or, if possible, measure any loss to exposed tendons and note the location.
- Quantify de-bonded tendons and fully or partially broken tendons. Note these locations.
- Investigate previously repaired areas.

- Document findings with notes, photographs, and drawings, including full crack and deterioration documentation.

The two most common causes of losing prestressing forces are impact and corrosion. Generally, deterioration occurring in prestressed concrete members is evident to the inspector. Still, in some cases, severe but latent corrosion of the prestressing strands may exist without many outward signs of problems. Be sure to check for:

- Concrete delamination, hairline cracks, efflorescence, or rust stains at the level of the prestressing strands, which can indicate strand corrosion.
- Longitudinal cracks in the beam may be the result of expansion forces caused by prestressing steel corrosion.
- Efflorescence, leakage, and staining indicate the likelihood of prestressing steel corrosion and a diminished load-carrying capacity.
- Concrete delamination or spalling is the more definitive sign of prestressing steel corrosion and diminished capacity.
- Check for tendon damage if any of the beams have been impacted. Cracks spreading from the damaged area indicate the extent of prestress loss.
- Longitudinal cracks in the wearing surface may indicate that the shear keys of the primaries have failed or are not working as designed.

Recent research has suggested that once outward signs of prestressing steel corrosion are visible, deterioration occurs very rapidly. The Inspector should pay particular attention to areas where the concrete is patched.

7.2.5 Concrete Channel Beams

Concrete channel beams are usually precast and consist of a conventionally reinforced deck cast monolithically with two stems. Precast channel beam stems may be conventionally reinforced or prestressed, but in Arkansas, most are conventionally reinforced. Stem tie bolts and shear keys are used to achieve monolithic action between precast channel beams.

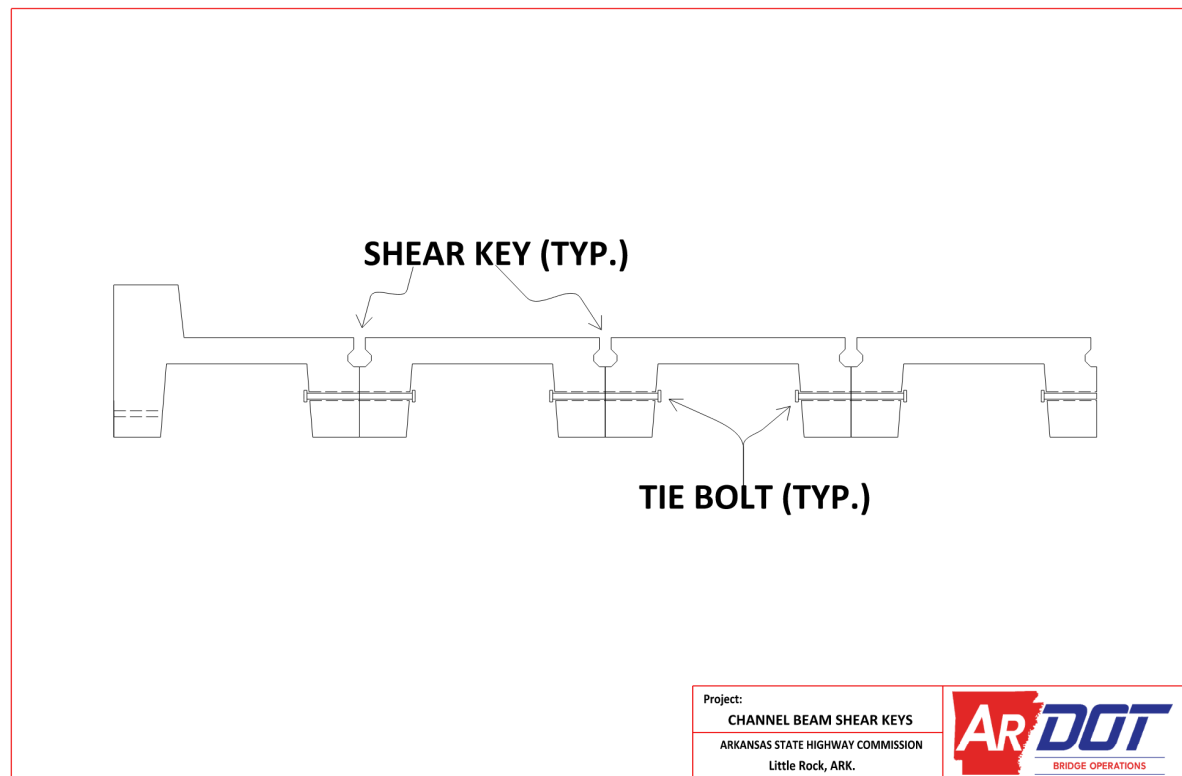


Figure 10. Channel Beams

While both the tie bolts and grouted shear keys are mechanisms for the units to work together to carry the traffic load, the main feature needed to transfer load is that grout (and the only feature factored in by load rating) is placed in the shear key between the units. The notes on the superstructure should state whether the tie bolts are in place and whether the shear key is grouted. If you can't see the shear key because of an overlay, you should note if there are longitudinal cracks in the asphalt over the shear keys and if the units are spalling. You may notice the units appear to act or not act together while traffic is traveling on the span. Your observations should also be recorded to help rating staff with their load rating.

Concrete channel beams are extremely robust units. They can lose much of the cover over the reinforcing in their stems in the center of the span before they have a reduction in their capacity. As long as the reinforcing has good embedment at the ends of the units, there is little concern for a load reduction due to bending. The loss of embedment length of the primary reinforcing steel at the ends of the units typically will cause a reduction in load carrying capacity.

The channel beam units will almost always fail in shear before bending. Shear cracking will typically occur about 15 inches from the face of the bearing and run at a 45-degree angle from the bottom of the stem and move away from the support. Before 1974 there was no shear reinforcement in the units, so shear cracks in these older units could be a serious concern, and the rating staff should be made aware of problems.

7.3 TIMBER

7.3.1 Timber Bridge Overview

Wood is an organic material rather than a manufactured material such as concrete, steel, or masonry. It tends to be less homogeneous and more susceptible to various recurring random defects. Lumber is generally classified according to its species, size, and natural variations.

Wood is a natural engineering material prone to deterioration caused by decay fungi, insect attack, fire, and mechanical damage. Typically, areas of high moisture content in decking, girders, abutment caps, and pilings create conditions suitable for biological damage. Types of biological damage include decay and insect damage caused by various species of fungi and insects such as ants or termites. Mechanical damage might consist of damaged members or mechanical fasteners. The application of preservative treatment by pressure methods enhances the durability of timber bridge components, but regular inspections are vital for the identification of damage and implementation of timely repairs and proactive maintenance programs.

7.3.2 Visual Signs of Deterioration

The simplest method for locating external deterioration is visual inspection. An inspector observes bridge elements for signs of actual or potential deterioration. Visual inspection often requires intense light and is useful for detecting intermediate or advanced surface decay, water damage, mechanical damage, or failed members. Visual inspection cannot detect early-stage decay when remedial treatment is most effective. A visual inspection should focus on identifying the extent of the following signs of deterioration.

Fruiting Bodies

Although they do not indicate the amount or extent of decay, fruiting bodies positively indicate a fungal attack. Some fungi produce fruiting bodies after small amounts of decay have occurred, while others develop only after extensive decay. When fruiting bodies are present, they indicate the possibility of a severe decay problem. The presence of decay fungi and fruiting bodies suggests that the member has a high moisture content, usually above 28% dry weight. Plant or moss growth in splits and cracks, or soil accumulation on the structure, indicates that adjacent wood has been at a relatively high moisture content for a sustained period and may sustain the growth of decay fungi. It is vital to include maintenance activities that remove dirt accumulation and plant growth from timber elements.

Sunken Faces or Localized Collapse

Sunken faces or localized surface depressions can indicate underlying decay. Decay voids or pockets may develop close to the surface of the member, leaving a relatively thin, depressed layer of intact or partially intact wood at the surface.

Staining or Discoloration

Staining or discoloration of wood indicates that it has been subjected to water and potentially has a high moisture content, making it susceptible to decay. Rust stains from connection hardware are also an indication of wetting.

Insect or Animal Activity

Insect activity is often identified by the presence of holes, frass, and powder posting. For wood-boring insects like carpenter ants, frass is defined as the mix of insect excrement and excavated wood material from timber members where they are active. The presence of insects may also indicate the presence of decay, as carpenter ants often create tunnels and nests in decay cavities. Carpenter ants deposit sawdust in gallery openings, trapping moisture and increasing an element's decay rate. In addition to insects, birds often nest under bridge decks. The nests may trap moisture against a timber element, potentially increasing the moisture content resulting in localized decay.

Checks and Splits

Timber members are susceptible to drying and weathering, resulting in surface and deep surface checks, ring shake, end checks, and through splits. Checks and splits in members can indicate a weakened member and create an entry for moisture to enter the element. If a check or split develops sufficiently, the untreated inner wood is susceptible to moisture and decay fungi. This will create conditions that can result in severe decay and premature deterioration of a timber bridge element. Railing posts and abutment cap ends are typically the most common location to observe lumber checking or splitting. In rail posts, overtightening of bolts during construction can contribute to their occurrence. Severe splits in timber abutment caps often lead to substantial decay. They should be thoroughly evaluated, especially when multiple spans are butted together over the support or when the wood deck does not shelter the cap beam effectively.

Weathering or Impact Damage

Weathering

Frequently, weathering and aging of bridge elements impact the performance and durability of timber bridges. This occurs with both timber and non-timber materials like bituminous or other wear layers. Further natural weathering damage occurs to timber piles exposed to water and materials flowing down the river or stream. Members in the mud zone (+/- 2 ft. of normal water level) have ideal conditions (oxygen, moisture) to promote decay. This can affect the structural performance both through loss of cross-section and the removal of the preservative treatment.

Damage

Additional damage to timber bridge components can be caused by impact from vehicle traffic. Snowplows can damage timber curbs and railings during winter months, as the curb is hidden by snow. Floating objects, such as trees and logs, can damage timber substructures during high flow rates associated with heavy rain events or seasons.

Miscellaneous Conditions

During visual inspections of timber bridge components, other significant conditions need to be further explored using the full combination of inspection and assessment techniques. These conditions can include the rotation of timber piers and abutments caused by the loss of fill behind the backwall or some other mechanism. Misalignment of caps and piles will not effectively transfer vehicle loads to the ground, causing piles to be overstressed in bending and compression. A second significant condition is the build-up of road materials like gravel or sand that hold moisture in contact with structural timber elements.

7.3.3 Sounding and Probing Techniques

One of the most used techniques for detecting deterioration is hitting a member's surface with a hammer or other object. An inspector can identify areas of concern for further investigation using advanced tools like a stress wave timer or resistance micro-drill based on the sound quality or surface condition. Deteriorated areas typically have a hollow or dull sound that may indicate internal decay. Care must be taken not to confuse the sound associated with high moisture content pile with decay. A pick hammer commonly used by geologists is recommended for timber bridges because it allows inspectors to combine sound and the pick end to probe the element.

Probing with a moderately pointed tool, such as an awl or knife, locates decay near the wood surface as indicated by excessive softness or a lack of resistance to probe penetration and the breakage pattern of the splinters. A brash break means decayed wood. A splintered break reveals sound wood. Although probing is a simple inspection method, experience is required to interpret results. Care must be taken to differentiate between decay and water-softened wood that may be sound but somewhat softer than dry wood. Probes can also be used to assess the depth of splits and checks. Flat-bladed probes like pocketknives or calibrated feeler gauges are recommended for use in this process.

7.3.4 Drilling and Coring Techniques

Drilling and coring are the most common methods used to detect internal deterioration in wood members. Both techniques are used to detect voids' presence and determine the thickness of the residual shell when voids are present. Drilling is usually done with an electrical power drill or hand-crank drill equipped with a 3/8 to 3/4-in—diameter bit. Power drilling is faster, but hand drilling allows the inspector to monitor drilling resistance and may be more beneficial in detecting pockets of deterioration. In general, the inspector drills into the member in question, noting zones where drilling becomes easier and observing drill shavings for evidence of decay. The presence of common wood defects, such as knots, resin pockets, and abnormal grain, should be anticipated while drilling and should not be confused with decay. The inspection hole is probed with a bent wire or a thickness gauge to measure shell thickness. Since these holes are typically ¼ to ½ in. diameter, they should be plugged with a wood dowel section that has been soaked in a preservative.

Coring with an increment borer (often used for determining the age of a tree) also provides information on the presence of decay pockets and other voids. The resultant solid wood core can be carefully examined for evidence of decay. In addition, the core can be used to obtain a measure of the depth of preservative penetration. Typically, coring should be conducted on a horizontal plane. To prevent moisture and insect entry, a bored-out core hole should be plugged with a wood dowel section that has been soaked in a preservative.

Bridge Operations has an electric timber micro-driller with a bit only 1/8" in width. This machine can take readings and graph both lateral and rotational resistance as it drills. The Inspector may request Bridge Operations to use the micro-driller when additional information is needed about a pile. ARDOT is currently working with a University on developing techniques to apply these drill measurements to timber inspections. **This section will be updated when TRC 2502 project is complete.**



Bridge Inspection Guidelines

Chapter 8 SNBI and Elements

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

8.1 ARDOT – SNBI GUIDANCE

8.1.1 [Introduction](#)

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. ARDOT currently uses two separate condition rating systems for bridges and culverts. 1. the NBI condition ratings and 2. the element condition ratings. All state bridges and local bridges on the NHS shall be evaluated under both systems. Local bridges not on the NHS need only be evaluated under the NBI rating system. District inspectors may choose to perform element level inspection where it is not required.

The specifications for the national bridge inventory can be found here:
https://www.fhwa.dot.gov/bridge/snbi/snbi_march_2022_publication.pdf

Reference the [Appendix 8.A](#) for Scour, Channel and Channel Protection Guidance.

Reference the [Appendix 8.B](#) for SNBI Q&A.

8.1.2 Codes Applicable to Decks of Different Materials

CODE	GENERAL DESCRIPTION	GENERAL TERMS	CONCRETE	STEEL	TIMBER
N	Not Applicable		Use N for Culverts	Use N for Culverts	Use N for Culverts
9	Excellent condition	Isolated inherent defects.	Isolated inherent defects.	Isolated inherent defects.	Isolated inherent defects.
8	Very Good	Some inherent defects.	Minor Transverse Cracks. No Spalling, Scaling, Delamination	Tightly Secured. No Rust.	Tightly Secured. No Crushing, Rotting, or Spalling.
7	Good	Some minor defects.	Sealable Cracks, Light Scaling (less than ¼”), No Spalling but visible tire wear in wheel line	Loose at some connections, Few Cracked Welds /Broken grids, Minor Rust	Minor Cracking or Splitting. Few loose Planks.
6	Satisfactory	Widespread minor or isolated moderate defects.	Excessive Number of Open Cracks (5' spacing) Med. Scaling (1/4"-1/2" deep) Spalling 2% or Less Area: Delam. Area < 5%	Considerable Rust / Initial Sect. Loss, Loose at Many Locations—some Cracked Welds / Broken Grids.	Minor Number of Rotted or Crushed Planks. Many Cracked, Split or Loose. No Sect. Loss on Fire Damage.
5	Fair	Some moderate defects; strength, and performance of the component are not affected	2 – 5% Area Spalled, 5 – 15% Area Delam., Heavy scaling (1/2" to 1" depth), Partial / Full Failures, Considerable leaching through the deck	Heavy Rust with Areas of Sect. Loss, Loose at Numerous Locations, Numerous Cracked Welds / Broken Grids.	Numerous Planks Cracked, Split, Rotted, Or Crushed. Majority of Planks Loose. Minor Sect. Loss From Fire Damage.
4	Poor	Widespread moderate or isolate major defects; strength or performance of the component is affected.	> 5% Spalled Area, 15 – 20% Delam., This area includes any repaired areas or areas in need of corrective action; many full depth present or imminent, Leaching throughout	Heavy Rusting with Considerable Sect. Loss., Some Holes, Majority of Welds Cracked and/or Grids Broken.	Majority of Planks Rotted, Crushed, and/or Split. Significant Sect. Loss From Fire Damage Reducing Load Capacity of the Member
3	Serious	Major defects; strength and/or performance of the component is seriously affected. Condition typically	+ 20% Delam., Many Full Depth Failures	Critical Signs of Structural Distress	Critical Signs of Structural Distress. Major Fire Damage Substantially Reducing Load Capacity of the Member.

		necessitates more frequent monitoring, load restrictions, and/or corrective actions.			
2	Critical	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.	Full Depth Failures Over Much of Deck	Many Holes Through Deck.	Advanced Deterioration with Partial Deck Failure.
1	Imminent Failure	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.	Bridge Closed. Corrective Action Possible.	Bridge Closed. Corrective Action Possible.	Bridge Closed. Corrective Action Possible.
0	Failed	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.	Bridge Closed. Replacement Necessary.	Bridge Closed. Replacement Necessary.	Bridge Closed. Replacement Necessary.

A deck rehabilitated by hydro-demolition and then overlaid will mainly be rated based on the condition of the top of the deck. The bottom of the deck may lower the rating by no more than one. This is to account for the poor concrete being removed during the rehabilitation. Refer to the SNBI guidance for further details.

8.1.3 Codes Applicable to Superstructure of Different Materials

CODE	GENERAL DESCRIPTION	GENERAL TERMS	CONCRETE	STEEL	TIMBER
N	Not Applicable		Use N for Culverts	Use N for Culverts	Use N for Culverts
9	Excellent Condition	Isolated inherent defects.	Isolated inherent defects.	Isolated inherent defects.	Isolated inherent defects.
8	Very Good	Some inherent defects.	Negligible Scaling, Insignificant Accident Damage.	No Visible Rust.	Minor Cracking / Splitting of Beams / Stringers at Non-Critical Locations.
7	Good	Some minor defects.	Non-Structural Hairline Cracks Without Disintegration	Some Rust but no Section Loss.	Insignificant Decay Cracking or Splitting of Beams / Stringers.
6	Satisfactory	Widespread minor or isolated moderate defects.	Minor Deterioration	Initial Section Loss (minor pitting, scaling, or flaking) in Non-Critical Areas.	Some Decay. Cracking or Splitting of Beams / Stringers. No Section Loss From Fire Damage.
5	Fair	Some moderate defects; strength, and performance of the component are not affected	Substantial Deterioration. Hairline Structural Cracks / Spalls. Possible Reinf. Steel Section Loss (minor).	Initial Section Loss in Critical Areas, Fatigue or out-of-plane bending in non-critical areas,	Substantial Decay, Cracking, Splitting of Beams / Stringers. Fire Damage with Minor Measurable Section Loss.
4	Poor	Widespread moderate or isolate major defects; strength or performance of the component is affected.	Extensive Disintegration. Measurable Structural Cracks. Large Spall Areas. Reinf. Steel Exposed With Measurable Section Loss.	Measurable Section Loss in Critical Stress Area. Fatigue Bending Cracks Possible in Major Structural Elements, Hinges may be frozen from corrosion	Extensive Decay, Cracking, Splitting, or Crushing of Beams or Stringers. Significant Section Loss From Fire Damage Reducing Load Carrying Capacity.
3	Serious	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates	Severe Disintegration. Large Structural Cracks. Advanced Corrosion in Exposed Reinf. Steel. Localized Loss of Bond.	Severe Section Loss in a Critical Stress Area.	Severe Decay, Cracking, Splitting or Crushing of Beams or Stringers. Major Fire Damage Substantially Reducing Load Carrying Capacity.

		more frequent monitoring, load restrictions, and/or corrective actions.			
2	Critical	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.	Concrete Disintegrated Around Reinf. Steel with Loss of Bond. Numerous Large Structural Cracks. Possible Local Bearing Failures.	Severe Section Loss in Many Areas With Holes at Numerous Locations.	Beam Ends Crushed or Split with Some Deck Settlement. Further Deterioration of Conditions Noted in Code 3.
1	Imminent Failure	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.	Bridge Closed. Corrective Action Possible.	Bridge Closed. Corrective Action Possible.	Bridge Closed. Corrective Action Possible.
0	Failed	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.	Bridge Closed. Replacement Necessary.	Bridge Closed. Replacement Necessary.	Bridge Closed. Replacement Necessary.

8.1.4 Codes Applicable to Substructures of Different Materials

CODE	GENERAL DESCRIPTION	GENERAL TERMS	CONCRETE	STEEL	TIMBER
N	Not Applicable		Use N for Culverts	Use N for Culverts	Use N for Culverts
9	Excellent Condition	Isolated inherent defects.	Isolated inherent defects. Insignificant Scrape Marks.	Isolated inherent defects. Insignificant Scrape Marks.	Isolated inherent defects. Insignificant Scrape Marks.
8	Very Good	Some inherent defects.	Cracks, Light Scaling, or Insignificant Spalling Not Exposing Reinf. Steel. Insignificant Damage with no Misalignment Not Requiring Correction.	Insignificant Damage with no Misalignment Not Requiring Correction.	Insignificant Damage with no Misalignment Not Requiring Correction.
7	Good	Some minor defects.	Deterioration or Initial Disintegration, Cracking with Some Leaching or Spalls. No Effect on Bearing Area. Minor Cracking Due to Leakage of Exp. Device.	Some Rust Without Measurable Section Loss. Minor Scour Possible.	Insignificant Decay Cracking or Splitting. Minor Scour Possible.
6	Satisfactory	Widespread minor or isolated moderate defects.	Moderate Deterioration, Disintegration, Spalls and Cracking with Leaching. Little Loss of Bearing Area Possible. Shallow Local Scour Near Foundation Possible.	Initial Measurable Section Loss. Shallow Local Scour Near Foundation Possible.	Initial Decay, Cracking or Splitting. Shallow Local Scour Near Foundation Possible. Fire Damage Limited to Surface Scorching. No Section Loss.
5	Fair	Some moderate defects; strength, and performance of the component are not affected	Some Section Loss with Exposed Reinf. Steel Possible. Scour More Prominent Possibly exposing Footing but no Settlement or Misalignment.	Measurable Section Loss. Scour More Prominent Possibly Exposing Footing but no Settlement or Misalignment.	Moderate Decay, Cracking or Splitting. Fire Damage Resulting in Minor Measurable Section Loss. Some Exposure as a Result of Erosion Reducing Pile Penetration. No Settlement or Misalignment.

4	Poor	Widespread moderate or isolate major defects; strength or performance of the component is affected.	Structural Cracks. Extensive Erosion / Scour Reducing Penetration or Affecting Stability Requiring Correction.	Extensive Section Loss. Extensive Erosion / Scour Reducing Penetration or Affecting Stability Requiring Correction.	Substantial Decay, Cracking, Splitting or Crushing of Primary Members Requiring Some Replacement. Significant Section Loss Due to Fire Reducing Load Carrying Capacity. Extensive Erosion / Scour Reducing Penetration Affecting Stability Requiring Correction.
3	Serious	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.	Severe Disintegration Exposing Reinf. Steel with Advanced Stages of Corrosion. Severe Section Loss in Critical Stress Areas. Bearing Area Loss. Severe Scour Affecting Stability. Settlement Possible. Shoring Necessary.	Severe Section Loss in Critical Stress Areas. Bearing Areas Seriously Deteriorated with Bearing Loss. Severe Scour Affecting Stability. Settlement Possible. Shoring Necessary.	Severe Section Loss in Critical Stress Areas. Major Fire Damage Substantially Reducing Load Capacity. Bearing Area Loss. Severe Scour Affecting Stability. Settlement Possible. Shoring Necessary.
2	Critical	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.	Spalling Soft Concrete Exposing Reinf. Steel Without Bond. Failure Cracks in Caps and Columns. Scour Resulting in Near Collapse. Settlement.	Critical Section Loss. Holes in Web or Knife Edge Flanges. Scour Resulting in Near Collapse.	Ineffective Primary Members Due to Crushing or Splitting. Scour Resulting in Near Collapse.
1	Imminent Failure	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.	Bridge Closed. Corrective Action Possible.	Bridge Closed. Corrective Action Possible.	Bridge Closed. Corrective Action Possible.
0	Failed	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.	Bridge Closed. Replacement Necessary.	Bridge Closed. Replacement Necessary.	Bridge Closed. Replacement Necessary.

8.2 ARDOT – AGENCY FIELDS

Coming soon. This will include a list and description of each agency field with party responsible.

8.3 ARDOT ELEMENT INSPECTIONS

8.3.1 Introduction

Structural element condition ratings divide a bridge into separate components, which are then rated individually based upon the severity and extent of deterioration. This rating system was developed by the American Association of State Highway and Transportation Officials (AASHTO) and is outlined in the “Manual for Bridge Element Inspection” – First Edition, 2013 with current Interims. This chapter is designed to answer questions that the Bridge Inspection Teams may have regarding coding the elements that is not clear in the MBEI. The subsequent sections contain unique case guidance for determining elements and quantities.

These definitions and quantity calculation guides are specifically for the AASHTO elements, not the NBI components. As noted before, this is to serve as a guide. Inspectors will need to use their judgment to identify and calculating quantities for elements.

8.3.2 Decks and Slabs

The AASHTO Manual for Bridge Element Inspection states that the quantity calculation should be determined edge to edge for each linear foot of deck length. The edge of the deck is considered the edge of the traffic carrying component. See the sketch below.

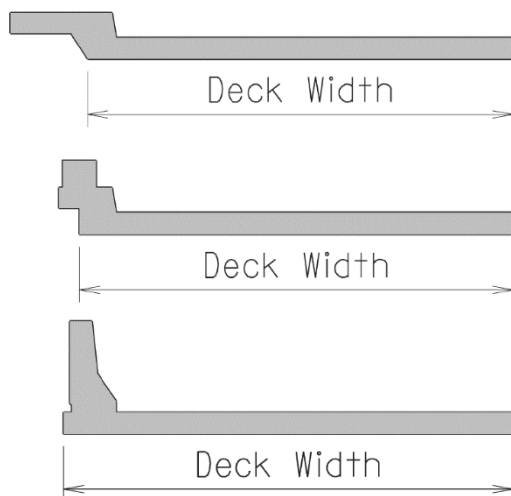


Figure 11. Deck Width

Polymer overlays consisting of coarse aggregate shall be recorded as a Wearing Surface. Low viscosity “Healer Sealers” with only fine aggregate (sand) should be recorded as Concrete Protective Surface.

8.3.3 Abutments

Substructure features at the end of the bridge that retain the embankment will be recorded as abutments. End bents consisting of separate components to transfer vertical loads and retain embankment will need to be recorded with multiple elements. The elements transferring vertical loads should be identified in the same manner as elements at intermediate bents. End bent consisting of just a cap on piles and wingwalls should be recorded as an abutment. Below are some diagrams and pictures to serve as a guide; as always, the inspectors will need to use their judgment.

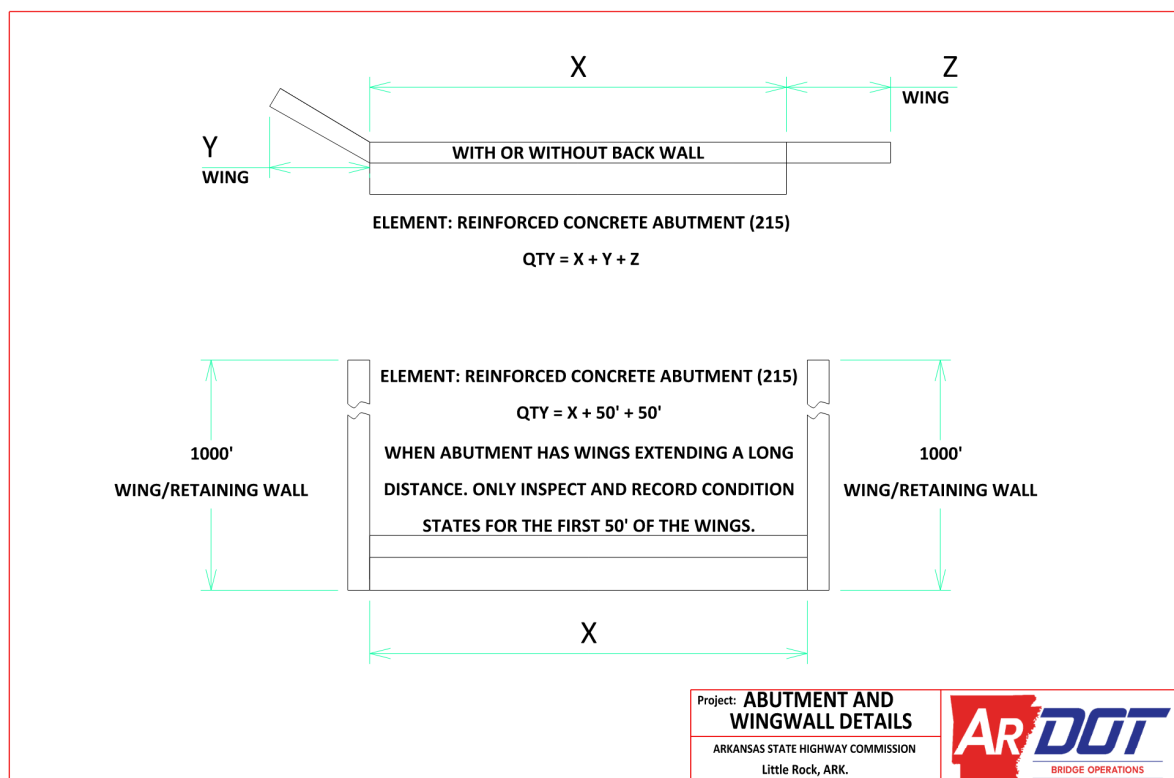


Figure 12. Abutment and Wingwall Details 1

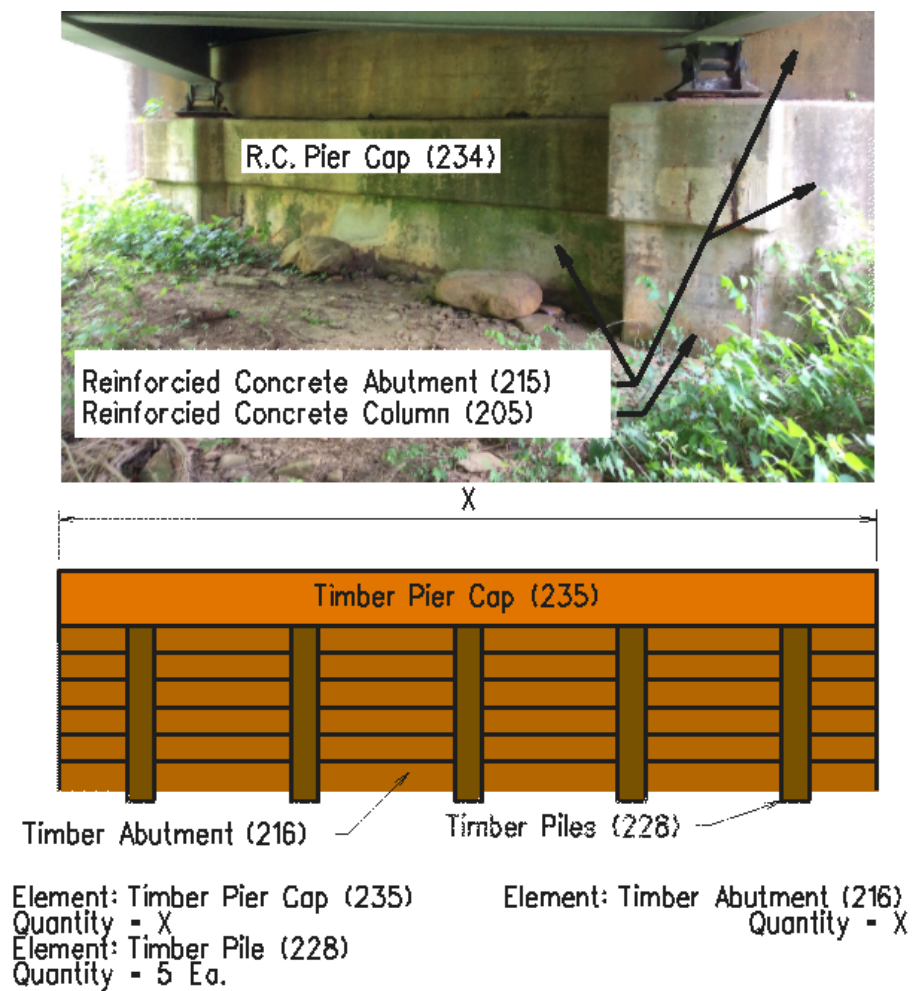


Figure 13. Abutment and Wingwall Details 2

8.3.4 Intermediate Bents

The following diagrams provide clarity for certain types of intermediate bents.

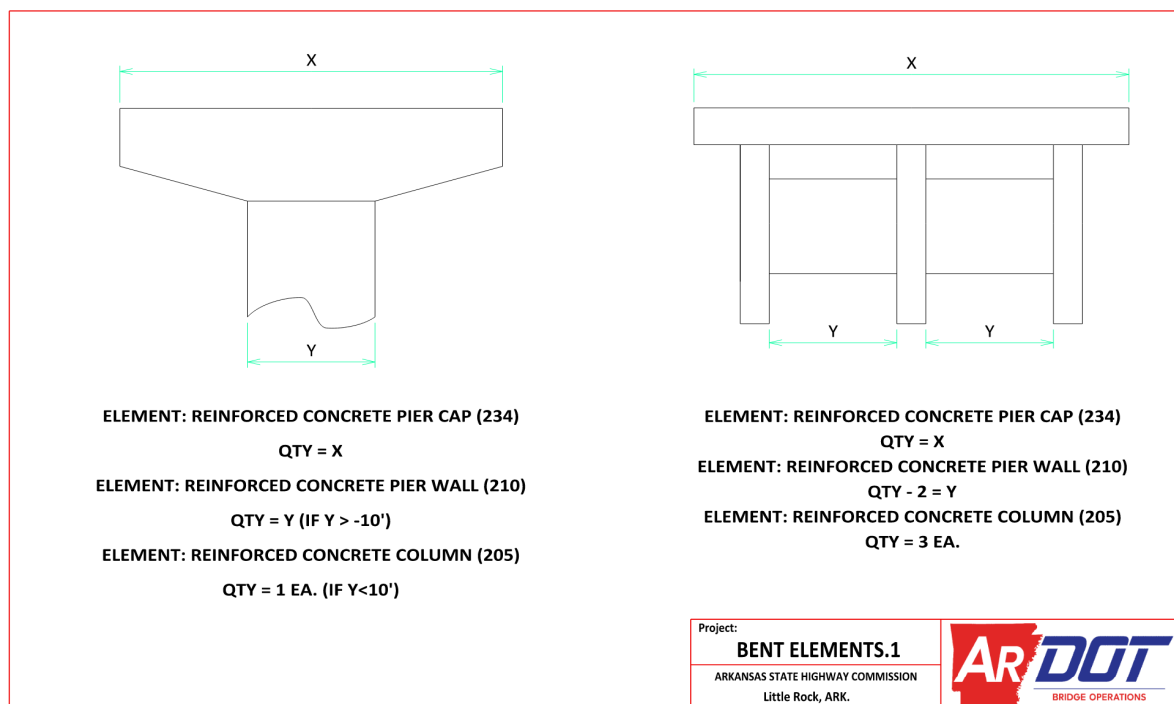


Figure 14. Bent Details 1

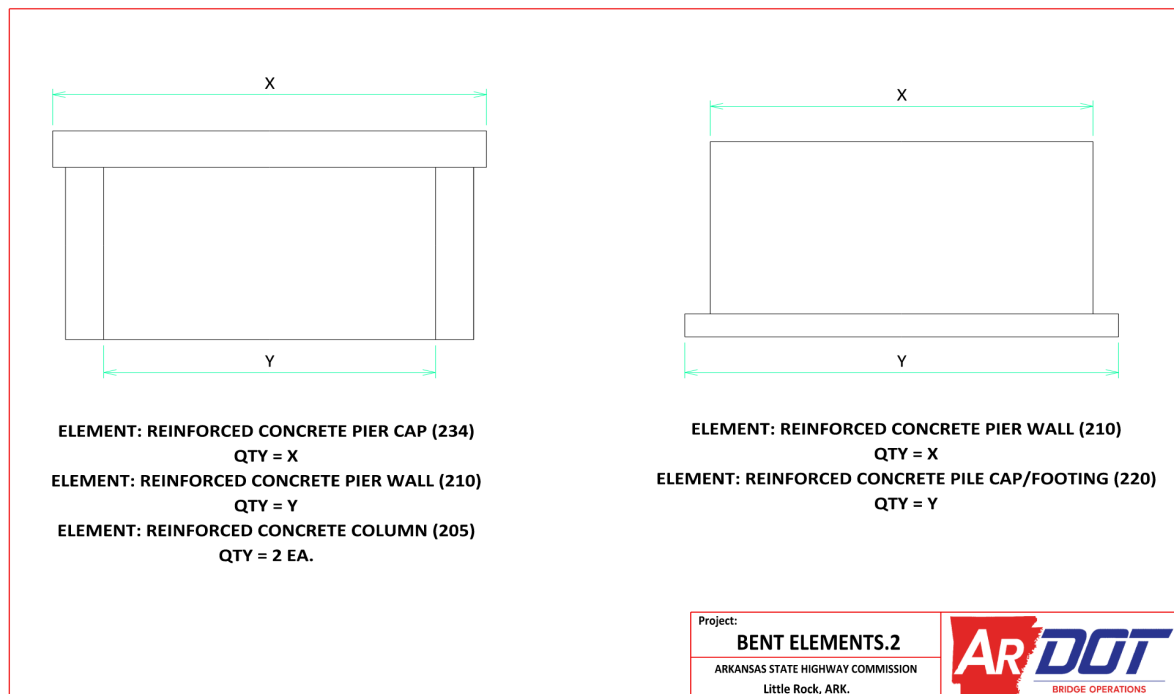


Figure 15. Bent Details 2

8.3.5 Bridge Rails

Bridge rails may consist of more than one element. Therefore, multiple element numbers may be required for recording the condition of a rail. See the example below. The quantity for bridge rails should be calculated only using the sections on the bridge, approach rails are not included. In a situation that defects to the underside of the bridge beyond the limits of the edge of slab as described above, the defects may be recorded in the rail. These quantities will be recorded in linear feet. Use element notes to specify the location as needed.

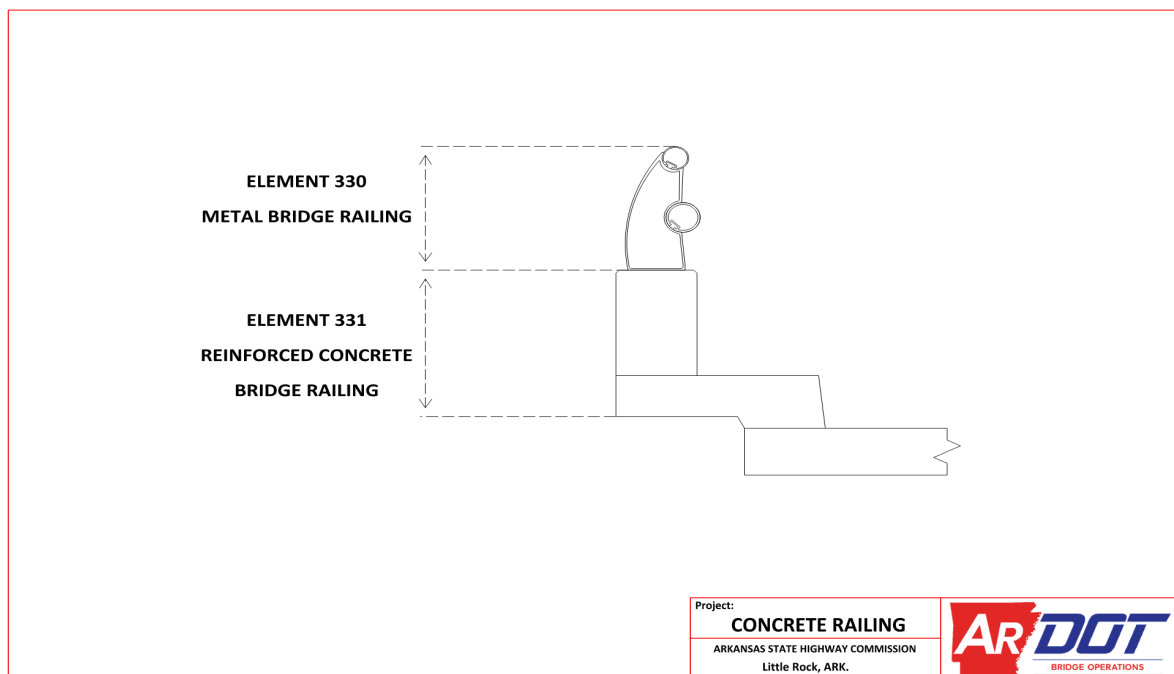


Figure 16. Railing Details

8.3.6 Joints

Joints under an asphalt overlay shall be documented to have the defect debris impaction in condition state 3. If the inspector has good reason to believe the joints were protected during the overlay, such as a functioning sliding plate, the condition state should reflect this fact. Likewise, the inspector may record condition state 4 for any defect if warranted.

8.3.7 Element Level Condition States

The condition rating of a bridge component is coded with a rating of '4' (worst) through '1' (best). The bridge elements are rated in quantitative units or percentages for each condition state.

The condition of each element is determined by performing a field inspection and recording quantities of the element that have identified defects. The evaluation of the item is complete when the sum of all four condition states equals 100%. The following chart provides a general guideline on how to collect and quantify the element.

Generic Item – Condition States (CS)				
Defect	GOOD <i>Condition State 1</i>	FAIR <i>Condition State 2</i>	POOR <i>Condition State 3</i>	SEVERE <i>Condition State 4</i>
Adjective	Quantity that is Good	Quantity that is Fair	Quantity that is Poor , does not warrant a structural review	Warrants Structural Review OR the defect impacts the strength or serviceability of the element
<i>Maintenance Response --></i>	<i>Monitor Protect Repair Rehab Replace</i>	<i>Monitor Protect Repair Rehab Replace</i>	<i>Monitor Protect Repair Rehab Replace</i>	<i>Monitor Protect Repair Rehab Replace</i>

Condition State 4 warrants a structural review or the defect impacts strength or serviceability. Quantities in CS4 may often have implications that affect public safety OR reduction in load capacity. If the inspector determines an impact on the load capacity or a direct impact on safety, then the 4 is the appropriate rating. All quantities in CS4 shall be accounted for with quantitative descriptions and/or pictures.

8.3.8 Material Specific, Defect Severity Descriptions

The following table details the language inspectors should use in regard to note taking descriptions in reference to various materials and defects.

Material	Defect	Minor	Moderate
Concrete	Delamination, Spall, Patched Area	Delamination. Patched Area. Spall less than 6" in diameter or less than 1" deep.	Unsound patched area. Larger/Deeper Spalls.
	Exposed Rebar	Present without measurable section loss.	Present with measurable section loss.
	Exposed Prestressing	N/A	Present.
	Cracking*	Unsealed medium width cracks or unsealed medium map cracking.	Wide cracks or heavy map cracking.
	Abrasion, Wear	Exposed but secure coarse aggregate.	Aggregate is loose or has popped out.
	Efflorescence, Rust Staining	Surface white or leaching with little build-up.	Heavy build-up or rust staining (from reinforcing steel).
Steel	Corrosion	Present. Freckled rust.	Section loss is evident.
	Cracking	Effectively arrested.	Not arrested.
	Connection	Connection is functionalizing as intended but has loose	Missing fasteners, broken welds, or pack rust with distortion.

		fasteners or pack rut without distortion.	
Timber	Cracking	Effectively arrested.	Not arrested.
	Decay, Section Loss	Affects up to 10% of the member section.	It affects more than 10% of the member's section
	Checks, Shakes	Penetrates 5%-50% of the thickness of the member, not in a high-stress zone.	Penetrates more than 50% of the member thickness and length equal to or greater than the member depth or penetrates more than 5% of the member thickness in a high-stress zone.
	Splits, Delamination	Length is less than the member depth, or it is effectively arrested.	Length equal to or greater than the member depth; not arrested
	Abrasion, Wear	Affects up to 10% of the member section.	Affects more than 10% of the member section.

*Concrete cracking clarifications:

- Insignificant - width less than 0.012" or 0.004" (prestressed) and medium cracks that have been sealed.
- Medium - width ranging from 0.012-0.05 or 0.004-0.009 (prestressed).
- Wide - width greater than 0.05" or 0.009" (prestressed).
- Medium Map Cracking – Spacing of 1'-3'.
- Heavy Map Cracking – Spacing less than 1'.

8.3.9 Weathering Steel Protective Coating

The inspection of weathering steel bridges differs from that of a painted steel bridge. The entire surface area of weathering steel is covered in a patina or rust layer. The inspector must distinguish between a protective and non-protective oxide coating. Slight variations in color and texture are important indicators of non-protective coating requiring close inspection. Inspector shall note any section loss associated with coating failure in the appropriate item. The following table summarizes the stages and colors of weathering steel to aid in field inspection:

Color	Film Stage	Condition
Yellow Orange	Initial stage of exposure	Acceptable
Light Brown	Early-stage of exposure	Acceptable
Chocolate brown to purple brown	Development of protective oxide	Acceptable
Black	Non-protective oxide	Failed

The oxide film must be tested by tapping or vigorously wire brushing to determine whether the film is adhering to the substrate. Physical and visual means are used in conjunction to determine the condition of the oxide film accurately. The oxide film texture may debond in the form of granules, flakes, or laminar sheets. New weathering steel requires 3 to 5 years to stabilize. An inspector should keep in mind the year built when evaluating the oxide film. The interior surfaces are likely to exhibit the same color as the exterior beams but sheltered

from the wind and rain, the initial dusty surface is not sweep clean, thus becoming embedded and leaving a coarse finish. The following table summarizes the stages and texture of weathering steel to aid in field inspection:

Texture	Surface Stage	Condition
Tightly adherent, capable of withstanding hammering or vigorous wire brushing	Protective oxide film	Acceptable
Dusty	Early stage of exposure	Acceptable
Granular	Possible development of non-protective oxide	Acceptable
Small flakes, 1/4" diameter	Non-protective oxide	Failed
Large flakes, 1/2" diameter	Non-protective oxide	Failed
Laminar sheets of nodules	Non-protective oxide, severe corrosion	Failed

8.4 DEFECT HIERARCHY

The ASHTO Manual for Bridge Element Inspection lists multiple defects to be used for specific bridge elements constructed of specific materials. A defect in a worse condition state (higher number on the 1-4 scale) controls over a separate defect for the same unit of quantity for the element. For example, if there is a spall of condition state 3 and exposed rebar of condition state 2 for the same square foot of deck, that square foot should be recorded as having a defect of spalling in condition state 3. To provide guidance in the situation that multiple defects of the same condition state are present at the same unit of quantity, the defects are listed below in a top first hierarchy format. The inspectors still should use their own judgment, for instance, a concrete girder with 20 feet of cracking in condition state two, but within those 20 feet, it contains 6" of efflorescence in condition state two it would be acceptable to record the 20 feet as condition state 2 for the defect cracking. Below is the hierarchy (top to bottom) that should be used as a guide.

Reinforced Concrete (All Elements)

- 6000 - Scour (Substructure Only)
- 4000 - Settlement (Substructure Only)
- 1090 - Exposed Rebar
- 1080 - Delamination/Spall/Patched Area
- 1120 - Efflorescence/Rust Staining
- 1130 - Cracking
- 1190 - Abrasion/Wear

Steel (All Elements)

- 6000 - Scour (Substructure Only)

- 4000 - Settlement (Substructure Only)
- 1010 - Cracking
- 1020 - Connection
- 1900 - Distortion
- 1000 – Corrosion

Timber (All Elements)

- 6000 - Scour (Substructure Only)
- 4000 - Settlement (Substructure Only)
- 1140 - Decay/Section Loss
- 1160 - Cracking
- 1170 - Split/Delamination
- 1150 - Check/Shake
- 1020 – Connection
- 1180 - Abrasion/Wear

Masonry

- 6000 - Scour (Substructure Only)
- 4000 - Settlement (Substructure Only)
- 1640 - Masonry Displacement
- 1620 - Split/Spall
- 1630 - Patched Area
- 1610 - Mortar Breakdown

Joints

- 2370 - Metal Deterioration or Damage
- 2310 - Leakage
- 2320 - Seal Adhesion
- 2330 - Seal Damage
- 2340 - Seal Cracking
- 2360 - Adjacent Deck or Header
- 2350 - Debris Impaction

Bearings

- 2220 - Alignment
- 2210 - Movement
- 2240 - Loss of Bearing Area
- 2230 - Bulging, Splitting or Tearing
- 1020 – Connection
- 1000 – Corrosion

Steel Protective Coating

- 3440 - Effectiveness
- 3420 - Peeling/Bubbling/Cracking
- 3410 - Chalking
- 3430 - Oxide Film Degradation Color/Texture Adherence (Weathering Steel Only)

Concrete Protective Coating

- 3540 - Effectiveness
- 3510 – Wear

Prestressed Concrete (All Elements)

Uses the same hierarchy as Reinforced Concrete given that: 1100 – Exposed Prestressing supersedes 1090 – Exposed Rebar for all elements.



Bridge Inspection Guidelines

Chapter 9 Engineering Analysis and Emergency Response

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

9.1 LOAD RATING OVERVIEW

The new ARDOT Load Rating Guidance Document is currently in development. This section will give an overview of this document and details specifically necessary for Bridge Inspection.

Reference the ARDOT Load Rating and Posting Guidelines – Coming Soon

9.2 LOAD RESTRICTIONS

The NBIS requires proper load restrictions at each bridge according to the Engineering Load Rating appraisal of the structure. Chapter 5 details the ARDOT load restriction requirements for new structures, posted structures and closures based on the owner type.

Reference restrictions [Chapter 5](#) for more details.

9.3 LOAD TESTING

Reserved for future section. TRC 2701 Bridge Load Testing Initiative is in the early stages of development.

9.4 SCOUR APPRASIAL PROCEDURES

9.4.1 [Overview and History](#)

The following describes the history of scour assessment and history taken by ARDOT Bridge Operations engineers in conjunction with the ARDOT Bridge Inspection Program Scour Committee (BIPSC) during 2024 alongside FHWA scour subject matter experts.

In the 1990s, scour evaluation and assessment was at the forefront of FHWA concerns after the Schoharie Creek Bridge collapse in 1987. The ARDOT Bridge Design Division calculated estimated scour depths and scour lines during this time after the FHWA started requiring every bridge over a waterway to have a scour analysis. These were all paper documents in a file box/cabinet located in the Load Rating Office. Unfortunately, and ironically, a pipe burst and destroyed numerous documents such that some bridges no longer had physical scour evaluation documentation.

In 2007, during a routine file review, FHWA communicated concern to ARDOT regarding bridges with unknown foundations in the National Bridge Inventory. ARDOT acquired the Illinois-created and FHWA-approved scour assessment sheet and began to assess bridges for scour followed by assigning the structures an NBI Item 113 value. The bridges that ARDOT was unable to assign a 113-value to were deemed “scour critical” in which Scour Plans of Action were developed. In addition there was limited documentation reclassifying a bridge with an unknown foundation.

FHWA assessed the ARDOT Bridge Inspection Program in 2021 and issued an assessment report outlining recommendations for improvement. One recommendation was to ensure that all bridges over water have a documented scour appraisal in the bridge inspection software to facilitate

access by all users. In response to this recommendation, ARDOT formed a multi-disciplinary scour appraisal team called the Bridge Inspection Program Scour Committee. The BIPSC was formed and actively meets to improve the scour appraisal process. The scour committee was tasked with improving the bridge design process for designing for scour, the documentation of existing scour, and the evaluation of potential scour.

During the 2023 Metric Review Process with ARDOT, the FHWA stated that there should be a scour assessment or evaluation in the bridge file for every bridge over a waterway. Even though the old form (Illinois form) had been approved originally, the newly appointed ARDOT Scour Committee did not feel it was a good representation of a bridge's vulnerability to scour. As a result, the Scour Committee adopted a document from the Ohio DOT with the help of the FHWA's scour expert. This document was finalized and approved by FHWA and ARDOT in Spring of 2024. This document outlines the process of assigning an SNBI B.AP.03 Scour Vulnerability code.

The first step to meet FHWA's recommendation was to identify all bridges that required a scour assessment or evaluation. According to HEC-18, "every bridge over water, whether existing or under design, should be assessed as to its vulnerability to floods in order to determine the prudent measures to be taken." A total of 11,786 structures were identified to have a waterway as part of their 42B- Type of Service Under Bridge field. Of those structures 8,261 were bridges (not culverts).

Secondly, the structures had to be separated into low, medium, and high-risk categories. Culverts and off-system bridges were designated as low-risk which require a screening and assessment if necessary. A culvert rating sheet was developed for box and pipe culverts. Bottomless culverts were to be assessed like a bridge. A scour assessment form was developed to rate low and medium risk structures.

Using the bridges' criticality scores developed as part of a TRC research project from the University of Arkansas, "Data-Driven Methods to Assess Transportation System Resilience in Arkansas," the bridges were split into low, medium, and high-risk categories based on average scores.

Using these risk categories, ARDOT is currently working to assess all existing structures over water for scour vulnerability where documentation was lacking.

9.4.2 Scour Procedures Overview

Every bridge over a waterway carrying public vehicular traffic on the structure with more than 20-ft clear span requires a Scour Appraisal. Pipe culverts and 4-sided boxes will be assessed using the Culvert Scour Assessment Worksheet in [Appendix 9.A](#). Bridge type structures will be assessed using the Bridge Scour Assessment Worksheet in [Appendix 9.B](#). Documentation shall be completed within the bridge inspection software. Directions are provided in this document.

The following Scour Assessment Procedure Flow Chart outlines the full process of evaluating a bridge for scour.

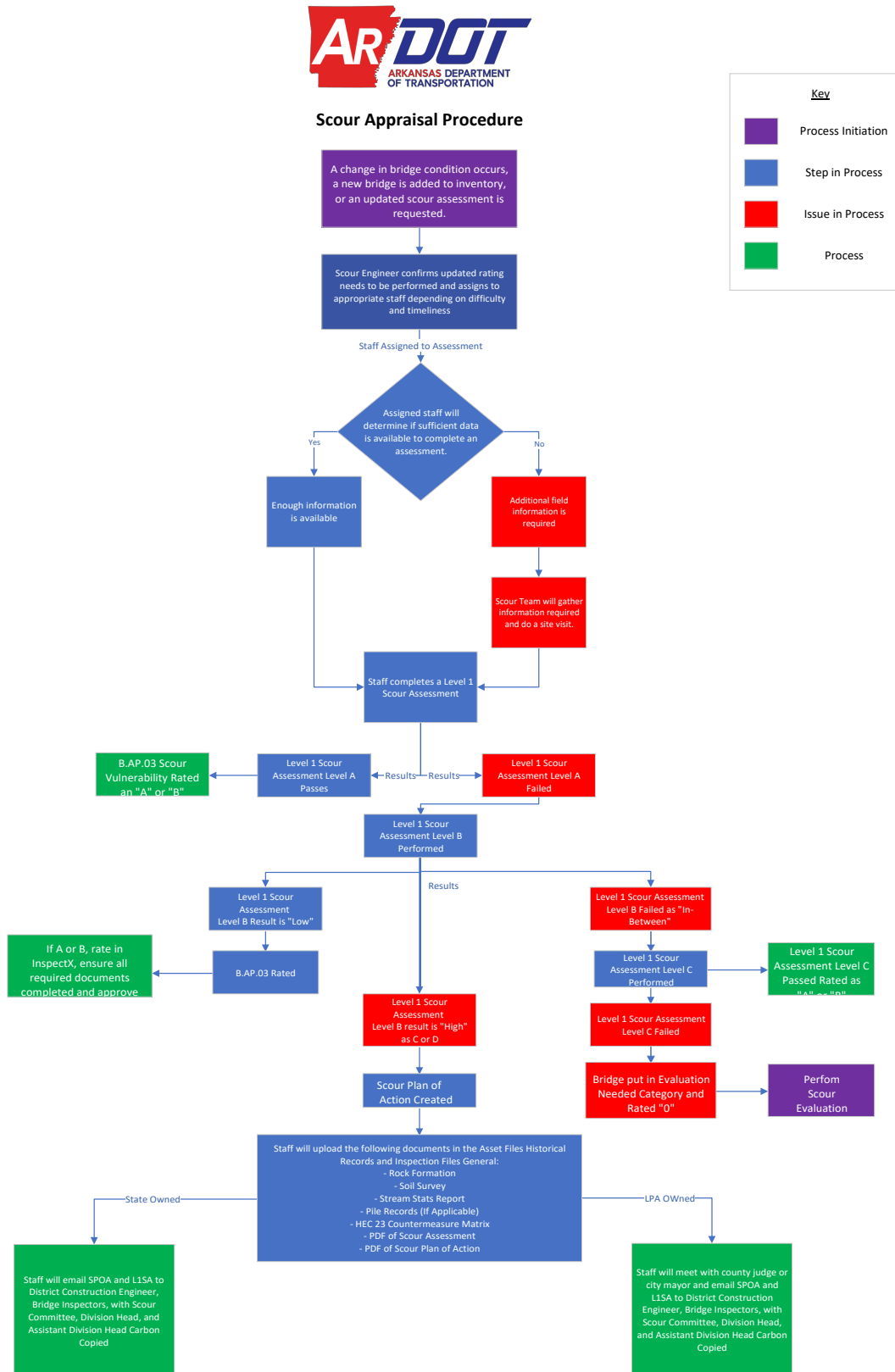


Figure 17. Scour Flow Chart

9.4.3 Scour Appraisal

Scour Appraisals are the risk-based and data-driven determination of a bridge's vulnerability to scour, resulting from the least stable result of scour that is either observed, or estimated through a scour evaluation or a scour assessment. Both field observed scour and office estimated scour must be performed to determine the least stable result. Observed scour results are recorded by inspectors in the inspection report(s). Estimated scour results are recorded by engineering staff on the Scour Appraisal form in the bridge inspection software. The terms can best be organized in an outline:

1. Observed Scour **AND**
2. Estimated Scour (which will consist of)
 - a. Scour Evaluations **OR**
 - b. Scour Assessment: All assessments performed will consist of three levels:
 - i. Level A– Stability Screening

Answer all 5 Questions. If all questions are answered “No”, then the Assessment is complete and Specification for the National Bridge Inventory (SNBI) (B.AP.03) Scour Vulnerability code will be assigned accordingly. If any answer is “Yes”, then continue to Level B.

- ii. Level B – Susceptibility Screening

Answer all 18 Questions. Each answer has a point total. Total points determine a triage-range of three (3) options. If the point total is low or high, then assign the (B.AP.03) Scour Vulnerability code will be assigned accordingly. If the point total is in the middle-range, or inconclusive, then continue to Level C.

- iii. Level C – Vulnerability Screening

Answer questions progressively in three groups (three (3), eight (8) or eleven (11) questions). Based on the results the appropriate (B.AP.03) Scour Vulnerability code will be assigned.

9.4.4 Observed Scour

Observed scour shall be documented by bridge inspection teams during various inspection types. All portions of a bridge substructure and the surrounding channel to the mudline at low water accessible by wading or probing are within the scope of each scheduled Routine Inspection. When wading or probing are not safe or feasible during each Routine Inspection then probing from a boat or snoopers bucket are acceptable alternatives when the inspection reaches to the mudline of all substructure units and can adequately determine in-service conditions. When probing and wading is unsafe nor feasible then underwater diving techniques are typically required. Underwater Inspection must not exceed the intervals specified in the ARDOT Bridge Inspection Manual. Channel cross-sections shall be taken periodically and compared to original ground line. This provides indications of the presence of contraction scour, lateral stream migration, and long-term degradation. See [Chapter 3](#) for underwater requirements.

9.4.5 Scour Assessment

A Scour Assessment is the determination of a bridge's vulnerability to scour which considers stream stability and scour potential as described in HEC 20 *Stream Stability at Highway Structures 4th Edition* and other scour-related data sources. All structures over water shall have a documented Scour Assessment. The results of a Scour Assessment may determine that further analysis through scour evaluation is required to determine scour vulnerability. There are three levels of assessment. Each assessment level is a progressive screening process that effectively documents the scour and directs the assessor coding the appraisal field (B.AP.03) Scour Vulnerability Code. Legacy assessments are considered valid; however, it is recommended that the updated progressive screening process is completed. The following information is required when completing all types of assessments in bridge inspection software:

1. Scour Assessment Level(s) Performed
 - A – Level A
 - B – Level B (Includes Level A)
 - C – Level C (Includes Level A and B)
 - O – Other, Documented File or Checklist on File
2. Scour Assessment Date
3. Countermeasure Type – Countermeasures are material, devices, or structures designed to prevent, slow, or stop the occurrence of scour. Select the most appropriate answer. Refer to HEC 23 – *Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance 4th Edition*, for determining the nature of the countermeasures.
 - Designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations.
 - Scour Appraisal Team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.
 - Temporary countermeasures are installed that were not designed. Bridge could become unstable for scour.
 - None.



Figure 18. Non Scour Resistant Rock

9.4.6 Scour Evaluation

Scour Evaluations are performed by a bridge, geotechnical, and/or hydraulic engineer. The purpose of an evaluation is to calculate the depth of potential scour so the foundation can be designed with sufficient depth, stability, and capacity. Hydraulic calculations are commonly performed during early design-stages for new construction or rehabilitation bridge projects. Scour evaluations are also performed for high-risk in-service bridges where calculations are not documented. These evaluations provide theoretical scour depths that are compared to in-place foundation depths to determine the bridge's vulnerability to scour. Refer to the latest [ARDOT Bridge Design Guidelines](#) for the scour evaluation and design procedures. The Scour Evaluation results (report with calculations explaining how the structure's vulnerability to scour was determined) shall be documented in the POA Scour Assessment/Evaluation Inspection within the bridge inspection software after construction of the bridge or after completion of scour evaluation of an existing bridge.

After documenting the Scour Evaluation results, the evaluating engineer shall code SNBI B.AP.03 (Scour Vulnerability) as described in the SNBI. When a documented evaluation exists then the Scour Appraisal is complete. If there are no observed bridge-threatening scour defects that demonstrate the bridge is vulnerable to estimated scour depths, then the evaluating engineer may code SNBI B.AP.03 (Scour Vulnerability) based on the results of the scour evaluation and the descriptions provided. When the results of the evaluation indicate a bridge is vulnerable to scour, a Plan of Action is required.

The following table references SNBI B.AP.03 Scour Vulnerability Codes.

Code	Scour Appraisal	Description
A	A – Scour appraisal completed.	Bridge determined to be stable for scour.2
B	B – Scour appraisal completed.	Bridge determined to be stable for scour, dependent upon designed, and functioning countermeasures. • <i>Use code B when designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations.</i> • <i>Use code B when the Scour Appraisal Team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.</i>
C	C – Scour Appraisal completed.	Bridge could become unstable for scour. Temporary (not designed) countermeasures installed to mitigate scour. Bridge is scour critical. Follow POA Requirement. • <i>Use code C for bridges that could become unstable for the potential scour, and temporary countermeasures are installed that were not designed.</i>

D	D – Scour Appraisal completed.	Bridge is, or may become, unstable for scour. Bridge is scour critical. Follow POA Requirement.
0	0 – Scour appraisal has not been completed.	
E	E – Scour appraisal has not been completed.	Temporary (not designed) countermeasures installed to mitigate scour.
U	U – Scour appraisal has not been completed.	Due to unknown foundations.

9.5 SCOUR TRIGGER INSPECTIONS

9.5.1 [EmergencyX Inspections](#)

ARDOT has implemented event triggering, monitoring, and inspection software, EmergencyX, which provides alerts for highwater flows in relation to the bridge inventory. This software assists ARDOT in monitoring scour issues within the State and Local bridge inventories. The software is consistently under refinement as Plans of Action change and thresholds for flooding events are adjusted. Bridge Operations personnel will perform the majority of scour monitoring inspections unless a storm event is too widespread or urgent for Bridge Operations to manage. If a largescale flood event occurs, Bridge Operations personnel will coordinate with District inspectors to assign alerts within their respective areas.

When an inspector inspects a structure due to an EmergencyX alert and no rating change is required, the inspection shall be documented only in EmergencyX. When a rating change is necessary, the inspector shall document a “Scour Monitoring Inspection” in InspectX. If the structure cannot be accessed during the flood event, the inspector will mark the bridge as “Follow Up”, and Bridge Operations Staff will schedule another inspection once water has receded and all substructure units can be evaluated.

When flood monitoring is not indicated in the Plan of Action (POA), a triggering event inspection is required only when:

- The bridge or roadway is reported as overtopped
- Substructure rotation and/or settlement is observed
- Roadway embankment loss occurs
- Debris accumulation threatens the stability of the structure
- Debris accumulation restricts or redirects channel flow
- Channel protection (riprap, grouted riprap, shotcrete, etc.) is displaced or undermined

9.5.2 [Local Bridge Owner Scour Monitoring](#)

For LPA structures with an associated Plan of Action, the local owner shall be responsible for the triggering event monitoring or inspection requirements identified in the POA document. It is recommended that local owners conduct all monitoring during the flood event and perform a follow

up inspection once water levels have receded when substructure is visible to check for stability. After completing the inspection, the local owner shall complete the Flood Monitoring Event Form and email it to District personnel will then record the information in the inspect software as a Scour Monitoring Inspection.

Each POA includes a countermeasure matrix from Hydraulic Engineering Circular 23 (HEC-23) to assist local bridge owners in selecting appropriate countermeasures. The choice and installation of countermeasures is the responsibility of the local bridge owner; however, Bridge Operations personnel are available to provide recommendations as needed.

If a local bridge owner elects to install countermeasures, it is recommended that they:

- Document countermeasures with design plans
- Provide before and after photographs
- Include dimensional sketches if design plans are not available
- Document quantities for all materials used

Local bridge owners are encouraged to share this information with ARDOT personnel so that appropriate follow-up actions can be taken.

9.6 EARTHQUAKE RESPONSE PLAN

9.6.1 Overview

The Arkansas Department of Emergency Management (ADEM), in collaboration with the Governor's Earthquake Advisory Council (GEAC), of which ARDOT is a member, develops and maintains statewide plans and procedures for responding to seismic events. The ARDOT Maintenance Division maintains the ARDOT Earthquake Annex, which outlines ARDOT's mitigation, preparedness, and response actions in the event of a catastrophic earthquake. ARDOT's primary mission after such an event is to assess, clear, repair, and reopen highways and bridges as quickly as possible to support emergency response and recovery.

[Link to the ARDOT Earthquake Annex – coming soon.](#)

Bridge Operations maintains procedures specific to post-earthquake inspection of structures under ARDOT's inspection responsibility within this chapter. A sizeable earthquake in the New Madrid Seismic Zone in Northeast Arkansas has not occurred in recent history so the response to this event will be dynamic, and procedures are subject to change based on the situation. Bridge Operations also recognizes that each sizable earthquake event will require fluid coordination with multiple stakeholders. This chapter provides guidelines for the immediate response necessary to ensure the safety of the traveling public. Detailed follow-up inspections may be required beyond the initial safety inspections described here. Routine inspections or damage inspections shall follow the procedures outlined in the relevant chapters of this guidance document.

9.6.2 Initial Earthquake Response Alerting

Bridge Operations will be responsible for monitoring seismic activity using ShakeCast currently hosted through the EmergencyX software. The system will automatically alert designated Bridge Operations staff members in the event of any earthquake potentially affecting structures within the state. Bridge Operations will use the output results of the notifications and upload the results into EmergencyX.

9.6.3 Earthquake Response Activation

The Bridge Operations Division Head and Assistant Division Head will determine the level of impact for each earthquake event and will coordinate the deployment of bridge inspectors. For every activation, Bridge Operations staff will notify the State Maintenance Engineer that a response is underway.

All personnel assigned to earthquake-related bridge inspections will report to Bridge Operations staff for assignment and coordination. Following an earthquake, inspection personnel must monitor email and phone communications for deployment instructions and updates.

9.6.4 EmergencyX Assignments and Inspections

Bridge Operations will utilize the EmergencyX software for inspection assignments and inspection reporting in the event of an earthquake large enough requiring safety inspections. Bridge Operations will assign inspections to inspection personnel based on priority of designated routes determined by the ARDOT Maintenance Division, predicted damage, and other relevant factors.

Inspection staff shall ensure they have the latest version of EmergencyX prior to deployment. After inspections have been assigned, inspection personnel will download the inspections to the device being used. The Bridge Management Section will serve as point of contact with software errors and troubleshooting.

Each initial inspection is required to have the overall bridge inspection safety rating completed:

- **Safe** – Bridge has been inspected and is determined to be safe for vehicular traffic.
- **Restricted Use** – Bridge shows suspected or confirmed earthquake-related damage and requires engineering review. The bridge may be determined to carry all lanes or a configuration of lanes safely until engineering review is completed.
- **Unsafe** – Bridge is unsafe, has been closed, and requires engineering review.
- **Follow-up** – Bridge could not be inspected and requires inspection at a later time; engineering review required.

After the completion of inspections, reports will need to be uploaded as soon as practical.

After shocks are expected following a sizeable earthquake event. These events that are equal to or less in magnitude of the initial earthquake event will not trigger additional inspections of structures already assessed for damage rated to be safe.



Bridge Inspection Guidelines

Chapter 10 Inspection of Ancillary Structures

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

10.1 SIGN STRUCTURES

10.1.1 Major Sign Structure Inspection Overview

Sign structures are very important to the traveling public for their informational value. The structural integrity of these signs is also critical to the safety of the traveling public due to the location at which these structures are built. If a sign structure falls into traffic, it could cause a serious accident. It is important to routinely perform and document inspections of these sign structures.

Bridge Operations Division is responsible for the inspection of most of the major sign structures. District bridge inspectors are responsible for the bridge mount structures. Bridge Operations and District inspectors shall coordinate with Maintenance Division staff on significant issues found in inspection.

All charges for sign structure inspection should be made to the county, route and section under Function 481, "Structure Inspection".

10.1.2 The 5 Major Classifications of Sign Structures

1. Overhead – characterized by space frame welded or bolted structural sections (trusses) spanning over the highway supported by single post, 2 chord, or 4 chord towers resting on concrete footings and pedestals and in some instances resting on some portion of a bridge (see Sketch No. 1). Structural sections can consist of monotube, planar (two chord) truss, tri-chord truss, or quad-chord truss structures. Members are described as top and bottom chords; verticals; diagonals; top and bottom horizontals; and top, bottom and interior diagonals. Towers can be in the form of single posts, or space welded or bolted structural sections (trusses) made up of vertical chords; horizontals; and diagonals.
2. Propped Cantilever – characterized by space frame welded or bolted structural sections (trusses) extending out over the roadway with one span supported at both ends and an additional span cantilevered from either side. The end is supported by a single 2 or 4 column tower, and the prop support is most commonly a 2-column tower. Both supports rest on concrete footings and pedestals and in some instances rest on some portion of a bridge (see Sketch No. 2). Members are described identical to those in the Overhead.
3. Overhead Cantilever – characterized by space frame welded or bolted structural sections (trusses) extending out over the roadway with only one end supported by a single post, 2 column tower, or 4 column tower resting on a concrete footing and pedestal and in some instances resting on some portion of a bridge (see Sketch No. 3). Members are described identical to those in the Overhead.
4. "T" Mount – characterized by space frame welded or bolted structural sections (trusses) where the frames are mounted on a single tower to form a "T" with the frames extending out from the tower in two directions. The tower rests on a concrete footing and pedestal and in some instances rest on some portion of a bridge (see Sketch No. 4). Members are described identical to those in the Overhead.
5. Bracket Mount (also referred to as "Bridge Mount") – characterized by steel or aluminum structural sections welded and bolted together to form a sign frame support that is bolted to the bridge (see Sketch No. 5).

The following list of material types are used to construct major sign structures:

- Aluminum – used in a high percentage of overhead space frames of simple and cantilever design.
- Galvanized Steel – used in a high percentage of overhead space frames and bracket mount sign structures.
- Stainless Steel – may be used in bolts for aluminum structures.
- Concrete – used in foundations for sign structures.

10.1.3 [Types of Inspection for Major Sign Structures](#)

- Initial Inspection – This inspection is made after initial erection to assure proper construction. It is common for bolts on sign structures, shortly after installation, to become loose and should be rechecked during this inspection. This will also serve as the first inspection made for initial documentation purposes.
- Routine Inspection – Most inspections will be made every four (4) years after the initial inspection. Bridge mounted sign structures whether overhead, overhead cantilever, or bracket mount will be inspected at a frequency to best align with the bridge it is mounted to.
- Accident/Damage Inspection – These inspections will be made after a major wind event or traffic incident that might have damaged the structure. This could include traffic impact to the post, an over height hit of the sign panels or truss, etc. Accident inspections will be carried out to inspect specific areas of concern (that the inspector deems necessary).
- Other Special Recurring Inspection – These inspections would be recommended by the inspector if a sign structure is found to have deficiencies or other problems that require more frequent inspection than the typical inspection frequency.

10.1.4 [Inspection Procedures for Major Sign Structures](#)

Pre-Inspection

Identify all safety hazards that may be encountered during the inspection and determine the proper avoidance/mitigation measures to ensure the safety of the inspection team and the public. Utilize all proper safety equipment including a double-lanyard harness when necessary.

Inspection

1. Start the inspection at the foundation. The foundation, typically made of concrete, is checked for cracks, spalls, and other signs of deterioration. Many times, drainage pathways in the foundation become blocked with debris, not allowing water to escape from the inside of the post. Some structures have grout pads to support the post base. These are often susceptible to deterioration. It is important to check historical documents to see if grout pads were part of the original design. If they were not, many times the existing deteriorated grout pads can be removed.

Watch for locations where sign structures are set close enough to the road that winter salt spray and snowplow wind rows can accumulate on the base support and cause deterioration of anchor rods and concrete pedestals.

2. Post to foundation connections usually consist of anchor rods that transfer the load from the structure post to the foundation. Anchor rods can become corroded over time and fail under fatigue loading. Many anchor rods initially installed may have been too short or too long. If too short, a coupler may have been used that cannot transfer the load. Many long rods are cut or flame torched which may change the mechanical properties of the rod.

Anchor rods should be initially sounded by the inspector with a hammer to determine if the anchor rods are loose, broken, or severely corroded. In addition to hammer sounding, nondestructive evaluation techniques (NDT) such as ultrasonic testing (D-meter) should be used to determine the length of anchor rods and determine if fractures are present in the rod. Most cracks are found in the upper foot of the anchor rod. Extra attention and testing should be done on cantilever structures and foundations with only four anchor rods present.

3. Anchor rod nuts should be checked for tightness and general condition. Loose or missing leveling nuts as well as top nuts can lead to load redistribution and overstressing of anchor rods. Nuts should be hammer sounded or checked using a large wrench. The inspector should check for broken, missing, or loose washers. Lock washers should not be used because they do not allow proper nut tightening and therefore reduce fatigue life. Double nuts should be used instead of lock washers if necessary.
4. The base plates that the anchor rods go through should be checked for defects. The base plates could be broken, cracked, or warped. Inadequate drainage can lead to advanced corrosion.

The post to base plate weld should be examined closely for cracking. Cracking may also be found at the termination of any stiffener plates. Close inspection and/or NDT techniques such as dye penetrant testing may be required to locate any cracks and accurately determine their limits. Cracks found during an inspection should have their beginning and end points marked on the structure along with the date so their progression can be monitored.

5. Any handholes present should be inspected. The handholes themselves, cut into the post, can prove to be areas of weld crack initiation. Handholes allow access for the inspector to see inside the post. Most of the noted corrosion of sign structure posts has occurred on the inside of the post as water and debris accumulate to form a corrosive environment. The inspector should look inside the handhole and inspect the interior of the post for corrosion. If there is no handhole or if the inspector cannot remove the handhole cover, a thickness meter (D-meter) can be used to determine if reduced section area is present due to interior corrosion. Missing handhole covers should be noted as they present an entry for water and animal life.
6. The post/tower should be examined for its general condition. Posts are frequently found with missing top caps that keep rain out. Many steel posts are galvanized and over time some of the coating begins to wear. The plumbness of the post should be checked. An out-of-plumb post could reveal foundation problems, past vehicular impacts, or initial erection errors. If a post is severely out-of-plumb, the vertical clearance over the traveled way may need to be checked.
7. The post/tower to truss connections should be checked for missing fasteners or misalignment. Overhead truss structures often have saddles and U-bolts at the truss to post connections. These should be examined for missing or loose nuts and cracked casings. Cantilever trusses are generally connected with high strength bolted flange connections. These should be examined for fit-up and loose or missing bolts.
8. The space frame, overhead truss, or mast arm should be inspected next. Truss members have welded or bolted connections that need to be checked. Failed welds in aluminum

structures have been a source of concern. These welds can be difficult to access and may require special equipment and/or additional safety measures to access.

Sign trusses are usually fabricated into smaller sections and erected at the site. The truss chord connection is the critical connection between these sections. A flanged splice connection may contain both bolted and welded connections. Since chords are critical truss members, their connections are critical as well. Connection fit-up, loose or missing bolts, and weld cracks should be areas of concentration during the inspection.

9. Sign panels should be inspected with the truss inspection. Many sign panel fasteners become loose over time. The inspector should note if any sign panels were added to the structure after initial erection or if sign panels were replaced with larger panels. This increased area can be dangerous if the original structural designer did not account for such changes. Larger sign panels will result in more wind loading on the structure.
10. After the inspection of all structural members, the inspector should proceed to any supplemental elements such as catwalks, electrical components, and other elements that do not comprise the actual structural system.

In addition to the structural integrity inspection procedures, inspectors should document issues noted with the position, legibility and function of the signs or message boards being supported by the structure. This information shall be communicated back to the TSMO or Maintenance Divisions for their use.

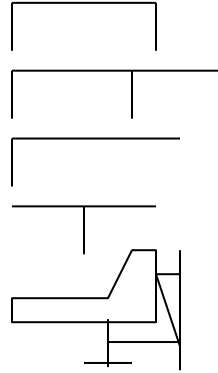
10.1.5 Documentation for Major Sign Structures

Each major sign structure has been given a unique number; Bridge Division coordinates these numbers and identifies on the plans.

The unique number will be in the form “TTrrrcnn”, where:

“TT” indicates the type structure as follows:

- OH – Overhead Structure
- PC – Propped Cantilever
- OC – Overhead Cantilever
- TM – “T” Mount
- BM – Bracket Mount



“rrr” indicates the Route as 430 or 030.

“cc” indicates the County code as 60 indicates Pulaski County.

“nn” indicates a unique number for the structure on that route.

Sign Structure numbers should be painted or stamped on all structures in a prominent location.

The Foundation, Columns, and Superstructure shall be rated during each inspection with the same NBI 0-9 rating scale that is used for bridge inspection.

Any maintenance and repair needs should be documented within the bridge inspection software. These items shall be shared with the Maintenance Division.

10.1.6 Example Drawings of 5 Major Sign Structures

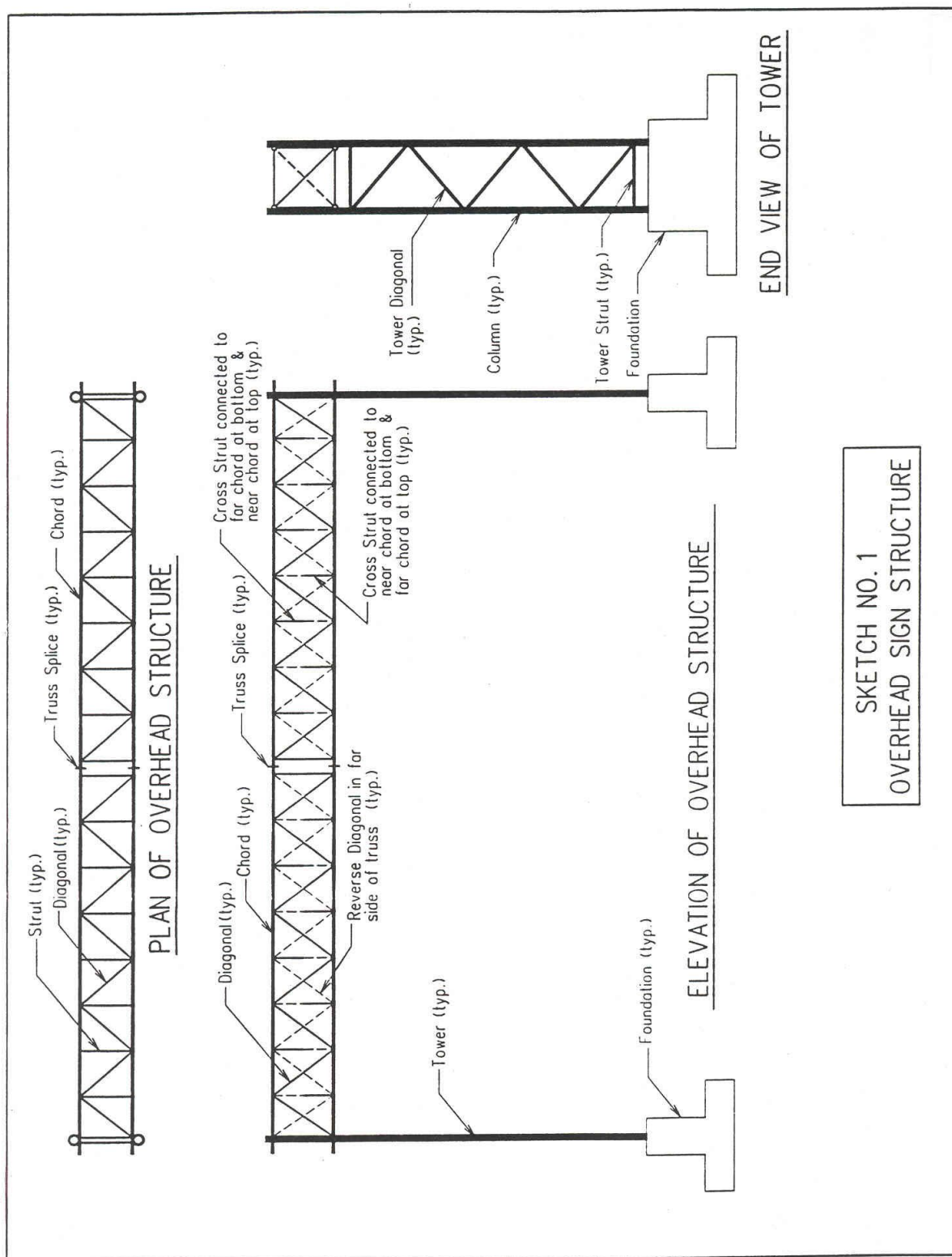


Figure 19. Overhead Sign Structure

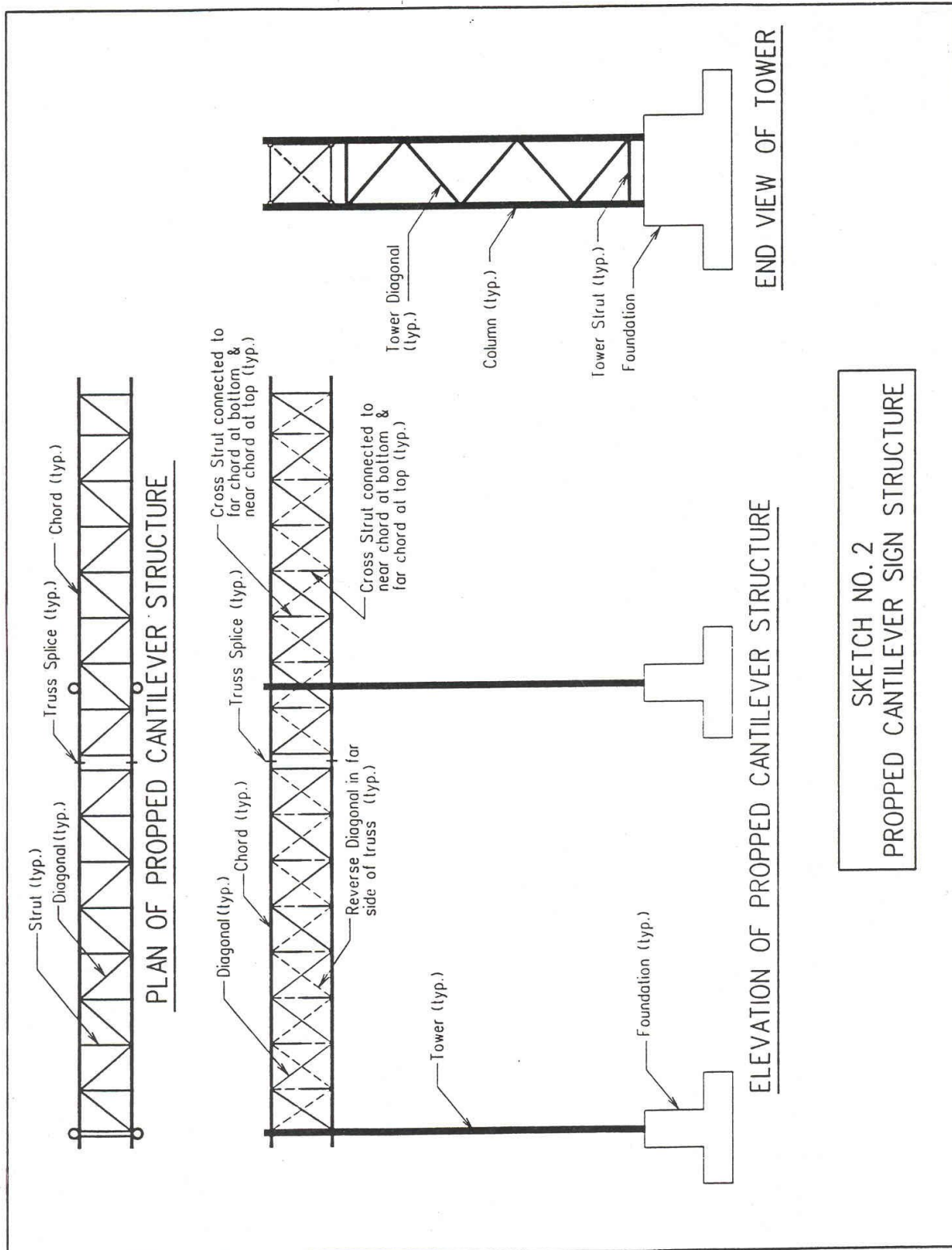


Figure 20. Propped Cantilever Sign Structure

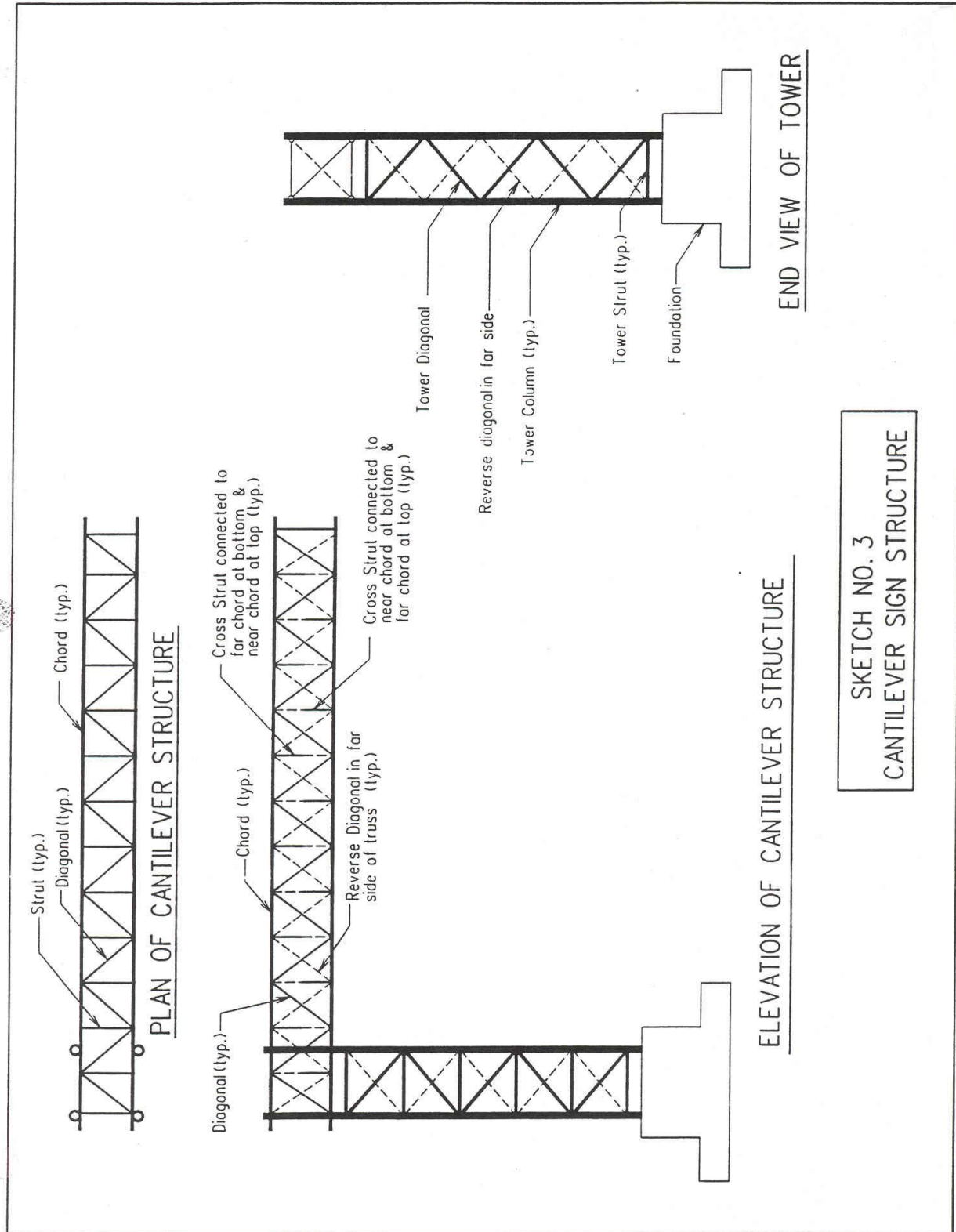


Figure 21. Cantilever Sign Structure

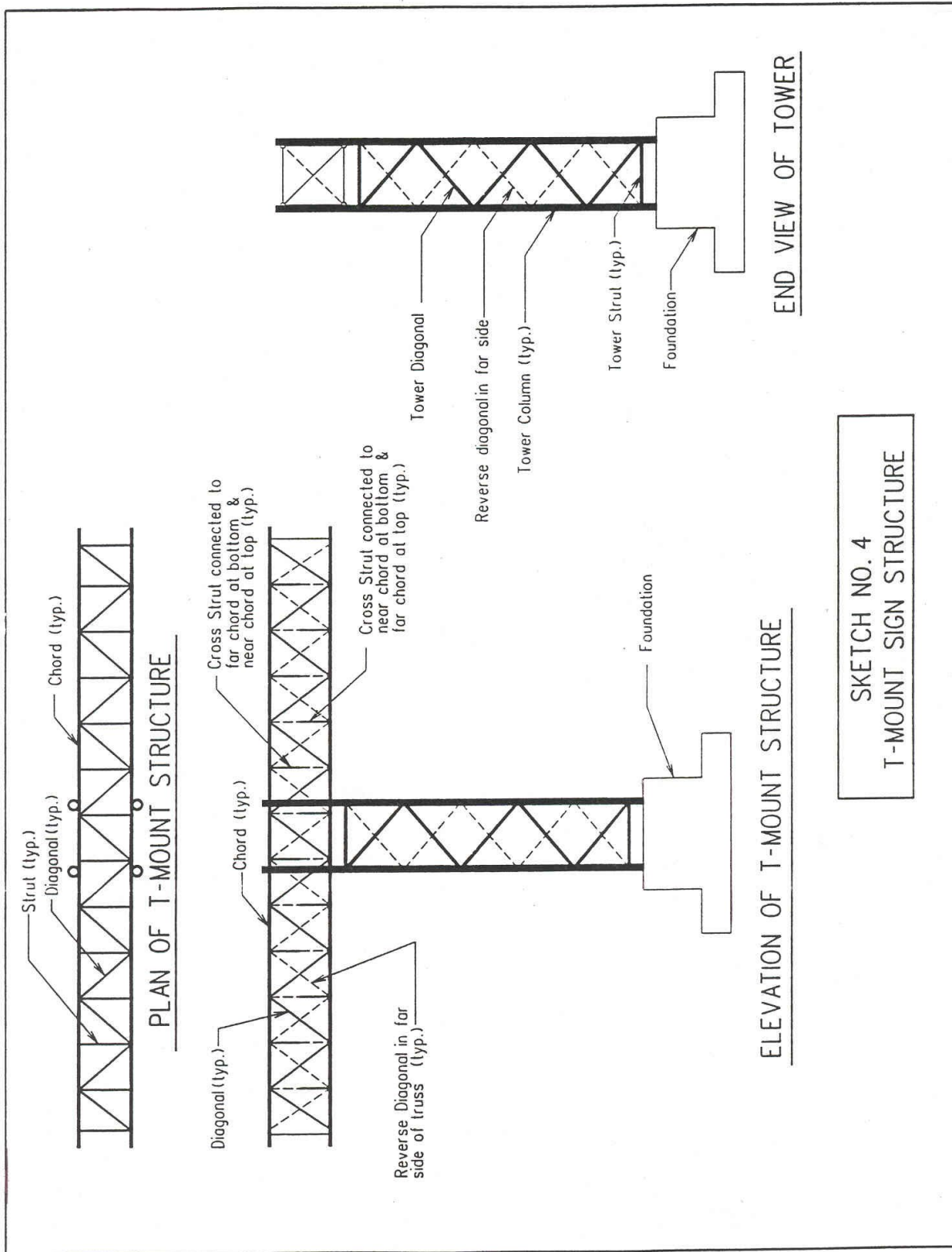


Figure 22. T-Mount Sign Structure

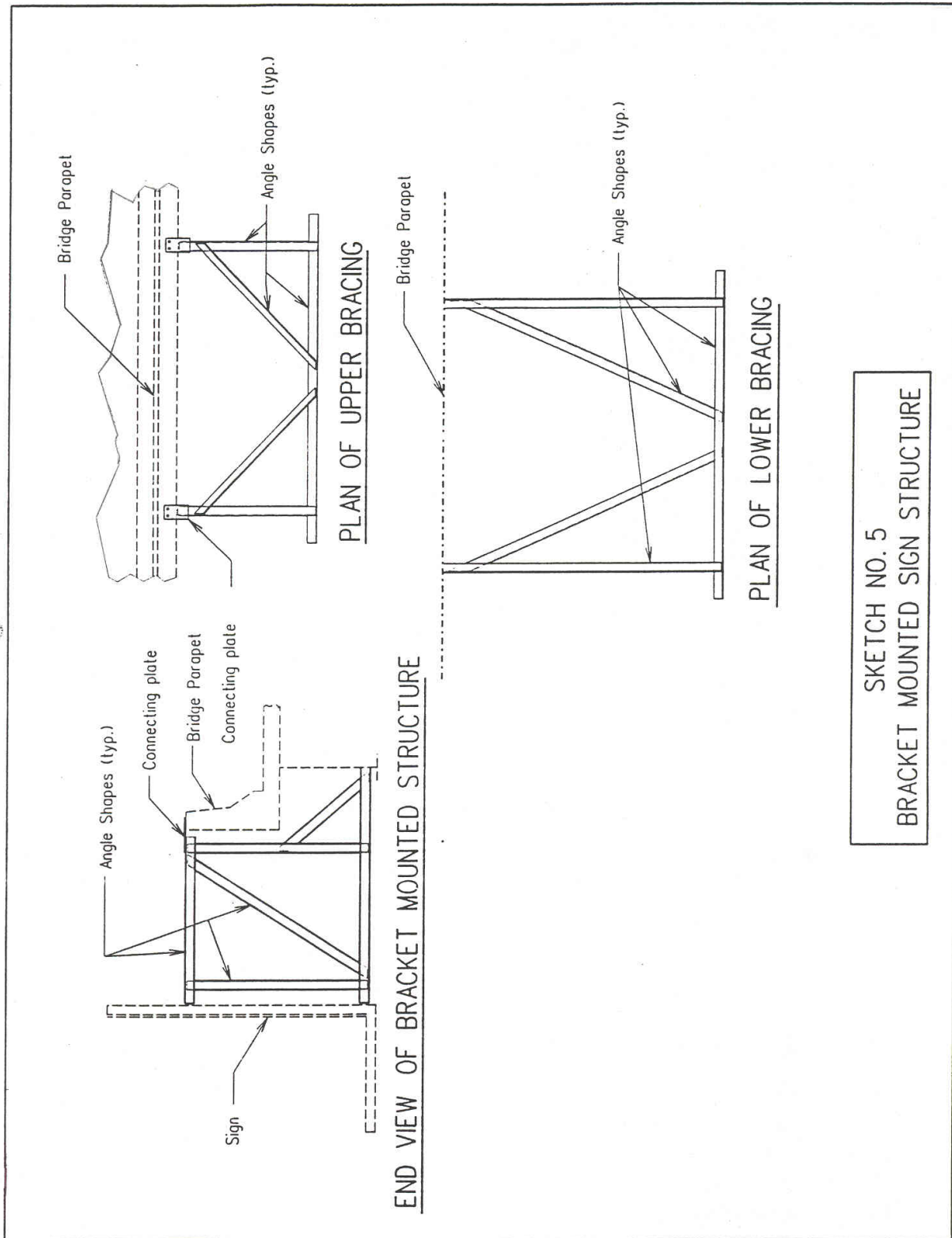


Figure 23. Bracket or Bridge Mounted Sign Structure

10.2 HIGH MAST POLES

10.2.1 High Mast Light Pole Inspection

High-Mast Light Poles are important to the safety of the traveling public due to the illumination they give to interchanges. High-Mast Light Poles could also be dangerous to the public due to the height of these structures and their vicinity near the roadways. A failure could cause a serious accident. It is important to perform and document inspections on these structures.

Bridge Operations will be responsible for the inspection of all high mast poles in inventory. Major structural concerns will be communicated to the owner of the high mast pole.

Only High-Mast Light Poles greater than 95 feet will be considered for the purpose of inspection. All charges for High-Mast Pole inspection should be made to the county, route and section under Function 481, "Structure Inspection".

10.2.2 Major Classifications for High Mast Light Poles

1. Round slip in fit – characterized by their round tubular shape of progressively smaller diameter made up of 2, 3, 4 or 5 sections.
2. Multi-sided slip in fit – characterized by their multisided tubular shape of progressively smaller diameter made up of 2, 3, 4 or 5 sections.

The material used for High-Mast Light Poles is steel. Steel High-Mast Light Poles are either galvanized or exposed. Exposed steel is of the type designed for that purpose and is characterized as having a rough rusty texture. Galvanized steel is characterized as having a rough zinc texture both inside and outside.

10.2.3 Types of Inspection for High Mast Light Poles

- Initial Inspection – This inspection is made after initial erection to assure proper construction. This will also be the first inspection made for initial documentation purposes.
- Routine Inspection – Most inspections will be made every four (4) years after the initial inspection. At this inspection, all elements of the structure will be examined.
- Accident/Damage Inspection – These inspections will be made after a major wind event or traffic incident that might have damaged the structure. Accident inspections will be carried out to inspect specific areas of concern (that the inspector deems necessary).
- Other Special Recurring Inspection– These inspections would be recommended by the inspector if a high mast pole is found to have deficiencies or other problems that require more frequent inspection than the typical inspection frequency.

10.2.4 Inspection Procedures for High Mast Light Poles

1. Start the inspection at the foundation. The foundation, typically made of concrete, is checked for cracks, spalls, and other signs of deterioration. Many times, drainage pathways in the foundation become blocked with debris, not allowing water to escape from

the inside of the post. Some structures have grout pads to support the pole base. These are often susceptible to deterioration. It is important to check historical documents to see if grout pads were part of the original design. If they were not, many times the existing deteriorated grout pads can be removed.

2. Pole to foundation connections usually consist of anchor rods that transfer the load from the structure pole to the foundation. Anchor rods can become corroded over time and fail under fatigue loading. Many anchor rods initially installed may have been too short or too long. If too short, a coupler may have been used that cannot transfer the load. Many long rods are cut or flame torched which may change the mechanical properties of the rod.
3. Anchor rods should be initially sounded by the inspector with a hammer to determine if the anchor rods are loose, broken, or severely corroded. In addition to hammer sounding, nondestructive evaluation techniques (NDT) such as ultrasonic testing (D-meter) should be used to determine the length of anchor rods and determine if fractures are present in the rod. Most cracks are found in the upper foot of the anchor rod.
4. Anchor rod nuts should be checked for tightness and general condition. Loose or missing leveling nuts as well as top nuts can lead to load redistribution and overstressing of anchor rods. Nuts should be hammer sounded or checked using a large wrench. The inspector should check for broken, missing, or loose washers. Lock washers should not be used because they do not allow proper nut tightening and therefore reduce fatigue life. Double nuts should be used instead of lock washers if necessary.
5. The base plates that the anchor rods go through should be checked for defects. The base plates could be broken, cracked, or warped. Inadequate drainage can lead to advanced corrosion.
6. The post to base plate weld should be examined closely for cracking. Cracking may also be found at the termination of any stiffener plates. Close inspection and/or NDT techniques such as dye penetrant testing may be required to locate any cracks and accurately determine their limits. Cracks found during an inspection should have their beginning and end points marked on the structure along with the date so their progression can be monitored.
7. Any handholes present should be inspected. The handholes themselves, cut into the pole, can prove to be areas of weld crack initiation. Handholes allow access for the inspector to see inside the pole. Much of the noted corrosion of high mast poles has occurred on the inside of the pole as water and debris accumulate to form a corrosive environment. The inspector should look inside the handhole and inspect the interior of the pole for corrosion. If there is no handhole or if the inspector cannot remove the handhole cover, a thickness meter (D-meter) can be used to determine if reduced section area is present due to interior corrosion. Missing handhole covers should be noted as they present an entry for water and animal life.
8. High mast lights usually have the apparatus for lowering the luminaire ring located inside the base of the pole. Checking the operation of this system is not normally part of the inspection. However, the apparatus is normally supported by steel members connected to the inside of the pole and these should be examined for loose connections and weld cracks and defects as these can migrate to the pole.
9. High mast poles often consist of more than one section. These are “spliced” by use of a slip joint, in which the upper segment simply slips over the lower segment. The condition of this joint should be examined for cracks, deformation along the base of the connection, and rust stains. Slip joints, partly because of the tendency of water to be drawn into them

by capillary action, sometimes experience corrosion between the two segments. This can lead to the buildup of pack rust, particularly in weathering steel poles, that may lead to a vertical crack emanating from the bottom of the upper pole segment.

10. Inspection of the luminaire ring is not usually part of the structural inspection. However, visual observation of any defects or non-functioning luminaires should be recorded. Some defects noted in the luminaire ring may relate to mechanical or structural components and should be examined further.
11. Due to the difficulty of accessing pole splices and luminaire rings, inspection techniques other than arm's length inspection are normally used for these areas. The use of UAVs (unmanned aerial vehicles) is recommended for the inspection of splices and luminaire rings. UAVs allow for a more detailed inspection of these areas than obtained by just using binoculars. High powered binoculars or spotting scopes can be used if a UAV is not available or practical. The use of UAVs for inspection is outlined in Chapter 14: UAVs in Bridge Inspection of this manual. All requirements and safety measures stated in that chapter shall apply to the inspection of high mast poles.

10.2.5 Documentation for High Mast Light Poles

Each High-Mast Light Pole should be given a unique number, route, section and log mile.

The unique number should be in the form “rrrcnn” where:

- “rrr” indicates the Route as 430 or 030.
- “cc” indicates the County code as 60 indicates Pulaski County.
- “nn” indicates a unique number for the structure on that route.

The unique number should be painted or stamped on the structure for identification.

Structural deficiencies should be reported to the District Maintenance Engineer if owned by ARDOT. Other structural deficiencies should be sent to the owner.

10.3 NON-BRIDGE LENGTH STRUCTURES

ARDOT owns and maintains several bridge-like structures that do not meet the NBIS definition. The bridge inspection software can handle the inspection and maintenance needs for these non-bridge length structures. It is currently optional for District to maintain an up-to-date inventory and inspection of the structures in their District. The District staff should contact Bridge Operations to coordinate this effort if it is decided to maintain these records in the bridge inspection software.

10.4 MSE WALLS

ARDOT partnered with a University in project TRC 2104 to develop Mechanically Stabilized Earth (MSE) Wall Inspection Guidelines. Reference should be made to this document to perform the inventory, inspection and follow-up action regarding MSE walls.

Reference [TRC 2104](#) for details on MSE walls.



Bridge Inspection Guidelines

Chapter 11 Tunnels

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

11.1 TUNNEL OVERVIEW

ARDOT owns and maintains a very limited number of tunnels. FHWA gives owners some discretion to determine how a structure is classified (tunnel, culvert, or bridge). A structure cannot be classified as more than one type and submitted to the national inventories more than once. ARDOT owns and maintains structures that fall into the category of meeting more than one structure definition (culvert, tunnel and/or bridge). Bridge Operations Division shall determine how best to classify a structure for the Department.

The National Tunnel Inventory Standards and supporting documentation can be found here: <https://www.fhwa.dot.gov/bridge/inspection/tunnel/ntis.cfm>.

11.2 QUALIFICATIONS

ARDOT has designated the Program Manager of the ARDOT Tunnel Inspection Program to be the same as the Bridge Inspection Program Manager, with the requirement to meet the Tunnel Program Manager requirements listed in the NTIS.

Staff in Bridge Operations and select Districts are qualified as team leaders to perform and oversee the inspection of ARDOT's tunnel inventory. Reference NTIS for specific requirements: <https://www.federalregister.gov/d/2015-16896/p-371>. Bridge Operations maintains these credentials in the bridge inspection software.

11.3 PROCEDURES

ARDOT uses aspects of the Bridge Inspection Software to perform the tunnel inspections and keep up with maintenance needs.

ARDOT has specific tunnel inspection procedures saved in the structure files within the bridge inspection software. The following list of items are considered at a minimum in the tunnel inspection procedures:

- Inspection Interval: Tunnels shall be inspected at a Routine Interval of 24 months.
 - Damage, in-depth, and special inspections will be scheduled if conditions warrant.
- Traffic Control: Lane closures will need to be considered for roadways.
- Element Level Inspection: The relevant structural plan sheets can be referenced in the asset files to help identify elements used in the construction of the tunnel. The elements used for each inspection will be in accordance with the NTIS.
- Defects are quantified, measured, and documented in the appropriate Condition State in accordance with the NTIS, TOMIE Manual, and this guidance document. An in-depth defect inspection procedure based on material type and tunnel element can be found in Chapter 4 of the TOMIE Manual.
- Critical Findings shall to be reported to ARDOT Bridge Operations Sta, immediately and in accordance with the NTIS and procedures documented in [Chapter 6](#) of this document.
- PPE: Standard bridge inspection PPE is required for this tunnel inspection. This may include but is not limited to: Retroreflective Safety Vest, Hard Hat, Safety Glasses, Gloves, and Adequate Boots.

- Equipment: Standard bridge inspection equipment is required for this tunnel inspection. This may include but is not limited to geology hammer, flashlight, ladder, pit gauge, crack size gauge, tape measure, measuring wheel, chain drag, and inspection iPad. A full list of inspection equipment can be found in [Chapter 1](#) of this document.



Bridge Inspection Guidelines

Chapter 12 Inspection Access

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

12.1 INSPECTION ACCESS OVERVIEW

ARDOT personnel inspects thousands of structures of varying complexity, height, length, material, etc. Each of these structures requires a unique strategy and approach to perform the inspection in a manner that is satisfactory to FHWA and ARDOT to ensure safety for the traveling public. Given that each structure is unique, the inspection access methods for the inspection of the structure shall be responsible for the Team Leader. The Team Leader shall determine when specialty access equipment such as a manlift or under bridge inspection vehicle is needed for proper inspection and documentation. The Team Leader shall determine when most appropriate to use a drone, a GoPro, ladder, boat, or other means of inspection access.

For NSTM bridge inspections, the Team Leader shall ensure that access to all NSTM members is available for each inspection.

For other inspection types, the inspection access is left up to the discretion of the team leader. ARDOT inspectors are highly trained to use their judgement for each bridge year to year. If an inspection is carried out and access is determined to be needed for documentation of defects or investigation of a location, the Team Leader shall ensure access is obtained.

If access to a member is not achieved that the inspector feels needs to be achieved for the safety of the structure or to meet the NSTM requirements, the inspector shall contact Bridge Operations and document the access issue in the inspection within the General Observation.

For an initial inspection without a load analysis, inspectors shall use their discretion and professional judgement when deciding to place an under-bridge inspection vehicle on the structure. Safety of the inspection team is of utmost importance while performing inspections. Bridge inspectors should request a preliminary load analysis providing supporting information if there is uncertainty regarding the structure supporting the under-bridge inspection vehicle.

12.2 UAVS (DRONES)

ARDOT maintains Department wide policies for the use of unmanned aerial vehicles in the ARDOT [Personnel Manual](#). Policies specific to bridge inspection use of unmanned aerial vehicles are detailed in this section.

12.2.1 [Overview:](#)

This policy will outline the minimum requirements for operating and using UAVs (unmanned aerial vehicles) to aid in the Arkansas Bridge Inspection Program. Each Arkansas Department of Transportation Employee (ARDOT) will need to sign off on this document to use these tools within the Bridge Inspection Program. It is understood from the Arkansas Bridge Inspection Program that a UAV is a tool in a growing toolbox for an inspector to best inspect a bridge. Use of a UAV can greatly enhance the overall inspection process when incorporated correctly into the process. The following documentation describes the correct process:

12.2.2 Minimum Requirements

- To operate (physically be the person flying the drone), an employee must have their Part 107 UAV pilot's license. This license must be current and on file with Bridge Operations files.
- Pilots must be either Assistant Bridge Inspector, Bridge Inspector, Statewide Bridge Inspector, or an Bridge Operations Staff member.
- Pilots must complete an online training course for the drone they plan to fly and/or be trained by a Bridge Operations pilot with extensive experience on that drone.
- For the first day of using a UAV, an experienced pilot from HBM must be on-site to help with questions.

12.2.3 Safety Guidelines

- Pilots will follow all rules under part 107.
- Pilots will under no circumstances maintain sustained flight over traffic or pedestrians.
 - Only flying a drone in transit perpendicular to traffic is allowed through part 107.
- Pilots must complete a preflight checklist before each flight.
- Pilots must take extreme caution on flying within proximity to bridge superstructure where GPS signal will be weak.
- The Remote Pilot in Command is responsible for all drone operations for a particular bridge inspection.

12.2.4 Use Cases for UAVs:

- UAVs will not be used to replace hands on NSTM inspections.
 - UAVs can provide supplemental information/data for NSTM members in addition to NSTM hands on inspections.
 - UAV footage will be taken of exterior facing NSTMs of complex/major structures on a frequency not to exceed 24 months. Footage will be reviewed and stored in accordance with the chapter 14 BIM requirements.
- UAVs can be used in Routine, Special, and Accident/Damage inspections in accordance with the NBIS.
 - Please refer to <https://www.fhwa.dot.gov/uas/resources/hif19056.pdf> for specific use cases for a drone to be incorporated into your inspection.
 - Reach out to Bridge Operations for further information.
- UAVs are ideal to be used as a screening tool for a bridge inspection. There are many good cases that an inspector can use a drone to evaluate a certain area, then after determining visual condition of that area, use other means and methods to get a closer look. ARDOT does not use UAVs in place of any required physical inspection.

12.2.5 Data Gathered with UAVs:

- The Bridge Inspection Program recognizes that video footage captured during a typical manual flight will result in significant data files.
 - Example: 1 day of flying could result in 200 GB of data.

- Data capture with the help of a drone will be maintained for one inspection cycle.
 - Video will be retained from one inspection until the next inspection of that bridge.
 - After that second inspection comes around, the video will be deleted.
- Data captured can be stored on a Department Server such as csd7, csd4, san1, etc... or in an online format such as SharePoint or Skydio Online.
 - Try to limit storage in personal file locations such as on your machine or on OneDrive. (reason: if a individual retires – that footage will be hard to obtain.)
- Video and Photos are acceptable to capture from a drone. If video is used, the entire video must be reviewed. Snapshots of the video may be used and included in the Bridge inspection report.
 - The team lead will designate who is responsible for reviewing all the footage capture by a drone video.

12.3 UNDERWATER DRONE

ARDOT has several structures (particularly culverts) in which portions stay submerged in water all year round. Many of these structures do not have the required depth to require an underwater inspection. To assist with the inspection of this group of structures, Bridge Operations uses an underwater vehicle.

For example, a particular reinforced concrete box is NBIS bridge length, but it is only 4' tall. This culvert has 1' of silt built up along the bottom and 1' of open-air space. By review, there is not enough room for a person to safely wade through the structure and there is not enough water to require the need for an underwater inspection. This situation is best handled with the use of an underwater inspection vehicle to document the defects within the 2' of water and above the water. Bridge Operations staff performs these special inspections to help document drift, silt, defects and scour that the District Bridge Inspectors cannot. Bridge Operations shall coordinate results with the District Bridge Inspectors to ensure that conditions are properly documented and district personnel is aware of the submerged maintenance needs.

12.4 RAILROADS

ARDOT structures often cross over railroads. Railroad owners have enhanced right of way (ROW) access requirements to increase safety standards for their cargo, personnel and outside personnel. Railroad owners require a high degree of coordination to operate on their ROW. To ensure the safety of ARDOT bridge inspection personnel, the railroad personnel and traveling cargo, ARDOT inspectors shall comply with each railroad owner's requirements when performing an inspection for bridges over railroads.

Coordination with the railroad is required for ARDOT equipment or personnel to enter the railroad's ROW below the bridge deck. Inspectors may need to perform a hands-on evaluation of bridge components near the tracks in the ROW for clear documentation of deficiencies or NSTM inspection requirements. In these situations, the Team Leader shall coordinate the inspection access with Bridge Operations and the Railroad Section in the Program Management Division. Bridge Operations and/or the Railroad Section will ensure proper coordination with the railroad and ensure required procedures are followed.

UASs may be a valuable tool to evaluate bridge spans over railroads. If the team performing the inspection with the use of a drone complies with all FAA, ARDOT and the specific railroad owner's policies, a UAS can be used within the ROW without needing prior approval. Team Leaders shall verify railroad owner UAS policies prior to inspection. Union Pacific UAS policies can be found here: <https://www.up.com/communities/rail-safety/pedestrians/safety-policies>



Bridge Inspection Guidelines Appendices



Bridge Inspection Guidelines

1.A BRIDGE INSPECTION PROGRAM CHARGES

Bridge Inspection Program Charges

Effective Date October 1, 2025

FUNCTIONAL CLASS CODE (SI & A, ITEM 26)	OWNER (SI & A ITEM 22)	CHARGES (TIME, EQUIPMENT, SUPPLIES)*		
		JOB NO.	FUNCTION	FAP NUMBER
01, 02, 06, 07, 11, 12, 14, 16, or 17 (ON - FA SYSTEM)	STATE COUNTY CITY	012555	3400	Y240-NBIS-088
		012556	3400	Y240-NBIS-089
		012557	3400	Y240-NBIS-090
08, 09 OR 19 (OFF-FA SYSTEM)	STATE COUNTY CITY	012555	3400	Y233-NBIS-088
		012556	3400	Y233-NBIS-089
		012557	3400	Y233-NBIS-090

*See notes 1 and 2 in Section 1.7 concerning methods for purchasing and charging equipment and supplies

Inspection Equipment

The following list is the inspection equipment authorized for purchase. Miscellaneous items not listed here may be approved by the Bridge Inspection Program Manager.

- Boat, 15' aluminum or metal alloy
- Ladder, aluminum extension 24'
- Steel Tape, in case, 50' white clad
- Steel Tape, 100'
- Reel, Fold Crack, 100' tape (reel only)
- Measuring wheel tape
- Non-Metallic Tape, 50' with case
- Hand Level, with case
- Carpenter Level, 18"
- Grade Level
- Plumb Bob, brass with sheath, 14 oz.

- Level Rod, fiber glass 25' oval type
- Range Pole, 8', two section
- Calipers, 6" outside
- Hammer, geological type, 22 oz.
- Clip Board, legal size, heavy duty
- Binoculars, 7x, with case
- Digital Camera, with case
- Tool Belt, with pouch
- Ball Peen Hammer, 12 oz., fiber glass handle
- Hammer, claw, 16 oz.
- Hammer, shop, double face sledge, 3 lb., 15" handle
- Pick, garden pick mattock, 36" handle
- Round Point Shovel, D handle, hollow back
- Folding Rule, 6' w/extension
- Pocket Rule, 12', white clad w/hook and lock
- Inspection Mirrors, 2" x 4", 18" extension handle
- Hip Boots
- Waders with Suspenders
- Screwdriver, square blade, stand tip 15"
- Pliers, heavy duty
- Wrench, crescent, 12" regular handle, 1 5/16" capacity
- Brace and Bits, bits 1/2" dia. X 12" – 15"
- Brush, wire, 1 1/8" x 6", four rows
- Center Punch, 1/2" x 5 1/2"
- Cold Chisel, 3/4" x 7 1/2"
- Carpenter Wrecking Bar, 24"
- Life Preserver Work Vest, A and P Type V
- Drop Harness
- Lanyard, for drop harness
- First Aid Kit
- Chain Drag, lamination detector
- iPad with case (Supplied by Bridge Operations)
- Electronic Depth Finder
- Reflective Safety Vest
- Leather Gloves
- Safety Goggles
- Snake Chaps
- Dye Penetrant
- Flashlight
- Electronic Range Finder
- Ultrasonic Thickness Gauge (Phase II UTG-2900 Recommended)

- Lever Pit Gauge
- Grinder or drill with Grinding Disk
- Toolbox
- Borescope or endoscope
- Rebar Scanner
- Unmanned Aerial Vehicle and Associated Software
- Kayak
- iPads and iPad accessories
- Wireless Radios
- Underwater Dive equipment and accessories not limited to:
- Gopro camera
- Scuba suits and tanks
- Regulators and masks
- Knives, flashlights, communication devices
- Impact wrenches
- Limb and chain saws



Bridge Inspection Guidelines

1.B DISTRICT CONSTRUCTION ENGINEER QA FORM

District:
District Construction Engineer:

District Construction Engineer
Quality Assurance Documentation

Instructions:

While DCE is on site during the inspections, the DCE will use this form to take observation notes. Once complete, the DCE will share these notes with the Bridge Operations Division and the District inspectors.

Structure Number:

Items District Team did well	
Items District Team can improve	
Items QA Team did well	
Items QA Team can improve	
Components where it seems too much or too little focus was spent	

Structure Number:

Items District Team did well	
Items District Team can improve	
Items QA Team did well	
Items QA Team can improve	
Components where it seems too much or too little focus was spent	





Bridge Inspection Guidelines

1.C QUALITY ASSURANCE YEARLY PROCEDURES

2026 ARDOT Bridge Inspection Quality Assurance Inspection Procedures

Inspect 20 bridges minimum per District. Districts 4 and 10 will require 30 inspections, District 6 will require 40 inspections. At least 50% of the bridges need to be state owned structures. 5 of the total QA inspections in a District shall be accompanied by the DCE. The DCE will inspect the same 5 bridges alongside both the District Inspection Team and the Bridge Operations Inspection Team.

Attempt to balance QA inspections with District Teams. There does not need to be completely equal number of QA inspections per District Team, but we need to get a representative number of QA inspections for all District Teams. If there are Grade 13 inspectors that are Team Leads on inspections in a District, try to select a couple of inspections for each Grade 13. Also attempt to select different structure types (slab, concrete girder, steel girder, timber, etc.).

QA inspections must be performed after the routine inspections in order to tie the data from the QA Inspection to the correct District inspection. Inspections should not be done more than 3 months after the routine inspections. Attempt to inspect structures that have not been inspected for QA purposes within the past 2 years.

QA Inspections

The QA teams will verify the following items during field inspections:

- Deck Rating
- Superstructure Rating
- Substructure Rating
- Culvert Rating
- Channel Rating
- Channel Protection Rating
- Scour Condition Rating
- Bridge Railing Rating
- Bridge Transition Railing Rating
- Bridge Bearings Rating
- Bridge Joints Rating
- Span and Substructure Coding
- All Bridge Geometry Fields (B.G.XX)
- MNs for all items requiring a MN according to Maintenance Need Guidance
- All Check Box/Routine maintenance needs
- Verify if MNs can be combined or deleted



QA Reviews

After the field QA inspections have been completed, the QA teams will compare the QA inspection teams reports with the routine reports to check for discrepancies between the two reports. The comparison working file can be documented in Word or Excel; the final deliverable must be a summary Word document. The teams will verify and review the QA and make a summary of any discrepancies or issues they find to the following items:

- Deck Rating
- Superstructure Rating
- Substructure Rating
- Culvert Rating
- Channel Rating
- Channel Protection Rating
- Scour Condition Rating
- Bridge Railing Rating
- Bridge Transition Railing Rating
- Bridge Bearings Rating
- Bridge Joints Rating
- Span and Substructure Coding
- All Bridge Geometry Fields (B.G.XX)
- MNs for all items requiring a MN according to Maintenance Need Guidance
- All Check Box/Routine maintenance needs
- Verify if MNs can be combined or deleted

Deliverables:

- Each Bridge Operations QA inspection must be filled out in inspectX.
- Each Bridge Operations QA review must be filled out in a summary Word document.
 - Discrepancies must be fully identified and final reasoning documented.



Bridge Inspection Guidelines

1.D AUTOMATED QUALITY CONTROL DATA CHECKS

Bridge Operations Data Automated Quality Control
PowerAutomate
Accident Inspections (MultiAsset)
All Budgets Expenditures Update
CFs in last 30 days
Check #1: Inspector Rotation Emails
Check #1: Inspector Rotation Emails - (Multiasset)
Check #12: Check that NBIS bridges have a Routine Inspection set for either 24 or 48 months
Check #13: Check that NSTM inspections are set for 24 month-IXMA
Check #13: Check that NSTM inspections are set for 24 month-IXMA - DEV
Check #14: Check for Owner Email
Check #9: Poor Bridge Scheduling
Check 15: Underwater Inspection Verification (MultiAsset)
Check 15th of Month Flows
Check 1st of Month Flows
Check#2: Maintenance Item In Open State For Over 30 Days
Check#2: Maintenance Item In Open State For Over 30 Days (MultiAsset)
Check#4: Posting - Matching Calculated and is not Closed (MultiAsset)
Check#5: Verify Item 41 Posting
Check#5: Verify Item 41 Posting (MultiAsset)
Closed Bridges Monthly Email
Closed Bridges Monthly Email - MultiAsset - DE
Critical Finding Email - Real
Daily Inspection Review Digest - Dale
Daily Inspection Review Digest - Kevin
Email Inspectors with Inspections in Review More Than 30 Days
Email Load Raters with Inspections in Review
Expired Part 107
Forward State Monthly Data
Inspection Clash Detector
Item 41 G Check - MultiAsset
Item 41 G Check - MultiAsset - DEV
ITS Accident Inspections (MultiAsset)
Load Rater Monthly Data
Load Rater Monthly Data - IXMA
Load Rating Inspections Completed
Local Owner CF Emails (MultiAsset)
Local Posting Emails
Metric 14 Check - Post or Restrict
Monthly Local CF Summary Email
Monthly Local CF Summary Email (MultiAsset)
Monthly Unassigned Maintenance
New Load Rating Requested sent to LR Planner
Newly Opened Bridges
Not Qualified for 48 Month Frequency - DEV

Not Qualified for Method 1
Open Low Operating Rating
Overdue Inspections
Overdue Inspections - DEV
PDF Autosaver New User Requested
Posting Changes in Last 24 Hours
Posting Changes in Last Month
Posting Changes in Last Month - SNBI
Recently Submitted
Requisition Requests
Scour Assessment Inspection Verification
Scour Assessments Completed
Sonar Bridge Requested
SPOA_Form_Automation
State CF Summary Email
State Posting Emails - real
State-Owned CF Notification Emails (MultiAsset) - Real
Underwater Errors
Unscheduled Assets
Upcoming Underclearance Inspections
Weekly Sign Maintenance
When a new response is submitted -> Get response details, Add a row ...
Clearance Changes - Monthly

Bridge Operations Data Automated Quality Control
PowerBi
BridgeBuilderExpenses
BridgeInspProgramCharges
BridgeDrawings
BridgeOpsBudget
BudgetBusters
ElementData
InspectionMonitor
InspectorDuration
LargeBridgeAsst
LiDAR
LoadRating
MaintCostAnalysis
MaintNeedPerforAnalysis
MaintNeedDates
Method1
OperatingSpending
PerformanceMeasure
ProgrammedBridges
ScourAsst
SignMaint
Sonar
Underwater
WeightRestrictedBridges

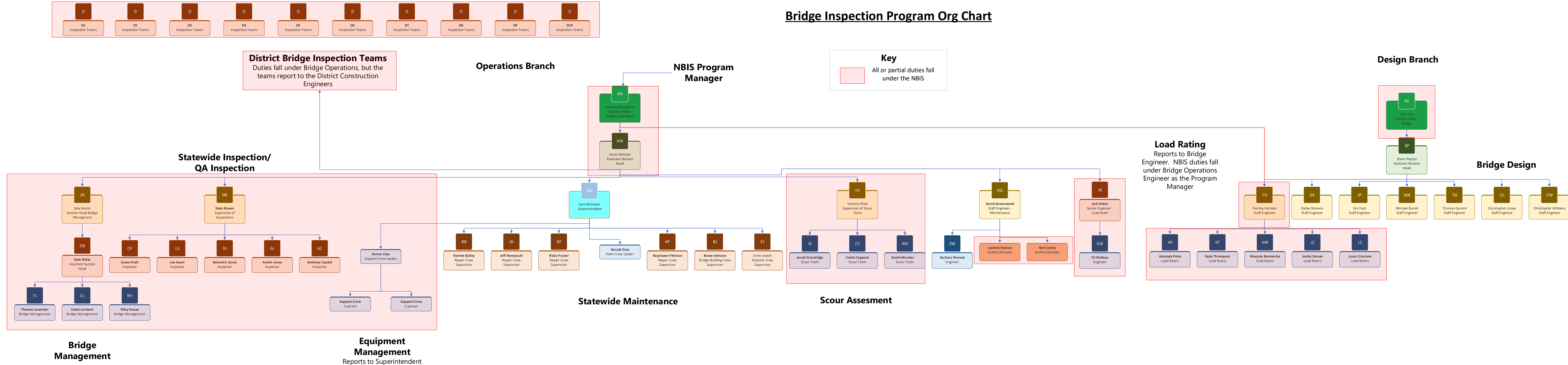


Bridge Inspection Guidelines

2.A INSPECTION PROGRAM ORGANIZATIONAL CHART



Bridge Inspection Program Org Chart





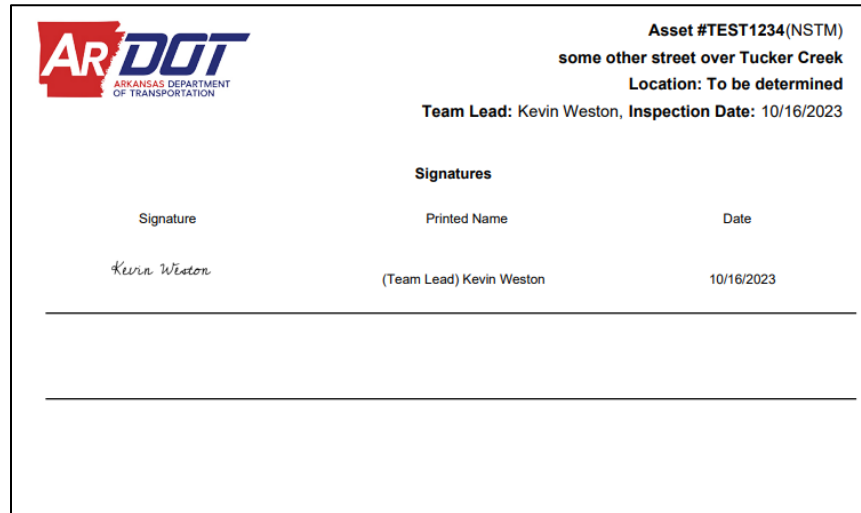
Bridge Inspection Guidelines

3.A NSTM INSPECTX HOW TO DOCUMENT

NSTM inspectX How-To Document

10/17/2023

Bridge Operations has worked with inspectX to develop an automatic way to print/format the NSTM procedures/reports going forward. This guide will walk you through the steps to fill this out. The first time or two will be slower, but this will drastically speed up the efficiency of this process.



The screenshot shows a signature page for the Arkansas Department of Transportation (AR DOT). The page includes the AR DOT logo, asset information, and a table for signatures.

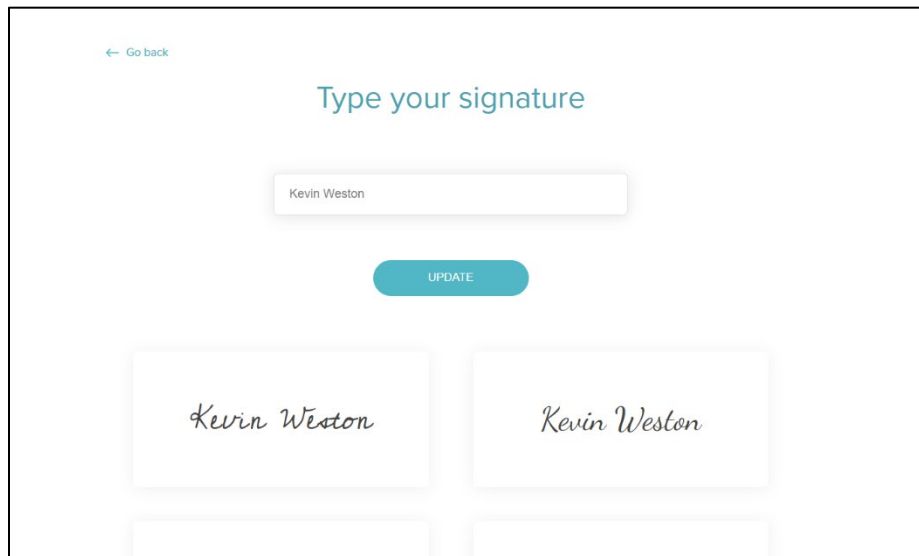
AR DOT
ARKANSAS DEPARTMENT
OF TRANSPORTATION

Asset #TEST1234(NSTM)
some other street over Tucker Creek
Location: To be determined
Team Lead: Kevin Weston, Inspection Date: 10/16/2023

Signatures		
Signature	Printed Name	Date
	(Team Lead) Kevin Weston	10/16/2023

Figure 1. Signature Page

- Create a signature via this website: <https://www.signwell.com/online-signature/type/>
- Type your name and choose an option you like
- Click on the option and click “save”



The screenshot shows the Signwell website interface for creating a signature. It includes a 'Go back' link, a text input field for the name, an 'UPDATE' button, and two preview boxes showing the generated signature.

← Go back

Type your signature

Kevin Weston

UPDATE

Kevin Weston

Kevin Weston

Figure 2. Picture of signature making website

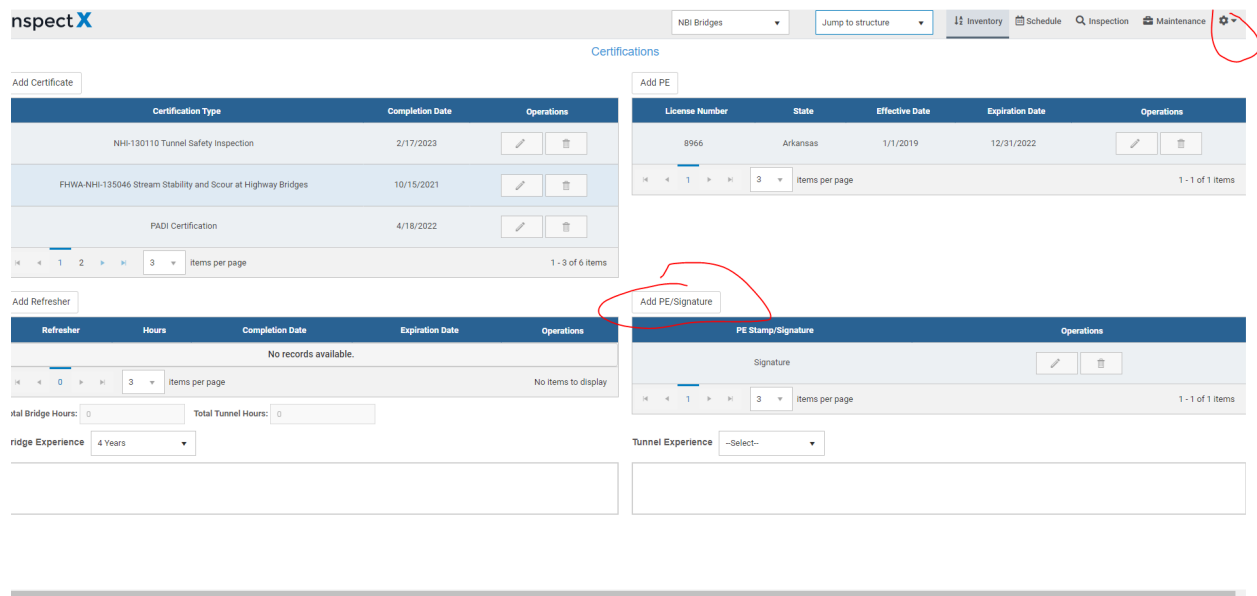


Figure 3. Adding signature to inspectX profile

- Within inspectX, go to the settings button, click user certifications, then click add PE/Signature.

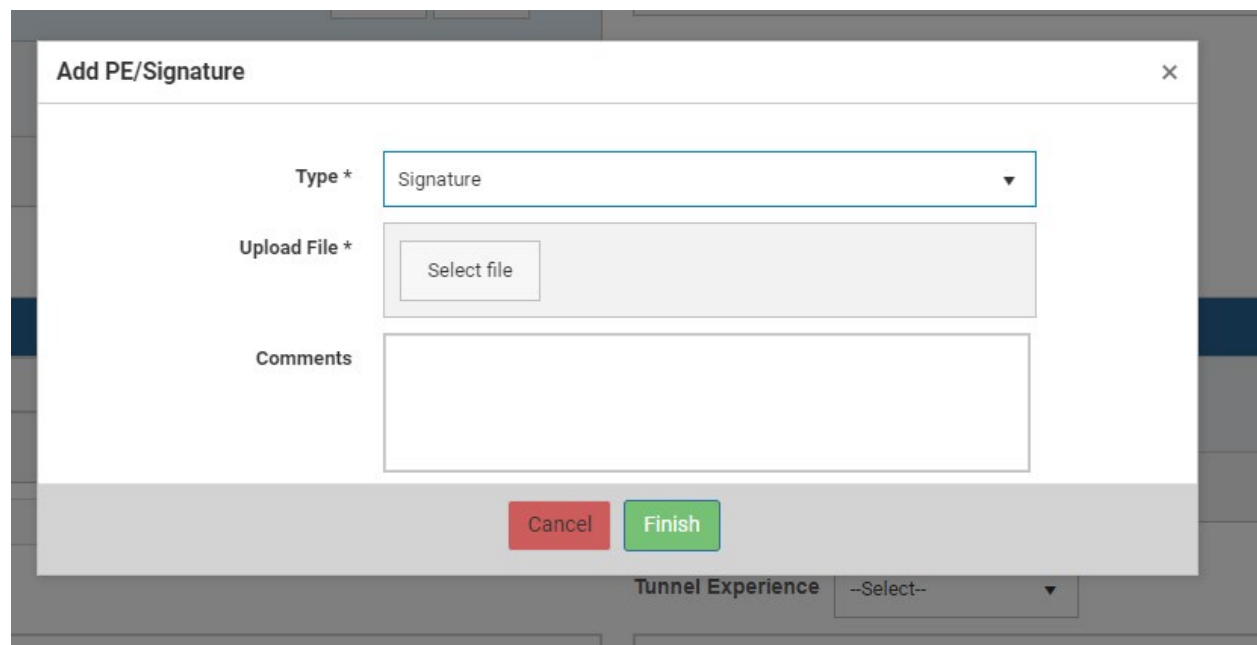


Figure 4. Uploading signature file

- You will upload the signature file you just created here.
- The signature will work automatically.

- For an NSTM inspection, click “inspect”. Fill out all fields listed at the bottom of the inspection tab on the first page that pulls up:

NSTM Report

NSTM Report	Value	Note
A-128 - Description of Structure ⓘ	Bridge 22534 is a three span structure constructed of concrete deck, steel superstructure and steel substructure. NSTMs are the steel caps at bents 1, 2, 3, and 4. NSTMs are shown in red on the NSTM sketch. NSTM inspection will consist of a hands-on visual inspection for any evidence of cracking, section loss or any other notable deterioration of members. Special attention areas include where the caps are welded to girders and tops of piles.	
A-129 - Range Of Dates, Personnel and Responsibilities ⓘ	10/11/2023 - 10/12/2023 Kevin Weston - Team Leader Jake Norris - Assistant All members were inspected hands on by both the team lead and the assistant inspectors.	
A-130 - Access Equipment ⓘ	The NSTM members were accessed via a man lift. A lane closure was not used for this inspection.	
B.IR.02 Fatigue Prone Details ⓘ	E/E details are present	
A-131 - NSTM Elements ⓘ	107 Steel Open Girder/Beam,120 Steel Truss	
B.C.14 NSTM Inspection Condition ⓘ	FAIR - Some moderate defects; strength and performance of the component are not affected.	
B.IR.04 Complex Feature ⓘ	Bridge does not have complex feature	

Figure 5. inspectX NSTM Fields

- A-128, A-129 and A-130 are the same as they have been.
- B.IR.02 is an SNBI field that is useful for an NSTM inspection information.
- A-131: for bridges with elements; here you will copy and paste the NSTM elements from the elements page separated by a comma. This will copy and paste your notes and quantities into the report for you.
 - For bridges without elements, leave blank.
 - Example: “107 Steel Open Girder/Beam,120 Steel Truss” (Don’t put quotes)
- B.C.14 is the overall condition rating of the NSTM inspection condition. Please give a general comment for this like the Deck, super, sub rating notes
- B.IR.04 is just a yes/no. Most of these will be no. there are 8 complex features in the state. If you have complex features on your structure, please type in the comment box the details of why the structure is considered by ARDOT to be complex. – I will help on these.

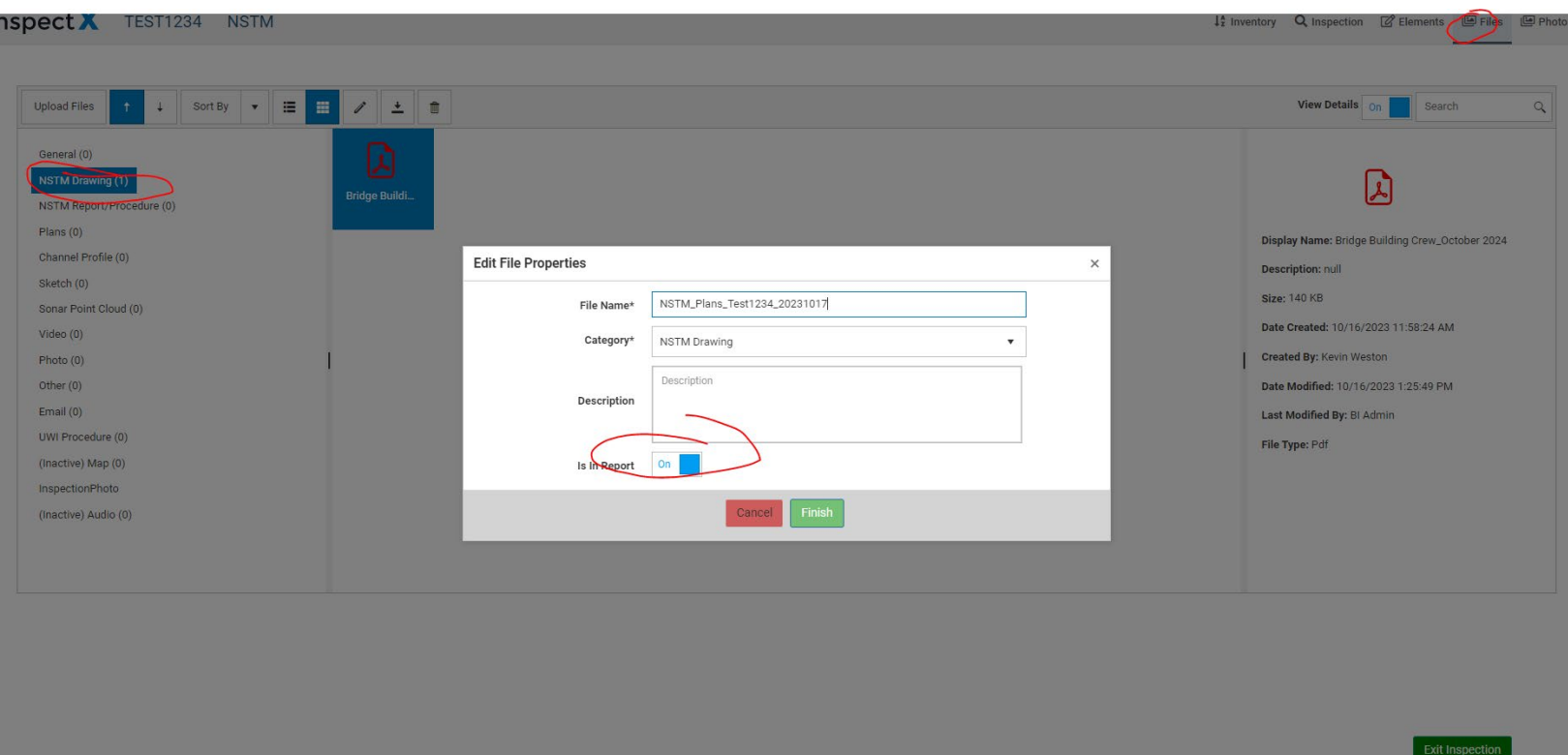


Figure 7. Attaching the NSTM PDF drawing

- Add your pdf drawing of your NSTM members to the files section and attach as the NSTM drawing
 - Please use print to pdf when you are printing this from microstation to not be blurry
- Make sure to turn the is in report to "On"

inspectX		TEST1234	NSTM	Inventory Inspection Elements Files Photos			
Add Photos Delete Photos		5 item(s) selected		month/day/year	month/day/year	Reset	
						Sort...	
	#	Image	Description	Report	Primary Photo	Photo Assignment	Actions
☐	1		NSTM Truss	On ☒	☐ Off	A-128 - Description of Structure	 
☐	2		Elevation	On ☒	On ☒	General Observation	 
☐	3		NSTM Floorbeam	On ☒	☐ Off	A-128 - Description of Structure	 

Figure 8. Attaching NSTM Reference Photos

- You will attach your reference photos to item A-128.

IS

SUMMARYINSPECTIONMAINTENANCEFILESUNDER RECORDS							
	Scheduled Date	Inspection Date	Team Lead	Inspector	Reviewer	Status	
	7/24/2023			Kevin Weston		Progress	
	7/31/2023					Progress	
	8/16/2023					Progress	
	10/16/2023					Progress	
	6/20/2025					Progress	
	8/2/2025					Progress	
	8/2/2025	N/A	Shane Byrd	Shane Byrd Kevin Weston	Kevin Weston	Scheduled	

Figure 9. Download your NSTM Report/Procedure

- Once finished with your inspection and prior to approval, you will download the NSTM inspection to verify the formatting as worked.
- Uncheck all the report options besides NSTM inspection to view.

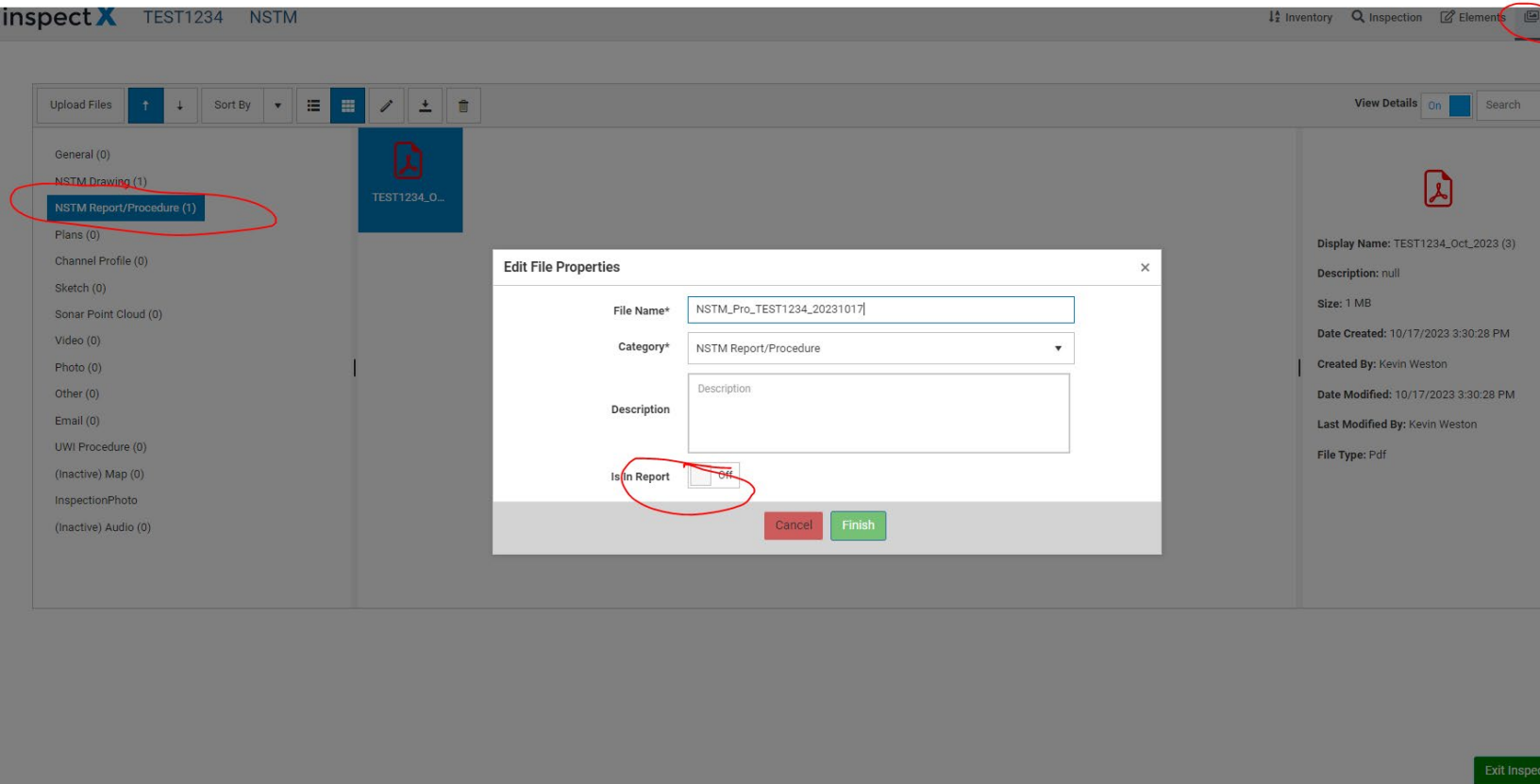


Figure 10. Attaching the NSTM Report/Procedure within the inspection

- Once the NSTM procedure/report is approved by bridge operations' staff, attach the NSTM specific report/procedure to the corresponding category within your inspection.
- Confirm that **is in report** is "off" as shown above.
- Approve the inspection.
- Attach a copy of this pdf file to the Asset files and delete the old NSTM inspection file.
- Attach the latest microstation NSTM drawing file to the Asset files as well.



Bridge Inspection Guidelines

3.B MEMORANDUM BRIDGE VERTICAL CLEARANCE

ARKANSAS DEPARTMENT OF TRANSPORTATION

LITTLE ROCK, ARKANSAS

August 21, 2023

MAINTENANCE MEMORANDUM 2023-01

TO: District Engineers and District Maintenance Engineers

SUBJECT: Posting Bridge Vertical Clearances

It shall be Department policy to post the actual clearance of all bridges that have a vertical roadway clearance of 15' 6" or less. A current list of those bridges is attached for each District.

Please ensure that these bridges are posted in accordance with the MUTCD and ARDOT Signing Policies and Guidelines.

In addition, changes in vertical clearances due to maintenance activities should be measured by the District Bridge Inspectors and reported to the Bridge Division, Bridge Operations Division, and Permits Section as soon as possible. Bridges whose vertical clearance has been reduced to 15' 6" or less shall be posted.



Deric Wyatt, P.E.
State Maintenance Engineer

Attachement

c: Director
Chief Engineer – Preconstruction
Chief Engineer – Operations
Assistant Chief Engineer – Construction
Assistant Chief Engineer – Design
Assistant Chief Engineer – Program Delivery
Assistant Chief Engineer – Maintenance
AHP – Permits
Bridge Division
Bridge Operations Division
Construction Division



Bridge Inspection Guidelines

4.A STANDARD NOTE TAKING CONVENTION



ARDOT Bridge Inspection

Standard Note Taking Convention

Description: The following is to try to help organize and create uniformity with reports and to help maintenance crews locate defects. The following does not address every situation and is meant to be a guide. This guide is to be used on element level and photo notes. Maintenance need notes should follow the same structure as outlined in this document when applicable. General description notes for bridges without element level notes shall follow this guidance as well to document bridge defects properly.

FHWA instructs inspectors that proper notes always have 3 things: location, description, severity (aka. condition state). General condition notes will not require specific locations, but rather general locations. Many notes do not need specific measurements (like deck map cracking, efflorescence on caps, etc.), but rather just the condition state listed in addition to the area or length. Other notes with structural defects like beam end issues need both condition state and the exact measurements listed out within the note.

All notes shall begin with the location. All notes shall end with the condition state (if applicable) in the format "CS_" without parenthesis. All notes shall list the quantity listed in the defects at the end of the note before "CS_" if quantified in the elements/defects. If note is not quantified, the quantity will not be listed. The description should be in between these with the size of defect to be listed at the beginning of the description. Notes for defects on bridges without elements shall contain location, description and severity but do not require the defect condition state to be listed.

Substructure labeling and naming will stay consistent with previous inspections. New substructure labeling and naming will start with Bent 1 with Bent 1 being the abutment.

Sections:

- Section 1: Defects in Deck
- Section 2: Defects in Undersurface
- Section 3: Defects in Primary Superstructure
- Section 4: Defects in Secondary Superstructure
- Section 5: Defects in Bearings
- Section 6: Defects in Substructure
- Section 7: Drawings/Details of Cross-Section Superstructure
- Section 8: Drawings/Details of Substructure

Section 1: Defects in Deck

Defects in deck should be called out as follows:

- Span
- Direction of traffic (If the bridge is separated by a median wall)
- Lane

EXAMPLE: Span 1, Northbound, Outside Lane: Moderate spalling throughout. 200SF CS3

Section 2: Defects in Undersurface

Defects in undersurface should be called out as follows:

- Span
- Bay
- Between Diaphragms / Floor Beams

EXAMPLE: Span 2, Bay 4, Between Diaphragms 2 & 3: Spalling with exposed reinforcing steel. Reinforcing steel has no section loss. 2LF CS3

Section 3: Defects in Primary Superstructure

Defects in primary superstructure should be called out as follows:

- Span
- Bent (If end of girder) / location.
- Member (Girder, Tie-Girder, Channel, etc.) with # (Left or Right for trusses, arches, channel legs)
- Location (Truss and Arch PP are labeled by plans)
- Floor Beam number is 0 - # with 0 being 1st floor beam for that span over bent.

EXAMPLE: Span 4, Girder 3, 5' from Bent 4: 2"(Height) X 4'(Length) hole rusted through w/ active corrosion. 4LF CS4

EXAMPLE: Span 3, Channel 2, Left Leg: Spalling throughout the entire length. 19LF CS3

Section 4: Defects in Secondary Superstructure

Defects in secondary superstructure members should be called out as follows:

- Span
- Bay
- Member (Diaphragm, Lateral Brace, etc.) with #
- Diaphragms are numbered 0 - # with 0 being 1st diaphragm for that span over bent.

EXAMPLE: Span 7, Bay 3, Diaphragm 4: 3 Loose bolts. CS2

Section 5: Defects in Bearings

Defects in bearings should be called out as follows:

- Span (If only one set of bearings on bent exclude span)
- Bent
- Bearing #

EXAMPLE: Span 3, Bent 3, Bearing 4: Active corrosion with pack rust. 1Each CS3

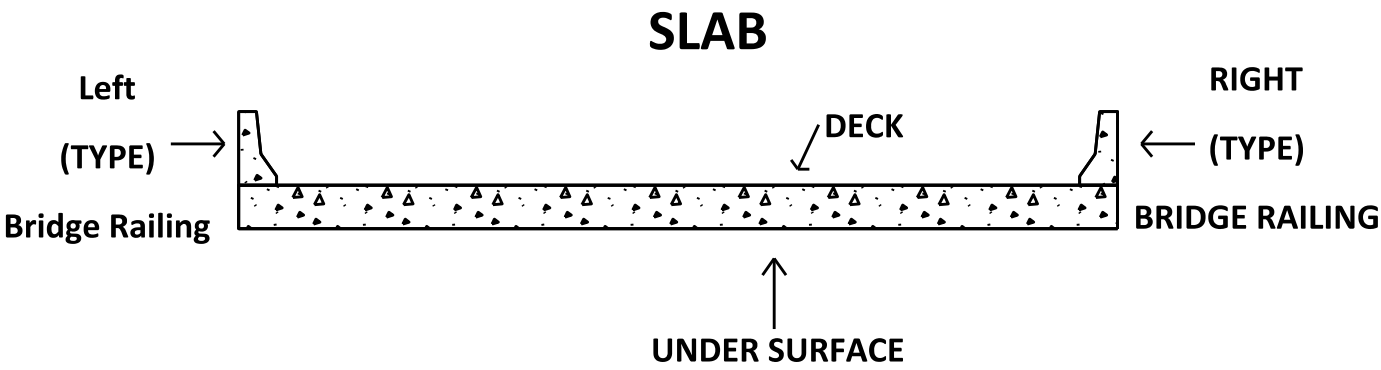
Section 6: Defects in Substructure

Defects in substructure should be called out as follows:

- Bent (Name of this is by plans)
- Member (If column or piles needs #)
- Ahead or Back
- Location (Left, Right, etc.)

EXAMPLE: Bent 5, Column 1, Spread Footing, Ahead, Left: Spalling throughout length. 10LF CS3

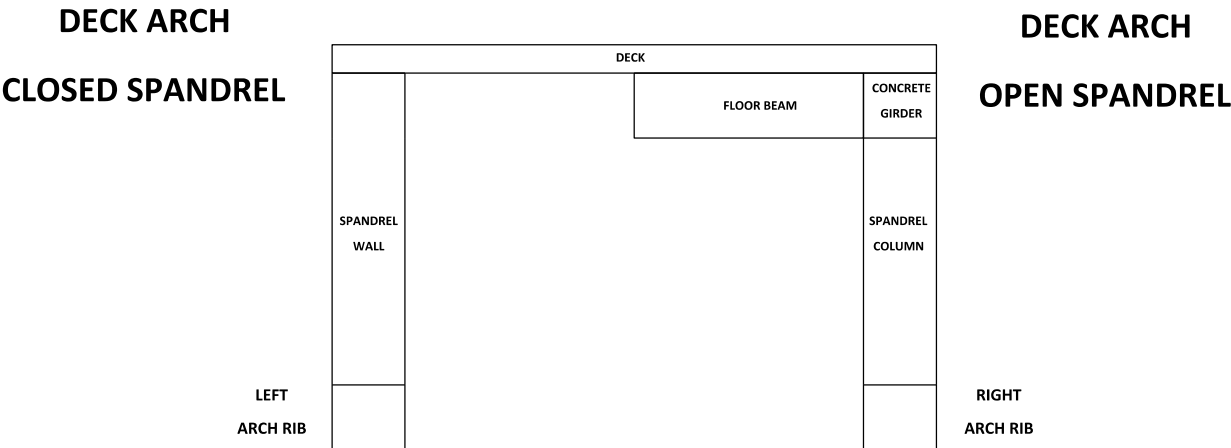
CROSS-SECTION SUPERSTRUCTURE



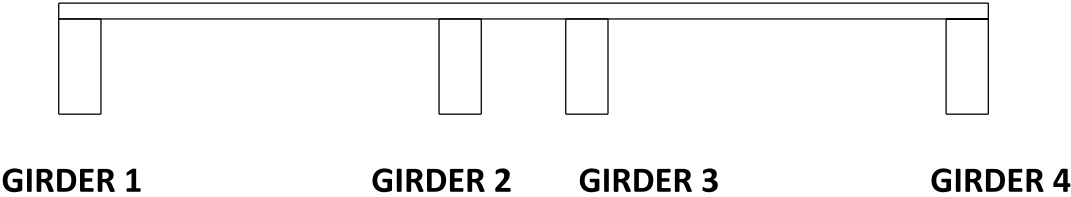
BOX GIRDER



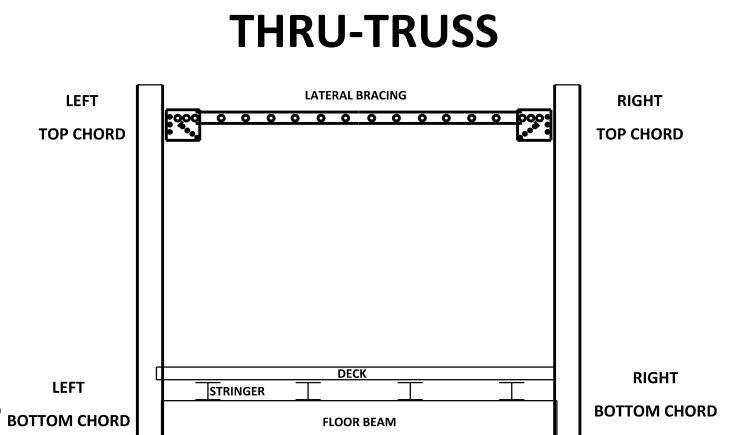
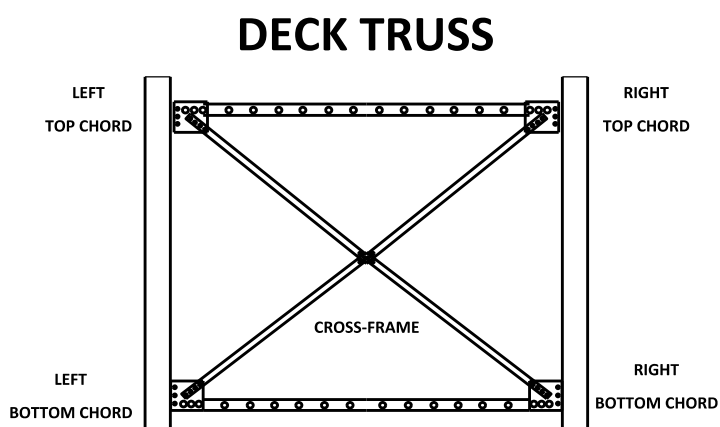
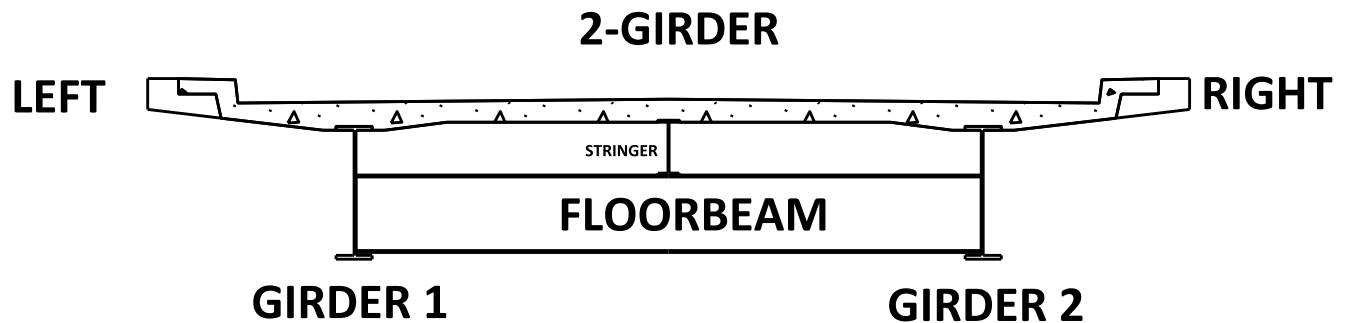
CROSS-SECTION SUPERSTRUCTURE



ARMY DECK TREAD

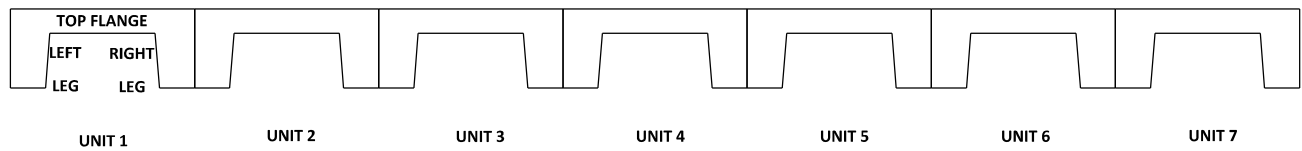


CROSS-SECTION SUPERSTRUCTURE

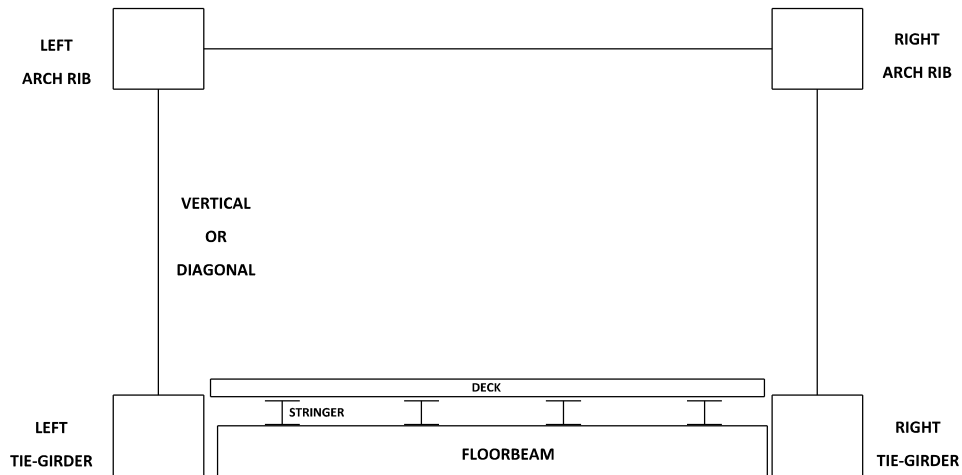


CROSS-SECTION SUPERSTRUCTURE

CHANNEL UNIT

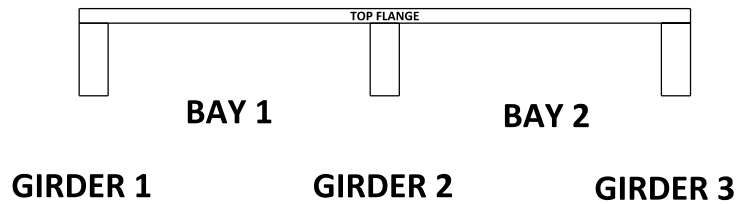


THRU-ARCH

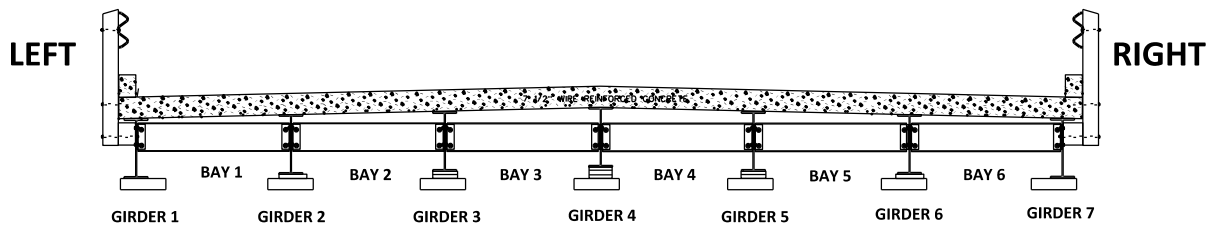


CROSS-SECTION SUPERSTRUCTURE

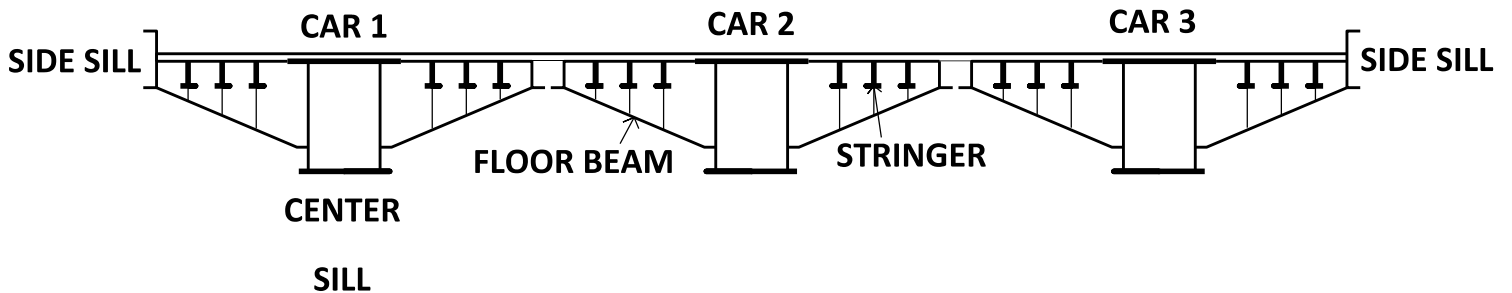
TEE BEAM



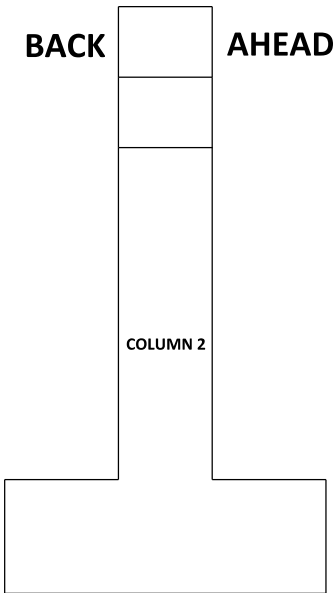
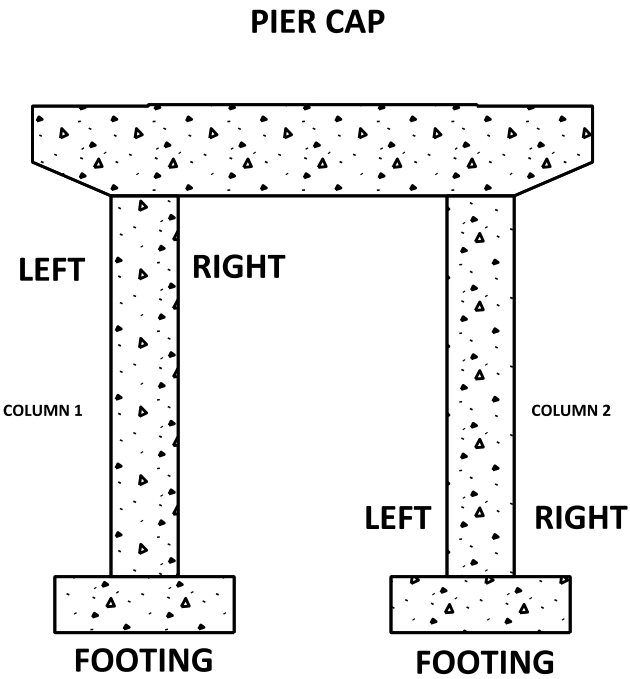
MULTI-GIRDER



RAIL CAR

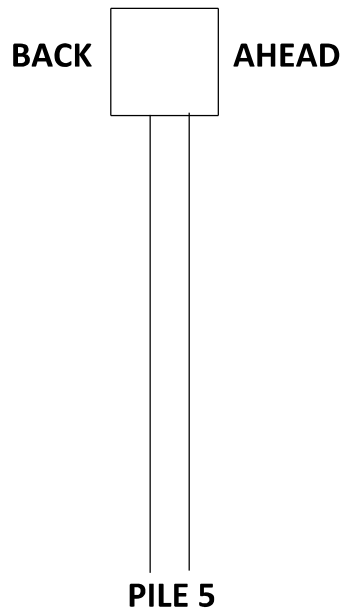
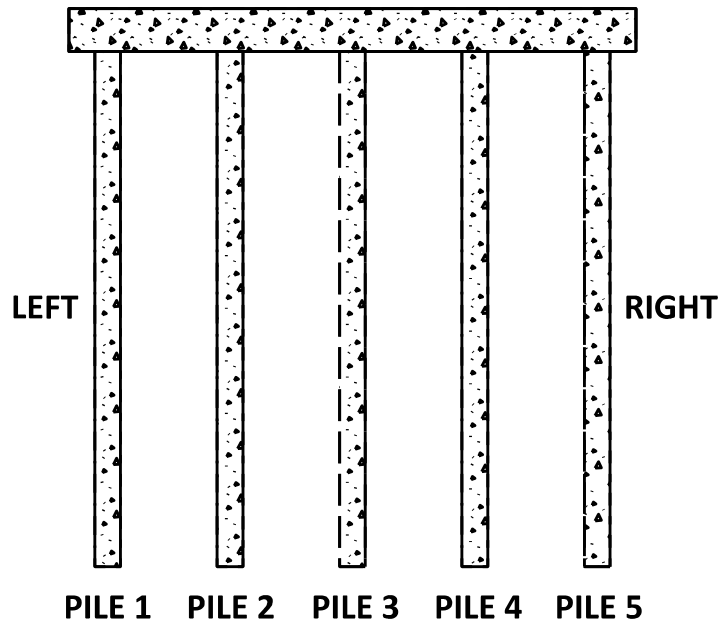


Substructure



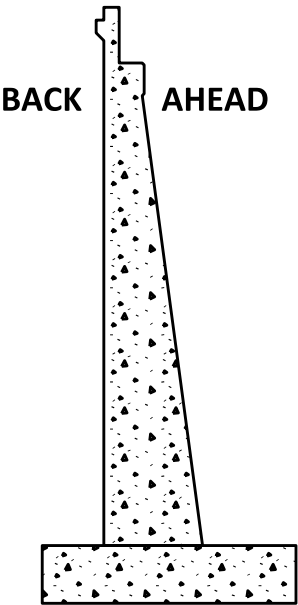
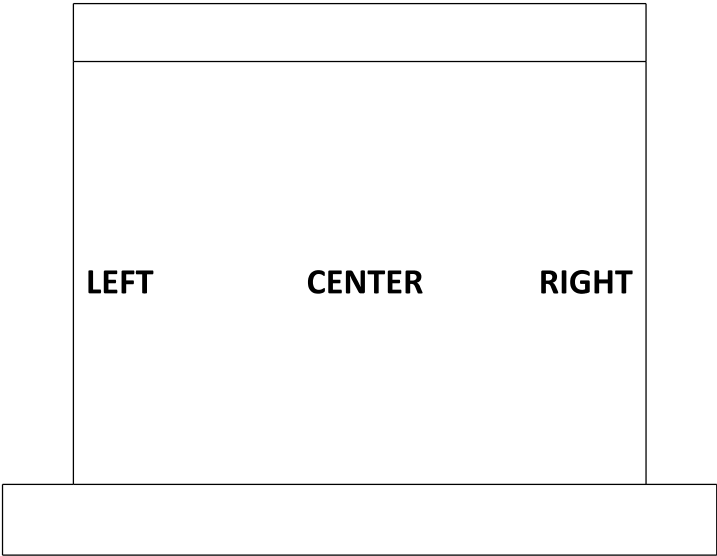
Substructure

PILE CAP



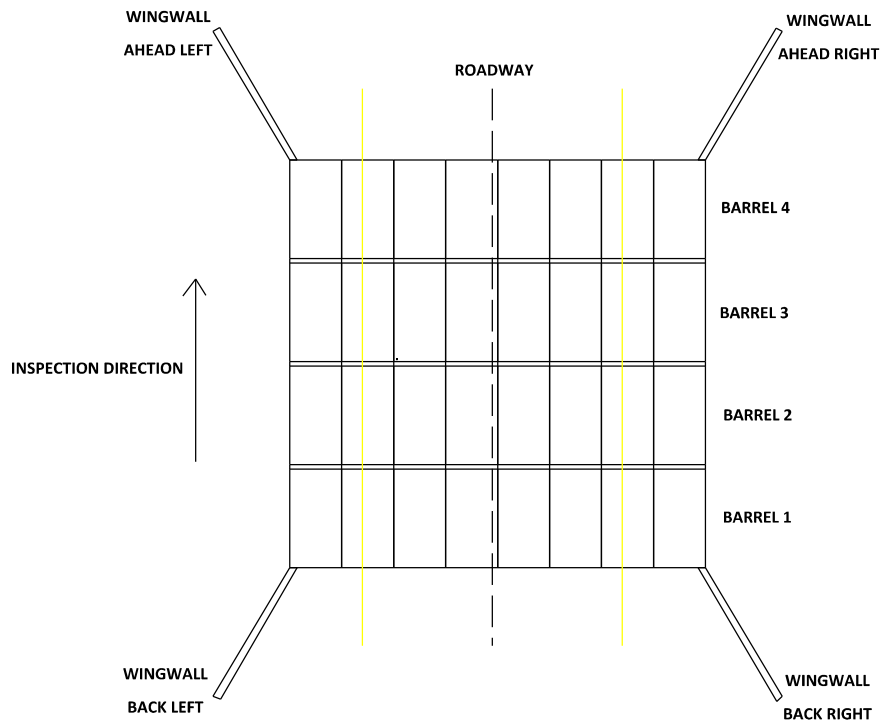
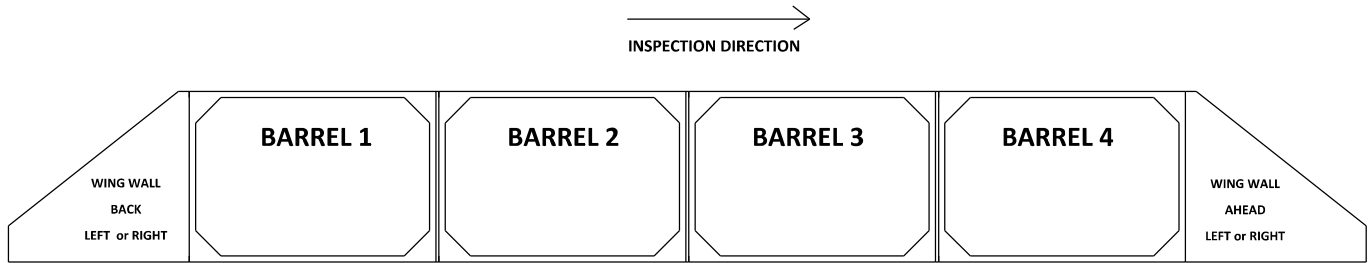
Substructure

ABUTMENT



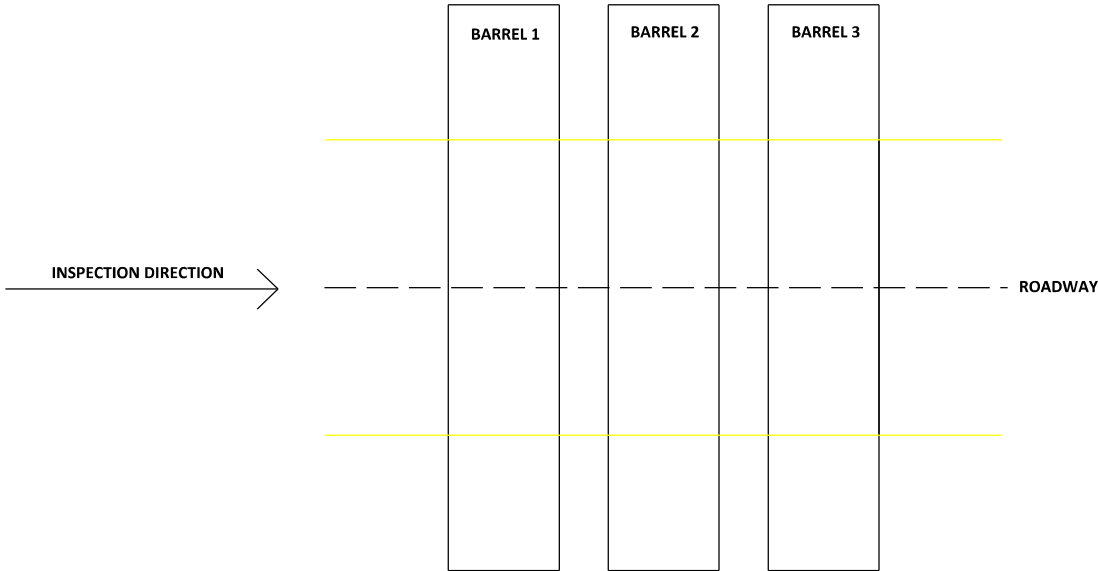
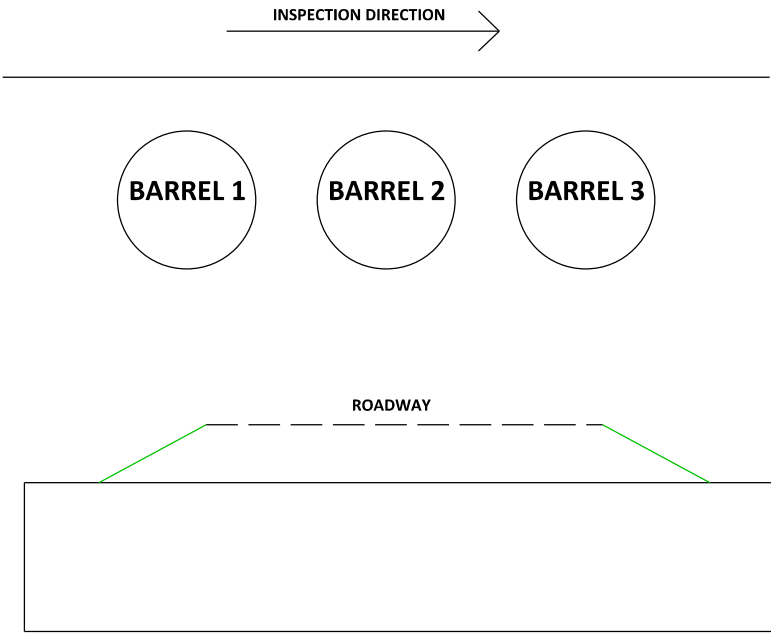
CULVERT SECTION

BOX CULVERT



CULVERT SECTION

PIPE CULVERT

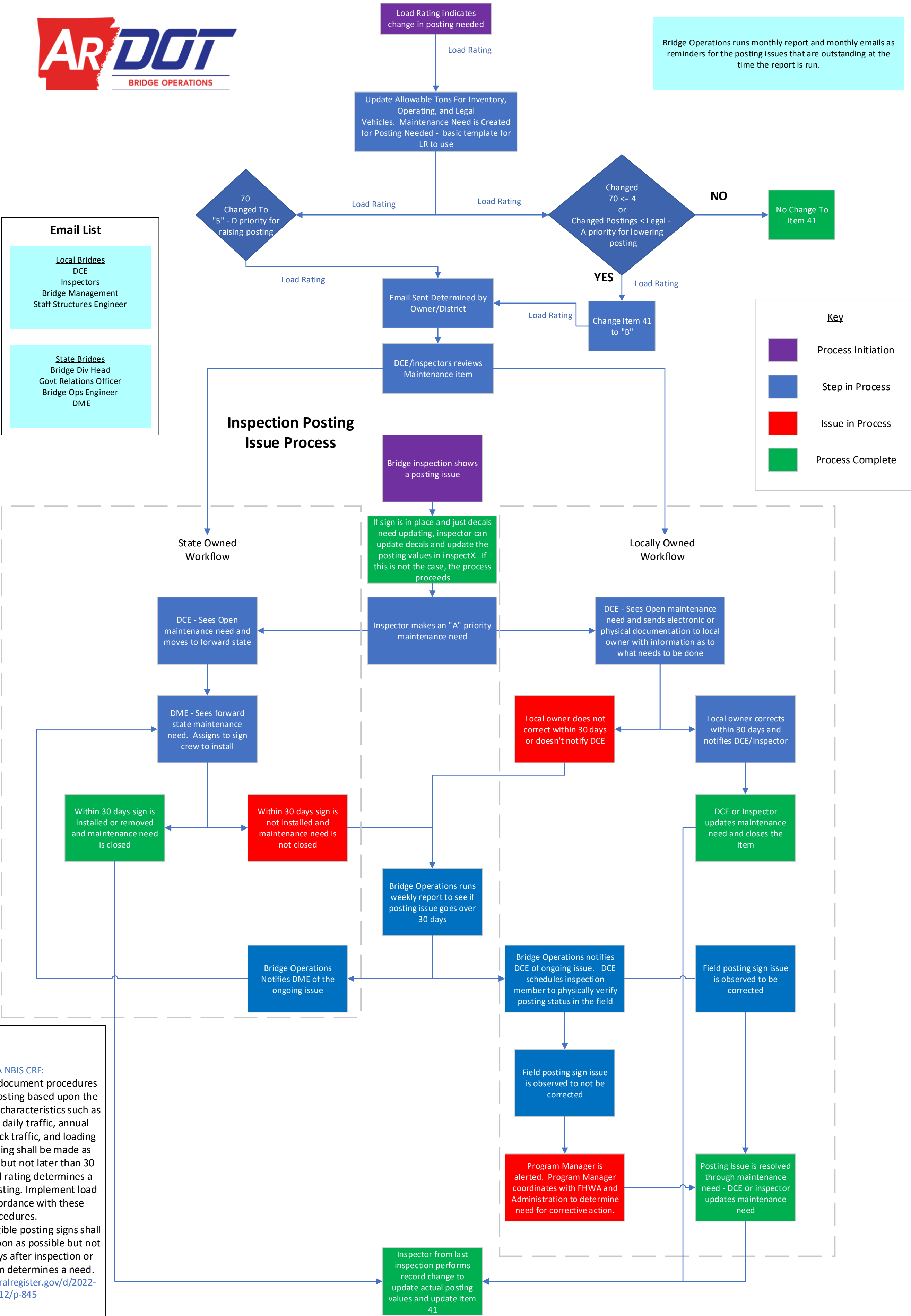




Bridge Inspection Guidelines

5.A POST LOAD RATING PROCESS FLOWCHART

Post Load Rating Process





Bridge Inspection Guidelines

5.B BRIDGE WEIGHT LIMIT SIGN COMBINATIONS

SIGN COMBINATIONS

AT BRIDGE END

EMERGENCY VEHICLE WEIGHT LIMIT	
SINGLE AXLE	XX T
TANDEM	XX T
GROSS	XX T

WEIGHT LIMIT	
 2-5 AXLES	XX T
 6+ AXLES	XX T
 XX T	XX T
 XX T	XX T

EMERGENCY VEHICLES	
SINGLE AXLE	XX T
TANDEM	XX T
GROSS	XX T

AT NEAREST INTERSECTION

BRIDGE	
EMERGENCY VEHICLE WEIGHT LIMIT	
SINGLE AXLE	XX T
TANDEM	XX T
GROSS	XX T

XX MILES

BRIDGE	
WEIGHT LIMIT	
 2-5 AXLES	XX T
 6+ AXLES	XX T
 XX T	XX T
 XX T	XX T

EMERGENCY VEHICLES	
SINGLE AXLE	XX T
TANDEM	XX T
GROSS	XX T

XX MILES

WEIGHT LIMIT XX TONS

ALL VEHICLES

BRIDGE	
WEIGHT LIMIT XX TONS	

XX MILES

ALL VEHICLES



Bridge Inspection Guidelines

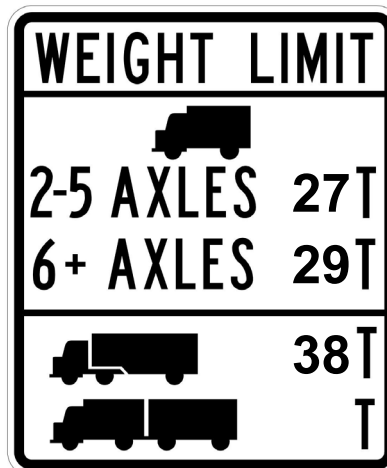
5.C CURRENT BRIDGE POSTING SIGN AND VALUES

Bridge Posting Information

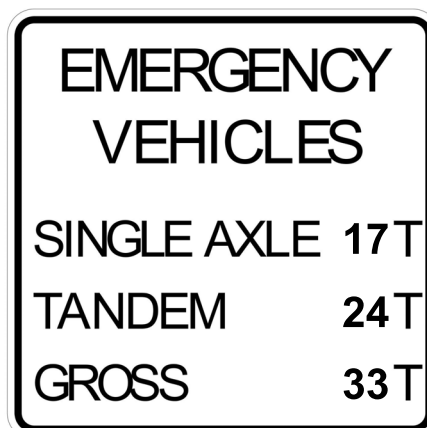
Latest Load Posting Status: PA - bridge posting needs action - new sign

Legal Load	Calculated Capacity	Beginning of Bridge Sign Current Value	End of Bridge Sign Current Value
2-5 Axles Posting	27		
6+ Axles Posting	29		
Truck and Trailer Posting	38		
Truck and Dual Trailer Posting			
EV - Single Posting	17		
EV - Tandem Posting	24		
EV - Gross Posting	33		

If calculated capacity is less than the Legal Load Listed, the Bridge Legally Requires Posting Signs to be installed by the Bridge Owner.



ARDOT
W/ MUTCD TRUCKS
R12-6



MUTCD 11TH EDITION
R12-7aP



Bridge Inspection Guidelines

5.D LEGACY BRIDGE POSTING SIGN AND VALUES

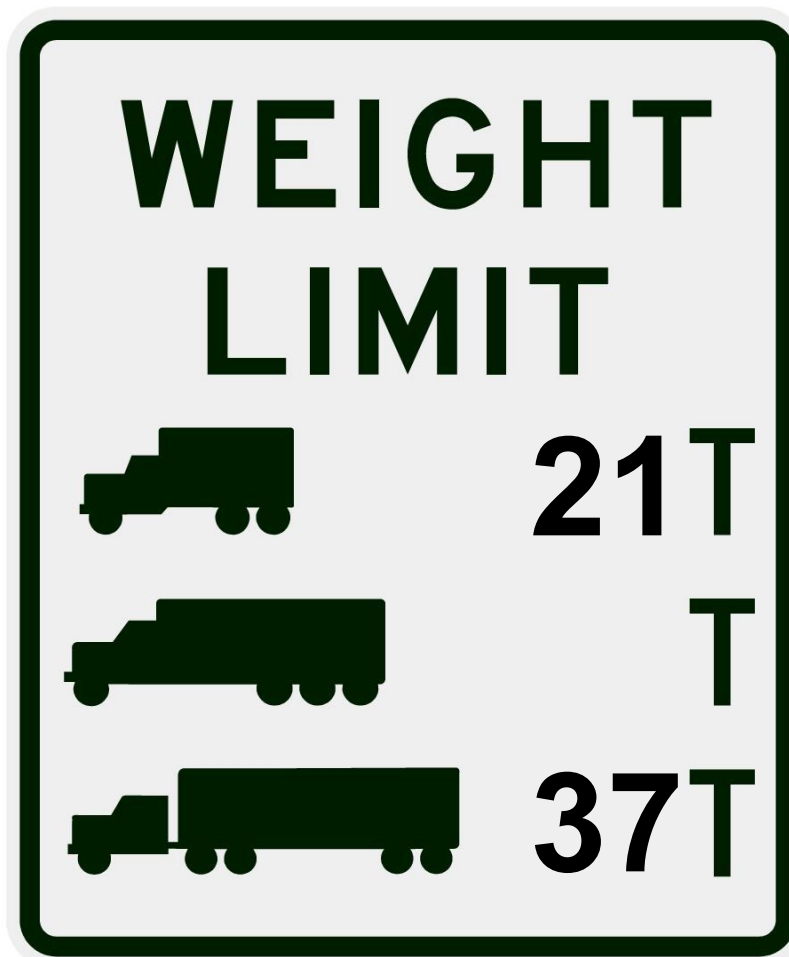
Bridge Posting Information

41 - Structure Open/Posted/Closed: P - Posted for load (may include other restrictions such as temporary bridges which are load posted)

70 - Bridge Posting: 4 - 00.1 - 09.9 % below

Legal Load	Calculated Capacity	Beginning of Bridge Sign Current Value	End of Bridge Sign Current Value
Code 4 (22 Tons)	21	21	21
Code 9 (31 Tons)	31		
Code 5 (40 Tons)	37	37	37

If calculated capacity is less than the Legal Load Listed, the Bridge Legally Requires Posting Signs to be installed by the Bridge Owner.



30"x36" AR



Bridge Inspection Guidelines

6.A MAINTENANCE NEED GUIDANCE AND EXAMPLES

Maintenance Need Guidance and Examples 2023

Bridge Inspection Program Technical Committee

Published 1/31/2023

Latest Revision 7/8/2024

Purpose: This document provides guidance and support for the BIPTC and BIPOC approved Updated to Bridge Maintenance Needs established in November of 2022

Maintenance needs are defects which, by their nature or by an advancement in severity over time, have risen to a level warranting specific notification to the authority responsible for maintenance with documentation of the defect and its priority level. Bridge Inspectors are chosen based on their experience and knowledge and must exercise judgement in determining when defects rise to the level of being noted as a maintenance need as well as assignment of the appropriate priority level. Management staff is also expected to provide sufficient oversight and guidance to ensure that all deficiencies are appropriately addressed. Similar types of maintenance needs may be combined but must be adequately documented for maintenance forces to determine the type and locations of maintenance and repair necessary.

Routine maintenance needs or “Check Box Items” consist of minor, common defects which have not risen to a level warranting the specific notification, documentation, and priority level assignment as noted in the previous paragraph.

Procedures for transitioning existing maintenance needs assigned with “D” or “G” priorities to routine maintenance/checkbox items:

- If a maintenance need can be covered with a check box item, the inspector can create the check box item and Erase the maintenance need in inspectX.
 - Do not close or put the item in repair documented it is misleading
 - If you are unsure, ask before erasing item.
 - It is possible to reassign photos to check box item. Please include a brief note and photo for each check box item recommended.
- If a maintenance need should be removed because it is not covered by a check box and it falls outside the scope of work that a maintenance item should cover, the inspector can erase the maintenance need if all defects are noted and accounted for in the corresponding element notes or component (based on owner).

Disclaimer: if you are unsure about a maintenance need, please ask a DME, DCE, or HBM engineer prior to removing the item. There are situations where an inspector might need to check both a check box item as well as a full maintenance need. Example: you may have section loss on beam ends that you would like your supervisor to review, but you also want to check the box that beam end painting is needed. –If the section loss is deemed minor and the painting is done, both the check box item and the maintenance need can be closed out.

Procedures for when partial work was completed within a maintenance item:

- If enough/significant repairs are made, an inspector may do a special inspection to update elements.



- When repairs are made, move defects from deficiency description into the comment box – completely remove the section of description for portion that was repaired. Standard initials, date, and repair made within the comment box.
- For locally owned structures – Attach form 8 in files and document that file is attached in the maintenance comments section.

Procedures for Maintenance Need photos:

- Turn off historical MN photos from the report.
- Keep first historical photo of MN then delete interim photos of the same maintenance need.

Procedures for updating MN description each inspection cycle. Adding on top of is very confusing.

- For each Routine inspection cycle, the inspector is responsible for entire MN note.
 - There is no need to document name/date in the description if inspector is responsible for each note during the inspection
 - Exception: special inspections, damage inspection, etc..

Maintenance Need Frequently Asked Question:

- How should maintenance needs be grouped?
 - Group Maintenance Needs based on severity. Example: CF beam ends needs to be separated from B priority beam ends. This helps repair crews and load rating.
- Should items related but a part of different components be in the same MN or different ones? Example: navigational light issue in the same MN as navigational sign.
 - Best to separate items based on component – Confusing to combine even if items are related.
- Questions on using check boxes?
 - Add photo and comment for “yes” selected
 - Can leave blank if no need to put “yes”

This document has 2 sections. The first section shows examples of maintenance needs that do not need to be a maintenance need; some of these can be check box items and some can be just quantified in the defects and noted in the corresponding element or component (based on owner). The second section shows examples of good maintenance needs with a priority they should be assigned. This document will grow with more examples and guidance going forward.

Section 1: Items that should not be maintenance needs.

During an inspection, if you find an item like this or another that should not be listed as a maintenance need, the Bridge Inspection Technical Committee has agreed to have inspectors or engineers delete/erase the item in inspectX.



Figure 1. Good example for: A-57 - Beam End and Bearing Painting Needed – No need for maintenance need



Figure 2. Good example of drift that does not need any maintenance need associated. Document in the channel notes.



Figure 3. Good example of minor exposed steel in RCBC that does not need a maintenance need.



Figure 4. Good example of minor spall in precast channel beams that does not need a maintenance need. Document defect in defect quantities and note in the corresponding element or component (based on owner).



Figure 5. Good example of graffiti out of the public view that does not need a maintenance need.
Graffiti in public view needs a maintenance need.



Figure 6. Good example of small spalls from gun shots that does not need to be a maintenance need



Figure 7. Good example of check box maintenance need for full beam painting



Figure 8. Example of efflorescence cracking in the overhang that does not need to be a maintenance need. Document in the element quantities.



Figure 9. Prestressed girders with diagonal or vertical crack (non-shear cracks) less than CS2 that do not need to be a maintenance need. CS3 or worse would need to be maintenance



Figure 10. Cracks in wearing surface that should not be a maintenance need.

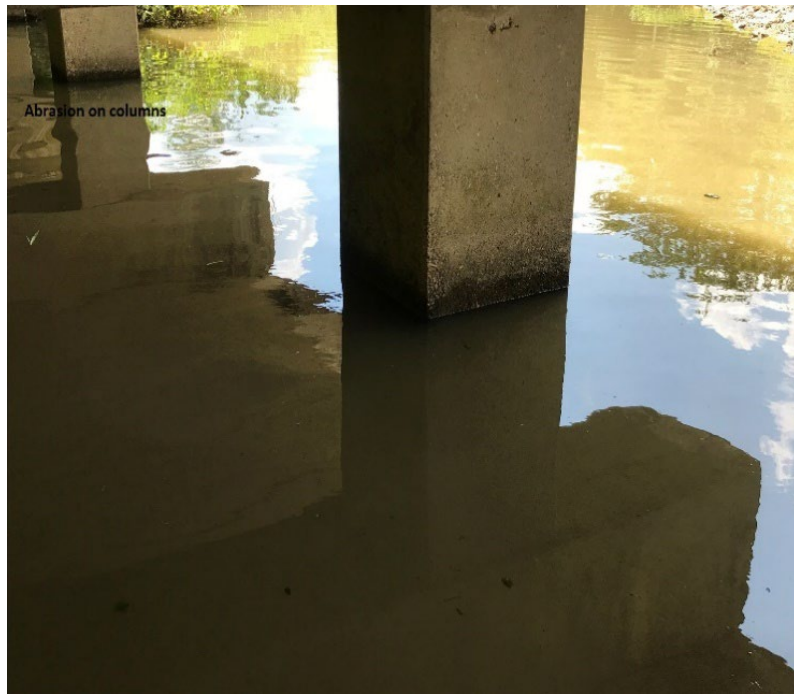


Figure 11. Abrasion on columns



Figure 12. Minor cracks in the pier wall



Figure 13. Corrosion on the bridge rail. Note: the deck shown should have a maintenance need



Figure 14. Exposed rebar in the bridge rail.



Figure 15. Minor cracks in the back wall



Figure 16. Small area of a single exposed bar in the back wall



Figure 17. Minor Spall on cap



Figure 18. Spall on exterior face of concrete slab



Figure 19. Delaminated concrete around drains



Figure 20. Flaking rust on steel girders. Can be covered with check box maintenance item.



Figure 21. Abrasion on concrete deck



Figure 22. Minor cracks in top of caps



Figure 23. Cracks in top of culverts. Document defect in defect quantities and note in the corresponding element or component (based on owner).



Figure 24. minor localized rust of steel columns. Note: rust and section loss on steel at concrete connections (like piles into caps) should be a maintenance need.

Section 2: Good examples of maintenance needs.

Defects on steel girders that should be a maintenance item and priority.



Figure 25. C/D priority of steel girder end



Figure 26. CF/A priority on steel girder end



Figure 27. C priority on steel girder end



Figure 28. Check box maintenance item for steel girder end



Figure 29. CF priority on Steel Girder end with crack through bottom flange

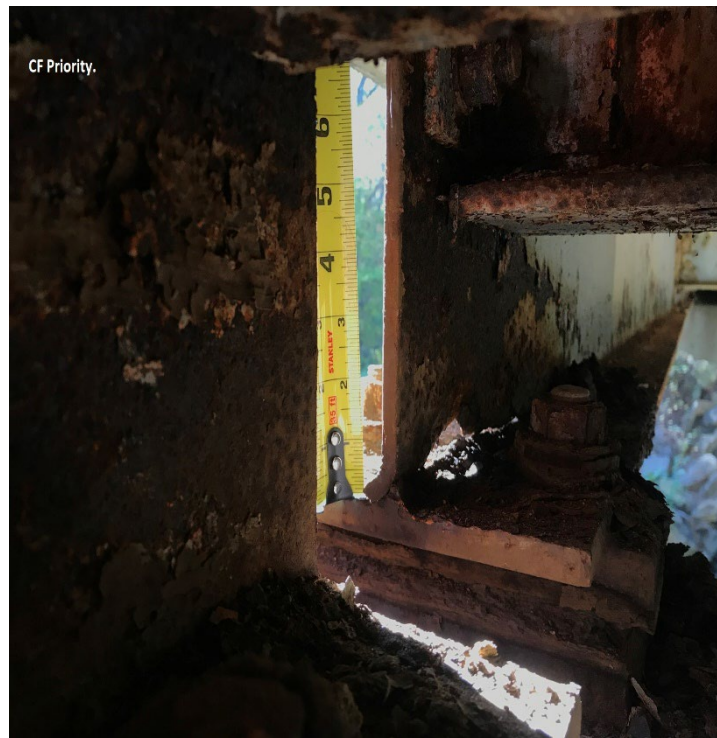


Figure 30. CF priority on Steel Girder end with crushing action



Figure 31. C/B priority on Steel Girder End section loss at haunch area



Figure 32. C/D priority of Steel Girder End



Figure 32. B/C priority of Steel girder end



Figure 33. CF of Steel girder end (on the left)



Figure 34. CF priority of Steel Girder end with crushing action

Good examples of General Maintenance Needs:



Figure 35. CF priority on the deck – full depth hole that could cause wreck



Figure 36. CF or A on the deck – full depth hole that needs full depth patch



Figure 37. B priority since the plate is in place. Full depth deck patch needed



Figure 38. B priority since the plate is in place (underside view)



Figure 39. D priority of erosion under pile cap/abutment



Figure 40. C priority of erosion under pile cap/abutment



Figure 41. Photos of A/B priority of erosion under pile cap with steel shell pile exposed and adjacent concrete exposed.



Figure 42. A Priority of multiple piles exposed at the abutment with material behind abutment spilling through. Needs Engineering review.



Figure 43. B Priority (depending on depth of piles or shafts). Needs to be evaluated by an engineer for depth of pile fixity



Figure 44. B/C priority of area that continues to erode from under the concrete cap.



Figure 45. B/C priority of delamination/spalled area that needs to be addressed in a timely manner. Also pictured: a joint seal that can be taken care of with a check box maintenance item.



Figure 46. A priority of missing or knocked down load posting sign that should read “10,10,10”



Figure 47. A leaning posting sign that is stable – should not be a maintenance need as long as it still conveys message to traveling public



Figure 48. B priority maintenance need for other posting issue where vegetation is partially obstructing signage



Figure 49. B priority maintenance need for other posting issue where sign is damaged and covered in debris making it hard to read.



Figure 50. A priority maintenance item for sign that is unreadable due to code 4.



Figure 51. A priority maintenance item for posting sign vandalism.



Figure 52. B priority maintenance item for sign vandalism.

Section 3: Examples of Vegetation Maintenance Needs and Vegetation Removal Check Box items



Figure 1. C/D priority maintenance item for vegetation.



Figure 2. C/D priority maintenance item for vegetation.



Figure 3. C/D priority maintenance item for vegetation.



Figure 4. C priority maintenance item for vegetation. If access is 100% limited code a B priority.



Figure 5. C/D priority maintenance item for vegetation.



Figure 6. D priority maintenance item for vegetation.



Figure 7. D priority maintenance item for vegetation.



Figure 8. D priority maintenance item for vegetation due to limiting inspection.



Figure 9. D priority maintenance item for vegetation if limiting inspection or impeding traffic.



Figure 10. Example of check box for Vegetation Removal Requested.



Figure 11. Example of check box for Vegetation Removal Requested.



Figure 12. Example of check box for Vegetation Removal Requested.



Asset #06999(Routine)
I-555/Sec-1/L-0.14 over I-555 & I-55
Location: Jct I-555 & I-55

Team Lead: Lee Swan, Inspection Date: 02/12/2024

Maintenance Needs

Date Reported: 04/05/2022

Priority: C - Important

Type of Work: Miscellaneous

Status: RepairDocumented

Component: Miscellaneous

Deficiency Description

Trees and vegetation growing beside and under bridge

Remarks

Trees cut down by bridge operations.

Great job!



Trees cut down by bridge operations.



Trees and vegetation growing beside and under bridge

Figure 13. Perfect example of inspectors dealing with vegetation while on site making great use of time, resources and planning for future inspection.



Bridge Inspection Guidelines

6.B MEMORANDUM FLAMMABLE MATERIALS

ARKANSAS DEPARTMENT OF TRANSPORTATION

LITTLE ROCK, ARKANSAS

April 26, 2024

BRIDGE OPERATIONS MEMORANDUM 2024-01

TO: District Engineers, District Construction Engineers and District Maintenance Engineers

SUBJECT: Reporting Storage of Flammable Materials Underneath Bridges

It shall be Department policy to report the storage of flammable materials underneath bridges to Bridge Operations Division. The storage of flammable, explosive, or hazardous materials on the ROW is considered a violation of 23 CFR 710.403 which requires that any alternate use of ROW must not impart risk to the safety of the infrastructure nor travelers.

During routine bridge inspections, inspectors will document the presences of any flammable or hazardous materials stored in close proximity to the structure. Discovery of large quantities of flammable materials will be communicated to the Bridge Inspection Program Manager within 24 hours. Such a discovery warrants immediate follow-up actions that could include removal of materials and or contact of owners of the bridge/materials. For further guidance reference the ARDOT Bridge Inspection Manual.

This Memorandum is in accordance with the CFR and FHWA's 11/15/23 "Documentation and Treatment of Materials Stored Under a Highway Bridge."



Andrew Nanneman, P.E.
State Bridge Operations Engineer

Attachment

cc: Director
Chief Engineer – Operations
Chief Engineer – Preconstruction
Chief Engineer – Administration
Assistant Chief Engineer – Construction
Assistant Chief Engineer – Design
Assistant Chief Engineer – Program Delivery
Assistant Chief Engineer – Maintenance
AHP – Permits
Bridge Division
Maintenance Division
Construction Division



U.S. Department
of Transportation

**Federal Highway
Administration**

Memorandum

Subject: **ACTION:** Documentation and
Treatment of Materials Stored Under a
Highway Bridge

Date: 11/15/2023

From: Emily Biondi /s/
Associate Administrator
Office of Environment and Planning

In Reply Refer To:
HEPR-1 and HIBS-1

Hari Kalla /s/
Associate Administrator
Office of Infrastructure

To: Division Administrators and Division
Directors

The recent fire that resulted in the closure of a bridge on the Santa Monica Freeway section of Interstate 10 (I-10) in Los Angeles, California, has caused the detour of approximately 290,000 vehicles a day, adversely affecting the lives of local travelers, the movement of goods and services, and the local and regional economies. Although the investigation is still ongoing, this incident appears to be very similar to the fire that resulted in the 2017 collapse of the Interstate 85 (I-85) bridge over Piedmont Avenue in Atlanta, Georgia. This event in California again raises serious concerns about storing materials, including flammable, explosive, or hazardous materials, under bridges and other elevated structures.

After the investigation of the I-85 bridge collapse, FHWA issued information to remind the State Departments of Transportation (SDOT) of the pertinent Federal regulations on the storage of materials in the right-of-way (ROW) (23 CFR 710.403 and 710.405). Specifically, 23 CFR 710.403 requires that any alternative use of the ROW must be “[c]onsistent with the . . . safety of the facility, and such use must not impair the highway or interfere with the free and safe flow of traffic.” Also, should an alternative use of the ROW be allowed, 23 CFR 710.405 requires the development and execution of a Right-of-Way Use Agreement ensuring, among other things, the safety of the facility. FHWA guidance concerning 23 CFR 710.405 ([Frequently Asked Questions \(FAQs\) – Right-of-Way \(ROW\) – Policy and Guidance – Real Estate – FHWA \(dot.gov\)](#)) provides:

32. Q: § 710.405. Are there fundamental restrictions on ROW use agreements?

A: The real property cannot be used for non-highway purposes if the real property is necessary, either currently or in the foreseeable future, for safe and secure operation and maintenance of the highway facility. If such conflicts exist, the real property would be considered unavailable. The only exception may be for interim uses, which are terminated when the real property is needed for highway purposes.

The proposed non-highway use must meet the conditions in 23 CFR 710.405(a), including preservation of safety of the facility and its users. ***The FHWA views the manufacture or storage of flammable, explosive, or hazardous material on the ROW as presumptively a safety hazard.*** [Emphases added] This presumption does not preclude the transverse or longitudinal installation of such items as petroleum pipelines that have been approved in accordance with the regulations.

Similarly, within the scope of the proposed non-highway use of the facility, there is a presumption that ***any structures, buildings, or facilities which utilize combustible materials (such as wood, wood fiber, plastic etc.) that may be fire hazards do not satisfy 23 CFR 710.405(a). Such non-highway uses cannot be allowed under or adjacent to overpasses and bridges, absent a showing that such uses would provide for the safe and secure operation and maintenance of the highway facility.*** [Emphasis added]

Although the FHWA has not defined flammable as used in the FAQ cited above, FHWA considers the plain language definition of flammable—“capable of being easily ignited and of burning quickly”—as being consistent with the direction and intent of the response.

Additionally, in April 2018, the National Transportation Safety Board issued a Safety Alert ([SA-073](#)) on “Protecting Bridges from Fire Damage and Collapse.” The Safety Alert recommended that SDOTs remove materials from beneath bridges if they pose a risk of a fire event, improve surveillance and lock storage areas to restrict entry.

In light of the I-85 and I-10 fires, bridge owners should continue to direct inspectors, during their routine inspections, to be observant of materials, including flammable, explosive, or hazardous materials, stored under bridges, document any such materials stored in the ROW in the inspection report, and, if concerns exist, to communicate those concerns appropriately to the SDOT bridge inspection program manager. The discovery of such materials stored underneath a highway bridge should be treated as a critical finding requiring immediate follow-up action in accordance with our regulations and guidance ([NBIS Regulations and Guidance](#)) to ensure public safety, and must be reported to the FHWA (23 CFR 650.313(q)).

Please share this memorandum with the appropriate officials and staff from the highway-bridge-owning State, Federal, and Tribal agencies in your State. In doing so, remind them of the requirements of the pertinent Federal regulations, and of the

direction to treat the discovery of materials, including flammable, explosive, or hazardous materials, stored in the ROW underneath bridges as an inspection critical finding.

If you have any questions or need additional information related to right of way, please contact Nic Thornton at (202)366-1352 or Nicholas.Thornton@dot.gov, or issues related to bridges or structures, please contact Joey Hartmann at (202)366-4599 or Joey.Hartmann@dot.gov.

Except for the statutes and regulations cited, the contents of this document do not have the force and effect of law and are not meant to bind the States or the public in any way. This document is intended only to provide information regarding existing requirements under the law or agency policies.



Bridge Inspection Guidelines

8.A GUIDANCE FOR CHANNEL AND CHANNEL PROTECTION

Guidance for Channel Condition, Channel Protection, and Scour Condition

Purpose: The purpose of this document is to provide standardized guidance for the consistent field assessment of channel condition, channel protection, and scour condition at bridge and culvert structures. This guidance is intended to ensure that visual observations, measurements, documentation, and condition ratings are applied uniformly across all inspections, regardless of inspector, district, or type.

This document supports the identification of active erosion, channel instability, and scour-related threats that may affect the structural integrity, serviceability, and safety of transportation assets. It establishes a common framework for evaluating observed conditions in a manner that is consistent with SNBI requirements and agency practices, thereby improving the reliability of data used for maintenance prioritization, hydraulic analysis, scour evaluations, and development of Scour Plans of Action.

Aerial Photo Reference for Bridges:



Aerial Photo Reference for Culverts:



Channel Condition Rating (SNBI - B.C.09.)

Assessment Objective: Evaluate the overall stability and functionality of the channel within the bridge vicinity.

What to Look For:

- General stability of the channel banks within the defined inspection limits, including up to 100 ft upstream and downstream of the bridge and within one full structure length for culverts/pipes, considering signs of embankment erosion, undercutting, and channel migration.
- Sediment deposition or aggradation affecting water flow.
- Channel constriction or widening due to natural or human-induced activities.
- Debris accumulation leading to partial or full flow obstruction.
- Vegetation growth that impacts channel alignment, water flow, or debris accumulation.
- Presence and condition of channel training features (e.g., spur dikes, riprap)
- If noticeable channel migration or damage is observed beyond the defined inspection limits, this information can be used at inspector discretion to support the channel condition rating.

Active Bank Undercutting and Lateral Channel Migration (*minor, not threatening*)

- Outer bank erosion on a meander bend
- Active lateral channel migration
- Vertical bank undercutting at the toe
- Loss of vegetative and soil support along the outside curve
- High-velocity flow concentrated against the outer bank



Channel-Induced Embankment Erosion (*minor, not threatening*)

- Longitudinal embankment erosion
- Loss of material along the channel side slope
- Exposed soil and root systems
- Evidence of concentrated flow paths
- Some localized rock protection but clearly not continuous or adequate



Dense In-Channel Vegetation Restricting Flow Area (*hydraulic impact present but not threatening*)

- Dense in-channel vegetation occupying the effective flow area
- Reduced hydraulic opening/narrowed low-flow channel
- Increased flow resistance (higher Manning's n)
- Likely backwater effects during high flow
- High potential for debris trapping
- Early-stage sediment capture and channel infilling



Examples of B.C.09 - Channel Condition Ratings 7 – 9 (Stable to Minor Defects)

9 - EXCELLENT - No defects

Notes:

- Channel banks are fully stable with no active erosion or migration.
- No sediment buildup, debris accumulation, or vegetation restricting flow.
- No threat to the structure, foundations, or approach roadway.



7 - GOOD - Some minor defects.

Notes:

- Minor sediment deposition and natural channel irregularities present.
- Vegetation and rock present within the channel but do not restrict flow capacity under normal conditions.
- Minor bank erosion or channel adjustment may be present but is stable and not progressing toward the roadway or structure.
- Channel remains hydraulically functional and stable at this time.



Examples of Channel Condition Ratings 4 – 6

5 - FAIR - Moderate defects; bridge and approach roadway are not threatened.

Notes:

- Moderate sediment deposition and localized bank erosion present.
- Channel alignment shows minor adjustment but remains generally stable.
- Vegetation and debris are present and affect flow locally but do not significantly reduce overall channel capacity.
- No evidence of progressive channel migration toward the roadway or structure at this time.



4 - POOR - Widespread moderate or isolated major defects; bridge and/or approach roadway is threatened.

Notes:

- Widespread bank erosion and/or channel widening or constriction is present.
- Channel alignment has shifted or is actively shifting toward the roadway or structure.
- Debris, sediment, or vegetation is causing significant hydraulic restriction or redirection of flow.
- Channel instability is actively threatening the roadway embankment or structure location.



Examples of Channel Condition Ratings 0 – 3

3 - SERIOUS - Major defects; bridge or approach roadway is seriously threatened. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

Notes:

- Major channel instability is present, including active lateral migration, rapid bank failure, or severe channel constriction or widening.
- Flow is being concentrated or redirected toward the roadway or structure location.
- Debris, sediment, or vegetation is causing severe hydraulic restriction or redirection of flow.
- Channel behavior is actively threatening the roadway embankment or structure location, requiring frequent monitoring and corrective planning.



0 - FAILED - Bridge is closed due to channel condition and is beyond corrective action. Bridge location or design can no longer accommodate the channel, and bridge replacement is needed to restore service.

Notes:

- Channel alignment, geometry, or instability has shifted beyond the capacity of the existing roadway crossing to function safely.

- Channel is no longer hydraulically compatible with the bridge or culvert location, and the crossing cannot safely convey design flows.
- Channel condition alone necessitates road closure and realignment or full replacement of the crossing to restore service.



West approach has been washed out



Approach roadway washed out no repairs have been made

Channel Protection Condition Ratings (SNBI - B.C.10.)

Assessment Objective: Evaluate the presence, condition, and performance of channel protective measures (e.g., riprap, retaining walls, wingwalls) in maintaining channel stability and resisting erosion and scour forces.

What to Look For:

- Presence and adequacy of installed protection (e.g., riprap, gabions, bulkheads, retaining walls, wing walls, ACB blocks).
- Physical integrity of installed protection (e.g., cracking, displacement, undermining, rotation, separation, or missing elements).
- Evidence of erosion or scour acting on or around protection elements, such as voids, settlement, or exposed underlying material.
- Signs of recent or ongoing deterioration or failure of protection due to hydraulic forces, traffic loads, weathering, or poor installation.
- Changes in channel alignment, flow direction, or hydraulic concentration that reduce the effectiveness of existing protective measures.

Failed Channel Protection on box culvert

Notes:

- Large protection element (concrete slab/headwall/apron segment) has displaced and rotated from its original position.
- Riprap and protection material at the toe appear displaced or missing, exposing underlying soil.
- Voids and material loss are visible beneath and adjacent to the protection, indicating loss of subgrade support.
- Flow is undercutting and bypassing the failed protection, reducing its ability to dissipate energy at the culvert outlet.
- Protection system is no longer functioning as intended to control erosion at the structure.



Articulated Concrete Block Design

Notes:

- Articulated concrete block (ACB) system is properly aligned and seated on the channel slope.
- Blocks appear interlocked with uniform contact, indicating correct installation.
- Continuous coverage of the channel surface is present with no visible gaps, voids, or displacements.
- Transitions at edges appear properly terminated and tied into adjacent protection or native material.
- No visible signs of undermining, rotation, cracking, or differential settlement of the protection system at the time of inspection.



Erosion affecting channel protection

Notes:

- Erosion of soil behind and beneath the protection layer is evident.
- Protection materials (riprap/blocks) show displacement and loss of embedment.
- Geotextile or filter fabric is exposed, indicating loss of overlying protective cover.
- Flow appears to be concentrating along the edge of the protection, accelerating material loss.
- Protection system is partially compromised and no longer fully effective at resisting erosion.



Examples of Channel Protection Ratings 7 – 9

8 – VERY GOOD – Some inherent defects.

Notes:

- Riprap is well graded, continuous, and properly keyed in at the toe of the slope.
- Individual stones appear tightly interlocked with minimal movement or displacement.
- No visible voids, sliding, rotation, or loss of underlying support beneath the protection.
- Protection fully covers the channel bed and lower bank within the protected area.
- Minor inherent irregularities in stone placement are present but do not reduce protective performance.
- Channel protection is functioning as intended to resist erosion and hydraulic forces.



7 – Good – Some Minor Defects

Notes:

- Concrete headwall and apron are intact and properly aligned with the channel.
- Protection elements show no visible cracking, rotation, or differential movement.
- Minor surface weathering and edge irregularities are present but do not compromise protective function.
- Protection transitions to the natural channel are stable with no visible flanking or bypassing.
- Channel protection remains hydraulically effective with only minor observable defects.



Examples of Channel Protection Ratings 4 – 6

6 – SATISFACTORY – Widespread minor or Isolated moderate defects.

Notes:

-Riprap protection has been displaced along the left side of the protection area, reducing continuous coverage.

-Several stones show loss of interlock and partial movement, indicating reduced stability.

-Underlying soil is **locally** exposed beneath the protection layer, indicating loss of support to the system.

-Protection at the toe is partially compromised, **but the majority of the protection remains in place.**

-Channel protection is still providing partial erosion resistance, but defects are moderate and may progress without maintenance.



4-Widespread moderate or isolated major defects; performance of channel protection is affected

Notes:

-Riprap protection has been displaced along the full length of the protected area.

-Large areas of the protection layer have lost embedment and interlock, resulting in widespread instability.

-Extensive exposure of underlying soil and filter material is present.

-Flow is bypassing, flanking, and undercutting the protection layer, preventing it from functioning as intended.

-Channel protection performance is significantly reduced, and



continued erosion is likely without corrective action.

Examples of Channel Protection Ratings 0 – 3

3 - SERIOUS - Major defects; performance of channel protection is seriously affected. Condition typically necessitates more frequent monitoring or corrective actions.

Notes:

- Concrete apron protection shows full-length loss of toe support, with visible voids beneath.
- Protection has lost continuous contact with the underlying channel bed, indicating failure of the support interface.
- Flow is passing beneath and along the edges of the apron, bypassing the protective function.
- Large portions of the protection system are no longer resisting erosive hydraulic forces.
- Channel protection performance is severely compromised and continued rapid deterioration is likely without immediate corrective action.



0 – FAILED – Channel protection is beyond repair and must be replaced.

Notes:

- Channel protection system has suffered complete loss of embedment, alignment, and load transfer.
- Large segments of the protection have separated, rotated, or collapsed out of their intended position.
- Underlying soil and filter layers are extensively exposed and eroding, indicating total loss of protective function.
- Protection is no longer capable of dissipating energy or controlling erosion at the crossing.
- Channel protection system is beyond repair and requires full replacement to restore protective function.



Scour Condition Rating (SNBI - B.C.11.)

Assessment Objective: Assess the extent of scour around bridge components (piers, abutments, foundations) to determine potential risks to structural integrity.

What to Look for in Bridges:

- Evidence of scour holes at or around bridge foundations.
- Exposed footings or undermined piers/abutments.
- Loss of supporting foundation material due to water flow.
- Signs of past scour remediation efforts and their current effectiveness.
- Sediment movement or void development affecting the structure's stability.
- Variations in hydraulic flow patterns increase scour potential.

What to Look for in Culverts/Pipes:

- Undermining of culvert floors
- Crushed, separated, or distorted pipe sections
- Loss of supporting foundation material beneath the barrel due to water flow.
- Signs of past scour remediation efforts and their effectiveness.
- Inlet/outlet side undermining
- Settlement, sagging, or vertical displacement of the culvert/barrel

Base slab undermined

Notes:

-Loss of supporting material beneath the concrete base slab is clearly visible along the slab edge.

-A continuous void is present under the slab, indicating active or recent scour.

-Flow is passing beneath the slab rather than over a supported subgrade, confirming loss of load-bearing support.

-Edge of slab is fully exposed, with no soil contact along the undermined portion.



-Scour is occurring directly at a primary structural support element (the culvert footing).

Undermining on pipe culvert

Notes:

- Severe loss of backfill and foundation material at the inlet end of the pipe culvert.
- Pipe barrel is partially unsupported, with visible voids beneath and around the structure.
- Headwall and surrounding soil have been outflanked, allowing water to bypass the intended flow path.
- Scour has progressed to the point that load transfer from the pipe to the surrounding soil is compromised.
- Adjacent roadway embankment material has been undercut and displaced by flow.



Crushed Pipe

- Pipe barrel exhibits cross-sectional deformation and collapse.
- Loss of uniform shape indicates failure of structural capacity, likely due to loss of external soil support and hydraulic forces.
- Invert is irregular and distorted, reducing hydraulic capacity.
- Evidence of scour-related support loss and internal hydraulic loading contributing to structural failure.
- Barrel is no longer capable of safely carrying flow at design conditions.



Examples of Scour Condition Rating 7 – 9

8 - Insignificant scour.

Notes:

- Channel bed at the culvert outlet is stable with no measurable scour holes at the structural elements.
- No exposure of footings, aprons, or foundation elements is observed.
- Natural bed material is intact and in contact with structural surfaces.
- Minor natural irregularities in the streambed are present but do not indicate active scour.
- No evidence of voids, undercutting, or loss of supporting material at the structure.



7 - Some minor scour.

Notes:

- Localized shallow scour is present around one or more piers.
- Scour depths are minor and do not extend far from the pier.
- No exposure of footing bottoms or loss of bearing support is observed.
- Scour appears stable with no indicators of rapid progression at the time of inspection.
- Surrounding bed material remains in contact with the majority of the foundation surfaces.



Examples of Scour Condition Rating 4 – 6

6 - Widespread minor or isolated moderate scour.

Notes:

- Moderate scour is present around one bent.
- Scour hole is clearly visible and measurable but limited to a small area.
- Foundation elements remain supported at this time.
- No signs of rapid widening or deepening were observed.
- Scour is documented for baseline comparison at future routine inspections.



Isolated moderate scour around bent 5.

9/25/2024

4 - Widespread moderate or isolated major scour; strength and/or stability of the bridge is affected.

Notes:

- Bent 1 shows up to 2.5 feet of undermining from the centerline toward the left end.
- Foundation support has been reduced due to scour.
- Scour is deep and extends beneath the structural element.
- Remaining support is not uniform across the bent.



Bent 1 is up to 2.5' undermined from centerline to left end 4-28-2025

-Continued scour could further weaken structural stability.	
---	--

Examples of Scour Condition Rating 0 – 3

3 - Major scour; strength and/or stability of the bridge is seriously compromised. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

Notes:

- Bent 2 shows deep scour directly beneath the foundation.
- Scour extends about 2.7 feet downward and 3 feet underneath the bent.
- Foundation support has been significantly reduced.
- Scour is actively affecting the stability of the bent.
- Condition meets the threshold for serious scour and requires corrective action planning and increased attention.



Bent 2 scour up to 2'-7" down and 3' back under 5-12-2025

5/12/

0 - Bridge is closed due to scour condition and is beyond corrective action. Bridge replacement is needed to restore service.

Notes:

- Severe scour has completely removed support at both abutments.
- Structural support has failed, and the bridge is no longer stable.
- The bridge is closed to traffic due to loss of structural integrity.



Bridge has failed and is closed.

-Scour damage is beyond repair, and full bridge replacement is required to restore service.	
---	--

Field Rules of Thumb

Spread footings:

- A spread footing that is properly keyed into competent, non-erodible rock is generally the most stable condition and typically less susceptible to progressive scour.
- A spread footing that is not keyed into non-erodible rock or is keyed into erodible material should be closely monitored for progression of undermining.
- If construction practices were not properly followed, rock layers may have been fractured during excavation or placement, leaving material more vulnerable to scour than originally intended.
- A spread footing that has lost approximately 20–30% of its effective bearing area due to scour or undermining shall be referred to the Scour Team for immediate engineering evaluation.
- A spread footing at which detailed substructure undermining measurements cannot be safely or accurately obtained through normal wading, probing, or visual methods shall be requested for advanced evaluation by the Scour Team immediately.

Pile Bents:

- Because piles in a pile bent have designed pile length exposed, visual exposure alone does not indicate scour unless there is additional loss of surrounding ground surface below original grade.
- A pile bent where the original ground line is still intact at the base of the piles and no loss of surrounding material is observed is generally considered stable.
- Scour at a pile bent is indicated by:
 - Lowering of the ground line below original grade
 - Formation of a scour hole around the pile group
 - Loss of surrounding soil that previously provided lateral support.
- If only 25% of original embedment remains, the bent shall be flagged for Scour Team review.
- If scour results in:
 - Loss of lateral support over a continuous vertical length
 - Visible pile movement, bending, or misalignment
 The bent shall be referred to the Scour Team for immediate evaluation.
- If original ground line cannot be reliably determined, the bent shall be requested for evaluation by the Scour Team.

Pile Caps with Pile Groups:

- These foundations are considered stable when:

- The pile group remains adequately embedded
 - There is no unusual tilt, cracking, or displacement at the column–cap interface.
- Any exposure of pile shafts beneath or adjacent to the cap that was *not* part of the original design condition is treated as evidence of scour.
- Minor pile exposure within the group (e.g., small area of shaft visible, but overall embedment still appears adequate) shall be documented and monitored.
- Exposure of multiple piles within the group, or exposure that indicates a reduction in embedment or lateral confinement of the pile group, shall be flagged for Scour Team engineering review, even if the cap itself shows no visible distress.
- If you observe:
 - Voids or washout around the pile group
 - Differential movement, cracking, or rotation at the column–cap or cap–pile connection
 - Evidence that the pile group is no longer acting uniformly
the foundation shall be referred to the Scour Team for immediate evaluation.
- If pile group conditions beneath or around the cap cannot be safely or accurately assessed (deep water, heavy debris, limited visibility), the structure shall be requested for advanced evaluation by the Scour Team immediately.

These rules of thumb are intended for field screening and consistency of visual assessments. Final structural capacity determinations shall be based on engineering analysis when significant undermining or pile exposure is observed.

Action Matrices

Channel Condition (B.C.09) – Action Matrix

Rating	Channel Condition Status	Inspection Action	Engineering / Maintenance Action
9–7	Stable to Minor Defects	Routine inspection	No action beyond documentation
6	Moderate Defects, Not Threatening	Routine inspection	Track as baseline condition
5	Moderate Defects, Trending	Baseline tracking only	Engineering review as needed
4	Actively Threatening Channel Instability	Increased observation	Engineering evaluation recommended
3	Serious Channel Instability	Frequent observation	Corrective action planning required
0	Channel Failure	Emergency response	Full replacement or realignment

Channel Protection (B.C.10) – Action Matrix

Rating	Protection Status	Inspection Action	Engineering Action
9–7	Fully Functional / Minor Defects	Routine inspection	None
6	Moderate Defects	Routine inspection	Maintenance planning as needed
5	Protection Performance Degrading	Baseline tracking only	Engineering review recommended
4	Protection Not Performing as Intended	Increased observation	Engineering evaluation required
3	Protection System Failing	High-priority inspection	Immediate corrective planning
0	Protection Failed	Emergency response	Full replacement required

Scour Condition (B.C.11) – Action Matrix

Rating	Scour Severity	Inspection Action	Scour Team / Engineering Action
--------	----------------	-------------------	---------------------------------

9-7	None to Minor Scour	Routine inspection	None
6	Moderate Scour, Support Intact	Routine inspection	Baseline tracking only
5	Moderate Scour, Trending	Supervisor awareness	Scour Team review as needed
4	Support Reduced	Increased inspection	Engineering evaluation required
3	Serious Loss of Support	Emergency inspection	Immediate Scour Team involvement
0	Structural Failure	Emergency response	Full replacement required

Field Pocket Guide

Spread Footings

- Keyed into solid rock = most stable
- Not keyed or in erodible material = monitor
- 20–30% bearing loss = Scour Team immediately
- If you can't measure safely = Scour Team

Pile Bents (Inline Piles, Originally Exposed)

- Original exposure $\neq$ scour
- Lowered ground line = scour
- 25% of original embedment is gone = Scour Team
- Bending/misalignment = Immediate evaluation

Pile Caps with Pile Groups

- Cap only transfers load to piles
- Any new pile exposure = monitor
- Multiple exposed piles with 25% of original embedment is gone = Scour Team
- Voids, cracking at column-cap or cap-pile interface = Immediate evaluation

***You can only use these percentages of pile embedment if the pile depths are known from pile driving records, design plans are not acceptable.**

GLOBAL SAFETY RULE

If you cannot safely verify support conditions, contact the Scour Team for evaluation immediately.

Scour Element Guide: Long Explanations

Defect	CS1	CS2	CS3	CS4
Aggradation	Small, stable deposits of bed material present (vertically: <1 ft or <10% of the local flow depth at design flow), (longitudinally: less than one pier width and doesn't extend beneath or past the downstream face of the substructure unit). No meaningful reduction in hydraulic opening. No observable flow acceleration, eddying, or jetting toward substructure units. Shows no evidence of frequent mobilization, reshaping, or scour around its margins. No associated local or contraction scour.	Moderate deposits of bed material present (vertically: >1ft or 10%-20% of the local flow depth at design flow, but no excessive relative to channel depth), (longitudinally: equal to or slightly greater than one pier width but does not extend significantly beyond the downstream face of the substructure unit. Causes a minor reduction in the effective hydraulic opening, up to 10% locally. May result in localized changes in flow patterns, including mild acceleration or eddying, but does not create strong jets or concentrated flow impinging directly on substructure units. May show limited reshaping or partial mobilization during higher flows but does not exhibit frequent or complete removal. Minor localized bed disturbance may be present. No defined or advancing scour holes observed at piers, abutments, or other substructure units.	Significant aggradation deposits of bed material present (vertically: 20-35% of the local flow depth at design flow), (longitudinally: exceeds one pier width and may extend beneath or beyond the downstream face of the substructure unit, affecting tailwater. Causes a notable reduction in the effective hydraulic opening (generally between 10-20% locally). Results in measurable flow acceleration, eddying, or jetting directed toward piers, abutments, or pile groups. May produce backwater effects or contraction of flow through the opening during high flow events. Deposit is partially unstable, showing evidence of periodic mobilization, reshaping, or removal during higher flows. Sudden loss or redistribution of material could result in increased velocities and scour potential at foundations. Localized scour holes may	Extensive aggradation deposits present (vertically: 35% or higher of the local flow depth at design flow), (longitudinally: deposit length is multiple pier widths and/or extends beneath and beyond the substructure unit such that it affects movement of water through the opening and tailwater conditions. Causes a major reduction in effective hydraulic opening (generally greater than 20% locally). Produces significant backwater through the bridge opening and/or produces strong flow concentration and persistent eddies within the opening. Deposit is unstable or actively changing, with evidence that it is frequently reshaped or mobilized during higher flows or deposit is persistent and permanent until removed, restricting water flow over time.

			be present or actively developing at or near affected substructure units.	
Degradation	Bed lowering or degradation hole depth is <1ft or <10% of the local depth at design flow, whichever is less. Limited in longitudinal extents generally < one pier spacing (or <1-2 channel widths where pier spacing is not applicable). Laterally, the degradation is confined to the active channel and does not show signs that the entire channel is cutting downward over a long distance. Stable with no evidence of active progression, headcut migration, or rapid reshaping since the last inspection. No visible signs that the channel is becoming unstable, such as new side channels forming, the main flow shifting out of its normal path, or widespread bank erosion caused by channel cutting downward.	Bed lowering or degradation hole depth is >1ft or 10%-20% of the local depth at design flow, but not excessively relative to overall channel depth. Degradation extends beyond isolated features, generally > one pier spacing (or >1-2 channel widths where pier spacing is not applicable), but is still limited to the immediate bridge area and does not continue for long distances upstream or downstream. Laterally, the degradation remains primarily within the active channel but shows indications that the channel bed is lowering over a longer distance upstream or downstream of the bridge. The condition may show early signs of progression including minor headcut development or noticeable reshaping since the last inspection but does not indicate rapid or uncontrolled change. May be early signs of channel instability, such as localized bank erosion related to bed	Bed lowering or degradation hole depth is >20%-35% of the local depth at design flow or is clearly large relative to the overall channel depth. Degradation extends well beyond the immediate bridge area, generally over multiple pier spacings (or several channel widths where pier spacing is not applicable). Laterally, the degradation is no longer confined to isolated low spots, and the channel shows clear signs that the bed is lowering over a long distance upstream and/or downstream of the bridge. The condition shows active progression including headcut migration, repeated reshaping since the last inspection, or noticeable depending on the main channel. Clear signs of channel instability, such as ongoing bank erosion caused by bed lowering, noticeable shifts in the main flow path, or formation of multiple flow	Bed lowering or degradation hole depth is >35% of the local depth at design flow, or the channel bed has lowered enough that it clearly controls how water moves through the reach during high flows. Degradation extends far upstream and downstream of the bridge, over a long continuous reach, rather than being limited to the bridge area. Laterally, degradation affects most or all of the active channel, with clear evidence that the entire channel is cutting downward, not just isolated areas. The condition shows ongoing and rapid progression, including active headcut migration, frequent reshaping, or continued deepening observed since the last inspection. Strong and widespread signs of channel instability, such as extensive bank erosion caused by bed lowering, major shifts in the main flow path, or the stream actively creating and

		lowering, minor shifts in the main flow path, or early signs of the stream starting to split or form small side flow paths, but the channel remains generally aligned and functional.	paths or developing side channels. The channel condition indicates continued degradation is likely during future high flow events.	abandoning multiple side channels. The channel condition indicates continued and potentially accelerating degradation during future high flow events.
Debris	Small debris (<0.5' diameter) is present in the channel. 0-5% of the effective flow area obstructed. Debris is free flowing or lightly deposited and not in contact with piers, abutments, or other substructure units. No observable scour associated with debris.	Medium sized debris (0.5' - 1') diameter) is present in the channel. Up to 10% of the effective flow area obstructed. Debris may collect in small bundles at the upstream face of piers, but accumulation is intermittent and may wash away during higher flows. Minor local bed disturbance possible, but no significant scour holes observed.	Large sized debris (>1' diameter) is present in the channel, including logs or large wood material. Up to 20% of the effective flow area obstructed. Debris is firmly lodged in large bundles at the upstream side of piers or substructure units. Localized scour may be present or developing at debris locations. Removal would likely require heavy equipment or specialized operations.	Large sized debris accumulations comparable to CS3. Significant obstruction of flow, often exceeding 20% locally. Debris is firmly entrenched against substructure units. Well-defined scour holes observed at or around debris bundles, potentially exposing footing, piles, or undermining foundations. Condition may warrant urgent evaluation or countermeasure consideration.
Local Scour	Piles: <10% of original embedment depth lost Minor embedment loss locally at one or more piles at a pile bent should not significantly decrease bearing or unbraced length. Spread Footings: Forces are evenly distributed to the soil/rock and bearing capacity of the	Piles: 10-19% of the original pile embedment depth lost Moderate embedment loss locally is starting to create a fixity issue or bearing issue. For very short piles the unbraced length may be an issue but for >25ft piles this is not critical. Spread Footings: 10% undermining	Piles: 20-24% of the original pile embedment depth lost Major localized scour has progressed to a need for countermeasures or Scour Plan of Action for more frequent monitoring. At this percentage, fixity, bearing, and unbraced length is no longer appropriate.	Piles: 25% of the original pile embedment depth lost Structural review is required to determine stability. Spread Footings: >30% undermining Forces are evenly distributed to the soil/rock. AND/OR The centroid has moved >1" in the x-axis or y-axis

	footing is as designed or original.	Forces are generally evenly distributed to the soil/rock and bearing capacity of the footing is close to designed or original. AND/OR The centroid is same as original.	Spread Footings: 20% - 30% undermining Forces are not evenly distributed to the soil/rock. AND/OR The centroid has moved 1" in the x-axis or y-axis when looking at plan view of footing. Substructure unit is at moderate risk of overturning.	when looking at the plan view of the footing. Substructure unit is at high risk of overturning.
Contraction Scour	Less than 4' of overall stream degrading. Minor contraction effects with little to no channel instability. Flow acceleration is present but not causing significant bed lowering. Channel bed remains relatively stable with only slight localized scour. No exposure of foundation or piles. Banklines remain intact with minimal signs of stress. Sediment transport appears balanced (no excessive deposition or erosion).	4' to 6' of overall stream degrading. Noticeable contraction effects causing moderate flow acceleration. Channel bed lowering is evident, especially near the structure opening. Initial exposure of pile caps or shallow foundation elements may begin. Banks may show minor sloughing or increased erosion near the constriction. Sediment transport is becoming unbalanced (more material being carried downstream). Flow alignment may begin shifting toward areas of least resistance.	6'-8' of overall stream degrading. Significant contraction scour with pronounced bed degradation through the structure. High-velocity flow concentrated through the opening, increasing erosive forces. Piles or footings partially exposed; embedment depth is being reduced. Channel cross-section is actively adjusting (widening or deepening). Banks show moderate to severe erosion, especially upstream of the constriction. Evidence of headcutting or downstream propagation of scour. Flow patterns may become turbulent and less uniform.	>8' of overall stream degrading. Severe contraction scour with major channel instability. Substantial bed lowering throughout the constricted reach. Foundations or piles significantly exposed, risking loss of structural support. Possible undermining of abutments or piers. Channel may be actively incising and widening, with unstable banks. Flow is highly concentrated and erosive, often bypassing intended flow paths. Sediment transport is highly imbalanced, with aggressive downstream erosion. Potential for rapid failure during high-flow events

Runoff erosion	Embankment fully covers abutments as designed or original. • Indicates no erosion issues. • Abutments are still protected as intended.	Embankment covers most of the abutments as designed or original. Pile bents have mild reeling coming from abutments. • Shows early erosion. • Some material has moved, but exposure is mild and limited.	Embankment has lost most covering abutments as designed or original. Pile bents have multiple deep reels coming from some piles. • Moderate to advanced erosion. • Abutment coverage is significantly reduced. • Pile bents show deeper, more concerning material loss.	Embankment has lost all covering abutments as designed or original. Pile bents are significantly exposed. • Severe erosion condition. • Full loss of protective embankment. • Pile bents visibly exposed and at higher risk.
-----------------------	--	---	---	--

Scour Element Guide: Bullet Point Chart

Defect	CS1	CS2	CS3	CS4
---------------	------------	------------	------------	------------

Aggradation	☐ Small, stable bed-material deposits: • Vertical size: <1 ft or <10% of local flow depth at design flow • Longitudinal size: less than one pier width; does not extend beneath or past downstream face of substructure ☐ Hydraulic impact: • No meaningful reduction in hydraulic opening • No observable flow acceleration, eddying, or jetting toward substructure ☐ Stability: • No evidence of frequent mobilization, reshaping, or scour around margins ☐ Scour: • No associated local or contraction scour	☐ Moderate bed-material deposits: • Vertical size: >1 ft or 10–20% of local flow depth at design flow (not excessive relative to channel depth) • Longitudinal size: equal to or slightly greater than one pier width; does not extend significantly beyond downstream face of substructure ☐ Hydraulic impact: • Minor reduction in effective hydraulic opening (up to 10% locally) • Possible localized flow changes: mild acceleration or eddying; no strong jets or concentrated flow toward substructure ☐ Stability: • May show limited reshaping or partial mobilization during high flows, not frequent or complete removal • Minor localized bed disturbance may be present ☐ Scour: • No defined or advancing scour holes at piers, abutments, or other substructure units	☐ Significant aggradation deposits: • Vertical size: 20–35% of local flow depth at design flow • Longitudinal size: exceeds one pier width; may extend beneath or beyond downstream face, affecting tailwater ☐ Hydraulic impact: • Notable reduction in effective hydraulic opening (10–20% locally) • Measurable flow acceleration, eddying, or jetting toward piers, abutments, or pile groups • May cause backwater effects or flow contraction during high flows ☐ Stability: • Partially unstable; evidence of periodic mobilization, reshaping, or removal during high flows • Sudden loss or redistribution could increase velocities and scour potential at foundations ☐ Scour: • Localized scour holes may be present or actively developing near affected substructure units	☐ Extensive aggradation deposits: • Vertical size: $\geq 35\%$ of local flow depth at design flow • Longitudinal size: spans multiple pier widths; extends beneath and beyond substructure, affecting water movement and tailwater conditions ☐ Hydraulic impact: • Major reduction in effective hydraulic opening ($>20\%$ locally) • Significant backwater through bridge opening • Strong flow concentration and persistent eddies within opening ☐ Stability: • Unstable or actively changing; frequently reshaped or mobilized during high flows • May be persistent and permanent until removed, restricting flow over time
Degradation	☐ Bed lowering/degradation:	☐ Bed lowering/degradation: • Depth: >1 ft or 10–20% of local flow depth at design	☐ Bed lowering/degradation: • Depth: >20–35% of local flow depth at design flow	☐ Bed lowering/degradation: • Depth: >35% of local flow depth at design flow,

	• Depth: <1 ft or <10% of local flow depth at design flow (whichever is less) • Longitudinal extent: generally < one pier spacing (or <1–2 channel widths if pier spacing not applicable) • Lateral extent: confined to active channel; no signs of widespread channel cutting ☐ Stability: • Stable; no evidence of active progression, headcut migration, or rapid reshaping since last inspection • No visible signs of channel instability (e.g., new side channels, main flow shifting, widespread bank erosion)	flow (not excessive relative to overall channel depth) • Longitudinal extent: > one pier spacing (or >1–2 channel widths if pier spacing not applicable); limited to immediate bridge area, not long distances upstream/downstream • Lateral extent: primarily within active channel; indications of bed lowering over a longer distance upstream/downstream ☐ Stability: • Early signs of progression: minor headcut development or noticeable reshaping since last inspection • No rapid or uncontrolled change ☐ Channel condition: • Possible early signs of instability: localized bank erosion related to bed lowering, minor shifts in main flow path, or small side flow paths forming • Channel remains generally aligned and functional	or clearly large relative to overall channel depth • Longitudinal extent: extends well beyond immediate bridge area; generally multiple pier spacings or several channel widths • Lateral extent: no longer confined to isolated low spots; bed lowering evident over long distances upstream and/or downstream ☐ Stability: • Active progression: headcut migration, repeated reshaping since last inspection, or noticeable deepening of main channel ☐ Channel condition: • Clear signs of instability: ongoing bank erosion caused by bed lowering, noticeable shifts in main flow path, formation of multiple flow paths or developing side channels • Continued degradation likely during future high-flow events	or channel bed lowering clearly controls water movement during high flows • Longitudinal extent: far upstream and downstream of bridge; long continuous reach, not limited to bridge area • Lateral extent: affects most or all of active channel; entire channel cutting downward, not isolated areas ☐ Stability: • Ongoing and rapid progression: active headcut migration, frequent reshaping, continued deepening since last inspection ☐ Channel condition: • Strong, widespread instability: extensive bank erosion from bed lowering, major shifts in main flow path, formation and abandonment of multiple side channels • Continued and potentially accelerating degradation likely during future high-flow events
Debris	☐ Small debris: • Size: <0.5 ft diameter	☐ Medium debris: • Size: 0.5–1 ft diameter	☐ Large debris:	☐ Extensive debris accumulations:

	- Obstruction: 0–5% of effective flow area □ Location/Condition: - Free-flowing or lightly deposited - Not in contact with piers, abutments, or other substructure units □ Impact: - No observable scour associated with debris	- Obstruction: up to 10% of effective flow area □ Location/Condition: - May collect in small bundles at upstream face of piers - Accumulation is intermittent; may wash away during higher flows □ Impact: - Minor local bed disturbance possible - No significant scour holes observed	- Size: >1 ft diameter (includes logs or large wood material) - Obstruction: up to 20% of effective flow area □ Location/Condition: - Firmly lodged in large bundles at upstream side of piers or substructure units □ Impact: - Localized scour may be present or developing at debris locations - Removal likely requires heavy equipment or specialized operations	- Size: large wood material, comparable to CS3 - Obstruction: significant, often >20% of effective flow area □ Location/Condition: - Firmly entrenched against substructure units □ Impact: - Well-defined scour holes at or around debris bundles - Potential exposure of footing, piles, or undermining of foundations - Condition may warrant urgent evaluation or countermeasure consideration
Local Scour	Piles: < 10% of the original pile embedment depth lost Spread Footings: - Scour hole has not exposed top of footing - Centroid is not affected	Piles: 10 - 20% of the original pile embedment depth lost Spread Footings: - Scour hole is within the limits of the footing - Centroid is not affected	Piles: 20 – 25% of the original pile embedment depth lost Spread Footings: - Footing is 20 – 30% undermined - Centroid has moved 1”	Piles: 25% of the original pile embedment depth lost Spread Footings: - Footing is >30% undermined - Centroid has moved >1”
Contraction Scour	Less than 4’ of overall stream degrading	4’ to 6’ of overall stream degrading	6’ -8’ of overall stream degrading	>8’ of overall stream degrading
Runoff Erosion	Erosion/instability that does not impact the bridge or approach roadway.	Erosion/instability is present and showing minor progression but remains a safe distance from the bridge or approach roadway.	Significant erosion/instability that is progressing toward the bridge or approach roadway.	Stability of the approach roadway embankment is impacted.
Riprap or Other Revetment	Revetment has no evidence of deterioration or segregation of sizes; and the distribution of stone sizes and there is no evidence of displacement of individual stones	Evidence of some deterioration of stones due to surficial weathering (abrasion, freeze-thaw or wet-dry spalling) or minor decrease in overall layer thickness is evident; geotextile or granular filter has NOT been exposed	Individual stones are rounded in shape due to significant deterioration or significant decrease in overall layer thickness is evident in local areas and the geotextile or granular filter has been exposed in local areas	Revetment installation is eroded and can no longer serve its function. Immediate maintenance is required.



Bridge Inspection Guidelines

8.B SNBI Q&A

SNBI Questions and Responses

- Q: For a bridge with column bents, pile caps, and steel H-piles, what is the Foundation Type?
A: Code SNBI Item B.SB.06 – Foundation Type as “P01 Pile – steel H-shape”. The “footing” foundation types are for shallow foundations that transfer the loads directly to the soil/rock. This bridge has a deep foundation where the loads are transferred through the pile cap, then through the piles to the rock layer below.

- Q: For SNBI Item B.SP.06 – Span Type, what do we code solid sawn timber girders?
A: Code B.SP.06 as “GX Girder/Beam – other” for timber girders.

- Q: How to code 4 barrel galvanized corrugated steel pipe culvert with welded seams?
A:

Span Units:

B.SP01A Span Set Designation	Culvert	B.SP01B Span Set Number	1
B.SP02 Number of Spans	4	B.SP03 Number of Beam Lines	0
B.SP04 Span Material	Steel – welded	B.SP05 Span Continuity	Buried
B.SP06 Span Type	Pipe - Flexible	B.SP07 Span Protective System	Coating – galvanizing/metallizing
B.SP08 Deck Interaction		B.SP09 Deck Material and Type	
B.SP10 Wearing Surface		B.SP11 Deck Protective System	
B.SP12 Deck Reinforcing Protective System		B.SP13 Deck Stay-In-Place Forms	

Substructure Units: Leave Blank

SUBSECTION 2.2: SUBSTRUCTURE MATERIAL AND TYPE

The data items in this subsection identify the substructure and foundation material(s) and type(s) for the bridge and are considered part of the Substructure Data Set. These data items have a many-to-one relationship with a bridge when applicable.

Data items for this subsection are reported for each substructure configuration present in the bridge. A substructure configuration characterizes all substructure units that have the same material, type, and foundation type. One or more substructure sets are reported for a bridge when applicable. Substructures of similar configuration do not need to be adjacent to be reported in the same data set.

These data items are not reported when Item B.SP.06 (Span Type) is a pipe (i.e. code P01 or P02). Deck and superstructure are not otherwise considered in the determination of a substructure set.

The data for items in this subsection typically remain static once a bridge has been inventoried. The following data items are included in this subsection.

Item ID	Data Item
B.SB.01	Substructure Configuration Designation
B.SB.02	Number of Substructure Units
B.SB.03	Substructure Material
B.SB.04	Substructure Type
B.SB.05	Substructure Protective System
B.SB.06	Foundation Type
B.SB.07	Foundation Protective System

- Q: Is boiled linseed oil considered as a type of deck protection?
A: Yes, code SNBI Item B.SP.11 – Deck Protective System as “CX Coating – other” for boiled linseed oil.
- Q: For SNBI Item B.G.12 – Curved Bridge, how do we code a horizontally curved slab span bridge?
A: Code B.G.12 as “CU Curved Girder”. This allows for consistency with B.SP.03 – Number of Beam Lines being coded as 1 for slab span bridges and meets the intent of the curved bridge field.
- Q: For SNBI Item B.G.13 – Maximum Bridge Height, do we update every inspection with a new water elevation?

SNBI Questions and Responses

A: No, this item only needs to be filled once.

SECTION 3: BRIDGE GEOMETRY

The data items in this section provide geometric data for bridges and are considered part of the Primary Data Set. These data items have a one-to-one relationship with a bridge.

The data for these items typically remain static once a bridge has been inventoried. The following data items are included in this section.

7. Q: For SNBI Item B.G.13 – Maximum Bridge Height, how do we code culvert structures?

A: For culverts and bridges with fill on top, excluding closed spandrel arches, the reported value for B.G.13 is measured from top of pipe or top of slab (in the case of three- and four-sided frames), to the water surface elevation. When there is no waterway feature, the measurement is taken to the inside bottom of pipe, inside of bottom slab, or ground line when the bottom is not exposed or the structure is bottomless.

For closed spandrel arches the reported value is measured from road surface. By future errata to the SNBI we intend to add this clarification and change the commentary from “Ground line represents dry terrain, pavement, or waterway bottom” to “Ground line represents dry terrain or pavement”.

We view this item as having multiple uses in support of bridge inventory and inspection management. Examples include serving as an approximate indicator to assist in identifying inspection access equipment needs, sizing of bridges for cost estimation (e.g., preservation, rehabilitation, and replacement), informing network-wide seismic vulnerability assessment, etc. With respect to access equipment needs, the reported value either large or small can be indicative of needs, e.g., small values are indicative of headroom constraints.

8. Q: For SNBI Item B.SB.06 – Foundation Type, do we code a footing as “F02 Footing – On Rock” if it is keyed into shale?

A: B.SB.06 is coded as “F02 Footing - On Rock” if the footing on shale (rock) is designed or engineered. That is, if a designer has determined the shale to be competent for footing design and installation, then for purposes of the SNBI this can be considered a footing on rock.

When determining the competency of a footing on shale (rock), the engineer must evaluate and satisfy multiple foundation requirements including that of strength, serviceability, stability, and rock durability and erodibility within its environment over the life of the structure. For example, in the case of a bridge over water, the evaluation must consider the potential effects of scour and longer-term degradation of the shale (rock) when making a competence determination.

9. Q: For bridges with transverse steel channel decks like the one in the picture, how do we code SNBI Items B.SP.08 and B.SP.09?

SNBI Questions and Responses



A: Code SNBI Item B.SP.08 – Deck Interaction as “Non-composite”. This creates consistency with Load Rating as they do not count on the channel deck planks to transfer load from one girder to the next.

Code SNBI Item B.SP.09 – Deck Material and Type as “Steel – Other”. None of the other steel deck types accurately describe steel channel decks like this.

10. Q: For steel plate decks on railcar bridges, what do we code SNBI Item B.SP.08 as?

A: If the steel plate deck is acting as the top flange of railcar “girders”, then code SNBI Item B.SP.08 – Deck Interaction as “Integral or Monolithic”.

11. Q: For the purposes of rating SNBI Items B.RH.02 and B.C.06, what are the limits of the “transition railings”?

A: The limits of the transition railing should be defined on both ends as follows:

For the bridge side of the railing, the transition section starts at the point that the rail type changes (e.g. w-beam meets concrete parapet) or if the rail type is the same for the approach and the bridge it would start at the beginning/end of the bridge.

For the approach side, the transition section starts where the “stiffness” of the rail changes. This would mainly be determined by where the post spacing begins to tighten from the normal spacing of the approach guardrail. Or it could be where the rail is doubled up or nested together to stiffen the rail.

SNBI Questions and Responses

In other words, the transition should be distinguishable from the bridge rail and approach rail as it will have different geometry and/or structural stiffness.

Code B.C.06 - Bridge Railing Transitions Condition Rating as “N” when approach guardrail does not attach to the bridge/bridge railing.

12. Q: For SNBI Item B.SP.07 – Span Protective System, what do we code a pipe culvert that utilizes Polymer Coated Pipes?

A: Code SNBI Item B.SP.07 as “Coating – Other” for polymer coated pipes as no other coating accurately describes these pipes.

13. Q: For SNBI Item B.SP.10 – Wearing Surface, what do we code a deck that has a chip seal over it?

A: Code SNBI Item B.SP.10 as “Bituminous (Asphalt)” for chip seals as they include the application of a layer of liquid asphalt binder that seals the driving surface and a layer of aggregate that acts as the wearing surface. This is consistent with our construction spec book which classifies chip seals as an “Asphaltic Surface Treatment”.

If the chip seal has sealing properties that will slow the deterioration rate of the deck, report “X – Other” for B.SP.11 Deck Protective System.

14. Q: For a Reinforced Concrete Deck Girder (T-Beam) bridge that was widened with slabs on both sides, would Item B.SP.03 - Number of Beam Lines be coded as 1 or 2 for the Widened Span Set?

A: For the widened span set, which in this case includes the slabs on both sides of the reinforced concrete deck girder, code B.SP.03 as “1”. This is in line with the Specification for B.SP.03 that indicates to “Report 1 for bridges where Item B.SP.06 (Span Type) is F01, F02, S01, or S02.”

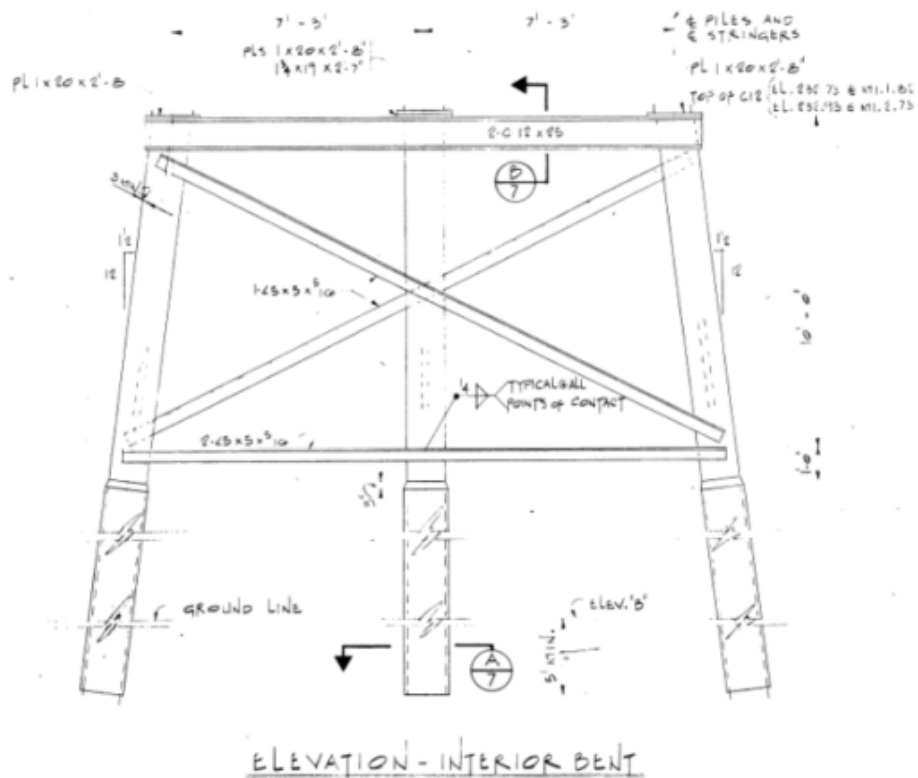
15. Q: For an aluminum culvert like the one pictured below, what do you code B.SP.06 - Span Type?

SNBI Questions and Responses

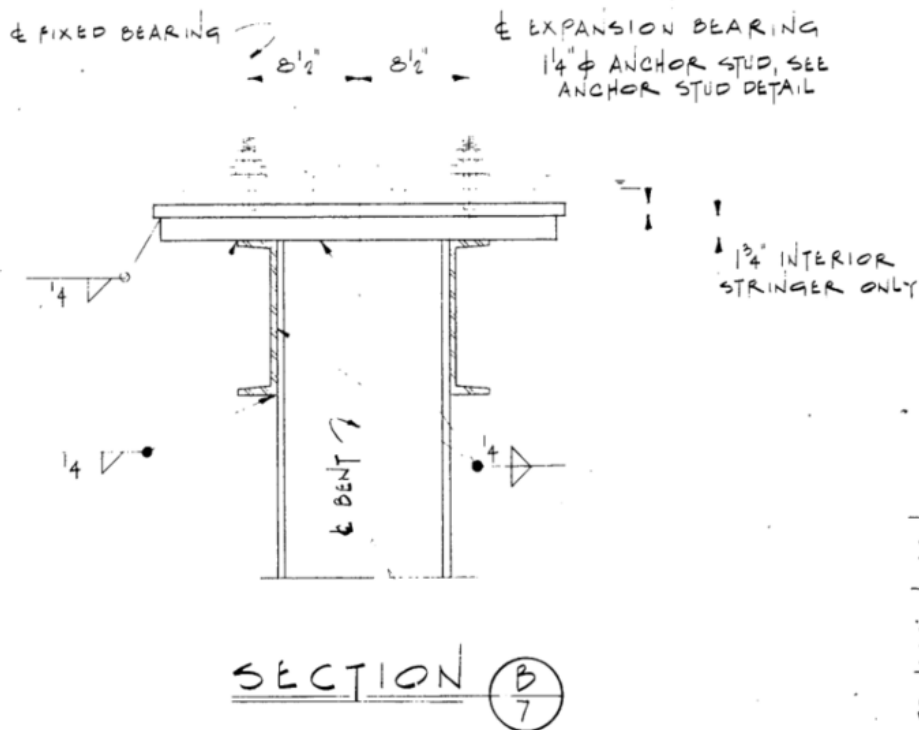


A: Code B.SP.06 as either "F01 - Frame – three-sided" or "F02 - Frame – four-sided" depending on if it is bottomless (three-sided) or has an aluminum or concrete bottom (four-sided).

16. Q: For a bridge with piles that extend all the way to the bottom of the girders (separated by steel plates such as the one shown in the plans below, what do we code B.SB.03?



SNBI Questions and Responses



A: Code B.SB.03 - Substructure Material as "0 - None". This follows with the SNBI guidance of "Use code 0 when the superstructure rests directly on the foundation." Item B.SB.04 - Substructure Type would also be "0 - None" and Item B.SB.05 - Substructure Protective System would be left blank.

17. Q: For Item B.SB.06 - Foundation Type, what do we code precast concrete piles that are conventionally reinforced?

A: Code Conventionally reinforced precast concrete piles as PX Pile – Other.

18. Q: For a bridge with a large number of girders with small spaces between the flanges (like the 4" spaces between flanges in the photo below), do we code Item B.SP.06 - Span Type as "G01 Girder/beam - I-shaped adjacent" or "G02 Girder/beam - I-shaped spread"?

SNBI Questions and Responses



A: Code SNBI Item B.SP.06 as "G02 Girder/beam - I-shaped spread" because it is constructed like a typical multi-girder bridge (just with more closely spaced girders). The "I-shaped adjacent" field is mostly reserved for states that use precast concrete girder shapes in configurations like those in the sketch from the BIRM below:

Deck bulb tee beams, a variation of AASHTO-PCI-certified bulb tee shapes, were developed to provide a beam cross section that would not need a separately placed concrete deck, but would generally have a flexible or rigid overlay placed on the top flange. Using similar geometry as the AASHTO-PCI-certified bulb tee, with the exception of the top flange width (see Figure 9.1.49), these PCI Deck bulb tee beams may be a viable alternative to adjacent box beam superstructures.

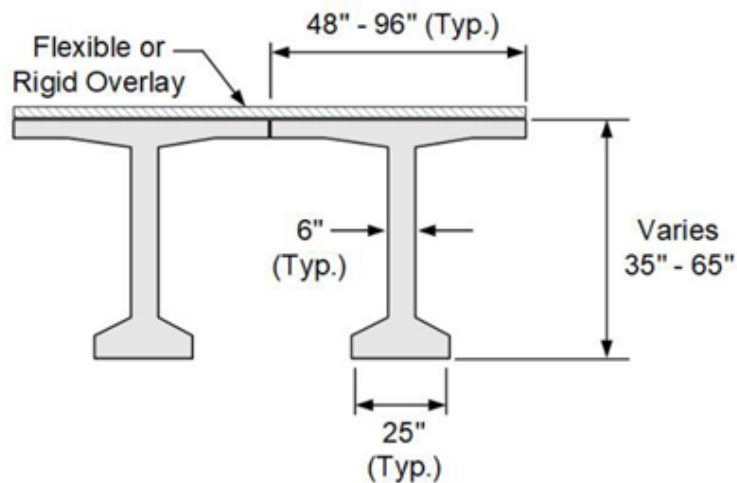


Figure 9.1.49 Cross Section - PCI Deck Bulb Tee Beam



Bridge Inspection Guidelines

9.A CULVERT SCOUR ASSESSMENT WORKSHEET

Every bridge over a waterway carrying public vehicular traffic on the structure with more than 20-ft clear span requires a Scour Appraisal. Pipe culverts and 4-sided boxes will be assessed using the Culvert Scour Assessment Worksheet in Appendix B. Documentation must be done in InspectX, ARDOT's bridge inventory and appraisal data collection system, starting April 01, 2024. Directions are provided in this document.

Scour Appraisal

Scour Appraisals are the risk-based and data-driven determination of a bridge's vulnerability to scour, resulting from the least stable result of scour that is either observed, or estimated through a scour evaluation or a scour assessment. Both field observed scour and office estimated scour must be performed to determine the least stable result. Observed scour results are recorded by inspectors in the inspection report(s). Estimated scour results are recorded by engineering staff on the Scour Appraisal form in InspectX. The terms can best be organized in an outline:

1. Observed Scour **AND**
2. Estimated Scour (which will consist of)
 - a. Scour Evaluations **OR**
 - b. Scour Assessment: All assessments performed will consist of three levels:
 - i. Level A– Stability Screening
Answer all 5 Questions. If all questions are answered “No”, then the Assessment is complete and Specification for the National Bridge Inventory (SNBI) (B.AP.03) Scour Vulnerability code will be assigned accordingly. If any answer is “Yes”, then continue to Level B.
 - ii. Level B – Susceptibility Screening
Answer all 18 Questions. Each answer has a point total. Total points determine a triage-range of three (3) options. If the point total is low or high, then assign the (B.AP.03) Scour Vulnerability code will be assigned accordingly. If the point total is in the middle-range, or inconclusive, then continue to Level C.
 - iii. Level C – Vulnerability Screening
Answer questions progressively in three groups (three (3), eight (8) or eleven (11) questions). Based on the results the appropriate (B.AP.03) Scour Vulnerability code will be assigned.

Observed Scour

Bridge Inspection Team Leaders perform Routine Inspections. All portions of a bridge substructure (Figure 1 and 2) and the surrounding channel to the mudline at low water accessible by wading or probing (Figure 3) are within the scope of each scheduled Routine Inspection. When wading or probing are not safe or feasible during each Routine Inspection then probing from a boat (Figure 4) or snooper bucket are acceptable alternatives when the inspection reaches to the mudline of all substructure units and can adequately determine in-service conditions. When probing and wading is unsafe nor feasible then underwater diving techniques are typically required. Underwater Inspection must not exceed the intervals specified in the ARDOT Bridge Inspection Manual. Channel cross-sections should be taken periodically and compared to original ground line. This provides indications of the presence of contraction scour, lateral stream migration, and long-term degradation.



Figure 1 Undermining of the abutment exposing piles.



Figure 2 Exposed footing with undermining.



Figure 3 Wading and Probing.



Figure 4 Probing from a boat.

Scour Evaluation

Scour Evaluations are performed by a bridge, geotechnical, and/or hydraulic engineer. The purpose of an evaluation is to calculate the depth of potential scour so the foundation can be designed with sufficient depth, stability, and capacity. Hydraulic calculations are commonly performed during early design-stages for new-construction or rehabilitation bridge projects. Scour evaluations are also performed for high-risk in-service bridges (at a minimum) where calculations are not documented. These evaluations provide theoretical scour depths that are compared to in-place foundation depths to determine the bridge's vulnerability to scour, i.e. to determine if the existing bridge scour critical. Refer to the latest ARDOT Bridge Design Guidelines for the scour evaluation and design procedures. The Scour Evaluation results (report with calculations explaining how the structure's vulnerability to scour was determined) must be documented in the POA Scour Assessment/Evaluation Inspection within InspectX after construction of the bridge or after completion of scour evaluation of an existing bridge.

After documenting the Scour Evaluation results, the evaluating engineer must code SNBI B.AP.03 (Scour Vulnerability) as described in the SNBI. When a documented evaluation exists then the Scour Appraisal is complete. If there are no bridge-threatening observed scour defects that demonstrate that the bridge is vulnerable to estimated scour depths, then the evaluating engineer may code SNBI B.AP.03 (Scour Vulnerability) based on the results of the scour evaluation and the descriptions provided. When a stand-alone scour evaluation is performed on an existing bridge (that is missing a documented scour evaluation), if the results show a bridge is vulnerable to scour, a Plan of Action is required.

Table 1 SNBI (B.AP.03) Scour Vulnerability Code

Code	Scour Appraisal	Description
A	A – Scour appraisal completed.	Bridge determined to be stable for scour.
B	B – Scour appraisal completed.	Bridge determined to be stable for scour, dependent upon designed, and functioning countermeasures. • <i>Use code B when designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations.</i> • <i>Use code B when the Scour Appraisal Team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.</i>

C	C – Scour Appraisal completed.	Bridge could become unstable for scour. Temporary (not designed) countermeasures installed to mitigate scour. Bridge is scour critical. Follow POA Requirement. Use code C for bridges that could become unstable for the potential scour, and temporary countermeasures are installed that were not designed.
D	D – Scour Appraisal completed.	Bridge is, or may become, unstable for scour. Bridge is scour critical. Follow POA Requirement.
O	O – Scour appraisal has not been completed.	
E	E – Scour appraisal has not been completed.	Temporary (not designed) countermeasures installed to mitigate scour.
U	U – Scour appraisal has not been completed.	Due to unknown foundations.

Scour Assessment

A Scour Assessment is the determination of a bridge's vulnerability to scour which considers stream stability and scour potential as described in HEC 20 *Stream Stability at Highway Structures 4th Edition* and other scour-related data sources. Based on risk, a Scour Evaluation is required for high-risk structures. All remaining non-high-risk structures over water will have a Scour Assessment. There are three levels of an Assessment. Each Assessment Level is a progressive screening process that affectively documents the scour and directs the assessor in coding the appraisal field (B.AP.03) Scour Vulnerability Code. Legacy Assessments will be accepted; however, it is recommended that the new progressive screening process is completed. The following information is required when completing all types of Assessments in InspectX:

- Scour Assessment Level(s) Performed
 - Level A
 - Level B (Includes Level A)
 - Level C (Includes Level A and B)
 - Other, Documented File or Checklist on File
- Scour Assessment Date
- Countermeasure Type – Countermeasures are material, devices, or structures designed to prevent, slow, or stop the occurrence of scour. Select the most appropriate answer. Refer to HEC 23 – *Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance 4th Edition*, for determining the nature of the countermeasures.
 - Designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations.

- B. Scour Appraisal Team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.
- C. Temporary countermeasures are installed that were not designed. Bridge could become unstable for scour.
- D. None.



Figure 5 Bridge with non-scour-resistant rock.

References

- Specifications for the National Bridge Inventory (https://www.fhwa.dot.gov/bridge/snbi/snbi_march_2022_publication.pdf)
- Scour-Hydraulics – Bridges & Structures – Federal Highway Administration (<https://www.fhwa.dot.gov/engineering/hydraulics/scourtech/>)
- ARDOT Bridge Design Guidelines (<https://www.ardot.gov/wp-content/uploads/2020/11/Bridge-Division-Guidelines.pdf>)
- ARDOT Bridge Inspection Manual (https://www.ardot.gov/wp-content/uploads/2022/05/ARDOT_BIM_20220507.pdf)

APPENDIX B

Item 113 - Scour Critical Box or Pipe Culverts

Bridge No. ___ Date: ___ County: ___

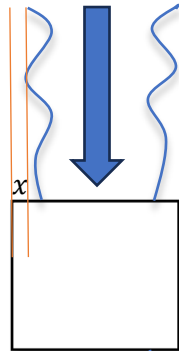
Assessed By: ___ Checked By: ___

Code Description

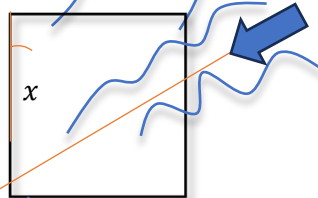
- ☐ **8** Well aligned with channel, hydraulically sized.
- ☐ **5** Not well aligned with channel and no major scour history, or not hydraulically sized/designed.
- ☐ **4** Culvert is in stable condition: Settlement and / or undermining of culvert not endangering the roadway.
- ☐ **3** Culvert is scour critical: extensive settlement and / or undermining under roadway, endangering the roadway.

Examples:

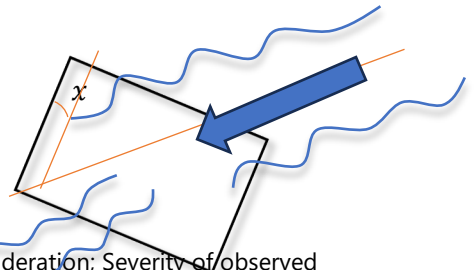
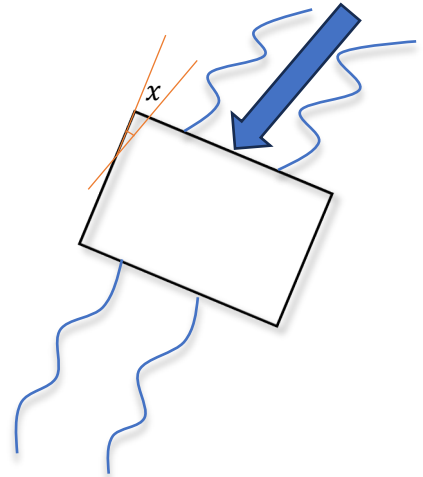
A: Rated number 8
Channel is well aligned.
 $0^\circ \leq x \leq 30^\circ$



B: Rated number 5
Channel is not well aligned.
 $x > 30^\circ$



Culvert Scour Description



Note: If the culvert's stability isn't compromised, flow alignment may not be a consideration; Severity of observed scour conditions should be reflected in '4' and '3' to describe where variance from '8' are appropriate (as well as B.C.04).

Item B.AP.03 – Box or Pipe Culvert Scour Vulnerability

Code Description

- ☐ **O** Channel/Scour appraisal has not been completed.
- ☐ **A** Well aligned with channel, hydraulically sized and no major scour history, Or culvert is not well aligned with channel, not hydraulically sized, but is determined to be stable with no major scour history.
- ☐ **B** Culvert is stable with countermeasures.

*From SNBI Commentary for Scour Vulnerability:

Use code B when designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations. Use code B when the scour appraisal team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.

- ☐ **C** Culvert is scour critical; Use code C for bridges that could become unstable for the potential scour, and temporary countermeasures are installed that were not designed.
- ☐ **D** Culvert is scour critical; Culvert is or may become unstable for scour.
- ☐ **E** Scour appraisal has not been completed. Temporary (not designed) countermeasure installed to mitigate scour.
- ☐ **U** Scour appraisal has not been completed due to unknown foundations.



Bridge Inspection Guidelines

9.B BRIDGE SCOUR ASSESSMENT WORKSHEET

Every bridge over a waterway carrying public vehicular traffic on the structure with more than 20-ft clear span requires a Scour Appraisal. Pipe culverts and 4-sided boxes will be assessed using the Culvert Scour Assessment Worksheet in Appendix B. Documentation must be done in InspectX, ARDOT's bridge inventory and appraisal data collection system, starting April 01, 2024. Directions are provided in this document.

Scour Appraisal

Scour Appraisals are the risk-based and data-driven determination of a bridge's vulnerability to scour, resulting from the least stable result of scour that is either observed, or estimated through a scour evaluation or a scour assessment. Both field observed scour and office estimated scour must be performed to determine the least stable result. Observed scour results are recorded by inspectors in the inspection report(s). Estimated scour results are recorded by engineering staff on the Scour Appraisal form in InspectX. The terms can best be organized in an outline:

1. Observed Scour **AND**
2. Estimated Scour (which will consist of)
 - a. Scour Evaluations **OR**
 - b. Scour Assessment: All assessments performed will consist of three levels:
 - i. Level A– Stability Screening
Answer all 5 Questions. If all questions are answered “No”, then the Assessment is complete and Specification for the National Bridge Inventory (SNBI) (B.AP.03) Scour Vulnerability code will be assigned accordingly. If any answer is “Yes”, then continue to Level B.
 - ii. Level B – Susceptibility Screening
Answer all 18 Questions. Each answer has a point total. Total points determine a triage-range of three (3) options. If the point total is low or high, then assign the (B.AP.03) Scour Vulnerability code will be assigned accordingly. If the point total is in the middle-range, or inconclusive, then continue to Level C.
 - iii. Level C – Vulnerability Screening
Answer questions progressively in three groups (three (3), eight (8) or eleven (11) questions). Based on the results the appropriate (B.AP.03) Scour Vulnerability code will be assigned.

Observed Scour

Bridge Inspection Team Leaders perform Routine Inspections. All portions of a bridge substructure (Figure 1 and 2) and the surrounding channel to the mudline at low water accessible by wading or probing (Figure 3) are within the scope of each scheduled Routine Inspection. When wading or probing are not safe or feasible during each Routine Inspection then probing from a boat (Figure 4) or snooper bucket are acceptable alternatives when the inspection reaches to the mudline of all substructure units and can adequately determine in-service conditions. When probing and wading is unsafe nor feasible then underwater diving techniques are typically required. Underwater Inspection must not exceed the intervals specified in the ARDOT Bridge Inspection Manual. Channel cross-sections should be taken periodically and compared to original ground line. This provides indications of the presence of contraction scour, lateral stream migration, and long-term degradation.



Figure 1 Undermining of the abutment exposing piles.



Figure 2 Exposed footing with undermining.



Figure 3 Wading and Probing.



Figure 4 Probing from a boat.

Scour Evaluation

Scour Evaluations are performed by a bridge, geotechnical, and/or hydraulic engineer. The purpose of an evaluation is to calculate the depth of potential scour so the foundation can be designed with sufficient depth, stability, and capacity. Hydraulic calculations are commonly performed during early design-stages for new-construction or rehabilitation bridge projects. Scour evaluations are also performed for high-risk in-service bridges (at a minimum) where calculations are not documented. These evaluations provide theoretical scour depths that are compared to in-place foundation depths to determine the bridge's vulnerability to scour, i.e. to determine if the existing bridge scour critical. Refer to the latest ARDOT Bridge Design Guidelines for the scour evaluation and design procedures. The Scour Evaluation results (report with calculations explaining how the structure's vulnerability to scour was determined) must be documented in the POA Scour Assessment/Evaluation Inspection within InspectX after construction of the bridge or after completion of scour evaluation of an existing bridge.

After documenting the Scour Evaluation results, the evaluating engineer must code SNBI B.AP.03 (Scour Vulnerability) as described in the SNBI. When a documented evaluation exists then the Scour Appraisal is complete. If there are no bridge-threatening observed scour defects that demonstrate that the bridge is vulnerable to estimated scour depths, then the evaluating engineer may code SNBI B.AP.03 (Scour Vulnerability) based on the results of the scour evaluation and the descriptions provided. When a stand-alone scour evaluation is performed on an existing bridge (that is missing a documented scour evaluation), if the results show a bridge is vulnerable to scour, a Plan of Action is required.

Table 1 SNBI (B.AP.03) Scour Vulnerability Code

Code	Scour Appraisal	Description
A	A – Scour appraisal completed.	Bridge determined to be stable for scour.
B	B – Scour appraisal completed.	Bridge determined to be stable for scour, dependent upon designed, and functioning countermeasures. • <i>Use code B when designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations.</i> • <i>Use code B when the Scour Appraisal Team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.</i>

C	C – Scour Appraisal completed.	Bridge could become unstable for scour. Temporary (not designed) countermeasures installed to mitigate scour. Bridge is scour critical. Follow POA Requirement. Use code C for bridges that could become unstable for the potential scour, and temporary countermeasures are installed that were not designed.
D	D – Scour Appraisal completed.	Bridge is, or may become, unstable for scour. Bridge is scour critical. Follow POA Requirement.
O	O – Scour appraisal has not been completed.	
E	E – Scour appraisal has not been completed.	Temporary (not designed) countermeasures installed to mitigate scour.
U	U – Scour appraisal has not been completed.	Due to unknown foundations.

Scour Assessment

A Scour Assessment is the determination of a bridge's vulnerability to scour which considers stream stability and scour potential as described in HEC 20 *Stream Stability at Highway Structures 4th Edition* and other scour-related data sources. Based on risk, a Scour Evaluation is required for high-risk structures. All remaining non-high-risk structures over water will have a Scour Assessment. There are three levels of an Assessment. Each Assessment Level is a progressive screening process that affectively documents the scour and directs the assessor in coding the appraisal field (B.AP.03) Scour Vulnerability Code. Legacy Assessments will be accepted; however, it is recommended that the new progressive screening process is completed. The following information is required when completing all types of Assessments in InspectX:

- Scour Assessment Level(s) Performed
 - Level A
 - Level B (Includes Level A)
 - Level C (Includes Level A and B)
 - Other, Documented File or Checklist on File
- Scour Assessment Date
- Countermeasure Type – Countermeasures are material, devices, or structures designed to prevent, slow, or stop the occurrence of scour. Select the most appropriate answer. Refer to HEC 23 – *Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance 4th Edition*, for determining the nature of the countermeasures.
 - Designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations.

- B. Scour Appraisal Team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.
- C. Temporary countermeasures are installed that were not designed. Bridge could become unstable for scour.
- D. None.



Figure 5 Bridge with non-scour-resistant rock.

References

- Specifications for the National Bridge Inventory (https://www.fhwa.dot.gov/bridge/snbi/snbi_march_2022_publication.pdf)
- Scour-Hydraulics – Bridges & Structures – Federal Highway Administration (<https://www.fhwa.dot.gov/engineering/hydraulics/scourtech/>)
- ARDOT Bridge Design Guidelines (<https://www.ardot.gov/wp-content/uploads/2020/11/Bridge-Division-Guidelines.pdf>)
- ARDOT Bridge Inspection Manual (https://www.ardot.gov/wp-content/uploads/2022/05/ARDOT_BIM_20220507.pdf)

APPENDIX A

Scour Assessment Level A– Stability Screening

Bridge Number: ___ B.AP.03: ___ Item 113: ___ Date: ___

Assessed By: ___ Checked By: ___

The stability screening must be performed by an assessor working under direct supervision of an engineer familiar with Scour Assessments. If any of the following Level A questions are answered “yes”, then continue to the Level B Assessment.

If all Level A answers are “no”, the Scour Assessment is complete, and the bridge is deemed “stable” unless conditions change. Code (B.AP.03) Scour Vulnerability A or B. The difference between A and B is the Countermeasure Type identified previously.

1. Unknown Foundations ○ If depth or type unknown = Yes	☐ Yes ☐ No
2. Visible Scour Issues? ○ If rock (Figure 5) (Must check with Geotechnical for rock properties.) ○ Scour Resistant Rock = No. ○ Ex. Layers of scoured interbedded shale code “Yes” (Figure 5)	☐ Yes ☐ No
3. Shallow Foundations (Must check with Geotechnical for rock properties.) ○ Spread footing on soil code or scourable rock “Yes.” ○ Spread footing keyed into non-scourable rock code “No”	☐ Yes ☐ No
4. Evidence or history of overtopping ○ When B.AP.02 (Overtopping Likelihood) is coded 4-6 then code “Yes” ○ When debris is stuck in cross frames or on an abutment or pier seats then code “Yes” ○ When historical photos or witness-accounts indicate high-water touching the underside of the superstructure then code “Yes.”	☐ Yes ☐ No
5. Are any of the SNBI Code Scour, Underwater, or Channel component ratings rated 5 or worse? ○ Underwater Inspection Condition, Channel Condition, Channel Protection Condition, Scour Condition Rating	☐ Yes ☐ No

Scour Assessment Level B – Scour Susceptibility Screening Score

The scour susceptibility screening score will be performed by an assessor working under direct supervision of an engineer familiar with Scour Assessments. Fill in the check box for all twenty-four (24) criteria if they apply to the site and record the point total. The point total will determine the Scour Vulnerability code or next steps. Point values are on a scale from 0 to 8 and are based on risk to the structure.

Structure	PTS
1. Bridge Category	
Substructure on pile foundation, and continuous span superstructure	☐ 3
Single span on pile foundation	☐ 3
Substructure on pile foundation, and simple span superstructure	☐ 4
Single span on spread footing	☐ 6
Substructure on spread footing, and continuous span superstructure	☐ 6
Substructure on spread footing, and simple span superstructure	☐ 7
2. Number of piers in the main channel	
No piers in the main channel	☐ 0
One pier	☐ 1
Two piers	☐ 2
Three piers	☐ 3
Four or more piers	☐ 4
3. Pier Shape	
Sharp nose	☐ 1
Round, circular cylinder, hexagonal, octagonal	☐ 2
Square nose	☐ 3
4. Pier Type	
Single column	☐ 1
Multi-column or Pile bent	☐ 2
Pier wall	☐ 3
5. Pier Foundation	
No piers or all piers above flood flows (flood flows are determined by site conditions, hydraulic calculations, or historical information)	☐ 0
Spread footing foundations:	
Spread footing on scour resistant rock	☐ 0
Spread footings on non-scour resistant rock	☐ 2
Unknown foundation type	☐ 5
Spread footings on soil or gravel	☐ 6

Pile cap/piling or drilled shaft, depth below existing stream bed:	
Piles driven to refusal on bedrock	☐ 0
Pile depth greater than 40'	☐ 0
Pile depth 20' to 40'	☐ 2
Unknown pile depth	☐ 3
Pile depth less than 20'	☐ 5
6. Abutment foundation	
Abutments located above flood flows (flood flows as determined by site conditions, hydraulic calculations, or historical information)	☐ 0
Spread footing foundations:	
Spread footing on erosion resistant bedrock	☐ 0
Spread footing on erodible rock	☐ 2
Unknown footing depth	☐ 4
Spread footing on soil or gravel	☐ 6
Pile cap/piling or drilled shaft, depth below existing stream bed:	
Piles driven to refusal on bedrock	☐ 0
Pile depth greater than 40'	☐ 0
Pile depth 20' to 40'	☐ 2
Unknown pile depth	☐ 4
Pile depth less than 20'	☐ 4
7. Likelihood of submergence	
Submergence of low member is improbable.	☐ 0
Low member elevation is above road low point, submergence possible.	☐ 1
Low member elevation is below road low point, submergence probable.	☐ 4
Superstructure is routinely overtopped	☐ 8
History	
8. Observed scour at piers:	
No piers or all piers above flood flows (flood flows as determined by site conditions, hydraulic calculations, or historical information)	☐ 0
Spread foundations:	
No scour hole	☐ 0
Scour hole above top of footing	☐ 2
Scour hole within limits of footing	☐ 5
Undermining of footing present	☐ 8
No measurement taken at piers	☐ 7

Pile cap/piling foundations:	
No scour hole	☐ 0
Scour hole above top of pile cap	☐ 2
Scour hole within limits of pile cap	☐ 4
Piling exposed	☐ 6
No measurement taken at piers	☐ 5
Pile bent foundations:	
Piles driven to refusal on bedrock	☐ 0
No scour hole	☐ 0
Minor scour	☐ 2
Moderate scour	☐ 4
Major scour	☐ 6
No measurement taken at piers	☐ 3
9. Abutment type and condition:	
Stub/Integral abutments, effective berm slope:	
2:1 or flatter	☐ 0
Steeper than 2:1 but flatter than 1.5:1	☐ 3
1.5:1 or steeper	☐ 6
Full height abutments, depth of footing or backwall planking below channel cross-section:	
More than 5'	☐ 0
0 to 5'	☐ 4
Footing is exposed	☐ 6
Unknown footing depth	☐ 6
Footing is undermined	☐ 8
10. Abutment protection:	
No protection necessary	☐ 0
Designed wing, dikes, or revetment protection in good condition	☐ 0
Designed other protection in good condition	☐ 1
Not designed wing, dikes, or revetment protection in good condition	☐ 2
Not designed other protection in good condition	☐ 3
Designed protection condition poor or not provided but needed	☐ 4
Not designed protection condition poor or not provided but needed	☐ 5
11. Measure the minimum horizontal level distance from the closest abutment down to the waterline	
More than 25' away	☐ 0
5' to 25'	☐ 2
Less than 5'	☐ 6
Abutment within stream banks	☐ 8

12. Observed local scour at or around abutments:

No problems	☐ 0
Minor scour problems	☐ 4
Moderate scour problems	☐ 6
Major scour problems observed in past inspections	☐ 8

13. Observed debris lodged against bridge

Remote or none	☐ 0
Occasional slight amounts – every 3 years or more	☐ 3
Frequent – more than once every 3 years	☐ 6
Moderate to heavy debris or continually present	☐ 8
No available information	☐ 4

Stream Geomorphic

14. Average degradation of stream bed since construction, not including local scour:

Less than 4' of stream degrading	☐ 0
4' to 6'	☐ 2
Greater than 6'	☐ 6
No comparative cross-sections	☐ 4

15. Observed lateral movement of stream (within one bridge length up and downstream):

Stable	☐ 0
Movement, no threats to bridge	☐ 2
Unstable, threatens bridge	☐ 8
No information available	☐ 4

16. Channel bottom material

Bedrock (non-erodible)	☐ 0
Fully armored	☐ 0
Boulders and cobbles	☐ 1
Clay or silty clay	☐ 2
Gravel, sand, and silt	☐ 4

17. Lowest SNBI Component Conditions for Channel, Channel Protection, or Scour

Rated a 6 or more	☐ 0
Rated a 5 or less	☐ 4

Site Geomorphic

18. Bridge location:

Mainstreams of Arkansas: Red, Ouachita, Arkansas, White, Black, Mississippi, Saline, St. Francis, Spring, Little Red, Current, Big Maumelle, Buffalo, Eleven Point

Bridge over mainstream. Tributary, or spillway nearby:

No tributary nearby	☐ 0
Tributary downstream within 100 ft	☐ 1
Tributary or spillway upstream within 100 ft	☐ 4

Bridge over tributary. Mainstream nearby:

No mainstream within 1,000 ft	☐ 0
Mainstream within 1,000 ft	☐ 2
Mainstream within 500 ft	☐ 4
19. Sinuosity	
Straight	☐ 0
Sinuuous	☐ 1
Meandering	☐ 2
Highly Meandering	☐ 3
20. Stream size	
Small (<100 ft wide)	☐ 1
Medium (100 – 500 ft wide)	☐ 2
Wide (>500 ft wide)	☐ 3
21. Flow characteristics	
Ephemeral	☐ 2
Intermittent	☐ 4
Perennial but Flashy	☐ 6
Perennial	☐ 8
22. Upstream Stream bend within the subject bridge's length:	
0- to 15-degree bend	☐ 1
15- to 45-degree bend	☐ 3
45- to 90-degree bend	☐ 6
23. Alignment of piers to flood flows:	
No piers or all piers above flood flows (flood flows as determined by site conditions, hydraulic conditions, or historical information)	☐ 0
0- to 5-degree skew	☐ 1
5- to 15-degree skew	☐ 3
15- to 90-degree skew	☐ 6
Assessment Level B Scour Assessment Screening Score:	
Add up all points answered for each of the 23 questions.	

Points are organized into three ranges: Low, High, and In-Between

- Low
 - Point totals in the low range are stable, or less than 35 points. Code Scour Vulnerability (B.AP.03) A or B.
- High
 - Point totals in the high range should be considered scour critical and code Scour Vulnerability (B.AP.03) C or D.
 - Greater than 45 points for a single span bridge or
 - Greater than 55 points for a multi-span bridge
- In-Between
 - All other point totals are neither high nor low. The mid-range point totals must continue to the Level C Assessment.
 - Between 35-45 range for a single span bridge or
 - Between 35-55 range for a multi-span bridge

Scour Assessment Level C – Scour Vulnerability Screening

The scour vulnerability screening will be performed by an assessor under direct supervision of an engineer familiar with Scour Assessments. Answer the progressive questions. The answers will determine the Scour Vulnerability coding.

Section 1 Questions – If any of the following are yes, code Scour Vulnerability A or B. If all 3 are no, continue to Section 2.	
a. Is the bridge over a flat and straight drainage ditch?	☐ Yes ☐ No
b. Is the bridge over still water? (Lake, pond, wetland, etc.)	☐ Yes ☐ No
c. Is the bridge a single span with designed rip rap and no scour issues?	☐ Yes ☐ No
Section 2 Questions – If any of the following 5 are yes, code Scour Vulnerability A or B. If all are no, continue to section 3.	
a. Does the bridge have piles driven more than 35' below the streambed?	☐ Yes ☐ No
b. Does the bridge have piles driven to refusal on bedrock?	☐ Yes ☐ No
c. Does the bridge have piles driven 25'-35' below the streambed with less than 10' of highly erodible soils?	☐ Yes ☐ No
d. Does the bridge have spread footings on scour resistant rock?	☐ Yes ☐ No
e. Is the bridge a single span with an effective floodplain width less than 5x the span length AND one of the following are true: - Concrete abutments on piles - Timber abutments less than 6' high on piles - Stream slope less than 5' per mile	☐ Yes ☐ No
Section 3 Questions – Answer the following 3 questions to complete the assessment. Code Scour Vulnerability A or B. If all are no, recommend this structure for a Scour Evaluation.	
a. Has the bridge been previously overtopped, and no evidence of scour problems exist?	☐ Yes ☐ No
b. Is the bridge scheduled for replacement or scour countermeasures within 5 years?	☐ Yes ☐ No
c. Is the bridge on a local street with an ADT less than 25?	☐ Yes ☐ No

SNBI B.AP.03	NBI Item 113
A	8 or 5
B	7 or 5
C & E	7
D	≤ 4
U	U
0	6



Bridge Inspection Guidelines

9.C SCOUR PLAN OF ACTION WORKSHEET

ARDOT Bridge Scour Plan of Action

1. GENERAL INFORMATION

Structure Number:	City, County, State:		Waterway:
Structure Name:	Facility Carried:		Owner:
Year built:	Year rebuilt:	Bridge replacement plans (if scheduled): <u>N/A</u> Anticipated opening date: <u>N/A</u>	
Structure type: ☐ Bridge ☐ Culvert Structure size and description:			
Foundations:			
Type: ☐ Spread footings ☐ Piles ☐ Pile cap with piles ☐ Drilled shafts ☐ Unknown ☐ Box Culvert ☐ Pipe Culvert		Depth: ☐ Known _____ ☐ Unknown	
Subsurface soil information (check all that apply): ☐ Non-cohesive ☐ Cohesive ☐ Non-erodible rock ☐ Erodible rock			
Bridge ADT:	Year/ADT:	% Trucks:	
Does the bridge provide service to emergency facilities and/or an evacuation route? ☐ Yes ☐ No If so, describe:			

2. RESPONSIBLE PARTIES

Author(s) of POA (name, title, agency/organization, telephone, email): <u>Arkansas Department of Transportation, (501)569-2992, @ardot.gov</u> Date: _____ POA updated by (name, title, agency, organization): _____ Date of update: _____ Item(s) updated: _____ *POA to be updated every 48 months
Agency and department responsible for monitoring, closure, and countermeasures (emergent and long-term): <u>ARDOT District 3 Inspection Crew will evaluate the bridge conditions on the regular inspections, but the City of Texarkana is responsible for monitoring the bridge any time the triggering events noted in this document occur.</u>
Contact person/Concurrences on POA (include name, title, telephone, e-mail): _____

3. SCOUR RELEVANT SNBI & NBI CODES

Item 113 Code:

B.AP.02 Overtopping Likelihood:

B.AP.03 Scour Vulnerability:

Source of Scour Critical Code: ☐ Observed ☐ Assessment ☐ Calculated ☐ Other:

B.C.09 Channel Condition Code:

B.C.10 Channel Protection Condition Code:

B.C.11 Scour Condition Code:

4. HISTORY AND RECOMMENDATIONS

Scour History:

Scour Appraisal Summary: Bridge determined to be scour critical. For details, please see Scour Assessment document in asset files

☐ **Increased Inspection Frequency:**

☐ Increased Inspection Frequency of ____ mo.

☐ w/ channel profile

☐ Increased Underwater Inspection Frequency of ____ mo.

*This box will only be checked if we recommend more frequent inspection than what is recommended based on condition codes and the inspection manual. (Ex: We suggest a 3-month special when only a 1-year UWT2 is required.)

☐ **Monitoring Program:**

☐ Fixed Monitoring Device

If so, describe:

☐ Flood Monitoring

☐ When triggered by EmergencyX

Impact Status	B.C.11	Response Time
Orange	< 6	Within 3 months of alert
Red	5	Within 1 month of alert
Red	≤ 4	Within 24 hours

☐ Flood Warning NWS Flood Warning within miles of bridge location

Frequency of flood monitoring: Once

Frequency of post-flood monitoring: Once within 2 days of water receding

Criteria for termination of monitoring: Verification of bridge stability

☐ **Structural/hydraulic countermeasures:**

☐ See HEC 23 Countermeasure Matrix for guidance

☐ Recommended: _____

☐ **Closure Recommended if:**

☐ Water surface elevation reaches ____

☐ Overtopping Road or structure

☐ Scour measurement results from fixed device

If so, describe: _____

- ☐ Observed structure movement / Settlement
- ☐ Discharge: _____cfs/cms
- ☐ Flood forecast: _____
- ☐ Other:
 - ☐ Debris accumulation
 - ☐ Movement of riprap/other armor protection
 - ☐ Loss of road embankment

5. DETOUR ROUTE

Detour route description. Include map in Section 10, Attachment E.

Bridges on Detour Route:

Bridge Number	Waterway	Sufficiency Rating/ Load Limitations	Item 113 Code	B.AP.03 Code

6. ATTACHMENTS

Please indicate which materials are being submitted with this POA:

*Attachments for state owned bridges can be found in the inspection files for the POA Inspection.

- ☐ Attachment A: Subsurface Information (Boring logs, Web Soil Survey, Rock Formation Map, etc.)
- ☐ Attachment B: Channel Profile
- ☐ Attachment C: Scour Sketch
- ☐ Attachment D: Plan view showing location of scour holes, debris, etc.
- ☐ Attachment E: Detour Map
- ☐ Attachment F: Supporting documentation, calculations, estimates and conceptual designs for scour countermeasures.
- ☐ Attachment G: Photos
- ☐ Attachment H: HEC 23 Scour Countermeasure Matrix
- ☐ Attachment I: Pile Driving Records
- ☐ Attachment J: Scour Assessment
- ☐ Attachment K: Stream Stats Report
- ☐ Attachment L: Other _____



Bridge Inspection Guidelines

12.A UNDER BRIDGE INSPECTION UNIT PROCEDURES



Standard Operating Procedures
for use of
Under Bridge Inspection Units (UBIU)

1. Traffic control devices and setup for

- a. Interstate Bridges – Typical Application 33 from MUTCD
 - i. Bridge Inspectors will coordinate with Bridge Crew to provide traffic control on interstate bridges.
 - ii. Use 2 message boards; bridge inspectors will provide truck to pull one of the message boards to the lane closure if needed.
 - iii. Bridge inspectors will coordinate with area maintenance crew for attenuator truck.
- b. Other multi-lane bridges – typical application F from ARDOT Standard Drawing TC-3 Modified for Outside Lane Closure (Use W4-2R & W20-5R)
- c. Two lane bridges – Use Typical Application 10 from MUTCD – attenuator may be used if available
- d. Local low traffic two lane bridges - Use Typical Application 10 from MUTCD – attenuator may be used if available
- e. Local/State one lane bridges – Traffic must be detoured since the road will be closed – Coordinate with local government if applicable or use Typical Application 20. As an alternate on low volume roads, traffic may be held for no longer than 15 minutes – Use Typical Application 10 from MUTCD. Coordinate all road closures with the District staff.

****If questions arise or there is a need to significantly alter/use a different traffic control plan, coordinate this with the District staff.**

2. Conduct a Bridge Pre-Inspection Meeting on site immediately prior to the inspection

- a. Discuss and mark locations of piers
- b. Discuss other obstacles such as
 - i. Trees
 - ii. Skew of bridge
 - iii. Splice plates
 - iv. Anything else that might be encountered
- c. Discuss where to deploy UBIU platform to begin inspection.

- d. Review UBIU operation procedures.

3. UBIU Operation (DR = Driver, PO = Platform Operator) Procedures

- a. DR deploys UBIU platform for inspectors to board. (Bridge Crew Supervisor prefers that driver performs all the setup operations).
- b. A thorough walkaround inspection of the vehicle, performed by DR, verifying condition and operation of safety features must be completed before heading to the bridge.
- c. Once onsite: DR deploys UBIU platform for inspectors to board.
- d. DR and PO check operation of intercom system and emergency stop override.
- e. PO positions platform under bridge.
- f. DR stays near intercom at controls on truck to insure that all functions are working properly.
- g. Once platform is in position to begin inspecting the bridge the PO will notify the DR that the operation is ready to begin, DR will get in the truck and notify the PO that he is ready.

4. Driver & Platform Operator Communication

When inspectors (or maintenance teams) are on the platform, the Driver is to communicate with the operator(s) working on the platform if any movement is to be done. “MOVING” MEANS GOING FORWARD OR BACKING UP. When the driver exits the truck, he/she is to communicate with the operator(s) that they are exiting the truck; when the driver returns, he/she is to communicate with the operators that they are back in the truck. Then the Platform Operator will communicate to the driver to pull forward or back up. No movement is to be done to the truck unless the operator(s) on the work platform gives the command to move and receives a response from the driver that is moving. Once equipment has been moved, operator(s) will communicate to the driver to stop, and the driver will communicate back that he/she acknowledged the command, the air brakes will be set and work will resume.

Communication when moving

- a. PO will give the command to move and an approximate distance to travel to the next stop such as a pier. DR will communicate back the direction of travel and wait for a command from the PO to proceed.
 - i. When moving a distance greater than 20 feet the PO will give a response to the DR every 20 feet and the DR will give a response that it was received.
 - ii. When moving a distance less than 20 feet the PO will give a response to the DR every 5 feet and the DR will give a response that it was received.

- iii. When approaching an object such as a pier the PO will give a command to stop at 5 feet from the object.
- iv. At any time that the DR does not receive a response following the guidelines above he/she will stop.

5. Driver's Observation

- a. Driver will maintain awareness of all obstacles discussed at the Pre-Inspection meeting.
- b. At any time if the driver has any concerns he or she should stop and discuss further.
- c. Driver should make the PO aware of any situations on the top of the bridge and roadway such as accidents, traffic back-ups, etc....

Example of UBIU Operations/Commentary:

- DR deploys UBIU platform (action)
- PO boards platform (action)
- PO & DR check intercom and emergency stop (action)
- DR stays near controls on outside of truck until platform is in position to begin inspection procedures (action)
- PO positions platform under bridge (action)
- PO notifies DR - We're ready to begin (communication)
- DR moves into cab and notifies PO of – Ready to begin (action and communication)
- PO Move forward 100 feet (communication)
- DR Moving forward (communication)
- PO we're ready (communication)
- DR begins moving forward (action)
- PO communicates every 20 feet and DR response (communication)
- When platform is within 20 feet of stopping, PO communicates every 5 feet and DR acknowledges (communication)
- PO gives command to stop when platform is 5 feet from stopping destination (communication)
- DR acknowledges and puts truck in neutral and sets parking brake (action)
- If DR needs to get out of the truck, he/she communicates with PO and PO acknowledges (communication and action)
- When the DR gets back in the truck he or she communicates with PO and PO acknowledges (communication and action)



Bridge Inspection Guidelines

Chapter LPA Local Public Agency Requirements

Prepared for the
Arkansas Department of Transportation by:
Bridge Operations Division

LPA.1 OVERVIEW**LPA.1.1 Purpose of this Document**

The purpose of this document is to simplify and condense the information in the ARDOT Bridge Inspection Guidelines document for use by Local Public Agencies concerning the bridges they own and maintain. LPAs can reference the entire guidelines document for more detailed information regarding the inspection process and documentation. The information in the following sections explains the responsibilities and procedures for Federal and State compliance regarding the Bridge Inspection Program.

LPA.1.2 Local Bridge Inspection Program Background

As a result of a catastrophic bridge collapse in December 1967, which took the lives of 46 people, the Congress of the United States enacted legislation requiring that the Federal Highway Administration (FHWA) establish National Bridge Inspection Standards (NBIS) and a National Bridge Inventory (NBI). A copy of the current NBIS is found here: <https://www.ecfr.gov/current/title-23/chapter-I/subchapter-G/part-650/subpart-C>.

Initially, inspections were to be performed only on state and federally owned bridges. The Surface Transportation Assistance Act of 1978, expanded this requirement to include all bridge length structures on the public highway systems. This includes all bridges under the jurisdiction of federal, state, and local public agencies (city/county).

The principal objective of the NBIS program is to ensure public safety. ARDOT makes recommendations regarding bridge maintenance needs, load postings and closings, but each local government is ultimately responsible for the safety of bridges in their jurisdiction.

It is vital that weight restriction signs be properly maintained and promptly replaced if damaged or removed. Failure to post load limits on bridges that a public agency has knowledge to be structurally inadequate of carrying legal loads constitutes negligence. The same is true for failure to close a structure incapable of supporting at least a 3-ton vehicle. Arkansas state law specifically addresses responsibilities of public bridge owners.

Arkansas Code § 27-85-101 titled Conservation of Bridges mandates that all administrators of public highway, road, and street systems in Arkansas make every effort to safely conserve the bridges under their jurisdiction. **“It is directed that the administrators of the various public highway, road, and street systems shall make every effort to conserve the safe function of the bridges under their jurisdiction pursuant to the findings and recommendations of the bridge safety inspections by the bridge inspection teams of the Arkansas Department of Transportation in accord with the national bridge inspection standards published in the Federal Register.”**

LPA.1.3 ARDOT Responsibilities

The District Construction Engineer (DCE) is the designated contact person for the ARDOT Bridge Inspection Program for Local Public Agency correspondence.

ARDOT is responsible for the inspection and load rating of bridge length structures on the local public agency road systems in compliance with NBIS and Arkansas Law. ARDOT shall bill the owner 20% of the associated administration costs for the bridges under their jurisdiction annually.

ARDOT will inspect each bridge at the required intervals. Updated inspection data is reviewed by ARDOT and load rating data is revised as necessary. ARDOT will notify the bridge owner if it is found that a problem regarding safety or structural integrity is discovered during an inspection or analysis of any bridges.

ARDOT will notify the owner if an analysis or review indicates a change in posting requirements or bridge closure is warranted. If a load rating analysis determines the safe load carrying capacity of a bridge is less than 3 tons, federal regulations mandate that the bridge be closed to all traffic. If conditions warrant bridge closure, the owner will be contacted by the ARDOT DCE and by the Bridge Engineer. Upon notification, the owner should take immediate action to physically close the structure with acceptable barriers until it has been rehabilitated or replaced.

ARDOT will notify the owners regarding maintenance needs, load posting, and closures using correspondence such as a Maintenance Needs report. It is the owner's responsibility to promptly address any noted deficiency or need.

Each month, a reminder will be sent from ARDOT to the email address on file for any bridge with a Maintenance Need that has not been shown as completed for any issue with a "critical finding" (CF) priority, or a load posting deficiency with an "A" priority (A).

The NBIS also requires each state to prepare and maintain an inventory of all bridges subject to these standards. To keep the inventory current and accurate, newly completed structures or any modification of existing structures that would alter previous recorded data in the inventory system shall be entered in the state's records within 90 days.

Upon written notification by the owner of a structural change, the addition, or the removal of a bridge from their inventory, ARDOT will inspect the bridge for an inventory update if deemed necessary.

ARDOT will include on [IDriveArkansas.com](https://drive.arkansas.com) links to maps showing data regarding bridges with load posting recommendations on the state and local highway systems including the bridge location and posting values. This will allow the data to be viewed by the public for use in safe travel on public roads.

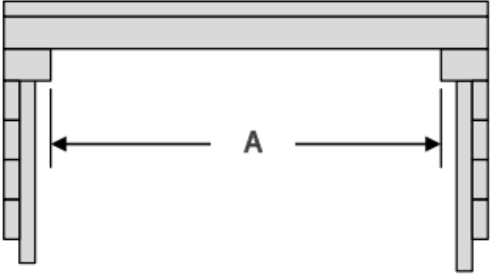
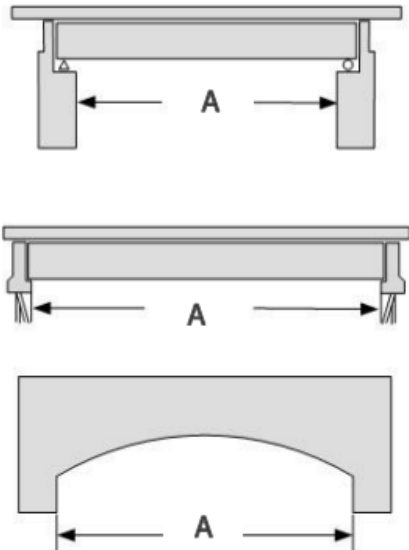
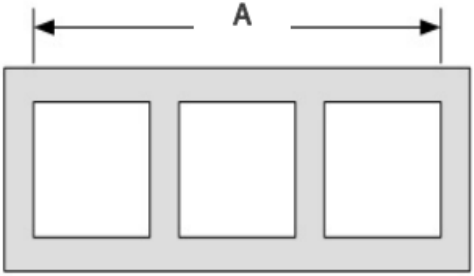
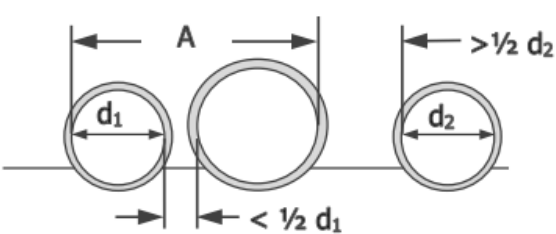
Arkansas is divided into ten highway Districts. Communication between ARDOT and the owners will be through the District Construction Engineer designated in [LPA.6](#) and the owner's administrator or the contact person designated by owner on NBIS Form VII as shown in the attachments chapter of this document.

[LPA.1.4 Definition and Examples of Bridge Length Structures](#)

NBIS bridge definition: A structure, including supports, erected over a depression or an

obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it includes multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening. (23 CFR 650.305)

To qualify as a NBIS bridge length structures, measurement “A” in the examples below shall be greater than 20 feet.

Examples – NBIS Bridge Length	
Report measurement A.  Figure 14. Profile view of a single span bridge with pile bent abutments.	Report measurement A.  Figure 15. Profile views of various single span bridges.
Report measurement A.  Figure 16. Profile view of a four-sided, multi-cell culvert under fill.	Report measurement A.  Figure 17. Profile view of a multi-pipe culvert under fill.

LPA.1.5 Providing Details for Bridges Constructed by the Local Government

For bridges constructed by the local government staff or on a project contracted solely by the local government, bridge structure details are very beneficial in determining a bridge's safe load capacity or scour susceptibility. Thus, when these details are available, they should be provided to the ARDOT DCE to use in the bridge evaluation. These details should include:

1. Contract drawings for bridge members used in bridge construction.
2. Final length of piling driven in a bridge pier/bent (scour assessment).
3. Depth or elevation of the bottom of a pier/bent footing (scour assessment).
4. Details of a steel girder/beam that is new or salvaged from another bridge. This could include the girder size, steel type and grade, or if shear studs are used to make the concrete deck composite with the girder.
5. Concrete compressive strength and reinforcing steel size, strength, and spacing used in a girder, footing, column, or slab.

LPA.1.6 Bridge Abandonment or Removal from Inventory

According to 23 U.S.C. 101(a) (21), The term public road means “any road or street under the jurisdiction of and maintained by a public authority and open to public travel.” As such, the public authority has a responsibility to maintain any bridge that the public can traverse. To remove a bridge from the local inventory, the public authority must provide certification to the District Construction Engineer of one of the following:

- The ownership of the route is not the local entity that ARDOT has on file.
- The ownership and responsibility have been transferred to another public authority.
- The owner must maintain restricted access to the structure so that the public may not traverse the structure.
- The road is not open to public access.

LPA.2 BRIDGE MAINTENANCE NEEDS

ARDOT uses the term “Maintenance Needs” to refer to bridge work orders. These are the items that are documented primarily by bridge inspectors and recommended for repair. ARDOT uses a robust process where inspectors can see previous work orders and create new work orders alongside their NBIS bridge inspection while out in the field. Upon approval of the bridge inspection, these items are available for engineering review within the software.

ARDOT makes every effort to inform local bridge owners of the items that need to be addressed on their structures. An inspector will document a new maintenance need or increase the priority of an existing in the field. From there, the District Construction Engineer will move the item to the monitor status when he or she notifies the local owner of the issue. After repairs have been performed on local public agency bridges, local governments should complete [LPA Maintenance Repair Documentation Form 8](#) and submit it to the District to update the Maintenance Item(s). The Form 8 should be linked to one of the completed items before being marked completed and locked from changes. If the returned Form 8 indicates that major structural repairs have been performed, a new special inspection may be required. If the bridge inspector observes or is notified that an item on a local bridge has been completed, they will note the work done.

LPA.2.1 Overview of Priority Codes

ARDOT employs the following list of priority codes to prioritize and plan for preservation and bridge maintenance activities based on importance.

- CF = Critical Finding; immediate action (see [FHWA NBIS definition](#))
 - Further details in [Section 6.3](#)
- A = Safety Deficiency; requires prompt action
- B = Pressing; pressing
- C = Important
- D = Routine

The [LPA Maintenance Repair Documentation Form 8](#) is a form provided to local public agencies to document repairs to maintenance needs recommended for follow up action by ARDOT. The Local public agency should use this form to provide documentation of work performed on the structure back to ARDOT.

When a Critical Finding priority maintenance need involves a locally owned bridge, the local bridge owner will be promptly notified verbally and with an official notification letter by certified mail. It is required by Federal Law that these safety concerns are addressed immediately and within 30 days by the bridge owner. Local public agencies will receive monthly communication from ARDOT regarding the status of Critical Findings.

Bridge inspection reports also note routine maintenance needs. Routine maintenance needs or “Check Box Items” consist of minor, common defects which have not risen to a level warranting the specific notification, documentation, and priority level assignment as noted in the previous paragraph. Each of these items is a yes/no field with an option for comments and photos. If an item is selected as “yes” for this type of routine maintenance is being recommended, at least one supporting photo and note will be documented and provided.

LPA.3 BRIDGE WEIGHT RESTRICTIONS

All LPA bridges on the NHS will be physically posted for weight restrictions (if required) for both commercial vehicles and emergency vehicles. All other LPA bridges will be physically posted for weight restrictions (if required) for commercial vehicles only; the restrictions for emergency vehicles (if required) will be shown electronically through idrivearkansas.com.

LPA.3.1 Posting Changes for Non-State-Owned Bridges

If a rating analysis change by Load Rating staff requires a change in the current posting, the District Construction Engineer shall notify the Local Owner by mail for their information. All weight-posted bridges will require sign verification and photographs taken to verify the posting status.

A local bridge that has a reduction in load carrying capacity determined by a load analysis shall have signs installed within 30 days of the update in rating per the NBIS. The bridge owner will be promptly notified verbally and with an official notification by certified mail. In addition, the local

owner will receive an automated email notice on the 1st of each month of this posting issue from the inspection software until the owner has verified completion and it has been documented completed in the corresponding maintenance item. The District Construction Engineer, Bridge Operations Staff, and the Staff Structures Engineer will also receive an email about all posting issues. The email shall convey the reason for the posting change.

The District Construction Engineer shall review the email notifications for local bridges. If any posting issue has passed the required timeframe to be addressed, the District Construction Engineer shall contact the Local Owner by phone to discuss the safety concern, and a resolution plan shall be discussed. If a posting issue has passed its required timeframe of action by two months or more, the State Program Manager will confer with the Assistant Chief of Operations for assistance in resolving the posting issue. The Chief Legal Counsel of the AAC shall be included in consultation for those issues involving counties.

Upon written notification by the Owner of a structural change or the addition or the removal of a bridge from their inventory, ARDOT will inspect the bridge if deemed necessary for an inventory update.

For situations where owners post a bridge for load but the load rating does not require load posting due to capacity, a higher frequency inspection will not be required to verify sign installation.

The public shall be kept aware of the posting status of locally owned bridges. This will be accomplished by the Department by maintaining an up-to-date map showing all locally owned posted bridges. This will be made available to the public through the web portal www.idrivearkansas.com.

LPA.3.2 Posting Issues Identified for Non-State-Owned Bridges

When a bridge is found to have a weight posting safety issue during a bridge inspection, the District Bridge Inspection staff will send a Maintenance Needs Report to inform the Owner of the deficiency within one week of the inspection. The District Inspection Staff shall instruct the Owner to submit [LPA Maintenance Repair Documentation Form 8](#) as documentation that the posting has been corrected. The Owner shall also be encouraged to include dated photographs showing legal signs at both ends of the bridge. The Department will accept a returned Form 8 or email notification from the Owner as documentation of completed posting. The date and means of notification shall be recorded in the bridge inspection software.

LPA.3.3 Evidence of Posting Deficiency Correction

When a bridge posting deficiency (signing not in place; incorrect posting tonnages) is corrected, a dated photo of the posting sign on each end should be included with the posting correction notification sent to ARDOT DCE to show that the correction has been completed. It is preferred that the photos be transmitted via email to the ARDOT DCE.

LPA.3.4 Posting Sign Material Assistance

Posting Signage for Local Owners is of utmost importance. As such, The Department will provide signs to local owners for bridges that require posting. The sign material will be charged to the appropriate bridge inspection project number in the Department's fiscal system. These sign charges will be incorporated into the annual inspection related charges to each municipality. The Department will make every effort to coordinate assistance to the local municipalities to get the proper signage installed within 30 days of notification. This can include sign delivery, sign sticker editing, and in extreme cases sign installation at the request of Department Administration.

The owner is responsible for providing the proper information when requesting posting materials (see [LPA Sign Request Form 9](#)) and for also certifying that the installation has been completed. Identification and current load posting information for requesting sign material may be obtained from the most current Bridge Inspection report or other supplemental ARDOT notification.

After the decals are placed on the signs and signs are installed, the documentation of the installation shall be sent to the District personnel for record keeping.

LPA.4 BRIDGE CLOSURE

Bridge Closure of a locally owned bridge may occur due to one of the following scenarios

- Load Rating staff have determined that the structure cannot safely carry a minimum live load of 3 tons.
- Scour Assessment staff have determined that the bridge is not stable in the current condition due to scour or stream conditions.
- Bridge Inspection staff have determined that the bridge is not safe in the current condition due to reasons found during the inspection.

When a bridge closure is deemed necessary by ARDOT staff, the District personnel will contact the local owner of the requirement to close the structure.

If the local owner has not closed the bridge within two business days of being notified of the need for closure by any of these scenarios, the District and Bridge Operations will directly contact the local owner to persuade the owner to comply with the closure immediately. The Chief Legal Counsel of the Association of Arkansas Counties (AAC) will receive an email report of county issues when help is required for compliance.

LPA.4.1 Reopening a Structure

When a local public agency intends to reopen a bridge after corrective action has been taken to address the reason for bridge closure, the local public agency should contact the District. The District shall perform an inspection of the corrective action taken.

The corresponding section of ARDOT staff (Load Rating, Scour Assessment, or Bridge Inspection) or the Bridge Inspection Program Manager shall make determination if the corrective action is sufficient for reopening the structure to traffic.

If the entire structure is replaced by the local agency, the local agency is permitted to open the structure and required to notify the District. ARDOT shall inspect the new structure within 3 months of being open to traffic in accordance with the NBIS.

LPA.5 SCOUR CRITICAL BRIDGES

Local bridge owners are responsible for the scour monitoring inspections of their structures during a flooding event. This requirement is detailed in the [Scour Plan of Action Concurrence Letter](#) that is provided to the LPA if a bridge is determined by engineering staff to be at risk for scour. It is recommended that local owners conduct all monitoring during the flood event and perform a follow up inspection once water levels have receded when substructure is visible. ARDOT personnel will assess the structure using a scour monitoring inspection as well, but due to the limitations of personnel and location, the ARDOT inspection will not be as prompt as the local inspection. Local bridge owners shall use the SPOA Event Monitoring Form as detailed in the attachment [LPA Scour Plan of Action Event Monitoring Form](#).

An ARDOT representative has previously met with the administrator of each owner having scour critical/susceptible bridges, to explain the responsibility of assessing a bridge for a high-water event that could affect the stability of the bridge. A copy of the Scour Plan of Action (SPOA) which details the procedures to follow for the affected bridge was provided.

The following steps summarize the general procedures to follow, as defined in a SPOA:

- The owner should be aware of weather conditions that could potentially create water flow under the bridge that could reach the triggering event stage.
- If the triggering event stage is reached, the recommended action steps in the SPOA will be taken by the owner. If hazardous conditions are found, access to the bridge shall be restricted and ARDOT shall be notified.
- The owner records the actions taken at the bridge using a copy of the SPOA Event Report, available at http://www.ardot.gov/bridge_division/bridge_rating_inventory.aspx, and submits it to the District Construction Engineer for processing and archiving in the inspection record.

If a local bridge owner elects to install scour countermeasures to address the concern, it is recommended that they:

- Document countermeasures with design plans if applicable
- Provide before and after photographs
- Include dimensional sketches if design plans are not available
- Document quantities for all materials used

LPA.6 PROGRAM FUNDING AND BILLING

ARDOT has an agreement with local owners and other agencies to be responsible for the inspection and load rating of bridge length structures on the state and locally owned public road systems in compliance with the NBIS. ARDOT will annually bill local owners 20% of the associated administration costs for the bridges under their jurisdiction. In addition, a voluntary

program was developed where local owners could secure load posting materials from ARDOT stockpiles at a reduced cost if program procedures are followed. Guidelines for local bridge owners are detailed in the Local Government Procedures Appendix of this document.

Billing statements will be sent by ARDOT Fiscal Services Division to local bridge owners with bridge length structures for the following:

- Annually, an invoice will be sent for the cost of the owner's portion of bridge inspections performed during the year on bridges owned by the public agency. The amount depends on the number of inspections made, number of load posting analysis performed, and corresponding load posting materials supplied to the owner.

The owner is responsible for sending a reimbursement check made payable to the Arkansas Department of Transportation, Fiscal Services Division, P.O. Box 2261, Little Rock, AR 72203.

LPA.6.1 Location of ARDOT District Headquarters

Updated District personnel contact information and a map of the Arkansas Highway Districts can be found here: <https://ardot.gov/districts/>

District One	Wynne – 2701 US Hwy. 64 west of Jct. SH 1 North P.O. Box 278 Wynne, AR 72396-0278
District Two	Pine Bluff – 4900 US 65 South; east of Jct. US 425 and 65 P.O. Box 6836 Pine Bluff, AR 71611-6836
District Three	Hope – 2911 SH 29 North; I-30, Exit No. 31 P.O. Box 490 Hope, AR 71802-0490
District Four	Fort Smith/Barling – 808 Frontier Rd., Barling, AR 72923 P.O. Box 11170 Fort Smith, AR 72917-1170
District Five	Batesville – 1673 Batesville Blvd. (US 167); 3 miles south of Batesville P.O. Box 2376 Batesville, AR 72503-2376
District Six	Little Rock – 8900 Mabelvale Pike, Southwest Little Rock, I-30 Exit No. 130 (Baseline Rd./SH 338) P.O. Box 190296 Little Rock, AR 72219-0296
District Seven	Camden – 2245 California Ave. (US 79) P.O. Box 897

Camden, AR 71711-0897

District Eight Russellville – 372 Aspen Ln., I-40 Exit No. 81, N of I-40 & east of SH 7
P.O. Box 70
Russellville, AR 72811-0070

District Nine Harrison – 4590 US 65; 0.5 miles south of Jct. US 65 & 62
P.O. Box 610
Harrison, AR 72602-0610

District Ten Paragould – 2510 US 412 West; 1 mile west of Jct.49 & 412
P.O. Box 98
Paragould, AR 72451-0098



Bridge Inspection Guidelines

LPA ATTACHMENTS



Bridge Inspection Guidelines LPA Requirements

LPA Concurrence Letter

Coming Soon



Bridge Inspection Guidelines LPA Requirements

LPA Maintenance Repair Documentation Form 8

**ARKANSAS' BRIDGE INSPECTION PROGRAM
FOR LOCAL PUBLIC AGENCIES**

BRIDGE MAINTENANCE REPAIR DOCUMENTATION FORM 8

Local Public Agency Name: _____ Official's Signature: _____

Bridge Number	Route Number or Name and Feature Under Bridge	Description of Work Performed	Date Work Performed	* Recommended Action (ARDOT Use Only)

* Recommended Actions by ARDOT District Office:

- 1 = Schedule Bridge Inspection and update maintenance information
- 2 = Work performed does not necessitate reinspection (No Further Action Taken)
- 3 = Request Updated Load Rating
- 4 = Request Updated Scour Assessment

PLEASE SUBMIT THE COMPLETED FORM PROMPTLY TO YOUR ARDOT DISTRICT CONSTRUCTION ENGINEER



Bridge Inspection Guidelines LPA Requirements

LPA Sign Request Form

Revised 6/2026

Totals:

1. Complete columns of the "Bridge Information" area, using information from ARDOT notification.
2. Determine material quantities needed and complete the columns of "Requisition Information" area as necessary for each bridge.
3. LPA Administrator signs "Requesting Official's Signature".
4. Completed and signed form is delivered to ARDOT District Headquarters where materials are requisitioned using the columns of the "Requisition Information" area.
5. The requesting agency retains the original and one copy of the form and the District saves a copy in the bridge files.
6. Upon properly installing requisitioned materials, the requesting agency completes "Installation Information" and sends original to District Headquarters.
7. After review of completed form, District inspectors will verify installation and update the bridge file.

1. By completing columns in the "Installation Information" area, the agency which requisitioned the signing material certifies that these materials were properly installed at the designated bridge site on the date shown.
2. The agency requisitioning the material will be billed for only 20% of the material cost if "Installation Information" is completed and the original form is returned to the District Headquarters within one month of the date shown in the "Requisition Information" area. If completed and returned beyond the one month limit, the agency may be billed for 100% of the material cost.

LPA Official

LPA:



Bridge Inspection Guidelines LPA Requirements

Scour Plan of Action Concurrence Letter



Date

The Honorable Click or tap here to enter text.

County Name Judge

Address

RE: Scour Critical Bridges –Plan of Action and Monitoring
Responsibilities (Bridge No. #####)

Dear Judge Judge name,

The Federal Highway Administration (FHWA) requires bridges inspected by ARDOT to be assessed for scour vulnerability. Scour is erosion due to flowing water that can undermine foundations, resulting in misalignment, settlement, or failure of a structure. Section 650.307.e.10 of the National Bridge Inspection Standards (NBIS) Final Rule states, “Each State transportation department, Federal agency, and Tribal government must include a bridge inspection organization that is responsible for the following: (10) Managing scour appraisals and scour plans of action.” Section 650.313.o.2, the NBIS Final Rule states “For bridges which are determined to be scour critical or have unknown foundations, prepare and document a scour Plan of Action (POA) for deployment of scour countermeasures for known and potential deficiencies, and to address safety concerns. The plan must address a schedule for repairing or installing physical and/or hydraulic scour countermeasures, and/or the use of monitoring as a scour countermeasure. Scour plans of action should be consistent with HEC 18 and 23.”

A review has been made of one of the bridges in your county’s jurisdiction, Br. No. ##### on Road ., Zone L, LM # over waterway , regarding scour conditions. Through a detailed assessment this bridge was determined to be vulnerable to scour. This has put the bridge in the category of Scour Critical and requires special inspection procedures to be followed.

Included with this letter is a Scour Plan of Action (SPOA) document detailing actions to be taken when the bridge is subjected to potential scour situations. Please review and note in Section 4 of that document, your agency’s responsibilities regarding monitoring. This includes:

- When the water flow conditions at the bridge reach the “trigger” conditions defined in the SPOA, the local agency is responsible for monitoring the bridge for significant settlement or stability concerns that might have occurred as a result of the subject event.
- A report regarding the findings of the monitoring actions at the bridge is to be completed and sent to ARDOT. A report template is provided for your use. A copy of this report, “Bridge Scour Plan of Action (SPOA) – Event Monitoring Form”, can be acquired from your District Construction Engineer or downloaded at <https://www.ardot.gov/wp-content/uploads/2020/11/SPOA-Event-Report-REV-2017.pdf>.

Details of the bridge can be found in Section 1 of the SPOA.

Be assured that ARDOT will continue to make the required bridge inspections and notify your agency regarding any bridge element’s maintenance needs. The maintenance and safety of this structure is ultimately your agency’s responsibility. If any significant problems arise with a structure from a flood event, action should be taken.

The signature of the agency administrator below indicates that ARDOT personnel have met with the agency, notifying them of the documentation and agency responsibilities for each bridge in the jurisdiction classified as “scour critical” and have answered any questions about this matter.

Sincerely,

Judge

DCE

Date



Bridge Inspection Guidelines LPA Requirements

LPA Scour Plan of Action Event Monitoring Form

LOCAL PUBLIC AGENCY (LPA) BRIDGE SCOUR PLAN OF ACTION (SPOA) – FLOOD EVENT MONITORING FORM

ARDOT Bridge No.: _____ Route Carried: _____

Waterway Crossed: _____

Scour Plan of Action Triggering Event: _____

IMPORTANT: Send a copy of the completed/updated document to the District Bridge Inspection staff for them to save in the bridge file after each triggering event.

Scour Monitoring Event Report

Inspected By:	
Date:	
Triggering Event Description: <i>(Significant rainfall that raises water elevation or Flood Warning Triggered)</i>	
High Water Elevation/Reference Height <i>(reference mark relative to bridge deck)</i>	
Action Taken <i>(description of actions performed at bridge; if accessible, for example: soundings taken, closed bridge, verified bridge stability...)</i>	
Length of Time Out of Service <i>(Days):</i>	
Inspection Notes <i>(New Damage, Repairs, etc.)</i>	
Date Opened <i>(if closed)</i>	