Bridge Inspection Manual

New York State Department of Transportation

Office of Structures

January 2016
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In order to serve, protect and preserve the health, safety and welfare of the public, New York State requires the comprehensive inspection of all bridges that are publicly owned, operated, or maintained as defined in section 230 of the Highway Law, and that also carry public highway traffic.

This document replaces the *Bridge Inspection Manual – 2014* published in 2014 by the New York State Department of Transportation Office of Structures.

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*DEPUTY CHIEF ENGINEER (STRUCTURES)*
This edition of the Bridge Inspection Manual is the result of a collective effort of many people in the NYSDOT bridge inspection community. In the final stages of the work, the Main Office Bridge Inspection Unit coordinated all technical comments, did several rewrites and the final edit to achieve uniformity in presentation, technical content and writing style.

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# TABLE OF CONTENTS

**FOREWORD**

**ACKNOWLEDGEMENTS**

**TABLE OF CONTENTS**

**NY SECTION 1: INTRODUCTION**

1.1—Purpose.................................................................................................................... 1

1.2—Applicability............................................................................................................. 1

1.3—Policy....................................................................................................................... 1

1.4—Referenced Standards, Manuals and Documents.................................................... 2

**NY SECTION 2A: PLANNING AND PERSONNEL**

2A.1—Types of Inspection............................................................................................... 3

2A.2—Scheduling, Planning and Preparation for Inspection........................................... 4

2A.3—Personnel Requirements....................................................................................... 5

**NY SECTION 2B: THE INSPECTION REPORT**

2B.1—General Notes....................................................................................................... 8

2B.2—Condition States.................................................................................................... 8

2B.3—Condition Comments.......................................................................................... 11

2B.4—Condition Photographs and Standard Photographs............................................ 12

2B.5—Condition Sketches............................................................................................. 15

2B.6—Flagging Documentation....................................................................................... 15

2B.7—Non-Structural Condition Observations.............................................................. 15

2B.8—Additional Information......................................................................................... 16

**NY SECTION 2C: ADDITIONAL DOCUMENTATION GUIDANCE**

2C.1—Bridge Inspection Diary....................................................................................... 17

2C.2—Bridge Inspection Date and Inspection Time......................................................... 17

2C.3—The Bin Folder..................................................................................................... 18

2C.4—Plan Verification and Update............................................................................... 19

2C.5—Inventory............................................................................................................. 19

2C.6—Bridge Orientation Conventions......................................................................... 19

2C.7—Pier and Span Numbering................................................................................... 20

2C.8—Special Case Ramp Bridges............................................................................... 21

2C.9—Vertical Clearance and Load Postings................................................................. 22

2C.10—Apparent Violations of Load Postings................................................................. 23

2C.11—Recommend Further Investigation...................................................................... 24

2C.12—Overhead Sign Structures.................................................................................. 25

2C.13—Recommendation for Vulnerability Reassessment........................................... 25
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.3.2</td>
<td>Element 135—Timber Truss</td>
<td>76</td>
</tr>
<tr>
<td>3.3.3.3</td>
<td>Element 136—Other Truss</td>
<td>76</td>
</tr>
<tr>
<td>3.3.3.4</td>
<td>Element 141—Steel Arch</td>
<td>81</td>
</tr>
<tr>
<td>3.3.3.5</td>
<td>Element 142—Other Arch</td>
<td>81</td>
</tr>
<tr>
<td>3.3.3.6</td>
<td>Element 143—Prestressed Concrete Arch</td>
<td>81</td>
</tr>
<tr>
<td>3.3.3.7</td>
<td>Element 144—Reinforced Concrete Arch</td>
<td>81</td>
</tr>
<tr>
<td>3.3.3.8</td>
<td>Element 145—Masonry Arch</td>
<td>81</td>
</tr>
<tr>
<td>3.3.3.9</td>
<td>Element 146—Timber Arch</td>
<td>81</td>
</tr>
<tr>
<td>3.3.5.1</td>
<td>Element 147—Steel Main Cables</td>
<td>84</td>
</tr>
<tr>
<td>3.3.5.2</td>
<td>Element 148—Secondary Steel Cables</td>
<td>84</td>
</tr>
<tr>
<td>3.3.5.3</td>
<td>Element 149—Other Secondary Cable</td>
<td>84</td>
</tr>
<tr>
<td>3.3.5.4</td>
<td>Element 161—Steel Pin and Pin &amp; Hanger Assembly or both</td>
<td>84</td>
</tr>
<tr>
<td>3.3.5.5</td>
<td>Element 162—Steel Gusset Plate</td>
<td>86</td>
</tr>
<tr>
<td>3.4</td>
<td>Bearings</td>
<td>87</td>
</tr>
<tr>
<td>3.4.1</td>
<td>Element 310—Elastomeric Bearing</td>
<td>87</td>
</tr>
<tr>
<td>3.4.2</td>
<td>Element 311—Movable Bearing</td>
<td>87</td>
</tr>
<tr>
<td>3.4.3</td>
<td>Element 312—Enclosed/Concealed Bearing</td>
<td>87</td>
</tr>
<tr>
<td>3.4.4</td>
<td>Element 314—Pot Bearing</td>
<td>87</td>
</tr>
<tr>
<td>3.4.5</td>
<td>Element 315—Disk Bearing</td>
<td>87</td>
</tr>
<tr>
<td>3.4.6</td>
<td>Element 316—Other Bearing</td>
<td>87</td>
</tr>
<tr>
<td>3.5</td>
<td>Substructures</td>
<td>93</td>
</tr>
<tr>
<td>3.5.1.1</td>
<td>Element 202—Steel Column</td>
<td>108</td>
</tr>
<tr>
<td>3.5.1.2</td>
<td>Element 203—Other Column</td>
<td>108</td>
</tr>
<tr>
<td>3.5.1.3</td>
<td>Element 204—Prestressed Concrete Column</td>
<td>108</td>
</tr>
<tr>
<td>3.5.1.4</td>
<td>Element 205—Reinforced Concrete Column</td>
<td>108</td>
</tr>
<tr>
<td>3.5.1.5</td>
<td>Element 206—Timber Column</td>
<td>108</td>
</tr>
<tr>
<td>3.5.1.6</td>
<td>Element 207—Steel Tower</td>
<td>111</td>
</tr>
<tr>
<td>3.5.1.7</td>
<td>Element 208—Timber Trestle</td>
<td>111</td>
</tr>
<tr>
<td>3.5.1.8</td>
<td>Element 210—Reinforced Concrete Pier Wall</td>
<td>112</td>
</tr>
<tr>
<td>3.5.1.9</td>
<td>Element 211—Other Pier Wall</td>
<td>112</td>
</tr>
<tr>
<td>3.5.1.10</td>
<td>Element 212—Timber Pier Wall</td>
<td>112</td>
</tr>
<tr>
<td>3.5.1.11</td>
<td>Element 213—Masonry Pier Wall</td>
<td>112</td>
</tr>
<tr>
<td>3.5.2.1</td>
<td>Element 215—Reinforced Concrete Abutment</td>
<td>115</td>
</tr>
<tr>
<td>3.5.2.2</td>
<td>Element 216—Timber Abutment</td>
<td>115</td>
</tr>
<tr>
<td>3.5.2.3</td>
<td>Element 217—Masonry Abutment</td>
<td>115</td>
</tr>
<tr>
<td>3.5.2.4</td>
<td>Element 218—Other Abutment</td>
<td>115</td>
</tr>
<tr>
<td>3.5.2.5</td>
<td>Element 219—Steel Abutment</td>
<td>115</td>
</tr>
<tr>
<td>3.5.3.1</td>
<td>Element 220—Reinforced Concrete Pile Cap/Footing</td>
<td>119</td>
</tr>
<tr>
<td>3.5.3.2</td>
<td>Element 225—Steel Pile</td>
<td>121</td>
</tr>
<tr>
<td>3.5.3.3</td>
<td>Element 226—Prestressed Concrete Pile</td>
<td>121</td>
</tr>
<tr>
<td>3.5.3.4</td>
<td>Element 227—Reinforced Concrete Pile</td>
<td>121</td>
</tr>
<tr>
<td>3.5.3.5</td>
<td>Element 228—Timber Pile</td>
<td>121</td>
</tr>
<tr>
<td>3.5.3.6</td>
<td>Element 229—Other Pile</td>
<td>121</td>
</tr>
<tr>
<td>3.5.3.7</td>
<td>Element 231—Steel Pier Cap</td>
<td>124</td>
</tr>
<tr>
<td>3.5.3.8</td>
<td>Element 233—Prestressed Concrete Pier Cap</td>
<td>124</td>
</tr>
<tr>
<td>3.5.3.9</td>
<td>Element 234—Reinforced Concrete Pier Cap</td>
<td>124</td>
</tr>
<tr>
<td>3.5.3.10</td>
<td>Element 235—Timber Pier Cap</td>
<td>124</td>
</tr>
<tr>
<td>3.5.3.7</td>
<td>Element 236—Other Pier Cap</td>
<td>124</td>
</tr>
</tbody>
</table>
3.6—Culverts

3.6.1—Element 240—Steel Culvert

3.6.2—Element 241—Reinforced Concrete Culvert

3.6.3—Element 242—Timber Culvert

3.6.4—Element 243—Other Culvert

3.6.5—Element 244—Masonry Culvert

3.6.6—Element 245—Prestressed Concrete Culvert

3.7—Joints

3.7.1—Element 300—Strip Seal Expansion Joint

3.7.2—Element 301—Pourable Joint Seal

3.7.3—Element 302—Compression Joint Seal

3.7.4—Element 303—Assembly Joint with Seal

3.7.5—Element 304—Open Expansion Joint

3.7.6—Element 305—Assembly Joint without Seal

3.7.7—Element 306—Other Joint

3.8—Wearing Surfaces, Protective Coatings, and Concrete Reinforcing Steel Protective Systems

3.8.1—Element 510—Wearing Surface

3.8.2—Element 515—Steel Protective Coating

3.8.3—Element 521—Concrete Protective Coating

3.8.4—Element 520—Concrete Reinforcing Steel Protective System

3.9—Approach Slabs

3.9.1—Element 320—Prestressed Concrete Approach Slab

3.9.2—Element 321—Reinforced Concrete Approach Slab

3.10—Agency Defined Elements

3.10.1—Element 800—Scour

3.10.2—Element 801—Stream Hydraulics

3.10.3—Element 810—Sidewalk

3.10.4—Element 811—Curb

3.10.5—Element 830—Secondary Members

3.10.6—Element 831—Steel Beam End

3.10.7—Element 850—Backwall

3.10.8—Element 851—Abutment Pedestal

3.10.9—Element 852—Pier Pedestal

3.10.10—Element 853—Wingwall

3.10.11—Element 860—Culvert Headwall

3.10.12—Element 870—Culvert Apron/Cut-Off Wall

NY SECTION 4: QUALITY CONTROL & QUALITY ASSURANCE

4.1—Quality Control

4.2—Quality Assurance

4.3—Field Reviews & Field Review Form

NY SECTION 5: NON-STRUCTURAL CONDITION OBSERVATIONS

5.1—Introduction

5.2—Conditions

5.3—Limits and Documentation
NY SECTION 6: GENERAL RECOMMENDATION

NY APPENDIXES:
A—UNIFORM CODE OF BRIDGE INSPECTION
B—INSPECTION FLAGGING PROCEDURE
C—SPECIAL EMPHASIS INSPECTION REQUIREMENTS
D—DIVING INSPECTIONS AND FATHOMETER SURVEYS
E—MOVEABLE BRIDGES
F—SUSPENSION AND CABLE-STAYED BRIDGES
G—REQUIRED TOOLS AND EQUIPMENT
H—LEAD PAINT CONTAINMENT
I—TECHNICAL ADVISORIES
J—USING THE FEDERAL SCALE
K—SPECIFICATION FOR IN-DEPTH INSPECTIONS
L—GROUND BASED SAFETY INSPECTIONS
M—RAILROAD BRIDGES – BRIDGE MANAGEMENT PLAN
N—LARGE CULVERT INSPECTION
O—GLOSSARY
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NY SECTION 1
INTRODUCTION

1.1—Purpose

This Bridge Inspection Manual (BIM) has been prepared to provide guidance for bridge, large culvert, and diving inspections for the New York State Department of Transportation (NYSDOT) which satisfies the policy shown below in NY Section 1.3.

This manual is not an engineering textbook, nor a primer on the fundamentals of bridge inspection. For questions related to material behavior, mechanics, or fundamentals of bridge inspection, consult the latest edition of the Federal Highway Administration (FHWA) Bridge Inspector’s Reference Manual (BIRM). Professional judgment and common sense should always dictate actions taken by Professional Engineers during the inspection and evaluation process.

1.2—Applicability

This manual supplements the American Association of State Highway and Transportation Officials (AASHTO) Manual for Bridge Element Inspection (AMBEI). Together they provide a methodology for performing inspections in New York State which meet or exceed the requirements of the Uniform Code of Bridge Inspection (UCBI) (see NY Appendix A) and Federal data collection requirements. They shall be used when inspecting:

- UCBI mandated structures
- Non-mandated structures in New York State which are routinely inspected by NYSDOT.

The data produced by these inspections shall reside in the NYSDOT structures database.

Instructions which are unique to diving inspections and fathometer surveys are provided in NY Appendix D. This manual also satisfies the “Bridge Diving Inspection Rating Criteria” which is referenced in the UCBI section 165.6. Instructions which are unique to large culvert inspections are provided in NY Appendix N. Henceforth in this manual, the term bridge(s) refers to bridges as well as large culverts and diving substructure units (SSU), when applicable.

1.3—Policy

The National Bridge Inspection Standards (NBIS) establish the regulations for the inspection and evaluation of the Nation’s bridges. The NBIS is defined in the Code of Federal Regulations (23 CFR 650 Subpart C).

Incorporating the Code of Federal Regulations, New York State has issued the UCBI pursuant to Chapter 781 of the Laws of 1988, to establish a program of comprehensive bridge management and inspection within the NYSDOT.

In accordance with Title 23 United States Code 144(d)(2), State agencies shall report bridge inspection element level data to the Secretary of Transportation. Accordingly, NYSDOT bridge inspection element level data collection shall be performed in accordance with the AMBEI.
Additionally, the Code of Federal Regulations requires State agencies to prepare and maintain an inventory of all bridges subject to the FHWA “Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges” (see NY Section 2C.5 and NY Appendix J).

All bridge inspection efforts must adhere to the safety requirements defined in the NYSDOT Bridge Inspection Safety Manual, NYSDOT Safety Bulletins, and Occupational Safety and Health Administration (OSHA) standards, where applicable.

1.4—Referenced Standards, Manuals and Documents

The following references contain material that is relevant to inspection. They contain provisions that pertain to a particular type of inspection, part of the inspection process or information related to the elements requiring inspection. Instead of reproducing them in full in this manual, they are incorporated by reference. Inspection personnel need to consider their provisions where applicable.

- American Railway Engineering & Maintenance of Way Association Manual for Railway Engineering (AREMA)
- American Association of State Highway and Transportation Officials (AASHTO) Manual for Bridge Element Inspection (AMBEI)
- AASHTO Manual for Bridge Evaluation (MBE)
- Code of Federal Regulations (23 CFR 650 Subpart C)
- Federal Highway Administration (FHWA) Bridge Inspector’s Reference Manual (BIRM)
- FHWA Manual on Uniform Traffic Control Devices (MUTCD)
- FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges (FHWA-PD-96-001)
- FHWA Underwater Bridge Inspection (FHWA-NHI-10-027)
- NYSDOT Bridge Inventory Manual
- NYSDOT Bridge Inspection Safety Manual
- NYSDOT Uniform Code of Bridge Inspection (UCBI)
- NYSDOT Supplement to the MUTCD
- NYSDOT Overhead Sign Structure Inventory and Inspection Manual
- NYSDOT Technical Advisories (TA), Engineering Instructions (EI), and Engineering Bulletins (EB) (NYSDOT’s website should be consulted for current and additional issuances of NYSDOT Technical Advisories, Engineering Instructions and Engineering Bulletins.)

Unless specifically stated, documents referenced within this manual are made to the current version of these documents.
NY SECTION 2A
PLANNING AND PERSONNEL

2A.1—Types of Inspection

Several types of inspection are available. They are as follows:

I. **General Inspection:** General Inspections are required for all highway bridges at a maximum interval of 24 months. These inspections encompass both biennial and interim inspections as defined in the UCBI. Interim inspections are performed during the calendar year between the required biennial inspections and are required if one or more of the criteria in UCBI Section 165.4.a.2 (see NY Appendix A) exists.

Inspection intensity and documentation for general inspections will be the same regardless of the criteria that triggered the need for the inspection. Scheduling of general inspections will be governed by the requirements that are defined in both the Code of Federal Regulations (CFR) and the UCBI. When there is a conflict, the stricter requirements shall be adopted.

II. **Diving Inspection:** Diving Inspections are performed on individual substructure units (SSU) or portions thereof which cannot be inspected under the General Inspection due to water restrictions. Criteria for qualifying an SSU to receive a Diving Inspection are defined in UCBI Section 165.4.b. These inspections are required at a maximum interval of 60 months. Scheduling of Diving Inspections will be governed by the requirements that are defined in both the Code of Federal Regulations (CFR) and the UCBI. When there is a conflict, the stricter requirements shall be adopted.

III. **In-Depth Inspection:** In-Depth Inspections are performed on an "as needed" basis. The Specification for In-Depth Inspection is located in NY Appendix K. Note that this inspection is different than the “In-Depth” inspection described in NBIS.

IV. **Special Inspection:** Special Inspections are performed on an "as needed" basis. Information collected during these inspections does not directly impact the condition assessment of a structure. Use of these inspections may not follow the normal Quality Control and Quality Assurance workflow that is utilized for General and Diving Inspections. Several sub-categories of the Special Inspection are available. They are as follows:

   a. **Flood Watch:** This sub-category will be utilized to attach summary forms of flood watch inspections.

   b. **Post-Flood Inspection:** This sub-category will be utilized to document post-flood inspections.

   c. **Post-Seismic Event:** This sub-category will be utilized to document post-seismic inspections.

   d. **Impact Assessment:** This sub-category will be utilized to document post-impact inspections/assessments.

   e. **Found Structural Flag Repair:** This sub-category will be utilized to document the instance when a structural flag can be removed due to a found structural repair and there is no other reason to inspect the structure. In such instances, the inspector shall fully document the findings,
recommend removal of the structural flag and re-designation of the type of inspection from General /Special In Lieu of to “found structural flag repair.”

g. **Ground Based Safety Inspections** (not applicable to SSU which require diving inspections): This sub-category will be utilized to document inspection of non-highway bridges and other structures that cross over highways. See NY Appendix L for additional information.

h. **Other:** This sub-category will be utilized for other instances of non-scheduled inspection events.

V. **Special In Lieu of Interim Inspection:** Special In Lieu of Interim Inspections may be performed in lieu of General Inspections that are scheduled for inspection due to the UCBI interim requirements. Note that Special In Lieu of Interim Inspections require written approval of the Deputy Chief Engineer (Structures) or designee. In no case will a Special In Lieu of Interim Inspection be granted in back to back inspection seasons. See the last paragraph of the UCBI Section 165.4.a.2 for specific details regarding Special In Lieu of Interim Inspections.

VI. **None Due to Construction:** This category of inspection is used for bridges that are closed to all traffic due to reconstruction. Note that temporary structures constructed within a work zone to handle staged traffic are the contractor's responsibility and do not get inspected as part of the General Inspection or Diving Inspection program and are, therefore, not covered by these inspection types. Note further that all new bridges, reconstructed bridges, and rehabilitated bridges shall receive a biennial inspection within 60 days of formal project acceptance or fully opening the bridge to highway traffic, whichever occurs first. The inspection must occur after opening to traffic in order to ensure that the inspector can view the structural behavior of the bridge after having experienced live load conditions. Any portion of an existing bridge or SSU that is under contract and carries traffic shall remain on the inspection schedule.

2A.2—**Scheduling, Planning and Preparation for Inspection**

Scheduling, planning, and preparation for all inspection efforts shall follow the relevant sections in the BIRM.

All scheduling efforts should maximize efficiency between the first and the last day of an inspection. When scheduling work, the project manager must consider the following:

1) Ensure that inspection meets the intervals of inspection requirements given above.

2) Maximize efficient use of labor, Work Zone Traffic Control (WZTC) and special access equipment.

3) Minimize need for return visits by scheduling initial visit(s) to stream bridges during low flow.

4) Minimize travel distance between bridges.

5) Minimize traffic disruptions.

6) Successive inspections are not performed by the same inspector.

7) Job Hazard Analysis: although an on-going process, all potential hazards must be identified, evaluated and mitigated. This may effect:
   - The quantity and qualification of inspection teams.
   - The access equipment being used.
   - The inspection methodology including coordination with other involved entities.
   - The Personal Protective Equipment (PPE) being used.
   - The inspection tools being used.
8) Before scheduling interim inspections solely due to structural flags, contact the Region to verify if flags are still active and inspection is still necessary. Also, at the very beginning of the inspection, the Team Leader should check the structural flags on the bridge; if flags are repaired and can be removed, then contact the Region to confirm if inspection is still necessary before proceeding further. See Type IV.e “Special Inspection, Found Structural Flag Repair” above for additional information.

The inspection team's planning and preparation measures prior to the field inspection shall include organizing the proper tools and equipment and locating and reviewing bridge structure plans and files. The success of the on-site field inspection is largely dependent on the effort spent in preparing for the inspection.

2A.3—Personnel Requirements

(Refer to NY Appendix N for requirements specific to large culvert inspection.)

Type I, III, and V inspections shall be performed by an inspection team consisting of a Team Leader (TL) and an Assistant Team Leader (ATL). The Team Leader is responsible for ensuring that the bridge is inspected and that the inspection report is prepared in conformance with the requirements of this manual. Under the Team Leader's direct supervision, an Assistant Team Leader may also inspect, measure, and document components.

Type II inspections shall be performed by an inspection team consisting of a TL and two divers. Additional personnel may be added to the inspection team based upon justifiable circumstances. In a diving inspection, the TL typically conducts the inspection through the aid of the in-water diver using audio and visual communication. The other diver remains top-side and manages the diving equipment which supports the in-water diver. When the TL is the in-water diver, the TL will remain responsible for ensuring that the inspection information is transcribed correctly into notes and sketches by one of the top-side divers, during the diving inspection. The Team Leader is responsible for ensuring that the SSU is inspected and that the inspection report is prepared in conformance with the requirements of this manual.

Type IV inspections shall be performed by an inspection team consisting of personnel defined by the Regional Structures Management Staff or the Main Office Bridge Inspection Unit; the Type IV.e inspector shall be a NYS Professional Engineer.

Type I, II, III and V inspection field work must be reviewed by a Quality Control Engineer (QCE) and Quality Assurance Engineer (QAE) whose duties are described in NY Section 4.

All personnel assigned to the project shall meet the minimum educational and experience requirements for their positions as described in Section 165.5 of the UCBI (see NY Appendix A) and as required by the NBIS. In addition to these requirements:

- the Quality Control Engineer (QCE) will have at least five (5) years of recent experience in bridge design, bridge inspection, or other bridge engineering related experience which is acceptable to the Department.
- the Fathometer Surveyor will have at least three (3) years of recent experience in conducting fathometer surveys which is acceptable to the Department.
- all field personnel shall satisfy OSHA requirements.
• all field personnel assigned to the project must be physically capable of performing the
tasks associated with their positions. All field personnel must be able to work at
heights, on ladders, on scaffolding and on aerial lifts, or other bridge inspection access
equipment. They must be able to climb, work in confined spaces, and be able to work
under adverse weather conditions as required. Divers must be capable of working
within the tolerable limits of underwater hazards.
• all QCEs, TLs, ATLs and Divers will have a working knowledge of personal computers in a
Windows environment and be fully conversant with the NYSDOT inspection software
and related software prior to commencing any inspection work. They must be
knowledgeable in the use of digital cameras, scanners, and other hardware necessary
for the project.
• All QCEs, TLs, LREs and ATLs will have a working knowledge of the information required
to document section loss and other conditions for load capacity evaluations conducted
using the current load rating software used by the Department (For example:
AASHTOWare Bridge Rating analytical software, previously known as “Virtis”).
• The Project Manager shall have demonstrated experience successfully managing
projects of similar size and scope.

Prior to performing any inspection work with NYSDOT, QAEs, QCEs, TLs, Divers and Load Rating
Engineers (LREs) must:
• successfully complete an FHWA approved comprehensive bridge inspection training course (for
example, the National Highway Institute “Safety Inspection of In-Service Bridges”) and have
successfully completed the NYSDOT 1 day Supplementary Bridge Inspection Workshop. (Note
that if the personnel has successfully completed the NHI training but has not taken the NYSDOT
1 day Workshop, they may be approved to begin working with the condition that they complete
the next available NYSDOT 1 day Workshop), or
• have successfully completed the NYSDOT 5 day Bridge Inspection Workshop (this Workshop was
discontinued after 2015).

Although this is a one-time requirement, based on significant changes in the NYSDOT Bridge Inspection
Program or a personnel’s prolonged lapse from bridge inspection work, these individuals may have to
repeat this requirement. ATLs performing NYSDOT inspection work are encouraged to comply with the
above training requirements.

Team Leaders and QCEs shall meet the refresher training attendance requirements noted in the NBIS.
Additionally, approved QCEs, TLs, Divers and Project Managers are to attend the NYSDOT Bridge
Inspector’s Meeting every time it is organized. Exception to this requirement may be provided by the
NYSDOT Main Office Bridge Inspection Unit if extenuating circumstances prevent attendance.
Attendance of this Meeting may be used to satisfy the refresher training requirements noted in the
NBIS.
NY SECTION 2B
THE INSPECTION REPORT

An inspection report is a unique, stand-alone document compiled from information collected during the field inspection of a structure. Depending on the type of inspection (see NY Section 2A.1) and the condition of the structure, the report may consist of:

- General Notes (NY Section 2B.1)
- Condition States (NY Section 2B.2)
- Condition Comments (NY Section 2B.3)
- Condition Photographs and Standard Photographs (NY Section 2B.4)
- Condition Sketches (NY Section 2B.5)
- Flagging Documentation (NY Section 2B.6)
- Non-Structural Condition Observations (NY Section 2B.7)
- Additional Information (NY Section 2B.8)

NY Sections 2C and 2D provide additional information regarding documentation and forms that must be maintained and completed with the inspection. The NYSDOT Bridge Inventory Manual and NYSDOT load rating instructions shall also be consulted when necessary for proper documentation of the structure.

NY Sections 3.1 through 3.9 provide supplemental element guidance, documentation requirements, and photographic condition state examples which coincide with the detailed element descriptions shown in the AMBEI Sections 3.1 through 3.9. NY Section 3.10 provides detailed element descriptions for NYSDOT Agency Defined Elements (ADE). NY Section 3.10 also provides supplemental guidance, documentation requirements, and photographic condition state examples for the ADEs.

NY Appendixes A through N provide additional inspection requirements and guidance that must be incorporated into the inspection and subsequent report.

Prior to beginning any inspection, the TL shall review the previous inspection report and the BIN folder to ensure familiarity with the structure and its inspection requirements.

The inspection report should be completed during the inspection at the structure site.
2B.1—General Notes

These are general remarks and comments which are applicable to the whole bridge: these are not assigned to a specific element condition assessment. General notes are also referred to as "bridge level notes".

2B.2—Condition States

The inspector is responsible for evaluating each element and assigning to it a descriptive Condition State (CS) assessment of "good", "fair", "poor", "severe", or "unknown". The following are general condition state guidelines and shall not be used in place of the AMBEI defects’ condition state definitions:

<table>
<thead>
<tr>
<th>Condition State</th>
<th>Condition Type</th>
<th>General Condition Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS-1</td>
<td>Good</td>
<td>That portion of the element that has either no deterioration or the deterioration is insignificant to the management of the element, meaning that portion of the element has no condition based preventive maintenance needs or repairs. Areas of an element that have received long lasting structural repairs that restore the full capacity of the element with an expected life equal to the original element may be coded as good condition.</td>
</tr>
<tr>
<td>CS-2</td>
<td>Fair</td>
<td>That portion of the element that has minor deficiencies that signify a progression of the deterioration process. This portion of the element may need condition based preventive maintenance. Areas of the element that have received repairs that improve the element, but the repair is not considered equal to the original member may be coded as fair.</td>
</tr>
<tr>
<td>CS-3</td>
<td>Poor</td>
<td>That portion of the element that has advanced deterioration but does not warrant structural review. This portion of the element may need condition based preventative maintenance or other remedial action.</td>
</tr>
<tr>
<td>CS-4</td>
<td>Severe</td>
<td>That portion of the element that warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge; OR a condition where that portion of the element is no longer effective for its intended purpose.</td>
</tr>
<tr>
<td>CS-5</td>
<td>Unknown</td>
<td>That portion of the element not assessable due to lack of access.</td>
</tr>
</tbody>
</table>

Irrespective of the above guidance and the photo examples presented in NY Sections 3.1 through 3.10, the inspector shall assess the condition state in a manner consistent with the criteria established in the BIRM and AMBEI. Meaningful statewide and nationwide assessment of bridge conditions is possible only through consistent use of these manuals.

A bridge element shall be assessed in comparison to its original design capacity and to its original functioning; do not assess the condition of the bridge element in comparison to the present-day standards. For example, the condition state for a bridge element should not be reduced because its design and/or configurations are out of compliance with present-day standards. The following are exceptions to this requirement: Agency Defined Elements (ADE) for Scour and Stream Hydraulics (see NY Section 3.10) and the General Recommendation (see NY Section 6). The Scour ADE and Stream
Hydraulics ADE are assessed for site-specific performance requirements. The General Recommendation (see NY Section 6) is the Team Leader's assessment of the overall bridge condition.

At times, it may not be possible to assess the condition state of an inventoried element; for instance,

- The element is completely concealed from view.
- It is not possible to gain access for inspection.

In such instances, the element is assessed CS-5.

Superstructure elements will rarely be assessed CS-5; unique instances where this might occur could be completely closed vaults or cells with no means of entry. An assessment of CS-5 for any element other than footings and piles must be thoroughly explained in the inspection report.

For bridges under stage construction, assess only those portions open to highway traffic. Portions under construction (closed to highway traffic) should remain in the existing total quantity and be assessed a CS-5. The bridge inventory and element quantities should be updated when the bridge or portions thereof are reopened to highway traffic. Upon reopening to traffic, the bridge shall be inspected per UCBI Section 165.4 (see NY Appendix A). Include a brief bridge level note detailing stage construction conditions and any changes to the bridge; for example “Stage 1 of bridge widening contract. Existing deck and girders 2-4 carry traffic. Deck removed from existing girder 1.” Condition comments shall clarify which portions of the element(s) are assessed CS-5; for example, “Girder 1 assessed CS-5” or “Left 14 feet of demolished deck assessed CS-5”.

Elements assessed CS-5 for reasons other than those listed above shall be inspected immediately after access is made available. In such cases, a Special Inspection should be used for this effort.

Temporary elements, such as construction barrier, shall not be assessed, but shall be noted in the inspection report. Immediate safety concerns regarding temporary elements shall be addressed through the flagging procedure.

While inspecting an element, temporary repairs such as a steel plate over a hole in a deck or shoring to support a deteriorated beam or pier, shall not be considered in the condition state assessment. The element should be assessed as though the temporary repair does not exist; however, the presence of a temporary repair shall be documented in the inspection report.

**Use of Diving Inspections and Fathometer Surveys**

For bridges which normally receive diving inspections and/or fathometer surveys, the Team Leader should, in conjunction with the diving/fathometer report, evaluate the current stream channel and scour conditions. If significant changes are detected, the NYSDOT Regional Hydraulics Engineer should be notified. The Regional Hydraulics Engineer can decide the need for an immediate diving inspection or a change in diving inspection frequency.
The bridge inspection Team Leader shall not use the diving/fathometer report to provide an assessment for elements, or portions thereof, they cannot see. In such cases, the Team leader shall include a reference to the most recent diving/fathometer report for additional information. The reference shall include the date of the diving/fathometer report.

Guidelines and instructions which are unique to the diving inspection and fathometer survey program are provided in NY Appendix D.

**Element Quantities**

Prior to inspecting an element, its total quantity shall be established and verified through contract plans and/or field measurements. Total quantity calculations shall be stored in the BIN Folder (see NY Section 2C.3). Change to a previously established total quantity is only warranted when the existing computation is proven incorrect, or modification, rehabilitation or replacement of the element warrants such changes (see NY Section 2C.4).

Element quantities recorded within the inspection report shall adhere to the following tolerances:

<table>
<thead>
<tr>
<th>Elements</th>
<th>Unit of Measure</th>
<th>Maximum Error from Actual Value (+/-)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total Quantity</td>
</tr>
<tr>
<td>Decks</td>
<td>Square Feet</td>
<td>5%</td>
</tr>
<tr>
<td>Bridge Rail</td>
<td>Linear Feet</td>
<td>5%</td>
</tr>
<tr>
<td>Superstructure</td>
<td>Linear Feet</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Each</td>
<td>0%</td>
</tr>
<tr>
<td>Bearings</td>
<td>Each</td>
<td>0%</td>
</tr>
<tr>
<td>Substructure</td>
<td>Linear Feet</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Each</td>
<td>0%</td>
</tr>
<tr>
<td>Culverts</td>
<td>Linear Feet</td>
<td>5%</td>
</tr>
<tr>
<td>Joints</td>
<td>Linear Feet</td>
<td>5%</td>
</tr>
<tr>
<td>Wearing Surface &amp; Protective Systems</td>
<td>Square Feet</td>
<td>10%</td>
</tr>
<tr>
<td>Approach Slabs</td>
<td>Square Feet</td>
<td>5%</td>
</tr>
<tr>
<td>Agency Defined</td>
<td>Square Feet</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Linear Feet</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Each</td>
<td>0%</td>
</tr>
</tbody>
</table>

The total quantity and condition state quantity of each element shall be rounded to the nearest whole number. When several condition states are assessed for one element, the inspector shall ensure the sum of the individual condition state quantities equals the total quantity for that element.
2B.3—Condition Comments

To ensure a comprehensive inspection and as part of the requirements of record keeping and documentation, an inspector is responsible for recording the location, type, size, quantity, and severity of deterioration and deficiencies for each element of a given component.

Condition comments are required for:
- select elements with CS-1 or CS-2, as deemed necessary by TL, QCE or Quality Assurance Engineer (QAE).
- all elements with a CS-3 or CS-4.
- all elements assessed CS-5, except footings and piles.
- all elements previously assessed CS-5 that now rate CS-1 thru CS-4.
- all elements newly removed or added to the bridge and/or report.
- all elements whose CS is raised due to repair/replacement.
- all elements whose CS is raised from a CS-4 when a structural review has been completed and the defects do not impact strength or serviceability of the element or bridge. This comment shall be carried through subsequent inspections (noting year of structural review) until no longer valid.

Condition comments must include a complete technical description of the location, nature, and extent of the problem, condition and/or reason for the condition state change. Include numerical and condition specific descriptions, such as: "15% section loss of bottom flange of girder 1 along the entire length," "delamination over 25% of the beginning left wingwall face," or "like-new footing recently exposed by scour." Comments shall be cross-referenced to photos. Vague or general statements, such as "significant primary member section loss" or "deteriorated concrete" are unacceptable.

Besides describing individual elements, written comments should describe aspects of the bridge that cannot be photographed, including (but not limited to):
- Excessive deflection under live load.
- Unusual noises when vehicles are crossing.
- Observations of stream velocity.
- Observations regarding traffic volume.
- Vehicle (tire) impact caused by approach settlement or heave.
- Scour

Inspectors should strive to provide well-written comments using complete sentences, proper grammar and correct spelling.

See NY Section 2B.6 for additional guidance regarding condition comments.
2B.4—Condition Photographs and Standard Photographs

Photographs are classified as either "condition" or "standard" photographs. The photographs shall have an accurate date stamp (format: month/day/year) electronically imprinted at time of capture. The photographs shall be reviewed for content, clarity and perspective prior to being placed in the inspection report. Generally, photograph content should not be altered electronically or otherwise. Minor adjustments in exposure and the addition of text, lines or arrows for clarification and emphasis are acceptable.

Condition photographs document deficiencies and must be taken for:
- all elements with a CS-3 or CS-4.
- select elements with CS-1 or CS-2, as deemed necessary by TL, QCE or Quality Assurance Engineer (QAE)
- Non-structural condition observations (see NY Section 5)
- repaired or new bridge elements.

When identical deficiencies for an element occur at several locations, one typical photo may be taken instead of photographing each location. For example, one overextended or rusted bearing may be photographed and identified as typical of all similarly deficient bearings.

Condition photos shall include a brief description of what is being photographed (e.g.: "Pier 1, column 3 spalling, looking left") and a cross-reference to written comments in the inspection report, if any. Include a photo location plan for all condition photographs in the inspection report. See NY Figure 2B.4-1 for an example.

See NY Section 2B.6 for additional guidance regarding condition photos.
Inspection reports shall contain the following standard photographs:

<table>
<thead>
<tr>
<th>Description</th>
<th>Digital Image Name</th>
</tr>
</thead>
</table>
| The bridge from each approach, standing about 100 feet from each end of the bridge. All topside deck elements should be visible. When necessary, multiple photos for each approach should be taken, for example: wide bridge or multi-lane obscured by median barrier separation. All posting signs (load restriction, vertical clearance, etc.) shall be readable, otherwise take additional standard photos as necessary. | ApproachBegin.jpg  
ApproachEnd.jpg |
| Elevation views showing the general structural configuration of each side of the bridge, and if possible, taken from a 90-degree angle to the centerline of the bridge. All vertical clearance signs shall be readable, otherwise take additional standard photos as necessary. | Elevation{Face}{Span #}.jpg  
e.g.: ElevationLeftSpan1.jpg |
| Deck underside showing each different type of underdeck structural system. Take a separate photo of the structural deck, if it is not visible in the first underside shot. | Framing{Span #}.jpg  
e.g.: FramingSpan2.jpg |
| Elevation view of each type of abutment and wingwall.                      | Abutment{Begin or End}.jpg  
e.g.: AbutmentBegin.jpg |
| Elevation view of each type of pier.                                       | Pier{pier #}.jpg  
e.g.: Pier3.jpg |
| Any individual posting or unusual components or details, including (but not limited to) dolphins, fenders, moveable bridge components, wingwalls and unusual weld details. | {detail}.jpg  
e.g.: FenderPier2.jpg |
| Features under the bridge (streams, highways, etc.) as seen from both fascias. | Feature#CrossedSpan#Left.jpg  
Feature#CrossedSpan#Right.jpg  
e.g.: F2CrossedSpan3Right.jpg |

Standard photographs shall be replaced:

- Every 6 years or
- if significant changes are observed (e.g.: major deck repair or deck replacement, railing replacement, full superstructure repainting, major change in stream alignment or bank protection, etc.), then replace only the effected standard photo(s).

The Regional Structures Management Engineer may grant a waiver to standard photograph replacement for large, complicated or difficult-to-photograph bridges.
2B.5—Condition Sketches

Condition sketches are required whenever element conditions cannot be documented completely with photographs and written comments. Such situations include (but are not limited to):

- Scour and undermining.
- Plan view of poorly aligned stream channel.
- Delaminations, spalls, and hollow-sounding areas of concrete elements.
- Bearing over-extension or under-extension.
- Impact damage to elements
- Tilting abutments or wingwalls.
- Primary member section loss
- Deck deficiencies

Condition sketches must be drawn neatly and clearly with all pertinent dimensions recorded. Condition sketches should be produced in an electronic format to facilitate and simplify edits/updates during subsequent reports. The electronic format must be compatible with the NYSDOT inspection software. It is acceptable to digitally scan hand sketches from previous reports and update them for the current report, as long as the updated sketch remains clear and legible. Sketches may be provided in lieu of condition comments if there is a benefit to conveying the condition information. In such cases, the comments shall reference the sketch and provide a brief description of the contents.

See NY Section 2B.6 for additional guidance regarding condition sketches.

2B.6—Flagging Documentation

Bridge flags are stand alone documents issued to provide timely notification of critical inspection findings to responsible parties. Flags shall contain all information necessary to thoroughly document and locate flagged deficiencies including (but not limited to) condition comments, condition photos, location and condition sketches, measurements, and calculations.

Bridge flags are included in the bridge inspection report; therefore, duplication of flag contents within other sections of the report is generally unnecessary. A flag, whose contents satisfy the requirements of NY Sections 2B.3, should be referenced in the element’s condition comments in lieu of duplicating the information. Similarly, that flag’s condition sketches and condition photos, which satisfy NY Sections 2B.4 and 2B.5, need not be attach to the element. When referencing a flag, the condition comment shall include a brief summary of the condition(s) and its location(s); for example, “Girders 2 thru 4 have web section loss above the end abutment; see attached flag RXNYYYYYNNN”. Also, attach one condition photo from the flag to the element.

For additional information regarding bridge flags, see NY Appendix B “The Inspection Flagging Procedure for Bridges”.

2B.7—Non-Structural Condition Observations

See NY Section 5 for guidance regarding non-structural condition observations.
2B.8—Additional Information

In addition to general notes, condition states, condition comments, photographs, sketches, flagging documentation, and non-structural condition observations, the inspection report will contain some or all of the following information:

- General Recommendation
- Complex/Unique Bridge Specific Inspection Requirements
  NOTE: These requirements are unique to each bridge. Prior to beginning any inspection, the TL shall review the previous inspection report and the BIN folder to ensure all requirements are met.
- Problems Requiring Further Action (Recommended Further Investigation, see NY Section 2C.11)
- Postings
- Overload Observations
- Federal NBI Ratings (see NY Appendix J)
- Diving Inspection Needs
- Inventory Problems
- Special Emphasis Inspection Requirements
  NOTE: Special emphasis requirements are unique to each bridge. Prior to beginning any inspection, the TL shall review the previous inspection report special emphasis section, the BIN folder special emphasis section, as well as NY Appendix C of the BIM, to ensure all 100% hands-on requirements are met.
- Notes to Next Inspector:
  Unique access requirements may exist at a bridge site. In such cases, inspectors should record appropriate access guidance within the ‘notes to the next inspector’. These notes may include special coordination procedures (Coast Guard, security, operations personnel, contact and phone number, certification requirements, etc.), safety concerns (rattlesnakes, bats, presence of homeless persons or belongings, poison ivy, giant hogweed, etc.), and optimum periods of the year to inspect the bridge (lake draw down, canal dry time, snow, ice, bird nesting seasons, etc.).
- Improvements Observed
- Personnel Present During Inspection
- Others not listed above
NY Section 2C

Additional Documentation Guidance

2C.1—Bridge Inspection Diary

Each Team Leader is required to record, in a hard copy Bridge Inspection Diary, the following information about the inspection team's daily activities:

- Bridge Identification Number (BIN), Substructure Unit (SSU) when applicable, county, feature carried and crossed.
- Time of arrival at the bridge site and time of departure from the bridge site.
- Inspection vehicle’s inspection related odometer readings.
- For diving inspections and fathometer surveys: starting and ending time for diving or survey.
- Weather conditions.
- Names of all inspection team personnel and their designated titles: TL, ATL, Diver, WZTC, Railroad flagmen etc.
- For each of the personnel, names of the affiliated firm or organization: Region, consultant, subconsultant, subcontractor, etc.
- Description of the inspected area(s) and the type of inspection work.
- Description of traffic control activities such as lane closures (number and duration).
- Description of all equipment used: boom truck, under bridge inspection unit, boat, etc.
- Any noteworthy actions or occurrences: bridge flagged, visitors, motor vehicle accident occurred at the bridge site, personal injury of inspection team member, etc.

When the team is not in the field, a brief general entry should be made describing the activities, BIN specific and other, the inspection team is working on.

The diaries should be kept and maintained throughout the year by the Team Leader and retained for 6 years.

2C.2—Bridge Inspection Date and Inspection Time

Bridge inspections are often performed over the course of several days. Dates and times for each field inspection must be entered into the inspection report specific to that bridge. If the inspection took more than one day, the bridge inspection date is the last day that the inspection team was in the field. Other documentation in the inspection report, such as remarks, photos, sketches, scour documentation, etc., should show dates that reflect when that part of the work occurred.

Total bridge inspection hours should include the approximate time required for the inspection team to complete all inspection tasks, including travel, access, inspection, inventory, report preparation and submission associated with the bridge. (Note: The total bridge inspection hours are not a summation of the TL hours + the ATL hours for the described tasks. It is the Team hours.)

Occasionally, after submission of a completed inspection report, the QCE or QAE may request a follow-up visit to the bridge. For such instances, where minor revision to the inspection report is
required, the bridge inspection date (last day in the field) should not be modified to reflect the follow-up visit and a note shall be provided indicating the reason for the date discrepancy. For example: if QCE or QAE requests a follow-up visit for additional condition photos, place a note in the report explaining why the photo date and last day in field date do not match, but do not change the bridge inspection date. For significant revisions, additional guidance regarding the bridge inspection date may be obtained by contacting the Regional Structures Management Engineer. An example of a significant revision is when the QCE or QAE requests section loss measurements of a primary member.

2C.3—The BIN Folder

Every bridge in the State requiring inspection under the Uniform Code of Bridge Inspection must have a folder identified with the bridge identification number (BIN). This folder should be maintained in accordance with the AASHTO Manual for Bridge Evaluation (MBE), Section 2 and shall contain at a minimum the following items:

- Current and previous inspection reports, inventory, and special emphasis documentation, if required (see NY Appendix C). Reports over six years old may be removed and archived.
- Plans (rehabilitation, retrofit and "as-built", if available) or sketches in lieu of plans, if plans are not available.
- Paper copies of Level 1 Load Rating Summary sheet and electronic or paper copies of calculations (if available).
- Level II Load Rating Summary Sheet.
- Copy of the most recent diving inspections and/or fathometer surveys, if applicable.
- All pertinent correspondence.
- Independent flag correspondence subfolder.
- Total quantity calculations for each element.

The BIN folders for state and local bridges are kept in the Regions. BIN folders for bridges owned by the eleven public authorities which inspect their own bridges, are maintained by the respective authorities. These eleven authorities are:

- Niagara Falls Bridge Commission
- New York State Bridge Authority
- New York State Thruway Authority
- Ogdensburg Bridge and Port Authority
- Port Authority of New York and New Jersey
- New York State Power Authority
- The Seaway International Bridge Corporation
- Thousand Islands Bridge Authority
- MTA Bridges and Tunnels (a.k.a. Triborough Bridge and Tunnel Authority)
- Nassau County Bridge Authority
- Buffalo and Fort Erie Public Bridge Authority
2C.4—Plan Verification and Update

The inspector must examine the report binder, diving reports, fathometer surveys, and plans or sketches in lieu of plans before every inspection to become familiar with the structure and identify features requiring special attention. If the bridge, approaches, or features crossed were modified, replaced or repaired since the last inspection, plans or sketches and element total quantities must be updated to illustrate current conditions clearly and the inventory items must be verified and updated as necessary. Note these modifications, replacements and repairs with the observation date in the inspection report. Updated total quantity calculations shall be dated and have both “done by” and “checked by” entries completed.

On new state bridges, the as-built plan dimensions may be assumed to have been verified if the job has been accepted by the Engineer in Charge (E.I.C.). This assumption cannot always be made for new local bridges. Plans or sketches in lieu of plans must be dated and initialed by the Team Leader, regardless of modifications. Instead of signing the plans directly, it is acceptable to attach a sheet to the plans or sketches that can be used for Team Leader signature and to show whether changes have occurred since the last inspection.

Sketches in lieu of plans must be prepared when existing plans or sketches are missing, incomplete, or inaccurate. If totally new sketches are needed, they must be drawn in U.S. Customary units and include plan, elevation, and cross-section views with the pertinent dimensions recorded.

2C.5—Inventory

Generally, the NYSDOT inspection software system will contain the required inventory items prior to an inspection. When the information for a required inventory item is not shown or is incorrect, the inspection Team Leader shall complete/update this information in accordance with the NYSDOT Bridge Inventory Manual.

2C.6—Bridge Orientation Conventions

Directions, stationing, and element numbering should be made relative to the direction of orientation of the bridge. The direction of orientation is an inventory item available in the NYSDOT inspection software system. Looking across the bridge in the direction of orientation, a two-girder bridge, for example, would have a left and a right girder; a multi girder bridge would have girders starting with #1 at the left fascia. Stationing for measurements, such as channel cross-sections or profiles, should increase in the direction of orientation or from left to right when looking in the direction of orientation. To maintain a historical trend, an exception should be considered when a different convention has been used in previous inspections for rating the various bridge elements.

For more information on direction of orientation, see the NYSDOT Bridge Inventory Manual.
2C.7—Pier and Span Numbering

Spans are numbered sequentially between substructures on multi-span bridges looking in the direction of orientation. Pin and hangers do not delineate the begin or end of a span. The pier number is associated with the end of the span it supports looking in the direction of orientation. Refer to NY Figure 2C-1.
2C.8—Special Case Ramp Bridges

Ramp bridges connected to mainline bridges are oriented such that the beginning of the ramp bridge is at the mainline bridge (see NY Figure 2C-2). If the beginning of the ramp bridge is supported by a pier that also supports a part of the mainline bridge, only the bearings supporting the ramp structure shall be assessed with the ramp bridge (for example, Ramp “A”). If the ramp bridge is framed directly into the primary members of the mainline bridge, the components supporting the beginning of the ramp bridge are inspected as primary members for the ramp bridge (for example, Ramp “B”).

When inspecting a pier on the mainline structure of a bridge that also supports a ramp structure (for example, Ramp “A”), inspection should include the part supporting both the mainline and ramp structures. All elements supporting the mainline structure should be included in the assessment for the pier of the mainline structure. The cap beam, columns, footings and piles supporting both the main bridge and the ramp bridge should be inspected with the main bridge. If mainline pier deficiencies adversely affect the ramp bridge, cross-referenced remarks on the mainline and ramp inspection reports are necessary. If a deck joint exists, the joint between the ramp and mainline should be assessed with the ramp’s beginning substructure.

![Diagram of ramp bridge configuration](image-url)
2C.9—Vertical Clearance and Load Postings

Vertical Clearance and Load Posting entries show whether the inventory database has a record of these signs either on or under the bridge. These are not entered during the time of inspection unless the current information is incorrect or absent. All vertical posting information is recorded in feet and inches. All load posting information is recorded in U.S. tons.

Existing inventory information will be available in the database for inspectors to review at the time of the inspection. If the existing information is consistent with conditions encountered in the field, no update is necessary. If the existing inventory shows that the bridge is not posted, but the bridge is actually posted for clearance or load, the existing inventory postings must be updated. When no existing inventory posting information is given, such as for a new bridge, enter values for these items based on observations and measurements made in the field.

**Vertical Clearance:**

If the minimum vertical clearance (see NYSDOT Bridge Inventory Manual for additional information) in the field varies from the existing inventory information, the clearance value must be updated. If the existing inventory information shows that the bridge is posted for clearance, but no signs are present, consult the Flagging Procedure (NY Appendix B) for further guidance.

Any differences from the existing inventory’s minimum vertical clearance values must be verified by measuring clearance in the field. Measure the minimum vertical clearance, to the nearest 1 inch (rounded down), between the lowest permanent overhead obstruction and a point on the travel lane which is directly below it (not including shoulders). A bridge intersecting a highway shall be posted for clearance if the actual measured minimum clearance is less than 14 feet. If posting for vertical clearance is necessary, a bridge is posted for 1 foot less than the actual measured minimum vertical clearance. If the legend on the posting sign does not meet this requirement, refer to the Flagging Procedure.

For bridges with railroad vertical clearance 25 feet or less, direct field measurements shall be made to determine the smallest vertical dimension between the top of each rail of each track and the underside of the above structure. These measurements shall be taken at a minimum of every 6 years or when any new work on either the bridge or the rails affects the previous measurements. If the vertical clearance is greater than 25 feet, a general bridge note shall be placed in the inspection report indicating “Railroad vertical clearance greater than 25 feet therefore no direct field measurement required.”
A simple line sketch with accompanying table shall be prepared to record the minimum vertical clearances over the railroads. The sketch shall show a plan view of the bridge and/or spans and locate all railroad tracks in relation to the bridge. The sketch shall also show the approximate location (point) of each minimum vertical clearance measurement being recorded. These points shall be numbered in ascending order and recorded in the table with the corresponding minimum vertical measurement. The following descriptive information shall also be provided on each sketch:

- BIN
- Feature Carried
- Features Crossed
- North Arrow
- Labeling of bridge elements based on inspection orientation
- Prepared by:
- Date:

The sketch shall be kept in the BIN folder. When new measurements are documented, note this in the bridge inspection report and update the inventory accordingly.

**Load Posting:**

If a load posting is less than the existing inventory value, enter the new lower value. If a new load posting is greater than the existing inventory value, review the BIN folder to determine if the posting was raised for sound technical reasons. If so, explain this in the "Remarks" section and inventory the new, higher value. If review of the folder suggests no sound technical reason for raising the posting, do not update the inventory, but immediately consult the Flagging Procedure (NY Appendix B) for further guidance.

If inventory information indicates that the bridge is posted for load, but no posting signs are found, review the BIN folder. If the bridge has been replaced and NYS Professional Engineer-signed documents show that the new bridge was designed for legal loads, update the inventory to indicate that no posting is required. If the bridge was rehabilitated or additional analysis determined posting no longer required and the NYS Professional Engineer-signed documents indicate the load capacity is increased to allow for legal loads, update the inventory value accordingly; however, if the bridge should still be posted and signs are missing, do not inventory this item and immediately consult the Flagging Procedure (NY Appendix B) for further guidance.

For bridges closed temporarily for reconstruction, do not code this item. For additional load posting guidance and load posting guidance on closed bridges see the NYSDOT Bridge Inventory Manual.

**2C.10—Apparent Violations of Load Postings**

The inspector must note any apparent violations of load postings by any privately or publicly owned vehicle. This should be recorded within the inspection report. If possible, it should include the owner and plate number and estimated weight of each vehicle. For multiple violations by the same vehicle, the number of violations observed should be noted.
2C.11—Recommend Further Investigation

 Recommending further investigation brings bridges, which might require further action, to the attention of the Regional Structures Management Engineer and/or bridge owner. This is intended to help the Region and/or the bridge owner avoid the possibility of no action due to oversight but is not meant to serve as notification for matters requiring immediate action. Do not use this space to show need for repair work; flags, maintenance observations, condition state assessments and condition comments will do that. The following conditions are examples of when to recommend “Further Investigation”.

- Calculations are needed to evaluate structural significance of a particular observation. For example, deterioration may be progressing rapidly on the primary members of a bridge not posted for load. Recommend “Further Investigation” and indicate "Evaluate for load posting" under "Remarks."
- The scope of inspection being performed is insufficient to evaluate structural significance of a potentially serious condition. For example, one may be inspecting a steel bridge where the primary members are encased in concrete, which show evidence of heavy leakage with rust stains. The primary members should be rated based on what is visible, the limitation of the rating should be explained, and “Further Investigation” recommended with a comment added recommending removal of the encasement.
- For the National Bridge Inspection (NBI) Substructure Condition rating, the Team Leader must consider scour as well as the physical condition of the substructure. If the Scour Critical Rating is 2 but there is no evidence of scour at the substructures, or if the Scour Critical Rating is 8 and there is evidence of scour at the substructures, then recommend “Further Investigation” by the Regional Hydraulics Engineer. It is also recommended that the Hydraulic Vulnerabilities Assessment Request (HVA) form be completed.
- Additional examples for recommendation of “Further Investigation” can be:
  - Pin and hangers should receive non-destructive testing
  - Level 1 Load rating needed
  - Determine height of footing
  - Determine existence of piles
  - Core underside of arches to determine strength
  - Core deck to determine strength
  - Deck evaluation needed due to widespread cracking
  - Exposure of significant number of piles with unknown foundation information such as pile-tip elevation.
  - Bridge improvements are noted. Work History Update is required.

These examples are cases where it is appropriate to call for further investigation. That is a matter of judgment by the Team Leader. When “Further Investigation” is recommended an explanation is required.

Actions taken and findings due to recommended “Further Investigation” should be recorded in the BIN folder by the RSME, bridge owner or their designee.
2C.12—Overhead Sign Structures

Do not inspect overhead sign structures (OSS) as this responsibility rests with the OSS Inspector. Inspect the connection of the OSS to the bridge. Non-structural condition observations and flagging concerns (for example, missing or loose base connection bolts) should be documented per NY Section 5 and NY Appendix B, respectively. Bridge elements which support the OSS should be assessed with the appropriate superstructure element (for example, transverse supports extending past the fascias).

For additional information regarding OSS inspection, see the NYSDOT Overhead Sign Structure Inventory and Inspection Manual.

For information regarding other types of bridge related signs and how to report their condition, see NY Section 5 and NY Appendix B.

2C.13—Recommendation for Vulnerability Reassessment

The NYSDOT Bridge Safety Assurance program requires review of the following vulnerability reassessment forms during the inspection:

- Collision Reassessment Recommendation – If a change condition is observed, for example, any modifications to the bridge, any evidence of collision impact damage, any significant increase of the AADT, etc., then the corresponding question on the reassessment form should be answered “Yes”.
- Hydraulic Reassessment Recommendation – If a change condition is observed, for example, any evidence of the channel changing course, any evidence of erosion or scour around footings or embankments, any evidence of debris around substructures, if any scour countermeasures have been installed, etc., then the corresponding question on the reassessment form should be answered “Yes”.
  - Note: the stream channel should be observed underneath the bridge and at least 250 feet from each fascia.
- Steel Reassessment Recommendation – If a change condition is observed, for example, any modification to the steel superstructure, any significant increase of the AADT, any structural flag issued for metal cracking, corrosion, or impact damage, any new evidence of metal cracking, etc., then the corresponding question on the reassessment form should be answered “Yes”.

When one or more of the form questions are answered “Yes”, then the form must be completed and submitted.
NY SECTION 2D
STREAM CHANNEL DOCUMENTATION

See NY Section 3.10 for Agency Defined Elements:
- 800—Scour
- 801—Stream Hydraulics

2D.1—Introduction

Generally, channel cross-sections at fascias, channel profiles near substructures and substructure undermining must be documented during each general inspection at bridges over water. The inspection should also document erosion problems identified at bridges over other features.

Not all documentation is required at every bridge. For example:

- A bridge crossing a gorge where the stream channel is remote from any part of the bridge might not require channel cross-sections at fascias.
- Swift and/or deep water at a bridge river crossing prevents collection of channel cross-section readings at the fascia.

The features limiting the documentation may be permanent or may be a singular event. For either situation, the Team Leader must use sound engineering judgment when deciding to omit documentation. When necessary documentation is omitted, the feature(s)/condition(s) limiting the documentation shall be stated in the inspection report’s general notes and the most recent documentation shall be attached.

For bridges which normally receive diving inspections and/or fathometer surveys, the Team Leader should, in conjunction with the diving/fathometer report, evaluate the current stream channel and scour conditions. If significant changes are detected, the NYSDOT Regional Hydraulics Engineer should be notified. The Regional Hydraulics Engineer can decide the need for an immediate diving inspection or a change in diving inspection frequency.
2D.2—Channel Cross-Section at Fascias

The purpose for collecting these measurements, also known as dropline readings, is to document changes in the waterway opening at the bridge fascias. Measurements from successive inspections may reveal a trend of lateral stream migration which helps identify any scour problems before they endanger the bridge. The readings shall document:

- The streambed relative to fixed points along the bridge fascias.
- The water level relative to a fixed point on the bridge.
- If dropline readings indicate scour holes.

Dropline readings shall be taken during every general inspection. At some locations, channel cross-section readings at the fascias may be reduced or eliminated, based on the recommendation of the Regional Hydraulic Engineer, as directed by the RSME. Examples where this may occur include, but are not limited to:

- Median side fascia readings on parallel interstate type bridges.
- Fascias above non-erodible rock beds.

How to Document:

Take dropline readings along each fascia of all floodplain spans. Take readings along each fascia, starting at the first substructure before the floodplain and proceeding with spacing not to exceed 10 feet increments to the substructure beyond the floodplain. For short span bridges, consider reducing this to 5 feet increments. A minimum of 4 readings shall be taken along each fascia. Consider taking dropline readings at railing post locations if the spacing does not exceed 10 feet. If readings were previously taken, new readings should be taken at the same locations and referenced to the same fixed portion of the bridge. Dropline readings should be measured to a reference datum line on the bridge that is not likely to change with time. For example, the top of the bottom chord of a truss is a better choice than top of railing because of possible railing replacement. If the top of railing is used, be sure to measure the railing height relative to a more permanent reference line such as bottom of sidewalk or deck. If accurate readings cannot be taken because of physical conditions at the site, they can be omitted. Document the reason in the inspection report.

The inspection report shall include a channel cross-section reference sketch showing:

- Partial transverse section identifying the reference datum, water level, and streambed. If the top of railing is used as a datum, show the railing height.
- Plan location of the measurement taken from the datum to the water level. This measurement should be taken where the water depth typifies the stream depth at the bridge at the time of inspection.
- Plan layout of dropline reading locations. Show the direction of stream flow, a North arrow, and label the abutments and piers.
- Significant observations should be included in the Notes table.
- Tabulated dropline readings.

See NY Figures 2D.2-1 and 2D.2-2 for sample channel cross-section documentation.
**CROSS SECTION CHANNEL READINGS**

**BIN** 3346530  **July 7, 2015**

*Feature Carried: County Road 77*  
*Feature Crossed: Rondout Creek*

- Water Level Reading Taken at 110’

<table>
<thead>
<tr>
<th>NOTE</th>
<th>2011</th>
<th>New bridge. Therefore, new stations and readings established.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Significant changes noted since last inspection.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>See readings for areas of change.</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Changes are as noted.</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

**SAMPLE**

**CHANNEL CROSS-SECTION DOCUMENTATION**

*NY Figure 2D.2-1*
### CROSS SECTION CHANNEL READINGS

**BIN** 3346530  
**July 7, 2015**

**Feature Carried:** County Road 77  
**Feature Crossed:** Rondout Creek

FBA. = Face of Begin Abutment, FEA = Face of End Abutment,  
WL = Water Level (Taken at 110’),  
* = Edge of Stream,

<table>
<thead>
<tr>
<th>STA.</th>
<th><strong>LEFT SIDE READINGS</strong></th>
<th>STA.</th>
<th><strong>RIGHT SIDE READINGS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>YEAR</strong></td>
<td><strong>2011</strong></td>
<td><strong>2013</strong></td>
</tr>
<tr>
<td></td>
<td><strong>FBA</strong></td>
<td>21.2</td>
<td>20.3</td>
</tr>
<tr>
<td></td>
<td><strong>10’</strong></td>
<td>24.4</td>
<td>23.2</td>
</tr>
<tr>
<td></td>
<td><strong>20’</strong></td>
<td>27.1*</td>
<td>25.2</td>
</tr>
<tr>
<td></td>
<td><strong>30’</strong></td>
<td>28.5</td>
<td>28.7*</td>
</tr>
<tr>
<td></td>
<td><strong>40’</strong></td>
<td>30.8</td>
<td>29.8</td>
</tr>
<tr>
<td></td>
<td><strong>50’</strong></td>
<td>32.9</td>
<td>30.4</td>
</tr>
<tr>
<td></td>
<td><strong>60’</strong></td>
<td>32.4</td>
<td>31.5</td>
</tr>
<tr>
<td></td>
<td><strong>70’</strong></td>
<td>32.8</td>
<td>31.2</td>
</tr>
<tr>
<td></td>
<td><strong>80’</strong></td>
<td>29.5</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td><strong>90’</strong></td>
<td>33.3</td>
<td>31.9</td>
</tr>
<tr>
<td></td>
<td><strong>100’</strong></td>
<td>33.4</td>
<td>33.1</td>
</tr>
<tr>
<td></td>
<td><strong>110’</strong></td>
<td>33.5</td>
<td>33.0</td>
</tr>
<tr>
<td></td>
<td><strong>WL</strong></td>
<td>30.6</td>
<td>30.4</td>
</tr>
<tr>
<td></td>
<td><strong>120’</strong></td>
<td>33.6</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td><strong>130’</strong></td>
<td>32.9</td>
<td>32.8</td>
</tr>
<tr>
<td></td>
<td><strong>140’</strong></td>
<td>29.9</td>
<td>29.7</td>
</tr>
<tr>
<td></td>
<td><strong>150’</strong></td>
<td>24.6*</td>
<td>22.4*</td>
</tr>
<tr>
<td></td>
<td><strong>FEA</strong></td>
<td>20.7</td>
<td>20.2</td>
</tr>
</tbody>
</table>

Note: Tree and debris at right side station readings 78, 82 and 90.

**SAMPLE CHANNEL CROSS-SECTION DOCUMENTATION**  
**NY Figure 2D.2-2**
2D.3—Channel Profile Near Substructures

The purpose for collecting this information is to document the streambed profile at each affected substructure. Readings from successive inspections are intended to help determine if the streambed is either aggrading or degrading which will contribute to scour assessment and the determination of ratings at the substructures.

Channel profiles near substructures are required for diving inspections. They are required for bridge inspections whenever the depth or turbidity of the water preclude an adequate visual inspection of the stream bottom next to the substructure. Document the streambed profile relative to fixed points (datum) on the substructure; such as top of footing, bridge seat or top of pier cap. In situations where a fixed point on a substructure cannot be used, as with concrete culverts, document relative to a fixed reference such as bottom of slab. If a rod can be used, note also the depth of penetration into the streambed.

How to Document:

Take readings along the face of the substructure at 5 feet increments and extending up to 25 feet, if necessary, beyond each end of the substructure. If the footing is exposed, readings should be next to the footing; if not, then about 1 foot from the face of the substructure. All readings should be referenced to a datum. If possible, link this datum to the datum used for fascia dropline readings.

Using a probing tool such as a steel rod, check for soft areas in the streambed along the substructures, recording the depth of penetration. Probing might indicate the in-filling of a possible scour hole or the streambed susceptibility to scour. These measurements should be taken at increments not to exceed 10 feet along the substructure length: a minimum of two measurements. If the streambed is rock, stone or similar, penetration documentation is not required.

For diving inspections, see NY Appendix D for additional requirements.

Sketches for channel profile near substructure should show the following:

- Plan-view of the substructure showing locations of the measurements, the estimated velocity and direction of stream flow, a North arrow and any protective measures such as fenders or dolphins.
- Elevation-view showing the datum and the water surface either as an elevation or as a distance.
- Measurements in a tabular form:
  - The first columns should represent the locations.
  - Each column thereafter should represent the measurements for the given year.
  - The final column should represent the change in values between the current and the previous measurements: positive (+) values indicate aggradation, negative (-) values indicate scour.
- Type and extent of scour and/or stone protection.
- Early indications of scour, including any loss of scour protection.
- Water surface elevation and time of reading for tidal waters.
- Changes that have occurred since the previous inspection should be noted on the sketch.

See NY Figures 2D.3-1 and 2D.4-1 for sample channel profile near substructures documentation.
CHANNEL PROFILE ALONG ABUTMENTS (Feet)

<table>
<thead>
<tr>
<th>Loc.</th>
<th>READINGS:</th>
<th>ROD PENETRATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Begin Abutment</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>6.00</td>
<td>6.95</td>
</tr>
<tr>
<td>B</td>
<td>6.55</td>
<td>7.30</td>
</tr>
<tr>
<td>C</td>
<td>6.95</td>
<td>7.35</td>
</tr>
<tr>
<td>D</td>
<td>7.00</td>
<td>7.40</td>
</tr>
<tr>
<td>E</td>
<td>6.85</td>
<td>7.00</td>
</tr>
<tr>
<td>F</td>
<td>6.80</td>
<td>6.85</td>
</tr>
<tr>
<td>G</td>
<td>6.80</td>
<td>6.90</td>
</tr>
<tr>
<td>H</td>
<td>6.20</td>
<td>6.20</td>
</tr>
<tr>
<td>I</td>
<td>5.55</td>
<td>5.50</td>
</tr>
<tr>
<td>J</td>
<td>4.20</td>
<td>4.25</td>
</tr>
<tr>
<td>K</td>
<td>4.70</td>
<td>4.70</td>
</tr>
<tr>
<td>L</td>
<td>5.20</td>
<td>5.15</td>
</tr>
<tr>
<td>M</td>
<td>5.30</td>
<td>5.30</td>
</tr>
<tr>
<td>N</td>
<td>5.20</td>
<td>5.20</td>
</tr>
<tr>
<td>O</td>
<td>5.35</td>
<td>5.35</td>
</tr>
<tr>
<td>P</td>
<td>4.90</td>
<td>4.90</td>
</tr>
<tr>
<td>Q</td>
<td>3.80</td>
<td>3.80</td>
</tr>
<tr>
<td>R</td>
<td>3.80</td>
<td>3.80</td>
</tr>
</tbody>
</table>

Notes:
- No significant changes.
- Water Level from top of stem = 5.2 ft
- Minor erosion at Begin Left Wing Wall
- Water Level from top of stem = 5.2 ft
- Begin Left Wing Wall footing now exposed. Maximum vertical footing reveal is 3 inches.
- Water Level from top of stem = 5.2 ft

SAMPLE SKETCH
CHANNEL PROFILE NEAR ABUTMENTS
NY Figure 2D.3-1
2D.4—Substructure Undermining and Erosion

In addition to the above documentation of the Channel Profile Near Substructures, document any substructure undermining observed during inspection. Erosion and undermining problems along substructures at bridges over features other than water should also be documented. Erosion distant from substructures needn’t be documented unless the inspector judges otherwise.

How to Document:

Documentation consists of a sketch showing the problem location and all three dimensions of the limits of material loss. If undermining extends under a footing with piles, their condition should be noted. Note type of embankment or streambed material and its average size.

In addition to any applicable sketch requirements for channel profile near substructures, sketches for substructure undermining and erosion should also show:

- The horizontal and vertical limits of material loss under and adjacent the substructure.
- In the presence of piles, the following should be provided:
  o Pile-layout with spacing
  o Condition of pile: for example, awl penetration(s) for each exposed timber pile
  o Section loss including method of measurement
  o Vertical exposed length of each pile
  o Pile-tip elevation and the embedment length. For unknown pile-tip elevation, documentation should state “pile-tip information unknown”.

See NY Figures 2D.4-1 thru NY 2D.4-3 for sample sketches.
### CHANNEL PROFILE AND UNDERMINING READINGS ALONG PIER (FT)

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2011</th>
<th>2013</th>
<th>Depth Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>0.8</td>
</tr>
<tr>
<td>B</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
<td>1.2</td>
</tr>
<tr>
<td>C</td>
<td>1.1</td>
<td>-</td>
<td>-</td>
<td>2.0</td>
</tr>
<tr>
<td>D</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>2.2</td>
</tr>
<tr>
<td>E</td>
<td>1.1</td>
<td>-</td>
<td>-</td>
<td>3.1</td>
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<tr>
<td>F</td>
<td>2.3</td>
<td>-</td>
<td>-</td>
<td>3.2</td>
</tr>
<tr>
<td>G</td>
<td>2.7</td>
<td>-</td>
<td>-</td>
<td>2.9</td>
</tr>
<tr>
<td>H</td>
<td>2.7</td>
<td>-</td>
<td>-</td>
<td>2.7</td>
</tr>
<tr>
<td>I</td>
<td>2.6</td>
<td>-</td>
<td>-</td>
<td>2.7</td>
</tr>
<tr>
<td>J</td>
<td>2.6</td>
<td>-</td>
<td>-</td>
<td>2.7</td>
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<td>K</td>
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</tr>
<tr>
<td>L</td>
<td>2.3</td>
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<td>-</td>
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</tr>
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<td>M</td>
<td>2.1</td>
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<td>2.0</td>
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<tr>
<td>N</td>
<td>1.9</td>
<td>-</td>
<td>-</td>
<td>1.9</td>
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<tr>
<td>O</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
<td>1.9</td>
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<td>P</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
<td>1.9</td>
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<tr>
<td>Q</td>
<td>1.8</td>
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<td>1.9</td>
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<td>R</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>1.2</td>
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<tr>
<td>S</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
</tr>
<tr>
<td>T</td>
<td>0.1</td>
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<td>0.5</td>
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<td>U</td>
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<td>-</td>
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<td>0.3</td>
</tr>
<tr>
<td>V</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
</tr>
</tbody>
</table>

(-) Depth Change indicates scour. (+) Depth change indicates aggradation.

<table>
<thead>
<tr>
<th>Year</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>No significant changes.</td>
</tr>
<tr>
<td>2011</td>
<td>New undermining at S.E. corner (values highlighted in table)</td>
</tr>
<tr>
<td></td>
<td>Otherwise no significant changes.</td>
</tr>
<tr>
<td>2013</td>
<td>Undermining has increased.</td>
</tr>
<tr>
<td></td>
<td>Otherwise no significant changes.</td>
</tr>
</tbody>
</table>
EROSION AND UNDERMINING OF END ABUTMENT

**Sample Sketch**

EROSION AND UNDERMINING OF ABUTMENT

NY Figure 2D.4-2

NOTE: NO STREAM. EROSION WAS CAUSED BY MISDIRECTED SUPERSTRUCTURE DRAINAGE.
SCOUR AND UNDERMINING OF END ABUTMENT

STREAM BED: MIXED COARSE GRAVEL AND SAND.

ELEVATION END ABUTMENT

PLAN END ABUTMENT

SAMPLE SKETCH
SCOUR AND UNDERMINING AT ABUTMENT
NY Figure 2D.4-3
2D.5—Stream Alignment Sketch

Any deficiencies or alignment problems in the stream channel that cannot adequately be shown in photos should be sketched in a simple plan view.

A plan-view sketch should indicate:

- The general configuration of the bridge including dolphins and fender systems
- Scour protection measures such as riprap or concrete aprons
- Deficiencies in the stream channel
- Locations of debris, siltation, scour pockets and loss of bank protection
- Stream flow direction and estimated angle of flow. Estimate the angle of flow relative to an axis perpendicular to the bridge fascia. For flow parallel to the substructure faces, the angle is zero.

A condition photograph should be taken to emphasize a deficiency or attribute.

When no stream alignment sketch is provided, the Condition Photo Location Plan (see NY Figure 2B.4-1) shall include the direction of flow.

See NY Figure 2D.5-1 for a sample sketch.
Stream Channel Alignment Sketch

NY Figure 2D.5-1
NY SECTION 3
DETAILED ELEMENT GUIDANCE

The following sections provide NYSDOT guidance for the National Bridge Elements (NBE), Bridge Management Elements (BME), and Agency Defined Elements (ADE):

3.1—Decks and Slabs
3.2—Railings
3.3—Superstructure
3.4—Bearings
3.5—Substructures
3.6—Culverts
3.7—Joints
3.8—Wearing Surfaces, Protective Coatings, and Concrete Reinforcing Steel Protective Systems
3.9—Approach Slabs
3.10—Agency Defined Elements

These sections include general guidance, element determination sketches, and condition state examples. The sketches are a primer to assist inspectors with determining the proper assignment of elements to a structure. Configurations encountered in the field that are not represented by the sketches require engineering judgment and coordination with the QC for proper element assignment. The condition state examples shall not replace the use of an element’s Condition State Definitions when assessing defects.

Elements are grouped for presentation of common guidance. The elements are presented in the same order in which they are found in the AMBEI, with the exception of the Superstructure elements; these are generally grouped by material type.

Additionally, Section 3.10 provides the Agency Defined Elements:

- Description
- Unit of Measurement
- Condition State Definitions
- Element Commentary
This page intentionally left blank.
3.1—DECKS AND SLABS

(Note: Similar elements are grouped for presentation of information.)

See NY Appendix C for special emphasis inspection intensity requirements.

See NY Section 3.10 for Agency Defined Elements:
- 810—Sidewalks
- 811—Curbs

General Deck and Slab Guidance

Sleepers and crossbeams are included in the assessment for the structural deck.

3.1.1—Element 12—Reinforced Concrete Deck

3.1.2—Element 13—Prestressed Concrete Deck

3.1.3—Element 38—Reinforced Concrete Slab

3.1.4—Element 15—Prestressed Concrete Top Flange

3.1.5—Element 16—Reinforced Concrete Top Flange

General Guidance

T-beam flanges are assessed as deck Element 16. NEXT ‘D’ beam flanges are assessed as deck Element 15. NEXT ‘F’ beam flanges, used as deck forming aids, are included with the assessment of the separately cast structural deck Element 12. The tops of adjacent prestressed box beams and voided slabs are assessed as deck Element 15. See NY Figure 3.1-1 for additional information.

Provide a sketch for concrete decks/slabs assessed CS-3 or CS-4. The sketch should indicate the extent and type of CS-2, CS-3 and CS-4 deficiencies. The deck sketch may be omitted if:
- conditions are uniform throughout the bridge deck and accurately documented through condition comments and condition photos
- conditions are isolated and their individual locations are accurately documented through condition comments and condition photos.

In such cases, condition comments shall indicate why the deck sketch was not provided.

When a concrete integral wearing surface is present, assess its riding quality and skid resistance with the Delamination/Spall/Patched Area (1080) and the Abrasion/Wear (PSC/RC) (1190) defects, respectively. The Abrasion/Wear (PSC/RC) (1190) defect should also be used to assess integral wearing surface:
- wheel path ruts
- worn saw cutting or grooving
DECK CROSS SECTIONS

NY Figure 3.1-1

- Reinforced or prestressed concrete bridge deck (NBE 12 or 13)
- Steel open girder/beam (NBE 107)
- Reinforced or prestressed concrete bridge deck (NBE 12 or 13)
- Steel closed web/box girder (NBE 102)
- Top of box assessed as prestressed concrete top flange (NBE 15)
- Wearing surface (BME 510)
- Open utility bay
- Reinforced concrete top flange (NBE 16)
- Web and bottom flange assessed as prestressed concrete closed web/box girder (NBE 104)
- Cast-in-place T-beams, reinforced concrete open girder/beam (NBE 110)
- Wearing surface (BME 510)
- Prestressed concrete top flange (NBE 15)
- Reinforced or prestressed concrete bridge deck (NBE 12)
- Next 'D' beam, prestressed concrete open girder/beam (NBE 109)
- Next 'F' beam, prestressed concrete open girder/beam (NBE 109)
Condition State Examples
(Note: Only the indicated condition is considered for assessment in the examples shown below.)

**NY Example 3.1-1**
The materials covering the deck (S.I.P. forms and asphalt wearing surface) are like new. The reinforced concrete deck has no indicators of deterioration. Element 12 assessed **CS-1**.

**NY Example 3.1-2**
White efflorescence is present along the top flanges and at cracks located throughout the entire deck. Element 12 assessed **CS-2**.
NY Example 3.1-3
Buildup of white efflorescence is evident at the flange interface of the NEXT D beam. Element 15 assessed CS-2.

NY Example 3.1-4
The reinforced concrete deck surface is polished in the wheel paths. Course aggregate is exposed. Element 12 assessed CS-2.
NY Example 3.1-5
The patched area is hollow sounding and moist around its perimeter. Element 12 assessed CS-3.

NY Example 3.1-6
The concrete fascia is severely spalled with exposed reinforcement. The rail posts anchorages are still solid and the deck strength/serviceability is not affected. Element 12 assessed CS-3.
NY Example 3.1-7
The bottom mat of deck reinforcement was built with shallow cover (<1”). The concrete cover is spalled and minor corrosion of the reinforcement is present. Element 16 assessed CS-3.

NY Example 3.1-8
The reinforced concrete slab exhibits locally severe deterioration with deep spalling, exposed debonded reinforcement and the possibility of punch through. Element 38 assessed CS-4.
3.1.6—Element 28—Steel Deck with Open Grid

3.1.7—Element 29—Steel Deck with Concrete Filled Grid

3.1.8—Element 30—Steel Deck Corrugated/Orthotropic/Etc.

General Guidance

Do not assess bridge deck scuppers; their conditions may be reported as non-structural condition observations or with the appropriate flag (see NY Section 5 and NY Appendix B, respectively), when necessary.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.1-9
The Steel Deck with Open Grid and the Steel Deck with Concrete Filled Grid are both in good condition with freckled rust. Elements 28 & 29 assessed CS-2. The concrete fill was finished to create a wearing surface. This wearing surface has large diameter spalls greater than 6 inches. Element 510 assessed CS-3.
NY Example 3.1-10
Adjacent the deck joint, the concrete filled steel grid has one area of broken and deformed bars. Element 29 assessed C.S. 3. Within this area the concrete has fallen thru. The remainder of the open deck grid appears in good condition. Element 28 assessed CS-1.

NY Example 3.1-11
The intermittent grates are moderately rusted, but without any appreciable section loss. The seal between the grate frame and the adjoining deck is good. Element 28 assessed CS-2.
NY Example 3.1-12
The underside of the asphalt-filled corrugated metal structural deck exhibits heavy corrosion and delamination, most notably near the holes in the bottom of the troughs, throughout. Element 30 assessed CS-3.

NY Example 3.1-13
The transverse sleepers are in poor condition with isolated areas of heavy corrosion and rusted thru holes in the web. Element 28 assessed CS-4.
3.1.9—Element 31—Timber Deck

3.1.10—Element 54—Timber Slab

General Guidance

Assess longitudinal planking over timber decks/slabs as Wearing Surface Element (Element 510).

For timber decks/slabs without a separate wearing surface, the surface characteristics such as riding quality and skid resistance are assessed with the Abrasion/Wear (PSC/RC) (1190) defect.

[Diagram showing timber deck and slab components, including steel girder/beam (NBE 107), wearing surface (BME 510), and timber slab (NBE 54).]

TIMBER DECK
NY Figure 3.1-2
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.1-14
The timber deck is wet with random localized soft areas over the girders. Element 31 assessed CS-2.

NY Example 3.1-15
Several timber deck planks are loose or checked and deteriorated to the point of leaving gaps. Element 31 assessed CS-4.
3.1.11—Element 60—Other Deck

3.1.12—Element 65—Other Slab

General Guidance

No comments or example photos.
3.2—RAILINGS

(Note: Similar elements are grouped for presentation of information.)

3.2.1—Element 330—Metal Bridge Railing

3.2.2—Element 331—Reinforced Concrete Bridge Railing

3.2.3—Element 332—Timber Bridge Railing

3.2.4—Element 333—Other Bridge Railing

3.2.5—Element 334—Masonry Bridge Railing

General Guidance

Railings composed of two or more materials running contiguously and longitudinally together shall have both materials assessed under their respective elements; for example, see the metal and concrete combination shown in NY Example 3.2-2.

For bridges with newer independently supported railing systems placed traffic side of existing abandoned systems (see NY Example 3.2-1), assess only the condition of the new system and comment on both as necessary.

Railing system posts may often have defects which warrant a lower rating than the rail they support. In such cases, each affected post should be assessed as an increment of 1 foot.

Do not assess pedestrian-only fencing and snow fencing. Their condition should be flagged (see NY Appendix B) or reported as non-structural condition observations (see NY Section 5), when appropriate.
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.2-1
Shown is a new, independently supported railing system placed traffic side of existing abandoned railing. The newer railing system is in excellent condition. Element 330 assessed CS-1.

NY Example 3.2-2
The steel rail is in good condition. Element 330 assessed CS-1. The concrete parapet has tight map cracking. Element 331 assessed CS-2.
NY Example 3.2-4
The metal railing was impacted, shearing one metal post at the base. Also, a rail section and end vertical are missing. Element 330 assessed CS-4.

NY Example 3.2-5
Several non-structural face stones are displaced from the masonry railing. The underlying material is sound. Element 334 assessed CS-3.
NY Example 3.2-6

The fascia is severely spalled up to 6 inches deep with exposed reinforcement. All post anchorages have lost adequate embedment and the bridge rail can be easily moved by hand. Element 330 assessed CS-4.
3.3—SUPERSTRUCTURE

(Note: Similar elements are grouped for presentation of information.)

See NY Appendix C for special emphasis inspection intensity requirements.

See NY Section 3.10 for Agency Defined Elements:
- 830—Secondary Members
- 831—Steel Beam Ends

Diaphragms on curved girders and diaphragms which directly support live load shall be included in the assessment (but not added to the element total quantity) of the adjacent 1 linear foot of each girder to which they are attached. For example, one deteriorated diaphragm will influence the assessment of 2 LF of girder element, whereas two adjacent deteriorated diaphragms will influence the assessment of 3 LF of girder element, etc.

3.3.1.1—Element 102—Steel Closed Web/Box Girder

3.3.1.5—Element 107—Steel Open Girder/Beam

3.3.2.1—Element 113—Steel Stringer

3.3.4.1—Element 152—Steel Floor Beam

General Guidance

Assess the members' condition and their ability to carry the loads for which they were designed.

For non-encased steel members, look for corrosion and section loss, cracking of the base metal or welds, buckling, impact damage, signs of overstress, and condition of welds, bolts, and rivets.

Of primary concern should be the following:

- Corrosion and section loss, particularly of webs in high shear areas or flanges in high moment areas.
- Cracks in welds or girders in any tension or stress reversal area, most likely to occur at fatigue-prone locations where stress concentrations are high, at out-of-plane bending locations, impact damage sites, plug welds, or tack welds.
- Distortions in the girders caused by heavy loads, section loss, fire, or impact damage.
- Crevice corrosion causing weld or rivet overstress.
- Check alignment and profile for deviation that could result in undesirable stresses.
- Check webs near supports at abutments and piers (including pin and hanger "piers") for any indications of crippling or section loss.
• Spalled deck areas adjoining girders indicate that some section loss of the primaries should be expected. Girder webs adjoining sidewalks are also subject to accelerated corrosion and section loss.

• Short or rusted scupper downspouts can concentrate road salts on bottom flanges and contribute to significant section loss.

• Riveted, built-up members typical of thru-girder design are susceptible to crevice corrosion. Visually check the alignment for a ripple-like effect and note extent of rivet section loss or overstress.

• Check for cracks in welds or girders especially at fatigue prone areas.

• Check for cracks at poor details such as coped members.

For concrete-encased steel members, base the rating on condition of the concrete and any exposed portion of the girder. Look for signs of leakage through the concrete and for cracking, spalling, efflorescence, and rust staining. Use a masonry hammer to determine if the concrete encasement is delaminated.
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.3-1
The floorbeam above the pier is in excellent condition. Element 152 assessed **CS-1**.

NY Example 3.3-2
Rust bubbles, bleed through, and localized failure of the paint system for the girders, floor beams and stringers are evidence of widespread surface corrosion of the steel. No section loss is present. Elements 107, 113 and 152 assessed **CS-2**.
NY Example 3.3-3
Surface corrosion of the bottom flange caused the concrete encasement to crack and spall off. Full length cracks along the adjacent girders’ encasement indicate these girders also have similar corrosion. Element 107 assessed CS-2.

NY Example 3.3-4
The concrete coating is extensively delaminated, presumably due to expanding rust on the steel girder. Element 107 assessed CS-2.
NY Example 3.3-5
The main girders, floorbeams, and stringers are heavily and uniformly corroded, but do not require load posting of the structure. Elements 107, 113 and 152 assessed CS-3.

NY Example 3.3-6
The thru-girder web stiffener has a corrosion hole at its base. The hole does not warrant a structural review. Element 107 assessed CS-3.
NY Example 3.3-7
New corrosion perforations exist at the web/sidewalk of the thru-girder near the end of span. Shear strength is a concern and a structural review is recommended. Element 107 assessed CS-4.

NY Example 3.3-8
Section loss is evident along the end of Span 1’s lower web end. Element 107 assessed CS-3. Section loss is evident along the end of Span 2’s lower web end; however, certified repairs restored its original design capacity. Element 107 assessed CS-1. Note: Steel Beam Ends (Element 831) also must be assessed (see NY Section 3.10).
NY Example 3.3-9
Girder G2 has sustained severe impact damage and distortion. Additionally, there is a tear in the bottom flange near 1/3 span. Element 107 assessed CS-4.

NY Example 3.3-10
The girder flange is heavily corroded within the high moment area of the span. This condition has not changed significantly since the last inspection and the bridge is posted accordingly. Element 107 assessed CS-4.
NY Example 3.3-11
A new crack in a girder web, near the bottom flange is a result from out-of-plane bending. This crack is over 2 inches in length and is considered a working crack likely to propagate. Element 107 assessed CS-4.

NY Example 3.3-12
There is a severe crack in a fascia girder. The entire bottom flange is fractured near center span. Element 107 assessed CS-4.
3.3.1.2—Element 104—Prestressed Concrete Closed Web/Box Girder

3.3.1.6—Element 109—Prestressed Concrete Open Girder/Beam

3.3.2.2—Element 115—Prestressed Concrete Stringer

3.3.4.2—Element 154—Prestressed Concrete Floor Beam

General Guidance

Examine alignment, profile, and impact damage with all primary members. Inspect for and document any cracks in the members. Most cracks in prestressed beams are potentially serious since tensile forces exist that might not have been accounted for in the design. Vertical or diagonal tension cracks in prestressed members are signs that the prestressing steel (tendon) has failed or is failing, and the loads are being carried by adjoining beams. This is a serious condition and steps should be taken to ensure the stability of the bridge as soon as possible.

Generally, there are three main types of structural cracks (see NY Figure 3.3-2):

- **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).

- **Flexural Shear Cracks:**
  Found between the support and maximum moment area. These cracks consist of both vertical and diagonal cracks occurring together.

- **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 detensioning forces. These cracks generally can be seen across the beam end and/or along the sides and bottom at the end.
When inspecting these types of structures, at a minimum, 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 which can lead to loss of bearing area and local crushing of the remaining concrete, especially when there are low skews and short end of beam overhangs.
- Mid-span area (maximum moment) for flexural cracks.
- Between mid-span and bearing for 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 check, the following activities, at a minimum, 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 location.
- Quantify debonded tendons and fully or partially broken tendons. Note these locations.
- Investigate previously repaired areas.
- Check drain holes and clear if clogged.
- Document findings with notes, photographs and sketches including full crack and deterioration documentation.

The two most common causes of prestressing force loss are impact and corrosion. Generally, deterioration occurring in prestressed concrete members is evident to the inspector, but in some cases, serious 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 are more definitive signs 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 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.
- Check drain holes on box beams for rust stains possibly indicating deterioration not visible until it becomes more serious. Plugged drain holes should be cleared to check for possible water accumulation.

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. In such cases, the Regional Structures office should try to get information on the condition of the prestressing steel from those who did the repairs. This information, if available, should be included in the BIN folder.

**Condition State Examples**
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

![Image of concrete delamination](image_url)

**NY Example 3.3-13**
The NEXT-D beam webs are in good condition. Element 109 assessed **CS-1**. The visible efflorescence should be assessed with the Prestressed Concrete Top Flange element.
NY Example 3.3-14
As the result of possible over-stress, tight transverse cracks (highlighted by chalk marks) extend across the bottom flange of the segmental box beam and into the web at mid-span. Element 104 assessed CS-2.

NY Example 3.3-15
The bottom edge of the fascia beam is severely spalled. The outermost strand is broken and four adjacent exposed strands are estimated with 50% section loss. The prior inspection assessed these conditions CS-4 and a subsequent review indicates no effect on strength or serviceability. No significant changes since the last inspection. Element 104 assessed CS-3.
NY Example 3.3-16
The beam has a wide longitudinal crack leaking efflorescence with localized rust bleed through. The crack controls the assessment. Element 109 assessed **CS-3**.

NY Example 3.3-17
Two (of seven) beams are heavily cracked and deeply spalled with exposed reinforcement and prestressing strands. The beams’ undersides are wet, effloresced, and rust stained. The exposed prestressing strands are severely corroded and considered non-functioning, thus reducing the reserve capacity of the bridge. Element 104 assessed **CS-4**.
3.3.1.3—Element 105—Reinforced Concrete Closed Web/Box Girder

3.3.1.7—Element 110—Reinforced Concrete Open Girder/Beam

3.3.2.3—Element 116—Reinforced Concrete Stringer

3.3.4.3—Element 155—Reinforced Concrete Floor Beam

General Guidance

Generally, alignment and profile of concrete superstructure elements should be examined for damage due to impact, overstressing, or substructure movement. Note any excessive vibrations or movement with passage of live loads. The inspection should determine the cause of any unusual sounds, excessive movement, or vibrations with passage of heavy loads.

The inspection should cover the following:

- Deterioration at the end of the beam which can lead to loss of bearing area and local crushing of the remaining concrete, especially when there are low skews and short end of beam overhangs.
- Near bearing areas at the ends of slabs, girders, T-beams, channel beams, etc., for spalling and cracked concrete. Any diagonal cracking 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 midspan of simple spans for flexural cracks extending transversely across the underside of the primary member. 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 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 passage of live loads, leakage, etc.
- Areas of previous repairs, impact damage, honeycombing, scaling, and any other conditions indicating potential deterioration of concrete or rebars.
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.3-18
Map-cracking with moderate efflorescence is present on the concrete t-beams. Element 110 assessed CS-2. One beam exhibits localized rust stains. Element 110 assessed CS-3.

NY Example 3.3-19
This cast-in-place fascia T-beam exhibits deep spalling with exposed reinforcement. Concrete behind the reinforcement is sound. The reinforcement has some section loss, but not enough to warrant a structural review at this time. Element 110 assessed CS-3.
3.3.1.8—Element 111—Timber Open Girder/Beam

3.3.2.4—Element 117—Timber Stringer

3.3.4.4—Element 156—Timber Floor Beam

General Guidance

Untreated wood is vulnerable to damage from fungi and insects. All wood is vulnerable to damage from checking and splitting because of drying and wetting cycles, and to damage from fire and exposure to extreme heat. Timber structures are also vulnerable to the more typical causes of damage such as normal wear, collision, and overload (crushing). Inspectors must be able to identify signs that damage has or is occurring, and assess its effect on the ability of the member to function as intended.

Decay: This is a result of attack by microscopic organisms called fungi. Decay occurs when conditions of moisture content, oxygen level, and temperature are favorable. Pay special attention to areas where wood members are in direct contact with other members. Treating the wood kills the fungi and stops decay. Discoloration is often (but not always) evident in early stages. In later stages, decay causes easily noticeable changes in both wood color and texture. Later stages are accompanied by substantial decrease in structural capacity of the member, which must be reflected in the rating.

Insects: For some insects, wood is both a source of food and a place of shelter. The most destructive is the termite. Other potentially destructive insects are powder post beetles, carpenter ants, and marine borers. Since most damage caused by insects is inside the wood members, often the only sign of damage is accumulation of sawdust at the base of the member or white mud shelter tubes indicating termites. The inspector may have to probe the member with an awl or other suitable tool to properly assess the extent of damage. Do not probe excessively, since probe holes will allow moisture penetration thus initiating decay. Tapping the member with a hammer can also detect hollow areas.

Fire/Heat: Remove any charred material and/or take core samples to determine extent of damage and section loss.

Checking/Splitting: Checking results from rapid decrease in wood moisture content combined with moisture differential between the inner and outer portions of the member. Splitting is commonly called through-checking. A nominal amount of checking is considered when establishing basic working stresses, but excessive or cross-grain checks or splits that enter connection areas may be serious and require closer evaluation. Checks have less effect on strength of laminated members. Splitting could indicate possible overstressing.

Warping: This is caused by differential shrinking caused by uneven moisture loss. This can induce very high stresses into the wood.
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

**NY Example 3.3-20**
The timber girders have only slight surface discoloration. The girders sound solid when tapped with a hammer and there is no awl penetration. Element 111 assessed CS-1.

**NY Example 3.3-21**
The glue laminated girder is comprised of several timber pieces which are delaminating from each other. Yearly tracking indicates the delaminations are worsening. Element 111 assessed CS-3.
NY Example 3.3-22

The multi-girder timber bridge’s fascia girder is completely rotted through. Element 111 assessed CS-4.
3.3.1.4—Element 106—Other Closed Web/Box Girder

3.3.1.9—Element 112—Other Open Girder/Beam

3.3.2.5—Element 118—Other Stringer

3.3.4.5—Element 157—Other Floor Beam

General Guidance

These elements are used for superstructure materials other than steel, concrete, and timber.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.3-23
The aluminum orthotropic superstructure is good condition. Element 106 assessed CS-1.
3.3.3.1—Element 120—Steel Truss

3.3.3.2—Element 135—Timber Truss

3.3.3.3—Element 136—Other Truss

General Guidance

All members and connections should be inspected for the following:

**Member Condition:** Truss members are designed for axial forces. It is important to know whether a member acts in tension, compression, or both. Section loss in only one truss member results in loss of load carrying capacity for the entire truss. Likely areas of deterioration are around pockets that can hold debris and moisture, especially near bearings and within gusset plates at panel points. Debris should be removed to facilitate inspection. Corrosion can also occur between plates of built-up members. Check areas vulnerable to deicing salts such as lower chords, floorbeam connections, end floor beams and their connections to stringers.

Damage can occur by direct impact or indirect impact transmitted by an attachment such as guiderail or overhead bracing. Impact damage may result from water borne channel debris and errant or over height/width vehicles. Check members closely for cracks and steel yielding near areas of impact or damaged attachments.

Improper modifications to truss chords (such as plug welds) can greatly affect load carrying capacity by initiating cracks, especially for tension members. Check areas of welded repairs or attachments for undercut slag, porosity, or cracked welds. Check bolted retrofits for excessive section removal due to drilling, flame cutting or punching.

Check for proper tension in truss rods. Looseness in one member may result in excessive force in another member. Listen for rattling and banging under live loading, as this is indicative of loose members. Pay particular attention as the live load passes from one panel point to the next.

Inspect the flooring system by the same criteria used for a flooring system in a two or three-girder system.

**Alignment:** Improper alignment of individual truss members can significantly affect their ability to carry axial loads.

Check truss alignment by sighting down the truss. Look for tilt, bends, kinks, dips, and sag. They may be signs of other problems not immediately evident. Check individual members for proper shape and position. Bowed or buckled compression members may severely reduce the capacity of the entire truss.

**Overstressed Members:** It is important to classify members as tension or compression members and those that may control truss capacity. Some may be over-designed for simplicity and to simplify construction.
Check for local or lateral buckling in compression members. Wrinkles or waves in flanges, webs, or cover plates may be signs of overstress. Check for necking down of cross-sectional area in ductile tension members. This indicates yielding steel before strain hardening occurs, and is usually accompanied by paint flaking. Higher strength steels may be less ductile than carbon steels. Overstress in a non-ductile tension member is difficult to recognize and failure may be sudden. Many early trusses were constructed of wrought iron with cast iron fittings at panel points. These members should be closely examined for small cracks and notches. Critical crack length for fracture may be very short.

Early eyebars were manufactured by forging eyes onto bar stock. Loop rods were made by bending and forging a loop into a straight rod. Eyebars and loop rods are tension members. Check their ends closely for forging discontinuities.

**Connections**: Those between individual truss members and flooring system members may be critical to the integrity of the entire structure. Look for stress indications in the paint. Check for loose or missing pin caps, pin nuts, rivets, or bolts. Listen for noises with the passage of vehicles. Look for cracks in the web where flanges have been cope for connections. Check for section loss of threaded connections at the bolt-nut interface which can occur at turnbuckles and floor beam hanger U-bolts. Eyebar and loop rod spacing at pins can greatly affect bending stresses in the pin. Look for corroded or missing spacers and bent pins. Check for corrosion at lower panel points, especially where deicing salts may wash onto trusses and connections.

**TYPICAL TRUSS MEMBERS**

*NY Figure 3.3-3*
**Condition State Examples**
(Note: Only the condition indicated is considered for assessment of the examples shown below.)

**NY Example 3.3-24**
The pony truss has localized minor corrosion with no apparent loss of section along the bottom chord. Element 120 assessed **CS-2**.

**NY Example 3.3-25**
The truss end post was impacted. The channel flange is locally buckled, but the member overall is not out of alignment. Element 120 assessed **CS-3**.
NY Example 3.3-26
There are holes in the web of a diagonal truss member. Element 120 assessed CS-3.

NY Example 3.3-27
The loop bar after a dye penetrant test reveals a curved transverse crack in the bar. Element 120 assessed CS-4.
NY Example 3.3-28
The truss panel point is newly missing the retaining nut for the eyebar connection. Element 120 assessed CS-4.

NY Example 3.3-29
One of 4 longitudinal timbers compiling the right truss bottom chord is newly fractured. Element 135 assessed CS-4.
3.3.3.4—Element 141—Steel Arch

3.3.3.5—Element 142—Other Arch

3.3.3.6—Element 143—Prestressed Concrete Arch

3.3.3.7—Element 144—Reinforced Concrete Arch

3.3.3.8—Element 145—Masonry Arch

3.3.3.9—Element 146—Timber Arch

General Guidance

Spandrel walls on filled arches and spandrel columns shall be included with the arch assessment.

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![Diagram of a filled arch showing spandrel walls and vertical portion]

**FILLED ARCH**

NY Figure 3.3-4
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.3-30
The timber arch top chord is moderately checked. Bridge capacity is not affected. Element 146 assessed CS-2.

NY Example 3.3-31
The cast-in-place concrete exhibits extensive spalling with exposed, moderately corroded reinforcement throughout the arch. Several areas of spalling exhibit debonded reinforcement. Element 144 assessed CS-3.
NY Example 3.3-32
Concrete cover at the fascia is severely spalled. The exposed reinforcement has minor section loss and a tight bond to the underlying concrete. Element 144 assessed CS-3. (Note: the assessment includes the spandrel column, but the beams are assessed as Element 110.)

NY Example 3.3-33
The brick arch has lost up to 16 inches of depth. The bridge is posted and permanent barriers restrict traffic to one lane. Element 145 assessed CS-4. The adjacent bricks are loose and missing mortar.
3.3.5.1—Element 147—Steel Main Cables

3.3.5.2—Element 148—Secondary Steel Cables

3.3.5.3—Element 149—Other Secondary Cable

General Guidance

See NY Appendix F for additional guidance regarding Suspension Bridges.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.3-34
The steel cables’ anchors are corroded with approximately 25% loss of section at the anchor/concrete interface. As a result, the bridge is posted for load. Element 147 assessed CS-4.
3.3.5.4—Element 161—Steel Pin and Pin & Hanger Assembly or both

General Guidance

Assess only the assembly which may consist of through bolts, pin caps, nuts, cotter pins, spacer washers, hanger bars, etc. Do not assess the portion on which the assembly bears; this condition shall be assessed with its respective element (see NY Example 3.3-35).

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.3-35
The member paint is in like-new condition. The pin and hanger assembly were unaffected by corrosion prior to painting. Element 161 assessed CS-1. However, the web around the lower pin shows notable section loss. Element 107 assessed CS-3.
3.3.5.5—Element 162—Steel Gusset Plate

General Guidance

No comments.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

**NY Example 3.3-36**
Freckled rust has initiated throughout the structure. Paint on the gusset plate, above the bottom chord is bubbled, chipping and missing. The steel in this location is corroded with little to no section loss. Element 162 assessed **CS-2**.

**NY Example 3.3-37**
The truss gusset plate has extreme section loss with multiple perforations and little remaining steel. The plate is slightly buckled. Element 162 assessed **CS-4**.
3.4—BEARINGS

(Note: In this section, similar elements are grouped for presentation of information.)

See NY Appendix C for special emphasis inspection intensity requirements.

3.4.1—Element 310—Elastomeric Bearing

May be fixed or expansion.

3.4.2—Element 311—Movable Bearing

Expansion bearing that is not an elastomeric bearing, pot bearing or disk bearing. For example: nested roller bearing or rocker bearing.

3.4.3—Element 312—Enclosed/Concealed Bearing

Assess the condition based on alignment, grade across the joint, persistence of debris, or other indirect indicators.

3.4.4—Element 313—Fixed Bearing

Fixed bearing that is not an elastomeric bearing, pot bearing or disk bearing.

3.4.5—Element 314—Pot Bearing

May be fixed or expansion.

3.4.6—Element 315—Disk Bearing

May be fixed or expansion.

3.4.7—Element 316—Other Bearing

General Guidance

Bearings are assessed with the span they support. In the case of continuous structures with 1 line of bearings on a pier, the bearings are assessed with the approaching span (for instance pier 1 bearings are assessed under span 1, pier 2 bearings under span 2, etc.). For special guidance regarding ramp bridges, see NY Section 2C.8.

Misalignment (over expanded or over contracted for temperature, improper lateral displacement, other) of bearing components should be measured and individually tracked to document rate of change. It is important to note the direction and degree of displacement as well as the temperature and other weather conditions at the time readings are taken.
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

Example NY 3.4-1
The pot bearings are in new condition and in the proper position for the ambient temperature. Element 314 assessed CS-1.

Example NY 3.4-2
The ambient air temperature is 28°F. Bearing is \( \frac{3}{4} \)” overextended. Element 310 assessed CS-2.
Example NY 3.4-3

The enclosed bearing is in proper position for the ambient temperature. Freckled rust is present. Element 312 assessed CS-2.

Example NY 3.4-4

The expansion rocker bearing is improperly rotated for the ambient temperature. The degree of rotation has not changed as expected over a wide temperature range as indicated through the Rocker Bearings monitoring documentation. Paint buildup and pack rust are present under the rockers hindering rotation and expansion. Element 311 assessed CS-3.
Example NY 3.4-5
The sliding plate bearing is severely contracted and overhangs the masonry plate by 3 inches, but should be in an expanded position for the ambient air temperature of 80°F. Element 311 assessed CS-4.

Example NY 3.4-6
The bridge is open to highway traffic. The original bearing is currently removed and a temporary jacking operation provides support. Element 311 assessed CS-4. The temporary support should be noted in the commentary, but not considered in the assessment of the bearing.
Example NY 3.4-7
The multi-rotational expansion bearing is floating with the elastomeric disc lifted 1/8" above the pot. The girder vibrates slightly when traffic passes, but the bearing was not observed to come into contact under load. Otherwise, the bearing appears to be in good material condition with intact sliding surfaces and paint. Element 315 assessed CS-4.

Example NY 3.4-8
The non-continuous trough girder bridge has bearings which are intended to expand toward each other. The air temperature is 80°F. The span 1 (left) bearing is significantly expanded for the temperature. The span 2 (right) bearing should be expanded; however, it is severely contracted for the temperature. Element 311 assessed CS-4.
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3.5—SUBSTRUCTURE

(Note: In this section, similar elements are grouped for presentation of information.)

See NY Section 3.10 for Agency Defined Elements:

- 850–Backwall
- 851–Abutment Pedestal
- 852–Pier Pedestal
- 853–Wingwall

See NY Appendix C for special emphasis inspection intensity requirements.

General Substructure Guidance

**Backwalls:** Pier Cap and Abutment NBES shall include the condition of the backwall, when present. The backwall condition shall also be assessed under its respective ADE.

**Non-structural facings:** A special case is made for all substructures having non-structural stone or brick facings. When assessing such substructure, facing material should be considered only to the extent that its condition may indicate condition of what it is covering. Problems with facing materials (such as loose brick) should be explained in the condition comments and reported as a non-structural condition observation (see NY Section 5) or reported as a flag (see NY Appendix B), when appropriate.

**Notes on Multi-Level Piers:** The multi-level pier is found primarily at interchanges with multi-level structures. It can be either steel or concrete or some combination of both materials. The lower portion is integral with the upper portion and must be inspected as a whole unit. Each superstructure carried by this frame may have upper and lower level BINs or entirely separate BINs.

The following procedure should be observed when inspecting each superstructure level and its supporting substructure:

- Inspect all portions of the vertical elements that support the structure. When inspecting the pier columns of the upper structure, the condition of the columns in the lower portion also has to be considered. Include lower cap beams that are connected to columns even though they are not part of the superstructure being inspected.

**Substructure Deficiency Sketch:** Inspectors should use a sketch similar to that shown below (NY Figure 3.5-1) to record the extent of substructure deterioration under water, when necessary.

Document any erosion of concrete, missing masonry, broken or rotten timber lagging, holes in sheet piling, and any other form of deterioration which cannot be accurately described in the condition comments.

Sketch location and size of deterioration and note the type, showing all three dimensions.
SUBSTRUCURE DEFICIENCY SKETCH

1 INCH DEEP SPALL
6 INCH TO 10 INCH WIDE
BOTH SIDES OF NOSE ANGLE

6 INCH X 6 INCH
NOSE ANGLE

WATER SURFACE

FLOW APPROX. 12 FT/SEC.

9.5' 10'

1.5'

SPALLING 6 INCH DEEP

EAST ELEVATION

Deterioration of Pier 1

SAMPLE SUBSTRUCTURE DEFICIENCY SKETCH
NY Figure 3.5-1
Typical Abutment Types

TYPICAL CANTILEVER ABUTMENT
NY Figure 3.5-2

TYPICAL GRAVITY ABUTMENT
(Wingwalls not Shown)
NY Figure 3.5-3
TYPICAL COUNTERFORT ABUTMENT
NY Figure 3.5-4

TYPICAL SOLDIER PILE ABUTMENT
(STEEL SHEET PILE ABUTMENT is similar)
NY Figure 3.5-5
The backwall shall also be assessed under the materially appropriate Abutment NBE.

STEMLESS ABUTMENT  
(Wingwalls not Shown)  
NY Figure 3.5-6

TYPICAL SPILL THROUGH ABUTMENT  
NY Figure 3.5-7
Integral abutments do not include the following elements:

- Bearings
- Pedestals
- Backwall

**TYPICAL INTEGRAL ABUTMENT**
NY Figure 3.5-8

**TYPICAL SEMI-INTEGRAL ABUTMENT**
NY Figure 3.5-9
TYPICAL STACKED STEMS
(With Mechanically Stabilized Earth System Wall)
NY Figure 3.5-10

TYPICAL MULTI-SPAN CONCRETE FRAME
NY Figure 3.5-11
Typical Pier Types

TYPICAL FRAME PIER
NY Figure 3.5-12

TYPICAL PI PIER
NY Figure 3.5-13
TYPICAL HAMMERHEAD PIER
NY Figure 3.5-14

TYPICAL DOUBLE HAMMERHEAD PIER
NY Figure 3.5-15
TYPICAL COLUMN PIER WITH STRUT
NY Figure 3.5-16

TYPICAL COLUMN PIER WITH CRASHWALL
NY Figure 3.5-17
COLUMN PIER WITH STRUT
NY Figure 3.5-18

TYPICAL COLUMN PIER WITH CRASHWALL
NY Figure 3.5-19
TWO-COLUMN PIER WITH WEB WALL
NY Figure 3.5-20

PIER COLUMN WITH WEB WALL
NY Figure 3.5-21
TYPICAL SOLID STEM PIER
NY Figure 3.5-22

TYPICAL SOLID STEM PIER WITH CAP
NY Figure 3.5-23
TYPICAL PILE BENT PIER
NY Figure 3.5-24

TYPICAL STEEL FRAME PIER
NY Figure 3.5-25
**TYPICAL STEEL BENT PIER**
NY Figure 3.5-26

**TYPICAL STEEL COLUMN**
NY Figure 3.5-27
3.5.1.1—Element 202—Steel Column

3.5.1.2—Element 203—Other Column

This element includes Fiber Reinforced Polymer (FRP) Wrapped columns, where the FRP is structural.

3.5.1.3—Element 204—Prestressed Concrete Column

3.5.1.4—Element 205—Reinforced Concrete Column

3.5.1.5—Element 206—Timber Column

General Guidance

For steel or timber pile bents, consider the bracing condition when assessing the column. For each column, assess the half of the bracing nearest that column.

For steel columns, include lacing and batten plates in column assessment.

A substructure unit with a maximum width less than 10 feet is assessed as a pier column; otherwise, it is assessed as a pier wall (see NY Figure 3.5-14).

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.5-1
Both columns are in good condition. Element 202 assessed CS-1.
NY Example 3.5-2
The concrete column has major deterioration. Deep and widespread spalls, exposed and corroded reinforcement, and delaminations are evident throughout the column. The underlying concrete is solid and has a tight bond with the reinforcement. Element 205 assessed CS-3.

NY Example 3.5-3
The steel column is in fair condition. Heavy deterioration of the transverse bracing may compromise the lateral strength and stability of the pier. A load capacity review is recommended. Element 202 assessed CS-4.
NY Example 3.5-4
Nearly half of the column’s horizontal tie bars are corroded through, thus severely reducing confinement of the corroded and debonded vertical reinforcement. These conditions have reduced the column’s load capacity. The temporary columns are not considered in the assessment. Element 205 assessed CS-4.

NY Example 3.5-5
The concrete column is destroyed. The steel columns are temporary supports and are not considered in the column assessment. Element 205 assessed CS-4.
3.5.1.6—Element 207—Steel Tower

3.5.1.7—Element 208—Timber Trestle

General Guidance

No comments.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.5-6
The timber trestles are in excellent condition. Element 208 assessed CS-1.
3.5.1.8—Element 210—Reinforced Concrete Pier Wall

3.5.1.9—Element 211—Other Pier Wall

3.5.1.10—Element 212—Timber Pier Wall

3.5.1.11—Element 213—Masonry Pier Wall

General Guidance

This is either the stem of a solid pier, or crash wall of a frame pier that resists forces from the superstructure and transfers those forces to the foundation.

A substructure unit with a maximum width less than 10 feet is assessed as a pier column; otherwise, it is assessed as a pier wall (see NY Figure 3.5-14).

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.5-7
The crash wall is in like-new condition. Element 210 assessed CS-1.
NY Example 3.5-8
The pier stem is stained from a broken drainage pipe, but otherwise is in good condition. Element 210 assessed CS-1.

NY Example 3.5-9
The pier nose is spalled up to 2 inches deep by 3 feet wide by 2 feet high. Element 210 assessed CS-3.
NY Example 3.5-10
There are several spalls exposing reinforcement. Element 210 assessed CS-3. To the right of the spalls, sounding reveals delaminated concrete. Element 210 assessed CS-2.

NY Example 3.5-11
The pier stem has extensive spalling. A structural review is not warranted. Element 210 assessed CS-3. The remainder of the pier face has light scaling which exposes the course aggregate. Element 210 assessed CS-2.
3.5.2.1—Element 215—Reinforced Concrete Abutment

3.5.2.2—Element 216—Timber Abutment

3.5.2.3—Element 217—Masonry Abutment

3.5.2.4—Element 218—Other Abutment

3.5.2.5—Element 219—Steel Abutment

General Guidance

Round and elliptical-pipe structures do not have stems. Arches framing directly into footings or rock also do not have stems.

Abutments composed of two or more materials running contiguously and longitudinally together shall have both materials assessed under their respective elements (see NY Example 3.5-18).

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.5-12
The stem is half stone and half reinforced concrete. Some portions of the stone wall have slightly displaced stones and are missing joint mortar. Element 217 assessed CS-3. The concrete portion of the stem exhibits tight, surface map cracking throughout. Element 215 assessed CS-1.
NY Example 3.5-13
Severely deteriorated reinforcement is exposed and within the area of spalled concrete. The spalling stem does not undermine the pedestals. The remainder of the stem exhibits large areas of hollow sounding cracked concrete with heavy efflorescence. Element 215 assessed CS-3.

NY Example 3.5-14
The new upper stem is in excellent condition. Element 215 assessed CS-1. The existing stem, whose failure would affect the new stem’s stability, is assessed separately. It exhibits severe deterioration with spalling, efflorescence, large horizontal and vertical cracks, and horizontal displacement. Element 215 assessed CS-4.
NY Example 3.5-15
The stem face is disconnected and rotating away from the soft and hollowed, core concrete. Reinforcement is disconnected and hanging. Further deterioration of the stem threatens settlement or possible collapse of the pedestals and superstructure. Element 215 assessed CS-4.

NY Example 3.5-16
The abutment stem was poured directly on subgrade. Scour has deteriorated the interface between the stem and the subgrade resulting in a significant loss of bearing area. Element 215 assessed CS-4.
NY Example 3.5-17
Scouring along the abutment’s timber lagging behind the timber piles has resulted in some undermining. Element 216 assessed CS-3.

NY Example 3.5-18
The masonry abutment has missing and/or cracked mortar joints throughout (Element 217 assessed CS-3). Above this, the reinforced concrete abutment is in like new condition (Element 215 assessed CS-1).
3.5.3.1—Element 220—Reinforced Concrete Pile Cap/Footing

General Guidance

Wingwall footings monolithic with the abutment footing shall be assessed with the reinforced concrete pile cap/footing element (see NY Figure 3.5-2). Wingwall footings independent of the abutment footing shall be included in the assessment of the wingwall ADE (see NY Figures 3.5-5 and 3.5-8 and NY Section 3.10.10).

Assess only visible portions of the pile cap/footing. At locations where the footing is not visible, evidence of footing settlement or other movement will be reflected in the stem, pier or wingwall element assessment.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

![NY Example 3.5-19](image)

**NY Example 3.5-19**
The footing is in like new condition. The material condition of the footing rates CS-1; however, long term scour has exposed the footing, built on solid rock. Element 220 assessed **CS-2**.
NY Example 3.5-20
Exposed per designed, the abutment footing is solid and functioning as designed; however, the footing is severely worn along the top of the toe. Element 220 assessed CS-3.

NY Example 3.5-21
A full height wingwall crack exists with up to 2 inches of horizontal displacement and forward rotation. The wall displacement and rotation indicates the footing has uneven settlement. The footing is not visible. Element 220 assessed CS-5.
3.5.3.2—Element 225—Steel Pile

3.5.3.3—Element 226—Prestressed Concrete Pile

3.5.3.4—Element 227—Reinforced Concrete Pile

3.5.3.5—Element 228—Timber Pile

3.5.3.6—Element 229—Other Pile

General Guidance

Piles supporting wingwall footings monolithic with the abutment footing shall be assessed with the pile element (see NY Figure 3.5-2). A wingwall footing independent of the abutment footing shall have its piles included with the assessment of the wingwall ADE (see NY Figures 3.5-5 and 3.5-8 and NY Section 3.10.10).

For soldier pile & lagging walls (see NY Figure 3.5-5), driven sheeting or similar; compare the observed height to the record plans and/or previous inspections. An increase in reveal height may indicate the design pile embedment is compromised.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.5-22
The sacrificial, driven steel casing is corroded with localized areas of 100% section loss. The concrete is in good condition (materially, the pile would be CS-1); however, the reinforced concrete pile is exposed due to tidal scour action. Element 227 assessed CS-2 (Scour defect controls. Assessment can vary from CS-2 to CS-4 based on conditions and engineering judgment).
NY Example 3.5-23
The exposed pile (below the highlighted line) is in good condition (materially would be a CS-1); however, erosion at the stem face, evident by the dissimilar weathering of the sheet piling, has exposed a portion of the pile, thus reducing its design embedment length. Element 225 assessed CS-3 (Scour defect controls. Assessment can vary from CS-2 to CS-4 based on conditions and engineering judgment).

NY Example 3.5-24
The pier footing is undermined. The front row of steel piles is visible. The exposed piles are in decent condition. Minor surface rust is present with no notable section loss. Element 225 assessed CS-3. (Note: Scour defect controls. This assessment may vary from CS-2 to CS-4 based on conditions and engineering judgment).
NY Example 3.5-25
A timber pile bent pier supports the superstructure. The pile exhibits vertical splits above the water line. The top of the pile is hollow sounding and has minor decay. Element 228 assessed CS-3.
3.5.3.7—Element 231—Steel Pier Cap

3.5.3.8—Element 233—Prestressed Concrete Pier Cap

3.5.3.9—Element 234—Reinforced Concrete Pier Cap

3.5.3.10—Element 235—Timber Pier Cap

3.5.3.11—Element 236—Other Pier Cap

General Guidance

Struts between columns shall be considered a pier cap element and assessed accordingly (see NY Figures 3.5-16 and 3.5-18 for examples).

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.5-26
The cap beam shows no indications of deterioration. Element 234 assessed CS-1.
NY Example 3.5-27
Corrosion has formed across the top of the steel cap beam causing minor pack rust prying of the plates. Element 231 assessed CS-2.

NY Example 3.5-28
One small spall has exposed lightly corroded reinforcement. Element 234 assessed CS-3. Rust stained efflorescence is present to the left of the spall. Element 234 assessed CS-3. Moderate cracking exists to the right of the spall. Element 234 assessed CS-2.
NY Example 3.5-29
The underside of the pier cap beam is deeply spalled with exposed, rusted reinforcement. Three out of 5 exposed main reinforcement bars are partially debonded and many of the exposed stirrups are broken. The core concrete is sound and solid. Element 234 assessed CS-4

NY Example 3.5-30
The concrete pier cap has an extreme shear crack and documented short term movement. Element 234 assessed CS-4. The temporary repairs and in-place shoring are not considered in the pier cap rating.
3.6—CULVERTS

See NY Section 3.10 for Agency Defined Element:
- 860–Culvert Headwall
- 870–Culvert Apron/Cut-Off Wall

General Culvert Guidance

The following culvert elements are applicable to bride-sized and large culvert structures.

If aprons, headers, or end sections have attached walls that retain embankment not directly involved with culvert-soil interaction, these walls may be rated as abutment wingwalls.

Some culverts may have assessable substructure elements, whereas others may not. The following sketch (NY Figure 3.6-1) depicts several culvert examples and their assessable elements.

Invert slabs which support the culvert shall be assessed full width as one footing. For multi-span structures, quantify and assess separately for each span.
3.6.1—Element 240—Steel Culvert

General Guidance

Routine Measurements

There must be enough measurements taken routinely, to have a meaningful database so that any future deformations can be compared to previously recorded dimensions at or at least near the location of the deformation. Cross-section measurements must be taken and recorded at locations along the barrel, spaced close enough to ensure detecting changes from one inspection to the next. The dimensions AD, BE, AE, AC, and CE (see NY Figure 3.6-2) are the minimum set of measurements required at intervals not greater than approximately 50 feet, but no fewer than three locations along the barrel of the culvert. These dimensions are defined by the actual location of bolt rows. If there is no line of bolts at C, measure to the corrugation peak at the highest point at the cross-section, and so note in the inspection report. Do not measure the dimension between CF. This value will be automatically calculated by the NYSDOT inspection software and printed in the final report. Use of a laser distance measuring device is recommended.

Permanent reference points are essential to ensure that the measurements can be accurately repeated in future inspections. If permanent reference hooks were installed during construction, they may be used and should be compared to any dimensions that may be included in the as-built plans, if available. If permanent reference hooks do not exist, the inspector should use reference points such as bolt ends that should be permanently marked as reference points. A precise description of the reference points must be provided in the inspection report. This description needs to give future inspectors the exact location of the reference points and clearly define to what part of the bolt, nut or hook the measurements should be taken. Station numbering or longitudinal dimensions locating the sections where barrel dimensions are taken should start at the left of the bridge looking in the direction of orientation.

Problem-Area Measurements

In addition to the routine measurements taken at regular intervals along the length of the barrel as described above, field measurements as shown in NY Figure 3.6-2 are required where any of the following conditions exist:

- The section is not symmetrical.
- There is noticeable sag in the top arch (an extreme case might even display reverse curvature because of partial collapse.)
- There is significant distortion and/or deflection.

The Team Leader will decide the number and spacing of additional cross-section measurements as warranted by field observations.

Any distortion in the upper 2/3 of the circumference is always significant, and always critical to the structure's safety. In the lower 1/3, distortion is also always significant, but may not be critical to safety.
A, B, C, D and E ARE BOLT LINES. IF NO BOLT LINE AT C, USE THE HIGHEST POINT AT CROSS-SECTION. CROSS SECTION IS SHOWN LOOKING FROM BRIDGE LEFT TO BRIDGE RIGHT, THUS POINT ‘A’ IS AT BRIDGE ENDS AND POINT ‘E’ AT BRIDGE BEGINS.

TYPICAL METAL CULVERT CROSS-SECTION DIMENSIONS
NY Figure 3.6-2

Special Cases:

Some culverts that are very long, very high, submerged, or in some other way present unusual problems in obtaining barrel measurements may need to be evaluated in ways that are different from the approach used for most culverts. Such special cases should be judged on a case-by-case basis by the Regional Structures Management Engineer. Factors to be considered include safety, cost of special access, depth of fill, age and condition of the culvert, soil ph, hydraulics, etc.
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.6-1
The corrugated metal arch culvert is in like new condition. Element 240 assessed CS-1.

NY Example 3.6-2
The corrugated metal culvert’s galvanizing is in very poor condition below the high water line, resulting in loss of section and perforation of the steel. Element 240 assessed CS-4.
3.6.2—Element 241—Reinforced Concrete Culvert

General Guidance

No comments.

Condition State Examples:
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.6-3
The precast concrete arch is in excellent condition. Element 241 assessed CS-1.

NY Example 3.6-4
The concrete frame exhibits deep, localized spalling along the construction joint between the wall and ceiling. Element 241 assessed CS-3. The remainder of the joint has shallow spalling. Element 241 assessed CS-2.
3.6.3—Element 242—Timber Culvert

General Guidance

No comments.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.6-5
The timber double box culvert floor is spongy which indicates decay. Awl penetration into the decay is relatively shallow. Element 242 assessed CS-2.
3.6.4—Element 243—Other Culvert

General Guidance

No comments or example photos.
3.6.5—Element 244—Masonry Culvert

General Guidance

No comments.

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.6-6
Efflorescence, leakage and moss buildup are evident along areas of missing joint mortar. Element 244 assessed CS-3.

NY Example 3.6-7
The stones are weathered and a few are missing. Mortar in the joints is receding uniformly. Minor leakage is apparent from the buildup of white efflorescence. Element 244 assessed CS-3.
3.6.6—Element 245—Prestressed Concrete Culvert

General Guidance

No comments or example photos.
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3.7—JOINTS

(Note: Similar elements are grouped for presentation of information.)

3.7.1—Element 300—Strip Seal Expansion Joint

3.7.2—Element 301—Pourable Joint Seal

3.7.3—Element 302—Compression Joint Seal

3.7.4—Element 303—Assembly Joint with Seal

3.7.5—Element 304—Open Expansion Joint

3.7.6—Element 305—Assembly Joint without Seal

3.7.7—Element 306—Other Joint

General Guidance

Assess joints located over substructures and above pin & hangers (Element 161). When assessing the joint, include the condition of the joint-support framing, adjacent header concrete and armor angle (if present). Assess longitudinal bridge joints, except when located between parapets or on raised medians.

Do not assess construction joints. Do not assess joints located behind a backwall, such as those used with integral or joint-less abutments (see NY Figure 3.9-1).

Do not assess deteriorated or non-functioning baffles, troughs, and plumbing. Their condition should be flagged (see NY Appendix B) or reported as non-structural condition observations (see NY Section 5), when appropriate.

For ramp structures framing into a mainline, the joint between the ramps and mainline should be assessed with the ramps’ beginning substructure.
**Condition State Examples**
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

**NY Example 3.7-1**
The joint shown is in new condition. Element 301 assessed **CS-1**.

**NY Example 3.7-2**
The full joint length is leaking significantly as evident by the wet abutment stem. Element 302 assessed **CS-4**.
NY Example 3.7-3
The modular joint sealant exhibits failure with debonding throughout the width of the bridge. This condition allows for leakage through the joint and onto the superstructure below. Element 303 assessed CS-4.

NY Example 3.7-4
The finger joint is in excellent condition. Element 305 assessed CS-1. The open joint trough is clogged with debris, forcing drainage onto the superstructure; this is noted as a non-structural condition observation (see NY Section 5).
NY Example 3.7-5
Across the left shoulder and extending 4 feet into the roadway, the steel angle on the approach side has dropped. The top leg of the deck side angle is torn and missing, creating a sharp tire hazard. Element 302 assessed CS-4.
3.8—WEARING SURFACES, PROTECTIVE COATINGS, AND CONCRETE REINFORCING STEEL PROTECTIVE SYSTEMS

3.8.1—Element 510—Wearing Surface

General Guidance

Assess the wearing surface on the bridge. Do not assess approach slab wearing surfaces.

In addition to the conditions listed in the AMBEI, the ‘Effectiveness (Wearing Surface) (3230) Defect’ should be used to assess:

- **Concrete Overlays:** Reduced skid resistance (worn saw-cutting), exposure of aggregate, glossy or shiny surface, etc. may be indicative of a deficiency.

- **Asphalt Overlays:** Exposed polished aggregate, cracking, raveling, wheel path ruts, pot holes, a washboard surface, drying out of asphalt or a lack of a good seal against the curb may be indicative of a deficiency.

- **Timber Planks:** Wear, rot, insect attack, fire damage, splitting, inadequate fasteners and protruding fasteners are deficiencies. Audible "Slapping" of separate planking, whether full width or in strips, may be indicative of a deficiency.

- **Areas of Ponding Water:** This could be a serious deficiency if the wearing surface is not watertight.

![Typical Wearing Surface](NY Figure 3.8-1)
Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.8-1
The first 15 feet of asphalt wearing surface has full width alligator cracking and several potholes. The riding quality is poor and the wearing surface is not watertight. Element 510 assessed CS-4. The rest of the surface is in good condition. Element 510 assessed CS-1.

NY Example 3.8-2
The asphalt wearing surface is cracked and crumbling. Element 510 assessed CS-4.
NY Example 3.8-3
Asphalt patches in the extensively spalled concrete wearing surface are loose and potholed. The existing concrete is loose and broken with wide, deep cracks and water ponding in the voids. The ride is extremely rough. Element 510 assessed CS-4.
3.8.2—Element 515—Steel Protective Coating

General Guidance

Assess the protective coatings on steel decks, steel railings, steel bearings, and steel superstructure primary members. Do not assess protective coatings on steel secondary members, signs, lighting or utilities. Available Steel Protective Coatings are paint, galvanizing, weathering steel patina and concrete.

Weathering Steel:

The performance of weathering steel, first used by NYSDOT in the early 1970’s, is dependent on its ability to develop a protective patina of fine-grained and tightly adhered rust. Patina formation time will vary according to many factors and may take 2-3 years or more to form completely.

The patina will form only if the steel is able to cycle between being completely wet and then completely dry. The presence of chlorides will also severely and negatively affect the formation of the protective rust patina. Accumulated debris on the steel surface, encroaching vegetation that prevents air circulation, pooling water due to poor detailing, leaking scuppers, leaking joints, and dripping cracks through the deck that allow water, especially chloride laden water, onto the steel are detrimental conditions that will negatively affect the long-term performance of weathering steel. These conditions, even though they may not yet affect the beam rating, must be reported for maintenance (see NY Section 5) as failure to address these conditions in a timely manner will significantly reduce the effective lifespan of the weathering steel.

If the patina has not properly formed, the steel will continue to corrode. This will appear as either continuous flaking of the plates and/or by plate delamination. The plate delamination will appear as open cracks along the vertical edges of the flange plates or by blistering (bulging) on flat surface areas.

Inspect the formation of the patina by observing its color and texture. The color of a properly formed or forming patina will vary with the age of the steel and its chemical composition. Generally, the color will change over time from light yellow orange to dark chocolate or purple. An improperly formed patina will generally appear dark black. A properly formed patina has tight mill scale or a tight granular consistency which will not be adversely affected by vigorous brushing with a wire brush. An improperly formed patina will generally have flakes and/or delaminations which can be removed with a hammer tap, a wire brush or chipping hammer.
**Condition State Examples**
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

**NY Example 3.8-4**
The paint is in new condition. Element 515 assessed CS-1.

**NY Example 3.8-5**
The weathering steel patina failed resulting. As a result, rust holes have formed through the rail. Element 515 assessed CS-4. The bottom rail was recently replaced and its galvanized protection is in like new condition (rust staining is from top rail). Element 515 assessed CS-1.
NY Example 3.8-6
The concrete coating has wide cracks and sounds hollow when struck. Element 515 assessed CS-3.

NY Example 3.8-7
The paint is blistered from rust and its effectiveness is limited. Element 515 assessed CS-3.
NY Example 3.8-8
Just below the bolt line, the galvanizing is no longer effective in providing protection of the underlying metal. Element 515 assessed CS-4. Above the bolt line, the galvanization is in good condition and assessed CS-1. Portions covered by gravel are assessed CS-5.

NY Example 3.8-9
The light orange-colored, tight patina of new weathering steel is in excellent condition. Element 515 assessed CS-1.
NY Example 3.8-10
The weathering steel surface shows signs of patina formation problems with dark orange protective oxide forming intermittently throughout. The patina provides limited effectiveness for the protection of the underlying material. Element 515 assessed CS-3.

NY Example 3.8-11
The surface has a uniform coarse texture that is principally large, non-adhering flakes. There is continuous rusting of the steel made evident by the ability to easily remove much of the flaking with a wire brush or chipping hammer. Element 515 assessed CS-4.
3.8.3—Element 521—Concrete Protective Coating

General Guidance

Concrete Protective Coatings are generally transparent and not assessable.

Note that Fiber Reinforced Polymer (FRP) Wraps are generally not considered protective coatings.
3.8.4—Element 520—Concrete Reinforcing Steel Protective System

General Guidance

NYSDOT currently has no need to quantify or assess Concrete Reinforcing Steel Protective Systems.
3.9—APPROACH SLABS

(Nota: Similar elements are grouped for presentation of information.)

3.9.1—Element 320—Prestressed Concrete Approach Slab

3.9.2—Element 321—Reinforced Concrete Approach Slab

General Guidance

If present, do not include the sleeper slab or transverse pavement relief joint with the approach slab assessment (see NY Figure 3.9-1).

If the surface is not visible, then the condition shall be assessed based on destructive and nondestructive testing or indicators in the materials covering the surface.

APPROACH SLAB WITH JOINTLESS DECK
NY Figure 3.9-1
**Condition State Examples**
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

**NY Example 3.9-1**
The concrete approach slab’s right travel lane and shoulder are covered with moderate map cracking. Element 321 assessed **CS-3**. The far lane shows only minor signs of wear and abrasion. Element 321 assessed **CS-2**.

**NY Example 3.9-2**
The concrete approach slab has localized, full-depth cracking adjacent to the joint header. Element 321 assessed **CS-4**.
3.10—AGENCY DEFINED ELEMENTS

In addition to the AMBEI elements, NYSDOT requires inspection, condition state assessment, and reporting of Agency Defined Elements (ADE). ADEs are not reported to the FHWA. The Wearing Surfaces, Protective Coatings, and Concrete Reinforcing Steel Protective Systems elements shall not be assessed for ADEs. The NYSDOT ADEs are:

- 800—Scour
- 801—Stream Hydraulics
- 810—Sidewalk
- 811—Curb
- 830—Secondary Members
- 831—Steel Beam End
- 850—Backwall
- 851—Abutment Pedestal
- 852—Pier Pedestal
- 853—Wingwall
- 860—Culvert Headwall
- 870—Culvert Apron/Cut-Off Wall

Guidance for each ADE is detailed with two parts. The first provides a Detailed Element Description, similar in format to that shown for elements in AMBEI Sections 3.1 thru 3.9, which includes the ADE:

- Description
- Classification
- Units of Measurement
- Quantity Calculation
- Condition State Definitions (which often reference the AMBEI)
- Element Commentary

The second provides Detailed Element Guidance which includes General Guidance and Condition State Examples.
3.10.1—Element 800—Scour

**Description**: This element is used to evaluate the loss of the material next to and under a substructure.

**Classification**: ADE – Agency Defined Element  
**Units of Measurement**: ft

**Quantity Calculation**: Sum of the length of the substructure measure along the skew angle.

**Condition State Definitions**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition State 1</th>
<th>Condition State 2</th>
<th>Condition State 3</th>
<th>Condition State 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scour (6000)</td>
<td>None</td>
<td>Exists within tolerable limits or has been arrested with effective countermeasures.</td>
<td>Exists that exceeds tolerable limits but is less than the critical limits determined by scour evaluation but does not warrant structural review.</td>
<td>The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td>
</tr>
</tbody>
</table>

**Element Commentary**

In lieu of AMBEI defects, this Agency Defined Element shall be assessed using the condition state definitions listed in the table above.

It is important to note that the assessment of the National Bridge Elements listed in ‘Section 3.5 – Substructures’ includes scour as a defect. The Agency Defined Element – Scour does not replace the requirement to assess the scour defect for NBES. The Agency Defined Element – Scour is assessed in addition to the NBE scour defect for the Substructure Elements.
3.10.1—Element 800—Scour

General Guidance

Scour quantities shall be documented for:
- Abutments (measured along the face)
- Wingwalls (measured along the face)
- Piers (measured along both the begin and end faces)
- Culverts with open bottoms (measured along the abutment faces and begin and end pier faces)
- Outlets of Culverts with closed bottoms (measured parallel to the opening)
- Culvert Apron/Cut-Off Walls (measured along the face)

Two separate conditions shall be considered when assessing the Scour defect:

Scour: Loss of material from a streambed above, around, and under a substructure resulting from stream flow. Look for the three types of scour that affect bridge substructures: general scour, contraction scour, and local scour (see BIRM for more information). All three types of scour can seriously affect the performance of substructures.

Finding the maximum extent of scour is difficult because it occurs during a flood and its true extent may be masked by sediment that refills the hole when flood waters recede. The inspector should use a rod where possible to probe loose sediment deposited along the bridge substructures. If the sediment is finer than the typical bed material, or if it is easily penetrated by the rod, this means that the present sediment has accumulated in the scour hole, and local scour is more severe than indicated by channel profile readings along the substructures.

Erosion: Disturbance or loss of embankment covering material and the embankment material above, around, and under a substructure. Erosion is generally the result of runoff from the bridge superstructure or approach roadway. Look for an uneven surface on block paving near substructure which may indicate loss of embankment material below. Look for other signs of erosion including soil marks at the face of abutments or wingwalls or other irregularities in the embankment surface.

The terms erosion and scour are at times used interchangeably, but at other times have notably different meanings. Careful comparison of information obtained over the course of several bridge inspections at the substructures is one of the best ways to detect how much scour or erosion has occurred. Comparison of existing conditions against earlier photographs often quickly indicates material loss or movement.

Scour and erosion shall be documented in accordance with NY Section 2D. See also the requirements of underwater inspection in NY Appendix D.
Condition State Examples
(Note: Only the indicated condition is considered for assessment in the examples shown below.)

NY Example 3.10-1
No evidence of erosion or scour exists at the abutment. Element 800 assessed CS-1.

NY Example 3.10-2
Due to erosion and displacement of the block paving, the footing is exposed but not undermined. Element 800 assessed CS-3.
NY Example 3.10-3
The abutment spread footing is fully exposed with undermining extending no more than several inches behind the toe for its entire length. Changes from the prior inspection are insignificant. A scour monitoring program was established last year. Element 800 assessed CS-3.

NY Example 3.10-4
Since the last inspection, the shale steam bed has eroded and severely undermined the substructure. The undermining extends the full length and in some locations, nearly the entire width resulting in the potential for abutment and wingwall failure. Element 800 assessed CS-4.
3.10.2—Element 801—Stream Hydraulics

**Description:** This element is used to evaluate the condition of stream hydrology and countermeasure condition.

**Classification:** ADE – Agency Defined Element

**Units of Measurement:** each

**Quantity Calculation:** Maximum of 1 for structures over water regardless of the number of spans or bodies of water.

### Condition State Definitions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition State 1</th>
<th>Condition State 2</th>
<th>Condition State 3</th>
<th>Condition State 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Channel Alignment</strong></td>
<td>GOOD</td>
<td>FAIR</td>
<td>POOR</td>
<td>SEVERE</td>
</tr>
<tr>
<td><strong>Channel Scour</strong></td>
<td>Channel bottom stable. Little change in drop line readings over time.</td>
<td>Drop lines have displayed minor fluctuations over time.</td>
<td>Drop lines have displayed significant fluctuations over time.</td>
<td></td>
</tr>
<tr>
<td>(6130)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Waterway Opening</strong></td>
<td>Plenty of room for high water to pass through structure.</td>
<td>Horizontal opening is somewhat restricted, but adequate.</td>
<td>Vertical opening restricted. Minor impacts to superstructure.</td>
<td></td>
</tr>
<tr>
<td>(6140)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scour Protection</strong></td>
<td>Present and in good condition.</td>
<td>Minor displacement or damage to protection, but still adequate.</td>
<td>Significant washing away or displacement of scour protection material.</td>
<td></td>
</tr>
<tr>
<td>(6150)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bank Protection</strong></td>
<td>Bank protection in like-new condition.</td>
<td>Minor displacement in bank protection material.</td>
<td>Significant washing away or displacement of bank protection material.</td>
<td></td>
</tr>
<tr>
<td>(6160)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bank Erosion</strong></td>
<td>None present within 250’.</td>
<td>Minor erosion within 250’</td>
<td>Banks near structure show significant erosion.</td>
<td></td>
</tr>
<tr>
<td>(6165)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Debris Near Bridge</strong></td>
<td>Channel clear of gravel build-up or woody debris within 250’.</td>
<td>Vegetation overhanging channel, small gravel bars present.</td>
<td>Large gravel bars or choked woody debris is starting to restrict or redirect flow.</td>
<td></td>
</tr>
<tr>
<td>(6180)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grade Control / Countermeasures</strong></td>
<td>In like-new condition.</td>
<td>Minor displacement at grade control, rock or cross vane material – still functions well.</td>
<td>Significant displacement of Countermeasure material. Flanking appears possible.</td>
<td></td>
</tr>
<tr>
<td>(6190)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Element Commentary**

In lieu of AMBEI defects, this Agency Defined Element shall be assessed using the condition state definitions listed in the table above. This element shall not be assessed with individual SSU Diving Inspection Reports.
3.10.2—Element 801—Stream Hydraulics

General Guidance

Regardless of location, the Stream Hydraulics element shall be documented under span 1.

Condition State Examples
(Note: Only the indicated condition is considered for assessment in the examples shown below.)

**NY Example 3.10-5**
Sheet piling acts as scour protection (does not transmit superstructure load) is in excellent condition. Stream alignment is excellent. Element 801 assessed **CS-1**.

**NY Example 3.10-6**
The bank has eroded to the bridge. Further erosion could threaten the roadway. Element 801 assessed **CS-3**.
NY Example 3.10-7
Inadequate waterway opening is evident by debris caught between the girders. High water flow hits superstructure. Element 801 assessed CS-3.

NY Example 3.10-8
A large deposit of stone and sand has redirected the water to flow along the left stream bank resulting in bank protection failure, substantial bank erosion and channel scour. Element 801 assessed CS-4.
3.10.3—Element 810—Sidewalk

**Description:** This element defines all sidewalks which are usable for pedestrian traffic comprised of materials including, but not limited to reinforced concrete, steel and timber. Safety walks are assumed to be sidewalks for this purpose.

**Classification:** ADE - Agency Developed Element

**Units of Measurement:** ft²

**Quantity Calculation:** The area of the sidewalk measured from inside face of rail to roadside edge of curb times the length of the bridge.

**Condition State Definitions**

<table>
<thead>
<tr>
<th>Defect</th>
<th>Condition State 1</th>
<th>Condition State 2</th>
<th>Condition State 3</th>
<th>Condition State 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOOD</td>
<td>FAIR</td>
<td>POOR</td>
<td>SEVERE</td>
<td></td>
</tr>
</tbody>
</table>

Allowable defects include:
- Corrosion (1000)
- Cracking (1010)
- Connection (1020)
- Delam/Spall/Patched Area (1080)
- Exposed Rebar (1090)
- Efflorescence/Rust Staining (1120)
- Cracking (RC & Other) (1130)
- Decay/Section Loss (1140)
- Check/Shake (1150)
- Crack (Timber) (1160)
- Split/Delamination (Timber) (1170)
- Abrasion (Timber) (1180)
- Abrasion/Wear (1190)
- Deterioration (Other) (1220)
- Distortion (1900)
- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects (concrete, steel, timber, other) when assessing the condition of this element.

**Element Commentary**

The inspector should use judgment when utilizing the condition state defect definitions, especially for concrete cracking. The crack defect description definitions describe generalized distress, but the inspector should consider width, spacing, location, orientation, and structural or nonstructural nature of the cracking. The inspector should consider exposure and environment when evaluating crack width. In general, reinforced concrete cracks less than 0.012 inches can be considered insignificant and a defect is not warranted. Cracks ranging from 0.012 to 0.05 inches can be considered moderate, and cracks greater than 0.05 inches can be considered wide.
3.10.3—Element 810—Sidewalk

General Guidance

Sidewalks may be composed of an overlay placed on top of the bridge deck.

Sidewalks may be structural in nature, generally placed outside the bridge deck. Sometimes these structural sidewalks are partly supported by the deck (curb area) and sometimes they are separate from the deck (through girders and trusses).

The condition of the sidewalk support members is included in the assessment of superstructure members.

Check the quality of the sidewalk walking surface and, when necessary, the structural sidewalk.

Condition State Examples
(Note: Only the indicated condition is considered for assessment in the examples shown below.)

NY Example 3.10-9
Minor scaling of the concrete sidewalk surface is visible. Tight transverse cracks emanate parallel to the thru-girder’s stiffeners. Element 810 assessed CS-2.
NY Example 3.10-10
The sidewalk has scattered shallow spalling. Some areas are patched, but these areas sound hollow when struck. Element 810 assessed CS-3.

NY Example 3.10-11
The underside of the structural sidewalk is extensively deteriorated and spalled with exposed, rusted reinforcement. The top of the sidewalk is severely spalled and is closed to the public. One punch through is now covered with a steel plate and topped with asphalt. Element 810 assessed CS-4.
3.10.4—Element 811—Curb

**Description:** This element defines all curbs comprised of materials including, but not limited to reinforced concrete, steel granite and timber. Jersey barriers or safety shapes are not considered to be curbs.

**Classification:** ADE - Agency Defined Element  
**Units of Measurement:** ft

**Quantity Calculation:** The number of rows of curb times the length of the bridge.

**Condition State Definitions**

<table>
<thead>
<tr>
<th>Defect</th>
<th>Condition State 1</th>
<th>Condition State 2</th>
<th>Condition State 3</th>
<th>Condition State 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOOD</td>
<td>FAIR</td>
<td>POOR</td>
<td>SEVERE</td>
<td></td>
</tr>
</tbody>
</table>

Allowable defects include:
- Corrosion (1000)
- Cracking (1010)
- Connection (1020)
- Delam/Spall/Patched Area (1080)
- Exposed Rebar (1090)
- Efflorescence/Rust Staining (1120)
- Cracking (RC & Other) (1130)
- Decay/Section Loss (1140)
- Check/Shake (1150)
- Crack (Timber) (1160)
- Split/Delamination (Timber) (1170)
- Abrasion (Timber) (1180)
- Abrasion/Wear (1190)
- Deterioration (Other) (1220)
- Distortion (1900)
- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects (concrete, steel, granite, timber, other) when assessing the condition of this element.

**Element Commentary**

It is important to note that the assessment of the National Bridge Elements listed in ‘Section 3.2 – Railings’ includes curbing related to the proper function of that railing; for example, NBEs include brush curb below a two rail box beam, but NBEs do not include curb separated from the rail by a sidewalk. The Agency Defined Element – Curb does not replace the requirement to assess curb with the NBEs. The Agency Defined Element – Curb is in addition to the curbs assessed with Railing.

The inspector should use judgment when utilizing the condition state defect definitions, especially for concrete cracking. The crack defect description definitions describe generalized distress, but the inspector should consider width, spacing, location, orientation, and structural or nonstructural nature of the cracking. The inspector should consider exposure and environment when evaluating crack width. In general, reinforced concrete cracks less than 0.012 inches can be considered insignificant and a defect is not warranted. Cracks ranging from 0.012 to 0.05 inches can be considered moderate, and cracks greater than 0.05 inches can be considered wide.
3.10.4—Element 811—Curb

General Guidance

These are raised components on bridge decks that mark the edge of the roadway, redirect errant vehicles, and/or channel deck surface runoff to removal points.

Condition State Examples
(Note: Only the indicated condition is considered for assessment in the examples shown below.)

NY Example 3.10-12
The bridge, including the steel curb, was recently painted. The curb is in excellent condition. Element 811 assessed CS-1.
NY Example 3.10-13
The curb is in good condition, but subsequent pavement overlays have reduced the curb reveal from 6" to 3". Element 811 assessed CS-4.

NY Example 3.10-14
The curb is heavily deteriorated with exposed reinforcement present. Element 811 assessed CS-4.
3.10.5—Element 830—Secondary Members

**Description:** This element defines members that brace or stiffen individual primary members against buckling, provide lateral or torsional rigidity to the primary system or hold components of a primary member in proper relative position. Condition evaluation for this element includes all secondary members for all material types.

**Classification:** ADE – Agency Defined Element  
**Units of Measurement:** each

**Quantity Calculation:** 1 per span when present.

### Condition State Definitions

<table>
<thead>
<tr>
<th>Material</th>
<th>Condition State 1</th>
<th>Condition State 2</th>
<th>Condition State 3</th>
<th>Condition State 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel (8010)</td>
<td>No section loss due to corrosion, connections are sound, and the alignment of bracing is good. No unusual sounds or excessive movement under live load.</td>
<td>Minor bends or misalignment due to impact damage. Negligible section loss of members or connectors (rivets, bolts, or welds) due to corrosion.</td>
<td>Serious deterioration or loss of functional capacity due to corrosion, improper erection, improper repair, impact damage, or misalignment. Some limited functional capacity may exist.</td>
<td></td>
</tr>
<tr>
<td>Concrete (8020)</td>
<td>No spalling, scaling, cracking, efflorescence, etc., or other signs of deterioration. No unusual sounds or excessive movement under live load.</td>
<td>Isolated moderate surface scaling or minor spalling with negligible efflorescence. Hairline cracking associated with minor mapcracking or isolated tension cracking that does not compromise the member’s ability to function as designed.</td>
<td>Pervasive scaling/spalling/efflorescence/cracking and possible exposed corroded rebar with section loss with hollow sounding areas at many locations. The members may still retain a limited ability to function as designed.</td>
<td></td>
</tr>
<tr>
<td>Timber (8030)</td>
<td>New or near new condition; no decay and only minor discoloration, no evidence of insect damage, minimal checking/splitting, no evidence of fire damage.</td>
<td>Minor deterioration but still functioning as designed; minor decay, no appreciable penetration, minimal insect damage or hollow sounding areas, moderate checking/splitting, 5 percent or less section loss caused by fire, no visual evidence of sagging or warping.</td>
<td>Serious deterioration or not functioning as designed; loss of section more than 20 percent from any cause, isolated areas of deterioration as evidenced by awl penetration and hollow sound. Bridge load capacity is affected.</td>
<td></td>
</tr>
</tbody>
</table>

This condition warrants a structural review to determine the effect on strength of serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
**Element Commentary**

While the units of measurement for this element are “each”, it is not intended to count the total quantity of individual secondary members throughout the entire structure. Secondary members shall be assessed as a system relative to the primary member system and its level of load path redundancy. For example, assess a secondary member condition state lower if it adversely affects the performance of a truss member than one that affects a girder in a multi-girder system. Do not assess this element based on the worst individual secondary member within the span.

In lieu of AMBEI defects, this Agency Defined Element shall be assessed using the condition state definitions listed in the table above.
3.10.5—Element 830—Secondary Members

General Guidance

Include the condition of the connections in the element assessment. Rate the secondary members as a system relative to the primary member system and its level of load-path redundancy. For example, rate a secondary member deficiency lower if it adversely affects the performance of a truss member than one that affects a stringer in a multi-girder system.

Some of the more common secondary members are:

- Diaphragms (except those attached to curved girders or directly supporting deck loads)
- Lateral bracing
- Portals
- Lateral and sway struts and sway bracing on through trusses
- Lacing bars, stay plates, and tie plates on trusses
- Knee bracing

The actual location of secondary members and the details of connection of secondary members should be compared and verified against existing plans or sketches in lieu of plans. Variations observed between field conditions and plans/sketches should be noted on the plans/sketches.

Minor erection aids, such as rebars attached transversely across the bottom flanges of stringers of jack arches, are not considered secondary members.

Condition State Examples

(Note: Only the indicated condition is considered for assessment in the examples shown below.)

NY Example 3.10-15

The concrete diaphragm’s top face is partially spalled with no exposed reinforcement or rust stains. No other deficiencies are present. The adjacent utility supports are not considered in this rating. Element 830 assessed CS-1 (Locally, this condition is assessed CS-2).
NY Example 3.10-16
The batten plates and a bottom lateral connection plate have areas of severe section loss in isolated locations. Element 830 assessed CS-3.

NY Example 3.10-17
The lower horizontal lateral bracing timbers were noted to be damp with surface fibers breaking down throughout the structure. Minor surface decay allows awl penetrations. Element 830 assessed CS-2.
NY Example 3.10-18
Many of the diaphragms on the structure are severely rusted to the point of having holes through the web. Element 830 assessed CS-3.

NY Example 3.10-19
The truss sway frame is severely damaged from impact. Element 830 assessed CS-4.
3.10.6—Element 831—Steel Beam End

Description: This element defines the area from the end of a steel beam to a point five feet from the centerline of bearings of the steel beam, and is for all steel beams.

Classification: ADE – Agency Defined Element Units of Measurement: each

Quantity Calculation: The sum of each simply supported beam end.

Condition State Definitions

<table>
<thead>
<tr>
<th>Defect</th>
<th>Condition State 1</th>
<th>Condition State 2</th>
<th>Condition State 3</th>
<th>Condition State 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOOD</td>
<td></td>
<td>FAIR</td>
<td>POOR</td>
<td>SEVERE</td>
</tr>
</tbody>
</table>

Allowable defects include:
- Corrosion (1000)
- Cracking (1010)
- Connection (1020)
- Distortion (1900)
- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects when assessing the condition of this element.

Element Commentary:

Condition evaluation for this element includes all exposed faces of the steel beam in the area described above.
3.10.6—Element 831—Steel Beam End

General Guidance

Assess only the Steel Beam Ends located below deck joints, excluding pin and hanger locations.

The Steel Beam End Element supplements conditions documented with Elements 102, 107, and 113; however, its Condition State is recorded with an “Each” unit of measurement versus their linear “feet” unit of measurement.

This element will allow bridge owners to anticipate maintenance requirements specific to this area of the superstructure.

Condition State Example
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.10-20

Section loss is evident along the end of Span 1’s lower web end. Element 831 assessed CS-3. Section loss is evident along the end of Span 2’s lower web end; however, certified repairs restored its original design capacity. Element 831 assessed CS-1.
3.10.7—Element 850—Backwall

**Description:** This element defines the backwalls comprised of all materials including, but not limited to reinforced concrete, masonry, steel and timber.

**Classification:** ADE - Agency Defined Element

**Units of Measurement:** ft

**Quantity Calculation:** The sum of the lengths of the backwall measured along the skew angle.

**Condition State Definitions**

<table>
<thead>
<tr>
<th>Defect</th>
<th>Condition State 1</th>
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Allowable defects include:

- Corrosion (1000)
- Cracking (1010)
- Connection (1020)
- Delam/Spall/Patched Area (1080)
- Exposed Rebar (1090)
- Efflorescence/Rust Staining (1120)
- Cracking (RC & Other) (1130)
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- Deterioration (Other) (1220)
- Mortar Breakdown (Masonry) (1610)
- Split/Spall (Masonry) (1620)
- Patched Area (Masonry) (1630)
- Masonry Displacement (1640)
- Distortion (1900)
- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects (concrete, steel, granite, timber, other) when assessing the condition of this element.

**Element Commentary:**

The inspector should use judgment when utilizing the condition state defect definitions, especially for concrete cracking. The crack defect description definitions describe generalized distress, but the inspector should consider width, spacing, location, orientation, and structural or nonstructural nature of the cracking. The inspector should consider exposure and environment when evaluating crack width. In general, reinforced concrete cracks less than 0.012 inches can be considered insignificant and a defect is not warranted. Cracks ranging from 0.012 to 0.05 inches can be considered moderate, and cracks greater than 0.05 inches can be considered wide.
3.10.7—Element 850—Backwall

**General Guidance**

For jack-arch bridges that do not have recessed backwalls, assess the abutment sections between the girders as backwalls (see NY Example 3.10-22).

Do not assess this element for the following structure types: box culverts, pipe culverts, integral abutments, rigid frames, slabs, filled arches, and some spill-through abutments. Do not assess aesthetic curtain walls on the bridge seat.

Backwall headers, if present, shall be assessed with the appropriate joint element.

See NY Section 3.5 for backwall example sketches.

**Condition State Examples**

(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.10-21
Testing with a hammer produced solid soundings throughout the backwall. Element 850 assessed **CS-1**.
NY Example 3.10-22
The backwall between girders of a jack-arch bridge exhibits a spall 1.5 inch deep. Element 850 assessed CS-3. Hammer testing reveals hollow sounding (delaminated) concrete to the right of spall. Element 850 assessed CS-2.

NY Example 3.10-23
The backwall is seriously deteriorated. No signs of distress or movement have been detected, but concrete condition is poor, extensively spalled and crumbly with exposed reinforcement. A structural review is not warranted. Element 850 assessed CS-3.
3.10.8—Element 851—Abutment Pedestal

**Description:** This element defines the pedestals that support girders and transfer load into the abutments. For abutments without raised individual pedestals, the pedestal is considered the material directly below or adjoining individual bearings or superstructure elements (i.e., beams or girders) which represents the point of load transfer between the bearing (or superstructure) and stem.

**Classification:** ADE - Agency Defined Element

**Units of Measurement:** each

**Quantity Calculation:** Sum of each pedestal.

**Condition State Definitions:**

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Allowable defects include:
- Corrosion (1000)
- Cracking (1010)
- Connection (1020)
- Delam/Spall/Patched Area (1080)
- Exposed Rebar (1090)
- Efflorescence/Rust Staining (1120)
- Cracking (RC & Other) (1130)
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- Deterioration (Other) (1220)
- Mortar Breakdown (Masonry) (1610)
- Split/Spall (Masonry) (1620)
- Patched Area (Masonry) (1630)
- Masonry Displacement (1640)
- Distortion (1900)
- Loss of Bearing Area (2240)
- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects (concrete, steel, granite, timber, other) when assessing the condition of this element.

**Element Commentary:**

Account for the Loss of Bearing Area (2240) defect under the appropriate bearing element defined in the AMBEI, Section 3.4–Bearings.

The inspector should use judgment when utilizing the condition state defect definitions, especially for concrete cracking. The crack defect description definitions describe generalized distress, but the inspector should consider width, spacing, location, orientation, and structural or nonstructural nature of the cracking. The inspector should consider exposure and environment when evaluating crack width. In general, reinforced concrete cracks less than 0.012 inches can be considered insignificant and a defect is not warranted. Cracks ranging from 0.012 to 0.05 inches can be considered moderate, and cracks greater than 0.05 inches can be considered wide.
3.10.9—Element 852—Pier Pedestal

**Description:** This element defines the pedestals that support girders and transfer load into the piers. For piers without raised individual pedestals, the pedestal is considered the material directly below or adjoining individual bearings or superstructure elements (i.e., beams or girders) which represents the point of load transfer between the bearing (or superstructure) and stem.

**Classification:** ADE - Agency Defined Element

**Units of Measurement:** each

**Quantity Calculation:** Sum of each pedestal.

**Condition State Definitions:**

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Allowable defects include:
- Corrosion (1000)
- Cracking (1010)
- Connection (1020)
- Delam/Spall/Patched Area (1080)
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- Deterioration (Other) (1220)
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- Patched Area (Masonry) (1630)
- Masonry Displacement (1640)
- Distortion (1900)
- Loss of Bearing Area (2240)
- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects (concrete, steel, granite, timber, other) when assessing the condition of this element.

**Element Commentary:**

The inspector should use judgment when utilizing the condition state defect definitions, especially for concrete cracking. The crack defect description definitions describe generalized distress, but the inspector should consider width, spacing, location, orientation, and structural or nonstructural nature of the cracking. The inspector should consider exposure and environment when evaluating crack width. In general, reinforced concrete cracks less than 0.012 inches can be considered insignificant and a defect is not warranted. Cracks ranging from 0.012 to 0.05 inches can be considered moderate, and cracks greater than 0.05 inches can be considered wide.
3.10.8—Element 851—Abutment Pedestal

3.10.9—Element 852—Pier Pedestal

(Note: These elements are grouped for presentation of information.)

General Guidance

For raised pedestals, assess the entire pedestal, including the sides.

For substructures without raised pedestals, assess the condition of the area under the bearings or superstructure elements (i.e., beams or girders) including the horizontal and the vertical surfaces immediately next to the bearing which represents the point of load transfer between the bearing (or superstructure) and substructure.

Pedestals are assessed in association with their supporting substructure; for example, the separate bearing areas shown in NY Figure 3.10-1 are assessed with that hammerhead pier. (Note: bearings are assessed with they span they support (see NY Section 3.4)).

See NY Section 3.5 for pedestal example sketches.
**Condition State Examples**
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

**NY Example 3.10-24**
No delaminations are present and the full bearing area remains solid. The right face of the pedestal exhibits a moderate diagonal crack. Element 852 assessed **CS-2**.

**NY Example 3.10-25**
A 5 inch high by 3 inch deep concrete area has spalled. The reinforcement is exposed. Element 851 assessed **CS-3**.
NY Example 3.10-26
Severe spalling and scaling of the pedestal has significantly undermined the fixed bearing masonry plate and exposed all four anchor bolts. Element 851 assessed **CS-4**.

NY Example 3.10-27
The pedestals (supports two spans) are seriously deteriorated with broken confinement reinforcement and a vertical crack. Spalls and hollow sounding delaminations are present on the other faces. Element 852 assessed **CS-4**.
3.10.10—Element 853—Wingwall

**Description:** This element defines wingwalls comprised of all materials including, but not limited to reinforced concrete, steel and timber.

**Classification:** ADE – Agency Defined Element  
**Units of Measurement:** ft

**Quantity Calculation:** The sum of the lengths of the wingwalls measured along their skew angle from the end of the abutment extension to the end of the wingwall. The wingwall element quantity shall be calculated from the first construction joint to the end of the wingwall. Wingwalls monolithic with the abutment element, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element.

**Condition State Definitions**

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Allowable defects include:
- Corrosion (1000)
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- Connection (1020)
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- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects (concrete, steel, granite, timber, other) when assessing the condition of this element.

**Element Commentary:**

The inspector should use judgment when utilizing the condition state defect definitions, especially for concrete cracking. The crack defect description definitions describe generalized distress, but the inspector should consider width, spacing, location, orientation, and structural or nonstructural nature of the cracking. The inspector should consider exposure and environment when evaluating crack width. In general, reinforced concrete cracks less than 0.012 inches can be considered insignificant and a defect is not warranted. Cracks ranging from 0.012 to 0.05 inches can be considered moderate, and cracks greater than 0.05 inches can be considered wide.
3.10.10—Element 853—Wingwall

General Guidance

For very long wingwalls, consider the length of the wingwall that can be associated with the bridge. Lacking any other logical criterion, such as a vertical construction joint, use twice the height of the abutment as the length of wall to set inspection limits. If a problem is evident beyond this limit, do not include it in the wingwall assessment, but bring the problem to the Regional Structures Management Engineer's or the bridge owner's attention.

For walls having non-structural stone or brick facing, the facing material should be considered only to the extent that its condition may indicate the condition of the underlying element. See NY Section 3.5 for additional guidance regarding non-structural facings.

Wingwall footings and piles independent of the abutment footing shall be included in the assessment of the wingwall element (see NY Figures 3.5-5 and 3.5-8 and NY Sections 3.5.3.1 thru 3.5.3.6).

Condition State Examples
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.10-28
The wingwall has one insignificant diagonal crack near the top which leaks water. Element 853 assessed CS-1.
NY Example 3.10-29
The wingwall has tight map cracking over its entire surface. The cracks are effloresced, but no rust staining is apparent. Element 853 assessed CS-2.

NY Example 3.10-30
This wingwall has several missing and displaced stones. The wingwall is still retaining the embankment, but appears unstable. Element 853 assessed CS-4.
3.10.11—Element 860—Culvert Headwall

**Description:** This element defines culvert headwalls comprised of materials including, but not limited to concrete, steel, timber and masonry.

**Classification:** ADE – Agency Defined Element

**Units of Measurement:** ft

**Quantity Calculation:** The sum of the lengths of the headwalls measured along their skew angle from spring line to spring line.

**Condition State Definitions**

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Allowable defects include:

- Corrosion (1000)
- Cracking (1010)
- Connection (1020)
- Delam/Spall/Patched Area (1080)
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- Split/Spall (Masonry) (1620)
- Patched Area (Masonry) (1630)
- Masonry Displacement (1640)
- Distortion (1900)
- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects (concrete, steel, granite, timber, other) when assessing the condition of this element.

**Element Commentary**

The inspector should use judgment when utilizing the condition state defect definitions, especially for concrete cracking. The crack defect description definitions describe generalized distress, but the inspector should consider width, spacing, location, orientation, and structural or nonstructural nature of the cracking. The inspector should consider exposure and environment when evaluating crack width. In general, reinforced concrete cracks less than 0.012 inches can be considered insignificant and a defect is not warranted. Cracks ranging from 0.012 to 0.05 inches can be considered moderate, and cracks greater than 0.05 inches can be considered wide.
3.10.11—Element 860—Culvert Headwall

General Guidance

Stone headwalls may exhibit settlement or gaps from missing stones or mortar. Look for excessive localized loads deforming the culvert and loss of embankment retention. Look for headwall settlement and pulling away from the barrel, undercutting, deterioration and rotation of the headwall from the barrel.

See NY Section 3.6 for culvert headwall example sketches.

Condition State Example
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.10-31
The headwall is displaced and bulged outward above the arch. The entire surface is laced with cracks and small unit-to-unit displacements along horizontal and vertical mortar lines. Element 860 assessed CS-4.
3.10.12—Element 870—Culvert Apron/Cut-Off Wall

Description: This element defines culvert aprons/cut-off walls comprised of materials including, but not limited to concrete, steel, timber and masonry.

Classification: ADE – Agency Defined Element

Units of Measurement: each

Quantity Calculation: The sum of each culvert apron/cut-off wall.

Condition State Definitions

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Possible defects include:
- Corrosion (1000)
- Cracking (1010)
- Connection (1020)
- Delam/Spall/Patched Area (1080)
- Exposed Rebar (1090)
- Efflorescence/Rust Staining (1120)
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- Masonry Displacement (1640)
- Distortion (1900)
- Settlement (4000)
- Damage (7000)

Refer to AMBEI Appendix D for a listing of the specific defects (concrete, steel, granite, timber, other) when assessing the condition of this element.

Element Commentary

Culvert aprons/cut-off walls, when present, are located at the culvert’s inlet and outlet. Do not quantify aprons and cut-off walls as separate units; for example, if the culvert outlet has an apron and cut-off wall, then the quantity is 1; if the outlet has only a cut-off wall and the inlet has an apron, each would be quantified separately for a total of 2.

The inspector should use judgment when utilizing the condition state defect definitions, especially for concrete cracking. The crack defect description definitions describe generalized distress, but the inspector should consider width, spacing, location, orientation, and structural or nonstructural nature of the cracking. The inspector should consider exposure and environment when evaluating crack width. In general, reinforced concrete cracks less than 0.012 inches can be considered insignificant and a defect is not warranted. Cracks ranging from 0.012 to 0.05 inches can be considered moderate, and cracks greater than 0.05 inches can be considered wide.
3.10.12—Element 870—Culvert Apron/Cut-Off Wall

General Guidance

No comment.

Condition State Example
(Note: Only the indicated condition is considered for assessment of the examples shown below.)

NY Example 3.10-32
Moderate cracking is present throughout the concrete apron. Element 870 assessed CS-2.
4.1—Quality Control

Introduction

Quality control is a detailed process that includes field reviews and careful examination of all parts of the bridge inspection documentation. Quality control is accomplished mainly by checking all field reports for completeness, accuracy and conformance with this manual, and by reviewing the contents of the BIN folder. This effort is augmented by field visits where the actual inspection work is observed. The person responsible is the Quality Control Engineer (QCE), whom must review all inspection reports and certify that quality control has been done. An inspection report is not official until it is certified by the QCE and accepted by the Quality Assurance Engineer (QAE). The QCE is required to complete a field review checklist (see Section 4.3 below) for each inspection team at least once per year. The completed field review checklists should be submitted to Regional and Consultant Project Managers and the Main Office Quality Assurance Engineer.

Checking for completeness involves thorough review of BIN folder contents to ensure that all required items are in the folder (see NY Section 2C.3). Also, the QCE must make sure that all required documents are present and completed properly. Using the following quality control guidelines makes this easier.

Checking for accuracy and conformance with this manual requires the QCE to review the reports to make sure that all components of the bridge were properly assessed and documented. The photos and comments must be consistent with the assessments given and all elements requiring an increased level of intensity should be identified as so inspected. For example, if photos and descriptions indicate that a CS-2 is appropriate, but the element is assessed CS-4, there is a problem needing resolution. Similarly, the QCE must ensure that a statement is placed in the inspection report confirming that a 100% hands-on inspection was completed when necessary (see NY Appendix C for additional guidance). The QCE should discuss any apparent problems regarding report accuracy with the team leader.

Guidelines

The QCE shall ensure the inspection report is complete, thorough and accurate to the limit of available resources. The QCE is encouraged to use the following rules and checks for reviewing bridge inspection reports.

Summary of Rules on Photos and Comments:

- Comments and photos are required for each element assessed CS-3 or CS-4.
- Comments and photos are required for any element that is up-assessed since the previous inspection.
- Comments are required for all elements assessed CS-5 except footings and piles.
- Comments are required if newly acquired record plans indicate a previous CS-5 rating was not appropriate.
• Comments need to be provided for any of the following kinds of assessment changes:
  from blank to CS-1 thru CS-5
  from CS-5 to CS-1 thru CS-4
  from CS-1 thru CS-5 to blank

Checks:

[ ] Flags – Check to see if flag documentation and actions are consistent with the previous and current flag status.

[ ] Date –
  • Should be the same as the last day in the field (see NY Section 2C.2 for additional guidance).
  • For new bridges, reconstructed bridges or major rehabs, is the inspection completed within 60 days of reopening to traffic of the newly constructed bridge or any portion thereof.

[ ] Insp. Agency – Is this coded correctly?

[ ] Type of Inspection – Is this coded correctly?

[ ] Posting –
  • Are vertical clearances on and/or under the bridge coded correctly?
  • Is the load posting coded correctly?

[ ] Gen. Rec. – Is the number appropriate for the ratings and comments in the inspection report?

[ ] Access – Is the actual access used to inspect the bridge noted on the form? Are they applicable or in need of update?

[ ] Direction of Orientation – Did the inspector adhere to the established direction of orientation when providing ratings and comments?

[ ] CS = 5 (unknown) – Is a comment provided for every element (except footings and piles) that is assessed 5?

[ ] CS = 3 or 4 – Are conditions documented with a comment and photo(s)?

[ ] Ensure photos, ratings and comments are consistent with each other and BIM rating guidance.

[ ] Diving – Does scour documentation indicate water depths of 6 feet or more at any substructure indicating the need for a diving inspection?

[ ] Diving – Did inspector properly reference previous diving report in the bridge inspection report, where applicable?
[ ] Special Emphasis –
  • Does the special emphasis section in the BIN folder indicate non-redundant, fracture-critical, pins and hangers, fatigue-prone details, etc?
  • Have new details been introduced on the structure which are considered special emphasis details?
  • Is there an identifying sticker on the BIN folder cover?
  • Were bridges marked for special emphasis inspection, inspected and documented in sufficient detail in the inspection report?

[ ] 100% Hands-On –
  • Is this noted as being completed for fracture-critical members and/or special emphasis details (see NY Appendix C for additional guidance)?
  • Is the 100% hands-on inspection completed/waived for weld categories D, E, and/or E' welds? If so, is the correct cycle being maintained for 100% hands on inspection of the details?

[ ] Field Notes –
  • Is the recorded date consistent with that recorded elsewhere?
  • Are the date, arrival, departure, temperature and weather blanks completed?

[ ] BIN Plate –
  • Where is it located?
  • Notify the Regional Bridge Maintenance Engineer of missing or defaced BIN plates for eventual replacement. (Consultant inspection teams are equipped to replace BIN plates)

[ ] Are all cross references correct?

[ ] Are the proper bridge components included and rated?

[ ] Is the "Recommend Further Investigation" section completed, if necessary?

Documentation:

[ ] Forms – Were all applicable and necessary forms completed?  HVA, Steel Collision Vulnerability, Debris, Overhead Electrical Survey, etc.

[ ] Names – Do all documentation forms have TL and/or ATL names and other identifying information such as date and features?

[ ] Referenced by Report – Are inspection report comments cross-referenced with all relevant documentation?

[ ] Droplines –
  • Were dropline readings taken for bridges over water?  See NY Section 2D.2 for frequency and location requirements.  If not, is there a valid reason provided as to why not?
  • Does this documentation include flow depth, estimated flood flow depth, and flow direction?

[ ] Is diving recommended by TL for abutment, wingwall, stream channel or pier scour?  If so, bring to the diving Quality Assurance Engineer’s attention for possible addition to the diving schedule.
Scour –
- Are channel profiles near substructures taken if water depth and/or turbidity prohibit a visual inspection?
- Is the extent of scour documented by sketches?
- Are substructure deficiency (underwater) sketches done, if necessary?
- If there are any stream channel alignment problems, is there a stream alignment sketch?
- Is water depth measured and documented to determine if diving is required?

Non-Structural Condition Observations (See NY Section 5)–
- Are the non-structural condition observations appropriate?
- Are all necessary non-structural condition observations documented?

Photos:
Standard Photos (See NY Section 2B.4 for additional guidance) –
- Required for new bridges, after major rehabilitation or applicable change conditions noted.
- Are all standard photos up to date regarding bridge configuration?
- Were standard photos 6 years or older replaced?

North Arrow – Is the north arrow on the photo location sketch consistent with the direction of orientation?

Flow – Is the stream flow direction shown on the photo location sketch for bridges over water?

Photo Number & Location –
- Are all photos located in the photo location sketch?
- Are photo locations shown on the photo location sketch reasonably accurate?
- Are above-deck photos identified as solid circles and below-deck photos as dashed circles?

References – Do all photo descriptions agree with the photo shown and actual ratings and comments?

Inventory:
Was the inventory verified by the preparer and reviewer?

Clearances (R.R.) – Were vertical clearances measured, if the bridge crosses a railroad? Is the minimum clearance and its location noted? See NY Section 2C.9 for requirements.

Clearances (Hwy.) – Were vertical clearances measured if the bridge crosses a highway?

Debris Form – Was it completed if required?

Access Form – Was the form completed if there was a change from the previous access requirements?

Electric Proximity – If required, was the Overhead Electric Survey form completed?
Load Rating:

[ ] Match Plans –
  • Were structural changes to the primary members as shown on the plans or sketches-in-lieu of plans reflected in the Level II load rating? If the Level II load rating is not yet done for currently noted changes, are the critical changes noted in a communication to the Load Rating Engineer?
  • Were any changes in the condition of the primary members reflected in the Level II load rating?
  • Were additional overlay thickness and railing changes (concrete parapet & steel railing) noted on the Level II load rating?

[ ] Check results of the most recent Level I, if available, or Level II load rating. If inconsistent with load posting (if any), has the inspector appropriately flagged the problem?

Plans:

[ ] Plans –
  • Were record plans or sketches-in-lieu of plans reviewed by the Team Leader?
  • Were the plans initialed and dated by the Team Leader?
  • Were the plans updated to reflect comments in the inspection reports? (e.g., new wearing surface, railing replacement, bridge widening)

BIN Folder:

[ ] Are all appropriate stickers on the BIN folder, such as 100% hands-on, electric safety and/or complex bridge?

[ ] Special Emphasis – Are areas requiring 100% hands-on inspection clearly identified in a specially prepared section at the end of the bridge report binder.

[ ] Check recent correspondences. Does the inspection report show any inconsistency with the information in the BIN folder? In particular, check posting, flags, impact damage and repairs.

Special Emphasis Section:

[ ] Welds Located – Were D, E, and E’ category welds located on sketches in the Special Emphasis section of the binder?

[ ] Category – Were all D, E, and E' welds properly identified?

[ ] Fatigue Analysis – This must be done for all category D, E and E' welds to exempt the 100% hands-on requirement.

[ ] NR-FCM Drawn – Does the Special Emphasis section have sketches identifying all non-redundant and fracture-critical members/details.

[ ] Did the inspector indicate within the report that the special emphasis inspection was performed? If not, was a reason provided as to why?
4.2—Quality Assurance

Bridge inspection quality assurance is the responsibility of the Quality Assurance Engineer. The NYSDOT Bridge Inspection Unit staff normally fulfills this role for all bridges inspected by the NYSDOT. The goals of quality assurance are:

- Ensure compliance with the UCBI. This involves verifying that all bridges due for inspection are inspected and submitted within the prescribed time limits.
- Verification of inspectors’ credentials.
- Ensure that the Flagging Procedure is being correctly implemented.
- Verify compliance with bridge inspection policy and procedures described in the Bridge Inspection Manual (BIM) and Technical Advisories (T.A.’s). This is done by reviewing BIN folders and bridge inspection reports as well as performing field reviews of the inspection teams.
- Provide continuous interpretation, evaluation and updating of policy, procedures, and standards.
- Provide instruction on the NYS bridge inspection system individually as needed and to the bridge inspection community through the NYSDOT Bridge Inspection Workshop and Annual Bridge Inspectors Meeting.
- Ensure that bridges are inspected and conditions reported uniformly statewide.

The bridge inspections Quality Assurance Engineers perform the technical QA review. This may include a detailed review of sample BIN folders. All rated elements, comments, photos, sketches, flag reports, etc. are carefully checked for technical accuracy and compliance with this manual. This review may be as detailed as the quality control review. Additionally, the QAE should review who inspected the bridge and if they are approved for bridge inspection work?

Other inspection reports are sampled and given a less detailed review that focuses on the more important elements’ rating and documentation. Inspection reports not otherwise reviewed in more detail may be scanned briefly for obvious technical errors or omissions. The scope of the review by the QAE is discretionary based on several factors such as the level of experience of the inspection team and QC Engineer, and the past performance of the inspection group.

If there appears to be a serious problem with the use of the rating scale, if the report is incomplete, or there is some other significant technical problem, the QAE may reject the report and require resubmission. For minor problems, the report may be accepted, but comments provided so that the QCE can take steps to correct the problem for future inspections. If the Team Leader and/or the Quality Control Engineer disagree with the comments, they should contact the QAE to resolve any differences.

The technical review is documented by maintaining a database file that records, at a minimum, the submission number and date received, the number of bridges submitted, and number of bridges rejected during QA review.

Primary QA approval or failure of inspection reports should generally be completed within 30 days of receipt from the QC.
The QAE will also perform field reviews as part of quality assurance. These field review reports are maintained in the Bridge Inspection Unit’s project files. A copy of the report is sent to the Region (and Consultant).

Flag Review:

QAE’s should review flag reports for compliance with the flagging procedure. Since flags are reviewed by the QC engineer, the review by the QAE should be at a level consistent with other QA efforts. The following should be checked:

[ ] - Check the flag report for omissions.

[ ] - Check technical appropriateness. Does the description and photo support the type of flag?

[ ] - Was the flag reported to the Region within the required time?
**4.3—Field Reviews & Field Review Form**

The focus of field reviews is to ensure that the inspector is thoroughly familiar with the policies and procedures governing bridge inspection, that the team is composed of personnel who are suitable for their tasks, and the inspections are being performed efficiently and safely. Office quality control/assurance reviews of bridge inspection reports are inherently limited in their value because the end product rather than the process is examined. For this reason, field reviews of bridge inspections in progress are an essential component of quality control/assurance. The field reviews allow for a more thorough review of the inspection team's knowledge, abilities and thoroughness. The first priority is generally given to inspectors new to bridge inspection.

Field reviews should be done when the teams are inspecting bridges that are sufficiently large or complex and have some problems, to adequately judge the ability and knowledge of the teams.

Field reviews are part of both quality control and quality assurance. The QCE shall visit each new team in the field within six weeks of the new assignment. Subsequent visits by the QCE should be at approximately six month intervals. More frequent visits may be necessary if there are problems. Other field reviews may be done by Regional project managers, Regional Structures Management Engineers, Regional Bridge Evaluation Engineers, Main Office Bridge Inspection QAEs and the Federal Highway Administration.

Field reviews may be scheduled or unscheduled. In most cases, members of the inspection team should not be given any prior knowledge of the review. Therefore, Team Leaders are required to keep their QCE informed of the team’s current location and proposed schedule. The time needed to observe the team doing inspections depends on the experience of the team and the type of bridge inspected. Any observed problem with the work should be documented on the field review checklist, even if the problem is not specifically covered in the checklist.

Safety is the most important element in New York's bridge inspection program. With this in mind, field reviews shall include a review of the team's compliance with all applicable state and federal safety regulations. This is also a good time to discuss current safety issues and overall safety awareness with the team.

The following Safety Field Review Checklist is provided as guidance for all field reviews:
SAFETY FIELD REVIEW CHECKLIST

Field Review Date: [Blank] BIN: [Blank] No. of Spans/Bridge Type: [Blank]
Region: [Blank] County: [Blank] Firm: [Blank]
Carried: [Blank] Crossed: [Blank]
Team Leader: [Blank] Assistant Team Leader: [Blank]
Other Team Member(s): [Blank] QC Engineer: [Blank]

The following items were discussed with the inspection team during this field visit:

☐ Review of previous inspection report prior to present inspection to determine problem areas?
☐ Check BIN folder special emphasis section & bridge plans for areas requiring special attention.
☐ Structural behavior and primary load paths of bridge.
☐ Identification of D and E welds. FCMs and proper documentation.
☐ 100% hands-on inspection of non-redundant members.
☐ Proper determination & use of Direction of Orientation.
☐ Load restriction and vertical clearance postings.
☐ Use/Availability of proper access equipment.
☐ Proper use of safety equipment & procedures.
☐ Presence and use of basic inspection manuals (checklist on page 3), equipment, and forms.
☐ Section loss measurement (D-meter, caliper, estimated, other) and documented.
☐ Proper use of condition rating scales.
☐ Appropriate use of sketches and tables when preparing documentation.
☐ Channel cross-section & substructure profile measurement and documentation.
☐ Primary completion of inspection report in the field.
☐ Proper photo documentation & cross referencing.
☐ Verification of plans or preparation of sketches in lieu of plans.
☐ Maintenance of Bridge Inspection Diary
☐ Deployment of resources and progress of inspections.
☐ Understanding & implementation of flagging procedures.

REVIEWERS:

GENERAL REMARKS:
## SAFETY FIELD REVIEW CHECKLIST

### Equipment [“No” requires a comment]

<table>
<thead>
<tr>
<th>Condition</th>
<th>Y or N</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the required PPE available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the appropriate Personal Protective Equipment (PPE) being used?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is a First Aid Kit available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the team have a list of emergency phone numbers and locations available?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Work Zone Protection [“No” requires a comment]

<table>
<thead>
<tr>
<th>Condition</th>
<th>Y or N</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are cones and signs being utilized?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is Work Zone Traffic Control being used?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check type used:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrow board,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shadow Vehicle(van)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shadow Vehicle(truck)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact Attenuator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flaggers (highway or railroad)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for use:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the set-up in conformance with MUTCD Standards?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Access & Fall Protection

<table>
<thead>
<tr>
<th>Condition</th>
<th>Y or N</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are the inspection crew members trained in fall protection and scaffolding safety?</td>
<td></td>
<td>By Whom?</td>
</tr>
<tr>
<td>Who hasn’t been trained?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If a State UBIU is being used, are the operators certified?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is an aerial lift device being used?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If an aerial lift device is being used, have the operators been instructed in its use?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SAFETY FIELD REVIEW CHECKLIST

### Indicate Access Type Used:

<table>
<thead>
<tr>
<th></th>
<th>ft - UBIU</th>
<th>ft - Lift</th>
<th>ft - Bucket Truck</th>
<th>Other:</th>
</tr>
</thead>
</table>

### Question | Y or N | Comment |
--- | --- | --- |
Is the bridge being rigged? | | |
If yes, are all safety procedures being followed? | | |
If yes, are they riggers knowledgeable in all applicable OSHA regulations? | | |

### Check type used:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable and Catenary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pick with Trolley Rail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hook and Chain/Wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (describe):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### What type of fall protection equipment is being used?

**Questionnaire** [Note: “YES” requires a comment]

| Question | Y or N | Comment |
--- | --- | --- |
Does the inspection team feel additional safety equipment is needed? | | |
Does the inspection team feel additional safety training is needed? | | |
Does the reviewer feel additional equipment and/or safety training is needed? | | |

### General comments:

**Personal Protective Equipment in Use**

- Hard Hat
- Boots
- Respirator
- Lanyard
- High Visibility Apparel
- Protective eyewear
- Harness
- Gloves

**Required Manuals Available**

- NYSDOT Bridge Inspection Manual
- NYSDOT Bridge Inspection Safety Manual
- NYSDOT Bridge Inventory Manual
- AASHTO The Manual for Bridge Evaluation
- FHWA Bridge Inspector’s Reference Manual

January 2016
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NY SECTION 5
NON-STRUCTURAL CONDITION OBSERVATIONS

5.1—Introduction

Bridge maintenance is an important component of any comprehensive bridge management system. Bridge inspection reports are a primary resource from which bridge management engineers and planners make appropriate recommendations for corrective repairs, preventative maintenance actions, and the rehabilitation/replacement of bridge elements and bridge related features to ensure public safety and to maintain bridge durability in a cost-effective manner.

The bridge inspection procedure provides condition information to owners and maintenance personnel through the following:

- Timely issuance of safety flag PIAs and structural flags (see NY Appendix B).
- Documentation of bridge element condition assessment (see AMBEI).
- Documentation of non-structural condition observations.

Non-structural condition observations are conditions that:

- may become a danger to vehicular or pedestrian traffic before the next anticipated inspection date, but poses no danger of structural failure or collapse, or
- require remediation to maintain bridge durability, and
- do not duplicate conditions reported through safety flag PIAs, structural flags, nor any elements’ assessed defects.

Using sound professional engineering judgment the Team Leader shall record in the bridge inspection report, non-structural condition observations identified during field inspections.

Given the importance of the non-structural condition observations on public safety, bridge durability and cost-effectiveness, owners should be made aware of these conditions in a timely fashion. Hence, the Regional Structures Management Engineer shall transmit the inspection report to the owner within 30 days from the day the inspection report is finalized (i.e., passes QA review). Alternatively, if the NYSDOT provided access to these reports through an electronic system, within the same time-frame, the owner shall be informed of the availability of the inspection report.
5.2—Conditions

The nature and location of non-structural condition observations can vary widely. The following items identify typical locations and possible areas of concern that are not identified with an element assessment. Their prevalence will vary depending upon many factors, including the bridge type, age, traffic carried, and maintenance history. These are available in BDIS with an area for comment and photo/sketch attachments.

☐ APPROACH
  ☐ Drainage
  ☐ Embankment
  ☐ Settlement
  ☐ Erosion
  ☐ Railing
  ☐ Curb
  ☐ Sidewalk
  ☐ Vegetation
  ☐ Bridge Related Signs
  ☐ Other

☐ DRAINAGE
  ☐ Scupper issues (clogged, ponding, etc.)
  ☐ Downspouts (clogged, damage, draining on superstructure, etc.)
  ☐ Under Bridge Erosion (due to downspouts, etc.)
  ☐ Troughs (clogged, damaged, etc.)
  ☐ Other

☐ ATTACHMENTS
  ☐ Fascia Mounted Signs
  ☐ Bridge Related Signs
  ☐ Utilities
  ☐ Lighting
  ☐ Other

☐ FENCING
  ☐ Pedestrian
  ☐ Snow
  ☐ Other

☐ CLEANING
  ☐ Bridge Seat
  ☐ Top of Cap Beam
  ☐ Steel Superstructure
  ☐ Other

☐ OTHER—These are conditions which meet the definition of non-structural condition observations and are not listed above.

(The non-structural condition observations listed above may vary from what is available in BDIS based upon NYSDOT needs. See the BDIS “Non-Structural Condition Observations” tab for an up-to-date list.)
5.3—Limits and Documentation

Non-structural condition observations shall be limited to bridge related features located between the far ends of the bridge approach lengths. The bridge approach length is the transitional distance from a typical highway section to a bridge. It is not a fixed distance and each approach may have its own unique length. The inspector should decide the actual appropriate length at the site.

Non-structural condition observations shall, at a minimum, indicate the:

- element or bridge related feature
- location and extent of condition – be specific; vagueness or omission of location is not acceptable
- condition commentary – indicate condition, unique characteristics and other critical information.

Condition photo(s) (see NY Section 2B.4) are required for non-structural condition observations.

Maintenance Observation Examples:

NY Example 5-1
Begin 20 feet of left approach curb is missing and/or displaced. Drainage through the missing and misaligned curb sections is eroding embankment.
NY Example 5-2
End right approach catch basin is 100% clogged.

NY Example 5-3
Soundings indicate the full length of the begin-right approach box beam guide rail is severely corroded. The worst section loss is located adjacent to the splice where holes have formed in the rail.
NY Example 5-4
Begin of span 5 over parking area: One of two connections for the lighting fixture support angle has been cut off between Stringers S1 & S2. The support angle and lighting fixture are sagging down approximately 5 inches and are bouncing up and down due to live load over the bridge.

NY Example 5-5
End right approach: one lane bridge sign and vertical clearance sign are partially illegible due to graffiti.
NY Example 5-6
One utility conduit roller guard on span 2 at bay 5, diaphragm 4 is dislodged. As a result, the utility is no longer supported and the roller guard has the potential to fall. The area below consists of non-navigable water. Note that the adjacent roller guard is gone.

NY Example 5-7
The broken scupper outlet pipe allows water to fall on the primary member.
NY SECTION 6

GENERAL RECOMMENDATION

This rating is the team leader's assessment of the bridge condition overall. Stream channel, approaches and utilities are not considered. Give maximum weight to elements of most importance, such as primary members, abutment stems, piers, scour, etc. Elements of less importance have less influence in determining the General Recommendation.

The General Recommendation must be determined in comparison to the bridge’s original design capacity and to its original functioning; do not determine the General Recommendation in comparison to the present-day standards.

A General Recommendation must be provided for every General bridge inspection (see NY Section 2A.1). Leave the General Recommendation blank for all other inspection types.

Use the following narrative descriptions as a guide for the General Recommendation:

7 - The bridge is in new condition, without deterioration except perhaps minor flaking of the top coat of paint. No work is needed other than routine maintenance.

6 - Only minor deterioration is present. Touch-up painting may be required or other minor repairs to secondary elements. Minor bearing readjustments may be needed. There may be minor cracks or spalls in the substructures.

5 - Primary members and substructures are in good condition and do not need major repairs. Bridge load capacity is not reduced, but other parts of the bridge (such as deck elements) may need extensive repairs. The bridge may require repainting because of corrosion starting on steel members. Scour may have exposed, but not undermined footings.

4 - Moderate deterioration of primaries, secondaries, and substructures has occurred, but bridge load capacity is not substantially reduced. Considerable reconditioning of secondary members, substructures, and other components may be needed. Primary members do not yet need extensive reconditioning. There may be some minor substructure undermining.

3 - Considerable deterioration of some or all bridge components. The bridge may no longer be able to support original design loads. Load posting may be needed. There may be considerable section loss on primary and secondary members. Concrete components are spalled with rebar exposure over a large portion of the areas. Extensive footing undermining may have occurred.
2 - Most bridge components are in poor condition. Primary and secondary members are extensively deteriorated. The bridge can no longer safely carry original design loads. The bridge may still be open to traffic, but at a reduced load posting. Temporary shoring or bracing may be necessary. Substructures may be so badly deteriorated to require immediate repairs. Scour and undermining may be extensive enough to threaten the stability of the bridge.

1 - Deterioration is so extensive that partial or total collapse is imminent. There is little or no live load capacity and the bridge may be closed. For the bridge to remain open to traffic, substantially reduced load posting and temporary shoring are necessary. Substructures may have settled, and be in danger of failing due to extensive undermining.
NY APPENDIX A

UNIFORM CODE OF BRIDGE INSPECTION

PART 165
UNIFORM CODE OF BRIDGE INSPECTION
(Statutory Authority: Highway Law §§230, 231, 233)

Section 165.1 Purpose and Authority

In order to serve, protect and preserve the health, safety and welfare of the public, Chapter 781 of the Laws of 1988 established a program of comprehensive bridge management and inspection within the Department of Transportation to facilitate comprehensive bridge management, inspection, maintenance, improved knowledge of the condition of bridges, structured comparisons of bridge conditions, prioritized and optimized rankings of bridges in need of major maintenance, rehabilitation and replacement, a mechanism for improving historical predictions, the development of a means to assess and project bridge performance and deterioration, development of data to quantify the effectiveness of preventive maintenance, and increased scheduling of bridge maintenance.

Pursuant to Chapter 781 of the Laws of 1988, the Commissioner of Transportation hereby establishes a Uniform Code of Bridge Inspection which prescribes the standards for bridge inspections and evaluations; requirements for the establishment of a rating system; procedures for underwater inspections; requirements for the performance of bridge structural and foundation system evaluations in conjunction with an inspection and criteria for their need and frequency; and the qualifications of bridge design, construction, and inspection experience for licensed professional engineers who may perform or supervise bridge inspections and evaluations in accordance with the provisions of this Part.

165.2 Applicability

The Uniform Code of Bridge Inspection shall apply to all bridges which are publicly-owned, operated or maintained as defined in Section 230 of the Highway Law, which carry public highway traffic and shall not apply to bridges that exclusively carry railroad or subway tracks. This Code shall also apply to bridges which are owned, operated or maintained by railroads and carry public highway traffic over the railroad.
165.3 Definitions
As used in this Part, unless the context otherwise requires, the following words and terms shall have the following meaning:

a) "AASHTO" shall mean the American Association of State Highway and Transportation Officials.

b) "AASHTO Manual" shall mean the current edition of the "Manual for Maintenance Inspection of Bridges", and all interim updates published by the American Association of State Highway and Transportation Officials. *(Note: The current edition of the “Manual for Maintenance Inspection of Bridges” is the “AASHTO Manual for Bridge Evaluation”)*

c) "Bridge" shall mean a structure including supports erected over a depression or an obstruction such as water, highway, or railway, having a track or passageway for carrying public highway traffic and having an opening measured along the center of the roadway of more than twenty feet between under copings of abutments or spring lines or arches, or extreme ends of openings for multiple boxes and may include multiple pipes where the clear distance between openings is less than half of the smaller contiguous opening. The term bridge, as defined in this Part, shall also include the approach spans.

d) "Bridge Inspection Manual" shall mean the Bridge Inspection Manual published by the Department.

e) "Bridge Inventory and Inspection System" shall mean the inventory and inspection system for bridges maintained by the Department.

f) "Code" shall mean the Uniform Code of Bridge Inspection, as set forth in this Part.

g) "Commissioner" shall mean the Commissioner of Transportation of the State of New York.

h) "Department" shall mean the Department of Transportation of the State of New York.

i) "Inspection Flagging Procedure for Bridges" shall mean the engineering instruction of the same name published by the Department.

j) "OSHA" shall mean the Federal Occupational Safety and Health Administration.

k) "Public Entity" shall mean any department, board, bureau, commission or agency of the state or its political subdivisions, public benefit corporation or any public authority, including the Port Authority of New York and New Jersey.

l) "Publicly-Owned, operated or maintained" shall mean a bridge that is owned, operated or maintained by any public entity.

m) "Quality Control Engineer" shall mean the professional engineer responsible for reviewing and signing inspection reports. In signing the inspection reports, the Quality Control Engineer is attesting to the accuracy and correctness of the report in accordance with the established standards. The Quality Control Engineer shall not be the same individual responsible for performing the inspection or initially preparing the report.
n) "Redundancy" refers to the bridge's ability to retain structural capacity, stability and serviceability if one or more primary load carrying components or primary structural members were to structurally fail.

o) "Substantial Structural Alteration" shall mean any work that modifies the live load capacity, load distribution or load paths or structural behavior of the bridge.

165.4 Inspection Type and Frequency.

Bridge inspections shall fall into one or more or the following categories:

- General Inspection
- Diving Inspection
- In Depth Inspection
- Special Inspection

a) General Inspection. A general inspection is the regularly scheduled inspection which each bridge receives throughout its life and which focuses on bridge condition, ability to function, safety and maintenance issues, and produces the basic statistical data necessary to understand, study, monitor and manage all bridges subject to this Code. Where applicable, a general inspection shall be scheduled during periods of low water in order to minimize the need for a diving inspection.

There are two (2) types of general inspections, "biennial inspections" and "interim inspections," as follows:

1) Biennial Inspections. All bridges subject to the provisions of the Code shall receive a biennial inspection which is to be performed at least once every two years. In addition:

   i. All bridges open to highway traffic while undergoing repair, reconstruction or rehabilitation shall continue to receive biennial inspections during such construction when due.

   ii. All new bridges, reconstructed bridges, and rehabilitated bridges shall receive a biennial inspection within 60 days of formal project acceptance or fully opening the bridge to highway traffic, whichever occurs first.

2) Interim Inspections. All bridges subject to the provisions of the Code which meet one or more of the following criteria shall receive an interim inspection:

   i. All bridges which are posted for load capacity below the State unrestricted legal load limit.

   ii. All bridges which received a General Recommendation, as defined by the current Department Bridge Inspection Manual, of three (3) or less during their most recent general inspection;

   iii. All bridges which carry an active structural flag, as defined by the Department's
Engineering Instruction entitled "Inspection Flagging Procedure for Bridges".

iv. All bridges which received a condition rating, that is computed by the Department's Bridge Inventory and Inspection system, of three (3.00) or less from their most recent General inspection.

v. All bridges for which the entity with inspection responsibility determines that it is appropriate.

Interim inspections shall be performed at or near one year after each biennial inspection. Bridges open to highway traffic while undergoing repair, reconstruction or rehabilitation shall receive an interim inspection when due.

For very large or unusual structures, a program of scheduled special inspections may be substituted for interim inspections. In such cases, the inspection scope, schedule and findings must be documented and clearly demonstrate that the basis that is the cause for an interim inspection is being addressed. In no case shall such special inspections occur at an interval exceeding that required by an interim inspection.

b) **Diving Inspection.** A bridge subject to the provisions of the Code shall be designated as a bridge requiring diving inspection if it meets one or more of the following diving criteria:

1) A bridge with any portion of a substructure exposed to water deeper than six (6.0) feet, during periods of normal low water, shall be designated for diving inspection.

2) A bridge with any portion of a substructure exposed to water deeper than three (3.0) feet, but no deeper than six (6.0) feet, during periods of normal low water, may or may not be designated as a bridge requiring inspection by divers depending on the judgment of the responsible professional engineer in charge of diving inspection activity. In making this determination, the responsible professional engineer shall take into consideration, among other factors, structure type, materials of construction, foundation type, footing location relative to channel bottom, known or suspected problems, waterway characteristics, superstructure and substructure redundancy, etc. In making this evaluation and resulting determination, existing bridge records, including existing inspection information shall be reviewed.

3) A bridge with no portion of any substructure unit exposed to three (3.0) feet or more of water, during periods of normal low water, will normally not be designated for diving inspection.

Diving inspections may be performed as part of a general inspection, in-depth inspection, special inspection or as an independent inspection effort. When making determinations on the need for diving inspection, it must be recognized that bridges are constructed of differing structural configurations and situated in widely varying environments. This results in varying degrees of inspection difficulty, complexity, structural redundancy and structural sensitivity. Portions of the diving inspection criteria intentionally leave discretion to provide for proper bridge-by-bridge evaluation of the above and other factors in determining the need for a diving inspection.
Diving inspections shall be performed at maximum inspection intervals of sixty (60) months. However, it shall be determined, on a bridge-by-bridge basis, if a "complete" or "partial" diving inspection is needed on a more frequent basis. If it is determined that more frequent diving inspections are needed, they shall be scheduled.

c) **In-Depth Inspection.** An in-depth inspection is a comprehensive detailed inspection of an entire bridge which frequently incorporates destructive, as well as, non-destructive inspection techniques. It is more complete and more intensive than a general inspection and the results of such an inspection can be used to satisfy the Code requirements for a general inspection. In-depth inspections are performed on an "as needed" basis to assist in making bridge rehabilitation versus replacement decisions, and to assist in the development of bridge rehabilitation designs.

d) **Special Inspection.** A special inspection is a unique inspection effort targeted at special situations or conditions and may be performed to study a unique or unusual bridge feature in greater detail than would have normally occurred during a general inspection. A special inspection may also be performed to monitor the condition of a specific bridge detail or situation on a repetitive basis and shall be performed whenever the structural integrity of a bridge is or has been threatened by a storm, flood, natural phenomenon, accident or man made occurrence.

Due to the wide variability of situations and conditions requiring a special inspection, there can be no predetermined schedule or frequency interval for the performance of special inspections. Frequency intervals are determined based on the particular parameters of the different situations and conditions under consideration.

165.5 **Qualifications and Responsibilities of Bridge Inspectors.**

a) **Field Personnel:**

1) General and In-depth Inspection. All field work shall be performed by an inspection team consisting of at least a team leader and an assistant team leader.

The team leader shall be present at the bridge inspection site throughout the bridge inspection, shall personally inspect the bridge, supervise other inspection team member(s) to ensure that each bridge is properly inspected and shall ensure that the inspection results are properly documented. The team leader shall ensure that additional team members are appropriately qualified and trained for their required duties, such as, traffic control, debris removal, measurement or the preparation of sketches.

A Team Leader must meet both of the following minimum qualifications:

i. Be currently registered with the New York State Education Department as a Professional Engineer (P.E.). An out-of-state P.E. registration may be substituted for a New York State P.E. provided that the individual received the P.E. based upon satisfactory completion of a 16 hour written examination, has applied for P.E. registration in New York State, and the New York State Education
Department has acknowledged receipt of the individual’s intent to practice in New York under subsection (b) of Section 7208 of the Education Law, and

ii. Have at least three (3) years of bridge experience in design, construction, inspection or other bridge engineering related work.

Civil Engineering experience on Department projects or programs may be substituted for all or a portion of the experience requirement in Subsection (ii) herein, if the Department determines, on the basis of the Department work, that the engineer possesses the necessary experience and skill.

An Assistant Team Leader must:

i. Possess a Bachelor of Science Degree in Civil Engineering from an Accreditation Board for Engineering and Technology (ABET) accredited program or an equivalent degree acceptable to the Department, or

ii. Possess an Associate Degree in Civil Engineering Technology or an equivalent Associate Degree determined to be acceptable by the Department, and 1½ years of bridge experience in design, construction, inspection or other bridge related work, or

iii. Have at least three (3) years of bridge experience in design, construction, inspection, or other bridge related work.

Civil Engineering experience on Department programs or projects may be substituted for all or a portion of the experience requirements in subsections (ii) and (iii) herein if the Department determines, on the basis of the Department work, that the person possesses the necessary experience and skill.

2) Diving Inspection. All field diving inspection work shall be performed by an inspection team. The size and the makeup of diving inspection teams will vary depending on field conditions and project methodology. However, a diving inspection team shall always include a team leader meeting the qualifications of a general inspection team leader, a diver, a dive tender, if necessary, and additional personnel that are necessary to complete the inspection effort in accordance with OSHA and other regulatory requirements. The team leader and the diver may be the same person, provided that person meets the qualifications of both positions.

Divers shall have at least three (3) years experience in construction diving and/or inspection diving activities in performing the same type of diving to be used for the inspection, either "scuba" or "surface supplied air".

A dive tender shall meet all current applicable medical and OSHA requirements. In addition, a dive tender shall have at least two (2) years responsible experience in construction diving and/or inspection diving activities.

3) Special Inspection. Field work for a special inspection shall be performed by an
individual or an inspection team as the situation dictates. Minimum personnel qualifications cannot be standardized because of the widely varying situations requiring special inspections. The professional engineer in charge of such an inspection shall insure that individuals assigned to a special inspection effort are appropriately qualified and trained. This determination shall consider such factors as inspection difficulty and inspection criticality.

b) Office Personnel:

1) **Quality Control Engineer.** The Quality Control Engineer shall review and sign as "Reviewed By" all field inspection reports and shall meet the same qualifications specified for a general inspection team leader. An individual cannot function as a Quality Control Engineer over work for which the individual was, or is, responsible.

2) **Load Rating Engineer.** The Load Rating Engineer directs, supervises and signs all structural capacity load rating calculations. The Load Rating Engineer shall meet the same qualifications specified for a general inspection team leader.

3) **Load Posting Engineer.** The Load Posting Engineer shall make and sign all load posting determinations and shall meet the same qualifications specified for a general inspection team leader.

4) **Structural Integrity Evaluation Engineer.** The Structural Integrity Evaluation Engineer shall supervise the preparation of and signs all structural integrity evaluation reports and shall meet the same qualifications specified for a general inspection team leader.

165.6 Scope and Documentation of Inspections.

All general, in-depth and diving bridge inspections shall include a review of the most recent inspection report, the most recent structural integrity evaluation, and, to the extent available and reasonably retrievable and consistent with engineering practice and public safety to understand the structural performance and work history of the bridge, an examination of the design, as built plans, contract documents, history of construction including any history of structural alterations, repairs, rehabilitation or maintenance.

a) General Inspection.

1) Biennial Inspection. A biennial bridge inspection shall be performed and documented in accordance with Department's "Bridge Inspection Manual" including current updates, revisions and technical advisories and the AASHTO Manual.

2) Interim Inspection. An interim bridge inspection shall be performed and documented in accordance with the Department's "Bridge Inspection Manual" including current updates, revisions and technical advisories and the AASHTO Manual, subject to the following exceptions:

   i. Conditions that have not substantially changed since the previous biennial inspection do not have to be fully documented with sketches, notes and photographs. When changes have not occurred, notes indicating that no
changes have occurred since the previous biennial inspection will satisfy sketch, note and photographic documentation requirements.

ii. Conditions that have substantially changed since the previous biennial inspection either by increased deterioration, or by repair or improvement, shall be documented with sketches, notes and photographs as required for a biennial inspection.

b) **Diving Inspection.** A diving inspection shall be performed and documented in accordance with the requirements of the Department's "Bridge Diving Inspection Specifications" and "Bridge Diving Inspection Rating Criteria" including current updates, revisions and technical advisories and the AASHTO Manual.

c) **In-depth Inspection.** An in-depth inspection shall be done in accordance with the requirements of the Department's "Specification for In-depth Bridge Inspection" including current updates, revisions and technical advisories and the AASHTO Manual. However, applicability of this specification to a specific bridge or project shall be reviewed by the professional engineer responsible for the project to determine if modifications to the standard Specification are necessary. When appropriate, this professional engineer shall develop any necessary modifications in the form of an addendum to the standard Specification or shall develop a substitute specification, which shall be used for the in-depth inspection.

d) **Special Inspections.** The inspection scope and documentation required to satisfactorily inspect and document the situation under consideration shall be determined by the individual in charge of such inspection activities.

This flexibility is necessary due to the unique and variable situations being addressed by special inspections.

### 165.7 Filing Requirements for Bridge Inspection Reports.

Two copies of all bridge inspection reports shall be filed with the Department's Regional Director located in the Department's Regional Office in which the bridge is located. Reports shall be filed within the time allowed in the following table. All General and Diving inspections scheduled for a calendar year inspection cycle shall be filed no later than January 15th of the year following the inspection calendar year.

<table>
<thead>
<tr>
<th>Inspection Type</th>
<th>Number of Days after Completion of Field Work</th>
<th>Number of Days after Completion of Quality Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Inspection</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Diving Inspection</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Special Inspection</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>In-Depth Inspection</td>
<td>120</td>
<td>30</td>
</tr>
</tbody>
</table>

All reports filed shall be neat, easy to read, include original photographs or good quality photographic reproductions, and shall be signed and dated by the individual responsible for the field inspection as well as by a Quality Control Engineer.
165.8 Load Capacity Evaluation.
Each bridge which is subject to the inspection provisions of this Code, shall be rated for safe load carrying capacity. Load ratings shall be determined in accordance with the provisions of the AASHTO Manual. If it is determined by this load rating process that the maximum legal total load under State law exceeds the load equivalent to the Operating Rating Capacity Level as defined by the AASHTO Manual, the bridge must be load posted subject to Sections 233 and 234 of the Highway Law, and Sections 1621, 1640, 1650 and 1660 of the Vehicle and Traffic Law.

a) Level 1 and Level 2 Load Ratings. Level 1 and Level 2 load ratings are defined to differentiate between rating analyses of differing degree of sophistication and/or comprehensiveness, and to differentiate whether or not the rating is certified by a Licensed Professional Engineer.

1) Level 1 Load Rating: A level 1 rating refers to any fully documented analysis or capacity evaluation that is signed and certified by a Licensed Professional Engineer as being complete and correct in its computation of bridge load capacity. Generally, a Level 1 analysis shall be in conformance with the analysis assumptions and provisions of the AASHTO Manual. However, evaluation methods and/or analysis assumptions that differ from the AASHTO provisions are permitted provided that they conform to accepted structural engineering practice, and they are fully documented and certified as being correct and appropriate by the certifying Licensed Professional Engineer.

2) Level 2 Load Rating: A Level 2 load rating refers to a specific type of computerized load rating analysis produced by the Department as part of its general bridge inspection program. However, any uncertified rating analysis that substantially conforms to the provisions and assumptions of the AASHTO Manual may be referred to as a Level 2 load rating. Level 2 load ratings may be used to identify bridges that are likely to be load capacity deficient and must receive further evaluation. Level 2 ratings may be used to assign interim load restrictions to a deficient bridge until a Level I load rating can be undertaken.

The Department's Level 2 load ratings are computed using a Department owned and maintained system of computer programs whose logic substantially conforms to analysis methods and assumptions contained in the AASHTO Manual. For each type of bridge capable of being analyzed, the Level 2 programs contain some general assumptions relating to the location of critical components or cross sections to be analyzed. Although they normally appropriate and generally accurate for typical situations they may not be correct in every case. Although quality control reviews are made, the Department does not certify its level 2 ratings as being complete and fully correct in its computation of load capacity. The Department maintains computer records of its Level 2 data and analysis results, and updates this information on a periodic basis as part of its general inspection process.

b) Criteria for performing Level I Load Rating.

1) A Level 1 load rating shall be performed as part of the structural design process for all new and replacement bridges and for all rehabilitation and repair designs involving a
substantial structural alteration to the bridge. The Level 1 load rating results for the new or reconstructed structure shall be summarized in a table placed on the contract drawings which are prepared for the project.

2) A Level I load rating shall be included as part of all Structural Integrity Evaluations as defined and required by Section 165.11 of this Code.

3) A Level 1 load rating shall be performed whenever the posted load on a bridge, or full legal load if the bridge is not posted, exceeds the operating rating capacity determined by a Level 2 load rating.

c) Documentation of Level 1 Load Ratings:

1) Load Rating Vehicles: All Level 1 load ratings shall be based on both the AASHTO "HS" and "H" analysis vehicle configurations. Both the AASHTO "HS" and "H" truck loads and equivalent lane loads shall be used to determine the rating values. If the inventory rating as defined by the AASHTO manual based on the "HS" vehicle loading equals or exceeds HS-20 (36 tons), it is not necessary to compute ratings based on the "H" loading. Load ratings based on the AASHTO "Typical Legal Load Types" (Type 3, Type 3S2, Type 3-3) or any other rating vehicle configuration are not required by this Code, but may be desirable to use for individual posting evaluations.

2) Rating Summary Sheet: All Level 1 rating documentation shall contain a Rating Summary Sheet, which provides the inventory and operating ratings, as such terms are defined in the AASHTO manual, for the bridge. The rating summary sheet shall also tabulate the ratings for each individual span or continuous span structural unit. For bridges which have structural floor systems, the ratings of the controlling floor system components as well as the main members shall be tabulated. Individual load rating values shall be expressed in terms of the equivalent rating vehicle and tonnage as shown:

Examples:  HS-22 (39.6 tons)
        H-24 (24 tons)

The level 1 rating summary sheet shall be signed by the load rating engineer.

d) Filing Requirements for Level I Load Ratings. All Level 1 load ratings shall be filed with the Department. The Level 1 load ratings shall be filed by submitting two signed copies of the rating calculations and summary sheets to the Department's Region Office in which the rated bridge is located.

165.9 Load Posting.
A bridge must be posted for a restricted load limit when a load rating analysis and/or posting evaluation, as required by the AASHIO Manual and this Code, indicates that a bridge does not have sufficient live load capacity to safely carry full legal traffic loads.

A safe load level for a bridge is calculated by ascertaining the limits defined by the Inventory and Operating load rating levels and using the Operating load rating as the upper limit. However, in no case shall loads be allowed on a bridge which exceeds the bridge's operating rating capacity.
a) **Load Posting Requirements.** No bridge shall be posted for a load less than three (3) tons. In the event that a bridge's operating rating is less than three (3) tons, the bridge must be closed to all vehicular traffic.

b) **Load Posting Signing Requirements.** Load posting signing shall be in conformance with the New York State Manual for Uniform Traffic Control Devices.

### 165.10 Structural Integrity and Safety Rating System.

Structural Integrity and Safety Rating refers to a systematic method for evaluating and ranking the relative structural integrity and safety of a bridge or group of bridges against structural failure and/or collapse.

A Structural Integrity and Safety Rating system shall, at a minimum, consider the following fundamental bridge vulnerability factors, where applicable:

1. **Condition:** Refers to the extent of deterioration and/or loss of ability to structurally function as was intended by its original or rehabilitated design or loss of structural safety.
2. **Load Capacity:** Refers to the ability to safely carry live loads that may be imposed upon the bridge.
3. **Redundancy:** Refers to the bridge's ability to retain structural capacity, stability and serviceability if one or more primary load carrying components or primary structural members were to structurally fail.
4. **Fracture Susceptibility:** A measure of the presence of details and/or behavioral characteristics that are prone to fracture.
5. **Hydraulic vulnerability:** Refers to the bridge's potential for failure due to its exposure to hydraulic forces, or due to erosion or scour of the foundation material.

The rating system has the capability to rank the relative structural integrity of bridges, as well as identify bridges that have any significant vulnerability with regard to any one or a number of the above-noted vulnerability factors.

Structural integrity and safety ratings shall be made for all bridges. The rating system to be used shall be either the system developed by the New York State Department of Transportation for use on its bridges or the public entity may develop a rating system unique for bridges under its jurisdiction. Any public entity that establishes a rating system for use in complying with this Code shall file with the New York State Department of Transportation a description of the rationale and/or logic of the rating method, as well as a list of integrity ratings for all bridges under their jurisdiction. Filing of rating systems and bridge structural integrity and safety ratings shall be with the New York State Department of Transportation Main Office Structures Division. Structural integrity and safety ratings shall be updated on a biennial basis to reflect any changes recorded by general inspections.

The New York State Department of Transportation shall maintain a structural integrity and safety rating...
system which it will apply to all bridges which it inspects. This system is to be made available to all public entities for their own use. The description and criteria of the New York State Department of Transportation structural integrity and safety ratings are issued as a reference document to this Code, and is titled "New York State Department of Transportation Structural Integrity and Safety Rating Guide." This document also contains criteria, based on a structural integrity and safety rating system, for requiring a Structural Integrity Evaluation as described in Section 165.11 of this Code.

165.11  Structural Integrity Evaluation.

A Structural Integrity Evaluation is a detailed structural and foundation evaluation and analysis. Used in conjunction with an inspection, it details a bridge's structural condition and integrity as well as present and future needs to preserve or upgrade the safety and serviceability of the bridge.

The scope of a Structural Integrity Evaluation shall include, where applicable to the determination of integrity and safety, the following:

a) A review, where available and reasonably retrievable and consistent with engineering practice to perform such an evaluation, of the design, design as-built plans, contract documents, and history of construction, structural alterations, rehabilitation, and maintenance repairs.

b) A review of design Code changes since the time of original design with emphasis on the impact the original design assumptions have on the bridge's structural integrity and safety in comparison with current standards and practices.

c) A Level 1 Load Rating as defined by Section 165.8 of this Code.

d) For bridges over water, an evaluation of the effect of relevant or anticipated stream changes, as well as an evaluation of the effects of hydraulic flows, including design flood conditions. The Federal Technical Advisory (Code T 5140.20) titled "Scour at Bridges" published by the Federal Highway Administration may serve as a guide for evaluating bridges for scour vulnerability.

e) An evaluation of the effects of deterioration and modification to the original structure on structural integrity, in conjunction with a general inspection conforming to the requirements of this Code.

f) A life cycle projection of the scope and estimated cost of maintenance, repair, and/or rehabilitation needed to preserve or upgrade the structural integrity and safety of the bridge, in order to provide criteria for comprehensive bridge management and safety.

Structural Integrity Evaluations shall be documented in a detailed report format and shall be signed by a qualified Structural Integrity Evaluation Engineer as defined by Section 165.5 (b)(4) of this Code. Two copies of the Structural Integrity Evaluation report shall be filed with the New York State Department of Transportation Regional office in which the bridge is located. One copy of the report shall be made available to the bridge inspector as a reference for all subsequent general bridge inspections.

Whenever a Structural Integrity and Safety Rating indicates a high vulnerability to structural failure a structural integrity evaluation shall be performed. Specific criteria for requiring a Structural Integrity Evaluation to be performed based on the New York State Department of Transportation structural integrity and safety rating system are described in the New York State Department of Transportation Uniform Code of Bridge Inspection.
"Structural Integrity and Safety Rating Guide."

In cases where a bridge meets the criteria for requiring a Structural Integrity Evaluation, but already has such an evaluation on file, a repeat evaluation is not required unless it is determined that the evaluation on file is no longer appropriate for the bridge in question. A recommendation of appropriateness shall be made and documented by the Bridge Inspection Team Leader based on a review of the report as part of performing a general bridge inspection. In cases where only portions of the report are no longer appropriate, amendments to the original Structural Integrity Evaluation report may be produced.

165.12  Department Authorization to Close Bridge.
Each Department Regional Director is authorized to close any bridge subject to this Code which, if in his opinion, based upon inspection or otherwise, if not closed, may constitute a threat to the public health, safety or welfare.

When such a closure is required, the Regional Director shall document the reasons for the closure and transmit such documentation to the bridge owner. The bridge cannot be reopened to traffic without a certification of a professional engineer licensed in New York, that the bridge is safe for public use and travel with legal weights, or if posted, with such posted weights. The party having jurisdiction over the bridge is responsible for providing this certification to the Department.

165.13  Filing of Bridge Designs, and Maintenance Guidelines.

a) Every owner of a publicly owned, operated or maintained bridge, as defined in Section 165.2 of this Title, shall submit to the New York State Department of Transportation certified designs and "as built" plans for all bridges constructed or on which substantial structural alterations are made on or after June 1, 1989.

b) All designs and plans shall be certified by a licensed Professional Engineer and must bear the signature and seal or stamp of such Engineer.

c) All designs and plans shall be submitted to the Department of Transportation Regional Director within whose region such bridge is located.

d) Maintenance Guidelines. All certified designs and plans subject to this section shall contain desirable maintenance guidelines applicable to the bridge. Such guidelines shall be consistent with standards established by AASETO, and this requirement may be satisfied by the designer by reference to these standards. Designs and plans for very large or unique bridges and moveable bridges shall include special maintenance guidelines as is appropriate.
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I. INTRODUCTION

This procedure sets forth a uniform method of timely notification to Responsible Parties of bridge deficiencies that require timely attention. It also establishes requirements for certifying that proper responses are undertaken and completed within a specified time frame by a professional engineer licensed to practice in New York State.

The procedure shall only be used to report conditions posing a clear and present danger or conditions that, if left unattended, would likely become a clear and present danger within two years from the current inspection. A Flag is not used to report a structural condition of a component whose service life clearly extends well beyond that defined by scheduled inspection intervals nor used to draw attention to any maintenance or routine repair needs where no immediate or potential danger exists.

The Regional Director shall close any bridge that is determined to be unsafe, at any time, regardless of the steps being followed in this procedure.

II. DEFINITIONS

FLAG TYPES:

Red Flag - A structural flag that is used to report the failure or potential failure of a primary structural component that is likely to occur within two years from the current inspection.

Yellow Flag - A structural flag that is used to report a potentially hazardous structural condition which, if left unattended could become a clear and present danger within two years from the current inspection. This flag would also be used to report the actual or imminent failure of a non-critical structural component, where such failure may reduce the reserve capacity or redundancy of the bridge, but would not result in a structural collapse.

Safety Flag PIA - A flag that is used to report a condition presenting a clear and present danger to vehicular or pedestrian traffic, but poses no danger of structural failure or collapse. Safety Flag PIAs can be issued on closed bridges whose condition presents a threat to vehicular or pedestrian traffic underneath the structure or in its immediate vicinity.

Flagged - General term applied to a bridge which has received a flag or to the specific condition for which a flag is issued.

Flag Documentation - This consists of the "Flagged Bridge Report"(FBR), any additional notes or sketches, photos, scour documentation (if applicable), and any other items needed to document the flagged condition.
Prompt Interim Action (PIA) - A designation that is made by the inspection Team Leader or an engineer when a Red Flag condition is considered extremely serious and in need of immediate attention. This designation requires a prompt (within 24 hours) action or decision on whether to close or restrict loads on the bridge, make immediate repairs, or to determine that the condition is safe until repairs can be made. The PIA designation is applicable to all Safety Flags.

Regional Bridge Engineer (RBE) - A Professional Engineer licensed to practice in New York State (NYSPE), who is responsible for ensuring that the flagging procedure is followed and monitor the status of the flags. Generally, these are the responsibilities of a Regional Structures Management Engineer. The Regional Director is responsible for designating the RBE for his/her Region. The RBE shall not be the same person designated as the Responsible Party. References to the RBE shall also include the RBE's designee.

Responsible Party - The party (or parties) that have maintenance responsibility for the flagged portion of the bridge. The Regional Bridge Maintenance Engineer (RBME) is considered the Responsible Party for the State bridges in their respective Region. Occasionally, a condition that causes a flag occurs in a portion of a bridge that is the maintenance responsibility of one party, but protective actions must be taken by a second party. In such cases, the RBE shall identify such situations and notify all responsible parties.

State Bridge - Any bridge either partially or wholly owned or maintained by the New York State Department of Transportation (NYSDOT).

Non-State Bridge - Any bridge that cannot be defined as a State Bridge.

FLAG STATUS:

Red Flags are categorized as follows:

Active Flag - A Red Flag for which a "Flag Removal/Inactivation Report" has not been filed. Active Red Flags shall be categorized as:

A) Response pending: Status used from flag issuance to until six weeks from the written notification to responsible party unless categorized C thru J noted below.

B) Response overdue: Status used beyond six weeks from written notification to responsible party unless categorized C thru J noted below.

Inactive Flag - A Red Flagged condition for which a "Flag Removal/Inactivation Report" has been filed indicating "Flag Inactivation." Inactive Flag categories are as follows:

C) Bridge temporarily closed or partially closed (e.g., individual lane or shoulder closure).

D) Bridge temporarily posted or down posted for reduced load, based on certification by a NYSPE.
E) Certified safe by a NYSPE in its current condition for an interim period while subject to pending/scheduled repairs; or certified safe by a NYSPE subject to a defined condition monitoring program being implemented; or temporary repairs made and certified as safe by a NYSPE.

Removed Flag - A Red Flagged condition for which a "Flag Removal/Inactivation Report" has been filed indicating "Flag Removal." Flag Removals are categorized as follows:

F) Bridge is permanently closed.
G) Bridge is certified by a NYSPE as "safe," for legal load or the currently posted load.
H) Permanent repairs have been made and certified by a NYSPE.
I) Bridge is permanently posted for load on the basis of Load Rating calculations by a NYSPE.
J) Flag has been superseded or reclassified.

Safety Flag PIAs and Yellow Flags are categorized as follows:

Active Flag - A Safety PIA or Yellow Flag for which a "Flag Removal/Inactivation Report" has not been filed. Active Safety PIA and Yellow Flags shall be categorized as:

A) Active

Inactive Flag – Yellow Flags are not categorized as inactive. A Safety Flag PIA condition for which a "Flag Removal/Inactivation Report" has been filed indicating "Flag Inactivation." Inactive Flag categories are as follows:

B) Bridge temporarily closed or partially closed (e.g., individual lane or shoulder closure).
C) Certified safe in its current condition for an interim period while subject to pending/scheduled repairs; or certified safe subject to a defined condition monitoring program being implemented; or temporary repairs made and certified as safe.

Removed Flag - A Safety PIA or Yellow Flagged condition for which a "Flag Removal/Inactivation Report" has been filed indicating "Flag Removal". Flag Removals are categorized as:

D) Flag has been superseded or reclassified.
E) Removed

III. FLAGGING PROCEDURE

The following steps shall be taken to issue Red Flags, Yellow Flags, and Safety PIA Flags. These steps apply to both State and non-State bridges. A copy of the Flag Documentation and all related and subsequent correspondence shall be placed in a flag subfolder within the BIN folder. This procedure is written for an Inspection Team leader to use during a bridge inspection; however, other professional engineers may issue a flag as needed by following the appropriate steps.
Whenever the Region issues or receives flag info that leads to serious consideration of travel lane or complete closure, the RBE shall immediately forward info the following personnel:

- Regional Director
- Deputy Chief Engineer Structures (DCES)
- Technical Assistant to DCES
- Structures Evaluation Services Bureau Director
- Main Office Bridge Inspection Unit Head

In addition, the RBE should follow up with a phone call to the DCES to discuss specific details of the potential closure. This can be accomplished by calling direct during business hours or, through the Statewide Transportation Information Coordination Center (STICC) during non-business hours.

If a bridge needs immediate lane or complete closure to assure public safety, that shall take precedence prior to initiating contact as outlined above.

A. Red Flag

1. **Observation** - Immediately after the Flag condition is observed, the inspection Team Leader shall complete Steps 2, 3, and 4.

2. **Prompt Interim Action** - The inspection Team Leader shall determine if the problem warrants a designation of "Prompt Interim Action." If this designation is made, it shall be included in the verbal notification to the RBE (see Step 4 below). In an extreme case, where an actual failure or clearly perilous condition exists, the Team Leader shall take immediate measures to close the bridge and, where necessary, close the feature under the bridge prior to notifying the RBE.

3. **Prepare Flagged Bridge Report (FBR)** - The inspection Team Leader shall complete and review the FBR (see attached SAMPLE FBR) and shall attach photographs and other documentation as needed to adequately document the condition. The team leader shall consult with the Quality Control Engineer as needed to discuss the flag condition. If in the Team Leader's judgment, expediency is required, verbal notification (see Step 4) to the RBE may be made before completing the FBR.

4. **Verbal Notification of RBE** - The Team Leader shall immediately, upon completing the FBR, telephone the RBE describing the physical condition. The Team Leader shall record the name of the person notified and the date/time of notification on the FBR. The RBE shall determine who is the Responsible Party for the flagged portion of the bridge.
5. **Verbal Notification of Responsible Party** - The RBE shall immediately notify the Responsible Party. The RBE shall make the inspection team and necessary access equipment available at the bridge site to explain the flagged condition, if so requested by the Responsible Party.

6. **Decision on Prompt Interim Action Flags** - In case of a "Prompt Interim Action" designation, appropriate action by the Responsible Party is required to address the observed condition within 24 hours. Possible actions include:
   - Fully or partially closing the bridge.
   - Post for reduced load reflecting the current bridge condition.
   - Determine that the condition doesn't require Prompt Interim Action Designation and follow normal Red Flag procedure.
   - Specify when and what actions are needed, if less than 6 weeks.

Any action by the Responsible Party, except fully closing a bridge or replacing a posting sign, must be certified by a NYSPE in writing to the RBE within 24 hours. Any action that is deferred beyond the 24 hours shall also be certified by a NYSPE that the bridge is safe until appropriate action can be taken. The RBE shall document the decision made on any Prompt Interim Action designation in the written confirmation to the Responsible Party.

At the same time, for all flags, bridge closures, postings, changes in posting information, or temporary closures should be updated in the databases and necessary personnel informed (including the Main office Bridge Data Systems Unit within three days) following the established departmental procedures. The RBE is responsible for initiating the appropriate steps to accomplish this.

7. **Flag Documentation** - The flag documentation shall be completed and reviewed by the Team Leader, shall then receive a Quality Control Review and lastly be forwarded to the RBE within three working days from the date the flagged condition was observed.

8. **Written Notification (Flag Letter) to Responsible Party** - The RBE shall transmit a copy of the Flag Documentation by letter or memo to the Responsible Party (see attached Sample #1.) The flag transmittal must accurately state the facts and clearly emphasize the degree of urgency involved. It shall also clearly state that the Responsible Party is solely responsible for addressing the flag condition. As an alternate to restating all the particulars of the flag condition, the transmittal memo may refer to information contained in the Flag Documentation. This written notification shall be sent within a week from the date the flagged condition was observed. The letter shall also request written acknowledgment of receipt of the flagging letter. A signed certified mail delivery receipt can be substituted for the acknowledgment.

9. **Response from Responsible Party to Written Notification** - The response shall be signed by a NYSPE, explaining what action is or will be taken and when it will be taken. If no action is being taken, the response will explain the reasons for this decision. All actions proposed or taken, except for bridge closure, must be certified by a NYSPE. Generally, all actions taken shall be completed within six
weeks from the date of Written Notification to the Responsible Party, but if action is deferred, a NYSPE shall certify that the bridge is safe and the flagged condition is not a danger to the traveling public until appropriate action can be taken at a specified date. A response that the bridge has been closed or a posting sign replaced does not require a NYSPE certification.

This response is required within six weeks of the date of Written Notification to the Responsible Party. If the Responsible Party has not replied within four weeks, the RBE will verbally inform the Responsible Party of the impending deadline. A record of this verbal notification should be kept in the BIN folder. The RBE will monitor action taken on Red Flags. If no reply is received within five weeks of written notification of a flag, the RBE shall send a follow-up letter to the Responsible Party, with copies to the Regional Director and, for non-state bridges, to the Chief Executive Officer or Agency Head/Commissioner of the corporation or political jurisdiction which owns the bridge. This letter shall require that the responsible party take action to remove/inactivate the flag within the six week time limit from original notification. The letter shall be followed up with a phone call from the RBE to the responsible party. If the bridge owner does not take action within six weeks of original notification, in order to ensure the safety of the travelling public, the Regional Director may exercise their authority to close the bridge.

10. **Flag Removal/ Inactivation** - When certified corrective or protective actions are reported by the Responsible Party as completed for all deficiencies causing the Red Flag, or the bridge condition is certified as safe, the RBE shall remove or inactivate the flag. A flag is removed when the bridge is permanently closed, abandoned or removed, when the bridge is certified "safe" for legal load, when it is permanently posted for load on the basis of certified load rating, or when permanent repairs have been certified by a NYSPE. A flag is made inactive when the bridge is temporarily closed or partially closed, when it is temporarily posted for a reduced load, or when temporary repairs are made and certified as safe by a NYSPE, or certified safe by a NYSPE in its current condition for an interim period while subject to pending/scheduled repairs, or certified safe by a NYSPE subject to a defined condition monitoring program being implemented. The RBE shall complete a Flag Removal/Inactivation Report to remove the flag from the list of active Red Flags. A copy of the report shall be sent to the Responsible Party and a copy placed in the flag subfolder within the BIN folder. If the inactivation is valid only for a limited time, responsible party shall take appropriate actions thereafter.

**Note:** Removal/Inactivation requests shall be accompanied by photo documentation of a repair/posting where such action has taken place.

**Note on removal date:**  Removal date shall be the date of action of responsible party (examples include: date of certification memo, date of calculation, date
construction completed/certified, date structure or lane closed, etc...). It is not the date of Flag Removal/Inactivation report.

11. **Overdue Flag Response** - The RBE shall monitor the lists of bridges with active Red Flags for receipt of written replies from the Responsible Party. If the five week written/verbal notification does not produce a satisfactory response within the six week time limit and if the bridge is determined to be unsafe by RBE, the Regional Director shall close the bridge. The Responsible Party shall be made aware of this policy and its implications, especially for traffic and emergency vehicles.

B. **Yellow Flag**

1. **Observation** - Immediately after the problem is observed, the inspection Team Leader shall complete the "Flagged Bridge Report" FBR (see attached SAMPLE FBR). If part of Regional protocol, the inspector shall verbally notify the Region of the Yellow Flag while Work Zone Traffic Control is still in place.

2. **Flag Documentation** - The flag documentation shall be completed and reviewed by the Team Leader, shall then receive a Quality Control Review and lastly be forwarded to the RBE within five working days from the date the flagged condition was observed.

3. **Notification to Responsible Party** - All bridge owners will be given access to bridge information that is maintained in the NYSDOT inspection/inventory software. It is the RBEs responsibility to notify bridge owners of bridges that have had yellow flags issued. These notifications shall occur within 30 days of flag issuance and shall be accompanied by the yellow flag transmittal memo.

4. **Acknowledgment to Written Notification** - The Responsible Party shall acknowledge receipt of the Flag Documentation in writing within six weeks of the written transmittal. A signed certified mail delivery receipt will also be accepted as acknowledgment if hard copies of flags are sent with the notification.

5. **Flag Removal** - When corrective or protective actions are reported by the Responsible Party as complete for all deficiencies causing the Yellow Flag, the RBE shall remove the flag. The work must be certified by a NYSPE. If temporary measures are taken, the flag can be removed as long as the NYSPE certifies that the temporary measure is adequate at least until the next general inspection is scheduled. The RBE shall complete a Flag Removal Report to remove the flag from the list of active Yellow Flags. A copy of the report shall be sent to the Responsible Party and a copy placed in the flag subfolder within the BIN folder.

NOTE: Removal requests shall be accompanied by photo documentation of a repair/posting where such action has taken place.
Note on removal date: Removal date shall be the date of action of responsible party (examples include: date of certification memo, date of calculation, date construction completed/certified, date structure or lane closed, etc)... It is not the date of Flag Removal/Inactivation report.

C. Safety Flag PIA.

1. The notification procedures for Prompt Interim Action designation for "Red Flags" shall be followed.

2. Verbal notification of Safety Flag PIAs shall be made by the Team Leader to the RBE and by the RBE to the Responsible Party.

3. Flag Removal/Inactivation - Corrective action to remove a Safety Flag PIA does not have to be certified by a NYSPE. When corrective or protective actions are reported by the Responsible Party as complete for all deficiencies causing the Safety Flag PIA, the RBE shall remove the flag. The RBE shall complete a Flag Removal Report to remove the flag from the list of active Safety Flag PIAs. A copy of the report shall be sent to the Responsible Party and a copy placed in the flag subfolder within the BIN folder. If temporary measures are taken to address the Safety Flag PIA condition, the flag can be inactivated with the following stipulations:
   
   A. If it is determined that the temporary measure will be adequate at least for a minimum of two years, the Safety Flag PIA may be inactivated without restriction.
   
   B. If it is determined that the temporary measure will not be adequate at least a minimum of two years, the Safety Flag PIA may be inactivated but must be placed on a defined monitoring program until either the flag is removed or the next scheduled inspection occurs.

NOTE: Removal/Inactivation requests shall be accompanied by photo documentation of a repair where such action has taken place.

IV. FLAG RECLASSIFICATION

Red Flags may be replaced by Yellow Flags and vice versa based on an evaluation by the RBE. The RBE has the reclassification authority. In either case, the original flag should be removed and a new flag issued with a new flag number. Documentation requirements to change a Red Flag to a Yellow Flag are the same as for flag removal. The FBR used to reclassify the flag shall be filed in the flag subfolder within the BIN folder and a copy shall be forwarded to the Responsible Party.

A Flag Removal/Inactivation Report shall also be made for the Original Flag with the same distribution of copies. The reclassification process is intended to allow for further analysis after the initial Flagged Bridge Report has been completed and transmitted.
V. FLAG CONTINUATION

When an existing flagged condition is found by the Team Leader to remain in a subsequent inspection, the condition shall be reflagged with a new Flagged Bridge Report with complete documentation. The new flag shall be assigned a new flag number. All other information shall be completed on the Flagged Bridge Report including the superseded flag number. The Flagged Bridge Report shall note that an existing flag is being superseded. If a Yellow Flag becomes a Red Flagged condition and vice versa, then a new flag is issued with a new number. The original flag shall be removed in these situations.

VI. LOAD RATING FLAGS

The load rating and posting procedures for bridges are found in their respective Engineering Instructions (EI). Action shall be taken if the posting displayed on a bridge is inconsistent with the load rating information.

A. A Red Flag with a "Prompt Interim Action" designation shall be issued when the controlling "H" operating rating for a bridge is:

1. Less than 3 tons and the bridge is open to traffic; OR
2. Less than 50% of the posting on the bridge; OR
3. 15 tons or less when there is no posting on the bridge.

B. A Red Flag shall be issued when the controlling "H" operating rating for a bridge is:

1. 3 tons or more below the posting on the bridge; OR
2. 22 tons or less when there is no posting on the bridge.

C. A missing or illegible load posting sign (excluding “R” posting sign) shall be Red Flagged with "Prompt Interim Action" designation.

D. A missing or illegible "R" posting sign shall be Red Flagged.

E. A Yellow Flag shall be issued for all other cases of load rating/posting inconsistencies not covered by paragraph A thru D above. A legible posting sign with the correct posting information, but which is nonconforming in minor details, should be Yellow Flagged.
VII. SCOUR DAMAGE FLAGS

Scour damage poses a unique vulnerability to bridges. Hydraulic and scour induced damage is the leading cause of bridge failures both statewide and nationally. It is also recognized that scour induced damage takes a significant amount of time to repair. Therefore, the Responsible Party shall be urged to schedule repairs as quickly as possible.

With the possible exception of some very small bridges, a reduction in live load has little or no effect on the capacity or stability of a bridge foundation subject to scour damage. Therefore, the down posting of a bridge will rarely be sufficient by itself to inactivate a Red Flag resulting from scour damage. If the Responsible Party has scheduled repairs, and an evaluation by a NYSPE of the integrity and safety of the bridge during the interim has been made and appropriate flood watch procedures have been adopted, then these steps can be sufficient to inactivate a Red Flag. Red Flag removal can generally only be accomplished by repair of the scour damage.

Naturally occurring scour infilling can have a dangerously deceptive appearance that scour damage no longer exists. Such a possibility must be ruled out before a scour damage flag can be removed or inactivated.

An example of a Flag Letter (see the attached Sample #4) due to scour damage is attached.

VIII. CLOSING UNSAFE BRIDGES (ALL BRIDGES)

Closure proceedings shall be initiated at any point by the RBE, even in cases where this flagging procedure is being followed, when it is evident that the measures being taken by the Responsible Party do not eliminate a clear and present danger. If a Red Flag is not removed or inactivated within six weeks by appropriate corrective or protective action, and the bridge is determined by the RBE to be unsafe, the Regional Director shall close the bridge. A bridge closed because of a flag shall not be reopened until the structure is certified as safe by a NYSPE.

IX. UNDOCUMENTED REPAIRS

If during an inspection, a Team Leader finds that undocumented repairs have been or are being made to a previously flagged condition, but the flag has not been removed, then one of the following actions shall be taken:

A. If, in the Team Leader’s judgment, the repairs are adequate and complete enough to remove the flag, the Team Leader shall document the repairs and remove the flag using a Flag Removal/Inactivation Report.

B. In all other cases, the condition shall be reflagged using a Flagged Bridge Report. The superseded flag shall be removed when the new flag is entered.
X. INTERIM or SPECIAL IN LIEU OF INTERIM INSPECTIONS

Interim or Special In Lieu of Interim inspections shall be scheduled for all bridges with active or inactive Red Flags or active Yellow Flags. During the inspection, if the Team Leader finds the previously flagged condition has been corrected and is no longer deserving of a flag, the Team Leader shall remove the flag. If this flag was the sole reason for the bridge requiring an inspection, then the inspection should be terminated. The RBE shall remove the flag from the list of active flags and file the Flag Removal/Inactivation Report in the flag subfolder within the BIN file. If the flagged condition has not been corrected, or there is a new structural flag condition, the Team Leader shall continue the inspection and issue flags as appropriate.

For large and unusual bridges, Special In Lieu of Interim inspections may be substituted for interim inspections in accordance with the requirements of the Uniform Code of Bridge Inspection. If the bridge has been flagged for an isolated, localized, non-recurring condition, a Special In Lieu of Inspection covering inspection of the specific flagged condition can be substituted for the interim inspection. All such waiver requests shall be evaluated by the NYSDOT Main Office Bridge Inspection Unit Supervisor.

XI. FLAG INVENTORY

A flag inventory shall be maintained in the New York State Department of Transportation flag tracking system. It is the responsibility of the RBE to make sure that the information in this database for all the bridges in their Region is current and correct.

XII. PUBLIC AUTHORITIES

Public Authorities, responsible for their own bridge inspections, can elect to use this Flagging Procedure with appropriate modifications made to references to NYSDOT positions. Alternatively, they can develop an agency specific flagging procedure that has similar scope to assure public safety. The procedure shall be documented and shall have provisions to designate flags (similar to red, yellow, and safety), timely notification of flags, and a mechanism to ensure the flags are addressed in a timely manner.

At Regional discretion, Authorities shall immediately notify the RBE verbally of all flags that have the potential to disrupt traffic on NYSDOT or locally maintained highways. All flags issued during the bridge inspections shall be included in the inspection reports.

Any flags issued by State inspectors or consultant inspectors working for DOT that affect Authority traffic shall be reported to the Authority involved in the same manner and within the same time limits that the authorities are required to report to the Department.
XIII. ELECTRONIC COMMUNICATION

Except for the verbal notification required for PIA flags, all other verbal and written correspondence may be substituted with electronic communication such as e-mail. A mechanism should be in place to make sure that the electronic communication has been received and has been reviewed in a timely manner. The Regional Director is solely responsible to ensure that measures consistent with the flagging procedure are in place when electronic or other communication methods are adopted. The RBE shall clearly document this procedure with all steps and procedures and provide a copy to the RD and the Main office Bridge Inspection Unit. A printed copy of all correspondence shall be placed in the flag subfolder within the BIN folder. All e-mail correspondence should have the same information that would have been in verbal or paper correspondence.

PE certifications cannot be substituted with verbal assurances. If electronic mail is used to receive the certifications from the Responsible Party or their consultants, all e-mail should come directly from the NYSPE (not from someone in his/her staff on his/her behalf), and the e-mail should contain all the content which is required with a paper certification including the NYSPE's License Number and the NYSPE's mailing address. A printed copy of the e-mail should be placed in the flag subfolder within the BIN folder within two weeks after the flag has been addressed.

XIV. NYSPE LICENSE VERIFICATION

The Department periodically verifies the current registration status of the NYSPEs employed by the Department. The RBE is responsible for making sure that the non-NYSDOT certifying NYSPE has a current registration. This may be accomplished by accessing the State Education Department database that is available on-line. In order to achieve this, all non-NYSDOT NYSPE Certifications shall have the NYSPE's name, license number, and mailing address.

XV. GUIDELINES

A. Multiple Occurrences of Similar Conditions

Flags are issued separately for each condition noted on a bridge. Each condition can have only one structural flag, but it is possible for a bridge to have more than one flag or to have both Yellow and Red flags or other flag combinations. Multiple occurrences of similar conditions on a bridge requiring a Red or Yellow flag may be documented and submitted, using sound engineering judgment, under one Red or Yellow flag as long as every occurrence (location and extent) is explicitly described in the flag details. It should be noted that to remove or inactivate the flag, each condition shall be addressed appropriately with NYSPE certification specifically explaining how each of these conditions were addressed.
B. Flags on Closed Bridges

For closed bridges, red or yellow flags should not be issued unless conditions can cause structural collapse under existing loads before the next scheduled general inspection. If any of the observed conditions on a closed bridge constitute a safety hazard to traffic/users underneath, the appropriate safety flag (if necessary with PIA designation) shall be issued.

C. Post-repair PE Certification

In some cases, even though appropriate measures have been taken to address structural flags, there has been a failure to provide the required certifications that the repairs have been made in accordance with the PE design.

In most instances, the NYS licensed Professional Engineer (PE) responsible for the design of the repair is not involved with overseeing the construction and the construction engineer is not involved in the design. This has sometimes resulted in uncertainty with who should be certifying that the bridge is safe to open to traffic. To address this situation, adhere to the following:

1. The flag repair procedure shall be prepared and stamped by the PE responsible for its design and construction details. The stamped documentation shall include all appropriate details and calculations.

2. Once repairs are completed, the PE overseeing the construction activities shall provide PE stamped certification that the repairs have been made in accordance with the design. Depending on the situation, this could be the Engineer in Charge (EIC), Construction Supervisor, Regional Construction Engineer, Regional Bridge Maintenance Engineer or any PE designated by the Regional Director. This certification documents that the repair has been made in accordance with the stamped design referenced in step 1. It does not recertify the design. The design continues to be the responsibility of the designer referenced in step 1.

When unforeseen circumstances require changes in the field from the original design repair details, they typically fall into two categories.

i. A minor change that is not a significant departure from the original design intent. These minor changes can be approved by a Regional licensed professional, typically from the Regional Construction Group when work is performed by a Contractor or from the Regional Maintenance Group when work is performed by Bridge Maintenance crews. This effort would be comparable to stamping As-Built Plans at the end of a Construction Contract.

ii. A significant change that deviates from the original design intent. These changes need approval by the original designer referenced in step 1, or another PE who shall take responsibility of the new/revised design. This effort would be comparable to stamping Field Revision Sheets in a Construction Contract.
3. Within 5 business days of the completion of the repair, both certifications with attachments shall be forwarded to the Regional Structures Management Engineer for flag removal or inactivation.

D. Quality Review of Flags

As a quality control effort, the RBE shall periodically review the Flag Documentation and discuss with Team Leaders in order to ascertain the effectiveness of the flagging procedure; and discuss these findings with the Main Office Bridge Inspection Unit and other RBEs. As a quality assurance effort, the Main Office Bridge Inspection Unit shall review selected Flag Documentation and correspondence to evaluate the effectiveness of the inspection program and initiate changes, as needed. Flags Documentation shall contain sufficient information for this review.

XVI. HYPOTHETICAL EXAMPLES

Each bridge and its condition are different due to factors such as design, materials used, loadings, and deterioration. Hence, professional judgment by competent personnel is required. The hypothetical examples of conditions which might warrant various flag types are provided, and updated as needed, on the NYSDOT website where the Bridge Inspection Manual can be accessed. These examples are not meant to list all situations, nor be a limit guideline for determination of flag issuance, but are typical examples of conditions that have occurred in the past.
SAMPLE TRANSMITTAL #1 - "RED FLAG"

Dear __________________________:

This is the written follow-up to the verbal notification made to __________________________ on _______ concerning the Red Flag on BIN _______________________. Attached is a copy of the Bridge Inspector’s Flag Documentation. Our records indicate that you are responsible for taking appropriate corrective action within six weeks from the date of this letter to assure public safety. We request written acknowledgment from you to verify receipt of this notification.

NYSDOT defines a Red Flag condition as one which reports the actual or imminent risk of failure of a major structural component of a bridge, and requires prompt or short term corrective or protective action to assure safety. We further request a written reply by __________________________ , 20____ stating what action is being taken concerning the Red Flagged Condition. Such action should be to: 1) close, 2) post, 3) repair, or 4) furnish a written statement that the structure is capable of carrying a legal (as currently posted) load. For those actions which you propose to do in the future, please state what interim action you will implement to ensure the safety of the traveling public.

The Red Flag status will be removed or inactivated upon receipt of written notification that appropriate corrective or protective action has taken place to remove or inactivate the red flag. Such notification shall be accompanied by a certification by a Professional Engineer licensed to practice in New York State, that the corrective or protective actions are appropriate to ensure the safety of the public using the bridge. Such certification shall document that the corrective or protective actions have been completed and have been inspected or approved, as appropriate, by the engineer. Certification shall include the NYSPE's name, license number, and mailing address.

Unless we receive written notification and verify that you have taken action to remove or inactivate the "Red Flag" within 6 weeks, we will be compelled to exercise all the authority of this Department to protect the traveling public, which may include the closure of the structure.

Sincerely,

Attachments

cc: BIN File (w/attachments)
Regional Director
Main Office Bridge Inspection Unit
Dear ________________:

This is written notification that a Yellow Flag has been placed on BIN(s) ________________. Our records indicate that you are responsible for taking appropriate corrective action to assure public safety.

The State may withdraw this flagged status if we are provided written certification that the flagged condition has been corrected. Such certification shall consist of a written explanation of the action taken. Such action should be to 1) close, 2) post, or 3) repair. Any such action, except closure, shall be accompanied by a certification by a licensed professional engineer qualified to practice in New York State, that such action is appropriate to ensure the safety of the public using the bridge. Such certification shall document that the corrective or protective actions have been completed and have been inspected or approved, as appropriate, by the engineer. The certification shall include the NYSPE's name, license number and mailing address.

Sincerely,

Attachments

c:  BIN File (w/attachments)
    Main Office Bridge Inspection Unit
SAMPLE TRANSMITTAL #3 - "SAFETY FLAG PIA"

\[\text{Details of date and place}\]

Dear \[\text{Recipient's Name}\]:

This is the written follow-up to the verbal notification I made to \[\text{Details of date and place}\] concerning the Safety Flag PIA on BIN \[\text{Details of BIN}\]. Our records indicate that you are responsible for taking appropriate corrective action to assure public safety. Attached is a copy of the bridge inspector's Flag Documentation. We also request a prompt written acknowledgment from you verifying receipt of this notification.

NYSDOT defines a Safety Flag PIA condition as one which is a clear and present danger to vehicular or pedestrian traffic, but poses no danger of structural failure or collapse. We further request a written reply by \[\text{Date}\] stating what action has been taken concerning the Safety PIA Flagged Condition. Such action should be to: 1) close (partial or full) 2) repair 3) Certify as safe in existing condition 4) Certify as safe for a specified period.

The Safety Flag PIA status will be removed or inactivated upon receipt of written notification that appropriate corrective or protective action has taken place to remove or inactivate the Safety Flag PIA.

Unless we receive written notification and verify that you have taken action to remove or inactivate the "Safety Flag PIA", we will be compelled to exercise all the authority of this Department to protect the traveling public, which may include the closure of the structure.

Sincerely,

Attachments

cc:  BIN File (w/attachments)
     Main Office Bridge Inspection Unit
Dear __________________:

This is the written follow-up to the verbal notification made to __________________ on ____________, 20__ concerning the Red Flag on BIN __________________________. Attached is a copy of the bridge inspectors “Flag Documentation.” Our records indicate that you are responsible for taking appropriate corrective action. We request written acknowledgment from you to verify receipt of this notification. We further request a written reply stating what action is being taken concerning the “Flagged Condition.” For those actions which you propose to do in the future, please state what interim action you will implement to ensure the safety of the traveling public.

For cases of scour damage, the increased risk of failure due to future flooding or high flows merits special consideration. The presence of such damage clearly suggests the potential for future scour and the existing foundation exposure has reduced the resistance to such scour. We, therefore, strongly recommend that, unless the bridge is closed completely, the undermining be promptly repaired and protected. Until such repairs are made, we recommend that you put the bridge on a local "flood watch" whereby the bridge is observed during periods of high flows with the provision of temporarily closing the bridge under such conditions where the safety of the bridge is in question. We further point out that reducing the live load on the bridge usually has little or no effect in reducing the risk of a scour failure. Therefore, removing or inactivating the flag by posting the bridge or certifying that the bridge is safe “as is” must also include certifying that the bridge can safely withstand future expected flooding in its current condition.

In accordance with NYSDOT procedures, this flag will be removed or inactivated upon receipt of written notification that appropriate corrective or protective action has taken place to resolve the flag. Such notification shall be accompanied by certification of a Professional Engineer, licensed to practice in New York State, that the corrective or protective actions are appropriate to ensure the safety of the public using the bridge. Such certification shall document that the corrective or protective actions have been completed and have been inspected and approved, as appropriate, by the engineer. Certification shall include the NYSPE’s name, license number, and mailing address. We again note the special risks associated with scour damage and the importance of taking prompt corrective actions to repair the damage and minimize the risks due to future flooding or high flows.

Unless we receive written notification by ____________________________, 20__ and verify that you have taken corrective or protective measures, we will be compelled to exercise all of the authority of this Department to protect the traveling public. The authority includes closure of the structure.

Sincerely,

Attachments

cc: Regional BIN File (w/attachments)
    Regional Director
    Main Office Bridge Inspection Unit
SAMPLE FBR (Any other substitution, paper or electronic, should have all the details included in this form)

NEW YORK STATE DEPARTMENT OF TRANSPORTATION FLAGGED BRIDGE REPORT

INITIAL:

___RED FLAG*                          INSPECTOR ______________________________
___RED FLAG PIA*                       FLAG NUMBER __________________________
___YELLOW FLAG*                        DATE OF INSPECTION _____________________
___SAFETY FLAG PIA*                    SUPERSEDES FLAG NUMBER _______________

BRIDGE DESCRIPTION:

BIN ___________  REGION _____  COUNTY ______________________  TOWN ____________

FEATURES: CARRIED ______________________________  CROSSED __________________________

NUMBER OF SPANS BY TYPE ______________________  APPROXIMATE YEAR BUILT __________

POSTED FOR LOAD _____  NO _____  YES _____  TONS

IS BRIDGE WHOLLY OR PARTIALLY STATE OWNED? _____  YES _____  NO

Span No ___________  Flagged Element _______

Governing Condition State _______________ and Quantity ___________________________

DESCRIPTION OF FLAGGED CONDITION (Be specific as to exact nature and location of problem. Include direction of orientation):

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________
ATTACHMENTS? __ YES __ NO.   IF YES, NUMBER ATTACHED ____________

Flagged Bridge Report Completed By _________________________________ Date __

VERBAL NOTIFICATION: (For Red Flags and Safety Flags with PIA only)

To ________________________ of Regional Office on ________________ at _______ o'clock

To ________________________ (Responsible Party) on ________________ at _______ o'clock

By

______________________________          ____________
Signature of State Team Leader       Date
or Contract Engineer Representative

* The appropriate caption in the upper left of this form shall be initialed by the individual who is the signatory.
NEW YORK STATE DEPARTMENT OF TRANSPORTATION FLAG REMOVAL/INACTIVATION REPORT

REGION/COUNTY ___________________________ BIN __________

FLAG NUMBER ____________

_____ RED FLAG CARRIED ________________

_____ YELLOW FLAG CROSSED ______________

_____ SAFETY FLAG PIA

FLAG IS TO BE:

_____ REMOVED

______ INACTIVATED

CERTIFICATION BY ___________________________

ACTION TAKEN:

REPORT PREPARED BY ___________________________ , REGIONAL BRIDGE ENGINEER

DATE __________________
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NY APPENDIX C

SPECIAL EMPHASIS INSPECTION REQUIREMENTS

In addition to conventional visual inspections required for all bridges, certain details and components of metal structures require additional inspection intensity. This additional requirement, known as "100% hands-on" inspection, means that the inspector must get within 2 feet of the component to be inspected. Adequate lighting is also essential. A hand-held spotlight is ideal, but a flashlight is satisfactory if electric power is unavailable. A magnifying glass and mirror should also be used for suspect areas.

With respect to bridge structures, 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 temporarily carry additional load, and collapse of the structure may be avoided. On non-redundant structures, the redistribution of load causes additional members to also fail, resulting in a partial or total collapse of the structure.

The New York State Department of Transportation requires that for a bridge to be load path redundant, it must have four or more main load carrying members or load paths. For the purposes of this section, only those structural systems which are load path redundant are considered to be redundant.

A fracture critical member is a member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse.

All areas requiring 100% hands-on inspection must be clearly identified in a specially prepared section at the end of the BIN folder. This section must identify location and type of component to be inspected hands-on. Sketches, copies of plan sheets, and/or photos should be used for documentation. For reference during future inspections, the location of any deficiencies found should be noted in the special emphasis section. Also, the binder cover shall have a sticker stating "Special emphasis required during each General or Diving inspection. See BIN folder for general or bridge-specific procedures that apply. Inspections should note any additional special details that warrant attention."

Exceptions to the policy requiring 100% hands-on inspection as stated above can only be granted by the Main Office Bridge Inspection Unit Head (MOBIUH), and when necessary with consultation of the Deputy Chief Engineer (Structures) (DCES). If exemption is granted, then a copy of the Main Office letter must be included in the special emphasis section.

When a 100% hands-on inspection occurs under provisions of this Appendix, the Team Leader must note this and indicate the date when performed in the Special Emphasis section of the Bridge Inspection Report. If an exemption has been granted to the "special emphasis" requirement, the items must still be entered and a note added explaining that the exemption was granted and the reason. Structural or safety related deficiencies indentified by hands-on inspection should be flagged if necessary (See Appendix B).
Unless a written exemption is granted, exposed surfaces of the following elements and components must receive a 100% hands-on visual inspection during each general bridge inspection:

1. Non-Redundant or Fracture-Critical Structures
2. Pin-and-Hanger
3. All AASHTO Category D, E, and E' Welded Details
4. Field Welded Repairs
5. Details Vulnerable to Fatigue Cracks
6. Details Vulnerable to Cracking from Out-of-Plane Distortions
7. Bridges with Staggered Diaphragms
8. Steel Web Bearing Area
9. Stringer/Floorbeam Connection
10. Thru-Girder Shear Splice
11. High Rocker Bearings
12. Bearing Stools
13. Concrete Deck Haunch
14. Movable Bridge Trunnions
15. Fiber Reinforced Polymer (FRP) Wrap
16. Complex Bridges
17. Unique and Unusual Features

See the following pages for details.
1. Non-Redundant or Fracture-Critical Structures:

All non-redundant or fracture-critical metal superstructure and substructure elements subjected to any type of stress condition. These situations include (but are not limited to):

- Truss chords, gusset plates and diagonals.
- Main girders of two and three girder bridges.
- Floorbeams spaced more than 12 feet on-center on trusses or two and three girder bridges.
- Floorbeam/truss and floorbeam/girder connections if floorbeam spacing is greater than 12 feet on-center.
- Metal pier caps and pier columns.
- Anchorage zones of main cables of suspension bridges and the full length of the cables.
- Floorbeam hanger assemblies regardless of floorbeam spacing (example detail below)

![Diagram of truss bottom chord](image)

**ELEVATION**

**SECTION**

**TYPICAL DETAIL - TRUSS - FLOORBEAM HANGER CONNECTION (PLATE HANGER ON PIN CONNECTED TRUSS SHOWN)**

2. Pin-and-Hanger:

Inspect all pin-and-hanger details, regardless of element redundancy, and all primary members within 5 feet of the pin-and-hanger details.

3. All AASHTO Category D, E, and E’ Welded Details:

All exposed surfaces of AASHTO Category D, E, and E’ welded details (for examples, see Chapter 6 of the AASHTO LRFD Bridge Design Specifications) must receive a 100% hands-on visual inspection during each inspection unless a written exemption is granted by MOBIUH/DCES or calculations are performed and checked to ensure sufficient remaining Evaluation I Fatigue Life. The analysis
methods to be used for estimating remaining fatigue life can be found in the AASHTO Manual for Bridge Evaluation, Chapter 7.

Regardless of exemption herewith, these welded details must receive a 100% hands-on visual inspection every 6 years with the exception that partial length cover plate welds may be inspected every 12 years.

Automatic exemption from the 100% hands-on requirement will apply to only redundant members when:

- The calculated remaining Evaluation I Fatigue Life is greater than or equal to 12 years. Reanalysis shall be performed every 6 years using current traffic count data (12 years for partial length cover plate welds). Traffic counts more than 10 years old cannot be used.

If a written exemption is granted by the MOBIUH/DCES, a copy of the exemption letter must be included in the BIN folder special emphasis section.

If exemption is automatic because of fatigue-life calculations, then a copy of the calculations must be placed in the BIN folder special emphasis section. If calculations indicate no exemption, then a note must be placed in the BIN folder special emphasis section stating this and the reason (e.g. traffic count greater than 10 years old, calculated minimum expected fatigue life less than 12 years, etc.). The persons performing and checking the calculations must be identified.

The Inspection Report shall note why the 100% hands-on requirement was waived.

4. Field Welded Repairs:

All areas of primary members having field-welded repairs of gouges or cracks caused by impact damage or cracks due to fatigue. However, if documentation within the BIN folder indicates:

- the field repair was performed per a NYSDOT approved Weld Procedure Specification and the completed repair was certified satisfactory through ultrasound inspection
- the field repair by fillet weld or full pen stiffener splice is certified satisfactory by whomever is monitoring the repair (EIC, RBME, etc.), then the 100% hands inspection may be waived.

5. Details Vulnerable to Fatigue Cracks:

In tension and stress-reversal areas, all details not in the original design which are vulnerable to fatigue cracks. From the standpoint of crack propagation, any detail welded onto a primary member is considered part of the primary member, including (but not limited to):

- Tack welds \( \geq 2 \) inches.
- Welded erection aids.
- Remaining backup bars at groove welded connections, if the bars are discontinuous.
- Plug welded holes.
6. Details Vulnerable to Cracking from Out-of-Plane Distortions:

These include (but are not limited to) girder webs at girder-floorbeam connections (especially on skewed bridges), and coped or blocked floorbeam details.

7. Bridges with Staggered Diaphragms:

Plate girders with thin webs (<0.4”) and staggered diaphragms have shown a tendency to form web cracks adjacent to the connection plate snipe due to out of plane bending. The cracks tend to run both horizontally along the flange to web fillet weld and vertically along the connection plate to web fillet welds.

In general, these cracks can be detected by a hands-on visual inspection. Any areas of the web that exhibit oxide staining of the paint or paint creases should be thoroughly inspected.

The below figure is a framing plan that shows the staggered diaphragm layout and typical crack locations.
8. Steel Web Bearing Area:

Primary member bearing areas, where combined web and bearing stiffeners (when present) loss meets or exceeds 25%, require 100% hands-on inspection.

The primary member bearing area is the web design strip length including bearing stiffeners (when present) for 8 inches above the bottom flange that is directly over the bearing. Bearing stiffeners are generally a minimum of ¾” thick and located on both sides of the web. The web design strip length, 18 times the web thickness (for example: 0.625 inches x 18 = 11.25 inches), is considered as effective with the bearing stiffeners in acting as a column to transmit the entire beam reaction load to the bearing.

Although all built up plate girders require bearing stiffeners, AASHTO only requires bearing stiffeners on rolled beams when the shear at the bearing exceeds 75% of the allowable shear of the web. The web over the bearing acts like a thin column by itself to support the beam reactions and to transfer the loads to the bearings. Therefore, the area of the beam directly over the bearing is susceptible to failure due to loss of section from corrosion, especially for rolled beams without bearing stiffeners.

Bridge inspectors should note that some of the bridges without bearing stiffeners have connection plates in or near the bearing area that might be confused with bearing stiffeners. Connection plates are of limited benefit in reducing the possibility of web distortions and should not be confused with bearing stiffeners.

When corrosion is present, the inspector should measure and document the extent of that corrosion and section loss. Where loss of bearing area exceeds 25%, the corroded bearing area shall be well documented, preferably with a sketch.

For all cases, where there is more than a 50% section loss to the bearing area, the inspector shall consider issuing a structural flag based on condition, redundancy, loading and engineering judgment for each circumstance.
9. Stringer/Floorbeam Connection:

All stringers within 3 feet of a stringer/floorbeam connection, regardless of degree of redundancy, if the stringer webs are vulnerable to cracking from fatigue or out-of-plane distortions. The stringer webs are inspected hands-on if all the following conditions exist:

- The stringer bottom flange bears on, and may be bolted directly to, the floorbeam top flange.
- The stringer web is unstiffened.
- Any end diaphragms present do not extend the full depth of the stringer, making the web vulnerable to out-of-plane bending.

STRINGER/FLOORBEAM CONNECTION

The usual failure mode for this type of detail is longitudinal cracking near the bottom of the stringer which is undetectable from beneath the stringer. Failure is more likely under expansion joints where leakage of water, debris, and deicing chemicals accelerate deterioration.
10. Thru-Girder Shear Splice:

Multi-span in-line thru-girders, in certain cases, have shear splice connections which warrant particular concern. The connection in question is usually located adjacent to a pier bearing with only one end of the two girders being connected directly supported by the bearing. There is no web continuity between girders. The girder end not directly supported by the bearing is primarily dependent on the shear capability of the connection. This shear splice utilizes angles riveted and/or bolted to both faces (near and far sides) of the web at the ends of both girders. The outstanding legs of these angles are riveted and/or bolted back-to-back, connecting the ends of the two girders. Failure of this connection would most likely cause superstructure collapse. See figure below.

When inspecting thru-girder bridges with this detail, the following should routinely be done:

A. Thoroughly inspect each fastener for any signs of distress such as looseness, corrosion, bending, etc. and note any distress.
B. Thoroughly inspect 2 feet from both sides of the centerline of the connection for cracks or tears in the structural elements that make up the thru-girders. Attention should be given to cracks that could emanate from bolt and/or rivet holes.
C. Inspect the zone as described in B for crevice corrosion.
D. Inspect for any other signs of distress such as displacement of the connection, deformation of structural members, alignment and profile of members, etc.
E. Document the connection and its condition with sketches (if plans are not available), measurements, and photographs using clear, concise descriptions.

This list represents a set of general steps that are to be followed as a guide when a bridge with this detail is encountered. Since all bridges should be treated as unique, more steps may be required in some cases; therefore, these steps are to be considered as a minimum.
11. High Rocker Bearings

High rocker bearings are defined as an expansion bearing that uses a curved bearing surface (like a rocking chair) to allow expansion and contraction of a superstructure. A high rocker bearing is generally taller than it is wide and, for these requirements to apply, at least 8 inches high. “Abnormal behavior” of high rocker bearings refers to bearings that are in the contracted position in warm weather and bearings that are in the expanded position in cold weather.

**Action to be taken**

During any inspection of high rocker bearings, inspectors should consider what the normal behavior is for this type of bearing. In New York State, bearings are generally designed to be set at their neutral (vertical) position at 68° F. The design temperature range for bearings with steel superstructures in Regions 1 thru 9 is -30° to 120° F, and in Regions 10 and 11 the range is 0° to 120° F. Generally, this means rocker bearings should be nearly vertical (no tilt) at 68°. Normal behavior for this type of bearing is to tilt away from the center of the span when the temperature rises and the superstructure expands. The bearings should tilt back toward the center of the span as the temperature falls and the superstructure contracts. Note that when a bridge has two lines of expansion rocker bearings on a pier and a joint in the deck over the pier, the bearings should tilt toward each other when the temperature is high and tilt away from each other when the ambient temperature is colder than the midrange temperature. Abnormal movement of the bearings may indicate movement of the substructure on which the rocker bearing is founded or movement of the substructure with the fixed bearings. An effort should be made to determine if either of these cases caused the problem.

**Documentation of condition of high rocker bearings**

The following documentation is required for each high rocker bearings, assessed CS-3 or CS-4 due to excessive tilt or abnormal behavior. The inspection report shall include all the following that apply:

**A. Bearing notes shall include (as necessary) statements describing:**

1. Ambient temperature during inspection.
2. Documentation of extension or contraction (tilt). The angle of rotation, $\theta$, should be measured with a tilt meter or calculated from the measurements taken during the inspection. See the sketch below for the minimum measurements needed.
3. Documentation of behavior/movement. Record observations regarding direction of movement of the bearing if the bearing shows signs of movement (for example, cracks in the paint or lighter color rust stains) and if the bearing has sufficient capacity to move further in the direction of travel under temperature extremes.
4. Presence of corrosion (including pack rust) or any debris that could inhibit proper function and documentation of section loss to any portion of the bearing assembly including anchor bolts.
5. Any sheared off or bent anchor bolts and location of such bolts.
B. Rocker Bearing Field Documentation Summary

The Rocker Bearing Field Documentation Summary shall be included in the Inspection Report. The summary shall include sketches and a table with the following data, at a minimum, for the worst bearing in each line of rocker bearings on a pier (including piers with two sets of expansion bearings as described above) or on an abutment:

Ambient temperature, angle of rotation (with an indication if this angle is calculated or measured), dimensions A, B, C, D, E and X as shown in the documentation sketch shown on the following table.

**Rocker Bearing Field Documentation Summary**

1. Reference Sketch:

   - A = Height of rocker
   - B = High corner of rocker plate
   - C = Low corner of rocker plate
   - D = width of rocker plate
   - \( \Theta \) = Angle of rotation (tilt)
   - E = Eccentricity (translation)
   - X = minimum clear distance between girders or from girder to abutment

2. Bearing Data Table:

<table>
<thead>
<tr>
<th>Date</th>
<th>Bearing Location</th>
<th>Ambient Temp</th>
<th>Dim &quot;A&quot;</th>
<th>Dim &quot;B&quot;</th>
<th>Dim &quot;C&quot;</th>
<th>Dim &quot;D&quot;</th>
<th>Dim &quot;X&quot;</th>
<th>Dim &quot;E&quot;</th>
<th>Angle &quot;G&quot;</th>
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In extreme situations a special inspection should be scheduled to check the bearings at a higher ambient temperature, if the bearings are over extended or at a lower temperature if the bearings are over contracted.

The amount of allowable tilt varies with each type and configuration of rocker bearing. To compare the actual tilt to the allowable tilt the inspector should determine the allowable tilt from the record plans. If no plans of the bearings are available, the inspector should determine an acceptable tilt from the actual measurements assuming that the rocker should not bear on the outer quarter of the “D” dimension of the rocker as shown in the Section view above.

The QC engineer should check the calculations and the measurements that determined the allowable tilt. Note that the tangent or bearing point between the rocker and masonry plate should always be located in the middle half of “D”. Due to the wide variety of rocker bearings, engineering judgment is required when comparing the allowable tilt to the actual tilt and if a flag is required.
12. Bearing Stools:

The bearing stool detail of concern uses a wide-flange beam section placed vertically (strong axis perpendicular to the beam/girder) beneath a beam/girder end, with an outboard stiffener bracing the stool back up to the bottom flange of the beam/girder (see figure below). The stool, with “mill to bear” ends, and outboard stiffener are attached to the bottom flange of the beam/girder with all around welds. A potential problem exists where the stool bears against its supporting sole plate and bearing assembly. This occurs when only a near-side/far-side fillet weld (along the web of the vertical beam section) positively attached the stool to the sole plate, and the bearing stool's flanges only bear on the sole plate without positive attachment. (See location of missing welds on below figure.)

A failure scenario for this bearing stool detail can start with a leaking joint above the stool and the build up of debris around it. In this environment, the stool’s web can rust heavily above and around its fillet weld attachment to the sole plate. Concurrently the same moisture and debris causes the frictional resistance of participating expansion bearings to increase; increasing the horizontal loads applied to the stools. Under the additional horizontal loads, the rusted reduced web section of the stool can distort and tear at its fillet weld attachment to the sole plate. This can result in the stool’s lower web yielding; and the stool’s flanges riding off the sole plate’s edges, dropping several inches as the stool crushes around the sole plate and bearing assembly.

Welds attaching the stool’s flanges to the sole plate (along with the near-side/far-side fillet welds at the web) would greatly enhance the integrity of this bearing stool detail and extend its lifecycle. During an inspection, the absence of existence of such flange welds should be verified by the inspector. When no welds are found attaching the stool’s flanges to the sole plate; the inspector should: a) document (in the inspection report) the absence of the welds, and the present loss of section and distortion of each stool inspected; b) identify the stools without flange to sole plate welds as requiring a “special emphasis” (100% hands-on) inspection. Any stool missing the flange to sole plate welds and showing significant deterioration should be structurally flagged.
13. Concrete Deck Haunch:

Certain concrete deck haunches require 100% "hands-on" inspection. In this detail, the concrete haunch extends past the edges of the top flange (haunch is wider than top flange), with the bottom face of the concrete haunch flush with the bottom face of the top flange. This generally results in a 90° edge of unreinforced concrete that is prone to spalling.

This detail was used in removable bridge deck forming systems and has caused failures resulting in falling concrete. In some cases, the unreinforced parts of the haunch have cracked and fallen, thus creating a hazard to traffic beneath the bridge. Apparently, the failures occur due to forces resulting from corrosion products on the edge of the flange. The crack initiates at the edge of the flange and propagates upward at approximately 45° before intersecting the vertical haunch face, thus resulting in loose concrete. The inspector should be very careful to look for hairline longitudinal cracks along the vertical face of the haunch as shown in the below figure.

When performing the inspection of a bridge with this particular haunch detail, 100% "hands-on" inspection is required on every haunch for sections of structures over highway, pedestrian, railroad and/or waterway traffic. This 100% "hands-on" inspection should include sounding of the haunch with a hammer. The findings should be documented in the inspection report. Cracks or loose concrete on the haunches should be safety flagged.
14. Movable Bridge Trunnions:

Trunnions, cylindrical protrusions used as a mounting and/or pivoting point, are typically designed for bending, bearing and shear stresses based on the nominal section at the bearing. For certain lift bridge designs, little or no consideration was given to abrupt changes in section, which are ‘stress risers’ susceptible to fatigue cracking.

The potential for a catastrophic failure due to a fractured trunnion should be recognized by engineers responsible for inspecting bridges. In regard to movable bridges, a thorough 100% hands-on inspection shall be made of trunnions that have incorporated an abrupt change in section, especially in cases where the trunnion is subjected to more than 90 degrees of rotation under normal operating conditions. See figure below.

TRUNNION DETAIL

Any indication of cracking in a trunnion shall be structurally flagged. Additional guidance in identifying trunnions may be found in the FHWA BIRM.
15. Fiber Reinforced Polymer (FRP) Wrap:

FRP wrapped bridge elements require 100% hands-on inspection to adequately discern their condition and efficacy. FRP wrap documentation may be in the BIN folder, but can generally be identified by the grid pattern found in the fiber reinforcing sheets.

The inspector’s most effective method in determining the condition of an FRP wrap repair is to lightly tap the repaired area with a hammer, listening for hollow sounds which may indicate inadequately bonded FRP layers. The inspector should also watch for excessive deflection which may indicate continued deterioration of the underlying material or debonded pockets of air entrainment. Efflorescence and rust may bleed through the wrap which indicates continuing deterioration of the treated area. This should be documented accordingly.

Use of infrared thermographic camera (IRT), when available, is recommended to identify inadequate bonding. If the IRT camera is used, inspector should become familiar with appropriate ASTM specifications for use of the methodology.

Any loss of bond of an FRP wrap functioning in a structural capacity is a serious condition and should be flagged until such time that further investigation and evaluation can be performed. Loss of bond of an FRP wrap functioning in a non-structural role, such as splash zone protection, is still serious but does not merit a flag condition. Provide a sketch in the inspection report and/or flag documenting the location and extent of FRP delamination.

Newly found locations of FRP wrapping identified in the course of an inspection shall be documented in the special emphasis section of the BIN folder.

16. Complex Bridges:

Title 23 of the Code of Federal Regulations, Part 650, Subpart C-National Bridge Inspection Standards, requires that specialized inspection procedures be identified for "complex bridges". The Code defines complex bridges as "moveable, suspension, cable stayed, and other bridges with unusual characteristics".

The designer of complex bridges, or of bridges that incorporate innovative or unusual elements or details, shall identify those bridge elements or details that warrant specialized inspection attention. A "Special Emphasis Inspection Procedure" (SEIP) shall be assembled, submitted with the "Final Bridge Plans", and stored in the BIN folder.

Complex bridges shall be inspected according to the bridge SEIP and by inspectors with additional training and experience specific to that SEIP. The inspector of complex bridges, or of bridges that incorporate innovative or unusual elements or details, should note any additional special details that warrant attention, by adding them to the SEIP listed below and stored in the BIN folder.

The BIN folder cover of a Complex Bridge shall have a sticker stating, “Complex Bridge Special Emphasis Required. See BIN folder for general or bridge-specific procedures that apply. Inspections should note any additional special details that warrant attention.”
The contents of the SEIP shall be as follows:

- A brief statement of purpose presenting an explanation of why the SEIP is required.

- Characterization of the complex of unusual elements or details to be given special attention; a description of the element or detail and the reason(s) it is considered complex or unusual.

- A description of how the element or detail should function or behave and a description of the physical conditions that can be observed that would indicate that the element or detail is functioning appropriately.

- A description of the observable physical characteristics that would indicate that the element or detail is not functioning appropriately along with direction relative to how to assess the degree to which the element or detail is faulty in its performance.

17. Unique and Unusual Features:

All unique and unusual features designated as such by the RSME or the Main Office Bridge Inspection Unit.
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NY Appendix D

Diving Inspections and Fathometer Surveys
(a.k.a. “Bridge Diving Inspection Specifications”)

Table of Contents:

Section 1  1  Diving Inspection
1.1  Diving Inspection Intensity
1.2  Diving Inspection Frequency
1.3  Scour Documentation
1.4  Protection Systems
1.5  Damage Evaluation
1.6  Special Considerations
1.7  Diving Inspection Report Documentation

Section 2  2  Fathometer Surveys
2.1  Fathometer Survey Limits
2.2  Fathometer Survey Frequency
2.3  Field Procedures
2.4  Fathometer Survey Report Documentation

In addition to the pertinent sections of the NYSDOT Bridge Inspection Manual, this appendix provides guidelines and instructions for diving inspection teams and fathometer survey crews in conformance with the New York State Department of Transportation (NYSDOT) diving inspection and fathometer survey program based on Part 165.4(b) of the Uniform Code of Bridge Inspection.
Section 1 – Diving Inspection

1.1—Diving Inspection Intensity

Diving inspection is a detailed, visual and tactile inspection of a substructure unit (SSU) which may require partial cleaning. All surfaces of underwater components (e.g., footings, piles, stems, scour protection devices) are inspected and all anomalies such as section loss, voids, holes, etc. are measured. The diving inspection may use nondestructive testing procedures when specified and approved by Deputy Chief Engineer (Structures) (DCES).

Nomenclature of SSUs shall conform with the New York State bridge inventory.

Diving inspection shall be done by surface supplied air. Continuous audio and video communications link with the top-side crew shall be maintained.

Due to safety and/or efficiency concerns, some diving environments may require the divers to be substituted with an equivalent inspection means after receiving approval from DCES.

Impediments, such as debris or lock-down procedures, shall be mitigated before completing the inspection. When mitigation requires extensive resources, the available portion of an SSU may receive a partial inspection after receiving approval from DCES.

The use of additional personnel, equipment or procedures which are not considered the commonly-used methods, will require approval from the DCES.

The physical limits of the diving inspection are from 3 feet above the water surface to the accessible portion of the substructure below water, at the time of the diving inspection.

1.2—Diving Inspection Frequency

The diving inspection frequency is based on the General Recommendation determined during the Bridge Diving Inspection, as follows:

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>DIVING INSPECTION FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSU General Recommendation of 1 or 2, or active structural flag due to a diving condition</td>
<td>12 months</td>
</tr>
<tr>
<td>SSU General Recommendation of 3</td>
<td>24 months</td>
</tr>
<tr>
<td>SSU General Recommendation of 4 or higher</td>
<td>60 months</td>
</tr>
</tbody>
</table>

Some conditions may necessitate an inspection frequency other than the above. The recommendation to do a diving inspection may be made by the Regional Hydraulics Engineer in concurrence with the Regional Structures Management Engineer (RSME).
1.3—Scour Documentation

Soundings (water depth readings):
See chapter 4B.2

Probings along the SSU perimeter and perpendicular to the SSU:
Using a probing tool such as a steel rod, check for soft areas in the streambed along the substructure, recording the depth of penetration. These probing measurements should be equally spaced between the ends of the substructure, at increments not to exceed 10 feet; the locations should coincide with previous inspection readings. The cross-section measurements shall consist of 6 readings at 2 ft. intervals perpendicular to the exposed outer edge of the SSU with one reading at the edge: the sketches should locate the edge relative to the SSU stem. In the “Probing and Sounding Plan” illustration, the stationing is measured along the face of the stem but the probing and sounding measurements begin from the face of the sheet piling.

1.4—Protection Systems

Fenders, dolphins and other devices which protect the substructure from impact, shall be inspected for misalignment, damage, missing elements, assessment of the physical condition of the material and other anomalies. Assessment of all protective devices shall be included in the ratings for the nearest substructure on the rating forms: the backwall and stem ratings for an abutment, stem and column ratings for a pier.
1.5—Damage Evaluation

See the BIRM for scope details for damage due to environmental or accident related issues such as: floods, vessel impact, ice floes, propeller wash from vessels, buildup of debris, and evidence of movement or deterioration.

1.6—Special Considerations

See the BIRM for issues with debris, SSU cleaning, physical limitations, decompression sickness and marine traffic.

1.7—Diving Inspection Report Documentation

Site Conditions

Dry Exception: for an SSU scheduled for a diving inspection which no longer meets the diving inspection criteria: the diving inspection team will satisfy the requirements of BIM chapter 4B.2 or chapter 4B.3. Photographs of the SSU in elevation view should demonstrate that a general inspection team can adequately inspect this SSU.

Low Freeboard Condition: this condition exists when height between the lowest part of the superstructure and the water surface is two (2) feet or less. For tidal waters, if the inspection team is present, the water surface elevation at high tide and/or at low tide should be shown on the elevation sketch.

Evidence of High Water: some structures may show signs of a higher water surface elevation such as debris lodged in the superstructure, erosion of adjacent embankment and discoloration of vegetation on adjacent embankment. The height above the current water elevation should be noted including the supporting observation.

Water Velocity: this is an approximate measure of water flow for the SSU being inspected.

Water Visibility: this is the depth of vision available to the diver: good (2 feet or greater), fair (6 inches to 2 feet), poor (6 inches or less).

Marine Growth: this defines the extent of SSU surface which is available for inspection: negligible (10% or less of surface area), moderate (10% to 50%), heavy (50% or greater). When the growth is defined as moderate or heavy, the Team Leader should determine the need for cleaning with water-blasting equipment.

Polluted Water: this should be noted with supporting observation: smell, surface/water discoloration, foam, etc.

Improvements Observed: examples may include scour mitigation, repair, replacement or additions to the SSU. Scour mitigation examples include stream realignment, riprap/grout-bag repair and debris removal.
Maps and Photographs

Two location maps shall be provided:
- The first map shall be a general map showing the region and county, locating the bridge by BIN.
- The second map shall be a "street" map (USGS 1"=2000') showing the location of the bridge by BIN.
- Both maps shall have North Arrows and shall be adequately sub-titled.
Sufficient information should be detailed for a motorist to locate the BIN site.

Condition Photographs:
The photographs shall have an accurate date stamp (format: month/day/year) electronically imprinted at time of capture. The photographs shall be reviewed for content, clarity and perspective prior to being placed in the inspection report. Generally, photograph content should not be altered electronically or otherwise. Minor adjustments in exposure and the addition of text, lines or arrows for clarification and emphasis are acceptable.

Condition photographs document deficiencies and must be taken:
- When elements are rated 4 or lower.
- For repaired or new bridge elements.
Condition photographs shall include a brief description of what is being represented (e.g.: "Pier 1, column 3 spalling, looking left") and a cross-reference to written comments in the inspection report, if any. Include a photo location plan for all condition photographs in the inspection report. See figure 2.5.4.1 for an example.

Standard photographs typify the feature being represented:
- General configuration of each SSU
- Any unusual components or details, including (but not limited to) dolphins and fenders.
Section 2 – Fathometer Surveys

A fathometer survey is a topographic representation of the channel bottom at the bridge. Comparison with the previous survey identifies any progressive scour activity and any related stream channel aggradation and degradation.

2.1—Fathometer Survey Limits

The limits of the fathometer survey shall be:
- 100' upstream of the upstream structure fascia.
- 100' downstream of the downstream structure fascia.
- the full width of the waterway: edge-of-water to edge-of-water.

At a minimum, measurements shall be made at the intersection of lines that are:
- parallel with the centerline of the bridge at 20' intervals measured in a line perpendicular to the centerline of the bridge.
- perpendicular with the centerline of the bridge at 20' intervals measured in a line parallel to the centerline of the bridge.

Measurements shall be made at the faces of all submerged substructure units (SSUs); contours should end at the face of the substructure unit.

2.2—Fathometer Survey Frequency

The fathometer survey frequency is based on the hydraulic needs of a structure as determined by the Regional Hydraulics Engineer in concurrence with the Regional Structures Management Engineer (RSME).

2.3—Field Procedures

The following approved method of performing fathometer surveys may be substituted. The alternate method shall yield equivalent or better data precision, and shall cost less than or equal to the approved method.

- Existing permanent horizontal control points and benchmark(s) on the structure shall be referenced. Permanent horizontal control points and benchmarks shall be established if previous points are not available. However, if a more appropriate benchmark is to be used, this change shall be supported with sufficient documentation.
- Baseline stations shall be established at appropriate locations within the fathometer survey limits.
- Bridge SSUs and pertinent data shall be located from baseline stations via angle/distance method for horizontal control.
- The transducer arm shall be mounted on the boat so that the prism is continuously visible from the baseline stations.
- Water elevations and depth checks shall be frequently compared with survey data being generated.
- The fathometer unit shall be calibrated before every survey.
2.4—Fathometer Survey Report Documentation

The top right hand corner of every page shall display: Fathometer Survey, BIN, Region & County, Feature carried, Feature crossed.

Fathometer Survey Report shall be assembled in the following sequence:

- Cover sheet shall be formatted as follows:
  - page center shall show the title in bold: line 1: “New York State Department of Transportation,” line 2: "date by year" FATHOMETER SURVEY."
  - in the bottom right hand corner, the Quality Control Engineer (fathometer survey representative) shall sign the reviewed by line, print the name and the title.
  - in the bottom left hand corner, the name of the Prime Consultant and the address shall be shown. If the Subconsultant and/or the Subcontractor are involved, their name and address shall also be shown.

- Location Maps:
  - The first map shall be a general map showing the region and county, and locating the bridge by BIN, with appropriate labeling.
  - The second map shall be a "street" map (USGS 1"=2000’) showing the location of the bridge by BIN. This will be larger than the first map.
  - Both maps shall have North Arrows and shall be adequately sub-titled.

Sufficient information should be detailed for a motorist to locate the BIN site.

- Flag letter and flagged bridge report.

- Standard Photographs: appropriately labeled photographs of upstream and downstream views as seen from the structure fascias.

- Narratives and Notes:
  - Introduction will briefly describe the bridge: number of SSUs, length and width of the bridge, navigable waterway, tidal waters, approximate water velocity and its location, unusual features and conditions, weather, survey crew personnel, location and elevation of benchmarks.
  - The narrative will describe in detail the highest and lowest elevations, and locations of consecutive contour accumulations for the current fathometer survey with emphasis on potential or existing scour holes: these should match the points displayed on the contour plot.
  - For bridges with previous fathometer survey data, a comparative analysis shall compare the current fathometer survey to the previous fathometer survey(s) and to the as-built information. This comparative analysis must, at a minimum, address the differences or similarities between the fathometer surveys in terms of erosion, build-up of material, loss of embedment length, etc. Recommendations for corrective actions and the frequency of fathometer surveys shall also be stated.

- Movement of channel-bottom will be shown in a table:
  - SSU Identification
  - Minimum channel-bottom elevation location
  - Minimum channel-bottom elevation
- Historic minimum channel-bottom elevation: usually the elevation at time of SSU construction
- Year of historic minimum channel-bottom elevation
- Change in channel-bottom elevation
- For substructure units on piles:
  - Pile tip elevation.
  - Pile embedment length
  - If SSU foundation information is not available, state “Unknown”.

- Activity Log shall consist of:
  - Type of access: shore, boat, etc.
  - Boat launch location address and travel time to and from the bridge site
  - Unusual conditions should be explained
  - Special contacts for access or coordination
  - Name of consultant and surveyor performing the fathometer survey
  - Area of fathometer survey
  - The following can be tabulated: date, arrival and departure time from the bridge, temperature range, weather (including wind condition), relevant site comments

- The fathometer survey plot shall include:
  - a D-sized contour map (34"x22") showing the outline of:
    - the bridge fascias.
    - SSUs. The contour lines shall close or "touch" an SSU face. SSUs shall be labeled in accordance with New York State bridge inventory
    - Centerline of the roadway carried by the bridge.
    - For parallel structures, the plot should show the outlines of the adjacent structure’s: fascias, SSUs, roadway centerline
    - stream with streambed elevations at 1' intervals. Shoreline (edge of water) should be demarcated to clearly distinguish from the contour lines
    - North arrow.
  - plot scale.
  - location maps (see earlier definitions).
  - photographs: upstream and downstream bridge elevation views.
  - sketches that clearly locate the baseline, and the horizontal and vertical control points. The level of information shall be sufficient to establish these references for future surveys.
  - sketches shall show bottom of footing elevation. If the SSU is on piles, the sketch shall also show as-built pile-tip elevation and the as-built embedment length.
  - for each SSU, location of minimum channel-bottom elevation shall be identified
  - for an SSU on piles, pile with the least pile embedment shall be identified
  - location notes on benchmarks, and the horizontal and vertical control points.
  - approximate high water line with direction of stream flow (tidal flow direction, as applicable).
  - spot elevations should be shown to emphasize a contour pattern such as a scour pocket. The highest point of a mound or the lowest point of a depression, should be identified with a “+” and labeled with the associated elevation.
  - survey dates should be noted.
  - plot shall be signed and dated by the Fathometer Surveyor and the Quality Control Engineer.

All fathometer readings shall be converted to elevation values, based on an established benchmark on the structure.
Generally, inspection of mechanical and electric components of movable bridges is beyond the scope of general bridge inspections, but structural components of movable spans must be inspected with the same intensity and frequency required for conventional bridges. Therefore, movable bridges shall receive general bridge and diving inspections the same as required for conventional bridges. Additionally, the interaction between the movable bridge and the machinery will also need to be addressed because the mechanical/structural interaction is important for adequate inspection and maintenance of the machinery.

Inspection of electrical and mechanical components necessary for the safe and proper operation of movable bridges is the responsibility of the agency that operates the bridge. These inspections shall take place at a maximum frequency of 72 months (6 years) unless the deterioration or conditions warrant more frequent inspections.

A movable bridge should have its own Operation and Maintenance Manual, although these documents may not be readily available at the bridge site. If the Operation and Maintenance Manual is available, the inspection team should review the manual to determine if there are any special conditions that are exhibited on the bridge. If there is no Operation and Maintenance Manual, sound judgment should be used where specific conditions are encountered that are not covered by this manual.

Note that movable bridges are considered “complex bridges”. See Appendix C for guidance regarding 100% hands-on inspection and associated BiN folder documentation requirements.

Additional information regarding movable bridges may be found in the AASHTO Movable Bridge Inspection, Evaluation and Maintenance Manual and the FHWA Bridge Inspector’s Reference Manual.
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NY APPENDIX F

SUSPENSION AND CABLE-STAYED BRIDGES

Most suspension and cable-stayed bridges are large, unique structures that require specialized bridge-specific inspections according to specifications provided by the owner. If there are no specific instructions to the inspector, use the following information and the guidelines in the FHWA Bridge Inspector’s Reference Manual and the FHWA Primer for the Inspection and Strength Evaluation of Suspension Bridge Cables (Publication No. FHWA-IF-11-045). Note that suspension and cable-stayed bridges are considered “complex bridges”. See Appendix C for additional information regarding 100% hands-on inspection and associated BIN folder documentation requirements.

All suspension bridges have common features that the inspector needs to be aware of. The superstructure is supported by vertical suspenders, which in turn, are supported by a main suspension system. That system usually consists of two or more large cables, but eyebar chains may be found on older or smaller bridges. The suspension system is in tension and requires substantial end anchorage with at least one intermediate pier support. The main suspension system is considered fracture-critical, and load-path non-redundant, thus requiring special inspection techniques.

Eyebar chains must be inspected with the same inspection intensity as any fracture-critical tension member. The entire chain length must be inspected 100% hands-on. This type of detail is particularly vulnerable because steel used for eyebars often has poor notch toughness; therefore the chains are susceptible to cracks. The likelihood of corrosion especially at the connections, contributes to the vulnerability of this type of system.

Full hands-on inspection of main suspension cables may not be necessary because they are fabricated from many individual strands and thus have a high degree of internal redundancy. It is, however, necessary to give special consideration to these components and if the detected conditions so warrant, a full 100% hands-on inspection may be required. The inspector should walk along the entire length of the cable to assess the condition of the wrapping, cable bands, and the suspender to cable band connections. A mirror mounted on the end of a stick or pole is used to inspect the cable underside. Any corrosion on the cable underside may be very serious — water may be leaking through the cable.

At the splay casting, the main cable divides into smaller strands. All accessible wires and anchor bars in this area (anchorage zone) shall be inspected 100% hands-on. Document carefully and thoroughly, any broken or corroded wires or anchor bars.

Cable-Stayed bridges have one or more towers (piers), from which main cables directly support the bridge deck. These main cables should be inspected with some considerations similar to those mentioned above for the suspension bridge main suspension cables. These main cables will also have additional inspection requirements that are beyond the scope of this appendix.
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NY Appendix G

Required Tools and Equipment

Each team performing general bridge inspections must have proper tools available at the site. Additional equipment may be required and should be available on an as-needed basis. All tools must satisfy OSHA requirements.

As indicated in the most current version of the FHWA Bridge Inspection Reference Manual: Several factors play a role in what type of equipment is needed for an inspection. Bridge location and type are two of the main factors in determining equipment needs. If the bridge is located over water, certain pieces of equipment such as life jackets and boats may be necessary on-site. Also, if the bridge is made of timber, then specific pieces of equipment like increment borers and ice picks are needed, whereas they would not be necessary on a steel or concrete bridge. Another factor influencing equipment needs is the type of inspection. It is therefore important to review every facet about the bridge before beginning an inspection. A few minutes spent reviewing the bridge files and making a list of the necessary equipment can save hours of wasted inspection time in the field if the inspectors do not have the required equipment.

Each team should be equipped with the following:

- Work-zone protection and traffic control equipment, including signs, traffic cones and flags.
- Personal safety equipment including first-aid kit, hard hats, vests, goggles, face shields, full body harnesses, and lanyards.
- Basic access equipment such as a step ladder, extension ladder and rope.
- Tools for cleaning, including a whisk broom, wire brush, scraper, shovel and broom, heavy duty garbage bags to dispose of removed debris, and disk and die grinder.
- Tools for inspection, including chipping hammers, pocket knives, screwdrivers or awls, increment borer, magnifying glass, binoculars, flashlights, lead or drop light (including 110 VAC power source), mirrors, tool belt, etc.
- Tools for measuring, such as a plumb bob, protractor, levels, folding rules, tapes, calipers, pocket rulers, thickness gauges, optical crack gauge, D-meter capable of reading through paint, scour probing rods, vertical clearance rod, weighted sounding lines, thermometer, laser distance measuring device, tilt meter, etc.
- Tools for documentation, such as a digital camera with electronic flash, triangles, straight edges, steel scribes, center punches, engineer/architect scales, magnetic compass, inspection forms, inspection software and computer, etc.
- Cellular phone, internet access Air Card, and list of emergency contacts.
- Consumable supplies, including lumber crayons, spray paint, zinc-rich primer, dye-penetrant test materials (penetrant, cleaner, developer, rags), camera batteries, disposable dust/nuisance respirators, etc.
- GPS
Each team should have access to the following equipment as-needed:

- Equipment for working over water, such as life jackets, waders, one or more ring buoys with at least 115 feet 35 m of attached line, and if necessary an approved skiff which is properly equipped and manned with a trained operator.
- Drills or ram-set guns and epoxy adhesive for mounting BIN plates.
- Personal protective equipment such as rain suits, gauntlet gloves, rubber boots, etc.

Each Team Leader and Quality Control Engineer shall be equipped with the following manuals:

- NYSDOT’s
  - Bridge Inspection Manual (with Technical Advisories)
  - Bridge Inspection Safety Manual
  - Bridge Inventory Manual

- AASHTO’s
  - Manual For Bridge Element Inspection
  - The Manual for Bridge Evaluation

- FHWA’s
  - Bridge Inspector’s Reference Manual

These publications shall be available for reference in the field.
Environmental lead contamination is of increasing concern. Lead-based paint used on bridges can contribute to this contamination. While the impact of general bridge inspections on lead contamination levels is minimal due to the nature and volume of waste produced, NYSDOT will make every effort to avoid contributing to potential public health concerns as a result of its bridge inspection activities.

Paint debris released as a consequence of general bridge inspection must be collected, labeled, and disposed of properly. The debris should be collected in buckets or other suitable containers as it is produced by using brooms or other devices to prevent it from dropping below the bridge. If debris drops below the bridge, all reasonable and prudent steps must be taken to collect it. The collected debris should be disposed of under contract or removed from the site for disposal as directed by the Region, in conformance with State and Federal regulations.

Refer to the New York State Department of Transportation Bridge Inspection Safety Manual for additional guidelines on lead paint.
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Technical Advisories (T.A.’s) are a form of communication used by the Office of Structures to provide technical information to those involved with bridge inspection activities.

Some T.A.s issued have been superseded by this manual. Listed below are bridge inspection Technical Advisories that remain in effect as of the issuance of this manual:

**INSPECTION**

85-001  Introduction to Technical Advisory

The following T.A.’s are superseded by this manual:

**INSPECTION**

TA 13-001  Types and Required Intervals of Bridge and Diving Inspections
TA 15-001  Classification of Bridge Flagging Procedure Post-repair PE Certification
TA 15-002  Bridge Inspection Special Emphasis Details
Represented here is a new form for communication from the Structures Division. Entitled TECHNICAL ADVISORY, abbreviated as T.A., it will provide technical information to those involved with bridge Inventory, Inspection, and Level Two Load Rating activities.

Attached are copies of blank Inventory, Inspection, and Level Two Load Rating T.A. forms, differentiated by the shaded unit title boxes located along the right hand side of each page. The smaller box, below the unit title box, will contain the last two digits of the year issued plus a three digit T.A. issue number. Should a particular T.A. need revision, then a new T.A. will be issued with the year and T.A. number that it supersedes in the “Supersedes” box in the heading. At the end of each year, an index for that year's issuances will be printed for reference.

Issuance of all T.A.'s will be from the appropriate unit or sub-unit within the Structures Division. During training sessions, each attendee will receive a copy of all current T.A.'s. A normal issuance to the Regions will each consist of copies to the Regional Director, Regional Structures Engineer, Regional Bridge Inventory Coordinator and State Employee Bridge Inspection Team Leader, Assistant Team Leader and Senior Engineering Technicians. Current issuances will be given to all new Contract Engineers by the Structures Division at project start up meetings.

However, after the start up meeting, it will be the Regional Structure Engineer's responsibility to distribute any new T.A. issuances to onboard Contract Engineers.

Suggestions from Regions for possible issuance of a T.A. are encouraged. Suggestions should be sent to the appropriate unit in the Structures Division for consideration.

Questions concerning this T.A. should be addressed to the Inventory and Inspection Unit in the Structures Division.

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<th>SUBJECT:</th>
<th>DATE:</th>
<th>SUPERSEDES:</th>
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<td>INTRODUCTION TO TECHNICAL ADVISORY</td>
<td>2/21/85</td>
<td>85-001</td>
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<th></th>
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<th></th>
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</thead>
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<tr>
<td>J.M. O’Connell, Deputy Chief Engineer (Structures)</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
NY APPENDIX J
USING THE FEDERAL SCALE

Introduction

In order to accurately supply the Federal Highway Administration with required bridge condition information, it is necessary to collect the data directly in the field using the Federal Rating Scale. Inspectors will need to follow the instructions in the FHWA "Bridge Inspector's Reference Manual" and the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges" (Report No. FHWA-PD-96-001) when determining the Federal Ratings for all bridges. For each bridge, the inspector rates five items using the federal scale: deck, superstructure, substructure, channel and channel protection and culvert. When rating these items, the inspector shall consider the condition of the entire bridge. Refer to the FHWA "Bridge Inspector's Reference Manual" for further directions on item rating. This appendix contains the complete FHWA rating information (reprinted below verbatim) as described in the FHWA "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges" and is annotated in italics to clarify areas of possible confusion arising from differences between the FHWA and NY State inspection procedures. Inspectors should not use a table to convert from the NYSDOT rating to FHWA rating and instead provide a National Bridge Inventory (NBI) rating based on the following condition descriptions:

Federal Rating System

Item No. 58 through Item No. 62 - Indicate the Condition Ratings

In order to promote uniformity between bridge inspectors, these guidelines will be used to rate and code Items 58, 59, 60, 61, and 62.

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

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

Portions of bridges that are being supported or strengthened by temporary members will be rated based on their actual condition; that is, the temporary members are not considered in the rating of the item.

Completed bridges not yet opened to traffic, if rated, shall be coded as if open to traffic.
The following general condition ratings shall be used as a guide in evaluating Items 58, 59, and 60:

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>NOT APPLICABLE</td>
</tr>
<tr>
<td>9</td>
<td>EXCELLENT CONDITION - no problems noted.</td>
</tr>
<tr>
<td>8</td>
<td>VERY GOOD CONDITION - some minor problems.</td>
</tr>
<tr>
<td>7</td>
<td>GOOD CONDITION - structural elements show some minor deterioration</td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY CONDITION - all primary structural elements are sound, but may have minor section loss, cracking, spalling or scour.</td>
</tr>
<tr>
<td>5</td>
<td>FAIR CONDITION - structural elements show some minor deterioration</td>
</tr>
<tr>
<td>4</td>
<td>POOR CONDITION - loss of section, deterioration, spalling or scour.</td>
</tr>
<tr>
<td>3</td>
<td>SERIOUS CONDITION - all primary structural elements are sound, but may have minor section loss, cracking, spalling or scour.</td>
</tr>
<tr>
<td>2</td>
<td>CRITICAL CONDITION - advanced deterioration of primary structural elements.</td>
</tr>
<tr>
<td>1</td>
<td>&quot;IMMINENT&quot; FAILURE CONDITION - advanced deterioration of primary structural elements.</td>
</tr>
<tr>
<td>0</td>
<td>FAILED CONDITION - out of service beyond corrective action.</td>
</tr>
</tbody>
</table>

Item 58 – Deck

This item describes the overall condition rating of the deck. Rate and code the condition in accordance with the above general condition ratings. Code N for culverts and other structures without decks e.g., filled arch bridge.

Concrete decks should be inspected for cracking, scaling, spalling, leaching, chloride contamination, potholing, delamination, and full or partial depth failures. Steel grid decks should be inspected for broken welds, broken grids, section loss, and growth of filled grids from corrosion. Timber decks should be inspected for splitting, crushing, fastener failure, and deterioration from rot.

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

Decks integral with the superstructure will be rated as a deck only and not how they may influence the superstructure rating (for example, rigid frame, slab, deckgirder or T-beam, voided slab, box girder, etc.). Similarly, the superstructure of an integral deck-type bridge will not influence the deck rating.

Note: The New York State rating system requires the deck be rated "8" (not applicable) for structures such as frames, slabs, and those with side-by-side prestressed concrete box-beams. The Federal Rating System, on the other hand, requires a deck rating for all
structures except culverts and structures with fill between the riding surface and the superstructure which should be coded "N" (not applicable) on the Federal Rating Form. When coding an "N" on the Federal rating Form, the type of structure should be noted (i.e.) concrete rigid frame with fill. All structures which are not culverts or do not have fill between the riding surface and the superstructure should receive a rating number for this item.

**Item 59 – Superstructure**

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

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

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

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

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

*Note: Since the New York State rating system includes miscellaneous superstructure elements such as bearings, joints, paint system, etc., the coding of these individual elements is part of the (NYSDOT) Bridge Inspection Report (BIN folder). Therefore, it is not necessary to repeat notes specific to these elements on the Federal Rating Form.*

**Item 60 – Substructure**

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

All substructure elements should be inspected for visible signs of distress including evidence of cracking, section loss, settlement, misalignment, scour, collision damage, and corrosion. The rating given by Item 113 - Scour Critical Bridges, may have a significant effect on Item 60 if scour has substantially affected the overall condition of the substructure.

The substructure condition rating shall be made independent of the deck and superstructure. Integral-abutment wingwalls to the first construction or expansion joint shall be included in the evaluation. For non-integral superstructure and substructure units, the substructure shall be considered as the portion below the bearings. For structures where the substructure and superstructure are integral, the substructure shall be considered as the portion below the superstructure.
Note: Collision protection devices are considered in the determination of this item for the Federal Rating Form.

Item 113 is a Federal item. While scour is a critical situation and should be considered in the rating of a bridge substructure, the computation of Federal Item 113 is done by the Department’s Structures Division Bridge Safety Assurance Unit. However, if the Hydraulic Vulnerability Assessment report is available for the bridge, and contains a rating of 2 or less for item 113, it should be reflected in your coding of this item (no. 60).

Item No. 61 - Channel and Channel Protection

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

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

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>NOT APPLICABLE - use when bridge is not over a waterway (channel).</td>
</tr>
<tr>
<td>9</td>
<td>There are no noticeable or noteworthy deficiencies which affect the condition of the channel.</td>
</tr>
<tr>
<td>8</td>
<td>Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.</td>
</tr>
<tr>
<td>7</td>
<td>Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel have minor amounts of drift.</td>
</tr>
<tr>
<td>6</td>
<td>Bank is beginning to slump. River control devices and embankment protection have widespread minor damage. There is minor stream bed movement evident. Debris is restricting the waterway slightly.</td>
</tr>
<tr>
<td>5</td>
<td>Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.</td>
</tr>
<tr>
<td>4</td>
<td>Bank and embankment protection is severely undermined. River control devices have severe damage. Large deposits of debris are in the channel.</td>
</tr>
<tr>
<td>3</td>
<td>Bank protection has failed. River control devices have been destroyed. Stream bed aggradation, degradation or lateral movement has changed the channel to now threaten the bridge and/or approach roadway.</td>
</tr>
<tr>
<td>2</td>
<td>The channel has changed to the extent the bridge is near a state of collapse.</td>
</tr>
<tr>
<td>1</td>
<td>Bridge closed because of channel failure. Corrective action may put bridge back in light service.</td>
</tr>
<tr>
<td>0</td>
<td>Bridge closed because of channel failure. Replacement necessary.</td>
</tr>
</tbody>
</table>
**Item No. 62 – Culverts**

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

Item 58 - Deck, Item 59 - Superstructure, and Item 60 - Substructure shall be coded N for all culverts.

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

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>NOT APPLICABLE - Use if structure is not a culvert</td>
</tr>
<tr>
<td>9</td>
<td>No deficiencies.</td>
</tr>
<tr>
<td>8</td>
<td>No noticeable or noteworthy deficiencies which affect the condition of the culvert. Insignificant scrape marks caused by drift.</td>
</tr>
<tr>
<td>7</td>
<td>Shrinkage cracks, light scaling, and insignificant spoiling which does not expose reinforcing steel. Insignificant damage caused by drift with no misalignment and not requiring corrective action. Some minor scouring has occurred near curtain walls, wingwalls, or pipes. Metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting.</td>
</tr>
<tr>
<td>6</td>
<td>Deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls, or pipes. Metal culverts have a smooth curvature, non-symmetrical shape, significant corrosion or moderate pitting.</td>
</tr>
<tr>
<td>5</td>
<td>Moderate to major deterioration or disintegration, extensive cracking and leaching, or spalls on concrete or masonry walls and slabs. Minor settlement or misalignment. Noticeable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection in one section, significant corrosion or deep pitting.</td>
</tr>
<tr>
<td>4</td>
<td>Large spalls, heaving scaling, wide cracks, considerable efflorescence, or opened construction joint permitting loss of backfill. Considerable settlement or misalignment. Considerable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection throughout, extensive corrosion or deep pitting.</td>
</tr>
<tr>
<td>3</td>
<td>Any condition described in Code 4, but which is excessive in scope. Severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe scour or erosion at curtain walls, wingwalls, or pipes. Metal culverts have extreme scour or erosion at curtain walls, wingwalls, or pipes. Metal culverts have extreme distortion and deflection in one section, extensive corrosion, or deep pitting with scattered perforations.</td>
</tr>
<tr>
<td>CODE</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>2</td>
<td>Integral wingwalls collapsed, severe settlement of roadway due to loss of fill. Section of culvert may have failed and can no longer support embankment. Complete undermining at curtain walls and pipes. Corrective action required to maintain traffic. Metal culverts have extreme distortion and deflection throughout with extensive perforations due to corrosion.</td>
</tr>
<tr>
<td>1</td>
<td>Bridge closed. Corrective action may put bridge back in light service.</td>
</tr>
<tr>
<td>0</td>
<td>Bridge closed. Replacement necessary.</td>
</tr>
</tbody>
</table>

*Note: This item should be rated only if the General Type Main Span is coded "culvert" (19) in the Bridge Inventory. If the General Type Main Span is not "culvert", provide an "N". If the General Type Main Span is "culvert", give a rating for the Culvert item and rate the Deck Superstructure and Substructure items as "N".*
NY Appendix K

Specification for In-Depth Inspections

Introduction

Uniform Code of Bridge Inspection (UCBI) (see NY Appendix A) Section 165.4d defines an In-Depth Inspection as a comprehensive detailed inspection of an entire bridge which frequently incorporates destructive, as well as, non-destructive inspection techniques. It is more complete and more intensive than a General Inspection and the results of such an inspection can be used to satisfy the UCBI requirements for a General Inspection. In-depth Inspections are performed on an "as needed" basis to assist in making bridge rehabilitation versus replacement decisions, and to assist in the development of bridge rehabilitation designs.

It is imperative when planning an In-depth Inspection that Main Office/Regional design project managers coordinate with Regional Inspection Unit in order to ensure that duplicative inspection efforts will not occur. This coordination should explore the feasibility of utilizing existing consultant/state bridge inspection personnel to perform both the in-depth inspection and general inspection as one activity. All personnel performing an in-depth inspection are required to meet the qualifications specified in the UCBI (see Section 165.5), the NBIS and the BIM (see NY Section 2A.3). If the In-depth Inspection will be performed independent of consultant/state bridge inspection staff, then the contract Request for Proposal (RFP) and scope shall clearly specify the following:

1. An In-depth inspection shall also include producing a general bridge inspection report.
2. Inspection team shall meet appropriate qualifications and training requirements specified in the UCBI and the National Bridge Inspection Standards (NBIS).
3. Pre-approval of the Inspection Team (Team Leader and Assistant Team leader) and Quality Control Engineer by the Main Office Inspection Unit Supervisor is required before the start of the in-depth inspection.
4. A general inspection shall be waived only at the discretion of the Main Office Bridge Inspection Unit Supervisor.
TABLE OF CONTENTS

I. Purpose

II. Scope of Work

III. Personnel Requirements

IV. Recording Procedure
   A. BIN Folders
   B. In-Depth Inspection Documentation
   C. Design Approval Documents/Structural Integrity Evaluations

V. Details of In-depth Inspection
   A. General
   B. Approaches
   C. Waterways
   D. Piers, Abutments and Bents
   E. Bearings
   F. Stringers, Girders and Floor Beams
   G. Expansion Joints
   H. Decks and Wearing Courses
   I. Curbs
   J. Sidewalks
   K. Bridge Railing
   L. Trusses (Metal)
   M. Trusses (Timber)
   N. Movable Bridges
   O. Suspension Bridges
   P. Signs
   Q. Encroachments

VI. In-depth Inspection Form
I. Purpose

The purpose of this inspection is to provide comprehensive documentation as to the current condition of specific structure elements and the entire bridge. This information will be used to determine the extent to which a rehabilitation project must progress to satisfy project objectives and/or assist in the rehabilitation versus replacement decision. If, as the in-depth inspection progresses, it becomes obvious that rehabilitation will not be a viable option, the Designer should contact the Department’s Project Manager. The Project Manager will determine whether or not to continue the inspection. This should be done with concurrence from the Office of Structures. The Designer should document the findings along with the rationale for the decision.

II. Scope of Work

The Designer shall perform an in-depth inspection on the following structures:
BIN __________________ , …

The intent of these inspections is to perform a high-quality, detailed engineering study of each bridge and to document the findings for easy reference.

III. Personnel Requirements

Qualifications (experience, certifications, and training) and responsibilities of bridge inspectors shall be in accordance with Section 165.5. (a) (1) of the Uniform Code of Bridge Inspection and the NBIS.

IV. Recording Procedure

A. BIN Folders

BIN (bridge identification number) folders for each state and local bridge are kept in the Region. This file will have all available information which the Region has for this structure and should include:

1. Most recent General Inspection Report.
2. Inventory Computer print-out.
3. Original plans of the structure and subsequent contract work.
4. Photographs of the structure and of problem areas.
5. Copies of the Level I load rating calculations (if available).
6. Structural and Safety Flag Reports.

This folder will be turned over to the Designer for use on the project, but must be returned to the Regional Office upon completion of this contract.
B. **In-Depth Inspection Report**

Material generated from the bridge inspection and evaluation shall be included in the In-Depth Inspection Report. This shall include, but is not limited to:

2. Sketches, measurements, profiles, etc.
3. All photographs.
4. All load rating calculations.
5. All core information (when required).
6. Summary Report - This Summary Report shall generalize the overall condition of the bridge and document particular problem areas. The Summary Report shall include recommendations.

The original of these materials shall be put into the BIN folder.

C. **Design Approval Documents/Structural Integrity Evaluations**

When the In-depth Inspection is being performed as part of a capital project, the In-Depth Inspection Report should be included as a separate technical appendix to the Design Approval Document (DAD). In addition, the Summary Report should be included in the text of the DAD when describing feasible alternatives. See the current DOT Design Procedure Manual for its appropriate location in the DAD.

When the In-depth Inspection is being performed as part of a Structural Integrity Evaluation (SIE), the In-Depth Inspection Report should be included as a separate technical appendix to the SIE Report.

V. **Details of In-Depth Inspection**

A. **General Requirements for In-Depth Inspection**

In general, the In-Depth Inspection shall consist of:

1. Prepare a report for each bridge in conformance with the requirements of “Recording Procedure”.
2. Complete a “Bridge Inspection Report” for each bridge.
3. Photograph the bridge, as appropriate.
4. Direct access shall be made for visual examination to all bridge elements normally exposed to the atmosphere.
5. Field notes, sketches, photographs and measurements shall be made to document deterioration and unusual structural behavior, or observations.
6. When no plans of the existing bridge are available, sufficient measurements and sketches shall be made to analyze the superstructure for load rating. This includes connections.

7. If, after thorough visual inspection, the Designer feels that non-destructive testing is required at specific locations, they shall bring the situation to the attention of the Project Manager, in writing. After reviewing the situation, the Project Manager in coordination with Office of Structures Bridge Inspection Unit will determine if non-destructive testing is to be done. If testing is necessary, the Designer shall prepare the surfaces for the testing and provide suitable access to the test locations (scaffolding, etc.). Special consideration shall be given for the possible need of non-destructive testing in the following situations:

   a. To define the depth and length of visible cracks on main supporting members.
   b. To determine the quality of questionable appearing welds and adjacent base metal in tension areas on main supporting members.
   c. To examine hangers supporting suspended spans.
   d. To examine main member eyebars on eyebar trusses when these connections appear to be frozen or show significant signs of distress, such as corrosion, displacement, or cracks.
   e. To determine the condition of prestressing strands in concrete structures, when corrosion/section-loss of strands is suspected.
   f. At other locations that the team leader, Professional Engineer, determines necessary.

8. A bridge deck evaluation will be performed in accordance with the established industry standards (such as ground penetrating radar (GPR), chloride potentials, soundings, etc.).

9. Inspect, make field notes and measurements to evaluate and document the condition of nearby non-bridge related elements that could affect the bridges’ ability to function properly. Examples of this are inspecting channel rip-rap, inspecting the channel for scour and sandbars in the vicinity of the bridge and inspecting nearby embankments for stability and erosion.

10. Inspect, make field notes and measurements to evaluate and document the condition of the bridge approach elements. Examples of this are inspecting approach railings, approach slabs, pressure-relief joints, and approach drainage.

11. Prepare a written "Summary Report" describing the findings of the inspection. This report shall include:

   a. Summary of the condition of the bridge.
   b. Details of deficiencies found.
   c. Identification of potential future trouble spots.
   d. Suggestions about posting or changing existing postings.
   e. Comparison of the geometric of bridge in relation to the geometric of the highway it carries.
   f. Identification of any environmental problems.
   g. Recommendations as may be appropriate.
This "Summary Report" shall be written by the Professional Engineer supervising the field inspection.

12. The Inspector(s) shall sign and date the In-Depth Inspection form under “Inspected By”.

13. After all pertinent materials have been gathered, the Professional Engineer who supervised the field inspection shall review the entire content of each individual BIN folder, including bridge load rating calculations. After this review, he shall sign the In-Depth Inspection Form under "Completed In-Depth File Reviewed By". In signing, the Professional Engineer is confirming that he is of the opinion that each file is complete and accurately reflects the condition of the bridge.

B. Approaches

Approaches are considered to be no less than 100 ft from each end of the bridge.

Approach pavement shall be checked for cracking, rutting, unevenness, settlement, and roughness. General observations shall be made as to its rideability and its effectiveness in transitioning traffic on and off the bridge without inducing excessive impact toads. Pressure relief joints shall be inspected for condition and rideability.

C. Waterways

Observe the adequacy of the waterway opening under the structure. Existing bank protection and other protective devices shall be checked to observe if they are sound and functioning properly. Determine if changes in the channel have caused the present protection to become inadequate and if it may be advisable to place more protection or to revise the existing protection.

See that the waterway is not obstructed and that it affords free flow of water. State whether the waterway opening appears "adequate" or "inadequate".

Photograph the channel on both sides of the bridge.

D. Piers, Abutments and Bents

1. General – Elevations shall be taken at some convenient point near the outer limits of each independent substructure unit. The plumbness or batter of each independent substructure shall be measured.

2. Footings – Investigate footings in water for scour or undercutting. This shall be done by probing the channel surface in accordance with the procedure described in the current NYSDOT Bridge Inspection Manual. It may be required to provide a diver for underwater inspection of substructures for some special cases. It may be required to dig test pits to examine footings in unusual situations. The Designer shall obtain approval from the Regional Structures Unit before physically digging any test pits in the field.
3. **Concrete Elements** – Examine and document all exposed concrete surfaces for deterioration and cracking and noticeable movement.

4. **Metal Elements** – Examine and document all metal elements for loss of section due to corrosion. Where corrosion has occurred, enough debris, loose laminated metal and heavy rust shall be removed to determine the critical locations for metal loss of the various components. At these locations d-meters, micrometers, calipers, or other equally accurate devices shall be used to measure the remaining effective metal sections. Field notes and sketches shall be prepared to document the remaining metal. Where metal elements are encased in concrete, the Designer shall remove concrete at representative deteriorated locations and points where seepage might typically be expected in order to determine the condition of the metal. All metal members shall be visually examined for cracks. An especially close inspection shall be made at:
   
   a. Weld locations.
   b. Unusual connections.
   c. Bolts and rivet holes.
   d. Areas of extensive deterioration.
   e. Locations where members with large differences in relative stiffness are connected.
   f. Areas that exhibit unusually large deflections or vibrations with the passage of live loads.
   g. Areas subject to fatigue.
   h. Areas subject to impact damage.
   i. Tension areas of main load carrying members.

   All cracks found during the inspection shall be thoroughly documented with sketches, measurements, and photographs. Where cracks are found and are considered to be of particular significance due to location or size, they shall be brought to the attention of the Project Manager to be further defined by non-destructive methods.

5. **Timber** – Timber members must be checked for decay, especially in areas where they are alternately wet and dry.

   An increment borer shall be used to obtain representative samples of timber members. The location of these samples shall be selected so as to well represent overall timber conditions. The Professional Engineer supervising the inspection shall locate all borings. All holes made for testing shall be filled with treated plugs. Photographs shall be made of all core samples.

E. **Bearings**

   1. **General** – Examine all bearing devices, elements and anchor bolts to ascertain that they are functioning properly. Photographs shall be taken of typical bearing conditions. If it has already been determined that the bearings will be replaced, inspection/documentation should be limited to ensuring that the bearings will function until they are replaced.

   2. **Rocker Bearings** – Measure the tilt of each rocker bearing to the nearest 1/8”. Measure the amount the top edges project away from the bottom edges in addition to depth, width, and
thickness. Sketch each bearing. Record the temperature and weather conditions at the time of the measurements.

3. **Sliding Plate Bearings** – Sketch each bearing and make the necessary measurements to define the location of the sliding plate in reference to the fixed masonry plate. Record the temperature and weather conditions at the time of the measurements.

4. **Elastomeric Bearings** – Measure every elastomeric bearing to within 1/8”. Measure the amount the top edges project away from the bottom edges in addition to depth, width, and thickness. Sketch each bearing. Record the temperature and weather conditions at the time of the measurements.

5. **Hangers** – Suspended spans are often hung with tension hangers. On tension hangers, make a measurement between pins by dropping a plumb bob from the center of the top pin and measuring horizontally to the lower pin. Record the temperature and weather conditions at the time of the measurement. Examine hangers carefully for tension and shear cracks. If any welds, rivets, or bolts restrain any portion against rotation, the situation shall be recommended for non-destructive testing. Observe nuts for tightness and pin areas for excessive wear. Check to see if the pins appear frozen.

F. **Stringers, Girders and Floor beams**

1. **General** – Examine all stringers, girders, and floor beams for buckling, cracking, impact damage, and fire damage. Tension areas shall be inspected carefully for cracks. Determine if any unusual vibration or deflections occur with the passage of live loads. Photographs shall be taken of typical stringer and girder areas. Also, any unusual problem areas shall be photographed.

2. **Metal** – Examine all metal elements for loss of section due to corrosion.

   D-meters, microcomputers, calipers, or other equally accurate devices shall be used to measure the remaining effective metal sections at the critical locations. Field notes and sketches shall be prepared to document the remaining sections. Where metal elements are encased in concrete, the consultant shall remove concrete at representative deteriorated locations and points where seepage might typically be expected in order to determine the condition of the metal. This information shall be used in determining the load rating of the bridge.

   Examine all metal elements visually for cracking. An especially close visual inspection for cracks shall be made at:

   a. Weld locations, particularly weld terminations and other AASHTO fatigue category weld details.
   b. Re-entry cuts.
   c. Copes.
   d. Unusual connections.
   e. Bolt and rivet holes.
f. Areas of excessive deterioration.
g. Locations where members with relatively large differences in stiffness are connected.
h. Areas that exhibit unusually large deflections or vibrations with the passage of live loads.
i. Areas subject to fatigue.
j. Areas subject to accident damage.
k. Ends of stiffener welds.
l. Areas subject to tensile stress.

All cracks found during the inspection shall be thoroughly documented with sketches, measurements, and photographs. The visible limits of cracks shall be delineated with paint on the bridge member and dated for future reference. Where cracks are found of potentially major structural significance due to location or size, they shall be recommended to be further defined by non-destructive testing methods.

3. **Concrete Girders** – Examine all exposed concrete surfaces for deterioration and stress cracking.

   Particular attention shall be given to cracks in prestressed members. All cracks in prestressed members shall be documented. The visible ends of all significant cracks in prestressed members shall be marked with paint on the bridge member.

4. **Timber** – all requirements stated under "V. D. Piers, Abutments and Bents – 5. Timber", apply to timber stringers. This includes sampling with an increment borer.

G. **Expansion Joints** – Expansion joints shall be examined carefully both top and bottom.

   Determine if joints are effectively sealing out water from the roadway if they were designed to do so.

   The opening of all expansion joints shall be measured and recorded with the temperature and weather conditions at the time of the measurement.

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

   Concrete decks and wearing courses must be checked for cracking, leaching, scaling, pot-holing, spalling, damp spots, and other signs of deterioration. Each item must be evaluated to determine its condition and its ability to maintain a smooth riding surface.

   All decks should be examined for slipperiness to determine if a hazard exists. Also, check drainage to see that the decks are well drained with no areas where water will pond and produce a hazard to traffic. Check drains and scuppers to see that they are open and clear. Check to see that drain outlets do not discharge water where it may be detrimental to other members of the structure, cause fill and bank erosion, or spill onto a traveled way below.
I. **Curbs** – Examine concrete curbs for cracks, spalls, and deterioration. Note any loss of height resulting from building-up surfacing on the deck.

J. **Sidewalks** – Examine concrete sidewalks for cracks, scaling, potholing, spalling, or other deterioration.

Timber sidewalks should be checked for soundness of the timber and to determine if the floor planks are adequately supported. Determine if the floor is nailed or fastened down securely to the stringers or sleepers.

Steel sidewalks should be checked for corrosion and to see that all connections are secure.

All sidewalks should be examined for proper drainage and to see that the surface is not excessively rough.

K. **Bridge Railing** – All traffic rail systems and all pedestrian rail systems shall be inspected for damage and deterioration.

L. **Trusses (Metal)** – All provisions under Section 4.8.3.6 Trusses, of the current AASHTO *Manual for Bridge Evaluation* shall apply. In addition, the provisions under "V. F. Stringers, Girders, and Floor beams – 1. General and 2. Metal" in this Specification also apply.

M. **Trusses (Timber)** – All provisions under Section 4.8.3.6 Trusses, of the current AASHTO *Manual for Bridge Evaluation* shall apply. In addition, the provisions under "V. F. Stringers, Girders and Floor Beams – 1. General and 4. Timber" in this Specification also apply.

N. **Movable Bridges** – All provisions under Section 4.9.1 Movable Bridges of the current AASHTO *Manual for Bridge Evaluation* shall apply. In addition, the provisions under "V. F. Stringers, Girders and Floor beams – 1 General and 2. Metal" and "V. L. Trusses (Metal)" in this Specification also apply.

O. **Suspension Bridges** – All provisions under Section 4.9.2 Suspension Bridges of the current AASHTO *Manual for Bridge Evaluation* shall apply. In addition, the provisions under "V. F. Stringers, Girders and Floor beams – 1. General and 2. Metal" and "V. L. Trusses (Metal)" in this Specification also apply.

P. **Signs** – All signs shall be inspected for damage and deterioration. For bridges over navigable channels, check to see that the required navigational signs for water traffic are in place and in good condition. See that navigational lights are properly installed in their intended position and functioning. See that aerial obstruction lights on high bridges are functioning.
Q. **Encroachments** – The number and types of utilities, sewer pipelines and other encroachments attached to or enclosed in the bridge and encroachments in the immediate vicinity must be kept on record. Note if any encroachments are obstructing the waterway or are in such a position that they may hinder drift removal during periods of high water. Also, note if the encroachment is located where there is a possibility that it may be hit and damaged by traffic or by ice and debris carried by high water.

See that encroachments are adequately supported and are not a hazard to any traffic which may use or pass under the structure. Check closely for any adverse effect encroachment may have on the bridge. Check to see if vibration or expansion movements are causing cracking in the support members or if the paint is being damaged. Note the aesthetic effect encroachments may have on the bridge. This Item must be considered in permitting encroachments to remain on a bridge. The general appearance of the vicinity around the structure will be factor in making the determination.
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NY APPENDIX L
GROUND BASED SAFETY INSPECTIONS

In order to maintain a safe transportation infrastructure system, non-highway structures over the State highway system shall receive ground based safety inspections on a biennial basis. These inspections are not applicable to any such structures that are owned by the NYSDOT and are already included in the regular annual or biennial inspection program (for example, Department owned Railroad bridges that are inspected by the Department on an annual basis and Department owned pedestrian bridges that are inspected on a biennial basis).

The ground based inspection is a visual inspection performed from ground level to ascertain any obvious concerns with the structure as it relates to the safe operation of the under roadway. The ground based inspection applies only to those span(s) that pass directly over the State’s highway right-of-way or other spans whose failure or distress would affect the highway use or safety.

It is the responsibility of the Region to ensure that any non-highway structure that crosses a state highway:

- has a BIN number assigned.
- is listed in the current NYSDOT inventory.
- has accurate vertical clearance data in the inventory (relative to the feature crossed).
- has accurate vertical clearance posting signs in place per State highway law requirements.

A ground based inspection report should include:

- BIN: *(if available)*
- Location:
- Feature Carried:
- Feature Crossed:
- Primary Owner:
- Number of Spans Inspected:
- Date of Inspection:
- Weather:
- Minimum Vertical Clearance/Location: *(when applicable)*
- Type of Inspection:
- Inspected by:
- Inspection Findings:
- Recommendations:
- Location Map
- Elevation View
- Condition Photos

An example is given below.
SAFETY INSPECTION
Railroad Bridge over Built System

BIN: 7029280

Location: 3.7 mi E of junction of Rtes 67 & 22 - RENSSELAER COUNTY

Feature Carried: Vermont Railway

Feature Crossed: Rte 67 (67-1404-1054)

Primary Owner: Railroad

Number of Spans Inspected: 1 (Span 5 of 6)

Date of Inspection: 4/23/2015

Weather: Partly cloudy, 60°F

Minimum Vertical Clearance/Location: >30 ft span 5 over Rte 67

Type of Inspection: Visual (Ground based)

Inspected by: TL: Jean-Luc Picard, PE 123456
ATL: William T. Riker

Inspection Findings:

Orientation - E: The six-span structure carries the Vermont Railway over the Walloomsac River and Rte 67. The 2 girder Span 5 over Rte 67 carries one track. No major structural problems were found during the visual inspection. The BIN plate was mounted on the face of the guide rail and has its identifying numbers scraped off.

Recommendations:

Install a new BIN plate in a less exposed location.
Photo No: P4230016.jpg
Location: Left fascia spans 4, 5 and 6
Description: Left fascia spans 4, 5 and 6, and view of Rte 67 EB
Reference: Photo taken 4/23/2015

Photo No: P4230017.jpg
Location: Right fascia span 5
Description: Right fascia span 5 and view of Rte 67 WB
Reference: Photo taken 4/23/2015
<table>
<thead>
<tr>
<th><strong>Photo No:</strong></th>
<th><img src="P4230016.jpg" alt="Image" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location:</strong></td>
<td>Guide rail by left end of pier 4</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Remnants of BIN plate mounted on the guide rail face by the left end of pier 4</td>
</tr>
</tbody>
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| **Reference:** | P4230016.jpg  
Photo taken 4/23/2015 |
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NY APPENDIX M
RAILROAD BRIDGES – BRIDGE MANAGEMENT PLAN

Section 1—Introduction

The Federal Railroad Administration (FRA) established Railroad Bridge Safety Standards, 49 Code of Regulations (CFR) Parts 213 and 237 that became effective September 13, 2010, and which meet or exceed NYS Highway Law §236 Part §913 (Program of Railroad Bridge Inspection). These regulations require track owners to adopt and implement a Railroad Bridge Management Plan (RBMP).

The purpose of this document is to define the procedures and practices of the New York State Department of Transportation (NYSDOT) with respect to railroad bridges owned by NYSDOT. The Department requires the following for all of its railroad bridges:

- Establish and maintain an accurate inventory of railroad bridges owned by NYSDOT including a record of the safe load capacity of each bridge.
- Provide railroad bridge inspection, evaluation, load capacity, and reporting procedures.
- Establish policy for the NYSDOT railroad bridge inspection, evaluation and load rating program.
- Establish standards for the documentation of inspection reports, repairs and modifications of each railroad bridge.
- Define qualifications for persons responsible for executing the RBMP.
- List the types of railroad bridge inspections and identify the required inspection details.
- Serve as a standard and provide uniformity in the execution of the program by establishing the methods for documenting inspections including a standard format for doing so.
- Define program responsibilities for NYSDOT.
- Set guidelines for interpretation and implementation of the American Railway Engineering and Maintenance-of-Way (AREMA) and FRA codes and standards.
- Establish formal quality control and quality assurance procedures.

This RBMP is intended to be specific to structures owned by NYSDOT and shall be complemented by the current edition of the NYSDOT “Bridge Inspection Manual” (BIM). The AREMA “Bridge Inspection Handbook (2008)” shall be used as a supplemental reference, providing guidelines for inspectors specific to railroad structures.
1.1—Railroad Bridge Management Program Objectives

The objectives of NYSDOT’s Railroad Bridge Management Plan are:

- To fulfill the requirements of 49 CFR Parts §213 and §237, Bridge Safety Standards and NYS Highway Law §236.

- To prevent the deterioration of railroad bridges by preserving their capability to safely carry the traffic to be operated over them, and reduce the risk of human casualties, environmental damage, and disruption to the Nation’s railroad transportation system that would result from a catastrophic bridge failure.

- To maintain an accurate, up-to-date inventory that records the condition and load capacity of all railroad structures owned by the State of New York, and to meet the requirements for content of the inventory as defined in 49 CFR Part §237.33 including but not limited to: bridge identifier, location, configuration, type of construction, number of spans, span length(s), and safe load capacity.

- To establish policy for a railroad bridge inspection program that addresses the requirements for a bridge inspection program as defined in 49 CFR Part §237.33 including but not limited to: inspection personnel safety considerations, types of inspections, definitions of defect levels and condition codes, method of documenting inspections, and structure type.

- To define the required method of documentation by inspectors; including documentation through the use of the current Standard Format.

- To establish policy for obtaining and maintaining documents pertinent to the management of railroad bridges as defined in 49 CFR Part §237.33 including but not limited to: record plans, design plans, design calculations, and inspection reports.

- To determine the extent of deterioration and initiate routine maintenance and repair work.

- To determine the extent of major deterioration and prioritize the repairs and the capital investment in the rehabilitation or replacement of railroad bridges.

1.2—Background

The general requirements for the inspection, evaluation, and load rating of the nation’s railroad bridges are defined in the Code of Federal Regulations, 49 CFR Parts §213 and §237, which meet or exceed NYS Highway Law §236 Part §913. These regulations became effective on September 13, 2010 and each railroad track owner with railroad structures is required to adopt and implement a Railroad Bridge Management Plan (RBMP). This RBMP establishes policy for the management of the NYSDOT owned railroad structures.

There are currently 58 NYSDOT - owned bridges over which railroads operate. The inventory of NYSDOT owned railroad bridges is stored in the NYS Bridge Data Management System (BDMS).
NYSDOT has established this RBMP to meet the requirements of the Federal and State Laws and Regulations. This Program has been developed to set down the formal NYSDOT policy for complying with FRA Bridge Safety Regulations and to assign responsibilities for implementation of the stated policy.

49 CFR §237.101 mandates annual inspection of railroad bridges and NYSDOT’s current policy is to perform General Inspections of railroad bridges on an annual basis.

1.3—Definitions

**RBMP** - Railroad Bridge Management Plan - A plan designed to optimize the use of available resources for the inspection, evaluation, load rating, maintenance, rehabilitation, and replacement of railroad bridges.

**NYSBIM** – Current NYSDOT Bridge Inspection Manual

**BDMS** – NYSDOT Bridge Data Management System

**AASHTO** – American Association of State Highway and Transportation Officials, 444 North Capitol Street, N. W., Suite 225, Washington D.C. 20001

**AREMA** – American Railway Engineering and Maintenance-of-Way Association, 10003 Derekwood Lane, Suite 210, Lanham, MD 20706.


**Railroad Bridge** (§237.5) – Any structure with a deck, regardless of length, which supports one or more railroad tracks, or any other undergrade structure with an individual span length of 10 feet or more at such depth that it is affected by live loads.

**Active Railroad Line** – A railroad line or segment of a line that is connected to the general railroad system of transportation and over which trains may operate.

**Inactive or Abandoned Railroad Line** – A former railroad line or segment of a line that is or was connected to the general railroad system of transportation and over which trains do not operate but may in the future.

**NBIS** – National Bridge Inspection Standards, Federal regulations establishing requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of bridge inventory records. The NBIS apply to all structures defined as bridges located on or over all public roads.

**NYSDOT** - New York State Department of Transportation.

**Department** - New York State Department of Transportation.

**FRA** – Federal Railroad Administration, U.S. Department of Transportation.

Section 2—Inventory

2.1—Railroad Bridge Inventory

NYSDOT shall maintain an inventory of all NYSDOT owned railroad structures. The content of such inventory will include at a minimum, the information to satisfy the requirements of 49 CFR §237.33. This required content includes the following items:

- BIN
- Railroad Bridge Number
- Railroad Line Code (if applicable)
- County
- Operating Railroad(s)
- Feature(s) crossed
- Primary Owner
- Maintenance Responsibility
- Inspection Responsibility
- Year Built
- Year Rehabilitated
- Number of Tracks
- Type of Rail Service
- Total Length of Bridge
- Number of Spans
- Bridge Type
- Date of Rating Calculations
- Line Capacity
- Date of Last General Inspection
- Bridge Subject to Diving Inspection?
- Date of Last Diving Inspection

Additional information may be included in the inventory as deemed appropriate by NYSDOT to aid in the management of these structures. This inventory shall be updated as necessary when the bridge replacement, rehabilitation or other activities result in changes to the information maintained in the inventory.
Section 3—Qualifications

3.1—Qualifications

Each NYSDOT Region shall designate and maintain a list of individuals who perform activities critical to the effective management of the railroad bridge infrastructure as required by 49 CFR §237.57. Such lists shall be maintained for the following critical positions: Railroad Bridge Engineer; Railroad Bridge Inspector; and Railroad Bridge Supervisor. Each NYSDOT Region shall also maintain a record of each individual’s educational or work experience that supports the required competencies for the position. The list shall include both employees of NYSDOT and consulting engineering firms.

Railroad Bridge Engineer (49 CFR §237.51, §237.111) - A person competent to perform engineering work including: determination of forces and stresses in railroad structures; determination of structural capacity of railroad structures; prescribe inspection procedures for railroad structures; review bridge inspection reports and design repairs or modifications for railroad structures. Railroad Bridge Engineers shall satisfy either of the following educational requirements: possess a degree in engineering from a program accredited by ABET, Inc. or by a foreign organization recognized by ABET, Inc.; or be currently registered as a professional engineer in the State of New York State. Personnel shall be designated by the Regional Structures Management Engineer (RSME) that satisfy the requirements for this title.

Railroad Bridge Inspector (49 CFR §237.53) - A person technically competent to view, measure, report, and record the condition of a railroad bridge and its individual components. Such competence shall be established based on a combination of education, formal training and work experience. Bridge Inspection Team Leader as defined in NYSDOT Bridge Inspection Manual will satisfy these requirements. For RR Bridges that fall under both FRA and NYS regulations, Highway Bridge Inspection Team Leader or equivalent will satisfy the requirements for this title. For other RR bridges, Senior Culvert Inspector or equivalent will also satisfy the requirements of this title.

Railroad Bridge Supervisor (49 CFR §237.55, §237.111) - A person technically competent to supervise the construction, modification or repair of a railroad bridge in conformance with plans, specifications or instructions applicable to the work to be performed; and to review bridge inspection reports. Such competence shall be established based on a combination of education, formal training and work experience.
Section 4—Safe Load Capacity

4.1—Load Capacity

NYSDOT shall determine the safe load capacity of all railroad bridges on active railroad lines to satisfy the requirements of 49 CFR §237.71. Load rating is the determination of live load carrying capacity of a bridge using existing plans supplemented by information gathered during in-depth field inspections. Engineering judgment is required to incorporate the effect of defects and deterioration in the load rating analysis. For those bridges that do not have calculated capacities on file, NYSDOT shall complete the load rating assessments by no later than March 14, 2016, satisfying 49 CFR §237.71.e requirement that all capacities be determined within five years of the required date for adoption of the RBMP.

Load ratings for NYSDOT owned railroad bridges shall be performed in accordance with the provisions set forth in the AREMA “Manual for Railway Engineering” and using the Cooper E80 loading to represent the operating equipment. The Manual recognizes load ratings at two levels, Inventory and Operating. The Inventory Rating generally corresponds to the design level of stress, and results in a calculated live load that can safely use the bridge for an indefinite period of time. The Operating Rating sets the limiting live load which the structure can support at an infrequent interval. The Safe Load Capacity of a bridge shall generally be considered the Inventory Rating calculated for the bridge except in special cases where the RSME determines it is appropriate to consider the Operating Rating as the Safe Load. An example of a condition that might warrant the use of the Operating Rating levels for determining allowable operating loads includes a short to medium duration operational period while a known bridge deficiency is in the process of being repaired, rehabilitated or replaced. In no case shall an operating load producing structural demand exceeding the Operating Rating of a bridge be allowed to operate over the structure.

The load capacity for each railroad bridge on an active line shall be maintained in the Bridge Files and also be compiled in accordance with 49 CFR §237.33. The determination of load capacity shall be made by a designee of the RSME using appropriate engineering methods and standards.

Load rating calculations shall be updated whenever a general or special inspection reveals the conditions of the bridge or a bridge component might adversely affect the ability of the bridge to carry the traffic being operated. Bridge conditions that warrant an updated rating include but are not limited to: a reduction in a member’s load-carrying strength due to deterioration, a track modification that increases dead load, changes in track geometry, damage to members from collision, and structural modifications.

Inventory and Operating ratings shall be determined for the Cooper E 80 load defined by AREMA. The Inventory rating level corresponds to the usual design load level, but reflects the existing bridge conditions with regard to age, deterioration and loss of section. This analysis is comparable to that used for design and, therefore, results in an allowable live load that can be carried by the existing structure for its expected service life. The rating is dependent on a specified speed, as impact reductions are allowed for reduced speeds. The Operating rating is the load level which the structure can support at infrequent intervals, with any applicable speed restrictions. Unlimited usage of the bridge by rail vehicles at the Operating level will shorten the useful life of the structure.

Generally, the rating factor for a structure is obtained by subtracting the dead load effect on the member from the overall capacity of the member and dividing the results by the effect of the live load.
and impact induced by rail equipment with known weight and configuration. Allowable stress levels for the Inventory and Operating ratings shall be in accordance with AREMA guidelines. The capacity of a member in relationship to the Cooper E series live load configuration can be obtained by multiplying the rating factor by the 80 kip maximum axle load associated with the Cooper E 80 load used in determining the live load effect. The resulting ratings are considered to represent the “Equivalent Cooper” rating for the member under consideration.

Load rating calculations shall typically be performed for both the “as-inspected” and “as-built” conditions. The “as-inspected” ratings reflect the current status of the structure and are used for decisions regarding operations, while the “as-built” ratings provide a baseline for assessment of a structure’s condition and to assist decision making on bridge repairs, rehabilitation or replacement.

Railroad structures supporting multiple tracks require load ratings to be determined for each track considering the effect of concurrent track loading in accordance with AREMA guidelines.

NYSDOT shall compare the calculated “Equivalent Cooper” Inventory Ratings with the live load demand placed on structures of similar configuration by equipment known to operate on the line without restriction. For structures where this demand appears to exceed or is in the range of the Inventory Cooper Rating, bridge specific load ratings shall be performed using actual equipment in lieu of the notional Cooper loading. For structures that have calculated Inventory Capacity less than the demand from actual equipment operating without restriction, the NYSDOT Regional Structures Management Engineer shall evaluate the structure and determine appropriate actions that may include: scheduling of bridge component repair, modification or replacement, issuing instructions to the railroads placing operating restrictions necessary to ensure the bridge can safely accommodate traffic until such time when the capacity of the structure is increased to meet the demand; implementing a program of increased monitoring; or in cases where operating loads would exceed Operating Ratings, restricting operations over the bridge until adequate capacity can be restored.

For railroad bridges on active railroad lines that have not been analyzed for load capacity, NYSDOT shall prioritize the rating of these structures to ensure that all structures have calculated ratings on file by March 14, 2016 to satisfy the requirements of 49 CFR §237.71.e.
4.2—Protection of Bridges from Over-Weight and Over-Dimension Loads

Railroad equipment operating on NYSDOT owned track is controlled by the written instructions established by the individual railroad assigned responsibility for the operation on a given line or segment of a line. Such instructions, typically in the form of a timetable, are developed by the railroad and reviewed by NYSDOT to ensure the equipment allowed to operate does not exceed the safe load or dimensional restrictions associated with all structures on the line. When changes in the structural condition affect the capacity of a given line, NYSDOT provides written direction to the operating railroad with any recommended restrictions that may be appropriate to ensure safe operations. The operating railroad is responsible for issuing special instructions that address any restrictions imposed. In general, written instructions shall be sufficient in detail to meet the criteria of 49 CFR §237.73.

Load capacity for structures shall be expressed in terms of the maximum gross weight of rail cars with the minimum car length and axle configuration as established by the Association of American Railroads (AAR) Standards for Freight Cars. The load effects for all equipment not meeting the above standard including all locomotives shall be analyzed on an individual basis.
Section 5—Railroad Bridge Inspection

5.1—Bridge Inspection

Railroad bridge inspection shall be performed in conformance with the procedures established in the current NYSDOT Bridge Inspection Manual. AREMA’s “Bridge Inspection Handbook” may be used as a supplement to the NYSDOT BIM.

All railroad bridges, as defined by 49 CFR §237.5, on active railroad lines shall be inspected in conformance with the requirements of 49 CFR §237 Subpart E – Bridge Inspection.

All railroad bridges on active railroad lines shall be inspected at least once each calendar year, with no more than 540 days between successive inspections as required by 49 CFR §237.101.a.

Railroad bridges on inactive or abandoned lines shall not be placed in active service unless an inspection has been performed within the previous 540 days and a Railroad Bridge Engineer has reviewed the inspection report and load rating and determined it is safe to resume service as required by 49 CFR §237.101.d.

For railroad bridges that cross over public roads and are subject to the requirements of the National Bridge Inspection Standards (NBIS), bridges shall be inspected in conformance with both 23 CFR 650C and 49 CFR Parts 213 and 237.

The general bridge inspection procedures are addressed in detail in the NYSBIM, and detailed discussion is included on:

- Planning, Scheduling and Safety Considerations
- Types of Inspection
- Record Keeping and Documentation
- Each inspection must be conducted systematically so that all items are inspected with no duplication of effort

5.2—Types of Inspection

General Inspections are regularly scheduled bridge safety inspections that are conducted every year on all railroad bridges. These inspections are performed to satisfy the 49 CFR §237 Subpart E requirement for annual inspection of railroad bridges in service.

Special Inspections shall be performed for any railroad structure involved in an event which had the potential to compromise the integrity of the bridge, including but not limited to damage, flood, fire, earthquake, derailment or vehicular or vessel impact as required by §237.105. NYSDOT shall direct such inspections at the time notification is made by the operating railroad or other that such an event has occurred.

Railroad structures subject to the flow of water shall be inspected for scour in general conformance with Underwater Inspections as addressed in the NYSBIM.
All railroad structure inspections shall be conducted under the direct supervision of a designated Team Leader as required by 49 CFR §237.107.

When inspected by a consultant, the Inspection Report for a railroad structure shall be submitted to NYSDOT within 30 calendar days of the completion of the inspection and shall be reviewed, revised when appropriate, and filed as complete within 120 calendar days of the completion of the inspection as required by 49 CFR §237.109. An exception to the above schedule is allowed for complex structures including movable bridges where the amount of information and level of detail requires a greater period of time. In all cases, the goal is to issue final inspection reports in an expedient manner.

5.3—Bridge Inspection Records

NYSDOT shall for each railroad structure, prepare a “Bridge Inspection Report” that includes all information required by 49 CFR §237.109.

5.4—Review of Bridge Inspection Reports

After the completion of the bridge inspection report, the Railroad Bridge Engineer shall review the report as required by 49 CFR §237.111.

The QC/QA process defined in the NYSBIM Chapter 11 and the workflow of the NYSDOT inspection software shall be followed.
Section 6—Railroad Bridge Repair and Modification

6.1—Bridge Design Repairs or Modifications

Repairs or modifications of Railroad Structures on active lines shall be designed by an Engineer as required by 49 CFR §237.131.

Prior to design of repairs, an Engineer shall perform a field verification of prescheduled bridges for potential design of repairs.

Engineers shall perform field verifications and visual assessments for the structures identified by the Regional Structures Management Engineer. Field work shall concentrate on elements with a previously reported NBI condition rating of 5 or less and suspected to be in need of repair. The result of the field verification will be the collection and documentation of site specific data, including quantities and dimensions that can be used in the development of repair plans as needed.

Repairs or modifications include the replacement of structural members; strengthening of deteriorated or otherwise deficient members; heat straightening of misaligned members; addition of dead load to structures; attachment of sign supports or other miscellaneous material to structures; and the temporary or permanent modification of the structure configuration resulting in a modified load path. In general, repairs or modifications result in a change in the capacity of individual members or alters the stress in a primary load-carrying component either temporarily or permanently.

The design of structural repairs or modifications shall specify whether any restrictions to the rail traffic operating over such structure are required during the actual repair or modification work. Any restrictions shall be clearly indicated on the repair or modifications plans.

6.2—Supervision of Repairs and Modifications

The work to repair or modify a railroad structure as designed in accordance with this section shall only be performed under the immediate supervision of a Railroad Bridge Maintenance Engineer as required by 49 CFR §237.133. The Railroad Bridge Maintenance Engineer role shall be designated by and determined to be qualified by the Bridge Maintenance Engineer or equivalent. The Railroad Bridge Supervisor may be supported by qualified staff from Consulting Engineering Firms for the performance of the work. The Railroad Bridge Supervisor shall ensure that any required operating restrictions are in effect while the work is performed.
Section 7—Document Management

7.1—Document Management

NYSDOT shall collect, store and maintain documentation pertinent to the management of all NYSDOT owned railroad structures on active, inactive and abandoned lines as required by 49 CFR §237.33.c. Documentation shall be filed in either digital or hard copy format but in either case shall be filed by railroad line, and Bridge Identification Number (BIN) to facilitate retrieval.

Documentation to be maintained in the Railroad Bridge files shall include:

- Original Bridge Plans, Design Calculations, Shop Drawings and Working Drawings, and Sketches-in-lieu
- Repair and Rehabilitation Plans, Design Calculations and as-built plans
- Related correspondences
- General, Special, In-depth, and Underwater Inspection Reports
- Load Rating Calculations or alternate rating documentation

Given the age of the railroad infrastructure in New York State and the history of owners, it is recognized that original plans and design calculations are not available for many of the structures in the inventory. For such structures, all available information will be maintained in the Railroad Bridge Files.

Bridge Inspection Reports shall be maintained in the Railroad Bridge Files for a minimum period of two years from the completion of the inspection as required by 49 CFR §237.109.f.
Section 8—Quality Control/Quality Assurance

8.1—General

The effective and efficient management of NYSDOT owned railroad bridges requires dedication on the part of all the individuals who perform the many functions associated with the RBMP. It is critical to maintain the accuracy and consistency of all data used in the program including but not limited to inspection and load rating data.

The NYSDOT has instituted a Railroad Bridge Management Plan (RBMP) to meet the requirements of both FRA 49 CFR Parts 213 and 237 and NYS Railroad Laws and Regulations. Railroad bridge inspectors collect inventory and condition information on each bridge for inclusion in the Department’s Railroad Bridge files. The accuracy and consistency of the inspection and documentation are vital to public safety, and also impact programming and funding appropriations. In recognition of the importance of this information, NYSDOT has established quality control and quality assurance procedures for all bridge inspection and load rating work performed for NYSDOT owned structures.

Quality Control and Quality Assurance measures for the inspection and rating of railroad structures are similar to the requirements for highway bridges and the general requirements for Quality Control and Assurance contained in Chapter 11 of the NYSBIM are applicable for railroad structures.

Quality Assurance measures are instituted to monitor the effectiveness and compliance of the overall RBMP. Periodic audits of the RBMP shall be performed by NYSDOT Main Office Structures staff to ensure compliance with the provisions of the program as required by 49 CFR §237.151 and §237.153.

To be effective, quality control/quality assurance procedures must be followed by all personnel and the procedures should be evaluated and updated regularly. The program shall be flexible and shall be updated routinely by memos and directives from the Main Office Deputy Chief Engineer (Structures).
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NY APPENDIX N

INSPECTION OF LARGE CULVERTS

This appendix defines a Large Culvert and sets forth inspection frequency, personnel requirements, and special documentation requirements. This appendix shall be used in conjunction with the NYSDOT Bridge Inspection Manual (BIM). All requirements specified in the BIM apply to Large Culvert Inspections unless noted otherwise in this appendix.

Large Culvert Definition

A structure with an opening:

- measured perpendicular to its skew that is greater than or equal to 5 feet and
- measured along the centerline of the roadway that is less than or equal to 20 feet

including multiple pipe structures where the clear distance between pipes is less than half of the smaller pipe diameter.

It is noted that structures with an opening measured along the centerline of the roadway greater than 20 feet, including multiple pipe structures where the clear distance between pipes is less than half of the smaller pipe diameter, are defined as bridges.

Large Culverts Carrying Railroads

Refer to NY Appendix M “Railroad Bridges – Bridge Management Plan” for requirements concerning the inspection of Large Culverts that are defined as Railroad Bridges.

General Inspection Frequency

Large Culvert General Inspection frequency shall follow the criteria listed below.

(i) Large Culverts with General Recommendations of 7, 6 or 5 shall be inspected at a maximum interval of 48 months.

(ii) Large Culverts with General Recommendations of 4 or 3 shall be inspected at a maximum interval of 24 months.

(iii) Large Culverts with General Recommendations of 2 or 1 shall be inspected at a maximum interval of 12 months.

(iv) Large Culverts with active or inactive Red Flags or active Yellow Flags shall be inspected at a maximum interval of 12 months.

Where applicable, inspections shall be scheduled during periods of low water in order to minimize the need for a diving inspection.
**Personnel Requirements**

Large Culvert inspections must be performed by an inspection team consisting of a Senior Culvert Inspector and an Assistant Culvert Inspector. The Senior Culvert Inspector is responsible for ensuring that the Large Culvert is inspected and that the inspection report is prepared in conformance with the requirements of this manual. Under the Senior Culvert Inspector’s direct supervision, an Assistant Culvert Inspector may also inspect, measure, and document components.

The Quality Control Engineer and Load Rating Engineer must:

(i) Be currently registered with the New York State Education Department as a Professional Engineer (P.E.). An out-of-state P.E registration may be substituted for a New York State P.E. provided that the individual received the P.E. based upon satisfactory completion of a 16 hour written examination, has applied for the P.E. registration in New York State, and the New York State Education Department has acknowledged receipt of the individual’s intent to practice in New York State under subsection (b) of Section 7208 of the Education Law, and

(ii) Have at least three (3) years of bridge experience in design, construction, inspection of bridges or large culverts or other bridge engineering related work.

An individual cannot function as a Quality Control Engineer over work for which the individual was, or is, responsible.

Civil Engineering experience on Department programs or projects may be substituted for all or a portion of the experience requirements in Subsections (ii) herein, if the Department determines, on the basis of the Department work, that the engineer possesses the necessary experience and skill.

Prior to performing any inspection work with NYSDOT, the Quality Control Engineer must:

(i) Successfully complete an FHWA approved comprehensive bridge inspection training course (for example, the National Highway Institute “Safety Inspection of In-Service Bridges”) and have successfully completed the NYSDOT 1 day Supplementary Bridge Inspection Workshop. (Note that if the personnel has successfully completed the NHI training but has not taken the NYSDOT 1 day Workshop, they may be approved to begin working with the condition that they complete the next available NYSDOT 1 day Workshop), or

(ii) Have successfully completed the NYSDOT 5 day Bridge Inspection Workshop (this Workshop was discontinued after 2015).

Although this is a one-time requirement, based on significant changes in the NYSDOT Bridge Inspection Program or a personnel’s prolonged lapse from bridge inspection work, these individuals may have to repeat this requirement. Senior Culvert Inspectors performing NYSDOT inspection work are encouraged to comply with the above training requirements.
The Senior Culvert Inspector must:

(i) Posses a Bachelor of Science Degree in Civil Engineering from an Accreditation Board for Engineering and Technology (ABET) accredited program or an equivalent degree acceptable to the Department, or

(ii) Posses an Associate Degree in Civil Engineering Technology or an equivalent Associate Degree determined to be acceptable by the Department, and 3 years of bridge experience in design, construction, inspection of bridges or large culverts, or other bridge related work.

Civil Engineering experience on Department programs or projects may be substituted for all or a portion of the experience requirements in Subsections (ii) herein if the Department determines, on the basis of the Department work, that the person possesses the necessary experience and skill.

The Assistant Culvert Inspector must:

(i) Posses a Bachelor of Science Degree in Civil Engineering from an Accreditation Board for Engineering and Technology (ABET) accredited program or an equivalent degree acceptable to the Department, or

(ii) Posses an Associate Degree in Civil Engineering Technology or an equivalent Associate Degree determined to be acceptable by the Department, and 1 ½ years of bridge experience in design, construction, inspection of bridges or culverts, or other bridge related work, or

(iii) Have at least (3) years of bridge experience in design, construction, inspection of bridges or large culverts, or other bridge related work.

Civil Engineering experience on Department programs or projects may be substituted for all or a portion of the experience requirements in subsections (ii) and (iii) herein if the Department determines, on the basis of the Department work, that the person possesses the necessary experience and skill.

**Inspection Documentation for Metal Pipe Culverts**

Routine metal pipe culvert cross-section measurements may be waived for Large Culvert Inspections unless one or more of the following conditions exist:

- Dimensional changes to the cross-section are actively occurring.
- The section is not symmetrical.
- There is noticeable sag in the top arch (an extreme case might even display reverse curvature because of partial collapse.)
- There is significant distortion and/or deflection.
- There is severe corrosion and pitting throughout a significant length of the barrel.
- The existence of cracks and/or a significant number of missing bolts.

Metal pipe culvert deformation often occurs during installation. Some variations between in-place measurements and the metal pipe culvert’s design values may be acceptable, if the changes have occurred during compaction of fill.
If the Senior Culvert Inspector determines that the metal pipe culvert cross-section measurements are to be waived, the reason shall be documented in the General Notes section of the Inspection Report. Whenever possible a picture should also be included in the Inspection Report showing cross-sectional opening(s).
Glossary

AASHTO - American Association of State Highway and Transportation Officials

AMBEI – AASHTO Manual for Bridge Element Inspection

ATL – Assistant Team Leader

BIM – NYSDOT Bridge Inspection Manual

BIN – Bridge Identification Number; a unique seven character identifier assigned to bridges in NYS


BISM – NYSDOT Bridge Inspection Safety Manual

CFR – Code of Federal Regulations

DCES – Deputy Chief Engineer (Structures)

DOT – Department of Transportation

EB – Engineering Bulletin

EI – Engineering Instruction

Element – Component of a bridge or bridge related feature.

FHWA – Federal Highway Administration

Item – One of the several major components that comprise a bridge, for example:

- Stream channel
- Abutment
- Wingwall
- Pier
- Approaches
- Deck
- Superstructure
- Utilities

MBE – AAHSTO Manual for Bridge Evaluation

MOBIUH – Main Office Bridge Inspection Unit Head
MOLE – Main Office Liaison Engineer
NBI – National Bridge Inventory
NBIS – National Bridge Inspection Standards
NHI – National Highway Institute
NYSDOT – New York State Department of Transportation
OSHA – Occupational Safety and Health Administration
QAE – Quality Assurance Engineer
QCE – Quality Control Engineer
RSME – Regional Structures Management Engineer
Soundings – Water depth readings
SSU – Substructure Unit
TA – Technical Advisory
TL – Team Leader
UCBI – Uniform Code of Bridge Inspection
VIRTIS – Load rating and analysis software used by NYSDOT
WZTC - Work Zone Traffic Control