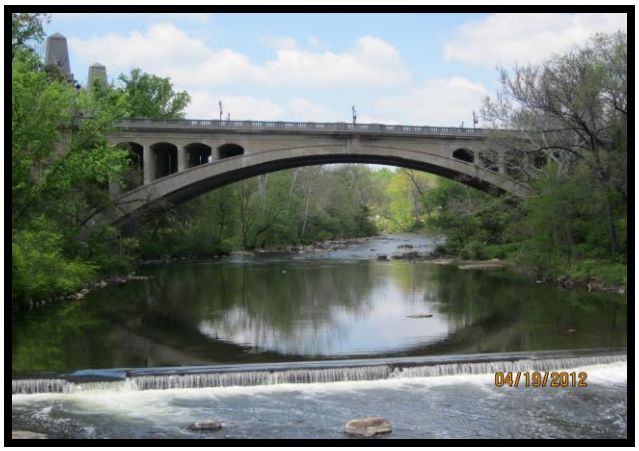

Delaware Department of Transportation
Bridge Management Section

BRIDGE ELEMENT INSPECTION MANUAL

2021 Edition

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DelDOT

BRIDGE SECTION

Bridge Management Section

BRIDGE ELEMENT INSPECTION MANUAL
2021 Edition

Adopted as policy for all DelDOT Bridge Inspection Projects and Activities as of February 1, 2021

Recommended By:

Bridge Management Engineer

Recommended By:

State Bridge Engineer

Approved By:

Chief Engineer

Approved By:

Cabinet Secretary

Approved For Use on All Federal Aid Projects By:

DOUGLAS S. ATKIN

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Division Administrator, Federal Highway Administration

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Manual Changes for 2021

1. Updated Table 2.1.8 to include new elements 825 and 840
2. Updated Table 2.1.10 to include Element 520
3. Added elements 520, 825 and 840 to element description in Section 2.2
4. Added element 825 to Section 3.8.2 – R/C Bridge Substructure Elements
5. Added element 840 to Section 3.8.4 – Timber Bridge Substructure Elements
6. Updated element commentary in Section 3.9.5 to include culvert spray liners
7. Added comment “not for frame culverts” to element 220 in Section 2.2
8. Updated Table C3 to include elements 825 and 840
9. Added comment to Section G1 noting that Table G1 should be used for slabs
10. Added element 520 to Section 3.10.3 – Concrete Protective Coating Elements
11. Added Fill Loss defect (8000) to Table 3.8.5
12. Modified comment for Span 1, Comment 1 in Section 5.3.3 to include overlays
13. Added comment to Element Commentary in Sections 3.9.3 about box culvert floor scaling
14. Added comment to Section G5.3 about box culvert floor scaling
15. Modified CS1, CS2 and CS3 % in Table G1 for NBI 5
16. Modified CS1, CS2 and CS3 % in Table G5.3 for NBI 5
17. Update CS2 and CS3 descriptions for Fill Loss defect (8000) in Section D2.5
18. Updated non-structural elements to include backwall in Section G4
19. Removed references to “PONTIS” and “Pontis” from Section 5.3.1
20. Modified CS3 % in Table G1 for NBI 4
21. Modified CS3 % in Table G5.3 for NBI 4

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INTRODUCTION

The proper assessment of the condition of bridge elements is the cornerstone of sound bridge management. The introduction of element inspection condition methods in the early 1990s represented a significant advancement in bridge inspection practice and has been adopted by the vast majority of the state transportation departments in the United States. Bridge owners nationwide have recognized the benefits of detailed condition assessments through the use of the raw inspection information, expanded performance measures, and bridge management system deterioration forecasting and evaluation. As the use of element-level inspection techniques has proliferated, the need for updates and enhancements to the standard element specification has been identified. This manual incorporates improvements through changes in the measurement units of decks and slabs, the development of a wearing surface element, the standardization of the number of element states, and the development of protective coating elements for concrete and steel, as well as deck protection systems. Elements constructed of innovative materials are also identified. The goal of this manual is to completely capture the condition of bridges in a simple, effective way that can be standardized across the nation while providing the flexibility to be adapted to both large- and small-agency settings.

This manual is not intended to supplant proper bridge and element inspection training or the exercise of engineering judgment by the inspector or professional engineer.

SECTION 1:
BACKGROUND

1.1—CONDITION ASSESSMENT PHILOSOPHY: MULTIPATH AND DEFECT CONCEPTS

This manual is based off the AASHTO *Manual for Bridge Element Inspection* and builds on the element-level condition assessment methods developed in the *AASHTO Guide for Commonly Recognized Structural Elements*. Improvements have been made to fully capture the condition of the elements by reconfiguring the element language to utilize multiple distress paths within the defined condition states. The multipath distress language provides the means to fully incorporate all possible defects within the overall condition assessment of the element. The overall condition of an element can be utilized in this aggregate form, or broken down into specific defects present as desired by the agency for Bridge Management System (BMS) use.

This manual provides a comprehensive set of bridge elements that is designed to be flexible in nature to satisfy the needs of DelDOT's Bridge Inspection Program and bridge inventory. The complete set of elements captures the components necessary for an agency to manage all aspects of the bridge inventory utilizing the full capability of a BMS.

The element set presented within includes two element types identified as National Bridge Elements (NBE's) and Bridge Management Elements (BME's). The combination of these two element types comprise the full AASHTO element set. All of the elements, whether they are NBE's or BME's, have the same general condition assessment characteristics:

1. Standard number of condition states is four.
2. The standard condition states are good, fair, poor, and severe general descriptions.
3. Units of measure are length in feet, area in square feet, and each for enumerated elements.

1.2—NATIONAL BRIDGE ELEMENTS (NBE's)

The National Bridge Elements represent the primary structural components of bridges necessary to determine the overall condition and safety of the primary load carrying members. The NBE's are a refinement of the deck, superstructure, substructure, and culvert condition ratings defined in the Federal Highway Administration's *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*. Additional elements included in this section are bridge rail and bearings. The NBE's are designed to remain consistent from agency to agency across the country in order to facilitate and standardize the capture of bridge element conditions at the national level. In order to capture the diversity of new element design types and materials, many elements in this category have an "other" element type defined.

1.3—BRIDGE MANAGEMENT ELEMENTS (BME's)

Bridge Management Elements include components of bridges such as joints, wearing surfaces, and protective coating systems and deck/slab protection systems that are typically managed by agencies utilizing Bridge Management Systems. The BME's are defined with a recommended set of condition assessment language that can be modified to suit the agencies' needs as these elements are not intended to be utilized for the purposes of national policy-making. The BME's defined within this manual were purposefully left fairly general in nature to provide the flexibility to develop

agency- specific elements that best suit the local bridge management practices. Agencies may choose to develop additional BME's as necessary following the agency-developed element conventions discussed in Appendix A. When considering additional elements, the agency should consider such factors as element performance, deterioration rates, feasible actions, and preservation costs, as well as the practical considerations of training and inspection costs.

1.4—AGENCY-DEVELOPED ELEMENTS (ADE's)

The elements presented within provide the flexibility for an agency to define custom elements in accordance with the defined element framework that may be sub-elements of NBE's or BME's, or may be agency-defined elements without ties to the elements defined in this manual.

By defining a comprehensive set of bridge elements necessary for robust bridge management and the minimum set of elements necessary to assess the condition of primary components of bridges, this manual provides a flexible element set that can be tailored to the needs of all agencies. The identification numbers 800 and above are used in this manual for ADE's.

1.5—HOW TO USE THIS MANUAL

Bridge inspection based on this manual consists of defining the elements (pieces of the bridge) and total quantities that exist at each bridge. The condition of each element is determined by performing a field inspection and recording quantities of the element that have identified defects that correlate to the severity of the defects defined in the particular condition state definition of this manual. The condition assessment is complete when the appropriate portion of the total quantity is stratified over the defined condition states. For agencies utilizing bridge management systems (BMS's), the appropriate element defects and environment shall be recorded for use in deterioration modeling.

In this manual, the element represents the aggregate condition of the defined element inclusive of all defects. The specific listing of all defects is optional; however, the element condition must be inclusive of all defined defects. Element defects are typically to be used when the element reaches Condition State 2 and they essentially act to break down the overall element condition into one or more specific observed problems. The defects defined within this manual shall always assume the units of the element with which they are associated. For example, the scour defect may be applied to a column or a pier wall. The defect language is the same for both elements; however, the units for the column defect would be each and the units for the pier wall would be linear feet. In some cases, multiple defects may operate in the same defined space. In this case, the inspector shall report the defect in the most severe condition state. If two defects in the same condition state operate in the same defined space, the inspector shall determine the predominant defect for reporting. For example, if a reinforced concrete bridge deck is cracked throughout and also has a spall in a portion of the deck, the spalling would likely be determined to be the predominant defect.

This manual attempts to cover the vast majority of all bridge elements found on highway bridges in Delaware. During the course of an inspection, the inspector may find materials or elements that are not defined. In these cases, the inspector should use judgment to select the closest element match or use the "other" element type. In a similar vein, there may be cases when the specific condition observed in the field is not defined in this manual. In these cases, the inspector should use the general description of the condition states to determine the appropriate condition.

The granularity of the defect details is typically not specified with defect descriptive language for Condition State 4, as this state is reserved for severe conditions that are beyond the specific defects

defined for Condition States 1 through 3. Elements with a portion or all of the quantity in Condition State 4 may often have load capacity implications warranting a structural review. Within this manual, the term "structural review" is defined as a review by a person qualified to evaluate the field observed conditions and make a determination of the impacts of the conditions on the performance of the element. Structural reviews may include a review of the field inspection notes and photographs, review of as-built plans, or analysis as deemed appropriate to evaluate the performance of the element. DelDOT has established additional guidance to aid the inspector in determining the field circumstances where structural review is warranted in this manual.

1.6—ORGANIZATION

Section 2 of the manual presents a master location matrix of all the elements and identification numbers for quick reference. Each element is displayed within an element grouping, then by material type. The groupings are arranged working from the top of the bridge downward as the inspector would be standing on the bridge deck.

Section 3 presents a detailed definition of each element with its applicable defects. Guidelines for measurement and condition assessment are included where appropriate.

The appendices provide additional guidance and background on the use of this manual. There are seven appendices to aid an agency in the development of their data collection process.

These appendices are:

A—Agency-Defined Elements (ADE's)

B—Inspection Examples

C—Element Groupings

D—List of Element Defects by Material Type

E—List of Feasible Actions by Material Type

F—Maximo Maintenance Requests

G—Guidance for NBI Condition Rating Assignments

Section 2:
ELEMENT SELECTION

This Section is designed to give inspectors a quick reference guide to the element options. The matrix of elements is grouped by general element type, material, and in accordance to their physical location on the bridge to facilitate ease of use by bridge inspectors in the field.

2.1— ELEMENT LOCATION MATRIX

2.1.1—Railings

Element	Units	Steel	Reinforced Concrete	Timber	Masonry	Other
Metal Bridge Railing	length, ft	330				
Reinforced Concrete Bridge Railing	length, ft		331			
Timber Bridge Railing	length, ft			332		
Other Bridge Railing	length, ft					333
Masonry Bridge Railing	length, ft				334	

2.1.2—Curbs, Medians, Sidewalks & Drains

Element	Units	Steel		Reinforced Concrete	Timber	Masonry	Other
		Open Grid	Filled Grid				
Sidewalks	length, ft	867	868	856	857	858	
Curbs	length, ft	860		859	866	861	
Median	length, ft	863		862		864	
Drains / Downspouts / Scuppers	each						865

2.1.3—Approach Slabs

Element	Units	Element Number
Prestressed Concrete Approach Slab	area, ft^2	320
Reinforced Concrete Approach Slab	area, ft^2	321

2.1.4—Decks and Slabs

Element	Units	Deck	Slab	Other
Reinforced Concrete Deck/Slab	area, ft^2	12	38	
Deck/Slab Under Fill	area, ft^2	837	838	
Prestressed Concrete Deck	area, ft^2	13		
Prestressed Concrete Top Flange	area, ft^2	15		
Reinforced Concrete Top Flange	area, ft^2	16		
Steel Deck—Open Grid	area, ft^2	28		
Steel Deck—Concrete Filled Grid	area, ft^2	29		
Steel Deck—Corrugated	area, ft^2	30		
Timber Deck/Slab	area, ft^2	31	54	
Other Material Deck/Slab	area, ft^2	60	65	
A/C Overlay Surface (On beams and culverts)	area, ft^2			801

2.1.5—Joints

Element	Units	Element Number
Strip Seal Expansion Joint	length, ft	300
Pourable Joint Seal	length, ft	301
Compression Joint Seal	length, ft	302
Assembly Joint/Seal (Modular)	length, ft	303
Open Expansion Joint	length, ft	304
Assembly Joint without Seal	length, ft	305
Other Joint	length, ft	306
Asphaltic Plug Joint	length, ft	809

2.1.6—Superstructure

Element	Units	Steel	Prestressed Concrete	Reinforced Concrete	Timber	Masonry	Other
Girder/Beam	length, ft	107	109	110	111		112
Closed Web/Box Girder	length, ft	102	104	105			106
Stringer	length, ft	113	115	116	117		118
Truss	length, ft	120			135		136
Arch	length, ft	141		144	146	145	142
Floor Beam	length, ft	152	154	155	156		157
Cable—Primary	length, ft	147					
Cable—Secondary	each	148					149
Gusset Plate	each	162					
Pin, Pin and Hanger Assembly, or Both	each	161					
Diaphragms	each	881		882	883		
Steel Live Load Anchor Assembly	each	869					
Filled Arch	length, ft			834			
Headwall	length, ft			896		897	

2.1.7—Bearings

Element	Units	Element Number
Elastomeric	each	310
Movable (roller sliding, etc.)	each	311
Enclosed/Concealed	each	312
Fixed	each	313
Pot	each	314
Disk	each	315
Other	each	316

2.1.8—Substructure

Element	Units	Steel	Prestressed Concrete	Reinforced Concrete	Timber	Masonry	Other
Column	each	202	204	205	206		203
Column Tower (Trestle)	length, ft	207			208		
Pile	each	225	226	227	228		229
Jacketed Column or Pile	each						807
Pier Wall	length, ft			210	212	213	211
Abutment	length, ft	219		215	216	217	218
Pier Cap	length, ft	231	233	234	235		236
Pile Cap/Footing	length, ft			220			
Sheeting	length, ft	822	823		824		
Backwall	length, ft			825			
Strut	length, ft			820	821		
Timber Pier Slab	area, ft^2				840		
Wingwall/Retaining Wall	length, ft			890		892	
Wingwall/Retaining Wall Cap	length, ft			886	885		
MSE Wall	length, ft						818
Sacked Concrete Wall	area, ft^2						895
Fender/Dolphin System	length, ft	851		852	850		

2.1.9—Culverts

Element	Units	Steel		Aluminum		Prestressed Concrete	Reinforced Concrete		Timber	Masonry	HDPE	Other
		Minor	Major	Minor	Major		Minor	Major				
Culvert	length, ft	240	844	847	848	N/A	241	845	N/A	244	846	243
Sacked Concrete Wall	area, ft^2											895
Headwall	length, ft						896			897		

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

Element	Units	Element Number
Wearing Surface: Rigid Overlay	area, ft^2	510
Wearing Surface: Thin Overlay	area, ft^2	810
Wearing Surface: Asphaltic Concrete Overlay	area, ft^2	811
Wearing Surface: Timber Planking	area, ft^2	812
Steel Protective Coating: Paint System	area, ft^2	515
Steel Protective Coating: Weathering Steel	area, ft^2	815
Steel Protective Coating: Concrete Encased Steel Protection	area, ft^2	816
Steel Protective Coating: Galvanizing System	area, ft^2	817
Concrete Reinforcing Steel Protective System	area, ft^2	520
Concrete Protective Coating	area, ft^2	521

2.1.11—Smart Flags

Element	Units	Element Number
Soffit	each	839
Erosion	each	829

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2.1.12—Movable Bridge Elements

Element	Units	Element Number
Electrical System	each	898
Mechanical System	each	899

2.2— ELEMENT DESCRIPTIONS

Element No.	Title and Definition	Units	Page No.
12	**Concrete Deck – Bare** This element defines those concrete bridge decks regardless of type of wearing surface or protection systems used. Also includes R/C deck panels with or without post tensioning.	**(FT^2)**	**54**
13	**Prestressed Concrete Deck** This element defines those prestressed concrete bridge decks regardless of the wearing surface or protection systems. Does not include R/C deck panels with post tensioning.	**(FT^2)**	**56**
15	**Prestressed Concrete Top Flange** All prestressed bridge girder top flanges where traffic rides directly on the structural element regardless of the wearing surface or protection systems used. These bridge types include bulb-tees, box girders and girders that require traffic to ride on the top flange.	**(FT^2)**	**56**
16	**Reinforced Concrete Top Flange** All reinforced bridge girder top flanges where traffic rides directly on the structural element regardless of the wearing surface or protection systems used. These bridge types include tee-beams, box girders and girders that require traffic to ride on the top flange.	**(FT^2)**	**54**
28	**Steel Deck with Open Grid** This element defines those bridge decks that are constructed of steel grids that are open and unfilled.	**(FT^2)**	**60**
29	**Steel Deck with Concrete Filled Grid** This element defines those bridge decks that are constructed of steel grids with either all of the openings or just those in the wheel tracks filled with concrete.	**(FT^2)**	**60**
30	**Steel Deck Corrugated** This element defines those bridge decks that are constructed of corrugated metal filled with Portland cement concrete or asphaltic concrete. This element does not include stay-in-place forms.	**(FT^2)**	**60**
31	**Timber Deck** This element defines those bridge decks that are constructed of timber regardless of type of wearing surface used.	**(FT^2)**	**58**

38	**Reinforced Concrete Slab - Bare** This element defines those concrete slab bridges regardless of type of wearing surface or protection system.	**(FT^2)**	**54**
54	**Timber Slab** This element defines those slab span bridges that are constructed of timber regardless of wearing surface used.	**(FT^2)**	**58**
60	**Other Deck** All bridge decks constructed of other materials regardless of the wearing surface or protection systems used. This element includes those bridge decks that are constructed of fiber-reinforced composites.	**(FT^2)**	**62**
65	**Other Slab** All bridge slabs constructed of other materials regardless of the wearing surface or protection systems used. This element includes those bridge slabs that are constructed of fiber-reinforced composites	**(FT^2)**	**62**
102	**Steel Closed Web/Box Girder** This element defines only those steel closed web/box girder units regardless of type of steel protective coating used.	**(L.F.)**	**74**
104	**Prestressed Concrete Closed Web/Box Girder** This element defines only those closed web/box girder units constructed of prestressed concrete. For adjacent box beams element 15 shall be created to identify defects in the top flange.	**(L.F.)**	**78**
105	**Reinforced Concrete Closed Web/Box Girder** This element defines only those closed web/box girder units constructed of reinforced concrete. For adjacent box beams element 16 shall be created to identify defects in the top flange.	**(L.F.)**	**76**
106	**Other Closed Web/Box Girder** All other material box girders or closed web girders regardless of protective coating used.	**(L.F.)**	**84**
107	**Steel Open Girder/Beam** This element defines only those steel open girder units regardless of type of steel protective coating used. This element includes two-girder systems as well as rolled beams on multiple-beam spans. Stiffeners should be included in the rating.	**(L.F.)**	**74**

109	**Prestressed Concrete Open Girder/Beam** This element defines only those open girder units constructed of prestressed concrete. This element includes two-girder systems as well as prestressed concrete beams on multiple-beam spans. For T, Double T and bulb T beams that don't have a separate deck on top, element 15 shall be created to identify defects in the top flange.	**(L.F.)**	**78**
110	**Reinforced Concrete Open Girder/Beam** This element defines only those open girder units constructed of reinforced concrete. This element includes two-girder systems as well as reinforced concrete beams on multiple-beam spans. For T, Double T and bulb T beams that don't have a separate deck on top, element 16 shall be created to identify defects in the top flange.	**(L.F.)**	**76**
111	**Timber Open Girder/Beam** This element defines only those open girders of timber construction. These can include either solid timber beams or glue-lam girders.	**(L.F.)**	**80**
112	**Other Open Girder/Beam** This element defines all other material girders regardless of protection system.	**(L.F.)**	**84**
113	**Steel Stringer (Stringer-Floor Beam System)** This element defines all steel stringers that support the deck in a stringer-floor beam system regardless of type of steel protective coating used.	**(L.F.)**	**74**
115	**Prestressed Concrete Stringer (Stringer-Floor Beam System)** This element defines only those prestressed concrete stringers that support the deck in a stringer-floor beam system.	**(L.F.)**	**78**
116	**Reinforced Concrete Stringer (Stringer-Floor Beam System)** This element defines only those reinforced concrete stringers that support the deck in a stringer-floor beam system.	**(L.F.)**	**76**
117	**Timber Stringer (Stringer-Floor Beam System)** This element defines only those timber stringers that support the deck in a stringer-floor beam system.	**(L.F.)**	**80**
118	**Other Stringer** This element defines all other material stingers regardless of protection system.	**(L.F.)**	**84**
120	**Steel Truss** This element defines steel trusses regardless of type of steel protective coating used. This element includes through, deck and pony trusses. Truss is measured in a straight line from end to end.	**(L.F.)**	**74**

135	**Timber Truss** This element defines all members of trusses that are constructed of timber. Truss is measured in a straight line from end to end.	**(L.F.)**	**80**
136	**Other Truss** This element defines all other material truss elements including all tension and compression members and though, deck and pony trusses regardless of protection systems.	**(L.F.)**	**84**
141	**Steel Arch** This element defines all members of those steel arches regardless of type of steel protective coating used. Does not include corrugated metal culverts.	**(L.F.)**	**74**
142	**Other Arch** Other material arches regardless of protective system.	**(L.F.)**	**84**
144	**Reinforced Concrete Arch** This element defines only those arches constructed of reinforced concrete. Does not include concrete culverts or arches under fill.	**(L.F.)**	**76**
145	**Masonry Arch** This element defines filled arches made of masonry or stacked stone regardless protective systems. Does not include culverts or span length (Item # 48) of 20' or less.	**(L.F.)**	**82**
146	**Timber Arch** This element defines all members of arches that are constructed of timber. Arch is measured in a straight line from end to end along each arch panel.	**(L.F.)**	**80**
147	**Steel Primary Cables** All steel main suspension or cable stay cables not embedded in concrete. For all cable groups regardless of type of protective coating used.	**(L.F.)**	**74**
148	**Steel Secondary Cables** All steel suspender cables not embedded in concrete. For all individual or cable groups regardless of type of protective coating used.	**(EA)**	**74**
149	**Other Secondary Cables** All other material cables not embedded in concrete. For all individual other material cables or cable groups regardless of protection systems.	**(EA)**	**84**
152	**Steel Floor Beam** This element defines only those steel floor beams regardless of type of steel protective coating used.	**(L.F.)**	**74**

154	**Prestressed Concrete Floor Beam** This element defines only those floor beams constructed of prestressed concrete.	**(L.F.)**	**78**
155	**Reinforced Concrete Floor Beam** This element defines only those floor beams constructed of reinforced concrete.	**(L.F.)**	**76**
156	**Timber Floor Beam** This element defines only those floor beams constructed of timber.	**(L.F.)**	**80**
157	**Other Floor Beam** Other material floor beams that typically support stringers regardless of protective system.	**(L.F.)**	**84**
161	**Steel Pin and/or Pin and Hanger Assembly** This element defines only those steel pin and hanger assemblies regardless of type of steel protective coating used.	**(EA)**	**74**
162	**Steel Gusset Plate Truss Connection** This element defines those primary gusset plate truss connections regardless of type of steel protective coating used. This element includes gusset plates in through, deck & pony trusses and steel arch bridges that connect primary members. The quantity for this element is the sum of the number of primary load path gusset plate assemblies. For multiple plate gusset connections at a single panel point, the quantity shall be one gusset plate regardless of the number of individual plates at the single connection point.	**(EA)**	**74**
202	**Steel Column** This element defines only those columns that exist between the cap and a footer, regardless of type of steel protection system used.	**(EA)**	**92**
203	**Other Column** All other material columns regardless of protective system.	**(EA)**	**104**
204	**Prestressed Concrete Column** This element defines only those columns that are constructed of prestressed concrete.	**(EA)**	**96**
205	**Reinforced Concrete Column** This element defines only those columns that are constructed of reinforced concrete.	**(EA)**	**94**
206	**Timber Column** This element defines only those columns that are constructed of timber.	**(EA)**	**98**

207	**Steel Column Tower (Trestle)** Steel built-up or frame tower supports regardless of type of steel protective coating used. Includes movable bridge machinery supports.	**(L.F.)**	**92**
208	**Timber Column Tower (Trestle)** Framed timber supports for timber trestle/towers regardless of protective system.	**(L.F.)**	**98**
210	**Reinforced Concrete Pier Wall** This element defines only those pier walls (shafts) constructed of reinforced concrete.	**(L.F.)**	**94**
211	**Other Pier Wall** This element defines only those pier walls constructed of other materials.	**(L.F.)**	**104**
212	**Timber Pier Wall** Those timber pier wall systems that include the pile, timber sheeting material and fill material. Does not include the timber pier cap or a timber bent systems.	**(L.F.)**	**98**
213	**Masonry Pier Wall** Those pier walls constructed of block or stone placed with or without mortar regardless of protective systems.	**(L.F.)**	**100**
215	**Reinforced Concrete Abutment** This element defines only those abutments constructed of reinforced concrete. Deficiencies in the header are noted in the appropriate joint element.	**(L.F.)**	**94**
216	**Timber Abutment** This element defines only those abutment caps constructed of timber.	**(L.F.)**	**98**
217	**Masonry Abutment** This element defines only those abutments constructed of masonry.	**(L.F.)**	**100**
218	**Other Abutment** Other material abutment systems, including the sheet material retaining the embankment, and integral wingwalls and abutment extensions. For all abutments regardless of protection systems.	**(L.F.)**	**104**
219	**Steel Abutment** Steel abutments, including the sheet material retaining the embankment and monolithic wingwalls and abutment extensions. For all abutments regardless of type of protective coating used. Does not include steel sheeting used as wingwalls.	**(L.F.)**	**92**

220	**Reinforced Concrete Pile Cap/Footing** Reinforced pile caps/ footings that are visible for inspections, including submerged pile caps/footings that are visible during an underwater inspection. The exposure may be intentional or caused by erosion or scour. This element also includes those reinforced concrete abutment or pile caps/footings belonging to a corrugated metal pipe arch that are submerged and are visible for inspection. This shouldn't be used for frame culverts.	**(L.F.)**	**94**
225	**Steel Pile** This element defines only those piles, including monotubes or steel pipe regardless of type of steel protective coating used. Piles may be submerged or un-submerged	**(EA)**	**92**
226	**Prestressed Concrete Piles** This element defines only those piles that are constructed of prestressed concrete. Piles may be submerged or un-submerged.	**(EA)**	**96**
227	**Reinforced Concrete Piles** This element defines only those piles that are constructed of reinforced concrete. Piles may be submerged or un-submerged.	**(EA)**	**94**
228	**Timber Piles** This element defines only those piles that are constructed of timber. Piles may be submerged or un-submerged.	**(EA)**	**98**
229	**Other Pile** All other material piles regardless of protective system. Piles may be submerged or un-submerged	**(EA)**	**104**
231	**Steel Pier Cap** This element defines only those steel pier caps regardless of type of steel protective coating used.	**(L.F.)**	**92**
233	**Prestressed Concrete Pier Cap** This element defines only those pier caps that are constructed of prestressed concrete.	**(L.F.)**	**96**
234	**Reinforced Concrete Pier Cap** This element defines only those pier caps that are constructed of reinforced concrete.	**(L.F.)**	**94**
235	**Timber Pier Cap** This element defines only those pier caps that are constructed of timber.	**(L.F.)**	**98**

236	**Other Pier Cap** Other material pier caps that support girders that transfer load into piles or columns. For all other material pier caps regardless of protective system.	**(L.F.)**	**104**
240	**Steel Culvert** This element defines all steel culverts that have a span length of less than seven feet (7').	**(L.F.)**	**106**
241	**Concrete Culvert** This element defines all precast and cast-in-place pipes.	**(L.F.)**	**110**
243	**Other Culvert** Other material/type culverts including arches, round or elliptical pipes. These culverts do not include metal, concrete, masonry or timber material types.	**(L.F.)**	**114**
244	**Masonry Culvert** This element defines all culverts constructed of masonry.	**(L.F.)**	**112**
300	**Strip Seal Expansion Joint** This element defines only those expansion joint devices that utilize a neoprene-type waterproof gland with steel extrusion to anchor the gland.	**(L.F.)**	**66**
301	**Pourable Joint Seal** This element defines only those joints filled with a pourable seal. This element includes sections of the joint between the deck and backwall, approach slab and backwall and parapet and approach slab.	**(L.F.)**	**70**
302	**Compression Joint Seal** This element defines only those joints filled with a performed compression-type seal.	**(L.F.)**	**66**
303	**Assembly Joint Seal (modular)** This element defines only those joints filled with an assembly mechanism, which does have a seal.	**(L.F.)**	**66**
304	**Open Expansion Joint** This element defines only those joints that are open and not sealed.	**(L.F.)**	**68**
305	**Assembly Joint w/o Seal (modular)** Only assembly joints that are open and not sealed, including finger and sliding plate joints.	**(L.F.)**	**68**
306	**Other Joint** Only those other joints that are not defined by any other joint element.	**(L.F.)**	**72**

310	**Elastomeric Bearing** This element defines only those bridges bearings that are constructed primarily of elastomers with fabric or metal reinforcement	**(EA)**	**86**
311	**Movable Bearing (roller, sliding, etc.)** This element defines only those bridge bearings that provide for both deflection and longitudinal movement by means of roller, rocker or sliding mechanisms.	**(EA)**	**88**
312	**Enclosed/Concealed Bearing** This element defines only those bridge bearings that are enclosed so that they are not open for detailed inspection.	**(EA)**	**88**
313	**Fixed Bearing** This element defines only those bridge bearings that provide for deflection only.	**(EA)**	**88**
314	**Pot Bearing** This element defines those high-load bearings with confined elastomer. The bearing may be fixed against horizontal movement, guided to allow movement in one direction, or floating to allow sliding in any direction.	**(EA)**	**86**
315	**Disk Bearing** This element defines those high-load bearings with a hard plastic disk. The bearing may be fixed against horizontal movement, guided to allow movement in one direction, or floating to allow sliding in any direction.	**(EA)**	**88**
316	**Other Bearing** All other material bridge bearings regardless of translation or rotation constraints.	**(EA)**	**90**
320	**Prestressed Concrete Approach Slab** This element defines those structural sections between the abutment and the approach pavement that are constructed of prestressed concrete. . Slabs with an AC overlay, element 811 shall be used to document the AC overlay condition.	**(FT^2)**	**52**
321	**Reinforced Concrete Approach Slab** This element defines those structural sections between the abutment and approach pavement that are constructed of reinforced concrete. Slabs with an AC overlay, element 811 shall be used to document the AC overlay condition.	**(FT^2)**	**50**

330	**Metal Bridge Railing** This element defines all types and shapes of metal bridge railing regardless of type of steel protective coating used. Steel, aluminum, metal beam, rolled shapes, etc., are all considered part of this element. This element includes chain link fence on top of parapets.	**(L.F.)**	**30**
331	**Reinforced Concrete Bridge Railing** This element defines all types and shapes of reinforced concrete bridge railing. Also includes the concrete core of a stone faced rail.	**(L.F.)**	**32**
332	**Timber Bridge Railing** This element defines all types and shapes of timber bridge railing.	**(L.F.)**	**34**
333	**Other Bridge Railing** All types and shapes of bridge railing except those defined as metal, concrete, timber or masonry	**(L.F.)**	**38**
334	**Masonry Bridge Railing** This element defines only those bridge railings constructed of masonry. Does **not** include reinforced concrete railing with facing.	**(L.F.)**	**36**
510	**Wearing Surfaces: Rigid Overlay** All decks/slabs that have a rigid overlay > 1" in thickness.	**(FT^2)**	**118**
515	**Steel Protective Coating: Paint System** Steel elements that have a protective coating paint system that includes a primer, base coat and top coat.	**(FT^2)**	**120**
520	**Concrete Reinforcing Steel Protective System** This element defines that the reinforcement in a deck has epoxy coating.	**(FT^2)**	**122**
521	**Concrete Protective Coating** Concrete elements that have a protective coating applied to them. These coating include silane/saloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or an top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion.	**(FT^2)**	**122**
801	**A/C Overlay Surface** This element defines only those A/C overlays that exist directly on reinforced concrete frame or box culverts. Element 811 shall be used for asphalt on beams, deck or slabs.	**(FT^2)**	**64**

807	**Jacketed Pile** This element defines only those piles or portions thereof that are fitted with a protective jacket/encasement. Jacketed piles may be submerged or un-submerged.	**(EA)**	**104**
809	**Asphaltic Plug Joint** This element defines only those joints that are constructed of an elastomeric asphalt without the use of a gland or seal.	**(L.F.)**	**70**
810	**Wearing Surface: Thin Overlay** This element defines those concrete bridge deck overlays that are $\leq$1" in thickness.	**(FT^2)**	**118**
811	**Wearing Surface: Asphaltic Concrete Overlay** This element defines those concrete or timber deck or slabs with an asphaltic concrete overlay.	**(FT^2)**	**118**
812	**Wearing Surface: Timber Planking** This element defines only those bridge decks with a timber planking wearing surface.	**(FT^2)**	**118**
815	**Steel Protective Coating: Weathering Steel** This element defines only those steel bridge elements that are have a weathering steel protection system.	**(FT^2)**	**120**
816	**Steel Protective Coating: Concrete Encased Steel Protection** This element defines only those steel beam elements that have a concrete encasement to protect the beam.	**(FT^2)**	**120**
817	**Steel Protective Coating: Galvanization System** This element defines only those steel elements that have a galvanic protection system.	**(FT^2)**	**120**
818	**Mechanically Stabilized Earth (MSE) Wall** This element defines those walls retaining soil through the use of a concrete facing material with metallic or geo-synthetic tensile reinforcement. Includes GRS abutments.	**(L.F.)**	**102**
820	**Reinforced Concrete Struts** This element defines only those struts constructed of reinforced concrete. Does not include reinforced concrete pile caps/footers.	**(L.F.)**	**94**
821	**Timber Struts** This element defines only those struts constructed of timber. Also includes column cross bracing.	**(L.F.)**	**98**
822	**Steel Sheeting** This element defines only those steel sheet piles that are painted regardless of type of steel protective coating used.	**(L.F.)**	**92**

823	**Prestressed Concrete Sheeting** This element defines only those sheet piles that are constructed of prestressed concrete.	**(L.F.)**	**96**
824	**Timber Sheeting** This element defines only those sheet piles that are constructed of timber.	**(L.F.)**	**98**
825	**Reinforced Concrete Backwall** This element defines only those abutment backwalls that are constructed of reinforced concrete.	**(L.F.)**	**94**
829	**Erosion** This condition state language addresses erosion distresses that are evident during visual inspections. Its primary purpose is to identify bridges that are experiencing erosion and to provide some measure of the magnitude of the erosion. Only applies to deterioration outside the limits of the stream, if a stream is present.	**(EA)**	**126**
8**34**	**Reinforced Concrete Filled Arch** This element defines only those concrete arches that are under fill. Does not include culverts or span length (Item # 48) of 20' or less.	**(L.F.)**	**76**
837	**Reinforced Concrete Deck Under Fill** This element defines only those concrete bridge decks that are under fill. (e.g. there is fill or GABC beneath the travel lanes. If hot mix rests directly on the deck use deck w/ AC overlay element).	**(FT^2)**	**54**
838	**Reinforced Concrete Slab Under Fill** This element defines only those concrete bridge slabs that are under fill. (e.g. there is fill or GABC beneath the travel lanes. If hot mix rests directly on the slab use slab w/ AC overlay element).	**(FT^2)**	**54**
839	**Soffit (or under surface) of Concrete Deck or Slab** This condition state language addresses deck distresses through visual inspection of the deck soffit (undersurface). It is extremely valuable when the top surface of the deck is covered with an overlay. Should be used for overhang sections when stay-in-place forms are present.	**(EA)**	**124**
840	**Timber Pier Slab** This element defines only those pier slabs that are constructed of timber.	**(FT^2)**	**98**
844	**Steel Culvert - Major** This element defines all steel culverts including arches, round or elliptical pipes and boxes. Span length must be equal to or greater than seven feet (7').	**(L.F.)**	**106**

845	**Concrete Culvert - Major** This element defines all those reinforced concrete box culverts and rigid frames, regardless of span length or amount of fill. Culverts that are "mitered" to the slope will have two elements, culvert for the portion with top slab and wingwall for portion without a top slab.	**(L.F.)**	**110**
846	**HDPE Culvert** This element defines all those culverts constructed of HDPE or plastic. Includes steel spiral reinforced plastic pipe.	**(L.F.)**	**114**
847	**Aluminum Culvert – Minor** This element defines all aluminum culverts that have a span length of less than seven feet (7').	**(L.F.)**	**108**
848	**Aluminum Culvert - Major** This element defines all aluminum culverts including arches, round or elliptical pipes and boxes. Span length must be equal to or greater than seven feet (7').	**(L.F.)**	**108**
850	**Timber Fender/Dolphin System** This element defines only those fender/dolphin systems that are constructed of timber. The quantity is measured along the length of fender system along each substructure unit.	**(L.F.)**	**98**
851	**Steel Fender/Dolphin System** This element defines only those steel fender/dolphin systems regardless of type of steel protective coating used. The quantity is measured along the length of fender system along each substructure unit.	**(L.F.)**	**92**
852	**Reinforced Concrete Fender/Dolphin System** This element defines only those fender/dolphin systems that are constructed of reinforced concrete. The quantity is measured along the length of fender system along each substructure unit.	**(L.F.)**	**94**
856	**Reinforced Concrete Sidewalk** This element defines those sidewalks on the bridge that are constructed of reinforced concrete. Reinforcement may be coated or uncoated.	**(L.F.)**	**40**
857	**Timber Sidewalk** This element defines those sidewalks on the bridge that are constructed of timber.	**(L.F.)**	**44**
858	**Masonry Sidewalk** This element defines those sidewalks on the bridge that are constructed of stone, brick, ect. material types.	**(L.F.)**	**46**

859	**Reinforced Concrete Curb** This element defines those curbs on the bridge with a defined joint between the sidewalk and the curb that are constructed of reinforced concrete. Reinforcement may be coated or uncoated.	**(L.F.)**	**40**
860	**Steel Curb** This element defines those curbs on the bridge regardless of type of steel protective coating used.	**(L.F.)**	**42**
861	**Masonry Curb** This element defines those curbs on the bridge that are constructed of masonry material types (i.e. stone, etc.).	**(L.F.)**	**46**
862	**Reinforced Concrete Median** This element defines those medians on the bridge that are constructed of reinforced concrete. Reinforcement may be coated or uncoated.	**(L.F.)**	**40**
863	**Steel Median** This element defines those medians on the bridge that are constructed of steel regardless of type of steel protective coating used.	**(L.F.)**	**42**
864	**Masonry Median** This element defines those medians on the bridge that are constructed of masonry material types (i.e. stone, brick, etc.).	**(L.F.)**	**46**
865	**Drains/Downspouts/Scuppers** This element defines those drains, downspouts and scuppers on the bridge that are constructed of any material type (painted or unpainted steel, cast iron, formed concrete, plastic, etc.).	**(EA)**	**48**
866	**Timber Curb** This element defines those curbs on the bridge that are constructed of timber.	**(L.F.)**	**44**
867	**Steel Sidewalk – Open Grid** This element defines those sidewalks that are constructed of steel grids that are open and unfilled.	**(L.F.)**	**42**
868	**Steel Sidewalk - Filled Grid** This element defines those sidewalks that are constructed of steel grids with all the openings filled with concrete, including orthotropic sidewalks.	**(L.F.)**	**42**
869	**Steel Live Load Anchor Assembly** This element defines only those movable bridge steel live load anchor assemblies regardless of type of steel protective coating used.	**(EA)**	**74**

881	**Steel Diaphragm** This element defines only those steel diaphragms regardless of type of steel protective coating used.	**(EA)**	**74**
882	**Reinforced Concrete Diaphragm** This element defines only those diaphragms that are constructed of reinforced concrete. Does not include haunches at the ends of concrete decks.	**(EA)**	**76**
883	**Timber Diaphragm** This element defines only those diaphragms or cross bracing units that are constructed of timber.	**(EA)**	**80**
885	**Timber Wingwall / Retaining Wall Cap** This element defines those wingwall caps constructed of timber.	**(L.F.)**	**98**
886	**Reinforced Concrete Wingwall / Retaining Wall Cap** This element defines those MSE wall or wingwall / retaining wall caps constructed of reinforced concrete that are not monolithic with the wall. Applicable to walls constructed of any material.	**(L.F.)**	**94**
890	**Reinforced Concrete Wingwall / Retaining Wall** This element defines only those wingwall or retaining wall units constructed of reinforced concrete.	**(L.F.)**	**94**
892	**Masonry Wingwall / Retaining Wall** This element defines only those wingwalls or retaining walls constructed of masonry or a combination of materials.	**(L.F.)**	**100**
895	**Sacked Concrete Wall** This element defines walls constructed of sacked concrete riprap. This element only applies to headwalls, wingwalls, and retaining walls constructed of sacked concrete riprap. Walls may have a slight batter.	**(FT^2)**	**116**
896	**Reinforced Concrete Headwall** This element defines only those headwall units constructed of reinforced concrete and retaining fill.	**(L.F.)**	**94**
897	**Masonry Headwall** This element defines only those headwall units constructed of masonry and retains fill.	**(L.F.)**	**112**
898	**Movable Bridge Electrical System** This element defines the entire electrical system for a movable bridge structure.	**(EA)**	**128**
899	**Movable Bridge Mechanical System** This element defines the entire mechanical system for a movable bridge structure.	**(EA)**	**130**

Section 3:
DETAILED ELEMENT CONDITION STATE DESCRIPTIONS

This Section describes the elements' detailed use in inspection and bridge management. Each detailed element description is broken down into three subsections:

1. **Description**—Detailed identification and classification of the element, including units of measurement, and guidelines on how to collect the quantity of the element in a consistent manner.
2. **Element Commentary—**Additional considerations for the inspector to be aware of during data collection. *(Not all elements will have an Element Commentary)*
3. **Condition State Definitions**—Defect descriptions and severity, with guidelines to the inspector for determining defect severity.

All the elements described in this Section include the standard set of National Bridge Elements (NBE's), Bridge Management Elements (BME's) and Agency developed Elements (ADE's). The elements are organized by major groupings such as Decks and Slabs, Superstructure, Substructure, Joints, and Bearings. The common defects identified for each element material are further detailed in Appendix E.

3.1— BRIDGE RAIL ELEMENTS

3.1.1 – Metal Bridge Railing

Description: All types and shapes of metal bridge railing. Steel, aluminum, metal beam, rolled shapes, ect. will all be considered part of this element. The correct steel protective coating element shall be used.

Element	Title and Definition	Units
330	**Metal Bridge Railing**	**(L.F.)**

3.1.1—Metal Bridge Railing

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.1—BRIDGE RAIL ELEMENTS

3.1.2 – Reinforced Concrete Bridge Railing

Description: All types and shapes of reinforced concrete bridge railing. This element includes reinforced concrete bridge railings with stone facing.

Element 521 (Concrete Protective Coating) shall be used for each individual element type that has a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion. Element 520 (Concrete Reinforcing Steel Protective System) shall be used for each individual element type that has a corrosion protection system installed. Protection systems may include cathodic protection or addition of anodes to mitigate corrosion.

Element	Title and Definition	Units
331	**Reinforced Concrete Bridge Railing**	**(L.F.)**

3.1.2—Reinforced Concrete Bridge Railing

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.1— BRIDGE RAIL ELEMENTS

3.1.3 – Timber Bridge Railing

Description: All timber bridge railings. This includes timber posts used for metal rails.

Element	Title and Definition	Units
332	Timber Bridge Railing	(FT^2)

3.1.3 – Timber Bridge Railing

Condition State Definitions

Defects	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Decay/Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5%–50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
Split/Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
Abrasion/Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.1— BRIDGE RAIL ELEMENTS

3.1.4 – Masonry Bridge Railing

Description: All types and shapes of masonry block or stone bridge railing. All elements of the railing must be masonry block or stone. This element does not include reinforced concrete bridge railing with stone facing.

Element	Title and Definition	Units
334	**Masonry Bridge Railing**	**(L.F.)**

3.1.5 – Masonry Bridge Railing

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Mortar Breakdown (Masonry) (1610)	None.	Cracking or small voids in joint with or without insignificant fill loss.	Large voids in the joint with or without minor to moderate fill loss.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.1— BRIDGE RAIL ELEMENTS

3.1.5 – Other Bridge Railing

Description: All types and shapes of bridge railing except those defined as metal, concrete, timber, or masonry.

Element	Title and Definition	Units
333	**Other Bridge Railing**	**(L.F.)**

3.1.5 – Other Bridge Railing

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination/Spall / Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	

3.2—BRIDGE CURB, MEDIAN, SIDEWALK & DRAINS

3.2.1 – Reinforced Concrete Bridge Curb, Median & Sidewalk

Description: All types and shapes of reinforced concrete bridge curb, median and sidewalks. This element only includes the curbs, medians and sidewalks that are placed directly on top of the bridge deck, slab or culvert.

Element 521 (Concrete Protective Coating) shall be used for each individual element type that has a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion. Element 520 (Concrete Reinforcing Steel Protective System) shall be used for each individual element type that has a corrosion protection system installed. Protection systems may include cathodic protection or addition of anodes to mitigate corrosion.

Element	Title and Definition	Units
856	**Reinforced Concrete Sidewalk**	**(L.F.)**
859	**Reinforced Concrete Curb**	**(L.F.)**
862	**Reinforced Concrete Median**	**(L.F.)**

3.2.1—Reinforced Concrete Bridge Curb, Median & Sidewalk

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.2—BRIDGE CURBS, MEDIANS, SIDEWALKS & DRAINS

3.2.2 – Steel Bridge Curb, Median & Sidewalk

Description: All types and shapes of steel bridge curb, median and sidewalks. The correct steel protective coating element shall be used.

Element	Title and Definition	Units
860	**Steel Curb**	**(L.F.)**
863	**Steel Median**	**(L.F.)**
867	**Steel Sidewalk – Open Grid**	**(L.F.)**
868	**Steel Sidewalk - Filled Grid**	**(L.F.)**

3.2.2—Steel Bridge Curb, Median & Sidewalk

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.2—BRIDGE CURBS, MEDIANS, SIDEWALKS & DRAINS

3.2.3 – Timber Bridge Curb & Sidewalk

Description: All types and shapes of timber bridge curb and sidewalks.

Element	Title and Definition	Units
857	**Timber Sidewalk**	**(L.F.)**
866	**Timber Curb**	**(L.F.)**

3.2.4 – Timber Bridge Curb & Sidewalk

Condition State Definitions

Defects	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Decay/Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5%–50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
Split/Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
Abrasion/Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.2—BRIDGE CURBS, MEDIANS, SIDEWALKS & DRAINS

3.2.4 – Masonry Bridge Curb, Median & Sidewalk

Description: All types and shapes of masonry bridge curb and median. This does not include stamped concrete or reinforced concrete with stone facing.

Element	Title and Definition	Units
858	**Masonry Sidewalk**	**(L.F.)**
861	**Masonry Curb**	**(L.F.)**
864	**Masonry Median**	**(L.F.)**

3.2.5 – Masonry Bridge Curb & Median

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Mortar Breakdown (Masonry) (1610)	None.	Cracking or small voids in joint with or without insignificant fill loss.	Large voids in the joint with or without minor to moderate fill loss.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.2—BRIDGE CURBS, MEDIANS, SIDEWALKS & DRAINS

3.2.5 – Bridge Drains

Description: All types and shapes of bridge drains and drain system components including scuppers, catch basins, downspouts and clean-outs. Only includes the drains and drain systems on the actual bridge structure and does not include roadway drainage systems along the approach roadway to the bridge.

Element Commentary: None

Element	Title and Definition	Units
865	**Drains/Downspouts/Scuppers**	**(EA)**

3.2.5—Bridge Drains

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Drainage Effectiveness (9000)	No drainage issues present.	Partial clog or blockage of drain, scupper or drainage system.	Drain, scupper or drainage system is completely clogged.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.3— APPROACH SLAB BRIDGE ELEMENTS

3.3.1 – Reinforced Concrete Approach Slab Bridge Element

Description: All reinforced concrete structural slabs that exist between the bridge abutment and approach roadway pavement. If the approach slab has an asphaltic concrete overlay, then element 811, Wearing Surfaces: Asphaltic Concrete Overlay, shall be created to account for deterioration in the overlay.

Element Commentary

This element includes only structural slabs and does not include roadway concrete approaches.

Element	Title and Definition	Units
321	**Reinforced Concrete Approach Slab**	**(FT^2)**

3.3.1— Reinforced Concrete Approach Slab Bridge Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

Any deterioration observed in the wearing surface of the bridge approach slab shall be addressed in the Wearing Surface element and not in the approach slab element.

3.3— APPROACH SLAB BRIDGE ELEMENTS

3.3.2 – Prestressed Concrete Approach Slab Bridge Element

Description: All prestressed concrete structural slabs that exist between the bridge abutment and approach roadway pavement. If the approach slab has an asphaltic concrete overlay, then element 811, Wearing Surfaces: Asphaltic Concrete Overlay, shall be created to account for deterioration in the overlay.

Element Commentary

This element includes only structural slabs and does not include roadway concrete approaches.

Element	Title and Definition	Units
320	**Prestressed Concrete Approach Slab**	**(FT^2)**

3.3.2— Prestressed Concrete Approach Slab Bridge Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

Any deterioration observed in the wearing surface of the bridge approach slab shall be addressed in the Wearing Surface element and not in the approach slab element.

3.4— DECK/SLAB BRIDGE ELEMENTS

3.4.1 – Reinforced Concrete Deck/Slab Bridge Elements

Description: All reinforced concrete bridge decks and slabs including R/C deck panels with or without post-tensioning. If the deck or slab has a Non-Structural Overlay, added to the deck/slab, then the correct wearing surface element type shall be created to account for deterioration in the overlay. The wearing surface or overlay type may include asphaltic concrete (811), thin (810) and rigid (510) materials. If an original bare concrete deck was milled and replaced with LMC or Class D concrete back to its original depth, then that is considered Structural Resurfacing and a Wearing Surface Element shall not be created.

Element Commentary

The deck evaluation is three-dimensional in nature with the defects observed on the top surface, bottom surface, edges, or all; and being captured using the defined condition states. Deck/slab top or bottom surfaces that are not visible for inspection shall be assessed based on the available visible surface.

Deterioration in the bottom of the deck or slab element shall be documented in the deck element and the Agency-Defined Element Smartflag element #839, Soffit.

Defects in the top surface of the Wearing Surface Element (Non-Structural Overlay) shall be addressed in the corresponding Wearing Surface defect elements.

Element	Title and Definition	Units
12	**Concrete Deck – Bare**	**(FT^2)**
16	**Reinforced Concrete Top Flange**	**(FT^2)**
38	**Reinforced Concrete Slab - Bare**	**(FT^2)**
837	**Reinforced Concrete Deck Under Fill**	**(FT^2)**
838	**Reinforced Concrete Slab Under Fill**	**(FT^2)**

3.4.1 – Reinforced Concrete Deck/Slab Bridge Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

Any deterioration observed in the wearing surface of bridge deck or slab, shall be addressed in the correct Wearing Surface element and not in the deck/slab element.

3.4— DECK/SLAB BRIDGE ELEMENTS

3.4.2 – Prestressed Concrete Deck Bridge Elements

Description: All prestressed concrete bridge decks. This doesnot include R/C deck panels that are post-tensioned. If the deck has a Non-Structural Overlay, then the correct wearing surface element type shall be created to account for deterioration in the overlay. The wearing surface or overlay type may include asphaltic concrete (811), thin (810) and rigid (510) materials. If an original bare concrete deck was milled and replaced with LMC or Class D concrete back to its original depth, then that is considered Structural Resurfacing and a Wearing Surface Element shall not be created.

Element Commentary

The deck evaluation is three-dimensional in nature with the defects observed on the top surface, bottom surface, edges, or all; and being captured using the defined condition states. Deck top or bottom surfaces that are not visible for inspection shall be assessed based on the available visible surface.

Deterioration in the bottom of the deck element shall be documented in the deck element and the Agency-Defined Element Smartflag element #839, Soffit.

Defects in the top surface of the Wearing Surface Element (Non-Structural Overlay) shall be addressed in the corresponding Wearing Surface defect elements.

Element	Title and Definition	Units
13	**Prestressed Concrete Deck**	**(FT^2)**
15	**Prestressed Concrete Top Flange**	**(FT^2)**

3.4.2 – Prestressed Concrete Deck Bridge Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

Any deterioration observed in the wearing surface of bridge deck, shall be addressed in the correct Wearing Surface element and not in the deck/slab element.

3.4— DECK/SLAB BRIDGE ELEMENTS

3.4.3 – Timber Deck/Slab Bridge Elements

Description: All timber structural deck and slabs. If the timber deck or slab has an overlay, then the correct wearing surface element shall be created to account for deterioration in the overlay. The wearing surface or overlay type may include asphaltic concrete (811) or timber planking (812).

Element Commentary

The deck evaluation is three-dimensional in nature with the defects observed on the top surface, bottom surface, edges, or all; and being captured using the defined condition states. Deck/slab top or bottom surfaces that are not visible for inspection shall be assessed based on the available visible surface.

Element	Title and Definition	Units
31	**Timber Deck**	**(FT^2)**
54	**Timber Slab**	**(FT^2)**

3.4.3 – Timber Deck/Slab Bridge Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Decay/Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5%–50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
Split/Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
Abrasion/Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.4— DECK/SLAB BRIDGE ELEMENTS

3.4.4 – Steel Deck Bridge Elements

Description: All steel structural decks including steel deck with open grid, steel deck with concrete filled grid and steel corrugated decks. Doesn't include R/C Decks with steel stay-in-place forms.

Element Commentary

The deck evaluation is three-dimensional in nature with the defects observed on the top surface, bottom surface, edges, or all; and being captured using the defined condition states. Deck top or bottom surfaces that are not visible for inspection shall be assessed based on the available visible surface.

Element	Title and Definition	Units
28	**Steel Deck with Open Grid**	**(FT^2)**
29	**Steel Deck with Concrete Filled Grid**	**(FT^2)**
30	**Steel Deck Corrugated**	**(FT^2)**

3.4.4 – Steel Deck Bridge Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.4— DECK/SLAB BRIDGE ELEMENTS

3.4.5 – Other Deck/Slab Bridge Elements

Description: All bridge decks/slabs constructed of composite (plastic) materials regardless of the wearing surface or protection systems used. . If the deck or slab has an overlay, then the correct wearing surface element shall be created to account for deterioration in the overlay. The wearing surface or overlay type may include asphaltic concrete (811), thin (810) and rigid (510) materials.

Element Commentary

The deck evaluation is three-dimensional in nature with the defects observed on the top surface, bottom surface, edges, or all; and being captured using the defined condition states. Deck/slab top or bottom surfaces that are not visible for inspection shall be assessed based on the available visible surface.

Element	Title and Definition	Units
60	**Other Deck**	**(FT^2)**
65	**Other Slab**	**(FT^2)**

3.4.5 – Other Deck/Slab Bridge Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.4— DECK/SLAB BRIDGE ELEMENTS

3.4.6 – A/C Overlay Bridge Element

Description: All reinforced concrete frame or box culverts that have overlays made with asphaltic concrete directly on top.

Element Commentary

The A/C Overlay Surface Element uses the same defect elements as that of the Wearing Surface type of Bridge Management Elements.

Element	Title and Definition	Units
801	**Asphaltic Concrete Overlay Surface**	**(FT^2)**

3.4.6— A/C Overlay Bridge Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall/ Patched Area/Pothole (Wearing Surfaces) (3210)	None. Patched area that is sound.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched area that is unsound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leakage or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.5— BRIDGE JOINT ELEMENTS

3.5.1 – Bridge Joints w/ Gland

Description: Those expansion joint devices which utilize a neoprene type waterproof gland with some type of metal extrusion or other system to anchor the gland.

Element	Title and Definition	Units
300	**Strip Seal Expansion Joint**	**(L.F.)**
302	**Compression Joint Seal**	**(L.F.)**
303	**Assembly Joint Seal (modular)**	**(L.F.)**

3.5.1 – Bridge Joints w/ Gland

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
Seal Adhesion (2320)	Fully adhered.	Adhered for more than 50% of the joint height.	Adhered 50% or less of joint height but still some adhesion.	Complete loss of adhesion.
Seal Damage (2330)	None.	Seal abrasion without punctures.	Punctured or ripped or partially pulled out.	Punctured completely through, pulled out, or missing.
Seal Cracking (2340)	None.	Surface crack.	Crack that partially penetrates the seal.	Crack that fully penetrates the seal.
Debris Impaction (2350)	Shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
Metal Deterioration or Damage (2370)	None.	Freckled rust; metal has no cracks, or impact damage. Connection may be loose but functioning as intended.	Section loss, missing or broken fasteners, cracking of the metal, or impact damage but joint still functioning.	Metal cracking, section loss, damage, or connection failure that prevents the joint from functioning as intended.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.5— BRIDGE JOINT ELEMENTS

3.5.2 – Bridge Joints w/o Gland

Description: Those expansion joint devices that are open and not sealed, including finger, sliding plate and open joints.

Element Commentary

Any vertical or lateral misalignment of the joint shall be noted in the Alignment (2220) defect element comments. If the misalignment is related to the bearings than the inspector shall also note this and refer to bearing element for more details.

Element	Title and Definition	Units
304	**Open Expansion Joint**	**(L.F.)**
305	**Assembly Joint w/o Seal (modular)**	**(L.F.)**

3.5.2 – Bridge Joints w/o Gland

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Debris Impaction (2350)	Shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Lateral or vertical alignment for the joint resulting in contact of the joint surfaces, but not preventing bridge movement.	Lateral or vertical alignment for the joint resulting in contact of the joint surfaces preventing bridge movement.
Metal Deterioration or Damage (2370)	None.	Freckled rust; metal has no cracks or impact damage. Connection may be loose but functioning as intended.	Section loss, missing or broken fasteners, cracking of the metal, or impact damage but joint still functioning.	Metal cracking, section loss, damage, or connection failure that prevents the joint from functioning as intended.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.5— BRIDGE JOINT ELEMENTS

3.5.3 – Bridge Joints w/ Pourable or Asphaltic Seal

Description: Those joints with a pourable or asphaltic type of seal with or without a backer rod.

Element	Title and Definition	Units
301	**Pourable Joint Seal**	**(L.F.)**
809	**Asphaltic Plug Joint**	**(L.F.)**

3.5.3 – Bridge Joints w/ Pourable/Asphaltic Seal

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
Seal Adhesion (2320)	Fully adhered.	Adhered for more than 50% of the joint height.	Adhered 50% or less of joint height but still some adhesion.	Complete loss of adhesion.
Seal Damage (2330)	None.	Seal abrasion without punctures.	Punctured or ripped or partially pulled out.	Punctured completely through, pulled out, or missing.
Seal Cracking (2340)	None.	Surface crack.	Crack that partially penetrates the seal.	Crack that fully penetrates the seal.
Debris Impaction (2350)	Shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.5— BRIDGE JOINT ELEMENTS

3.5.4 – Bridge Joint Other

Description: Only those joints that are not defined by any other joint element.

Element	Title and Definition	Units
306	**Other Joint**	**(L.F.)**

3.5.4 – Bridge Joint Other

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
Debris Impaction (2350)	Shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.
Metal Deterioration or Damage (2370)	None.	Freckled rust; metal has no cracks, or impact damage. Connection may be loose but functioning as intended.	Section loss, missing or broken fasteners, cracking of the metal, or impact damage but joint still functioning.	Metal cracking, section loss, damage, or connection failure that prevents the joint from functioning as intended.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.6—BRIDGE SUPERSTRUCTURE ELEMENTS

3.6.1 – Steel Bridge Superstructure Elements

Description: All steel bridge superstructure elements. The correct steel protective coating element shall be used for each individual steel element type.

Element	Title and Definition	Units
102	Steel Closed Web/Box Girder	(L.F.)
107	Steel Open Girder/Beam	(L.F.)
113	Steel Stringer (Stringer-Floor Beam System)	(L.F.)
120	Steel Truss	(L.F.)
141	Steel Arch	(L.F.)
147	Steel Primary Cables	(L.F.)
148	Steel Secondary Cables	(EA)
152	Steel Floor Beam	(L.F.)
161	Steel Pin and/or Pin and Hanger Assembly	(EA)
162	Steel Gusset Plate Truss Connection	(EA)
869	Steel Live Load Anchor Assembly	(EA)
881	Steel Diaphragm	(EA)

3.6.1—Steel Bridge Superstructure Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.6.2—Reinforced Concrete Bridge Superstructure Elements

Description: All reinforced concrete bridge elements including National Bridge Elements and Agency-Developed Elements. Element 521 (Concrete Protective Coating) shall be used for each individual element type that has a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion. Element 520 (Concrete Reinforcing Steel Protective System) shall be used for each individual element type that has a corrosion protection system installed. Protection systems may include cathodic protection or addition of anodes to mitigate corrosion.

Element Commentary: Condition evaluation for this element includes the web faces and the top and bottom flange surfaces. For adjacent box beams element 16 shall be created to identify defects in the top flange.

Element	Title and Definition	Units
105	**Reinforced Concrete Closed Web/Box Girder**	**(L.F.)**
110	**Reinforced Concrete Open Girder/Beam**	**(L.F.)**
116	**Reinforced Concrete Stringer (Stringer-Floor Beam System)**	**(L.F.)**
144	**Reinforced Concrete Arch**	**(L.F.)**
155	**Reinforced Concrete Floor Beam**	**(L.F.)**
834	**Reinforced Concrete Filled Arch**	**(L.F.)**
882	**Reinforced Concrete Diaphragm**	**(EA)**

3.6.2—Reinforced Concrete Bridge Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*The abrasion/wear type of defect is applicable for R/C elements exposed or adjacent to flowing water.

3.6.3—Prestressed Concrete Bridge Superstructure Elements

Description: All prestressed concrete bridge elements including National Bridge Elements. Element 521 (Concrete Protective Coating) shall be used for each individual element type that has a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion. Element 520 (Concrete Reinforcing Steel Protective System) shall be used for each individual element type that has a corrosion protection system installed. Protection systems may include cathodic protection or addition of anodes to mitigate corrosion.

Element Commentary: Condition evaluation for this element includes the web faces and the top and bottom flange surfaces if a separate reinforced concrete deck exists on top of the beams. If the bridge deck is the top flange of the beams (as in elements #15 & 16), then defects in the top, bottom, and side surfaces of the top flange shall be accounted for in element #15 or 16 and not in the beam element. Similarly, the NBI Deck Condition Rating shall account for defects in element#15 or 16.

Element	Title and Definition	Units
104	**Prestressed Concrete Closed Web/Box Girder**	**(L.F.)**
109	**Prestressed Concrete Open Girder/Beam**	**(L.F.)**
115	**Prestressed Concrete Stringer (Stringer-Floor Beam System)**	**(L.F.)**
154	**Prestressed Concrete Floor Beam**	**(L.F.)**

3.6.3—Prestressed Concrete Bridge Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.6.4—Timber Bridge Superstructure Elements

Description: This element defines all timber stringers, floorbeams, truss and arches regardless of protection system. These elements include solid timbers, glue-lam timbers and nail-lam timbers.

Element	Title and Definition	Units
111	**Timber Open Girder/Beam**	**(L.F.)**
117	**Timber Stringer (Stringer-Floor Beam System)**	**(L.F.)**
135	**Timber Truss**	**(L.F.)**
146	**Timber Arch**	**(L.F.)**
156	**Timber Floor Beam**	**(L.F.)**
883	**Timber Diaphragm**	**(EA)**

3.6.4—Timber Bridge Superstructure Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Decay/Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5%–50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
Split/Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
Abrasion/Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	

3.6.5—Masonry Bridge Superstructure Element

Description: Masonry or stacked stone arches regardless of protective system.

Element Commentary: Observed distress in arch spandrel walls shall be reported as the projected length along the arch length. For filled arches, the arch quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

Element	Title and Definition	Units
145	**Masonry Arch**	**(L.F.)**

3.6.5—Masonry Bridge Superstructure Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Mortar Breakdown (Masonry) (1610)	None.	Cracking or small voids in joint with or without insignificant fill loss.	Large voids in the joint with or without minor to moderate fill loss.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.6.6—Other Bridge Superstructure Elements

Description: All other material girders regardless of protection system.

Element Commentary: The other material open girder is intended for open girders constructed of composite materials, or other materials that cannot be classified using any other defined open girder element.

Element	Title and Definition	Units
106	**Other Closed Web/Box Girder**	**(L.F.)**
112	**Other Open Girder/Beam**	**(L.F.)**
118	**Other Stringer**	**(L.F.)**
136	**Other Truss**	**(L.F.)**
142	**Other Arch**	**(L.F.)**
149	**Other Secondary Cables**	**(EA)**
157	**Other Floor Beam**	**(L.F.)**

3.6.6—Other Bridge Superstructure Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self- arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that are sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.7— BRIDGE BEARING ELEMENTS

3.7.1 – Bridge Bearings w/ an Elastomer

Description: Those bridge bearings including elastomeric and pot type of bearings. Elastomeric bearings may or may not have fabric or metal reinforcement. Pot bearings are high load bearings with a confined elastomer that may be fixed against horizontal movement, guided to allow sliding in one direction or floating to allow sliding in any direction.

Element	Title and Definition	Units
310	**Elastomeric Bearing**	**(EA)**
314	**Pot Bearing**	**(EA)**

3.7.1 – Bridge Bearings w/ an Elastomer

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	
Bulging, Splitting, or Tearing (2230)	None.	Bulging less than 15% of the thickness.	Bulging 15% or more of the thickness. Splitting or tearing. Bearing's surfaces are not parallel. Does not warrant structural review.	
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.7— BRIDGE BEARING ELEMENTS

3.7.2 – Bridge Bearings w/o an Elastomer

Description: Includes movable, enclosed/concealed, fixed & disk bearings. Movable bearings provide for both rotational and longitudinal movement by means of a roller, rocker or sliding mechanisms. Fixed bearings only provide for rotation (no longitudinal movement). Disk bearings are a high load bearing with a hard plastic disk that may be fixed against horizontal movement, guided to allow movement in one direction or floating to allow sliding in any direction.

Element	Title and Definition	Units
311	**Movable Bearing**	**(EA)**
312	**Enclosed/Concealed Bearing**	**(EA)**
313	**Fixed Bearing**	**(EA)**
315	**Disk Bearing**	**(EA)**

3.7.2 – Bridge Bearings w/o an Elastomer

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.7— BRIDGE BEARING ELEMENTS

3.7.3 – Other Bridge Bearing

Description: All other material bridge bearings regardless of translation or rotation constraints.

Element	Title and Definition	Units
316	**Other Bearing**	**(EA)**

3.7.3 – Other Bridge Bearing

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.8—BRIDGE SUBSTRUCTURE ELEMENTS

3.8.1 – Steel Bridge Substructure Elements

Description: All steel bridge substructure elements. The correct steel protective coating element shall be used for each individual steel element type.

Element	Title and Definition	Units
202	**Steel Column**	**(EA)**
207	**Steel Column Tower (Trestle)**	**(L.F.)**
219	**Steel Abutment**	**(L.F.)**
225	**Steel Pile**	**(EA)**
231	**Steel Pier Cap**	**(L.F.)**
822	**Steel Sheeting**	**(L.F.)**
851	**Steel Fender / Dolphin System**	**(L.F.)**

3.8.1—Steel Bridge Substructure Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.8.2 – Reinforced Concrete Bridge Substructure Elements

Description: All reinforced concrete bridge elements including National Bridge Elements and Agency-Developed Elements. Element 521 (Concrete Protective Coating) shall be used for each individual element type that has a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion. Element 520 (Concrete Reinforcing Steel Protective System) shall be used for each individual element type that has a corrosion protection system installed. Protection systems may include cathodic protection or addition of anodes to mitigate corrosion.

Element	Title and Definition	Units
205	**Reinforced Concrete Column**	**(EA)**
210	**Reinforced Concrete Pier Wall**	**(L.F.)**
215	**Reinforced Concrete Abutment**	**(L.F.)**
220	**Reinforced Concrete Pile/Cap Footing**	**(L.F.)**
227	**Reinforced Concrete Piles**	**(EA)**
234	**Reinforced Concrete Pier Cap**	**(L.F.)**
820	**Reinforced Concrete Struts**	**(L.F.)**
825	**Reinforced Concrete Backwall**	**(L.F.)**
852	**Reinforced Concrete Fender / Dolphin Systems**	**(L.F.)**
886	**Reinforced Concrete Wingwall / Retaining Wall Cap**	**(L.F.)**
890	**Reinforced Concrete Wingwall / Retaining Wall**	**(L.F.)**
896	**Reinforced Concrete Headwall**	**(L.F.)**

3.8.2—Reinforced Concrete Bridge Substructure Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*The spacing of the cracks identified in the condition state descriptions is not applicable to map cracking.
**The abrasion/wear type of defect is applicable for R/C elements exposed or adjacent to flowing water.

3.8.3—Prestressed Concrete Bridge Substructure Elements

Description: All prestressed concrete bridge elements including National Bridge Elements. Element 521 (Concrete Protective Coating) shall be used for each individual element type that has a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion. Element 520 (Concrete Reinforcing Steel Protective System) shall be used for each individual element type that has a corrosion protection system installed. Protection systems may include cathodic protection or addition of anodes to mitigate corrosion.

Element	Title and Definition	Units
204	**Prestressed Concrete Column**	**(EA)**
226	**Prestressed Concrete Piles**	**(EA)**
233	**Prestressed Concrete Pier Cap**	**(L.F.)**
823	**Prestressed Concrete Sheeting**	**(L.F.)**

3.8.3—Prestressed Concrete Bridge Substructure Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Insignificant cracks or moderate cracks that are sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.8.4—Timber Bridge Substructure Elements

Description: All timber substructure elements regardless of protective system.

Element	Title and Definition	Units
206	Timber Column	(EA)
208	Timber Column Tower (Trestle)	(L.F.)
212	Timber Pier Wall	(L.F.)
216	Timber Abutment	(L.F.)
228	Timber Piles	(EA)
235	Timber Pier Cap	(L.F.)
821	Timber Struts	(L.F.)
824	Timber Sheeting	(L.F.)
840	Timber Pier Slab	(FT^2)
850	Timber Fender / Dolphin System	(L..F.)
885	Timber Wingwall / Retaining Wall Cap	(L.F.)

3.8.4—Timber Bridge Substructure Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Decay/Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5%–50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
Split/Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
Abrasion/Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.8.5—Masonry Bridge Substructure Elements

Description: Those pier walls constructed of block or stone. The block or stone may be placed with or without mortar. For all pier walls regardless of protective systems.

Element	Title and Definition	Units
213	**Masonry Pier Wall**	**(L.F.)**
217	**Masonry Abutment**	**(L.F.)**
892	**Masonry Wingwall / Retaining Wall**	**(L.F.)**

3.8.5—Masonry Bridge Substructure Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Mortar Breakdown (Masonry) (1610)	None.	Cracking or small voids in joint with or without insignificant fill loss.	Large voids in the joint with or without minor to moderate fill loss.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Fill Loss (8000)	No fill loss is present.	Fill loss is present, but no signs of settlement, misalignment or bulging of wall.	Fill loss resulting in movement of wall within tolerable limits or settlement of the approach roadway.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.8.6 – *Mechanically Stabilized Earth Wall Bridge Substructure Elements*

Description: All soil retaining wall systems that consist of a concrete or stone facing with steel or geosynthetic reinforcing fabric. This includes GRS abutments

Element Commentary: The Settlement defect (4000) is to be used to identify movement of a segment or portion of a MSE or GRS wall, whereas, the Masonry Displacement defect element (1640) is to be used for movement of individual panels, blocks or stones that are not adjacent to each other. The Loss of Fill defect element does not exist yet. In the meantime, place inspection notes in the MSE Wall element (818) comments and assign the quantity in the appropriate condition state in the element.

Element	Title and Definition	Units
818	**Mechanically Stabilized Earth (MSE) Wall**	**(L.F.)**

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Masonry Displacement (1640)	None.	Panels, block or stone that have shifted slightly out of alignment.	Panels, block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	

3.8.6—Mechanically Stabilized Earth Wall Bridge Substructure Elements (continued)

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Fill Loss (8000)	No fill loss is present.	Fill loss is present, but no signs of settlement, misalignment or bulging of wall.	Fill loss resulting in movement of wall within tolerable limits or settlement of the approach roadway.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

*The spacing of the cracks identified in the condition state descriptions is not applicable to map cracking.
**The abrasion/wear type of defect is applicable for elements exposed or adjacent to flowing water.

3.8.7—Other Bridge Substructure Elements

Description: All other material columns regardless of protective system.

Element Commentary: The other material column is intended for columns constructed of composite materials, or other materials that cannot be classified using any other defined column elements.

Element	Title and Definition	Units
203	**Other Column**	**(EA)**
211	**Other Pier Wall**	**(L.F.)**
218	**Other Abutment**	**(L.F.)**
229	**Other Pile**	**(EA)**
236	**Other Pier Cap**	**(L.F.)**
807	**Jacketed Pile**	**(EA)**

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	

3.8.7—Other Bridge Substructure Elements (continued)

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.9—BRIDGE CULVERT ELEMENTS

3.9.1—Steel Culvert Elements

Description: Those bridge culvert structures constructed of steel including arch, round or elliptical pipes regardless of protective systems.

Element Commentary: The Steel Culvert – Major element (844) shall be used for culverts with a 7' or greater span length. The Steel Culvert element (240) shall be used for steel pipe culverts that have a span length less than 7'. The distortion defect is contingent on a number of factors such as site, wall thickness, and fill depth. The inspector shall use such factors to assess the proper condition state.

Regarding pipe joint or seam connections that exhibit separation and/or loss of fill, the Connection (1020), Distortion (1900) or Settlement (4000) defect elements may be utilized to account for and document the deterioration/defect. If the seam has broken bolts, the Connection (1020) element should be considered. Similarly, if distortion of the pipe has caused the seam/joint to break or alter the shape of the pipe allowing fill loss to occur at the joint, then the Distortion (1900) defect should be considered.

For misaligned pipe segments, the Distortion (1900) defect element shall be used to identify and document alignment defects.

Element	Title and Definition	Units
240	**Steel Culvert**	**(L.F.)**
844	**Steel Culvert - Major**	**(L.F.)**

3.9.1—Steel Culvert Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	Some discoloration or surface corrosion may exist but there is no metal pitting.	There may be minor to moderate corrosion and pitting but cannot easily perforate with hammer.	Significant corrosion, deep pitting or flaking exists that can be easily perforated with a hammer.	Major corrosion with perforations and/or holes exists.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.9—BRIDGE CULVERT ELEMENTS

3.9.2—Aluminum Culvert Elements

Description: Those bridge culvert structures constructed of aluminum including arch, round or elliptical pipes regardless of protective systems.

Element Commentary: The Aluminum Culvert – Major element (848) shall be used for culverts with a 7' or greater span length. The Aluminum Culvert element (847) shall be used for aluminum pipe culverts that have a span length less than 7'. The distortion defect is contingent on a number of factors such as site, wall thickness, and fill depth. The inspector shall use such factors to assess the proper condition state.
When inspecting aluminum pipes, the inspection team shall not use a hammer since the corrosion occurs from the outside towards the inside and as a result, the inspection is more of a visual inspection.

Regarding pipe joint or seam connections that exhibit separation and/or loss of fill, the Connection (1020), Distortion (1900) or Settlement (4000) defect elements may be utilized to account for and document the deterioration/defect. If the seam has broken bolts, the Connection (1020) element should be considered. Similarly, if distortion of the pipe has caused the seam/joint to break or alter the shape of the pipe allowing fill loss to occur at the joint, then the Distortion (1900) defect should be considered.

For misaligned pipe segments, the Distortion (1900) defect element shall be used to identify and document alignment defects.

Element	Title and Definition	Units
847	**Aluminum Culvert - Minor**	**(L.F.)**
848	**Aluminum Culvert - Major**	**(L.F.)**

3.9.2—Aluminum Culvert Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	Some discoloration or surface corrosion may exist but there is no metal pitting.	There may be minor to moderate corrosion, pitting or white spots are starting to form that are less than 1″ in diameter.	Significant corrosion, deep pitting or "white spots" exists that are greater than 1″ in size with no visible fill.	Major corrosion with perforations and/or holes exists. Fill is visible.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.9.3—Reinforced Concrete Culvert Elements

Description: Those bridge culvert structures constructed of reinforced concrete including arch, round or elliptical pipes and box and frame culverts regardless of protective systems.

Element Commentary: The Reinforced Concrete Culvert – Major element (845) shall be used for box and frame culverts regardless of span length. Scaling in the floor of a box culvert shall remain in CS1; this includes deep scaling. The Reinforce Concrete Culvert element (241) shall be used for reinforced concrete pipe culverts including arch, round and elliptical pipes regardless of span length. The distortion defect is contingent on a number of factors such as site, wall thickness, and fill depth. The inspector shall use such factors to assess the proper condition state.

Regarding pipe joint or seam connections that exhibit separation and/or loss of fill, the Settlement (4000) or the Distortion (1900) defect elements should be utilized to account for and document the deterioration/defect using the guidance provided below.

CS1: Pipe joint gaps/seams are not within tolerable limits but no signs of fill loss.
CS2: Pipe Joint gaps/seams are not within tolerable limits with minor loss of fill.
CS3: Pipe joint gaps/seams are not within tolerable limits and have moderate to advanced fill loss that doesn't warrant structural review. May also include separated joints with exposed fill.
CS4: Advanced fill loss causing settlement or distortion that warrants structural review.

For misaligned pipe segments, the Distortion (1900) defect element shall be used to identify and document alignment defects.

Element	Title and Definition	Units
241	**Reinforced Concrete Culvert**	**(L.F.)**
845	**Reinforced Concrete Culvert - Major**	**(L.F.)**

3.9.3—Reinforced Concrete Culvert Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.9—BRIDGE CULVERT ELEMENTS

3.9.4—Masonry Culvert Element

Description: Those bridge culvert structures constructed of masonry.

Element Commentary: The distortion defect is contingent on a number of factors such as site, wall thickness, and fill depth. The inspector shall use such factors to assess the proper condition state

Element	Title and Definition	Units
244	**Masonry Culvert**	**(L.F.)**
897	**Masonry Headwall**	**(L.F.)**

3.9.4—Masonry Culvert Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Mortar Breakdown (Masonry) (1610)	None.	Cracking or small voids in joint with or without insignificant fill loss.	Large voids in the joint with or without minor to moderate fill loss.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.9.5—Other Culvert Element

Description: Other material-type culverts, including arches, round, elliptical pipes or spray liners. These culverts are not included in steel, concrete, aluminum, masonry or timber material types.

Element Commentary: The distortion defect is contingent on a number of factors such as site, wall thickness, and fill depth. The inspector shall use such factors to assess the proper condition state.

Regarding HDPE pipe joint or seam connections that exhibit separation and/or loss of fill, the Connection (1020), Distortion (1900) or Settlement (4000) defect elements may be utilized to account for and document the deterioration/defect. If the seam has broken or is cracked, the Connection (1020) element should be considered. Similarly, if distortion of the pipe has caused the seam/joint to break or alter the shape of the pipe allowing fill loss to occur at the joint, then the Distortion (1900) defect should be considered. For misaligned pipe segments, the Distortion (1900) defect element shall be used to identify and document alignment defects.

Element	Title and Definition	Units
243	Other Culvert	(L.F.)
846	HDPE Culvert	(L.F.)

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination/Spall / Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	

3.9.5—Other Culvert Element (continued)

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.9.6—Sacked Concrete Wall Element

Description: Those bridge walls belonging to pipe culvert structures that are constructed of sacked concrete bags.

Element Commentary: The defects for sacked concrete walls follows the defects for masonry walls since they are similar in nature. The distortion defect is contingent on a number of factors such as site, wall thickness, and fill depth. The inspector shall use such factors to assess the proper condition state

Element	Title and Definition	Units
895	Sacked Concrete Wall	(FT^2)

3.9.6—Sacked Concrete Wall Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Split/Spall (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	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
Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.10—WEARING SURFACES, PROTECTIVE COATINGS, AND CONCRETE REINFORCING STEEL PROTECTIVE SYSTEMS

3.10.1— Wearing Surface Elements

Description: All decks/slabs that have Non-Structural overlays made with flexible (asphaltic concrete), semi-rigid (epoxy and polyester material), and rigid (portland cement) materials; and timber running planks. If an original bare concrete deck was milled and replaced with LMC or Class D concrete back to its original depth, then that is considered Structural Resurfacing and a Wearing Surface Element shall not be created.

Element	Title and Definition	Units
510	**Wearing Surfaces: Rigid Overlay**	**(FT^2)**
810	**Wearing Surface: Thin Overlay**	**(FT^2)**
811	**Wearing Surface: Asphaltic Concrete Overlay**	**(FT^2)**
812	**Wearing Surface: Timber Planking**	**(FT^2)**

3.10.1— Wearing Surface Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall/ Patched Area/Pothole (Wearing Surfaces) (3210)	None. Patched area that is sound.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched area that is unsound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leakage or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.10—WEARING SURFACES, PROTECTIVE COATINGS, AND CONCRETE REINFORCING STEEL PROTECTIVE SYSTEMS

3.10.2— Steel Protective Coating Elements

Description: Steel elements that have a protective coating such as paint, galvanization, weathering steel patina, or other top coat steel corrosion inhibitor.

Element	Title and Definition	Units
515	**Steel Protective Coating: Paint System**	**(FT^2)**
815	**Steel Protective Coating: Weathering Steel**	**(FT^2)**
816	**Steel Protective Coating: Concrete Encased Steel Protection**	**(FT^2)**
817	**Steel Protective Coating: Galvanization Protection**	**(FT^2)**

3.10.2— Steel Protective Coating Elements

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Chalking (Steel Protective Coatings) (3410)	None.	Surface dulling.	Loss of pigment.	Not applicable.
Peeling/Bubbling/Cracking (Steel Protective Coatings) (3420)	None.	Finish coats only.	Finish and primer coats.	Exposure of bare metal.
Oxide Film Degradation Color/Texture Adherence (Steel Protective Coatings) (3430)	Yellow-orange or light brown for early development. Chocolate-brown to purple-brown for fully developed. Tightly adhered, capable of withstanding hammering or vigorous wire brushing.	Granular texture.	Small flakes, less than $^1/_2$-in. diameter.	Dark black color. Large flakes, $^1/_2$-in. diameter or greater, or laminar sheets or nodules.
Effectiveness (Steel Protective Coatings) (3440)	Fully effective.	Substantially effective.	Limited effectiveness.	Failed; no protection of the underlying metal.
Delamination/Spall / Patched Area (1080)	None.	Delaminated. Spall $\leq$ 1″ deep or $\leq$ 6″ in diameter.	Spall > 1″ deep or > 6″ in diameter.	Spall has exposed steel member.
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with minor-moderate rust staining.	Heavy rust staining
Cracking (RC and Other) (1130)	None	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks.	Wide cracks.
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or can be easily removed out of the concrete.	Coarse aggregate has popped out of the concrete.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.10—WEARING SURFACES, PROTECTIVE COATINGS, AND CONCRETE REINFORCING STEEL PROTECTIVE SYSTEMS

3.10.3— Concrete Protective Coating Element

Description: Concrete elements that have a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion.

Element Commentary: Element 520 shall always have a quantity of 1 and is only used for epoxy coated steel reinforcement in decks.

Element	Title and Definition	Units
520	**Concrete Reinforcing Protective System**	**(FT^2)**
521	**Concrete Protective Coating**	**(FT^2)**

3.10.3— Concrete Protective Coating Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Wear (Concrete Protective Coatings) (3510)	None.	Underlying concrete not exposed; coating showing wear from UV exposure; friction course missing.	Underlying concrete is not exposed; thickness of the coating is reduced.	Underlying concrete exposed. Protective coating no longer effective.
Effectiveness (Concrete Protective Coatings) (3540)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.11—SMART FLAG ELEMENTS

3.11.1— Soffit Smart Flag

Description: The concrete underside surface of concrete deck and slabs.

Element Commentary: Defect elements do not need to be created for the soffit element since they will be accounted for in the concrete deck or slab defect elements. This element helps identify distress in the under-surface of the deck or slab versus that in the top surface and will be used for assigning NBI Deck Condition Rating and for project scoping purposes.

Element	Title and Definition	Units
839	**Soffit (or under surface) of Concrete Deck or Slab**	**(EA)**

3.11.1 – Soffit Smart Flag

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall / Patched Area (1080)	Distressed area on the under-surface is light. The distressed area is <2% of the total underside area.	Distressed area on the under-surface is minor to moderate. The distressed area is ≥2% but <10% of the total underside area.	Distressed area on the under-surface is moderate to heavy. The distressed area is ≥10% but <25% of the total underside area.	Distressed area on the under-surface is severe. The distressed area is ≥25% of the total underside area.
Exposed Rebar (1090)				
Efflorescence/Rust Staining (1120)				
Cracking (RC) (1130)				
Damage (7000)				

3.11—SMART FLAG ELEMENTS

3.11.2— Erosion Smart Flag

Description: This element only applies to erosion adjacent to the structure outside of the stream and stream bank limits.

Element	Title and Definition	Units
829	**Erosion**	**(EA)**

3.11.2 – Erosion Smart Flag

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Exposed Substructure Foundation	Superficial erosion is starting to occur.	Erosion exists at the bridge site, but is of little concern to the structural integrity of the bridge. *~Minor Erosion*	Erosion exists at the bridge site and if left unchecked, could adversely affect the structural integrity of the bridge. *~Moderate Erosion*	Erosion is significant enough to warrant analysis to ascertain the stability of the structure. *~Advanced Erosion*
Slope and/or Roadway Embankment Protection				
Adjacent Roadway				
Settlement				

3.12—MOVABLE BRIDGE ELEMENTS

3.12.1— Movable Bridge Electrical System Element

Description: All electrical components associated with the operational activities for the movable bridge structure. Does not include the electrical components for the operator's house/facility.

Element	Title and Definition	Units
898	**Movable Bridge Electrical System**	**(EA)**

3.12.1 – Movable Bridge Electrical System Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Electrical Panels	No defects noted, components appear to be in new condition and functioning as designed. Less than 15% of predicted life expended for electrical components.	Minor to moderate deterioration or wear noted, components appear to be functional, but no longer operating like new. Components have useful remaining life. 15-65% of predicted life expended for electrical components.	Significant deterioration or wear noted, components appear to be generally functional, but exhibits signs that failure may result from continued wear or deterioration. Components are nearing the end of their useful life. 65-85% of predicted life expended for electrical components.	Severe deterioration or wear noted, components appear to be marginally functional and exhibits signs that failure may result from continued wear or deterioration. Corrective action is required as soon as possible to avoid failure. More than 85% of expected life expended for electrical components.
Circuit Breakers				
Control Panel				
Limit Switches				
Motors				
Resistor Bank(s)				
Generator				
Open Wiring & Wiring in Conduit				
Wiring Terminals				

3.12—MOVABLE BRIDGE ELEMENTS

3.12.2— Movable Bridge Mechanical System Element

Description: All mechanical components associated with the operational activities for the movable bridge structure. Does not include the mechanical components for the operator's house/facility.

Element	Title and Definition	Units
899	**Movable Bridge Mechanical System**	**(EA)**

3.12.2 – Movable Bridge Mechanical System Element

Condition State Definitions

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Gearing	No defects noted, components appear to be in new condition and functioning as designed.	Minor to moderate deterioration or wear noted, components appear to be functional, but no longer operating like new. Components have useful remaining life.	Significant deterioration or wear noted, components appear to be generally functional, but exhibits signs that failure may result from continued wear or deterioration. Components are nearing the end of their useful life.	Severe deterioration or wear noted, components appear to be marginally functional and exhibits signs that failure may result from continued wear or deterioration. Corrective action is required as soon as possible to avoid failure.
Motor Systems				
Brake Systems				
Span Lock Systems				

Section 4:

Element Factors

4.1—ENVIRONMENTAL FACTORS (SERVICE CONDITIONS)

Elements exposed to different environmental factors and service environments deteriorate differently. These factors may include:

- Operational activities from traffic volumes and truck movements,
- Exposure to water, road salt, and other corrosive materials,
- Condition of protective and water proofing systems, or
- Temperature extremes, either from nature or human activity.

When inventorying and assessing the condition of the elements, an inspector should consider the environment in which the element is operating. The environmental designation of an element can change over time; as it would, for example, if operating policies were changed to reduce the use of road salt. However, by definition, the environmental designation for any element cannot change as the result of maintenance work or deterioration.

Environment	Description
1—Benign	Neither environmental factors nor operating practices are likely to significantly change the condition of the element over time, or their effects have been mitigated by the presence of highly effective protective systems.
2—Low	Environmental factors, operating practices, or both either do not adversely influence the condition of the element, or their effects are substantially lessened by the application of effective protective systems.
3—Moderate	Any change in the condition of the element is likely to be quite normal as measured against the environmental factors, operating practices, or both that are considered typical by the agency.
4—Severe	Environmental factors, operating practices, or both contribute to the rapid decline in the condition of the element. Protective systems are not in place or are ineffective.

Examples of factors that could increase the severity of the environment rating for various types of elements may include any of the following. The inspector would record the predominant environmental factor affecting an element.

Element	Example Environmental Factors
Timber Elements	High moisture content
	Pest infestation
	Ice flow impacts
Steel Elements	Distance from salt air
	Water wet/dry cycles
	Exposure to corrosive soils and liquids
Concrete Elements	Freeze-thaw cycles
	Tire chain wear
	Deck salting
Petroleum-Based	High temperatures
Joints and Bearings	Extreme temperature ranges
Operating Practices	High traffic or truck volume, or both

4.2—ELEMENT SCALE FACTORS

Scale Factors are used to specify additional measurements for the element that can be used to adjust project-level cost calculations. Not all elements require scale factors – inspectors should refer to the tables in 4.2.2 to confirm which elements scale factors will need to be computed.

4.2.1—SCALE FACTOR COMPUTATIONS

All scale factors have been calculated and entered as of 12/31/14. If inspector(s) find scale factors missing, (check past inspection by clicking onto the inspection date and selecting the previous inspection to see if scale factors are entered), if present in the previous inspection, re-enter into the current inspection and notify the Bridge Inspection Engineer.

All new bridge inventories and inspections where elements are added or changed and now require a scale factor to be computed.

The inspector shall make a note under the **Note Tab, Structure Notes**, stating:

….NOTE: SCALE FACTORS ENTERED BY (inspectors initials) ON 00/00/00 (date of entry), DO NOT CHANGE OR ERASE….

NOTE: The scale factors that exist in the database (current and past) are ***NOT TO BE CHANGED, ERASED OR RE-CALCULATED.***

To enter scale factors, click on the **EDIT ELEMENT** tab; enter the factor where it says scale factor to three (3) decimal places and save.

ALL CALCULATED SCALE FACTORS THAT ARE WHOLE NUMBERS i.e. (1.000, 2.000, 6.000 etc.) SHALL BE ENTERED AS 1.001, 2.001, 6.001 etc. The reason for this is that 1.000 is the default value within the program for all scale factors and if an element has a value of 1.000 it is assumed that the scale factor was not computed.

Where / when available, **'Standard Dimensions'** shall be taken from the plans as per the **'Standard Dimension Description'**. If plans are not available or do not exist, field measurements must be taken. For elements that are partial under ground (not visible), the maximum height dimension shall be from the ground line to the top of the element at its highest point. Examples: Elements where footings would not normally be visible, Abutments to top of Backwall, Wing Walls, Sheeting, MSE Walls, etc.

Standard Dimension Values are common or average element dimensions determined by Bridge Management and shall not be changed for any reason.

Where element dimensions vary, a ***'Weighted Average'*** dimension for the element shall be used in the computation.

Example: Element #856 – R/C Sidewalk – Width (ft) with sidewalks widths = 5’ and 6’ and the lengths are 100’ and 50’.

The weighted average width = ((5’*100’)+(6’*50’))/150’ = 5.33’

Divided by the Standard Dimension Value of 5, Scale Factor = 1.067.

For structural steel elements, calculate the surface area for each girder/beam per span (from the ‘Structural Steel Shapes Manual’). Add the square footage for each span together and divide by the total liner footage of girders/beams to get the weighted average for the element, divide by the Value to get the Scale Factor.

4.2.2—Element Scale Factor Table

ELEMENTS FOR SCALE FACTOR COMPUTATION

Element	Element Description	Standard Dimension Description	Standard Dimension Value	Unit
856	Sidewalk, RC	Width	5	ft
857	Sidewalk, Timber	Width	5	ft
858	Sidewalk, Other	Width	5	ft
867	Sidewalk, Steel Open Grid	Width	5	ft
868	Sidewalk, Steel Filled Grid	Width	5	ft
862	Median, RC	Width	4	ft
863	Median, Steel Painted	Width	4	ft
864	Median, Other	Width	4	ft
102	Steel Closed Web/Box Girder	Paintable Surface Area	16	sf/ft
104	Prestressed Conc. Closed Web/Box Girder	Depth of girder in feet	2.25	ft
105	Reinf. Conc. Closed Web/Box Girder	Depth of girder in feet	2.25	ft
107	Steel Open Girder / Beam	Paintable Surface Area	10	sf/ft
109	Prestressed Conc. Open Girder / Beam	Girder Depth	3.75	ft
110	Reinf. Conc. Open Girder / Beam	Girder Depth	3.75	ft
111	Timber Open Girder / Beam	Girder Depth	1.17	ft
113	Steel Stringer (Str-Flbm-Sys)	Paintable Surface Area	7	sf/ft
115	Prestressed Conc. Stringer (Str-Flbm-Sys)	Girder Depth	3.75	ft
116	R/C Stringer (Str-Flbm-Sys)	Girder Depth	3.75	ft
117	Timber Stringer (Str-Flbm-Sys)	Depth of Stringer	1.17	ft
120	Steel Truss	Paintable Surface Area	5.66	sf/ft
135	Timber Truss	Truss Height	12	ft
144	Reinforced Conc. Arch **(1-576 ONLY)**	Circumference of the Arch Rib		
152	Steel Floor Beam	Paintable Surface Area	7	sf/ft
154	Prestressed Concrete Floor Beam	Girder Depth	3.75	ft
154	Reinforced Concrete Floor Beam	Girder Depth	3.75	ft
156	Timber Floor Beam	Depth of Beam	1.17	ft
202	Steel Column	Circumference	7.85	ft
204	Prestressed Concrete Column	Circumference	7.85	ft
205	Reinforced Concrete Column	Circumference	7.85	ft
206	Timber Columns	Circumference	7.85	ft
225	Steel Pile	Circumference	7.85	ft
226	Prestressed Concrete Pile	Circumference	7.85	ft
227	Reinforced Concrete Pile	Circumference	7.85	ft
228	Timber Pile	Circumference	7.85	ft

4.2.2—Element Scale Factor Table (continued)

Element	Element Description	Standard Dimension Description	Standard Dimension Value	Unit
210	Reinforced Concrete Pier Wall	Max height from top of footing	16	ft
213	Masonry Pier Wall	Max height from top of footing	16	ft
215	Reinforced Concrete Abutment	Max height from top of footing to top of backwall including the backwall	7	ft
216	Timber Abutment	Depth of Cap	1.33	ft
217	Masonry Abutment	Max height from top of footing	7	ft
818	MSE Wall	Avg Exposed Height	15	ft
220	Reinf. Conc. Submerged Pile Cap/Footing	Length of cap	40	ft
231	Steel Pier Cap	Paintable Surface Area	20	sf/ft
233	Prestressed Conc. Pier Cap	Depth of Cap	4	ft
234	Reinf. Conc. Pier Cap	Depth of Cap	4	ft
235	Timber Pier Cap	Depth of Cap	1.33	ft
240	Steel Culvert (Minor)	Culvert Span	6	ft
241	Conc. Culvert (Minor)	Culvert Span	6	ft
244	Masonry Culvert	Culvert Span	6	ft
844	Steel Culvert (Major)	Culvert Span	17	ft
845	Conc. Culvert (Major)	Culvert Span	17	ft
846	HDPE Culvert	Culvert Span	5	ft
847	Aluminum Culvert (Minor)	Culvert Span	6	ft
848	Aluminum Culvert (Major)	Culvert Span	17	ft
822	Steel Sheeting	Max Exposed Height	10	ft
823	Prestressed Conc. Sheeting	Max Exposed Height	10	ft
824	Timber Sheeting	Max Exposed Height	7	ft
321	Reinforced Conc. Approach Slab	Square footage	560	sf
885	Timber Wingwall Cap	Depth of Cap	0.33	ft
886	MSE Wingwall Cap	Depth of Cap	2	ft
890	Wingwall, RC	Max wall height from top of footing	10	ft
892	Wingwall, Other	Max wall height from top of footing	10	ft
896	Headwall , RC	Max Height	2	ft
897	Headwall - Other	Max Height	2	ft

Section 5:

Element Selection, Quantity Calculation and Inspection Guidance

5.1—ELEMENT SELECTION

If plans are available, all applicable elements should be determined for the bridge based on those plans. The inspector shall actually rate only those elements that can be seen by the inspector.

5.1.1—Bridge Railing

Bridge railings with multiple rail systems (concrete w/ aluminum handrail) will be recorded as per each material type, i.e., #330, Metal Bridge Railing and #331, Concrete Bridge Rail.

When recording guardrail as bridge rail, only guardrail attached to the structure will be considered bridge rail. Guardrail posts driven in fill over culverts is not considered bridge rail and should not be recorded as an element. This condition should be coded in NBI Item #36.

5.1.2—Curbs & Sidewalks

The sidewalk element should be used when the width is greater than 24" and not monolithic with the deck, i.e., raised. The curb element may also be used in conjunction with a sidewalk element in accordance with the element descriptions.

If the width is $\leq$ 24", only the curb element should be used.

5.1.3—Truss Elements

If there is deterioration of a vertical member, code the foot quantity of deterioration equal to the width of that vertical member.

5.1.4—Substructure Elements

Hammerhead Piers consisting of square or round shafts with a tapered pier cap shall be coded as #205 - Column and #234 - Pier Cap. If the hammerhead pier has a rectangular shaft with definitive joint or change of dimension at the cap, the pier shall be coded as #210 - Pier Wall and #234 - Pier Cap.

Substructures constructed of a combination of elements shall be separated into their respective elements (abutment, sheeting and piles). For example:

Timber abutments shall be separated into elements #824 – Timber Sheeting, #216 – Timber Abutment and #206 – Timber Piles.

Timber wingwalls shall be separated into elements #824 – Timber Sheeting, #206 – Timber Piles, and #285 – Timber Wingwall / Retaining Wall Cap.

5.2—ELEMENT QUANTITY CALCULATION

5.2.1—Estimating Total Quantities

Partial unit measurements are not permitted. Quantities should be entered utilizing the nearest whole foot within AASHTOWare BrM. Quantities should not be changed from inspection to inspection unless construction/rehab has been performed or current quantity is in obvious error. Quantities are not to be re-measured at every inspection.

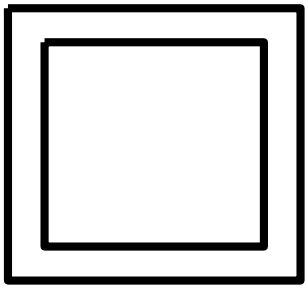
5.2.2—Conventions for Quantities

- Quantity for **decks** and **slabs** shall be measured on a square foot basis from out to out and backwall to backwall.
- Quantity for **joints** is measured in feet along the length of the joint.
- Quantity for **approach slabs** is measured on a square feet basis.
- Quantity for **culverts** is measured in feet along the centerline length of the bottom of the barrel times the number of barrels.
- Quantity for **abutments** is measured in feet along their face.
- Quantity for **bridge railing, medians, curbs and sidewalks** is measured in feet from backwall to backwall or to the end of the wingwalls or approach slabs when element is attached to either the wingwalls or approach slab.
- Quantity of **bridge railing** (parapets) for structures with bridge decks divided by a median parapet such as a jersey barrier type or structure with a traffic barrier protecting a sidewalk area shall be measured in feet along the face of the barrier, i.e., 30 ft bridge with a parapet on each side and a double face parapet in the median, quantity = 90 ft.
- Quantity for **pier walls** and **caps** is measured in feet from outside edge to outside edge. Use the pier wall element anytime the pier-supporting member is not round or square.
- Quantity for **arch** is measured in feet along the span length from spring line to spring line.
- Quantity for **filled arch** is measured in feet along the length from spring line to spring line. The material below the spring line is considered the substructure and the correct abutment or pier elements shall be used.
- Quantity for **sheeting** is measured in feet on a horizontal basis, not vertical.
- Quantity for **piles and columns** are measured as an each item. If there is a pile jacket, the pile length is measured as an each item as well.
- Bridges that include both **painted** and **unpainted steel elements**, should have quantities identified in the appropriate Steel Protective Coating elements accordingly.
- Quantity for **partially concealed** elements (i.e. wingwalls or beams) should be taken from plans. If no plans are available, measure the exposed quantity. Any quantity that is uninspectable shall be placed in CS-1. This does not apply to piles or columns. Any **totally concealed** element, except enclosed bearings, is considered uninspectable and should not be included.

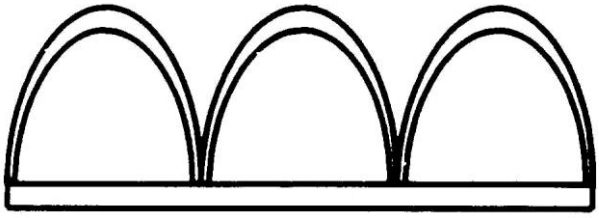
5.2.3—Element Quantity Calculation Examples

Culverts

The quantity for culverts will be the length of the barrel (measured from headwall to headwall) multiplied by the number of barrels. For example if you have a 2 barrel culvert that is 75' long, the total length of the culvert is 75' x 2 = 150'.



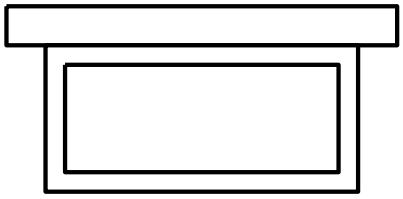
Quantity = 1 x Barrel Length



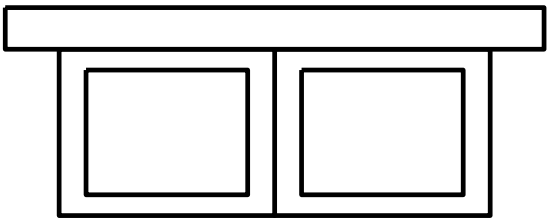
Quantity = 3 x Barrel Length

Box Girders

The quantity for box girder depends on the number of boxes which make up the girder. The quantity will be the number of "barrels" multiplied by the bridge length. See the following guideline:



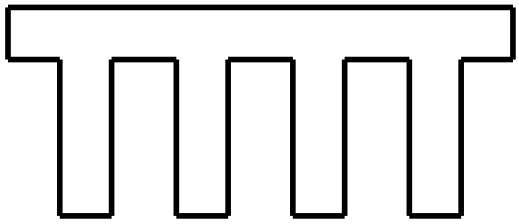
Quantity = 1 x Length



Quantity = 2 x Length

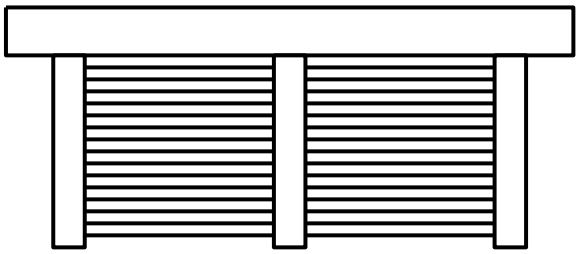
Integral Deck Girders

For this type of bridge include both an element for girder as well as one for deck (top flange). The two elements are rated separately, but the NBI Condition Rating will be the same for the deck & superstructure.



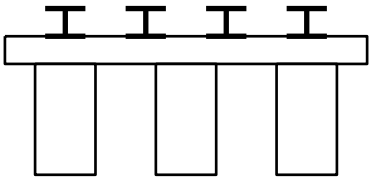
Quantity = 4 x Length

Timber Abutments
These types of abutments typically will get 3 different elements: a timber cap, timber pile, and timber sheeting.



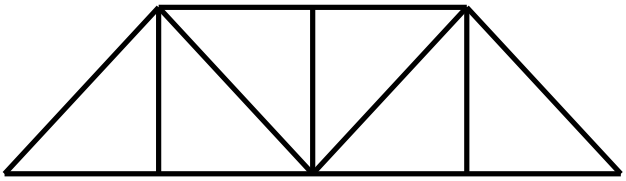
Quantity: timber piles = 3, timber cap = 1 x length, timber abutment = 1 x length

Pile Bent Pier
These piers will have two elements, a cap and piles. Any diagonal bracing will not be considered in rating the condition of the piless.



Quantity: piles = 3, cap = 1 x length

Trusses
These are recorded as the number of lineal feet on each side of the bridge. Diagonals, verticals or cross bracing are not counted as additional quantities.



Quantity = 2 x length (one for each side of the bridge)

Stringers/Floor beams/Girders

Stringers are the small elements which run longitudinally to the deck and carry the load from the deck to the floorbeams. Floorbeams are transverse to the deck and carry the stringer load out to the truss or girders. Girders are the main longitudinal superstructure members which carry the loads to the substructures.

Stringers

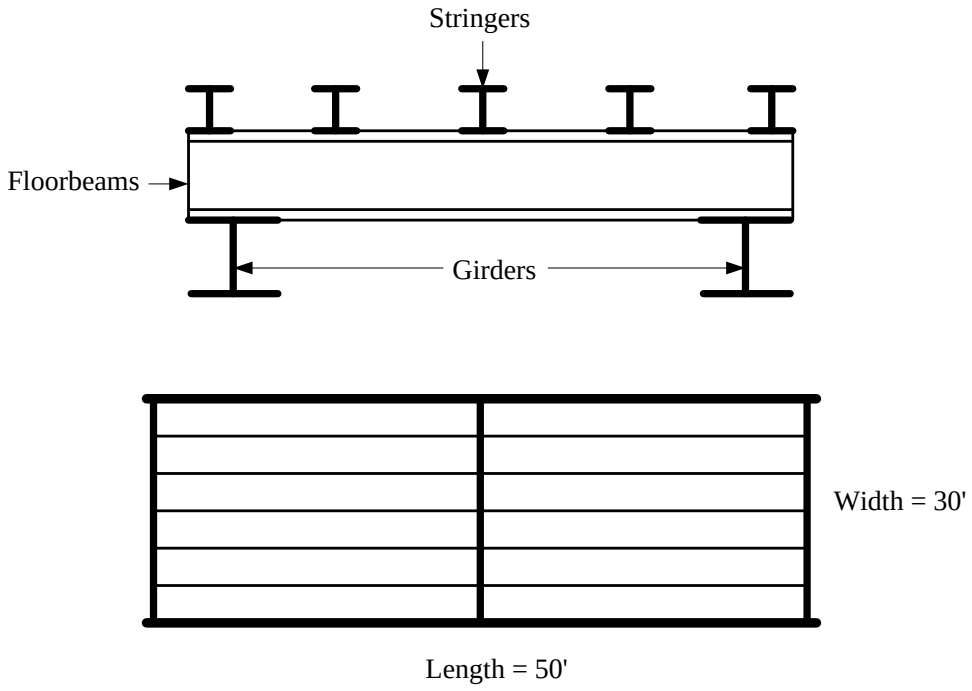
Quantity = length x number of stringers = 50' x 5 = 250 LF

Floorbeams

Quantity = width x number of floorbeams = 30' x 3 = 90 LF

Girders

Quantity = length x number of girders = 50' x 2 = 100 LF



5.2.4—Steel Protective Coating Element Quantity Calculation

When calculating the quantity for any of the Steel Protective Coating Elements, the linear foot perimeter along the member's cross-section shall be multiplied by the length of that element in the longitudinal direction in calculating the paint area for the element. The total quantity will include the calculated square foot area multiplied by the number of members. Some steel superstructure and substructure elements have units of "Each" versus that of linear foot. For these elements, the Steel Protective Coating Element should be calculated taking the total surface area multiplied by the number of the members for that element. An example of this would be for steel diaphragms.

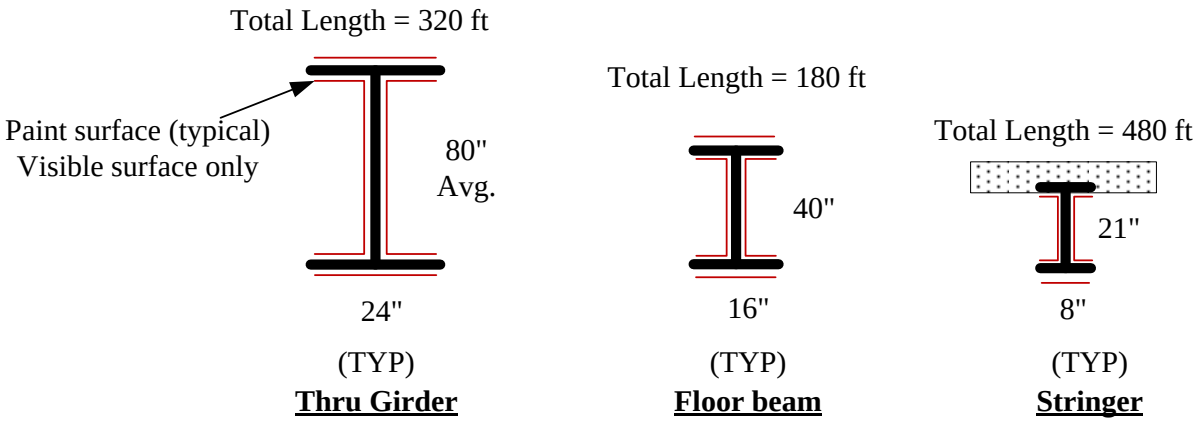
There are a few elements that are difficult to calculate a square foot area for and instead of having the inspector measure and calculate the actual exposed surface area, the values in the chart in 5.2.4.1 are to be used. The inspector shall take the value provided in the chart and multiply by the number of members for that element.

5.2.4.1—Steel Protective Coating Quantity Calculation for Other Elements

Element Number	Steel Element Description	Calculation (square feet)
867	Steel Open Grid Sidewalk	(Total Element Quantity) x 5
868	Steel Filled Sidewalk	(Total Element Quantity) x 0.5
311	Movable Bearing	(Total Each Quantity) x 6
312	Enclosed/Concealed Bearing	(Total Each Quantity) x 6
313	Fixed Bearing	(Total Each Quantity) x 6
314	Pot Bearing	(Total Each Quantity) x 6
315	Disk Bearing	(Total Each Quantity) x 6

5.2.4.2—Steel Protective Coating Element Quantity Calculation Examples

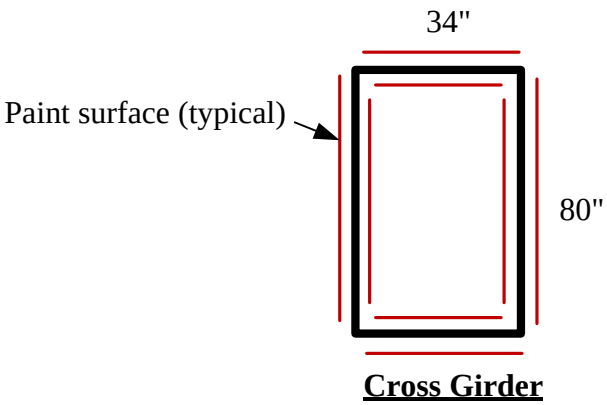
Example 1: Protective Coating for Thru Girder-Floor beam-Stringer System



Element	Calculations		Area/Length SF/LF	Length (LF)	Total (SF)
Stringers	(4 + 21 + 4 + 8 + 4 + 21 + 4) / 12 =	5.50	5.50 SF/LF	480	2,640
Floorbeams	(8 + 40 + 8 + 16 + 8 + 40 + 8 + 16) / 12 =	12.00	12.00 SF/LF	180	2,160
Thru Girders	(12 + 80 + 12 + 24 + 12 + 80 + 12 + 24) / 12 =	21.33	21.33 SF/LF	320	6,827

Example 2: Steel Protective Coating for Cross Girder

Length = 50 LF
Quantity = [(80 + 34 + 80 + 34) /12] x 2 x 50
= 19 x 2 x 50
= 1900 SF



5.3—INSPECTION GUIDANCE

5.3.1—General

The inspector shall review prior bridge inspection reports to verify that all element numbers and quantities are accurate according to previously stated guidelines. Current underwater inspections shall be reviewed and utilized when rating substructure elements.

5.3.2—Inspection Orientation

Orientation shall be stations ahead (from any existing plans) with left elements, such as girders, being numbered 1. If plans are not available, match the previous inspection orientation. If no previous inspection or plans are available, inspection orientation shall be west to east or south to north.

5.3.3—Multi-Span Orientation

Element Documentation for multi-span bridges on span-by-span basis

Span #1 should include:

1. The deck element and any overlays and/or defects.
2. Superstructure elements including the bearings supporting that span. Joint at abutment and pier #1
3. The substructure elements including the abutment and first pier.

Span #2 and remaining spans should include:

1. Superstructure elements including the bearings supporting that span. Joint at pier or abutment #2.
2. Substructure elements including the next pier or abutment if last span.

Element Documentation for multi-span bridges, with buried spans, on a span-by-span basis

First span should include:

1. The deck element (whole deck quantity) and any smart flags.
2. Any visible elements in the format as documented above.

Subsequent spans should include:

1. Any visible elements in the format documented above.

Note: For bridges with buried spans, the abutment may be placed in the span in which it is visible. A substructure element is considered a pier if it can be inspected on all sides otherwise it is an abutment.

Example: 3-span bridge, first two spans buried, third span visible with pier visible on one side only and an abutment.

Span 1 elements: Deck, Smart Flags, Railing, Joints, other visible elements
Span 2 elements: Railing, Joints, other visible elements
Span 3 elements: Two Abutments, Bearings, Beams, Railing, Joints, other visible elements

5.3.4—Element Condition State Assignment Guidance

All elements have four condition state options that the bridge inspection team may choose based on the type and severity of deterioration observed. The list below provides a general description of the types of defects associated with each condition state.

- Condition State 1 may include superficial type of defects or no defects at all.
- Condition State 2 includes minor defects or minor-moderate deterioration.
- Condition State 3 includes moderate – heavy deterioration.
- Condition State 4 includes advanced deterioration or defects that warrant a structural review. The structural review may consist of structural analysis computations or engineering judgment.

All primary and secondary structural components that are assigned any quantity in a Condition State 4 will require review by DelDOT's Bridge Inspection Engineer and/or Bridge Management Engineer. Upon completion of the structural review, the Condition State may be reduced to that of a Condition State 3 if the review shows that the load carrying capacity of the bridge has not been affected. The load carrying capacity is typically identified as whether or not the bridge needs to be posted for any of the Delaware Legal Loads.

5.3.5—Concrete Crack Size Definitions

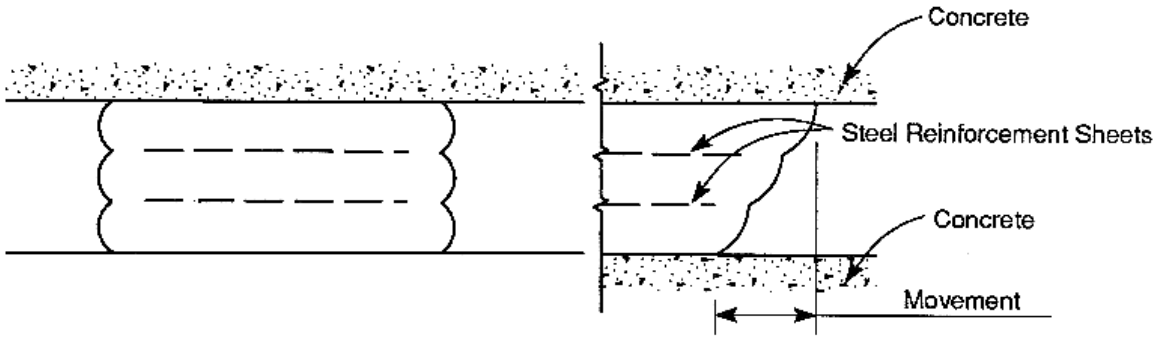
Reinforced Concrete			**Prestressed Concrete**		
Insignificant	-	$\leq$ 1/16"	Insignificant	-	< 0.004 "
Moderate	-	> 1/16 " – 1/4 "	Moderate	-	$\geq$ 0 .004 " - 0.009 "
Wide	-	> 1/4"	Wide	-	>.009 "

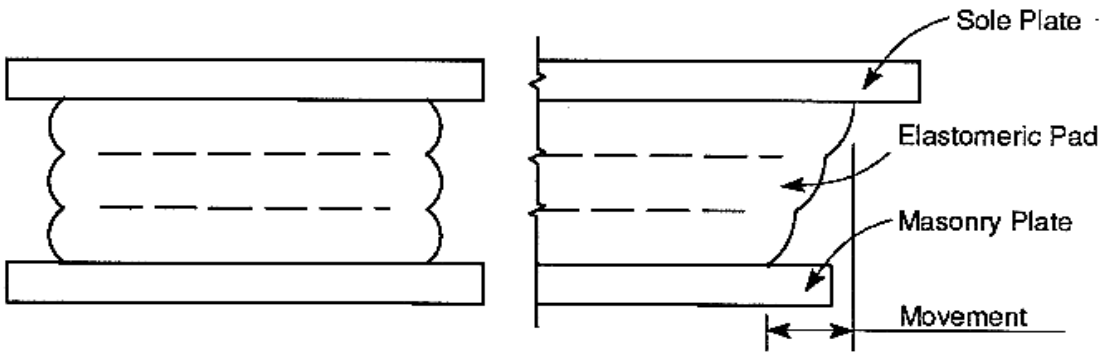
Note: Crack dimensions for prestressed concrete apply to cracks that are perpendicular to prestressing. For cracks that are parallel to prestressing, refer to crack dimensions for reinforced concrete.

5.4—*EXAMPLES OF BEARING TYPES*

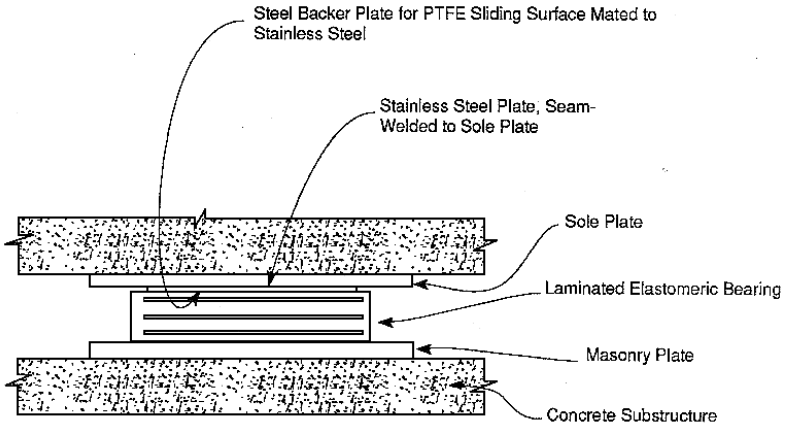
5.4.1—Elastomeric Bearing, Element No. 310

5.4.1.1—Elastomeric Bearing w/o Teflon Plates

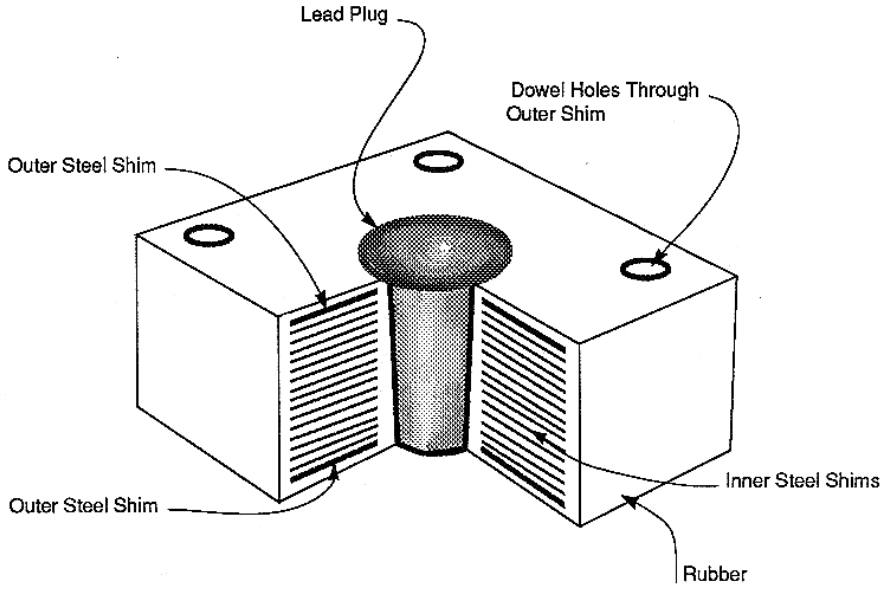




5.4.1.2—Elastomeric Bearing w/ Teflon Plates



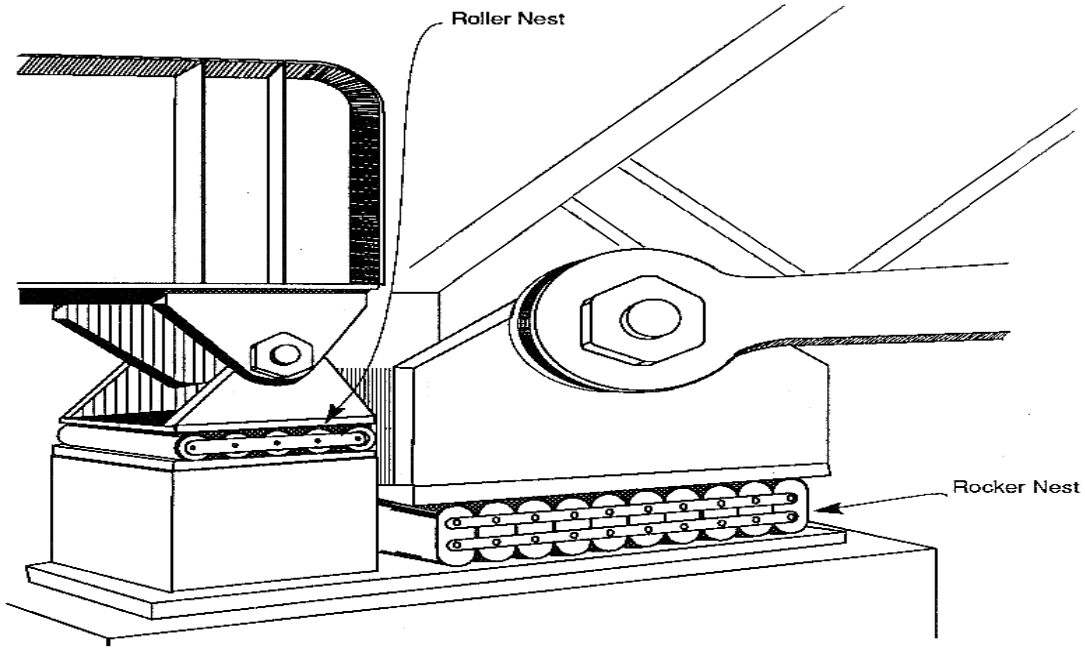
5.4.1.3— Isolation Bearing



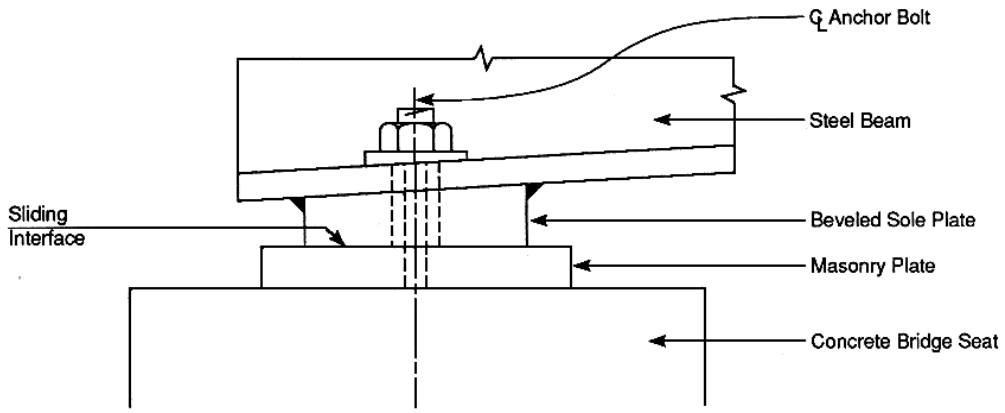
Typical Lead-Rubber Bearing

5.4.2—Moveable Bearing, Element No. 311

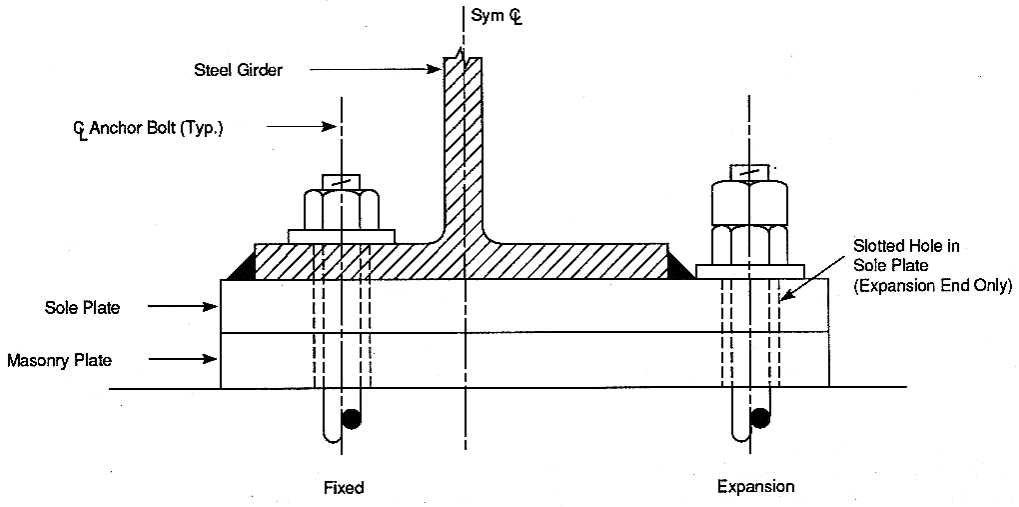
5.4.2.1—Roller and Rocker Nests



5.4.2.2—Sliding Plate Bearing

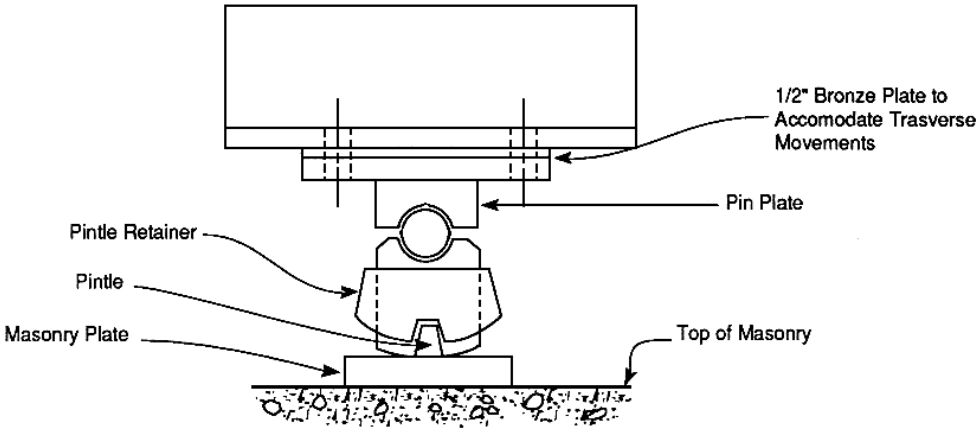


SIDE ELEVATION

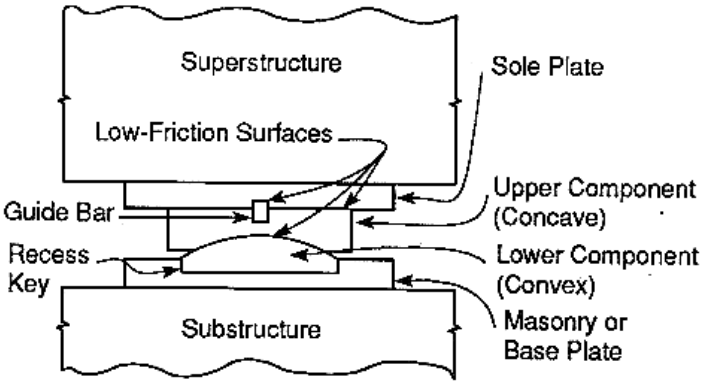


END ELEVATION

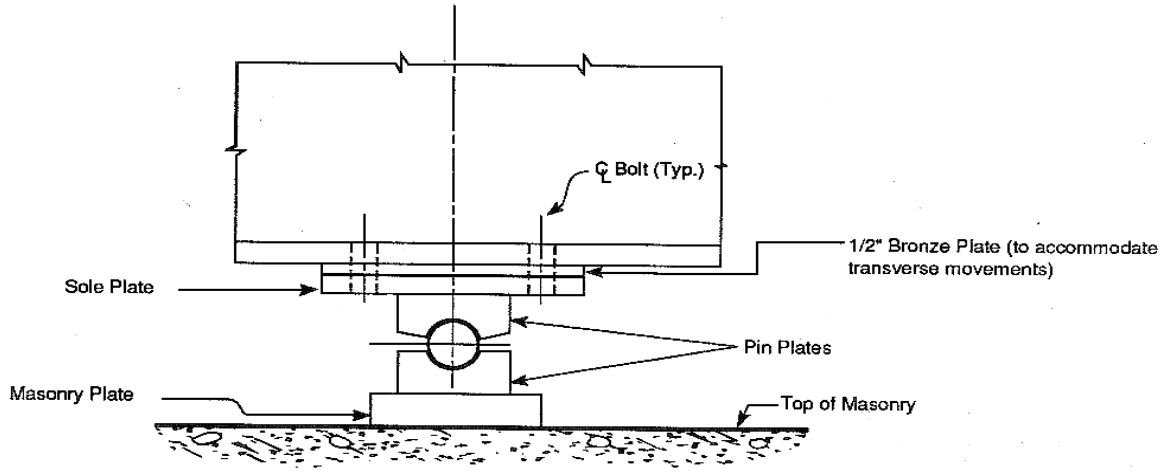
5.4.2.3—Rocker Bearing



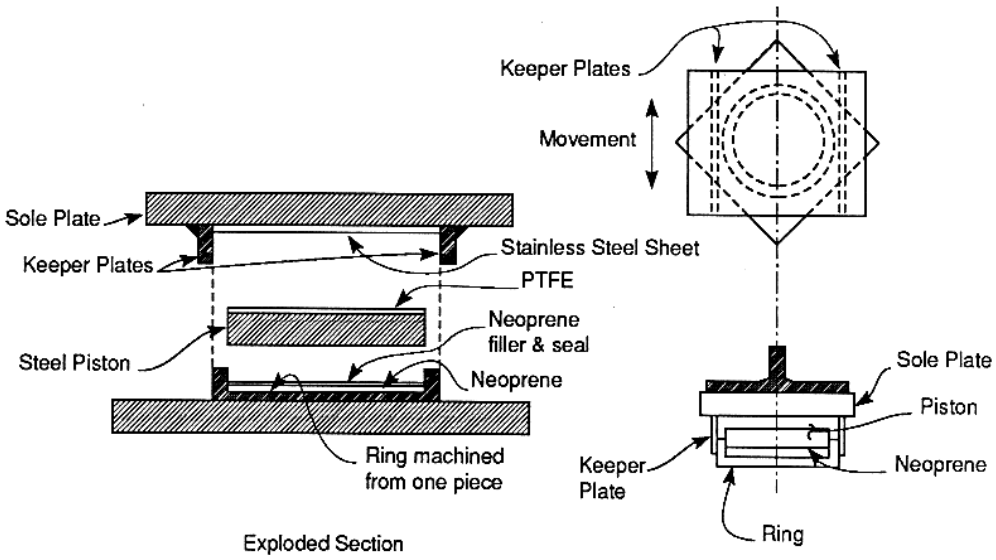
5.4.2.4—Spherical Bearing



5.4.3—Fixed (Pinned) Bearing, Element No. 313

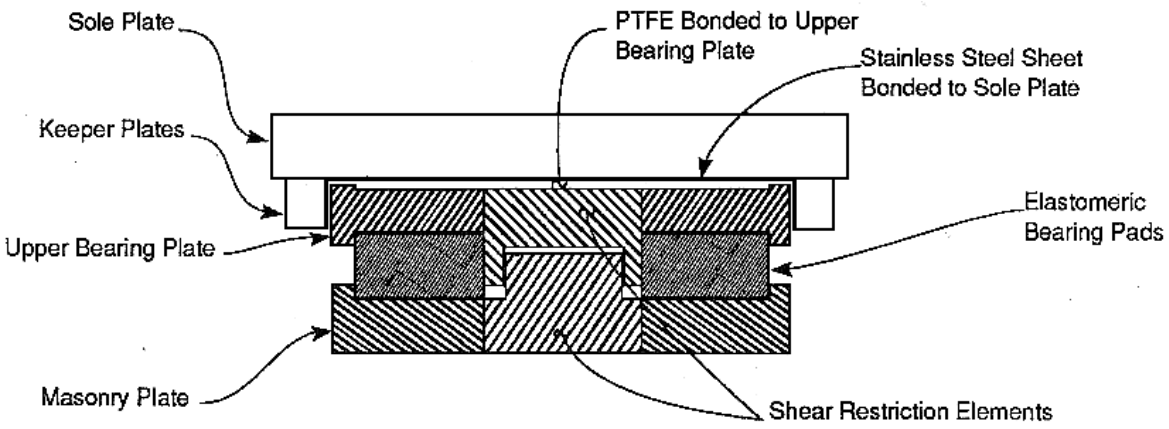


5.4.4—Pot Bearing, Element No. 314



Sliding Pot Bearing

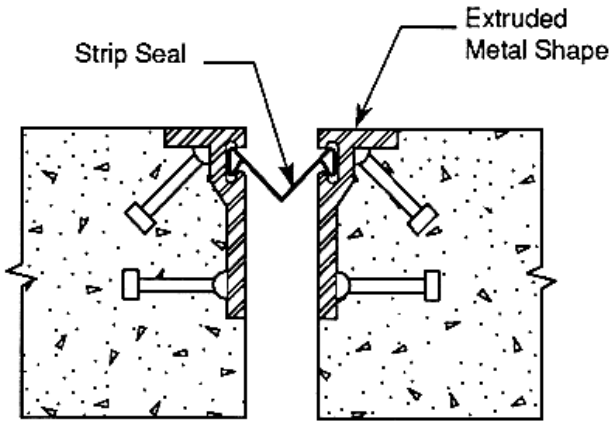
5.4.5—Disc Bearing, Element No. 315



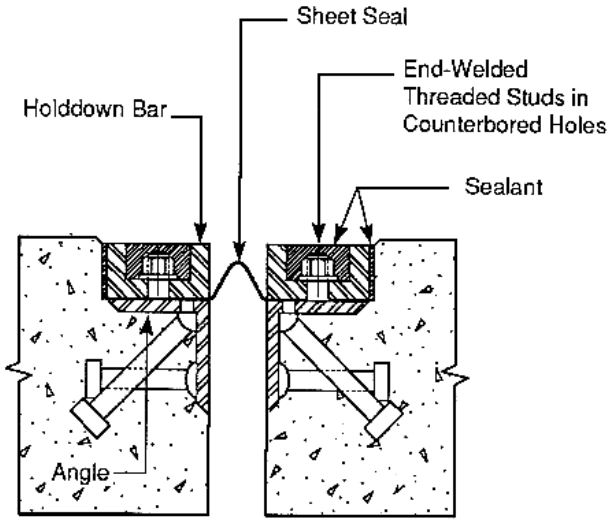
5.5—EXAMPLES OF JOINT TYPES

5.5.1--Strip Seal Expansion, Element No. 300

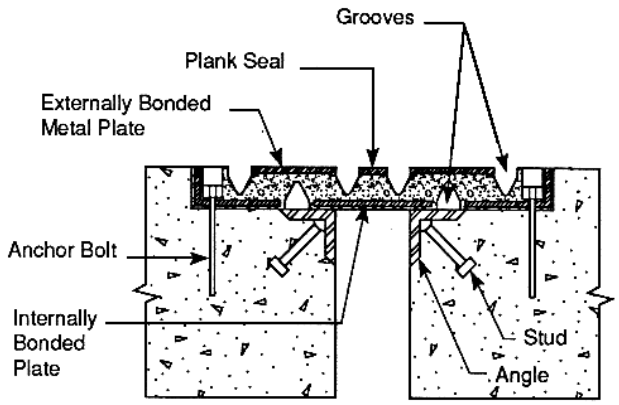
5.5.1.1—Traditional Strip Seal Joint



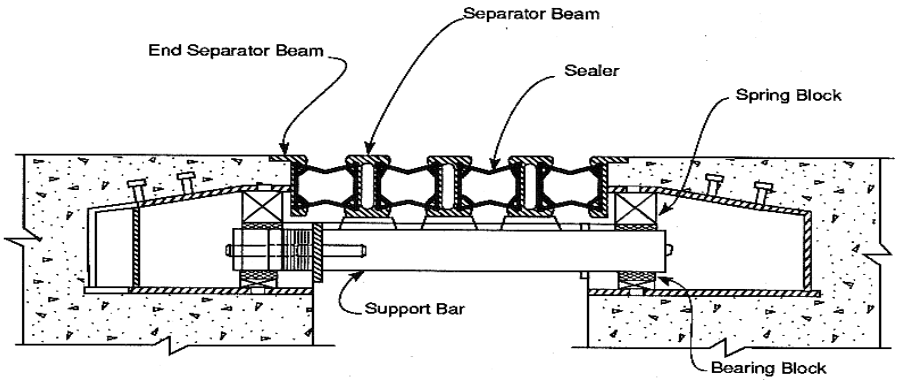
5.5.1.2— Elastomeric Flex-Type Joint (Sheet Seal Joint)



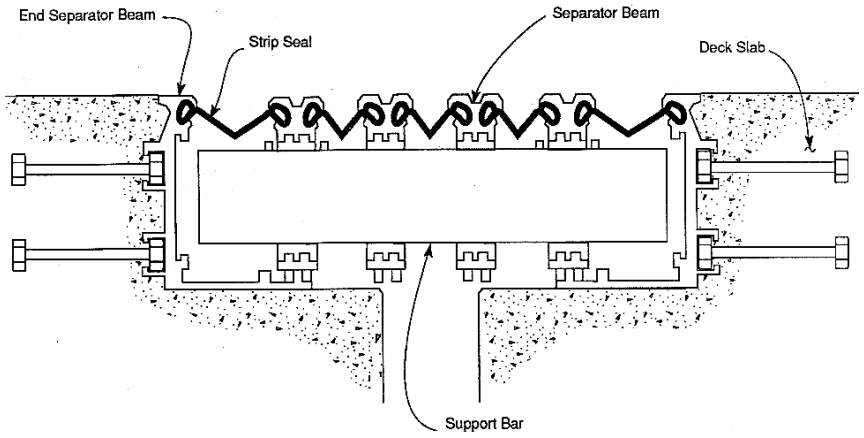
5.5.2— Plank Seal Joint (Waboflex), Element No. 306



5.5.3—Assembly Joint w/ Seal, Element No. 303

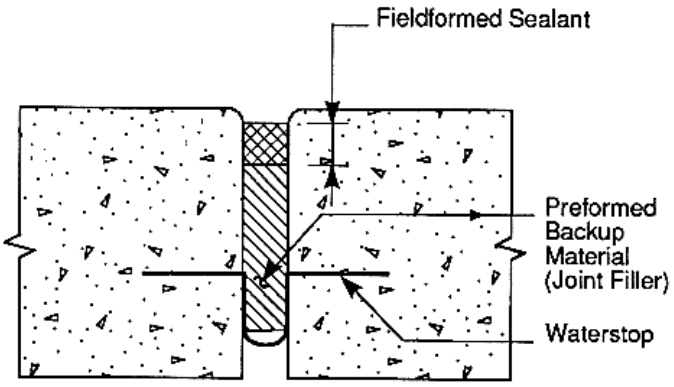


Modular Expansion Joint w/ Multiple Bar Support

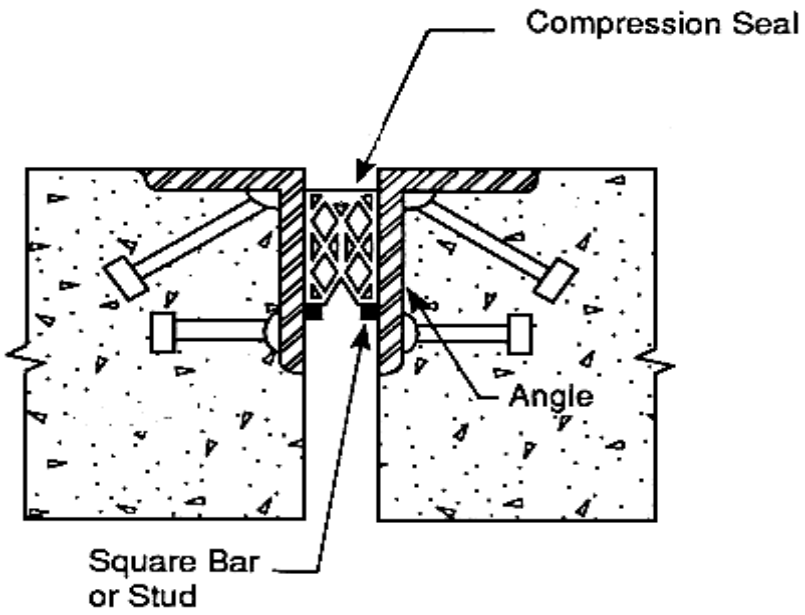


Modular Expansion Joint with Single Support Bar

5.5.4—Pourable Joint Seal, Element No. 301

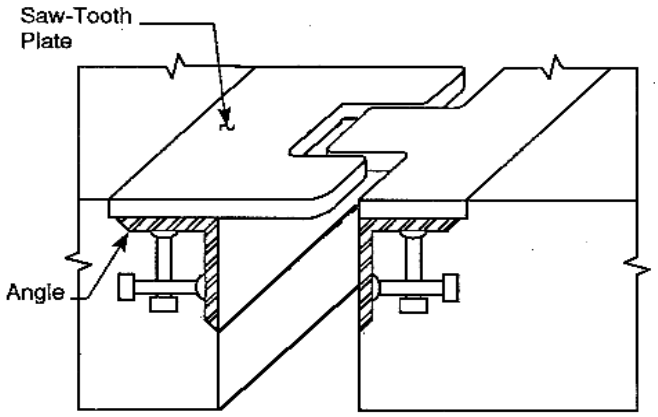


5.5.5—Compression Joint Seal, Element No. 302

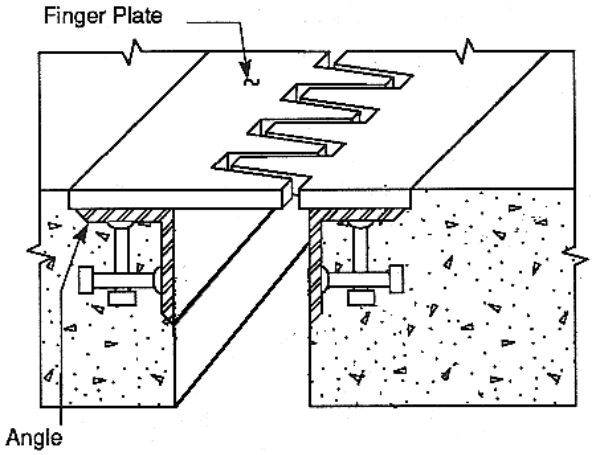


5.5.6—Assembly Joint w/o Seal, Element No. 305

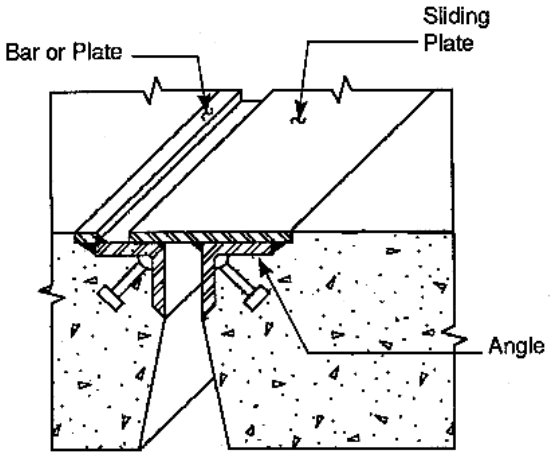
5.5.6.1—Sawtooth Plate Joint



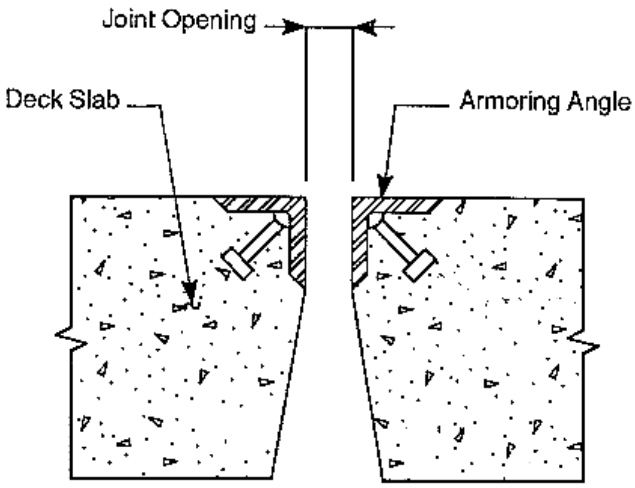
5.5.6.2—Finger Plate Joint



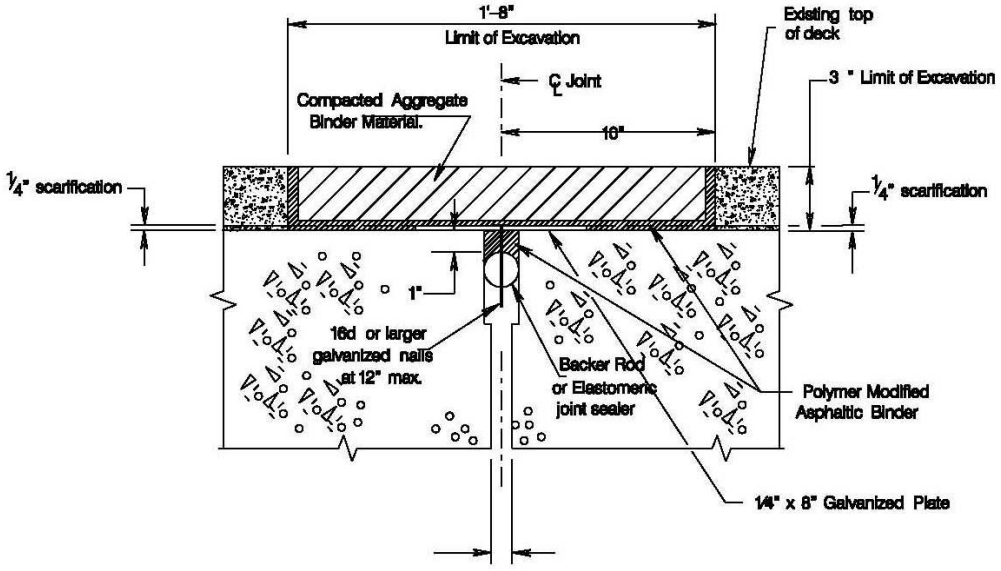
5.5.6.3—Sliding Plate Joint



5.5.7—Open Expansion Joint, Element No. 304



5.5.8—Asphaltic Plug Expansion Device, Element No. 809



APPENDIX A:

AGENCY-DEFINED ELEMENTS (ADEs)

This manual was developed with the understanding that agencies may have elements in their inventory that are not included in the defined element set. An unlimited number of agency elements can be defined as necessary, providing that they conform to this manual.

Agency elements fall into three main categories:

- Subsets of defined National Bridge Elements,
- Subsets of defined Bridge Management Elements, and
- Elements that are entirely independent of the defined elements.

A1—AGENCY-DEFINED SUBSETS OF THE NATIONAL BRIDGE ELEMENTS

The National Bridge Elements (NBE's) represent the primary structural components of bridges and are of national concern for safety. The NBE elements are intended to form an element basis for bridge condition assessment in the National Bridge Inventory (NBI). Due to the higher purpose for these NBEs, the flexibility for an agency to customize them is limited. An agency is permitted to create NBE sub-elements providing that the sub-elements can be aggregated back together for NBI submission. In all cases, the element condition states are fixed at four states and the specific condition state and defect criteria must remain consistent between the NBE and all agency-developed NBE sub-elements. For example, many agencies have developed elements to capture the quantity and condition of their "beam ends." This agency-developed element isolates the area around joints or hinges to capture the rapid deterioration that may occur in this area. Since the beam element itself is an NBE, this agency-developed sub-element would need to inherit all of the language characteristics of the encompassing NBE. In this example, the agency will simply subdivide the element quantity between two items that both share the same language. Combining the NBE beam element and the agency-developed "beam ends" together is simple addition and would permit consistent reporting of the quantity and condition distribution of this item to the NBI.

A2—AGENCY-DEFINED SUBSETS OF THE BRIDGE MANAGEMENT ELEMENTS

Agency-developed elements that are not a subset of an NBE have considerably more flexibility in customization. The Bridge Management Elements (BME's) represent many components of bridges that require preservation but are not primary structural members. These elements include joints, wearing surfaces, protective coatings, and deck protection systems. These elements as a class are defined to provide a sound basis for bridge management. In order to identify these additional agency elements, the number range of 800 and above has been used in this manual.

This manual has defined a set of basic BME's along with elements specific to our agency that provides more detail in certain areas. For example, DelDOT has defined additional wearing surfaces typically used in our bridge inventory into their own wearing surface elements in order to track performance and recognize cost differences for actions. In this example, these detailed wearing surface elements are considered sub-elements of the general BME for wearing surfaces. For this

wearing surface example, it is still required to define only four condition states following the good, fair, poor, and severe convention.

A3—INDEPENDENT AGENCY-DEFINED ELEMENTS

DelDOT has identified a need to develop completely independent custom elements that are not a subset or derivative of an NBE or BME. These custom elements provide flexibility; these elements are not intended to be reported at a national level, nor will they be expected to be rolled up into any element with defined condition state language in this manual. These elements are available for our agency utilizing a BMS to track elements unique to our inventory, such as movable bridge components, or to capture specific performance aspects of bridges. Independent agency-defined elements may or may not have defined feasible actions or defined deterioration, and don't follow any standard condition state or defect language. These are free-form elements that are only limited by the number of required condition states (four).

Independent agency elements have been created to track maintenance items that our agency wishes to capture during the inspection process. Items such as the condition of drains, roadway slope, etc. have been developed into elements that are not associated with deterioration but potentially have feasible actions.

Independent agency-developed elements have also been created to capture the components and condition of ancillary structures that our agency is required to inspect. These elements exist side by side with the bridge elements and have been defined with deterioration models or feasible actions. Custom element definitions provide a ready-made framework for capturing items such as retaining walls, median barriers and fender/dolphin systems within our agency's BMS.

A4—DELDOT DEVELOPED ADE'S

The following table summarizes the DelDOT Developed Elements (AASHTO ADE's) that are either created new or converted from the PONTIS CoRe or Non-CoRe Elements.

PONTIS Element #	PONTIS Element Description	Type of Element	New ADE #	New ADE Description	ADE Type
11	AC Overlay	ADE	**801**	A/C Overlay ON Beams/Culverts	Independent
37	R/C Deck/Slab Under Fill	ADE	**837**	R/C Deck Under Fill	Sub-element of NBE 12
(new)		ADE	**838**	R/C Slab Under Fill	Sub-element of NBE 38
56	R/C Sidewalk	ADE	**856**	R/C Sidewalk	Independent
57	Timber Sidewalk	ADE	**857**	Timber Sidewalk	Independent
58	Other Sidewalk	ADE	**858**	Other Sidewalk	Independent
59	R/C Curb	ADE	**859**	R/C Curb	Independent
60	Curbs (Steel) Painted	ADE	**860**	Steel Curb	Independent
61	Other Curb	ADE	**861**	Masonry Curb	Independent
62	R/C Median	ADE	**862**	R/C Median	Independent
63	Steel Median	ADE	**863**	Steel Median	Independent
64	Other Median	ADE	**864**	Masonry Median	Independent
65	Drains / Downspouts / Scuppers	ADE	**865**	Drains / Downspouts / Scuppers	Independent
66	Timber Curb	ADE	**866**	Timber Curb	Independent
67	Steel Sidewalk - Open Grid	ADE	**867**	Steel Sidewalk - Open Grid	Independent
68	Steel Sidewalk - Filled Grid	ADE	**868**	Steel Sidewalk - Filled Grid	Independent
134	R/C Filled Arch	ADE	**834**	R/C Filled Arch	Sub-element of NBE 144
163	Painted Steel Live Load Anchor Assembly	ADE	**869**	Steel Live Load Anchor Assembly	Independent
207	Jacketed Pile	ADE	**807**	Jacketed Pile	Sub-element of NBE 229
218	Mechanically Stabilized Earth (MSE) Wall	ADE	**818**	Mechanically Stabilized Earth (MSE) Wall	Independent
236	R/C Struts	ADE	**820**	R/C Struts	Independent
237	Timber Struts	ADE	**821**	Timber Struts	Independent
244	Steel Culvert - Major	ADE	**844**	Steel Culvert - Major	Sub-element of NBE 240
245	Concrete Culvert - Major	ADE	**845**	Concrete Culvert - Major	Sub-element of NBE 241
246	HDPE Culvert	ADE	**846**	HDPE Culvert	Sub-element of NBE 243
(new)		ADE	**847**	Aluminum Culvert - Minor	Sub-element of NBE 243
(new)		ADE	**848**	Aluminum Culvert - Major	Sub-element of NBE 243
260	Unpainted Steel Sheeting	ADE	**822**	Steel Sheeting	Independent
261	Painted Steel Sheeting	ADE	**822**	Steel Sheeting	Independent

PONTIS Element #	Old PONTIS Element Description	Type of Element	New ADE #	New ADE Description	ADE Type
262	P/S Concrete Sheeting	ADE	**823**	P/S Concrete Sheeting	Independent
264	Timber Sheeting	ADE	**824**	Timber Sheeting	Independent
309	Asphaltic Plug Joint	ADE	**809**	Asphaltic Plug Joint	Sub-element of NBE 306
359	Soffit	ADE	**839**	Soffit	Independent
364	Erosion	ADE	**829**	Erosion	Independent
380	Unpainted Steel Diaphragm	ADE	**881**	Steel Diaphragm	Independent
381	Painted Steel Diaphragm	ADE	**881**	Steel Diaphragm	Independent
382	Reinforced Concrete Diaphragm	ADE	**882**	Reinforced Concrete Diaphragm	Independent
383	Timber Diaphragm	ADE	**883**	Timber Diaphragm	Independent
385	Timber Wingwall/Retaining Wall Cap	ADE	**885**	Timber Wingwall/Retaining Wall Cap	Independent
386	R/C Wingwall/Retaining Wall Cap	ADE	**886**	R/C Wingwall/Retaining Wall Cap	Independent
390	R/C Wingwall /Retaining Wall	ADE	**890**	R/C Wingwall /Retaining Wall	Independent
392	Other Wingwall/Retaining Wall	ADE	**892**	Masonry Wingwall/Retaining Wall	Independent
395	Sacked Concrete Wall	ADE	**895**	Sacked Concrete Wall	Independent
398	R/C Headwall	ADE	**896**	R/C Headwall	Independent
400	Other Headwall	ADE	**897**	Masonry Headwall	Independent
(new)		ADE	**850**	Timber Fender/Dolphin System	Independent
(new)		ADE	**851**	Steel Fender/Dolphin System	Independent
(new)		ADE	**852**	Concrete Fender/Dolphin System	Independent
(new)		ADE	**810**	Thin Overlay Wearing Surface (≤1")	Sub-element of BME 510
(new)		ADE	**811**	Asphaltic Concrete Wearing Surface	Sub-element of BME 510
(new)		ADE	**812**	Timber Plank Wearing Surface	Sub-element of BME 510
(new)		ADE	**815**	Weathering Steel Protection	Sub-element of BME 515
(new)		ADE	**816**	Concrete Encased Steel Protection	Sub-element of BME 515
(new)		ADE	**817**	Galvanizing Steel Protection	Sub-element of BME 515
(new)		ADE	**898**	Movable Bridge: Electrical System	Independent
(new)		ADE	**899**	Movable Bridge: Mechanical System	Independent

A5—COMBINED PONTIS CORE & DelDOT NON-CORE ELEMENTS

The following table shows the DelDOT Elements that have been renamed or combined from the PONTIS CoRe and Non-CoRe elements to a new AASHTO NBE or ADE.

Pontis Element # & Type	Pontis Description	Element # & Type	Element Description	BME #	BME Description
13 / CoRe	Concrete Deck - Unprotected w/ AC Overlay	**12 (NBE)**	Reinforced Concrete Deck	**811 (ADE)**	Asphaltic Concrete Overlay
14 / CoRe	Concrete Deck Protected w/ AC Overlay	**12 (NBE)**	Reinforced Concrete Deck	**811 (ADE)**	Asphaltic Concrete Overlay
18 / CoRe	Concrete Bare Deck Protected w/ Thin Overlay	**12 (NBE)**	Reinforced Concrete Deck	**810 (ADE)**	Thin Overlay
22 / CoRe	Concrete Bare Deck Protected w/ Rigid Overlay	**12 (NBE)**	Reinforced Concrete Deck	**510 (AASHTO)**	Rigid Overlay
26 / CoRe	Concrete Bare Deck - Protected w/ Coated Bars	**12 (NBE)**	Reinforced Concrete Deck	**N/A**	N/A
27 / CoRe	Concrete Bare Deck - Protected w/ Cathodic Protection	**12 (NBE)**	Reinforced Concrete Deck	**N/A**	N/A
39 / CoRe	Concrete Slab - Unprotected w/ AC Overlay	**38 (NBE)**	Reinforced Concrete Slab	**811 (ADE)**	Asphaltic Concrete Overlay
40 / CoRe	Concrete Slab Protected w/ AC Overlay	**38 (NBE)**	Reinforced Concrete Slab	**811 (ADE)**	Asphaltic Concrete Overlay
44 / CoRe	Concrete Slab Protected w/ Thin Overlay	**38 (NBE)**	Reinforced Concrete Slab	**810 (ADE)**	Thin Overlay
48 / CoRe	Concrete Slab Protected w/ Rigid Overlay	**38 (NBE)**	Reinforced Concrete Slab	**510 (AASHTO)**	Rigid Overlay
52 / CoRe	Concrete Bare Slab - Protected w/ Coated Bars	**38 (NBE)**	Reinforced Concrete Slab	**N/A**	N/A
53 / CoRe	Concrete Bare Slab - Protected w/ Cathodic Protection	**38 (NBE)**	Reinforced Concrete Slab	**N/A**	NBE
101 / CoRe	Unpainted Steel Closed Web/Box Girder	**102 (NBE)**	Steel Closed Web/Box Girder	**815 (ADE)**	Weathering Steel
106 / CoRe	Unpainted Steel Open Beam/Girder	**107 (NBE)**	Steel Open Beam/Girder	**815 (ADE)**	Weathering Steel
112 / CoRe	Unpainted Steel Stringer (Stringer-Floor Beam System)	**113 (NBE)**	Steel Stringer (Stringer-Floor Beam System)	**815 (ADE)**	Weathering Steel
120 / CoRe	Unpainted Steel Through Truss (Bottom Chord)	**120 (NBE)**	Steel Truss	**815 (ADE)**	Weathering Steel
125 / CoRe	Unpainted Steel Through Truss (Top Chord)	**120 (NBE)**	Steel Truss	**815 (ADE)**	Weathering Steel

Pontis Element # & Type	Pontis Description	Element # & Type	Element Description	BME #	BME Description
130 / CoRe	Unpainted Steel Truss	**120 (NBE)**	Steel Truss	**815 (ADE)**	Weathering Steel
140 / CoRe	Unpainted Steel Arch	**141 (NBE)**	Steel Arch	**815 (ADE)**	Weathering Steel
151 / CoRe	Unpainted Steel Floor Beam	**152 (NBE)**	Steel Floor Beam	**815 (ADE)**	Weathering Steel
160 / CoRe	Unpainted Steel Pin and/or Pin and Hanger Assembly	**161 (NBE)**	Steel Pin and/or Pin and Hanger Assembly	**815 (ADE)**	Weathering Steel
201 / CoRe	Unpainted Steel Column or Pile	**202 (NBE)**	Steel Column	**815 (ADE)**	Weathering Steel
213 / SubCoRe	Concrete Encased Open Girder	**107 (NBE)**	Steel Open Beam/Girder	**816 (ADE)**	Concrete Encased Steel Protection
230 / CoRe	Unpainted Steel Pier Cap	**231 (NBE)**	Steel Pier Cap	**815 (ADE)**	Weathering Steel
260 / Non-CoRe	Unpainted Steel Sheeting	**822 (ADE)**	Steel Sheeting	**815 (ADE)**	Weathering Steel
380 / Non-CoRe	Unpainted Steel Diaphragm	**881 (ADE)**	Steel Diaphragm	**815 (ADE)**	Weathering Steel

A6—CONVERTED PONTIS SMART FLAG ELEMENTS

The following table shows the Pontis SmartFlag Elements that have been converted to AASHTO Defect Elements.

Pontis Element #	Pontis Element Description	AASHTO Defect Element #	AASHTO Defect Element Description
356	Steel Fatigue	1010	Cracking
357	Pack Rust	1000	Corrosion
358	Deck Cracking	1130 (Bare Decks)	Cracking (RC and Other)
		3220 (Deck Overlays)	Cracking (Wearing Surface)
360	Settlement	4000	Settlement
361	Scour	6000	Scour
362	Traffic Impact	7000	Damage
363	Section Loss	1000	Corrosion

APPENDIX B:

INSPECTION EXAMPLES

The examples provided show the evaluation and coding of bridge inspection data for timber, concrete, and steel bridges of varying complexity. The examples include the use of National Bridge Elements (NBEs) and Bridge Management Elements (BMEs) and the recording of defects. While it is an agency's choice of how to record defect codes, these examples were developed to demonstrate the use of the defect codes.

B1—TIMBER BRIDGE

The subject of this example is a four-span timber bridge crossing a small creek. The sketches in Figure B-1 show the bridge elements with relevant dimensions and note the locations of the defects described in Article B1.2.

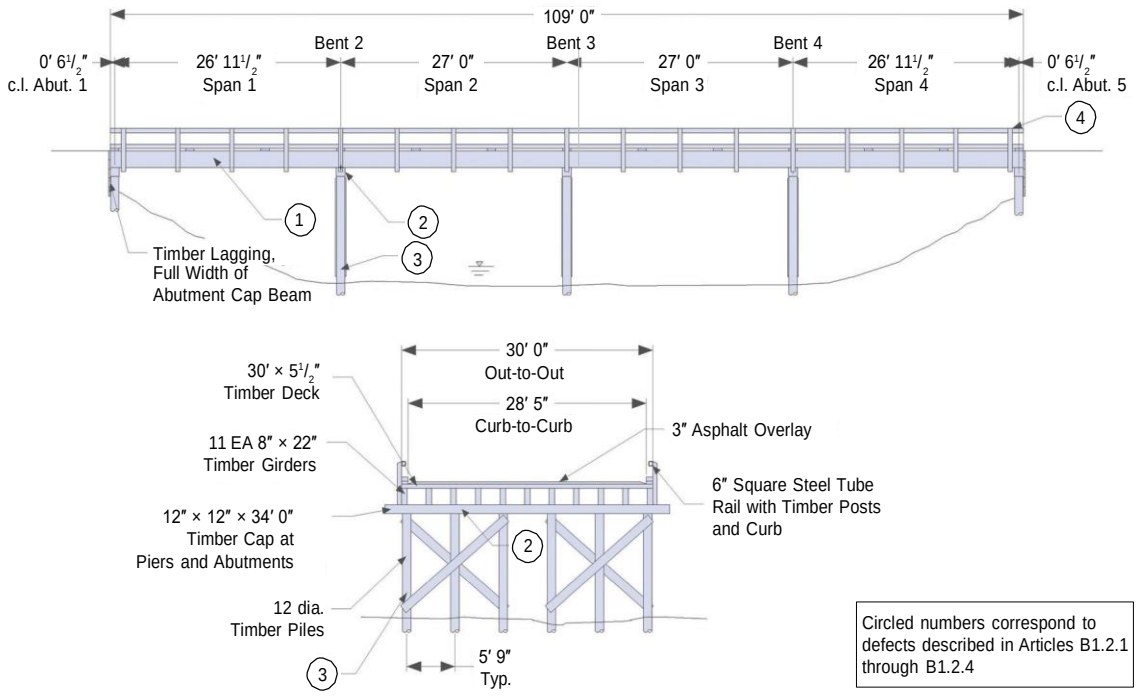


Figure B-1—Elevation and Typical Section of Bridge for Timber Bridge Example

B1.1—Element Quantities

B1.1.1—Deck

The timber deck has an asphalt wearing surface that runs curb to curb:

Timber Deck (Element 31) Quantity: 30 ft × 109 ft = 3,270 ft^2

Wearing Surface (Element 811) Quantity: 28.42 ft × 109 ft = 3,097.78 ft^2 (round to 3,098 ft^2)

The metal bridge railing has timber posts and curb. The square steel tube rail elements are galvanized:

Metal Bridge Railing (Element 330) Quantity: 109 ft × (2 railing lines) = 218 ft

Steel Protective Coating (Element 515) Quantity: 0.50 ft × (4 sides) × 109 ft × (2 railing lines) = 436 ft^2

B1.1.2—Superstructure

All four spans are composed of timber beams:

Timber Open Girder/Beam (Element 111) Quantity: 109 ft × (11 beams) = 1,199 ft

B1.1.3—Substructure

As separate elements distribute vertical loads to the piles and retain the approach embankment, the vertical load-carrying elements will be considered similar to a bent and the timber abutment will consist of only the lagging retaining the approach embankment behind the abutment piles and cap beam:

Timber Abutment (Element 216) Quantity: 34 ft × (2 abutments) = 68 ft

The timber piles at the abutments and bents can be visually inspected to mud line:

Timber Pile (Element 228) Quantity: (6 piles per substructure unit) × (3 bents + 2 abutments) = 30 piles

Vertical load is transferred to the piles at the abutments and bents by the timber bent caps:

Timber Pier Cap (Element 235) Quantity: (34 ft per substructure unit) × (3 bents + 2 abutments) = 170 ft

B1.2—Element Condition States

Aside from the defects described in Articles B1.2.1 through B1.2.4, all remaining element quantities are in good condition and are assigned to Condition State One. The following defects correspond to those labeled in Figure B-1.

B1.2.1—Defect #1, Timber Open Girder/Beam (Element 111)

A 2-in. deep check (Defect #1150) extends the length of the right side exterior beam in Span 1, shown in Figure B-2. As it penetrates 25 percent (2 in. of the 8-in. member thickness), the length of this beam (27 ft.) is placed in Condition State 2. No other defects are present in the element.

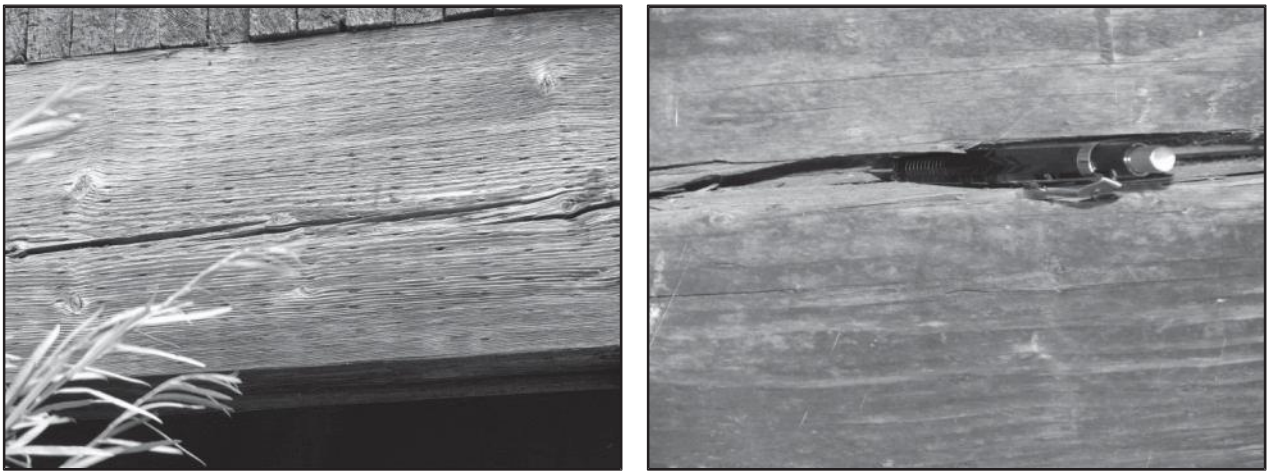


Figure B-2—2-in. Deep Check in Exterior Beam

B1.2.2—Defect #2, Timber Pier Cap (Element 235)

A 1-in. deep check (Defect #1150) extends the length of the bent cap at Bent 2 as shown in Figure B-3. As it penetrates 8 percent (1 in. of the 12-in. width of the member), the length of this beam (34 ft) is placed in Condition State 2. No other defects are present in the element.

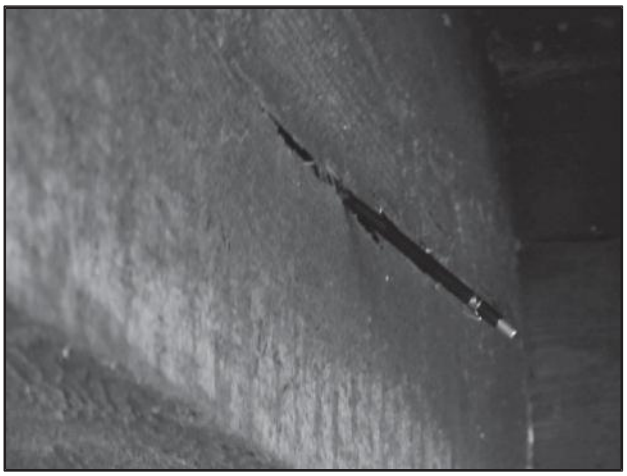


Figure B-3—1-in. Deep Check in Bent Cap at Bent 2

B1.2.3—Defect #3, Timber Pile (Element 228)

A 7-in. deep check (Defect #1150) 3 ft long is present in the left exterior pile of Bent 2 as seen in Figure B-4. As it penetrates 58 percent (7 in. of the 12-in. member thickness), this condition meets the criteria for either Condition State 3 or Condition State 4. Per agency guidance, the severity of the check does not warrant structural review; this pile is placed in Condition State 3. Five other piles exhibit $1^{1}/_{2}$-in. to 2-in. deep checks (not shown) and are placed in Condition State 2.

Figure B-4—7-in. Deep Check in Right Exterior Pile of Bent 2

B1.2.4—Defect #4, Metal Bridge Railing (Element 330)

Two posts at Abutment 4 exhibit severe decay (Defect #1140) affecting 80 percent of the post section as see bib Figure B-5. Based on the severity and extent of the decay, this defect warrants structural review and the horizontal length of rail represented by the posts (2 ft) is placed in Condition State 4.

Figure B-5—Decay in Timber Rail Posts

B1.3—Element Quantity and Condition State Summary

The element quantities and defects described above are summarized as follows:

Element Number	Element Description	Unit of Measure	Total Quantity	Condition State 1	Condition State 2	Condition State 3	Condition State 4	Defect #*
31	Timber Deck	ft^2	3,270	3,270	0	0	0	
811	Wearing Surfaces	ft^2	3,098	3,098	0	0	0	
330	Metal Bridge Railing	ft	218	218	0	0	0	
515	Steel Protective Coating	ft^2	436	436	0	0	0	
332	Timber Bridge Railing	ft	40	38	0	0	2	4
1140	*Decay/Section Loss*	*ft*	*2*	*0*	*0*	*0*	*2*	*4*
111	Timber Open Girder/Beam	ft	1,199	1,172	27	0	0	1
1150	*Check/Shake*	*ft*	*27*	*0*	*27*	*0*	*0*	*1*
228	Timber Pile	each	30	24	5	1	0	3
1150	*Check/Shake*	*each*	*6*	*0*	*5*	*1*	*0*	*3*
216	Timber Abutment	ft	68	68	0	0	0	
235	Timber Pier Cap	ft	170	136	34	0	0	2
1150	*Check/Shake*	*ft*	*34*	*0*	*34*	*0*	*0*	*2*

Notes:

***** See Figure B-1 for defect locations.
Violet background: National Bridge Element
Blue background: Bridge Management Element
Green Background: Agency Developed Element
Italic White type: Defect

B2—PRESTRESSED CONCRETE GIRDER BRIDGE

The subject of this example is a four-span prestressed concrete girder bridge crossing a divided highway. The sketches in Figure B-6 show the bridge elements with relevant dimensions and note the locations of the defects described in Article B2.2.

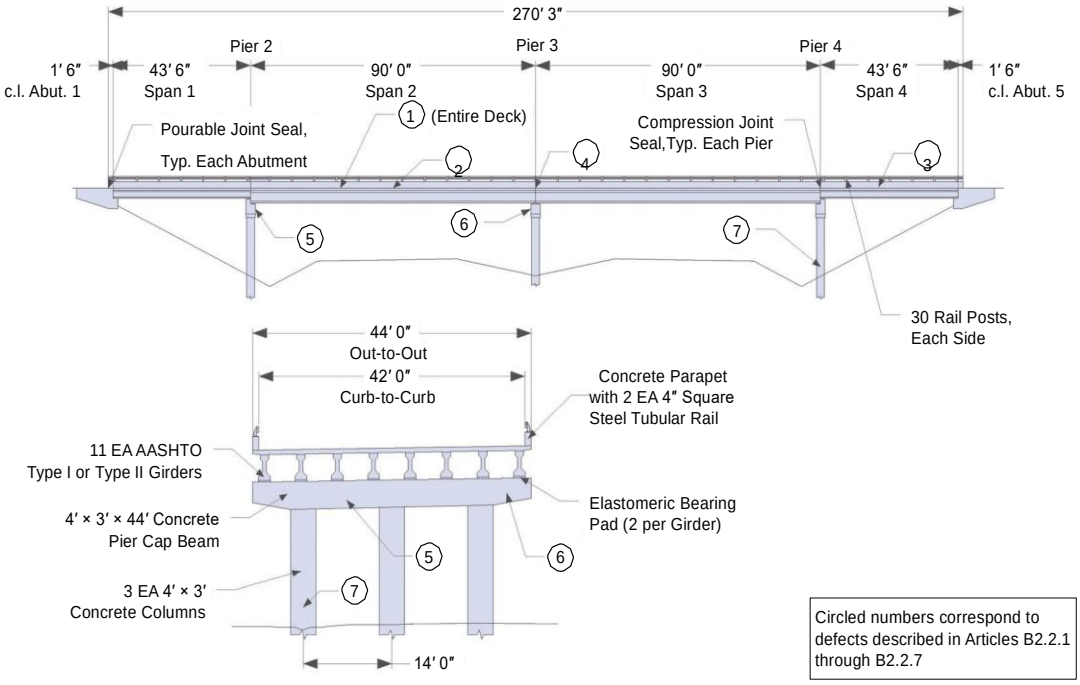


Figure B-6—Elevation and Typical Section of Bridge for Prestressed Concrete Girder Bridge Example

B2.1—Element Quantities

B2.1.1—Deck

The reinforced concrete deck has uncoated reinforcing steel and no protective overlay.

Reinforced Concrete Deck (Element 12) Quantity: 270 ft × 44 ft = 11,880 ft^2

As the redirective elements of the bridge railing consist of a combination of concrete and metal components, both the metal and reinforced concrete railing elements will be considered. The metal railing members are galvanized; estimate the surface area of each metal post as 5 ft^2:

Metal Bridge Railing (Element 330) Quantity: 270 ft × (2 railing lines) = 540 ft
Steel Protective Coating (Element 515) Quantity: [0.33 ft × (4 sides)] × (2 rails) × 270 ft + 5 ft^2 per post × 30 posts] × (2 railing lines) = 1,725.60 ft^2 (rounded up to 1,726 ft^2)
Reinforced Concrete Bridge Railing (Element 331) Quantity: 270 ft × (2 railing lines) = 540 ft

There is a deck joint at every substructure unit, extending out-to-out of the bridge deck, with pourable joint seals at the abutments and compression joint seals at the piers. There is no skew:

Pourable Joint Seal (Element 301) Quantity: 44 ft × (2 joints) = 88 ft
Compression Joint Seal (Element 302) Quantity: 44 ft × (3 joints) = 132 ft

B2.1.2—Superstructure

Since the prestressed concrete girders extend past the bearings and are embedded in the end and

pier diaphragms, the length of the bridge minus the backwall thickness (1 ft at each end) provides a good estimate of the total length of each girder line:

Prestressed Concrete Open Girder (Element 109) Quantity: [270 ft – (2 × 1 ft)] × (8 girders) = 2,144 ft

Elastomeric bearings transfer load from the girders to the substructure:

Elastomeric Bearing (Element 310) Quantity: (2 bearings per girder) × (8 girders per span) × (4 spans) = 64 bearings

B2.1.3—Substructure

The reinforced concrete abutment distributes vertical load to the piles (not visible for inspection) and retains the approach embankment.

Reinforced Concrete Abutment (Element 215) Quantity: (44 ft per abutment) × (2 abutments) = 88 ft

Each reinforced concrete pier consists of a pier cap (Element 234) and three columns (Element 205):

Reinforced Concrete Column (Element 205) Quantity: (3 columns per pier) × (3 piers) = 9 columns
Reinforced Concrete Pier Cap (Element 234) Quantity: (44 ft per pier) × (3 piers) = 132 ft

B2.2—Element Condition States

Aside from the defects described in Articles B2.2.1 through B2.2.7, all remaining element quantities are in good condition and assigned to Condition State One. The following defects correspond to those labeled in Figure B-6.

B2.2.1—Defect #1, Reinforced Concrete Deck (Element 12)

Transverse, hairline cracks throughout at variable spacing greater than 3 ft throughout the top surface of the deck. Based on the cracks' widths (less than 0.012 in.) and density (greater than 3 ft), these areas meet the criteria for Condition State 1.

B2.2.2—Defect #2, Reinforced Concrete Deck (Element 12)

1-in. to 2-in. deep spalls with exposed rebar (with no section loss) and areas of distressed patches in both lanes near midspan of Span 2, shown in Figure B-7. The total area of spalls is 12 ft^2.; the total area of distressed patches is 100 ft^2. With no section loss, the exposed rebar (Defect #1090) meets the criteria for Condition State 2. As the spalls (Defect #1080) are more than 1 in. deep, all of these areas (112 ft^2 total) meet the criteria for Condition State 3, which controls.

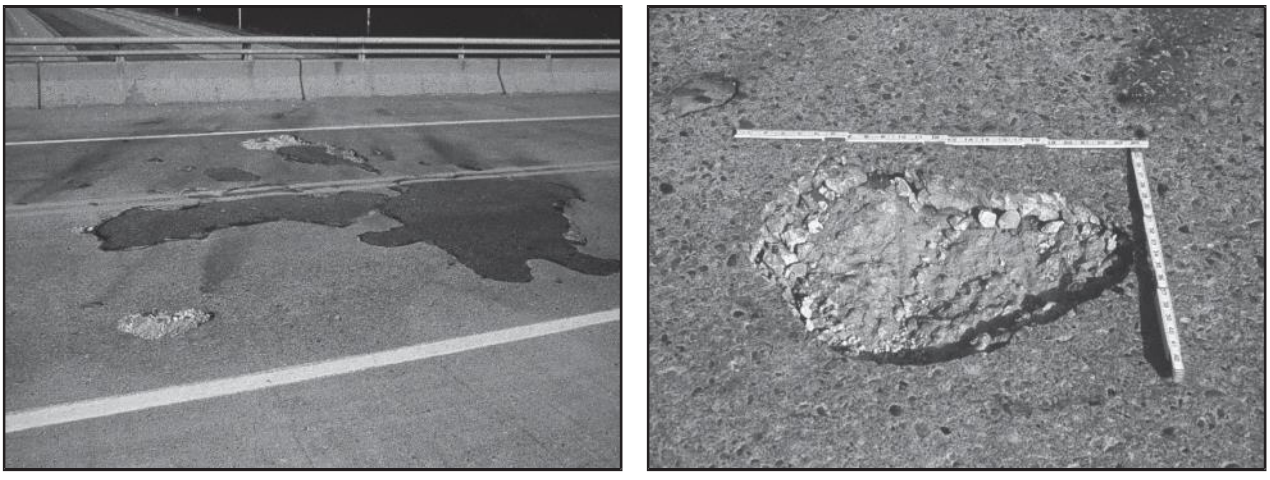


Figure B-7—Spalls and Distressed Patches in Span 2 Deck

B2.2.3—Defect #3, Reinforced Concrete Deck (Element 12)

1-in. to 2-in. deep spalls with exposed rebar (with no section loss) and areas of distressed patches in both lanes near midspan of Span 4, shown in Figure B-8. The total area of spalls is 40 ft^2; the total area of distressed patches is 60 ft^2. With no section loss, the exposed rebar (Defect #1090) meets the criteria for Condition State 2. As the spalls (Defect #1080) are more than 1 in. deep and the patches are not sound, all of these areas (100 ft^2 total) meet the criteria for Condition State 3.

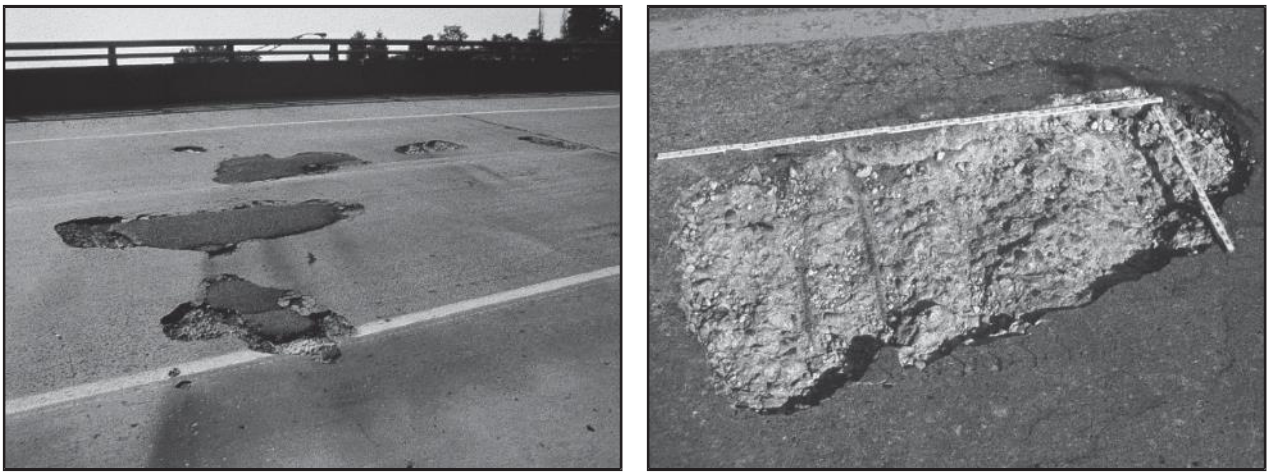


Figure B-8—Spalls and Distressed Patches in Span 4 Deck

B2.2.4—Defect #4, Compression Joint Seal (Element 302) and Reinforced Concrete Deck (Element 12)

Deep spalls with unsound concrete the full length (40 ft) of the deck 6 in. adjacent to the joint seal at Pier 3, shown in Figure B-9. The gland at this joint is also partially pulled out. For the joint element, the seal damage (Defect #2330) meets the criteria for Condition State 3 but the adjacent deck damage (Defect #2360) meets the criteria for Condition State 4, which controls. Due to their depth, the spalls (Defect #1080) in the concrete deck element in this area (40 ft × 1 ft = 40 ft^2) meet the criteria for Condition State 3.

Figure B-9—Deep Spalls in the Deck Adjacent to the Joint Seal at Pier 3

B2.2.5—Defect #5, Reinforced Concrete Pier Cap (Element 234)

The underside of the Pier 2 cap has a spalled area 12 ft long and 2 in. deep with exposed rebar and rust staining, shown in Figure B-10. The depth of the spall (Defect #1080) meets the criteria to place this length of cap beam in Condition State 3. The section loss measured on the exposed rebar (Defect #1090) does not warrant a structural review of the cap beam and also meets the criteria for Condition State 3. Agency policy in this situation places a higher priority on the exposed rebar, making it the predominant defect.

Figure B-10—Spall, Underside of Pier 2 Cap

B2.2.6—Defect #6, Reinforced Concrete Pier Cap (Element 234)

Both the right and left cantilevers of the Pier 3 cap exhibit 0.04-in. wide cracks, some with rust staining, shown in Figure B-11. This cracking extends for 2 ft on the left side and for 4 ft on the right. The widths of these cracks (Defect #1130) meet the criteria to place this quantity of the cap in Condition State 2; however, the presence of efflorescence (Defect #1120) with rust staining meets the criteria for Condition State 3, which controls.

Figure B-11—0.04-in. Width Cracks with Rust Staining in the Cantilevers of the Pier 3 Cap

B2.2.7—Defect #7, Reinforced Concrete Column (Element 205)

The left column of Pier 4 has a $^{3}/_{16}$-in. wide × 11-ft long vertical crack, shown in Figure B-12. A previous structural review found that this crack does not affect the strength or serviceability of the element; thus, the width of this crack (Defect #1130) meets the criteria to place this column in Condition State 2.

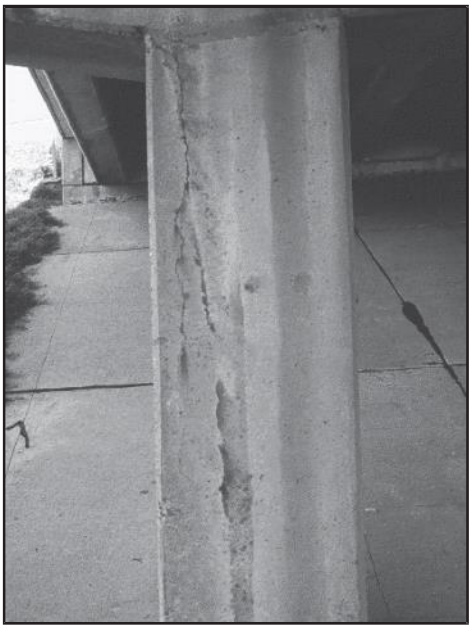


Figure B-12—$^{3}/_{16}$-in. Width Vertical Crack in Left Column of Pier 4

B2.3—ELEMENT QUANTITY AND CONDITION STATE SUMMARY

The element quantities and defects described above are summarized as follows:

Element Number	Element Description	Unit of Measure	Total Quantity	Condition State 1	Condition State 2	Condition State 3	Condition State 4	Defect #*
12	Reinforced Concrete Deck	ft^2	11,880	11,628	0	252	0	1,2,3,4
1080	*Delamination/Spall/ Patched Area*	*ft^2*	*252*	*0*	*0*	*252*	*0*	*2,3,4*
301	Pourable Joint Seal	ft	88	88	0	0	0	
302	Compression Joint Seal	ft	132	92	0	0	40	4
2360	*Adjacent Deck or Header*	*ft*	*40*	*0*	*0*	*0*	*40*	*4*
330	Metal Bridge Railing	ft	540	540	0	0	0	
817	Galvanization Protection	ft^2	1,726	1,726	0	0	0	
331	Reinforced Concrete Bridge Railing	ft	540	540	0	0	0	
109	Prestressed Concrete Girder/Beam	ft	2,144	2,144	0	0	0	
310	Elastomeric Bearing	each	64	64	0	0	0	
215	Reinforced Concrete Abutment	ft	88	88	0	0	0	
205	Reinforced Concrete Column	each	9	8	1	0	0	7
1130	*Cracking (RC and Other)*	*each*	*1*	*0*	*1*	*0*	*0*	*7*
234	Reinforced Concrete Pier Cap	ft	132	114	0	18	0	5,6
1090	*Exposed Rebar*	*ft*	*12*	*0*	*0*	*12*	*0*	*5*
1120	*Efflorescence/Rust Staining*	*ft*	*6*	*0*	*0*	*6*	*0*	*6*

* Exposed Rebar (Defect # 1090) for Condition State 2 (Quantity = 252 ft^2) is not aggregated into Element 12 because Delamination/ Spall/ Patched Area (Defect # 1080) is also located in the same area and is in a Condition State 3.

Notes:

****** See Figure B-6 for defect locations
Violet background: National Bridge Element
Blue background: Bridge Management Element
Green Background: Agency Developed Element
Italic White type: Defect

B3—STEEL TRUSS BRIDGE

The subject of this example is a two-span steel truss bridge crossing a river. The sketches in Figure B-13 show the bridge elements with relevant dimensions and note the locations of the defects described in Article B3.2.

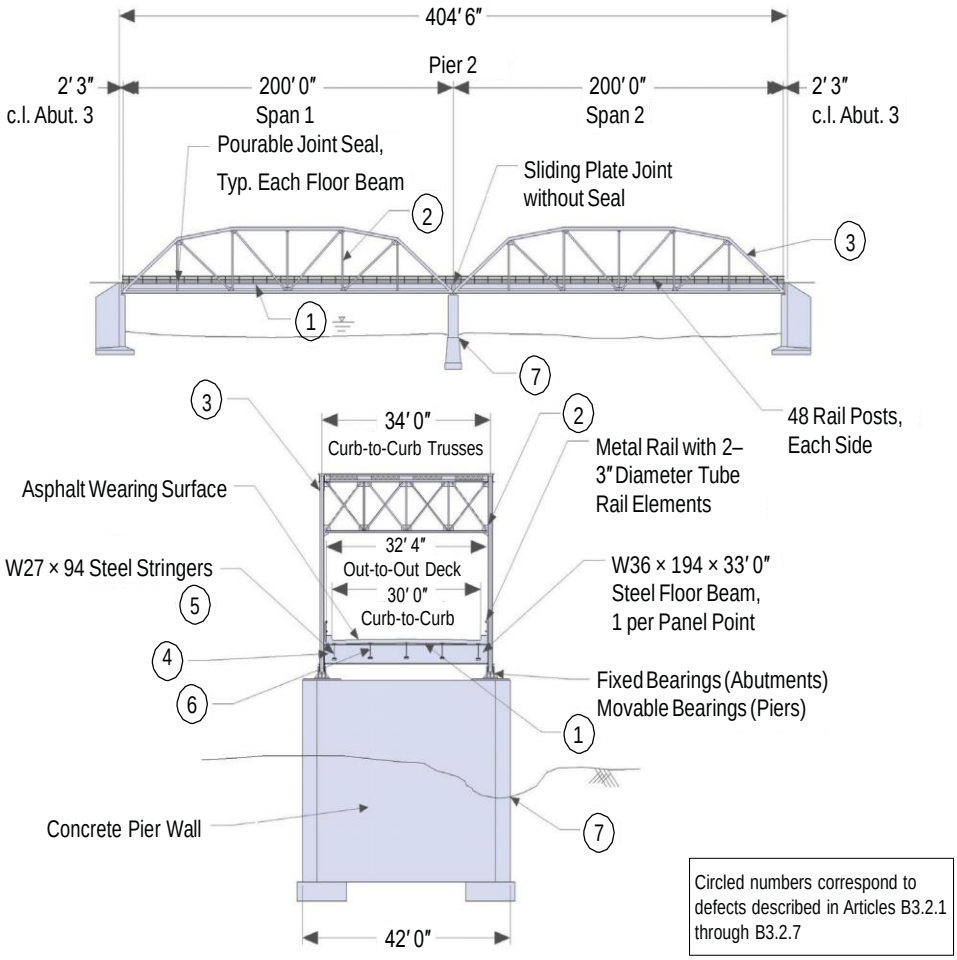


Figure B-13—Elevation and Typical Section of Bridge for Example B.3

B3.1—Element Quantities

B3.1.1—Deck

The reinforced concrete deck has uncoated reinforcing steel and an asphalt wearing surface overlay.

Reinforced Concrete Deck (Element 12) Quantity: 404.50 ft × 32.33 ft = 13,077.49 ft^2 (round up to 13,078 ft^2)
Wearing Surface (Element 510) Quantity: 404.50 ft × 30 ft = 12,135 ft^2

The metal railing has a concrete curb and metal posts. The metal railing members are painted; estimate the surface area of each metal post as 5 ft^2:

Metal Bridge Railing (Element 330) Quantity: 404.50 ft × (2 railing lines) = 809 ft
Steel Protective Coating (Element 515) Quantity: [3.1416 × 0.25 ft] × (2 rails) × 404.50 ft + 5 ft^2 per post × 48 posts] × (2 railing lines) = 1,750.78 ft^2 (round up to 1751 ft^2)

There are deck joints with pourable seals at 12 of the 14 floor beams. The sliding plate expansion joint at the pier does not have a seal. All joints extend from out-to-out of the deck. There is no skew:

Pourable Joint Seal (Element 301) Quantity: 32.33 ft × (12 joints) = 388 ft
Assembly Joint without Seal (Element 305) Quantity: 32.33 ft × (1 joint) = 32.33 ft (round up to 33 ft)

B3.1.2—Superstructure

The main superstructure elements are the steel truss, floor beams, and stringers. Each of these elements is painted:

Steel Truss (Element 120) Quantity: 200 ft × (2 trusses per span) × (2 spans) = 800 ft
Steel Protective Coating (Element 515) Quantity: Calculated from "as-built" plans; 18,696 ft^2

Steel Floor Beam (Element 152) Quantity: 33 ft × (7 floor beams per span) × (2 spans) = 462 ft
Steel Protective Coating (Element 515) Quantity: 33 ft × 8.9 ft^2/ft* × (14 floor beams) = 4,112 ft^2

Steel Stringer (Element 113) Quantity: 200 ft × (5 stringers) × (2 spans) = 2,000 ft
Steel Protective Coating (Element 515) Quantity: 200 ft × 6.8 ft^2/ft* x (5 stringers) × (2 spans) = 13,600 ft^2

* Surface area per foot length for W36 × 194 (floor beams) and W27 × 94 (stringers) steel sections are taken from the AISC *Steel Design Guide 19*, "Fire Resistance of Structural Steel Framing," Appendix A, and do not include the surface area of the top face of the top flange.

There is a gusset plate assembly at each truss connection composed of two gusset plates (one on each side). All of the assemblies are painted; estimate the painted surface area of each gusset plate as 16 ft^2:

Steel Gusset Plate (Element 162) Quantity: (12 plate assemblies per span) × (2 trusses) × (2 spans) = 48
Steel Protective Coating (Element 515) Quantity: (48 assemblies) × (2 plates per assembly) × (16 ft^2/plate) = 1,536 ft^2

Each truss is supported on one movable bearing and one fixed bearing. The bearings are painted; estimate the painted surface area of each bearing as 12 ft^2:

Movable Bearing (Element 311) Quantity: (1 bearing per truss) × (2 trusses per span) × (2 spans) = 4 bearings
Steel Protective Coating (Element 515) Quantity: (4 bearings) × (12 ft^2/bearing) = 48 ft^2

Fixed Bearing (Element 313) Quantity: (1 bearing per truss) × (2 trusses per span) × (2 spans) = 4 bearings
Steel Protective Coating (Element 515) Quantity: (4 bearings) × (12 ft^2/bearing) = 48 ft^2

B3.1.3—Substructure

The reinforced concrete abutment distributes vertical load to the spread footing foundation and retains the approach embankment. The abutments are the same width as the pier wall.

Reinforced Concrete Abutment (Element 215) Quantity: 42 ft × (2 abutments) = 84 ft

The trusses are also supported on a reinforced concrete pier wall:

Reinforced Concrete Pier Wall (Element 215) Quantity: 42 ft × (1 pier) = 42 ft

B3.2—Element Condition States

Aside from the defects described in Articles B3.2.1 through B3.2.7, all element quantities are in good condition and assigned to Condition State One. The following defects correspond to those labeled in Figure B-13.

B3.2.1—Defect #1, Reinforced Concrete Deck (Element 12)

Moderate efflorescence (Defect #1120) is noted in the two interior deck bays throughout the length of Span 1 (affected area: 15 ft × 200 ft = 3000 ft^2), shown in Figure B-14. Based on the extent of the efflorescence build-up and the lack of rust staining, these areas meet the criteria for Condition State 2. Cracks (Defect #1130) measuring 0.015 in. wide spaced at 1 ft are also noted. The width and density of these cracks also meet the criteria for Condition State 2. Agency policy in this situation places a higher priority on the efflorescence, making it the predominant defect.

Figure B-14—Efflorescence on the Underside of the Deck in Span 1

B3.2.2—Defect #2, Steel Truss (Element 120)

There is new impact damage to the sway bracing at panel point 4 in the Span 1 truss, resulting in a 1-in. distortion (Defect #7000) in the right side L4-U4 vertical member as shown in Figure B-15. As the impact of this damage on the strength and serviceability of the truss is unknown, the length of the truss attributed to the vertical, measured parallel to the traveled way (1 ft) is placed in Condition State 4.

Figure B-15—Sway Bracing Impact Damage in Span 1

B3.2.3—Defect #3, Steel Truss (Element 120), Steel Gusset Plate (Element 162), and Steel Protective Coating (Element 515)

Freckle rust throughout the length of both spans, both trusses as shown in Figure B-16. As no section loss is measured, this corrosion (Defect #1000) results in the entire quantity of the steel truss and gusset plate elements being assigned to Condition State 2. The paint system throughout is chalking (Defect #3410), exhibiting loss of pigment, and meeting the criteria for Condition State 3. The areas of paint where freckle rust is noted (estimated at 5 percent of the

painted area, or 18,696 ft^2 × 0.05 = 935 ft^2 of the trusses and 1,536 ft^2 × 0.05 = 77 ft^2 of the gusset plates) have failed (Defect #3440), meeting the criteria for Condition State 4.

Figure B-16—Freckle Rust, Typical, Both Trusses, Both Spans

B3.2.4—Defect #4, Steel Floor Beam (Element 152) and Steel Protective Coating (Element 515)

Freckle rust throughout the length of all floor beams; thus, the quantity of the steel floor beam element not showing further corrosion is assigned to Condition State 2. There is corrosion (Defect #1000) with less than 10 percent section loss in the top flange at 20 of the 28 beam ends, shown in Figure B-17, which meets the criteria for Condition State 3. Each affected area will be considered to represent 2 ft of floor beam length (20 × 2 ft = 40 ft total). The paint system in these areas (approximately 2 ft^2 per location, 20 × 2 ft^2 = 40 ft^2 total) has failed (Defect #3440) and is assigned to Condition State 4. The paint system throughout the rest of the beams is chalking (Defect #3410), exhibiting loss of pigment and meeting the criteria for Condition State 3. The areas of paint where freckle rust is noted (estimated at 5 percent of the painted area, or 4,112 ft^2 × 0.05 = 206 ft^2) has also failed (Defect #3440), meeting the criteria for Condition State 4.

Figure B-17—Corrosion at Floor Beam Ends

B3.2.5—Defect #5, Steel Stringer (Element 113)

Freckle rust present near the floor beam connections; total length affected is 50 ft. As no section loss is evident, the corrosion (Defect #1000) in these areas meets the criteria for Condition State 2. In these areas, the paint is chalking (Defect #3410), exhibiting loss of pigment and meeting the criteria for Condition State 3 (total affected area is 50 ft × 6.8 ft^2/ft = 340 ft^2). The areas of paint where freckle rust is noted (estimated at 5 percent of the affected area, or 340 ft^2 × 0.05 = 17 ft^2) have failed (Defect #3440), meeting the criteria for Condition State 4.

B3.2.6—Defect #6, Steel Stringer (Element 113)

Broken and missing rivets in 8 stringer-to-floor beam connections (Defect #1020), shown in Figure B-18. Each affected connection will be considered to represent 1 ft of stringer length, or 8 × 1 ft = 8 ft total. This condition led the inspector to assign these quantities to Condition State 4 in the field. However, a structural review of the floor system demonstrates that, despite the missing fasteners, the bridge can still carry legal loads and, per agency policy, these quantities are reassigned to Condition State 3.

Figure B-18—Missing and Broken Fasteners at Stringer-to-Floor Beam Connections

B3.2.7—Defect #7, Pier Wall (Element 210)

There is a small scour hole (Defect #6000) extending 10 ft in from the upstream end of the pier wall as shown in Figure B-19. The measured scour is within the tolerable limits established by the bridge's scour evaluation; thus, the affected length meets the criteria for Condition State 2.

Figure B-19—Scour Hole at the Upstream End of the Pier Wall

B3.3—Element Quantity and Condition State Summary

The element quantities and defects described above are summarized as follows:

Element Number	Element Description	Unit of Measure	Total Quantity	Condition State 1	Condition State 2	Condition State 3	Condition State 4	Defect #*
12	Reinforced Concrete Deck	ft^2	13,079	10,079	3,000	0	0	1
1120	*Efflorescence/Rust Staining*	*ft^2*	*3,000*	*0*	*3,000*	*0*	*0*	*1*
510	Wearing Surface	ft^2	12,135	12,135	0	0	0	
330	Metal Bridge Railing	ft	809	809	0	0	0	
515	Steel Protective Coating	ft^2	1,751	1,751	0	0	0	
301	Pourable Joint Seal	ft	388	388	0	0	0	
305	Assembly Joint without Seal	ft	33	33	0	0	0	
120	Steel Truss	ft	800	0	799	0	1	2,3
1000	*Corrosion*	*ft*	*799*	*0*	*799*	*0*	*0*	*3*
7000	*Damage*	*ft*	*1*	*0*	*0*	*0*	*1*	*2*
515	Steel Protective Coating	ft^2	18,696	0	0	17,761	935	3
3410	*Chalking*	*ft^2*	*17,761*	*0*	*0*	*17,761*	*0*	*3*
3440	*Effectiveness*	*ft^2*	*935*	*0*	*0*	*0*	*935*	*3*
152	Steel Floor Beam	ft	462	0	442	20	0	4
1000	*Corrosion*	*ft*	*462*	*0*	*442*	*20*	*0*	*4*
515	Steel Protective Coating	ft^2	4,112	0	0	3,866	246	4
3410	*Chalking*	*ft^2*	*3,866*	*0*	*0*	*3,866*	*0*	*4*
3440	*Effectiveness*	*ft^2*	*246*	*0*	*0*	*0*	*246*	*4*
113	Steel Stringer	ft	2,000	1,942	50	8	0	5,6
1000	*Corrosion*	*ft*	*50*	*0*	*50*	*0*	*0*	*5*
1020	*Connections*	*ft*	*8*	*0*	*0*	*8*	*0*	*6*
515	Steel Protective Coating	ft^2	13,600	13,260	0	323	17	5
3410	*Chalking*	*ft^2*	*323*	*0*	*0*	*323*	*0*	*5*
3440	*Effectiveness*	*ft^2*	*17*	*0*	*0*	*0*	*17*	*5*
162	Steel Gusset Plate	each	48	0	48	0	0	3
515	Steel Protective Coating	ft^2	1,536	0	0	1,459	77	3
3410	*Chalking*	*ft^2*	*1,459*	*0*	*0*	*1,459*	*0*	*3*
3440	*Effectiveness*	*ft^2*	*77*	*0*	*0*	*0*	*77*	*3*
311	Movable Bearing	each	4	4	0	0	0	
515	Steel Protective Coating	ft^2	48	48	0	0	0	

Element Number	Element Description	Unit of Measure	Total Quantity	Condition State 1	Condition State 2	Condition State 3	Condition State 4	Defect #*
313	Fixed Bearing	each	4	4	0	0	0	
515	Steel Protective Coating	ft^2	48	48	0	0	0	
215	Reinforced Concrete Abutment	ft	84	84	0	0	0	
210	Reinforced Concrete Pier Wall	ft	42	32	10	0	0	7
6000	*Scour*	*ft*	*10*	*0*	*10*	*0*	*0*	*7*

Notes:

***** See Figure B-13 for defect locations
Violet background: National Bridge Element
Blue background: Bridge Management Element
Italic White type: Defect

B4—SINGLE SPAN STEEL MULTI-GIRDER BRIDGE

The subject of this example is a single-span multi-girder bridge crossing a lake. The bridge was originally constructed using 7 concrete encased steel girders and later widened with 2 additional rolled steel beams and 2 additional welded plate girders. The sketches in Figure B1.1 show the bridge elements with relevant dimensions.

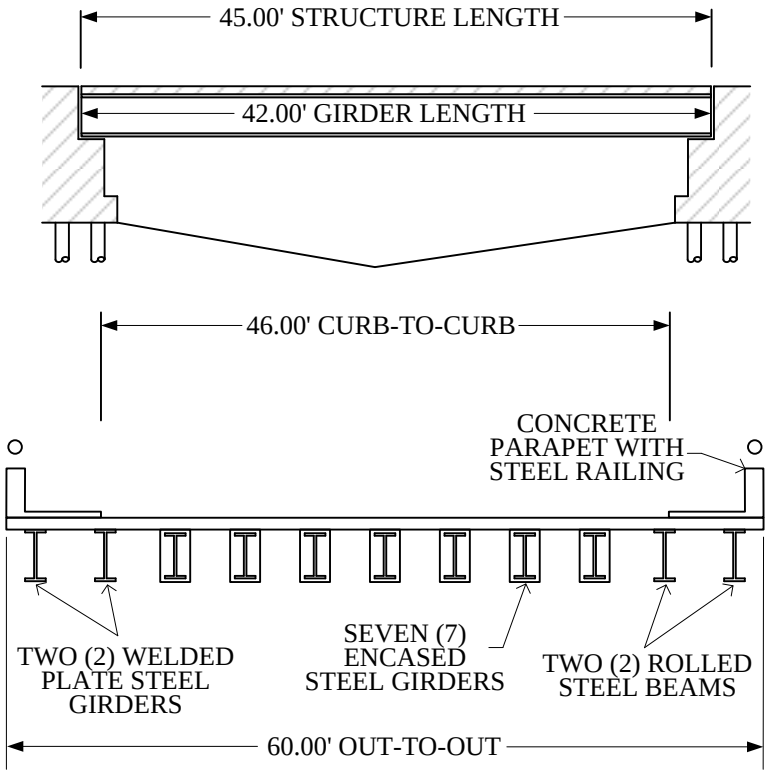


Figure B-20—Elevation and Deck Cross Section

B4.1 Element Quantities

B4.1.1 — Deck/Approaches

The reinforced concrete deck has epoxy coated reinforcing steel and no protective overlay. There is a compression joint seal at both abutments extending out-to-out of the bridge deck. There is no skew. There are reinforced concrete approach slabs at each end of the bridge that are consistent with the bridge curb-to-curb width and extend 20' from the bridge. The approach slabs do not have epoxy coated reinforcing steel.

Reinforced Concrete Deck (Element 12)
Quantity: 45 ft x 60 ft = 2,700 ft^2

Concrete Reinforcing Steel Protective System (Element 520)
Quantity: 45 ft x 60 ft = 2,700 ft^2

Compression Joint Seal (Element 302)
Quantity: 60 ft. x 2 seals = 120 ft.

Reinforced Concrete Approach Slab (Element 321)
Quantity: 46 ft. x 20 ft. x 2 Approaches = 1,840 ft^2

Reinforced concrete parapets with steel ornamental railings run on both sides of the bridge with curbs and sidewalks. However, as the steel railing does not serve as a redirective element, only he concrete bridge railing element is coded.

Reinforced Concrete Bridge Railing (Element 331)
Quantity: 45 ft. x 2 bridge railings = 90 ft.

Curbs/Sidewalks – Reinforced Concrete (Element 856)
Quantity: 45 ft. x 2 Curbs/Sidewalks = 90 ft.

B4.1.2 — Superstructure

All girders/beams extend approximately 1 ft past the bearings at each end as indicated on the bridge plans. The steel open girders/beams are protected with paint.

Steel Open Girder/Beam (Element 107)
Quantity: 42 ft x 11 girders = 462 ft.

Concrete Encasement (Element 816)
Quantity: 42 ft. x 7 girders = 294 ft.

Steel Protective Coating (Element 515)
Quantity: 2.25 ft. (Beam Depth) x 2 x 42 ft (Beam Length) + .83 ft (Flange Width) x 3 (exposed flange faces) x 42 = 294 ft^2 per beam (Rolled Steel Beams only)
3.79 ft. (Girder Depth) x 2 x 42 ft. (Girder Length) + 1 ft. (Flange Width) x 3 x 42 = 444 ft^2 per girder (Welded Plate Girders only)
= 294 x 2 + 444 x 2 = 1,476 ft^2 (Total Paint)

Fixed bearings are at one abutment while elastomeric bearings are on the painted steel girders/beams and sliding plate bearings are on the concrete encased girders at the other abutment.

Fixed Bearing (Element 313)
Quantity: 1 bearing per girder x 11 total girders = 11 Fixed Bearings

Sliding Plate Bearing (Element 311)
Quantity: 1 bearing per concrete encased girder x 7 concrete encased girders = 7 Sliding Plate Bearings

Elastomeric Bearing (Element 310)
Quantity: 1 bearing per steel open girder/beam x 4 steel open girder/beams = 4 Elastomeric Bearings

B4.1.3 — Substructure

The reinforced concrete abutments have integral wingwalls and distributes vertical load to the piles (not visible for inspection) and retains the approach roadway embankment. The wingwalls are approximately half covered with fill. Bridge plans also indicated epoxy coated reinforcement throughout the entire substructure.

Reinforced Concrete Abutment (Element 215)
Quantity: 60 ft. (Abutment Length) x 2 + 32 ft. (Wingwall Length) x 4 = 248 ft.

Concrete Reinforcing Steel Protective System (Element 520)
Quantity: 60 ft. x 25 ft. (Height that is visible for inspection inc. underwater) x 2 abutments + 32 ft. x 25 ft. x .5 (Half of wingwall visible for inspection due to fill) x 4 wingwalls = 4,600 ft^2

B4.2 Element Condition States

B4.2.1 — Defect #1, Reinforced Concrete Deck (Element 12)

Transverse, hairline cracks throughout at variable spacing greater than 3 ft throughout the top surface of the deck. Based on the cracks' widths (less than 0.012 in) and density (greater than 3 ft), the entire deck meets the criteria for Condition State 1.

B4.2.2 —Defect #2, R.C. Approach Slab (Element 321)

A wide crack was noted in the approach slab measuring approximately 0.25 in wide and 15 ft long. Based on the crack width measurement of 0.25 in, this area met the criteria for Condition State 2.
The affected area (Defect #1130) is coded in ft^2 (1 ft x 15 ft = 15 ft^2). Since this is the only defect noted in the approach slabs, the remainder of the area meets the criteria for Condition State 1.

Figure B-21—Wide Transverse Crack on Approach Slab

B4.2.3 — Defect #3, Steel Open Girder/Beam (107) & Steel Protective Coating (515)

The paint on both fascia girders/beams exhibits chalking with loss of pigment throughout the entire exterior web face. The exterior top side of the bottom flange exhibits peeling of the entire finish coat with the primer coat left intact. Localized at 1 area on the fascia girder web, there is some bubbling with exposed rusted bare metal (3 ft height x 5 ft length). No section loss was present. 5 feet is coded in Condition State 2 for Corrosion (Defect # 1000), as no section loss is evident. 15 ft^2 is coded Condition State 3 for Peeling/Bubbling/Cracking (Defect # 3420) and the remainder of the Steel Protective Coating is coded in Condition State 2 for Chalking (Defect # 3410).

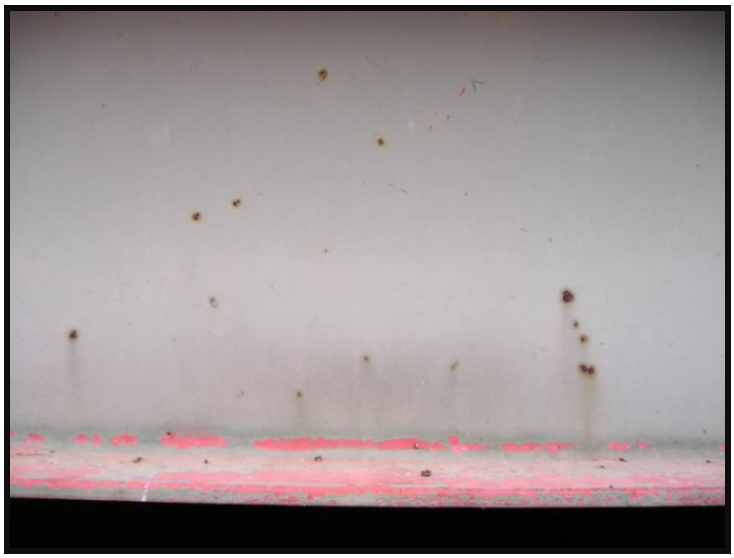


Figure B-22-–Fascia Beam Paint Condition

B4.2.4 — Defect #4, Elastomeric Bearing (Element 310)

The South fascia elastomeric bearing exhibits minor undermining with a loss of less than 10% of the total bearing area. Additionally, bulging was noted (less than 15% of the thickness). Both defects are Condition State 2. Since two defects exist at the same bearing, the only defect coded is Loss of Bearing Area (Defect # 2240) as it is the more severe of the two defects. The remaining elastomeric bearings exhibit no defects and are coded in Condition State 1.

Figure B-23-–South Fascia Elastomeric Bearing

B4.2.5 — Defect #5, Concrete Encasement (Element 816)

One girder exhibits a small spall approximately 1 in deep that has exposed the girder bottom flange. 1 ft is coded for Delamination/ Spall/ Patched Area (Defect #1080) in Condition State 4. There is an area of 15 ft^2 exhibiting minor rust staining, which is coded for Efflorescence/ Rust Staining (Defect #1120) in Condition State 3. All concrete encased girders exhibit moderate scaling that has exposed the coarse aggregate; however it remains secure in the concrete. The remaining area is coded for Abrasion/ Wear (Defect #1190) in Condition State 2. Due to the spall and rust staining defects, the condition of the Steel Open Girder/Beam element is coded in the same condition states because those encasement defects are indicative of problems with the steel.

Figure B-24–-Typical Concrete Encasement Condition (Left), Localized Spall of Concrete Encasement (Right)

B4.2.6 — Defect #6, Reinforced Concrete Abutment (Element 215)

Both abutments exhibit 22’ of heavy efflorescence build-up with some rust staining. This defect is coded 22 ft for Efflorescence/Rust Staining (Defect #1120) in Condition State 3. Additionally, the underwater inspection report noted an area of minor scour for approximately 12 ft on the Northwest wingwall. This defect is coded 12 ft for Scour (Defect #6000) in Condition State 2.

Figure B-25–-Typical Efflorescence Staining

B4.3 Element Quantity and Condition State Summary

Element Number	Element Description	Unit of Measure	Total Quantity	CS1	CS2	CS3	CS4	Defect #
12	**Reinforced Concrete Deck**	**ft²**	**2,700**	**2,700**	**0**	**0**	**0**	**1**
520	**Concrete Reinforcing Steel Protective System**	**ft²**	**2,700**	**2,700**	**0**	**0**	**0**	**N/A**
302	**Compression Joint Seal**	**ft**	**120**	**120**	**0**	**0**	**0**	**N/A**
331	**Reinforced Concrete Bridge Railing**	**ft**	**90**	**90**	**0**	**0**	**0**	**N/A**
856	**Curbs/Sidewalk – Reinforced Concrete**	**ft**	**90**	**90**	**0**	**0**	**0**	**N/A**
321	**Reinforced Concrete Approach Slab**	**ft²**	**1,840**	**1,825**	**15**	**0**	**0**	**2**
1130	*Cracking (RC and Other)*	*ft²*	*15*	0	15	*0*	0	*2*
107	**Steel Open Girder/Beam**	**ft**	**462**	**424**	**16**	**22**	**0**	**3**
1000	*Corrosion*	*ft*	*5*	0	*5*	0	0	*3*
515	**Steel Protective Coating**	**ft²**	**1,476**	**0**	**1461**	**15**	**0**	**3**
3410	*Chalking*	*ft²*	*1461*	*0*	*1,461*	*0*	0	*3*
3420	*Peeling/Bubbling/ Cracking*	*ft²*	*15*	*0*	*0*	*15*	0	*3*
816	**Concrete Encasement**	**ft²**	**294**	**0**	**278**	**15**	**1**	**5**
1080	*Delamination/Spall/ Patched Area*	*ft²*	*1*	0	0	0	1	5
1120	*Efflorescence/ Rust Staining*	*ft²*	*15*	0	*0*	*15*	0	*6*
1190	*Abrasion/ Wear (PSC/RC)*	*ft²*	*293*	0	278	0	0	5
310	**Elastomeric Bearing**	**each**	**4**	**3**	**1**	**0**	**0**	**4**
2240	*Loss of Bearing Area*	*each*	*1*	*0*	*1*	0	0	*4*
313	**Fixed Bearing**	**each**	**11**	**11**	**0**	**0**	**0**	**N/A**
311	**Sliding Plate Bearing**	**each**	**7**	**7**	**0**	**0**	**0**	**N/A**
215	**Reinforced Concrete Abutment**	**ft**	**248**	**214**	**12**	**22**	**0**	**6**
1120	*Efflorescence/ Rust Staining*	*ft*	*22*	0	0	*22*	0	*6*
6000	*Scour*	*ft*	*12*	0	*12*	0	0	*6*

Notes:

Violet Background: National Bridge Element
Blue Background: Bridge Management Element
Green Background: Agency Developed Element
Italic White Type: Defect

B5—SINGLE SPAN ADJACENT PRESTRESSED CONCRETE BOX BEAM BRIDGE

The subject of this example is a single-span adjacent prestressed concrete box beam bridge crossing a local roadway. The bridge was constructed with 8 beams in 2010 and is overall in very good condition with no significant defects noted in the most recent inspection report. The sketches in Figure B2.1 show the bridge elements with relevant dimensions.

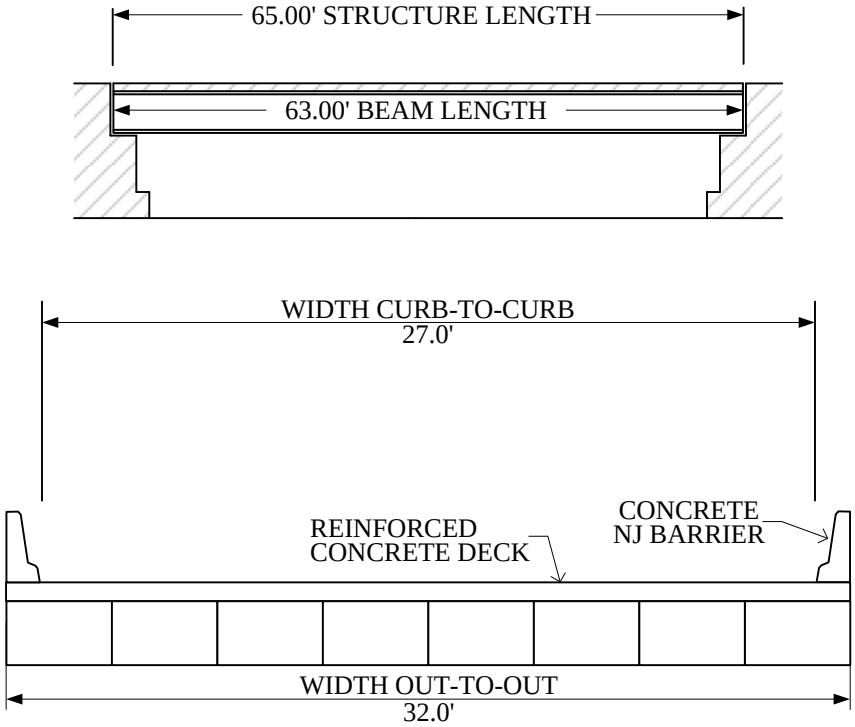


Figure B-26—Elevation and Deck Cross Section

B5.1Element Quantities

B5.1.1 — Deck/Approaches

The reinforced concrete deck has epoxy coated reinforcing steel and no protective overlay. There is a compression seal type of joint at each abutment extending out-to-out of the bridge deck. There is no skew. There are reinforced concrete approach slabs at each end of the bridge that are consistent with the bridge curb-to-curb width and extend 5' from the bridge. The approach slabs do not have epoxy coated reinforcing steel. Reinforced Concrete New Jersey-type barriers are at both sides of the bridge and there are no sidewalks.

Reinforced Concrete Deck (Element 12)
Quantity: 65 ft x32 ft = 2,080 ft^2

Concrete Reinforcing Steel Protective System (Element 520)
Quantity: 65 ft x 32 ft = 2,080 ft^2

Strip Seal Type Joint (Element 302)
Quantity: 32 ft x 2 seals = 64 ft

Reinforced Concrete Approach Slab (Element 321)
Quantity: 27 ft x 5 ft x 2 Approaches = 270 ft^2

Reinforced Concrete Bridge Railing (Element 331)
Quantity: 65 ft x 2 bridge railings = 130 ft

B5.1.2 — Superstructure

All box beams extend approximately 1 ft past the bearings (elastomeric) at each end as indicated on the bridge plans. Mild reinforcement steel is coated with epoxy.

Prestressed Concrete Closed Web/Box Girder (Element 104)
Quantity: 63 ft x 8 beams = 504 ft

Elastomeric Bearing (Element 310)
Quantity: 8 beams x 2 bearings per beam = 16 Elastomeric Bearings

Concrete Reinforcing Steel Protective System (Element 520)
Quantity: 63 ft (Beam Length) x 4 ft (Beam Width) x 8 beams + 63 ft x 2.25 ft (Beam Height) x 2 (Visible Fascia Beam Faces) = 2,300 ft^2 – Only visible surfaces are coded

B5.1.3 — Substructure

The reinforced concrete abutments have non-integral wingwalls separated from the abutments by construction joints and distribute vertical load to spread footings (not visible for inspection). Bridge plans do not indicate epoxy coated reinforcement.

Reinforced Concrete Abutment (Element 215)
Quantity: 40 ft (Abutment Length) x 2 = 80 ft

Wingwalls - Reinforced Concrete (Element 890)
Quantity: 20 ft (Wingwall Length) x 4 = 80 ft

B5.2Element Condition States

B5.2.1 — Defect #1, Reinforced Concrete Deck (Element 12)

Transverse, hairline cracks throughout at variable spacing greater than 3 ft throughout the top surface of the deck. Based on the cracks' widths (less than 0.012 in) and density (greater than 3 ft), the entire deck meets the criteria for Condition State 1.

B5.2.2 — Defect #2, Wingwalls – Reinforced Concrete (Element 890)

Vertical cracks measuring approximately 1/8" wide with variable spacing between 1.0 ft and 3.0 ft in the East wingwall for 15 feet length. Based on the cracks' width between 1/16"-1/4", 15 ft is coded for Cracking (Defect #1120) in Condition State 2. The remaining 65ft is coded in Condition State 1.

B5.3 Element Quantity and Condition State Summary

Element Number	Element Description	Unit of Measure	Total Quantity	CS1	CS2	CS3	CS4	Defect #
12	**Reinforced Concrete Deck**	**ft^2**	**2,080**	**2,080**	**0**	**0**	**0**	**1**
520	**Concrete Reinforcing Steel Protective System**	**ft^2**	**2,080**	**2,080**	**0**	**0**	**0**	**N/A**
861	**Compression Seal Joint**	**ft**	**64**	**64**	**0**	**0**	**0**	**N/A**
331	**Reinforced Concrete Bridge Railing**	**ft**	**130**	**130**	**0**	**0**	**0**	**N/A**
321	**Reinforced Concrete Approach Slab**	**ft^2**	**270**	**270**	**0**	**0**	**0**	**N/A**
104	**Prestressed Concrete Closed Web/Box Girder**	**ft**	**504**	**0**	**0**	**0**	**0**	**N/A**
520	**Concrete Reinforcing Steel Protective System**	**ft^2**	**2,300**	**2,300**	**0**	**0**	**0**	**N/A**
310	**Elastomeric Bearing**	**each**	**16**	**16**	**0**	**0**	**0**	**N/A**
215	**Reinforced Concrete Abutment**	**ft**	**80**	**80**	**0**	**0**	**0**	**N/A**
890	**Wingwalls – Reinforced Concrete**	**ft**	**80**	**65**	**15**	**0**	**0**	**2**
1130	*Cracking (RC and Other)*	*ft*	*15*	*0*	*15*	*0*	*0*	*2*

Notes:

Violet Background: National Bridge Element
Blue Background: Bridge Management Element
Green Background: Agency Developed Element
Italic Type: Defect

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B6—Single Barrel Reinforced Concrete Box Culvert with fill

The subject of this example is a single barrel, reinforced concrete box culvert with fill. The sketch in Figure B3.1 shows the culvert elements with relevant dimensions.

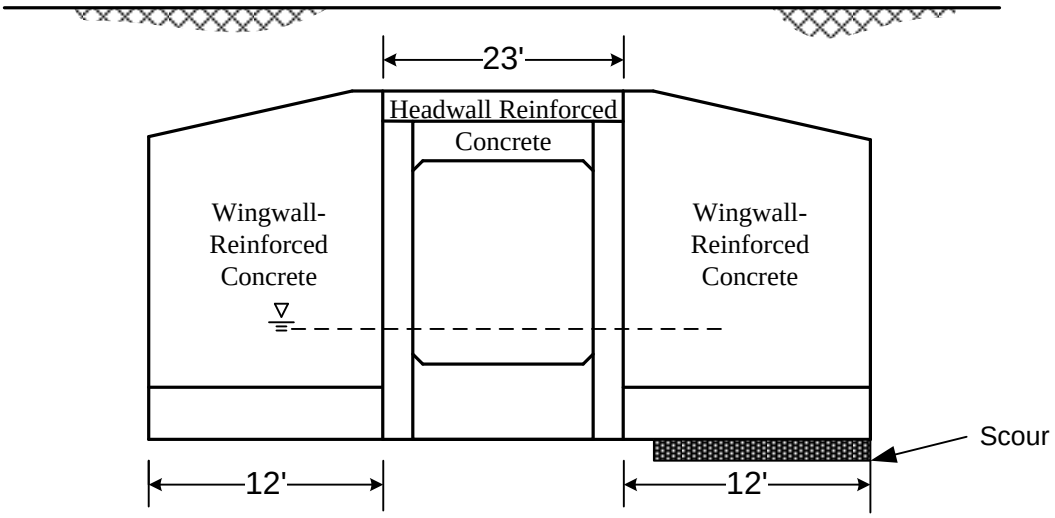


Figure B-27—Elevation and Deck Cross Section

B6.1Element Quantities

B6.1.1 — Culvert

The culvert is reinforced concrete box with fill. Plans indicate epoxy coated rebar only in the top layer of the roof slab, which is not visible for inspection. Therefore, we have not coded Item 520 for Concrete Reinforcing Steel Protective System.

Concrete Culvert (Element 845)
Quantity: 50 ft (length of barrel) x 1(barrel) = 50ft

Wingwalls – Reinforced Concrete (Element 890)
Quantity: 12 ft x (4 Wingwalls) = 48 ft

Headwalls – Reinforced Concrete (Element 896)
Quantity: 23 ft x (2 Headwalls) = 46 ft

B6.2Element Condition States

B6.2.1 — Defect #1, Concrete Culvert (Element 845)

1-in to 2-in deep spalls with exposed rebar (with no section loss). The total length of exposed rebar (Defect # 1090) is 1 ft, and it meets Condition State 2. The first spall is 4 feet long and less than 1-in deep (Defect # 1080) shown in Figure B3.2 (Left)meet the criteria for Condition State 2. The second spall is 3 feet long (with exposed rusted rebar), more than 1-in depth as shown in Figure B3.2 (Right), and meet the criteria of Condition state 3.

Figure B-28—Spalls with exposed Rebar at Roof Slab.

B6.2.2 —Defect #2, Reinforced Concrete Wingwall (Element 890)

Scour with exposed footing (11 feet long) along the south end of wingwall. Max vertical reveal of 6" and 12" probe through silt (Defect # 6000) meet the criteria for Condition State 2.

B6.3Element Quantity and Condition State Summary

Element Number	Element Description	Unit of Measure	Total Quantity	CS1	CS2	CS3	CS4	Defect #
845	**Reinforced Concrete Culvert**	**ft**	**50**	**43**	**4**	**3**	**0**	**1**
1080	*Delamination/Spall/ Patched Area*	*ft*	*7*	*0*	*4*	**3*	*0*	*1*
890	**Wingwalls – Reinforced Concrete**	**ft**	**48**	**37**	**11**	**0**	**0**	**2**
6000	*Scour*	*ft*	*11*	*0*	*11*	*0*	*0*	*2*
846	**Headwalls – Reinforced Concrete**	**ft**	**46**	**46**	**0**	**0**	**0**	**N/A**

Notes:

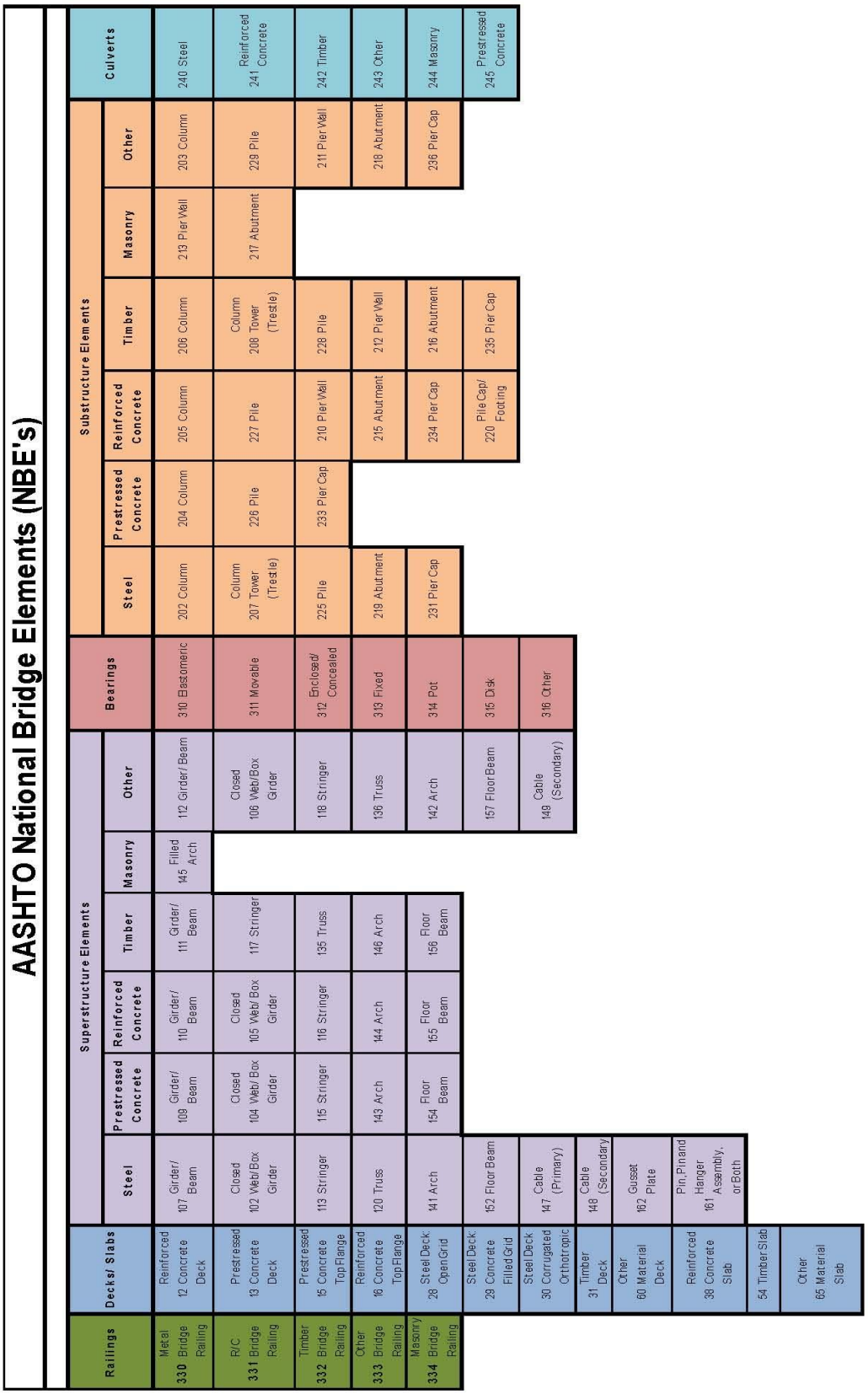
Violet Background: National Bridge Element
Blue Background: Bridge Management Element
Green Background: Agency Developed Element
Italic Type: Defect

* Exposed Rebar (Defect # 1090) for Condition State 2 (Quantity = 1 ft) is not aggregated into Element 845 because Delamination/ Spall/ Patched Area (Defect # 1080) is also located in the same area and is in a Condition State 3.

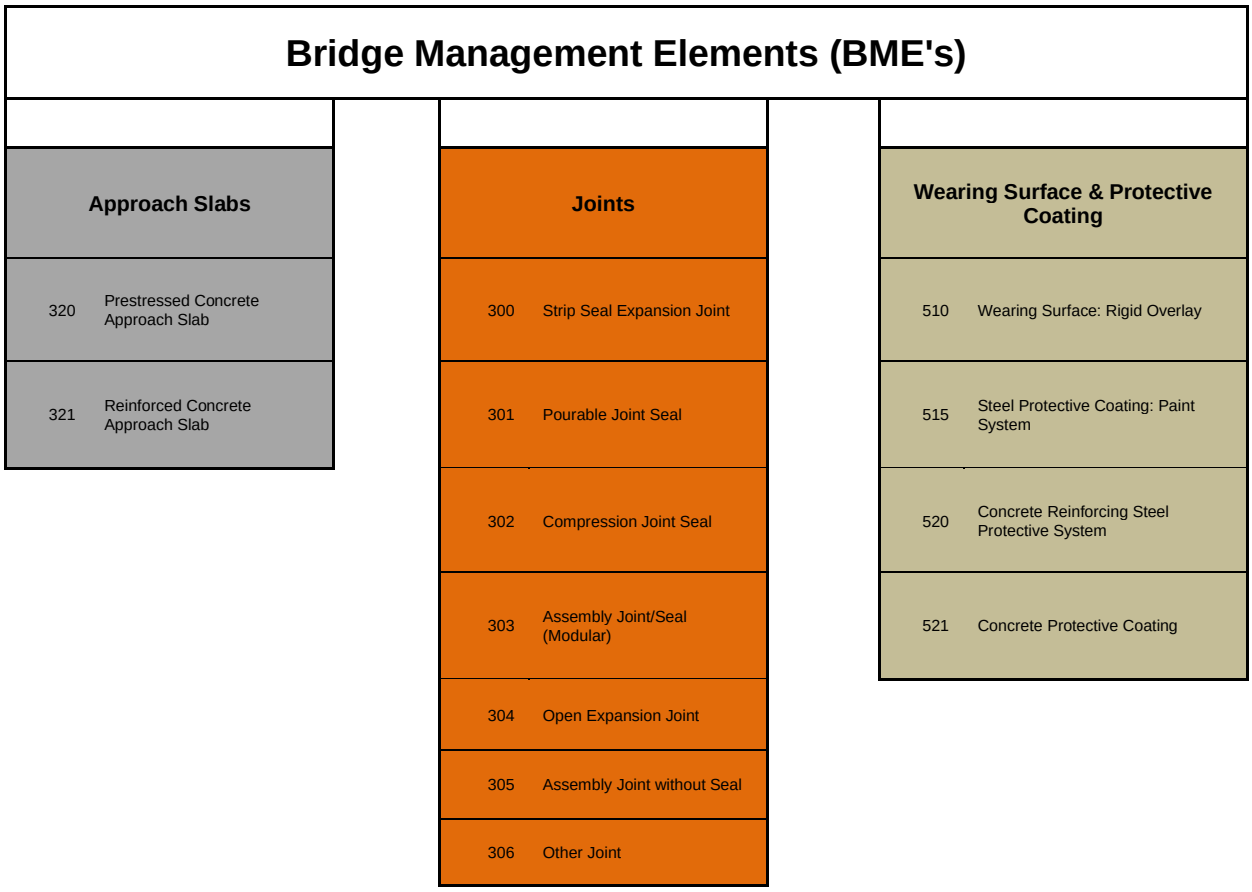
APPENDIX C:

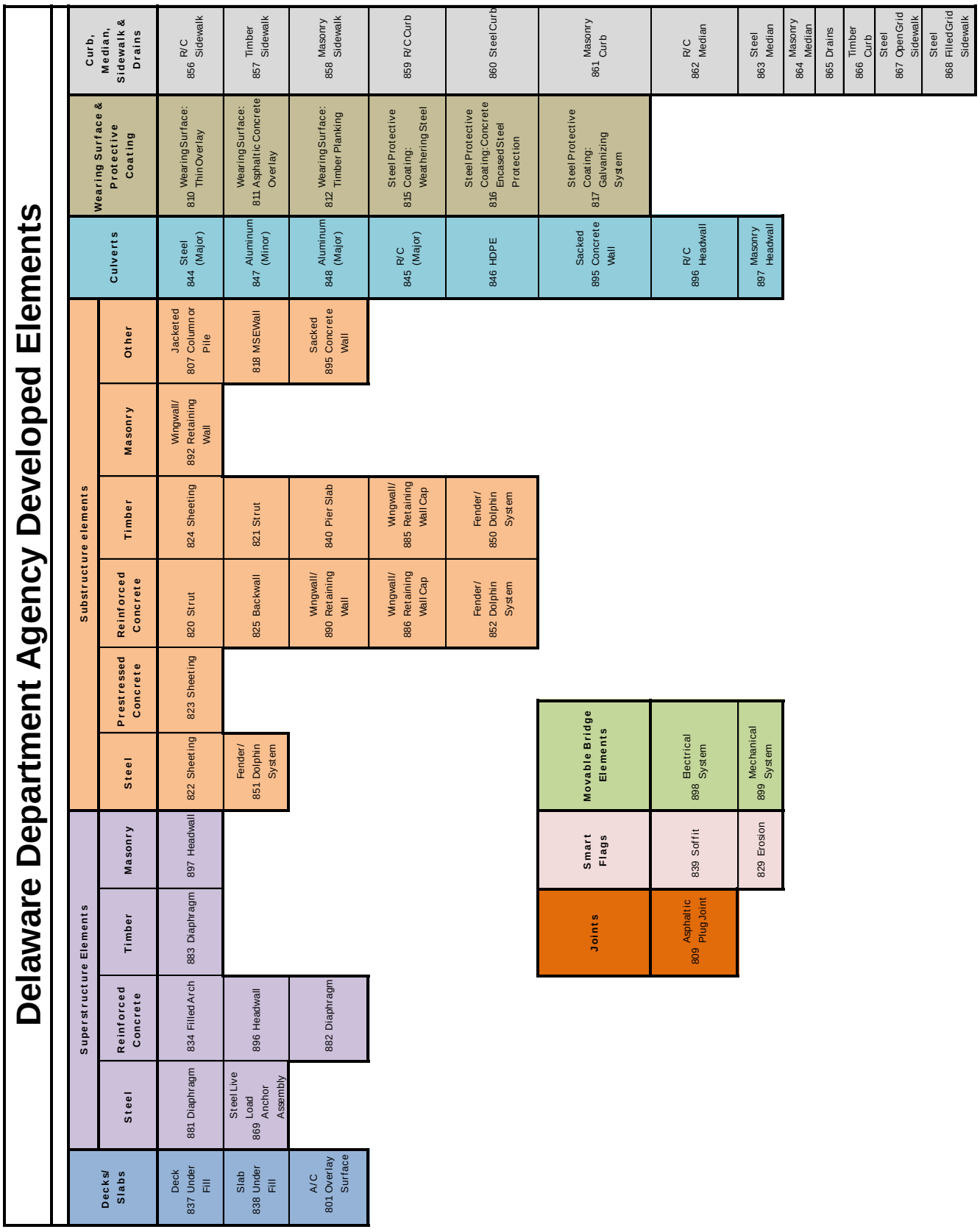
ELEMENT GROUPINGS

The charts on the following pages organize the elements defined in Section 3 into National Bridge Elements (NBE's) and Bridge Management Elements (BME's). For each element, the name, identifier, and units of measure are shown and elements are grouped by major bridge assembly and material type.


AASHTO National Bridge Elements (NBE's)
Railings
Decks/ Slabs
Superstructure Elements
Steel
Prestressed Concrete
Reinforced Concrete
Timber
Masonry
Other
Bearings
Substructure Elements
Steel
Prestressed Concrete
Reinforced Concrete
Timber
Masonry
Other
Culverts
330 Metal Bridge Railing
331 R/C Bridge Railing
332 Timber Bridge Railing
333 Other Bridge Railing
334 Masonry Bridge Railing
12 Reinforced Concrete Deck
13 Prestressed Concrete Deck
15 Prestressed Concrete Top Flange
16 Reinforced Concrete Top Flange
28 Steel Deck: Open Grid
29 Steel Deck: Concrete Filled Grid
30 Steel Deck: Corrugated Orthotropic
31 Timber Deck
60 Other Material Deck
38 Reinforced Concrete Slab
54 Timber Slab
65 Other Material Slab
107 Girder/ Beam
102 Closed Web/ Box Girder
113 Stringer
120 Truss
141 Arch
152 Floor Beam
147 Cable (Primary)
148 Cable (Secondary)
162 Gusset Plate
161 Pin, Pinand Hanger Assembly, or Both
109 Girder/ Beam
104 Closed Web/ Box Girder
115 Stringer
143 Arch
154 Floor Beam
110 Girder/ Beam
105 Closed Web/ Box Girder
116 Stringer
144 Arch
155 Floor Beam
111 Girder/ Beam
117 Stringer
135 Truss
146 Arch
156 Floor Beam
145 Filled Arch
112 Girder/ Beam
106 Closed Web/Box Girder
118 Stringer
136 Truss
142 Arch
157 Floor Beam
149 Cable (Secondary)
310 Elastomeric
311 Movable
312 Enclosed/ Concealed
313 Fixed
314 Pot
315 Disk
316 Other
202 Column
207 Tower (Trestle)
225 Pile
219 Abutment
231 Pier Cap
204 Column
226 Pile
233 Pier Cap
205 Column
227 Pile
210 Pier Wall
215 Abutment
234 Pier Cap
220 Pile Cap/ Footing
206 Column
208 Tower (Trestle)
228 Pile
212 Pier Wall
216 Abutment
235 Pier Cap
213 Pier Wall
217 Abutment
203 Column
229 Pile
211 Pier Wall
218 Abutment
236 Pier Cap
240 Steel
241 Reinforced Concrete
242 Timber
243 Other
244 Masonry
245 Prestressed Concrete

C2—BRIDGE MANAGEMENT ELEMENTS




Delaware Department Agency Developed Elements
Decks/ Slabs
Superstructure Elements
Steel
Reinforced Concrete
Timber
Masonry
Substructure elements
Steel
Prestressed Concrete
Reinforced Concrete
Timber
Masonry
Other
Culverts
Wearing Surface & Protective Coating
Curb, Median, Sidewalk & Drains
A/C 801 Overlay Surface
Deck 837 Under Fill
Slab 838 Under Fill
881 Diaphragm
Steel Live Load Anchor Assembly 869
834 Filled Arch
896 Headwall
882 Diaphragm
883 Diaphragm
897 Headwall
822 Sheeting
823 Sheeting
Fender/ 851 Dolphin System
820 Strut
825 Backwall
Wingwall/ 890 Retaining Wall
Wingwall/ 886 Retaining Wall Cap
Fender/ 852 Dolphin System
824 Sheeting
821 Strut
840 Pier Slab
Wingwall/ 885 Retaining Wall Cap
Fender/ 850 Dolphin System
Wingwall/ 892 Retaining Wall
Jacketed 807 Column or Pile
818 MSEWall
Sacked 895 Concrete Wall
844 Steel (Major)
847 Aluminum (Minor)
848 Aluminum (Major)
845 R/C (Major)
846 HDPE
895 Sacked Concrete Wall
896 R/C Headwall
897 Masonry Headwall
810 Wearing Surface: Thin Overlay
811 Wearing Surface: Asphaltic Concrete Overlay
812 Wearing Surface: Timber Planking
815 Steel Protective Coating: Weathering Steel
816 Steel Protective Coating: Concrete Encased Steel Protection
817 Steel Protective Coating: Galvanizing System
856 R/C Sidewalk
857 Timber Sidewalk
858 Masonry Sidewalk
859 R/C Curb
860 Steel Curb
861 Masonry Curb
862 R/C Median
863 Steel Median
864 Masonry Median
865 Drains
866 Timber Curb
867 Steel Open Grid Sidewalk
868 Steel Filled Grid Sidewalk
Joints
Smart Flags
Movable Bridge Elements
809 Asphaltic Plug Joint
839 Soffit
829 Erosion
898 Electrical System
899 Mechanical System

APPENDIX D:

MATERIALS AND DEFECTS BY MATERIAL TYPE

This Appendix describes the element materials defined for this manual and the defects that may be observed for each condition state. Included are individual materials, such as reinforced and prestressed concrete, steel, timber, masonry, and other materials; and element types that are made of mixed materials or are not material-based, including joints, protective coatings, wearing surfaces, and deck protection systems. For each material type, the defects are identified with a unique defect code and conditions are described for each state. The primary intent of this Appendix is to provide a roadmap of defined defects for each material, without considering the specific elements constructed of the material. Defect identification codes are provided for reference consistent with Appendix E. Article D1 provides a list of the defects cross-tabulated with the materials for which the defects are defined. Defect condition state descriptions are detailed in Article D2. Figure D-1 presents the information in graphical form.

D1—DEFECT DEFINITIONS AND MATERIALS

Defect names and ID numbers in the following table correspond to the defects associated with each element definition in Section 3.

Defect Name (Number)	Used to Report	Materials
Corrosion (1000)	Corrosion of metal and other material elements.	Steel/Metal
		Other Materials
Cracking (1010)	Fatigue cracking in metal and other material elements.	Steel/Metal
		Other Materials
Connection (1020)	Connection distress in metal and other material elements.	Steel/Metal
		Timber
		Other Materials
Delamination/Spall/ Patched Area (1080)	Spalls, delamination, and patched areas in concrete, masonry, and other material elements.	PSC
		RC
		Masonry
		Other Materials
Exposed Rebar (1090)	Exposed conventional reinforcing steel in reinforced and prestressed concrete elements.	PSC
		RC
Exposed Prestressing (1100)	Exposed prestressing steel in concrete elements.	PSC
Cracking (PSC) (1110)	Cracking in prestressed concrete elements.	PSC
Efflorescence/Rust Staining (1120)	Efflorescence/rust staining in concrete and masonry elements.	PSC
		RC
		Masonry
		Other Materials
Cracking (RC and Other) (1130)	Cracking in reinforced concrete and other material elements.	RC
		Other Materials
Decay/Section Loss (1140)	Decay (section loss) in timber elements.	Timber
Check/Shake (1150)	Checks and shakes in timber elements.	Timber
Crack (Timber) (1160)	Cracking in timber elements.	Timber

Defect Name (Number)	Used to Report	Materials
Split/Delamination (Timber) (1170)	Splits/delaminations in timber elements.	Timber
Abrasion/Wear (Timber) (1180)	Abrasion in timber elements.	Timber
Abrasion/Wear (PSC/RC) (1190)	Abrasion/wear in PSC and RC elements.	PSC
		RC
Deterioration (Other) (1220)	General deterioration in elements constructed of other materials such as fiber reinforced plastics or similar.	Other Materials
Mortar Breakdown (Masonry) (1610)	Breakdown of masonry mortar between brick, block, or stone.	Masonry
Split/Spall (Masonry) (1620)	Splits or spalls in brick, block, or stone.	Masonry
Patched Area (Masonry) (1630)	Masonry patched areas.	Masonry
Masonry Displacement (1640)	Displaced brick, block, or stone.	Masonry
Distortion (1900)	Distortion from the original line or grade of the element; used to capture all distortion regardless of cause.	Steel/Metal
		PSC
		RC
		Masonry
		Timber
		Other Materials
Movement (2210)	Movement of bridge bearing elements.	Other Materials
Alignment (2220)	Alignment of bridge bearing elements.	Other Materials
Bulging, Splitting, or Tearing (2230)	Bulging, splitting, or tearing of elastomeric bearing elements.	Other Materials
Loss of Bearing Area (2240)	Loss of bearing area for bridge bearing elements.	Other Materials
Leakage (2310)	Leakage through or around sealed bridge joints.	Other Materials
Seal Adhesion (2320)	Loss of adhesion in sealed bridge joints.	Other Materials
Seal Damage (2330)	Damage to the rubber in bridge joint seals.	Other Materials
Seal Cracking (2340)	Cracking in the rubber in bridge joint seals.	Other Materials
Debris Impaction (2350)	Accumulation of debris in bridge joint seals that may or may not affect the performance of the joints.	Other Materials
Adjacent Deck or Header (2360)	Concrete deck damage in the area anchoring the bridge joint.	Other Materials
Metal Deterioration or Damage (2370)	Metal damage or deterioration in the bridge joint.	Other Materials
Delamination/Spall/ Patched Area/Pothole (Wearing Surfaces) (3210)	Spalls, delaminations, patched areas, and potholes in wearing surface elements.	Wearing Surfaces

Defect Name (Number)	Used to Report	Materials
Crack (Wearing Surface) (3220)	Cracking in wearing surface elements.	Wearing Surfaces
Effectiveness (Wearing Surface) (3230)	Loss of effectiveness in the protection provided to the deck by the wearing surface elements.	Wearing Surfaces
Chalking (Steel Protective Coatings) (3410)	Chalking in metal protective coatings.	Steel/Metal Protective Coatings
Peeling/Bubbling/Cracking (Steel Protective Coatings) (3420)	Peeling, bubbling, or cracking in metal protective coatings.	Steel/Metal Protective Coatings
Oxide Film Degradation Color/ Texture Adherence (Steel Protective Coatings) (3430)	Oxide film degradation of texture in metal protective coatings.	Steel/Metal Protective Coatings
Effectiveness (Steel Protective Coatings) (3440)	Loss of effectiveness of metal protective coatings.	Steel/Metal Protective Coatings
Wear (Concrete Protective Coatings) (3510)	Wearing of concrete protective coatings.	Concrete Protective Coatings
Effectiveness (Concrete Protective Coatings) (3540)	Effectiveness of concrete protective coatings.	Concrete Protective Coatings
Effectiveness—Protective System (e.g. cathodic) (3600)	Effectiveness of internal concrete protective systems (epoxy rebar, cathodic protection, etc.).	Concrete Reinforcing Steel Protective Systems
Settlement (4000)	Settlement in substructure elements.	Steel/Metal
		PSC
		RC
		Masonry
		Timber
		Other Materials
Scour (6000)	Scour in substructure elements.	Steel/Metal
		PSC
		RC
		Masonry
		Timber
		Other Materials

Defect Name (Number)	Used to Report	Materials
Damage (7000)	Impact damage.	Steel/Metal
		PSC
		RC
		Masonry
		Timber
		Other Materials
		Wearing Surfaces
		Steel/Metal Protective Coatings
		Concrete Protective Coatings
		Concrete Reinforcing Steel Protective Systems
Fill Loss (8000)	Fill loss through MSE Walls or GRS Abutments	MSE & GRS Walls
Drainage Effectiveness (9000)	Clogged Drains, scuppers or drainage system	Bridge Drains

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D2—MATERIALS AND DEFECT CONDITION STATE DESCRIPTIONS

Defect condition state language in the following tables corresponds to the descriptions associated with each element definition documented in Section 3.

D2.1—Steel & Aluminum (100)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion Steel (1000)	None. Metal Culverts: Some discoloration or surface corrosion may exist but there is no metal pitting.	Freckled rust. Corrosion of the steel has initiated. Metal Culverts: There may be minor to moderate corrosion and pitting but cannot easily perforate with hammer.	Section loss is evident or pack rust is present but does not warrant structural review. Metal Culverts: Significant corrosion, deep pitting or flaking exists that can be easily perforated with a hammer.	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. Metal Culverts: Major corrosion with perforations and/or holes exists. Fill is visible.
Corrosion Aluminum (1000)	Some discoloration or surface corrosion may exist but there is no metal pitting.	There may be minor to moderate corrosion, pitting or white spots are starting to form that are less than 1″ in diameter.	Significant corrosion, deep pitting or "white spots" exists that are greater than 1″ in diameter, but fill is not visible.	
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

D2.2—Prestressed Concrete (300)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall/ Patched Area (1080)	None. Patched area that is sound	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (PSC) (1110)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004–0.009 in. or spacing 1.0–3.0 ft	Width greater than 0.009 in. or spacing less than 1 ft.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	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.
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

D2.3—Reinforced Concrete (400)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall/ Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear and > 1″ deep.	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.

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

D2.4—Timber (500)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Decay/Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5%–50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	The 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.
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Split/Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	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.

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Abrasion/Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	The 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.
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

D2.5—Other Materials (600)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack that is not arrested but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Delamination/Spall/ Patched Area (1080)	None. Patched area that is sound.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is unsound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	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.

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Cracking (RC and Other) (1130)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	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.
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Alignment- Bearings (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Alignment - Joints (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Lateral or vertical alignment for the joint resulting in contact of the joint surfaces, but not preventing bridge movement.	Lateral or vertical alignment for the joint resulting in contact of the joint surfaces preventing bridge movement.
Bulging, Splitting, or Tearing (2230)	None.	Bulging less than 15% of the thickness.	Bulging 15% or more of the thickness. Splitting or tearing. Bearing's surfaces are not parallel. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	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.
Leakage (2310)	None.	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
Seal Adhesion (2320)	Fully adhered.	Adhered for more than 50% of the joint height.	Adhered 50% or less of joint height but still some adhesion.	Complete loss of adhesion.
Seal Damage (2330)	None.	Seal abrasion without punctures.	Punctured or ripped or partially pulled out.	Punctured completely through, pulled out, or missing.
Seal Cracking (2340)	None.	Surface crack.	Crack that partially penetrates the seal.	Crack that fully penetrates the seal.
Debris Impaction (2350)	Shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement.	Completely filled and prevents joint movement.
Adjacent Deck or Header (2360)	Sound. No spall, delamination, or unsound patch.	Edge delamination or spall 1 in. or less deep or 6 in. or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Exposed rebar. Delamination or unsound patched area that makes the joint loose.	Spall, delamination, unsound patched area, or loose joint anchor that prevents the joint from functioning as intended.

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Metal Deterioration or Damage (2370)	None.	Freckled rust; metal has no cracks or impact damage. Connection may be loose but functioning as intended.	Section loss, missing or broken fasteners, cracking of the metal, or impact damage but joint still functioning.	Metal cracking, section loss, damage, or connection failure that prevents the joint from functioning as intended.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.
Fill Loss (8000)	No fill loss is present.	Fill loss is present, but no signs of settlement, misalignment or bulging of wall.	Fill loss resulting in movement of wall within tolerable limits or settlement of the approach roadway.	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.
Drainage Effectiveness (9000)	No drainage issues present.	Partial clog or blockage of drain, scupper or drainage system.	Drain, scupper or drainage system is completely clogged.	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.

D2.6—Masonry (650)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Mortar Breakdown (Masonry) (1610)	None.	Cracking or small voids in joint with or without insignificant fill loss.	Large voids in the joint with or without minor to moderate fill loss.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	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.
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	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.

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	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.
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

D2.7—Wearing Surfaces & A/C Overlay (800)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall/ Patched Area/Pothole (Wearing Surfaces) (3210)	None. Patched area that is sound.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched area that is unsound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks or unsealed moderate map cracking.	Wide cracks or heavy map cracking.	The wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leakage or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	The wearing surface is no longer effective.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

D2.8—Concrete Reinforcing Steel Protective Systems (820)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Effectiveness—Protective System (e.g. cathodic) (3600)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

D2.9—Steel Protective Coatings (850)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Chalking (Steel Protective Coatings) (3410)	None.	Surface dulling.	Loss of pigment.	Not applicable.
Peeling/Bubbling/Cracking (Steel Protective Coatings) (3420)	None.	Finish coats only.	Finish and primer coats.	Exposure of bare metal.
Oxide Film Degradation Color/Texture Adherence (Steel Protective Coatings) (3430)	Yellow-orange or light brown for early development. Chocolate-brown to purple-brown for fully developed. Tightly adhered, capable of withstanding hammering or vigorous wire brushing.	Granular texture.	Small flakes, less than $^1/_2$-in. diameter.	Dark black color. Large flakes, $^1/_2$-in. diameter or greater or laminar sheets or nodules.
Effectiveness (Steel Protective Coatings) (3440)	Fully effective.	Substantially effective.	Limited effectiveness.	Failed; no protection of the underlying metal.
Delamination/Spall/ Patched Area (1080)	None.	Delaminated. Spall $\leq$ 1″ deep or $\leq$ 6″ in diameter.	Spall > 1″ deep or > 6″ in diameter.	Spall has exposed steel member.
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with minor-moderate rust staining.	Heavy rust staining
Cracking (RC and Other) (1130)	None	Insignificant cracks or moderate cracks that have been sealed.	Unsealed moderate cracks.	Wide cracks.
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing, but may have exposed aggregate.	Exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or can be easily removed out of the concrete.	Coarse aggregate has popped out of the concrete.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

D2.10—Concrete Protective Coatings (880)

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Wear (Concrete Protective Coatings) (3510)	None.	Underlying concrete not exposed, coating showing wear from UV exposure, friction course missing.	Underlying concrete is not exposed; thickness of the coating is reduced.	Underlying concrete exposed. Protective coating no longer effective.
Effectiveness (Concrete Protective Coatings) (3540)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

APPENDIX E:

MATERIALS AND FEASIBLE ACTIONS BY MATERIAL TYPE

This Appendix describes the element materials defined for this manual and the feasible actions that may be applied for each condition state. Included are individual materials, such as reinforced and prestressed concrete, steel, timber, masonry, and other materials; and element types that are made of mixed materials or are not material-based, including joints, protective coatings, wearing surfaces, and deck protection systems. For each material or element type, the feasible actions are listed at a high level, with the understanding that agency practices will differ in scope and detail. The primary intent is to provide a roadmap of possible actions scaled by distress or defect severity, with the assumption that needed work for all elements constructed of these materials or in an element family may be addressed by one or more of these common feasible actions. Material identification codes are provided for reference consistent with Appendix D.

E1—STEEL & ALUMINUM (100)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E2—PRESTRESSED CONCRETE (300)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E3—REINFORCED CONCRETE (400)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E4—TIMBER (500)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E5—OTHER MATERIALS (600)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E6—MASONRY (650)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E7—WEARING SURFACES (800)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E8—CONCRETE REINFORCING STEEL PROTECTIVE SYSTEMS (820)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E9—STEEL PROTECTIVE COATINGS (850)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

E10—CONCRETE PROTECTIVE COATINGS (880)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

APPENDIX F:

MAXIMO MAINTENANCE REQUESTS

For each bridge inspected the following maintenance items shall be requested by the bridge inspector where applicable. The maintenance shall be entered into Maximo with the appropriate priority.

F1—MAXIMO PRIORITY 3 MAINTENANCE

Removal of vegetation and debris when affecting the bridge. Special attention shall be given to areas around MSE walls and concrete slope paving as these areas are more susceptible to damage from vegetation. See NBI Item #61. (BMS code B055-V1A) (Function code 11105.5)

Repair of erosion and placement of erosion control measures when the bridge is affected (CS2 or worse). (Element #829) (BMS code B054-S6D) (Function Code 11105.4)

Repair of open grid deck, repairing broken connections or replacing damaged areas. (BMS code B024-P1A) (Function code 11102.4)

Re-seal pourable deck joints, Element #301 (BMS code B007-S1H) (Function code 11100.7). Special attention should be given to the joint between the approach slab and wingwalls/parapet or other area where erosion and undermining potential exists. If it is apparent that MOT would be excessive do not re-seal the joint in the travel lanes.

Clean & paint deteriorated primary load carrying steel members (CS4– Steel). Typically, this work will be localized to a specific area or location. (BMS code B005-S2K) (Maximo Function Code 11100.5)

F2—MAXIMO PRIORITY 2 MAINTENANCE

Repair of deck, slab, and approach slab spalls. (Condition State 2 and top surfaces only) (BMS code B025-P1A or B022-S1D) (Function Code 11102.5)

Repair of header spalls. (BMS code B041-S3B) (Function code 11104.1)

Repair of AC overlay, Element #801 or 811, (CS 2 only) or repair of hot mix (any condition state) over; culvert, slab under fill, filled arch or approach slab, (BMS code B022-S1D) (Function code 11102.2) or hot mix wedge placement to account for settlement at the ends of bridges.

Clean out scuppers and/or drains (BMS code B002-S1G) (Function Code 11100.2)

F3—MAXIMO PRIORITY 1 MAINTENANCE

Cleaning/clearing weepholes in P.S. conc. box beams. (Function code 11107.1)

Clean/flush bearings/bearing seat (use when debris may cause deterioration of bearing or bearing seat) (BMS code B003-S2J) (Function code 11100.3)

Apply protective coating – deck (when element #1130 or 3220 is CS 2 or worse), parapets, sidewalk, or approach slab. (used to seal minor cracks, specify coating material to be used) (BMS code B060-A1C) (Function code 11106.0)

Seal joints in concrete slope paving and/or between the slope paving and the abutment or wingwall. (BMS code B007-S1H) (Function code 11100.7)

F4—GENERAL GUIDANCE

Critical maintenance needs shall be brought to the attention of the Bridge Inspection Engineer and will be addressed on a case by case basis. Scour smart flag (element # 6000) condition state 2 or 3 shall be brought to the attention of the Bridge Inspection Engineer who will determine if a Maximo maintenance request is required.

Stone Facing: Issues with stone facing shall be noted in the inspection report and brought to the attention of the Bridge Inspection Engineer to determine if a Maximo maintenance request should be entered.

Under the "NOTES" tab card in the space provided for Inspection Notes, the inspector shall enter the requested maintenance, maintenance code and the Maximo work order number.

In Maximo, (in the description box immediately to the right of the work order number box) enter the work description in the following format: **Bridge # / Work code (e.g. BR: 1-001-279 / Work: B055-V1A).** The source code of **BR MGMT** shall be used for all work orders.

Non-bridge elements requiring maintenance:
Maintenance not covered by elements listed in this manual shall be brought to the attention of the Bridge Inspection Engineer and will be addressed on a case by case basis. As a minimum these items shall be listed in the inspection report, the need for a Maximo work request will be determined by the Bridge Inspection/Bridge Maintenance Engineer. Non-elements that should be given a cursory inspection are; Sluice Gates and Spillways, Covered Bridge Siding/Roof, Guardrail, etc. This list is not all inclusive, if there is a bridge related item that is not covered in this manual, that requires maintenance, list it in the report and bring to the attention of the BIE.

F5—MAXIMO FUNCTION CODES

11100.1	Bridge – B001-P1A – Clean/Flush Deck	SqYd
11100.2	Bridge – B002-S1G – Clean/Flush Scupper/Downspouting	Each
11100.3	Bridge – B003-S2J – Bearings and Bearing Seat	Each
11100.4	Bridge – B004-P5S – Structural Steel Surfaces (Clean/Flush)	Each
11100.5	Bridge – B005-S2K – Spot Painting – Superstructure	Each
11100.6	Bridge – B005-S2K – Spot Painting – Superstructure	Each
11100.7	Bridge – B007-S1H – Reseal Deck Joints (Liquid Only)	Feet
11100.8	Bridge – B008-S1H – Repair/Reseal Deck Joints	Feet
11100.9	Bridge – B009-S1H – Compression Seal Deck Joints (repair/Rehabilitate)	Feet

11101.0	Bridge – B010-S1H – Modular Dam Deck Joints (repair/Rehabilitate)	Feet
11101.1	Bridge – B011-S1H – Steel Dam Deck Joints (Repair/Rehabilitate)	Feet
11101.2	Bridge – B012-S1E – Bridge/Parapet Railing (Repair/Replace)	Feet
11101.3	Bridge – B013-S1E – Structure Mounted Railing (Repair/Replace)	Feet
11101.4	Bridge – B014-S1E – Pedestrian Railing (Repair/Replace)	Feet
11101.5	Bridge – B015-S1E – Median Barrier (Repair/Replace)	Feet
11101.6	Bridge – B016-S2J – Lubricate Bearings	Each
11101.7	Bridge – B017-S2J – Steel Bearings (Repair/Rehabilitate)	Each
11101.8	Bridge – B018-S2J – Steel Bearings (Replace)	Each
11101.9	Bridge – B019-S2J – Expansion Bearings (Reset)	Each
11102.0	Bridge – B020-S2J – Bearing Pedestal/Seats (Reconstruct)	Each
11102.1	Bridge – B021-S6J – Approach Slab (Repair/Replace)	Each
11102.2	Bridge – B022-S1D – Bituminous Deck Wearing Surface (Repair/Replace)	SqYd
11102.3	Bridge – B023-P1A – Timber Deck (Repair/Replace)	SqYd
11102.4	Bridge – B024-P1A – Steel Open Grid Bridge Deck (Repair/Replace)	SqYd
11102.5	Bridge – B025-P1A – Concrete Deck (Repair)	SqYd
11102.6	Bridge – B026-S1B – Concrete Sidewalk (Repair)	SqYd
11102.7	Bridge – B027-S1C – Concrete Curb/Parapet (Repair)	Feet
11102.8	Bridge – B028-S1G – Scupper Grate (Replace)	Each
11102.9	Bridge – B029-S1G – Drain/Scupper (Install)	Each
11103.0	Bridge – B030-S1G – Downspouting (Repair/Replace)	Each
11103.1	Bridge – B031-P2E – Timber Stringers (Repair/Replace)	Each
11103.2	Bridge – B032-P6A – Other Timber Members (Repair/Replace)	Each
11103.3	Bridge – B033-P2E – Steel Stringer (Repair/Replace)	Each
11103.4	Bridge – B034-P2D – Steel Floorbeam (Repair/Replace)	Each
11103.5	Bridge – B035-P2A – Steel Girder (Repair)	Each
11103.6	Bridge – B036-S2H – Steel Diaphram/Lateral Bracing (Repair/Replace)	Each
11103.7	Bridge – B037-P2E – Prestressed/R. Conc. Stringer (Repair/Replace)	Each
11103.8	Bridge – B038-S2H – Prestressed/R. Conc. Diaphragm (Repair/Replace)	Each
11103.9	Bridge – B039-S2I – Prestressed/ R. Conc. Members - Other (Repair/Replace)	Each
11104.0	Bridge – B040-P2B – Steel Truss Member (Fracture Critical Members)	Each
11104.1	Bridge – B041-S3B – Abutment Backwalls (Repair/Replace)	CuYd
11104.2	Bridge – B042-P7A – Abutments (Repair)	CuYd
11104.3	Bridge – B043-S3C – Abutment Wingwalls (Repair/Replace)	CuYd

11104.4	Bridge – B044-P3F – Piers (Repair) Masonry	CuYd
11104.5	Bridge – B046-P7A – Masonry (Repoint)	Feet
11104.7	Bridge – B047-S6C – Abutment Slope Protection (Repair/Replace)	SqYd
11104.8	Bridge – B048-S4B – Culvert Headwalls/Wings (Repair/Replace)	CuYd
11104.9	Bridge – B049-P4C – Culvert Apron/Cutoff Wall (Repair/Replace)	CuYd
11105.0	Bridge – B050-P4A – Culvert Barrel (Repair)	SqYd
11105.1	Bridge – B051-S5E – Streambed Paving (Repair/Construct)	CuYd
11105.2	Bridge – B052-S5F – Rock Protection	CuYd
11105.3	Bridge – B053-S5G – Stream Deflector (Repair/Construct)	CuYd
11105.4	Bridge – B054-S6D – Scour Hole	CuYd
11105.5	Bridge – B055-V1A – Vegetation/Debris (Removal)	CuYd
11105.6	Bridge – B056-D1A – Deposition (Remove)	CuYd
11105.7	Bridge – B057-T1P – Temporary/Permanent Pipes (Construct)	Each
11105.8	Bridge – B058-T1B – Temporary Bridge (Acrow Bridge/Construct)	Each
11105.9	Bridge – B059-S8C – Slab/Box Culvert (Replacement)	Each
11106.0	Bridge – B060-A1C – Apply Protective Coating Deck/Parapet/Sidewalk	SqYd
11106.1	Bridge – B061-A2C – Apply Protective Coating (Substructure)	SqYd
11106.2	Bridge – B062-A3C – Apply Protective Coating (Piles)	SqYd
11106.3	Bridge – B063-M1B – Movable Bridges (Bascule/Swing)	Each
11106.4	Bridge – B064-P2G – Arches (Repair/Rehabilitate)	SqYd
11107.1	Bridge – Maintenance and Repair	CuYd
11107.2	Bridge – Remove and Replace	Each
11107.3	Bridge – Removal Only	Each
11107.5	Bridge – Maintain Dams and Sluice Gates	Each
11110.1	Dams and Spillways – Maintenance and Repair	Each
11111.8	Bridge – Navigation Lights	Each

F6---BRIDGE POSTING SIGNS

Replacement / Placement of Load Posting Signs: Check Item 41, if coded as "P" and no sign is present, consult Bridge Management Engineer to verify the need for placement of posting sign. If an existing sign needs replacement (damaged/missing), bring it to the attention of the Bridge Management Engineer.

Replacement / Placement of Vertical Clearance Signs: Check Item 53 and 54B, if underclearance is less than 14'-6" and no sign is present, consult Bridge Management Engineer to verify the need for placement of clearance sign. If an existing sign needs replacement (damaged/missing), bring it to the attention of the Bridge Management Engineer.

APPENDIX G:

GUIDANCE FOR NBI CONDITION RATING ASSIGNMENTS

G1—GENERAL CONDITION RATING GUIDANCE

NBI Condition Rating	Description	General Condition Rating Assignment Comments	Element Condition State Quantities (Primary Members)	Require BIE/BME Review
9	Excellent Condition	Only assigned to new bridges at the time of the inventory inspection. The assignment of a "9" during the first routine inspection, or any inspection thereafter, is prohibited.	CS1 = 100%	N
8	Very Good Condition	Assigned when there are no defects for structural components or superficial defects for non-structural componenets, i.e. element condition states are in a CS1 for non-structural and structural components.	CS1 = 100%	N
7	Good Condition	Assigned when minor deterioration of non-structural components or superficial to minor deterioration of structural components exist. *Superficial deterioration/defects correlates to an element condition rating of a 1 with a defect that was present from construction or cracking in concrete that is < 0.012" (R/C) and <0.004" (P/S). Minor deterioration correlates to an element condition rating of a "2".*	CS1 ≥83% CS2 ≤15% CS3≤2%	N
6	Satisfactory Condition	Assigned when moderate deterioration of non-structural component(s) or minor to moderate deterioration of structural component(s) exist. *Moderate deterioration correlates to an element condition rating of a "3".*	CS1 & CS2 ≥85% CS3 ≤15%	N
5	Fair Condition	Assigned when advanced deterioration of non-structural component(s) or moderate deterioration of structural component(s) exist. *Advanced deterioration correlates to an element condition rating of a "4".*	CS1 & CS2 ≥65% CS3 ≤35% CS4 =0%	N
4	Poor Condition (Structurally Deficient)	Advanced deterioration that does not affect the primary structural components exists. This is typically assigned when the element condition state of the primary structural component(s) have been assigned an element condition state rating of a "4". It may also be assigned once an analysis has been completed and the results indicate that the bridge does not need posting. The decision to assign a conditon rating of a "4" versus a "3" may be based on engineering judgement of the Bridge Inspection Engineer and/or the Bridge Management Engineer.	CS3 >35% CS4 = 0% (>0% Initially, but 0% after Structural Review)	**Y**
3	Serious Condition (Structurally Deficient)	Advanced deterioration exists and has affected primary structural components. This may have been determined through analysis or based on engineering judgement by the Bridge Inspection Engineer and/or Bridge Management Engineer. If determined through analysis, the rating should have originally been assigned a "4" by the inspection team.	CS4 > 0%	**Y**
2	Critical Condition (Structurally Deficient)	Sufficent deterioration exists such that corrective action is required. Corrective action may include a significant load posting restriction, emergency repairs, reducing the number of lanes carried by the bridge and restricting the type of traffic.	CS4 > 0%	**Y**
1	"Imminent" Failure Condition (Closed)	Assigned to bridges in which conditions exist that failure/collapse is likely to occur. Bridge will be closed, but corrective action may put bridge back in a reduced level of service.	CS4 > 0%	**Y**
0	Failed Condition (Closed)	Only assigned to bridges that have failed/collapsed or have partial failure. Condition of bridge is beyond corrective action.	CS4 > 0%	**Y**

Non-Structural Components:	Railings, curbs, medians, sidewalks, drains, joints, bearings, headwalls, approach slabs, wingwalls (retaining walls) and sheeting.

Some subjectivity exists as to whether or not a specific NBI Condition Rating is assigned based on just one defect location or a relatively small percentage of defect locations. Therefore, discretion can be used by the inspection team and/or the Bridge Inspection Engineer or Bridge Management Engineer in assigning the appropriate NBI Condition Rating. As an example, a reinforced concrete abutment wall that has one location of a 3' x 1' spall that is 2" deep and doesn't expose any rebar will have an element condition state of a 3. However, the inspection team may decide to assign a NBI Substructure Rating of a "6" instead of a "5" since it is an isolated defect and the rest of the abutment is in good shape. General table should be used to rate slabs.

G2—DECK CONDITION RATING GUIDANCE

G2.1—Bare Concrete Decks

NBI Deck Condition Rating Assignment: Bare Concrete Deck						
NBI Rating	**AASHTO BrM Element #12 Condition State Quantity**				**Comments**	**Action Required**
	CS1	**CS2**	**CS3**	**CS4**		
9	100% (new)	0%			---	N/A
8	100% w/ few superficial defects	0%			---	N/A
7	>95%	<5% with <1% CS3		0%	---	N/A
6	>90%	<15% with <5% CS3		0%	---	Additional testing may be required: Full-Deck Sounding or Impact echo
5	>75% & ≤90%	≥ 15% and <25% with <10% CS3		0%	Results of additional testing may make the deck Structurally Deficient	Additional testing is required and may include the following: Impact echo, GPR, Chloride Tests and Concrete Cores. Repair strategy is identified..
4	< 25%	≥25% or ≥10% CS3		0% (>0% Initially, but 0% after Structural Review)		
3	< 100%			> 0%	Pending punch-thru's , deep rutting, excessive deck "bounce" or crack opening and closing under traffic may exist.	Temporary repairs or patches may be necessary, but are not critical.
2	< 100%			> 0%	Presence of punch-thru's will make the Deck Structurally Deficient and result in a Critical Condition.	Immediate repairs are required. Bridge may be closed or individual lane(s) may be closed to keep bridge open until repairs are made.
1	< 100%			> 0%	Presence of multiple punch-thru's and/or excessive pending punch-thru's may be present.	Bridge Closure. Emergency repairs may put bridge back in reduced service
0	< 100%			> 0%	Excessive punch-thru's exist and the bridge is not safe for vehicular traffic.	Bridge Closure

G2.2—Concrete Decks w/ Overlay

NBI Deck Condition Rating Assignment: Concrete Deck w/ Overlay						
NBI Rating	**AASHTO BrM Condition State Quantity**				**Comments**	**Action Required**
	CS1	**CS2**	**CS3**	**CS4**		
9	100% (new)	0%			---	N/A
8	100% w/ few superficial defects	0%			---	N/A
7	**Element 12:** >95%	<5% with <1% CS3		0%	---	N/A
	Overlay: >90%	<10%				
6	**Element 12:** >90%	<15% with <5% CS3		0%	---	Additional testing may be required: Full-Deck Sounding or Impact echo
	Overlay: >75%	>10% & <25%		0%		
5	**Element 12:** >75% & ≤90%	≥ 15% and <25% with <10% CS3			Results of additional testing may make the deck Structurally Deficient	Additional testing is required and may include the following: Impact echo, GPR, Chloride Tests and Concrete Cores. Repair strategy is identified..
	Overlay: <75%	>25%		0%		
4	**Element 12:** < 25%	≥25% or ≥10% CS3		0% (>0% Initially, but 0% after Structural Review)		
3	**Element 12:** < 100%			**Element 12:** > 0%	Pending punch-thru's , deep rutting, excessive deck "bounce" or crack opening and closing under traffic may exist.	Temporary repairs or patches may be necessary, but are not critical.
2	**Element 12:** < 100%			**Element 12:** > 0%	Presence of punch-thru's will make the Deck Structurally Deficient and result in a Critical Condition.	Immediate repairs are required. Bridge may be closed or individual lane(s) may be closed to keep bridge open until repairs are made.
1	**Element 12:** < 100%			**Element 12:** > 0%	Presence of multiple punch-thru's and/or excessive pending punch-thru's may be present.	Bridge Closure. Emergency repairs may put bridge back in reduced service
0	**Element 12:** < 100%			**Element 12:** > 0%	Excessive punch-thru's exist and the bridge is not safe for vehicular traffic.	Bridge Closure

Once a concrete deck has been assigned a NBI deck condition rating of a 1, 2 or 3 and emergency or temporary repairs are made, the NBI deck condition rating should be raised to a 3. In addition the deck shall receive a special inspection every 6 months. Any deviation from this by the BIE or BME will be documented in the inspection file.

G3—SUPERSTRUCTURE CONDITION RATING GUIDANCE

NBI Superstructure Condition Rating should follow the guidance found in ***G1*** except for pre-stressed concrete beams which will follow Table G3.1 below**.** The rating will be based on primary and secondary structural members only. Non-structural members shall not affect the rating. Non-structural members include diaphragms, cross-bracing and sidewalk supports. Diaphragms may be considered primary structural members if the bridge is a curved bridge.

G3.1—PRE-STRESSED CONCRETE SUPERSTRUCTURE CONDITION RATING GUIDANCE

NBI Condition Rating	Description	Condition Rating Assignment Comments	Element Condition State Quantities (Primary Members)	Require BIE/BME Review
9	Excellent Condition	Only assigned to new bridges at the time of the inventory inspection. The assignment of a "9" during the first routine inspection, or any inspection thereafter, is prohibited.	CS1 = 100%	N
8	Very Good Condition	Assigned when there are no defects for structural components, i.e. element condition states are in a CS1 for structural components.	CS1 = 100%	N
7	Good Condition	Assigned when superficial to minor deterioration of structural components exist. *Superficial deterioration/defects correlates to an element condition rating of a 1 with a defect that was present from construction or cracking in concrete that is < 0.012" (Horizontal) and <0.004" (Transverse). Minor deterioration correlates to an element condition rating of a "2".*	CS1 ≥90% CS2 ≤10%	N
6	Satisfactory Condition	Assigned when minor to moderate deterioration of structural component(s) exist. *Moderate deterioration correlates to an element condition rating of a "3".*	CS1 & CS2 ≥90% CS3 ≤10%	N
5	Fair Condition	Assigned when moderate deterioration of structural component(s) exist.	CS1 & CS2 ≥75% CS3 ≤25%	N
4	Poor Condition (Structurally Deficient)	Significant moderate to advanced deterioration that does not affect the primary structural components exists. This is typically assigned when the element condition state of the primary structural component(s) have been assigned an element condition state rating of a "4". It may also be assigned once an analysis has been completed and the results indicate that the bridge does not need posting. The decision to assign a conditon rating of a "4" versus a "3" may be based on engineering judgement of the Bridge Inspection Engineer and/or the Bridge Management Engineer. *Advanced deterioration correlates to an element condition rating of a "4".*	CS3 >25% or CS4 = 0% (>0% Initially, but 0% after Structural Review)	**Y**
3	Serious Condition (Structurally Deficient)	Advanced deterioration exists and has affected primary structural components. This may have been determined through analysis or based on engineering judgement by the Bridge Inspection Engineer and/or Bridge Management Engineer. If determined through analysis, the rating should have originally been assigned a "4" by the inspection team.	CS4 > 0%	**Y**
2	Critical Condition (Structurally Deficient)	Sufficent deterioration exists such that corrective action is required. Corrective action may include a significant load posting restriction, emergency repairs, reducing the number of lanes carried by the bridge and restricting the type of traffic.	CS4 > 0%	**Y**
1	"Imminent" Failure Condition (Closed)	Assigned to bridges in which conditions exist that failure/collapse is likely to occur. Bridge will be closed, but corrective action may put bridge back in a reduced level of service.	CS4 > 0%	**Y**
0	Failed Condition (Closed)	Only assigned to bridges that have failed/collapsed or have partial failure. Condition of bridge is beyond corrective action.	CS4 > 0%	**Y**

G4—SUBSTRUCTURE CONDITION RATING GUIDANCE

NBI Substructure Condition Rating should follow the guidance found in ***G1.*** The rating will be based on primary support members only. Non-structural members shall not affect the rating. Non-structural members include wingwalls, sheeting, backwall and headwalls. Sheeting may be considered primary structural members if they directly support the abutment or pier cap.

G5—CULVERT CONDITION RATING GUIDANCE

G5.1—Small Span Metal Pipe Culverts

Corrugated Metal Culvert Inspection Guide					
	AASHTO BrM Condition State: elements #240 & 847				
NBI Condition Rating	**CS1**	**CS2**	**CS3**	**CS4**	**Load Posting**
9	100% (new)				N/A
8	100% (w/ no corrosion)				N/A
7	100% (w/ surface corrosion)				N/A
6		> 0%	0%		N/A
5			> 0%		N/A
4			> 75%		N/A
3				> 30%	15 Tons
2				> 30% (w/ minor loss of fill, or kinking)	3 Tons
1				> 30% (w/ loss of fill or separation)	Bridge Closure
0					Bridge Closure

For multiple barrel CMP locations, the above chart is applied to each CMP barrel and the lowest rating is used for the NBI culvert rating.

G5.2—Large Span Metal Pipe Culverts

Large-Span Corrugated Metal Culvert Inspection Guide					
	AASHTO BrM Condition State: Elements #844 & 848				
NBI Condition Rating	**CS1**	**CS2**	**CS3**	**CS4**	**Load Posting**
9	100% (new)				N/A
8	100% (w/ no corrosion)				N/A
7	100% (w/ surface corrosion)				N/A
6		> 0%	0%		N/A
5			>0-30% CS3 or >0-5% CS4		N/A
4			>30% CS3 or >5-10% CS4 No loss of fill Present		N/A
3			>10-20% CS4 No loss of fill present		15 Tons
2				>20-30% CS4 No Loss of fill present	3 Tons
1				>30% CS4 Or Loss of fill exists (See Note Below)	Bridge Closure
0				Pipe(s) have failed	Bridge Closure

For multiple barrel CMP locations, the above chart is applied to each CMP barrel and the lowest rating is used for the NBI culvert rating. If any large-span CMP (>10') is found to have loss of fill, then the structure will be closed unless a temporary repair can be made. Temporary repairs may include (but not limited to) sand bagging along areas where loss of fill is determined to be occurring or installing steel plates along the roadway to span the bad pipe(s). If a structure with a span length of 7-10' is found to have greater than 20% CS4 or minor loss of fill, the decision to post or close the road will be determined upon the QA/QC review.

Factors that may or may not affect the decision to close a road could include the following:

- **Severity of perforations or holes that exist in pipe(s)**
- **Location of perforations or holes that exist in the pipe(s)**
- **Deflection or distortion of the pipe(s) that may be present**
- **Type of backfill that is present**
- **Age of the structure**
- **The quantity of pipe(s) in a CS4 that exists**
- **Kinking or separation along the pipe invert that may exist**
- **Separation of pipe seams that may exist**
- **The quantity of pipe(s) in a CS3 that exists**
- **Where (vertically) along the invert the deteriorated areas are present**
- **Rate of deterioration (comparison of previous inspections)**
- **Shape of Pipe (round or elliptical**

G5.3—R/C Culverts

NBI Condition Rating	Description	Condition Rating Assignment Comments	Element Condition State Quantities (Primary Members)	Require BIE/BME Review
9	Excellent Condition	Only assigned to new bridges at the time of the inventory inspection. The assignment of a "9" during the first routine inspection, or any inspection thereafter, is prohibited.	CS1 = 100%	N
8	Very Good Condition	Assigned when there are no defects for structural components or superficial defects for non-structural componenets, i.e. element condition states are in a CS1 for non-structural and structural components.	CS1 = 100%	N
7	Good Condition	Assigned when minor deterioration of non-structural components or superficial to minor deterioration of structural components exist. *Superficial deterioration/defects correlates to an element condition rating of a 1 with a defect that was present from construction or cracking in concrete that is < 0.012" (R/C) and <0.004" (P/S). Minor deterioration correlates to an element condition rating of a "2".*	CS1 ≥80% CS2 ≤15% CS3≤5%	N
6	Satisfactory Condition	Assigned when moderate deterioration of non-structural component(s) or minor to moderate deterioration of structural component(s) exist. *Moderate deterioration correlates to an element condition rating of a "3".*	CS1 & CS2 ≥80% CS3 ≤20%	N
5	Fair Condition	Assigned when advanced deterioration of non-structural component(s) or moderate deterioration of structural component(s) exist. *Advanced deterioration correlates to an element condition rating of a "4".*	CS1 & CS2 ≥55% CS3 ≤45% CS4 =0%	N
4	Poor Condition (Structurally Deficient)	Advanced deterioration that does not affect the primary structural components exists. This is typically assigned when the element condition state of the primary structural component(s) have been assigned an element condition state rating of a "4". It may also be assigned once an analysis has been completed and the results indicate that the bridge does not need posting. The decision to assign a conditon rating of a "4" versus a "3" may be based on engineering judgement of the Bridge Inspection Engineer and/or the Bridge Management Engineer.	CS3 >45% CS4 = 0% (>0% Initially, but 0% after Structural Review)	**Y**
3	Serious Condition (Structurally Deficient)	Advanced deterioration exists and has affected primary structural components. This may have been determined through analysis or based on engineering judgement by the Bridge Inspection Engineer and/or Bridge Management Engineer. If determined through analysis, the rating should have originally been assigned a "4" by the inspection team.	CS4 > 0%	**Y**
2	Critical Condition (Structurally Deficient)	Sufficent deterioration exists such that corrective action is required. Corrective action may include a significant load posting restriction, emergency repairs, reducing the number of lanes carried by the bridge and restricting the type of traffic.	CS4 > 0%	**Y**
1	"Imminent" Failure Condition (Closed)	Assigned to bridges in which conditions exist that failure/collapse is likely to occur. Bridge will be closed, but corrective action may put bridge back in a reduced level of service.	CS4 > 0%	**Y**
0	Failed Condition (Closed)	Only assigned to bridges that have failed/collapsed or have partial failure. Condition of bridge is beyond corrective action.	CS4 > 0%	**Y**

Non-Structural Components:	Railings, curbs, medians, sidewalks, drains, joints, bearings, headwalls, approach slabs, wingwalls (retaining walls) and sheeting.

Scaling in the floor of a box culvert shouldn't be included in the quantity to reduce the NBI rating and should be left in CS1; this includes deep scaling.